

**B-07 Thematic Poster - Blood Flow**

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-101A

**517 Chair:** Kyra E. Pyke. *Queen's University, Kingston, ON, Canada.*

(No relevant relationships reported)

**518 Board #1** May 29 1:00 PM - 3:00 PM  
**Imaging Transcranial Doppler: A Novel Approach to Assess Cerebral Blood Flow**

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(No relevant relationships reported)

Cerebral blood flow is commonly assessed in the middle cerebral artery (MCA) as blood velocity, using non-imaging transcranial Doppler ultrasound (TCD). However, to accurately determine blood flow, both blood velocity and vessel diameter are critical components, and there is mounting evidence that the MCA is vasoactive. **PURPOSE:** Therefore, the purpose of this study was to employ imaging TCD (ITCD), utilizing color flow and pulse wave velocity, as a novel approach to measure both MCA blood velocity and diameter to quantify cerebral blood flow. **METHODS:** ITCD was performed at rest in 9 healthy participants (7M/2F; 29±5 yrs) with sublingual nitroglycerin (NTG, 0.8mg) and without (CON). Measurements were taken for 2 minutes prior, and for 5 minutes following NTG or sham delivery (CON). **RESULTS:** There was a 6-fold fall in MCA blood velocity in response to NTG ( $\Delta$  -4.8±4.2 cm/s) compared to negligible fluctuations in CON ( $\Delta$  -0.81±2.5 cm/s). MCA diameter increased much more in response to NTG ( $\Delta$  0.17±0.02 cm) compared to the basal variation in CON ( $\Delta$  0.01±0.04 cm). Interestingly, the product of this NTG-induced fall in MCA blood velocity and increase in MCA diameter was a significant increase in blood flow following NTG ( $\Delta$  159±59 ml/min) compared to CON ( $\Delta$  24±46 ml/min). **CONCLUSIONS:** These juxtaposed data highlight the importance of measuring both MCA blood velocity and diameter when assessing cerebral blood flow and document ITCD as a novel approach to achieve this goal. Supported by the Veterans Administration Rehabilitation Research and Development Service (E6910-R, E1697-R, E1433-P, E9275-L and E1572-P).

**519 Board #2** May 29 1:00 PM - 3:00 PM  
**Arm Circumference As A Method To Standardize The Practical Blood Flow Restriction Pressure**

Scott J. Dankel<sup>1</sup>, J Grant Mouser<sup>2</sup>, Takashi Abe<sup>1</sup>, Zachary W. Bell<sup>1</sup>, Samuel L. Buckner<sup>3</sup>, Kevin T. Mattocks<sup>4</sup>, Matthew B. Jessee<sup>5</sup>, Jeremy P. Loenneke<sup>1</sup>. <sup>1</sup>The University of Mississippi, University, MS. <sup>2</sup>Troy University, Troy, AL. <sup>3</sup>The University of South Florida, Tampa, FL. <sup>4</sup>Lindenwood University-Belleveille, Belleveille, IL. <sup>5</sup>University of Southern Mississippi, Hattiesburg, MS.

(No relevant relationships reported)

Practical blood flow restriction training using elastic cuffs is gaining popularity. A criticism of this method is that the pressure applied and the amount of blood flow restriction induced is difficult to quantify. **PURPOSE:** To quantify blood flow following the application of an elastic-cuff and compare that to what is observed using a more traditional pressurized nylon-cuff. **Methods:** 35 participants visited the laboratory once for testing. In a randomized order (one condition per arm), an elastic-cuff (5cm wide) was applied to one arm and blood flow was measured following the cuff being pulled to two distinct lengths; 110% (low pressure) and 120% (high pressure) of the individuals resting arm circumference. The other arm followed a similar protocol but used a pressurized nylon-cuff (5cm wide) inflated to 40% (low pressure) and 80% (high pressure) of the individuals resting arterial occlusion pressure. **RESULTS:** There was a main effect of pressure ( $p<0.001$ ) with blood flow decreasing from resting in a pressure dependent manner as follows: low pressure: -27.3 (95% CI: -39.5, 15.1) mL/min and high pressure: -47.2 (95% CI: -64.5, -29.9) mL/min. The mean difference (95% CI) in blood flow between cuffs at a given pressure was -5.9 (-18.9, 7.0) % for the lower pressure and -4.0 (-13.2, 5.1) % for the higher pressure. When the relative changes for each cuff were separated by sex, there were no differences in the changes from Pre. The relative difference (95% CI) between sexes were as follows: -5.3 (-23.5, 12.9) % for the nylon cuff inflated to a low pressure, -1.6 (-20.1, 16.8) % for nylon cuff inflated to a high pressure, 6.5 (-13.3, 26.3) % for the elastic pulled to a low pressure, and -4.5 (-24.2, 15.1) % for the elastic cuff pulled to

a high pressure. **CONCLUSIONS:** Our results indicate that an elastic cuff pulled to 110% and 120% of resting arm circumference decreases brachial artery blood flow in a pressure dependent manner. These pressure dependent decreases in blood flow were similar to that observed when a pressurized nylon cuff was inflated to 40 and 80% of the individuals resting arterial occlusion pressure. The application of a pressure relative to the initial cuff length, which is largely dependent upon arm circumference, appears to provide one method to standardize the practical blood flow restriction pressure for future research.

**520 Board #3** May 29 1:00 PM - 3:00 PM

**Exercise Intensity and Middle Cerebral Artery Dynamics in Humans**

Emily Witte<sup>1</sup>, Yumei Liu<sup>1</sup>, Jaimie L. Ward<sup>1</sup>, Katie S. Kempf<sup>1</sup>, Alicen Whitaker<sup>1</sup>, Eric D. Vidoni<sup>2</sup>, Jesse C. Craig<sup>3</sup>, David C. Poole, FACSMT<sup>3</sup>, Sandra A. Billinger<sup>1</sup>. <sup>1</sup>University of Kansas Medical Center, Kansas City, KS. <sup>2</sup>University of Kansas Alzheimer's Disease Center, Fairway, KS. <sup>3</sup>Kansas State University, Manhattan, KS.

(No relevant relationships reported)

Understanding the middle cerebral artery dynamic response during different exercise intensities is vital for understanding brain health and designing and evaluating exercise strategies for maximizing therapeutic potential. However, whether there is an interaction between exercise intensity and cerebrovascular kinetics is unknown. **PURPOSE:** To characterize mean middle cerebral artery blood flow velocity (MCAv) kinetics associated with two exercise work rates: low and moderate. We tested the hypotheses that increasing work rate would increase the MCAv amplitude and that age and estimated maximal oxygen uptake ( $\dot{V}O_{2max}$ ) would be related to the MCAv amplitude. **METHODS:** Baseline values were collected for 90-seconds followed by a 6-minute exercise bout on a recumbent stepper. Heart rate, end tidal  $CO_2$  ( $P_{ET}CO_2$ ), beat-to-beat blood pressure, and MCAv were recorded at rest and during exercise. The MCAv kinetics response for participants from baseline (BL) was described by the response amplitude (Amp), time delay (TD), and time constant ( $\tau$ ). **RESULTS:** Sixty-four adults completed the low and moderate intensity exercise transitions. MCAv Amp increased from rest as a function of work rate, low and moderate intensity, respectively, (11.8 and 14.7 cm/s;  $p<0.001$ ) while no difference between work rates were observed in either TD (43.5 and 45.8 s;  $p=0.65$ ) or  $\tau$  (35.2 and 31.4 s;  $p=0.47$ ). Age showed a moderate, negative association with MCAv Amp ( $r=-0.40$  and  $r=-0.42$ ;  $p<0.01$ ). Higher estimated  $\dot{V}O_{2max}$  demonstrated a moderate, positive correlation with MCAv Amp ( $r=0.41$  and  $r=0.50$ ;  $p<0.01$ ). **CONCLUSION:** Moderate intensity exercise induced a greater MCAv response amplitude compared to low intensity exercise. The amplitude of the initial MCAv response for both exercise intensities increased systematically with work rate whereas the TD and  $\tau$  kinetics parameters were invariant. Therefore, the possibility exists that the cerebrovascular system may have protective mechanisms in place to avoid the more rapid responses as seen in skeletal muscle, however more work is needed to address this hypothesis. Finally, although the MCAv Amp declines with age, maintaining higher cardiorespiratory fitness may benefit the cerebrovascular response to exercise.

**521 Board #4** May 29 1:00 PM - 3:00 PM

**The Influence of a High Sodium Meal on Cerebrovascular Reactivity**

Kamila U. Migdal<sup>1</sup>, Austin T. Robinson<sup>1</sup>, Joseph C. Watson<sup>1</sup>, Matthew C. Babcock<sup>1</sup>, Jorge M. Serrador<sup>2</sup>, William B. Farquhar, FACSMT<sup>1</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Rutgers University, Newark, NJ.

(No relevant relationships reported)

Single high sodium ( $Na^+$ ) meals transiently reduce peripheral blood vessel function in humans. Rodent models demonstrate that high dietary  $Na^+$  intake reduces middle cerebral artery (MCA) function. Cerebrovascular reactivity (CVR) to carbon dioxide ( $CO_2$ ) is a validated method for assessing the cerebrovasculature in humans. However, the effects of a single high dietary  $Na^+$  meal on CVR in humans is unknown. **PURPOSE:** We tested the hypothesis that a single high- vs low- $Na^+$  meal impairs CVR in young adults. **METHODS:** Nineteen healthy, normotensive adults (9M/10F; age: 26±4 yrs; BMI: 23.6±5.1 kg/m<sup>2</sup>; BP: 105±9/58±6 mmHg, mean±SD) participated in this crossover design study. We provided participants with high- (HS: 1,495 mg) and low- (LS: 138 mg)  $Na^+$  meals in randomized order. Visits were separated by one week for males. We tested females in the early follicular phase of their menstrual cycle. Transcranial doppler of the right MCA was assessed while participants lay supine. Serum  $Na^+$  and CVR (% $\Delta$ MCA velocity/ $\Delta$ CO<sub>2</sub>) to high CO<sub>2</sub> (hypercapnia) and low CO<sub>2</sub> (hypocapnia) were measured prior to-, 30 minutes post- and 60 minutes post-meal. Data were analyzed using two-way repeated measures ANOVA (meal x time). Tukey post hoc comparisons were used when appropriate. **RESULTS:** Serum  $Na^+$  was elevated on the high- $Na^+$  meal at 30- (HS=141.2±0.3 vs LS=140.0±0.5 mmol/L,  $p<0.01$ ) and 60-minutes post meal (HS=141.7±0.8 vs LS=140.2±0.6 mmol/L,  $p<0.001$ ). Hypercapnia increased MCA velocity from baseline at 30- (HS=29±1 vs

LS=28±1%) and 60- (HS=27±1 vs LS=29±1%) minutes post meal without an effect of the meal ( $p>0.05$ ). Hypocapnia decreased MCA velocity from baseline at 30- (HS=43±4 vs LS=45±4%) and 60- (HS=47±3 and LS=45±4%) minutes post meal without an effect of the meal ( $p>0.05$ ). Despite elevated serum Na<sup>+</sup>, the HS meal did not alter CVR to hypercapnia (30min: HS=Δ-0.03±0.21 vs LS=Δ-0.19±0.22 %/mmHg; 60min: HS=Δ-0.08±0.20 vs LS=Δ-0.16±0.21 %/mmHg,  $p>0.05$ ). Additionally, CVR to hypocapnia was not different between the two meals (30min: HS=Δ0.15±0.08 vs LS=Δ0.08±0.12 %/mmHg; 60min: HS=Δ0.17±0.07 vs LS=Δ-0.001±0.09 %/mmHg,  $p>0.05$ ). **CONCLUSION:** These preliminary data suggest that a high sodium meal does not acutely alter cerebrovascular reactivity in healthy young adults. Supported by: ACSM 17-00577 (KUM) and NIH Grant R01HL128288 (WBF)

**522 Board #5 May 29 1:00 PM - 3:00 PM**  
**The Effects of Prolonged Sitting on Cerebral Perfusion and Executive Function**

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**Purpose:** Little is known about the effects of prolonged sitting on cerebrovascular function. We hypothesized intermittent calf raises (every 10min) would: (i) prevent venous pooling in the lower extremities; (ii) maintain cerebral perfusion; (iii) maintain executive function. **Methods:** 20 healthy, yet sedentary subjects (19-35 years old) were recruited to participate in two 3 hr sitting conditions: control (CON) and experimental heel-raise (HEEL) study. Cerebral perfusion (total haemoglobin, tHb) and tissue oxygenation (tissue saturation index, TSI) were measured using near-infrared spectroscopy (NIRS) and the Stroop-color test evaluated executive function. Measurements were made at 10, 90 and 170min. **Results:** There were non-significant time effects for cerebral tHb ( $p=0.287$ ) and TSI ( $p=0.923$ ); however, calf raises decreased tHb ( $p<0.001$ ,  $d=0.633$ ) but had no effect on TSI ( $p=0.761$ ). There was a non-significant time ( $p=0.641$ ) and condition ( $p=0.083$ ) effect for the Stroop-color test. **Conclusion:** Intermittent calf raises prevent venous pooling in the lower extremities in healthy, yet sedentary young subjects, but do not improve cerebral perfusion or executive function.

**523 Board #6 May 29 1:00 PM - 3:00 PM**  
**Using Continuous And Interval Exercise To Manipulate Shear Rate Patterns In The Common Femoral Artery**

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Vascular shear rate (SR) assessed via ultrasound represents frictional force of blood flowing over the endothelium. Low and oscillatory shear confers a pro-inflammatory phenotype, whereas greater shear has an anti-inflammatory phenotype decreasing CVD risk. Exercise increases SR, however the impact of continuous (CON) and interval (INT) exercise upon the balance of anterograde (ANT) and retrograde (RET) SR and thus the oscillatory shear index (OSI) is unknown. **PURPOSE:** To examine the impact of acute CON and INT (no active recovery) exercise on SR patterns and OSI in the common femoral artery (CFA) during exercise. **METHODS:** 10 healthy individuals (25±3 years, n=5 male) underwent two work-matched exercise sessions (CON and INT) on a supine cycle ergometer at 125% lactate threshold. In each protocol repetitive ultrasound scans were taken of the CFA during a brief cessation in exercise to determine in-exercise shears. Flow mediated dilatation (FMD) was measured before and after exercise to assess acute changes in endothelial function. **RESULTS:** FMD did not differ after exercise in either protocol (CON: 9.9±8.1% vs 8.4±6.2%; INT: 9.1±5.9% vs 6.6±3.4%;  $P>0.05$ ). ANT and RET SR reached a plateau in each protocol. Total ANT SR was lower in CON than INT (CON: 861540±291534 vs INT: 1955615±674594 s<sup>-1</sup>;  $P<0.05$ ), however total RET SR did not differ between protocols (CON: 76625±89390 vs INT: 78126±78697 s<sup>-1</sup>;  $P>0.05$ ). Peak and mean SR were similar in CON and INT, respectively (peak ANT: 1258±403 vs 1480±510 s<sup>-1</sup>; RET: 107±123 vs 108±75 s<sup>-1</sup>;  $P>0.05$ ; mean ANT: 1171±372 vs 1358±469 s<sup>-1</sup>; RET: 61±81 vs 54±55 s<sup>-1</sup>;  $P>0.05$ ). Mean and peak OSI were also similar in both types of exercise (peak CON: 0.07±0.08 vs INT: 0.08±0.06 AU; mean CON: 0.05±0.06 vs INT: 0.04±0.04 AU;  $P>0.05$ ). No time was spent in pure oscillatory shear (>0.5 AU). **CONCLUSION:** During exercise matched for intensity and the duration of muscular work, using an INT approach ensured a similar OSI but a greater total ANT SR compared to CON. This would suggest that in the exercising limb INT exercise does not confer a negative oscillatory profile. GRANT FUNDING: Medical Research Council

**524 Board #7 May 29 1:00 PM - 3:00 PM**

**Impact of a Brief Period of Uninterrupted Sitting on Cerebrovascular Hemodynamics**

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Prolonged periods of uninterrupted sitting (1-6 hours) have been shown to reduce lower limb blood flow, impair vascular endothelial function of leg arteries, and increase central arterial stiffness. It is unclear whether sitting can have a similar negative impact on cerebrovascular hemodynamics. **PURPOSE:** To determine the impact of a brief period (1 hour) of uninterrupted sitting on total brain blood flow (BBF). **METHODS:** Eleven participants (25±1 years, BMI=26±1 kg/m<sup>2</sup>, Female=5) completed a 1-hour bout of sitting. Assessments of central (heart rate and mean arterial pressure) and cerebrovascular hemodynamics (carotid artery blood flow, assessed via Doppler-ultrasound) were performed pre-post 1-hour of sitting (supine), as well as during the sitting intervention (10- and 60-minutes). In a subset (N=7), blood flow through the internal carotid (ICA) and vertebral arteries (VA) was examined to estimate total BFF [(ICA+VA)\*2]. **RESULTS:** When measured supine, HR and MAP were similar pre-post sitting. However, there was a significant increase in HR when measured while seated (i.e., 10-mins=67±3 vs. 60-mins=70±4 bpm;  $p=0.02$ ). CCA blood flow was comparable pre-post sitting ( $p=0.25$ ), but decreased 10-60 minutes while seated (10-mins=1049±64 vs. 60-mins=921±63 mL/min;  $p=0.006$ ). Conversely, estimated total BBF significantly decreased pre-post sitting (pre=1039±135 vs. post=843±82 mL/min;  $p=0.01$ ), but was comparable between the 10- and 60-minute time points (10-mins=799±148 vs. 60-mins=802±125 mL/min;  $p=0.95$ ). **CONCLUSIONS:** These preliminary findings suggests that cerebrovascular hemodynamics are significantly affected by a 1-hour bout of uninterrupted sitting, largely due to a reduction in estimated total BBF.

**525 Board #8 May 29 1:00 PM - 3:00 PM**

**An Examination of Group and Individual Response Rates to Ischemic Preconditioning for Sport Performance**

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**PURPOSE:** Ischemic Preconditioning (IPC) has been shown to improve exercise performance; yet large variability in response exists between individuals and the mean changes reported between studies. It has been suggested that there are responders and non-responders to IPC and this is a common explanation for the observed variability. At present, existing studies that demonstrate individual responses to IPC lack an appropriate assessment of the within-subject variability of the exercise task, thereby preventing proper evaluation of response versus non-response to the stimulus. Thus, the purpose of this study was to use repeated control trials to measure within-subject variability to assess the existence of true responders to IPC. **METHODS:** In a randomized, crossover design, twelve recreational cyclists (7m/5f, 30yrs, 72kg, 175cm, 55ml·min<sup>-1</sup>·kg<sup>-1</sup>) completed six, 5km cycling time trials, each separated by one week. Three separate trials were performed with and without IPC to characterize the expected individual variability in performance with and without treatment. For each IPC trial, IPC was completed 15 minutes prior to exercise and consisted of 3x5-min cycles of bilateral occlusion and reperfusion to the upper thighs. **RESULTS:** Comparing baseline control to IPC, mean time to completion did not reach significance (5±8s or 1.0±1.8%,  $p=0.08$ ), despite a 1% change commonly being recognized as the benchmark for a meaningful alteration in performance. Examination of individual participant data revealed 8 of 12 (68%) participants improved mean 5km TT performance following IPC (2.1±1.3%). If the individual's mean IPC response is considered only as an improvement that exceeded one's own percent coefficient of variation from the repeated controls (0.4±0.8%) then 7 (58%) and 5 (42%) would be classed as legitimate responders and non-responders. When the individual response or non-response to IPC was examined over the three repeated IPC trials, 81% and 87% of trials confirmed the effect, respectively. **CONCLUSIONS:** We present evidence that individual performance is affected at a magnitude that exceeds normal variability. This suggests the existence of participants who consistently respond to IPC exposure at a magnitude that exceeds chance.

**B-08 Thematic Poster - Cooling Interventions, Physiological Responses, and Performance in the Heat**

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-101B

**526 Chair:** Scott Montain. *USARIEM, Natick, MA.*  
(No relevant relationships reported)

**527 Board #1 May 29 1:00 PM - 3:00 PM  
Extra- And Intra- Renal Vascular Responses To Sympathetic Activation Are Not Modified Following Cooling Recovery**

Christopher L. Chapman, Julia M. Benati, Nicole T. Vargas, Blair D. Johnson, Penelope C. Lema, Zachary J. Schlader, FACSM. *University at Buffalo, Buffalo, NY.* (Sponsor: Zachary J Schlader, FACSM)  
(No relevant relationships reported)

Elevated renal vascular resistance (RVR) during heat stress may provoke localized ischemia, especially when exposed to multiple sympathetic stressors. Whole-body cooling reduces risks associated with heat stress. However, this cooling raises RVR and could therefore exacerbate increases in RVR caused by prior heat stress, particularly during sympathetic activation. **PURPOSE:** To test hypotheses that increases in both extra- and intra- RVR to the cold pressor test (a sympathoexcitatory stimulus, CPT) are exacerbated by whole-body cooling following heat stress. **METHODS:** Nineteen healthy adults ( $22 \pm 2$  y) underwent passive heat stress sufficient to raise core temperature  $1.2^\circ\text{C}$  above normothermic baseline (NT), after which they underwent passive cooling recovery (CR) to within  $0.2^\circ\text{C}$  of NT. Participants completed a 2 min CPT at NT and at the end of CR. Changes in body weight provided an indication of dehydration. Heart rate (HR), mean arterial pressure (MAP), and renal blood velocity (RBV) were measured pre-CPT (Pre) and at the end of the CPT (End). RBV was measured using the coronal approach with Doppler ultrasound at the distal segment of the right renal artery (Extra-,  $n=11$ ) or in the same segmental artery within participants in the right kidney (Intra-,  $n=8$ ). RVR was calculated as  $\text{MAP}/\text{RBV}$ . Data are presented as mean  $\pm$  SD. **RESULTS:** The change in body weight was  $-1.2 \pm 0.5\%$ . In Extra- at Pre, MAP was elevated in CR compared to NT ( $95 \pm 9$  vs.  $85 \pm 7$  mmHg,  $P<0.01$ ) with no differences in HR ( $58 \pm 7$  vs  $56 \pm 9$  bpm,  $P=0.24$ ). MAP and HR in Intra- at Pre did not differ from Extra- ( $P\geq 0.72$ ). In Extra- at Pre, RBV ( $33 \pm 4$  vs  $36 \pm 5$  cm/s,  $P=0.01$ ) and RVR ( $0.35 \pm 0.06$  vs  $0.43 \pm 0.08$  mmHg/cm/s,  $P<0.01$ ) were lower in CR compared to NT. RBV was lower and RVR was higher in Intra- compared to Extra- ( $P\leq 0.02$ ) at Pre. At End, increases in HR ( $12 \pm 9$  vs  $14 \pm 7$  bpm,  $P=0.50$ ) and MAP ( $24 \pm 16$  vs  $24 \pm 16$  mmHg,  $P>0.99$ ) were not different between CR and NT in Extra-. Changes in RBV ( $-3 \pm 5$  vs  $-2 \pm 7$  cm/s,  $P=0.59$ ) and increases in RVR ( $1.24 \pm 0.97$  vs  $0.95 \pm 0.99$  mmHg/cm/s,  $P=0.29$ ) did not differ between CR and NT in Extra- at End. There were no differences in the HR, MAP, RBV, or RVR response to CPT in Intra- compared to Extra- ( $P\geq 0.10$ ). **CONCLUSION:** Whole-body cooling following passive heat stress does not affect the extra- or intra- renal vascular responses to sympathetic activation.

**528 Board #2 May 29 1:00 PM - 3:00 PM  
Cooling Treatment Induces Changes in Aquaporins Expression as a Protective Mechanism for Exertional Heat Stroke**

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**Abstract:** Cooling treatment is important to ensure the survival of patients with Exertional Heat Stroke (EHS); however, the protective mechanism of aquaporins in the cooling treatment of EHS is not very clear. Cooling treatment induces changes in renal aquaporins and regulates homeostasis of water metabolism, which mechanism involves aquaporin gene expression. **PURPOSE:** To determine the role of AQP2 mRNA expression and AQP2 protein expression in kidney in the homeostasis of water metabolism when EHS rats were treated with cooling. **METHODS:** In this study, there

were 4 groups of male SD rats, including normal control group (NC,  $n=8$ ), EHS onset group (EHSO,  $n=9$ ), EHS rest group (EHSR,  $n=9$ ) and EHS cooling group (EHSC,  $n=8$ ). We established the rat model of EHS by exercising to exhaustion in the environment of  $36^\circ\text{C}$  temperature and 75% humidity until rectal temperature reaching about  $42^\circ\text{C}$ . The cooling treatment for EHS was to immerse in cold water for 5 minutes at  $19^\circ\text{C}$ . Blood and kidney were taken. Hct in serum was measured by automatic blood cell analyzer. PCR and WB were used to detect AQP2 mRNA expression and AQP2 protein expression respectively. Data were analyzed with Mann-Whitney U in nonparametric test. **RESULTS:** When EHS occurs, Hct increased significantly (EHSO:  $0.43 \pm 0.29$  vs.  $0.40 \pm 0.04/\text{L}$ ,  $p<0.05$ ). To fit for water metabolism, AQP2 mRNA expression and AQP2 protein expression were up-regulated significantly (EHSO vs. NC) (mRNA:  $3.45 \pm 0.95$  vs.  $1.19 \pm 0.37$ ,  $p<0.01$ ; Protein:  $2.76 \pm 1.01$  vs.  $1.00 \pm 0.00/\text{g/L}$ ,  $p<0.01$ ). After cold water immersion, No significant change of Hct was found, AQP2 mRNA expression and AQP2 protein expression were significantly down-regulated (EHSC vs. EHSO) (mRNA:  $1.66 \pm 0.33$  vs.  $3.45 \pm 0.95$ ,  $p<0.01$ ; Protein:  $1.52 \pm 0.85$  vs.  $2.76 \pm 1.01/\text{g/L}$ ,  $p<0.05$ ). **CONCLUSIONS:** Hct, AQP2 mRNA expression and AQP2 protein expression are pathophysiological biomarkers of EHS. Cooling treatment restrain water reabsorption by down-regulating the expression of AQP2 mRNA and AQP2 protein in kidney.

**529 Board #3 May 29 1:00 PM - 3:00 PM  
The Central Mechanism Underlying Arginine Vasopressin Changes During Cooling Therapy For Exertional Heat Stroke Rats**

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**Abstract:**

Cooling therapy is very effective for improving the survival of patients with Exertional Heat Stroke (EHS); however, the central activation mechanism of Arginine Vasopressin in cooling therapy for EHS is not very clear. The central mechanism of cooling therapy induces changes of AVP to adjust water metabolism, which involves that the synthesis and release of AVP in hypothalamus. **PURPOSE:** To determine the central activation of AVP mRNA expression and AVP protein expression in hypothalamus in improving water metabolism when EHS rats were treated with cooling. **METHODS:** Male Sprague Dawley rats were randomly divided into normal control group (NC  $n=8$ ) and EHS group. EHS group was further divided into the onset group (EHSO  $n=9$ ), the rest group (EHSR  $n=9$ ) and the cooling group (EHSC  $n=8$ ). The rat model of EHS was induced by exercising to exhaustion and raising rectal temperature to about  $42^\circ\text{C}$  in the environment of  $36^\circ\text{C}$  temperature and 75% humidity. Cold water immersion for 5 min at  $19^\circ\text{C}$  was used as cooling treatment. Blood and hypothalamus were taken for testing. AVP in serum was measured by ELISA method. AVP mRNA expression and AVP protein expression were detected by PCR and WB respectively. We analyzed data with Mann-Whitney U of nonparametric test. **RESULTS:** Onset of EHS, to regulate water metabolism, AVP, AVP mRNA expression and AVP protein expression of EHSO group rats were upregulated significantly than that of NC group (AVP:  $66.02 \pm 24.55$  vs.  $33.52 \pm 11.13$ ,  $p<0.01$ ; mRNA:  $5.06 \pm 4.10$  vs.  $1.21 \pm 0.49$ ,  $p<0.01$ ; Protein:  $2.90 \pm 1.26$  vs.  $1.00 \pm 0.00/\text{g/L}$ ,  $p<0.01$ ). After cold water immersion, AVP mRNA expression and AVP protein expression were significantly downregulated, AVP changed little (EHSC vs. EHSO) (mRNA:  $1.22 \pm 0.50$  vs.  $5.06 \pm 4.10$ ,  $p<0.01$ ; Protein:  $1.48 \pm 0.89$  vs.  $2.90 \pm 1.26/\text{g/L}$ ,  $p<0.05$ ). **CONCLUSIONS:** AVP, AVP mRNA expression and AVP protein expression can be used as pathophysiological biomarkers of EHS. Cold water immersion inhibits anti-dehydration reaction by downregulating the expression of AVP mRNA and AVP protein in hypothalamus.

**530 Board #4 May 29 1:00 PM - 3:00 PM  
Continuous Forearm Cooling Attenuates Increase in Core Body Temperature of Elite Cyclists under Heat Stress**

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(No relevant relationships reported)

Physical activity results in the generation of heat which is dissipated through thermoregulatory processes, such as the production of sweat. Environmental conditions

can inhibit thermoregulation resulting in heat accumulation with eventual impairment in performance. **PURPOSE:** To determine if continuous inner forearm cooling helps to maintain body core temperature and athletic performance during cycling in a hot and humid environment. **METHODS:** Preliminary results report on data collected from three competitive triathletes [two male, one female; age:  $31 \pm 2$  years; mean  $\pm$  standard deviation]. Each performed two cycling sessions at  $70 \pm 4\%$  of their functional threshold power for up to 45 minutes in an environmentally controlled chamber (temperature:  $30^\circ\text{C}$ , humidity: 70%). One trial included continuous inner forearm cooling (FC), while the other was a control trial (NFC). Heart rate (HR) was monitored throughout the test and body core temperature ( $T_{\text{core}}$ ) was measured using an ingestible radio capsule. Ratings of perceived exertion and thermal comfort were assessed every 10 minutes throughout exercise. **RESULTS:** Preliminary data suggest that forearm cooling attenuated the increase in  $T_{\text{core}}$  during exercise (FC:  $2.32 \pm 0.36^\circ\text{C}\cdot\text{hr}^{-1}$  vs. NFC:  $2.85 \pm 0.33^\circ\text{C}\cdot\text{hr}^{-1}$ ), as  $89.6 \pm 11.7$  kJ of heat were removed from the body during the cooling trials. Furthermore, two of the three participants were unable to complete the non-cooling trial due to reaching the temperature threshold for test termination ( $39.3^\circ\text{C}$ ). Similarly, HR appeared to be lower in the FC condition compared to the NFC condition. Participants' ratings of perceived exertion were similar between conditions; however, participants' thermal comfort was improved with inner forearm cooling. **CONCLUSION:** Preliminary data analysis suggests that during cycling in the heat, continuous cooling of the forearms may improve athlete comfort by attenuating the exercise induced increase in core body temperature.

531 Board #5 May 29 1:00 PM - 3:00 PM

### Influence of Face and Head Cooling on Thermoregulation and Perception During Simulated American Football

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The skin of the human face and head is uniquely sensitive to cold stimuli, influencing whole body thermal perception more than most other skin surfaces. This sensitivity might be particularly relevant for American football, where padding and equipment cover much of the body but athletes regularly experience large thermal stress. **PURPOSE:** To assess how face and head cooling impact thermoregulation and perception during simulated American football. **METHODS:** Ten male American football or rugby athletes (age =  $27 \pm 5$  y, height =  $184.1 \pm 5.9$  cm, mass =  $96.7 \pm 18.2$  kg; mean  $\pm$  SD) completed two 165 min intermittent exercise protocols. Each protocol was divided into four quarters (Q1 - Q4) and consisted of maximal sprints and plyometric push-ups separated by breaks regularly occurring during an American football game (e.g. breaks between quarters, time outs, and offense-defense transitions). Sessions occurred in  $36^\circ\text{C}$  and 50% RH and participants wore full American football uniforms throughout. During one session (COOL), each participant removed his helmet and donned a cooling hood during breaks longer than two minutes; the cooling hood covered the cheeks, forehead, head, and neck and was activated by soaking in an ice slurry mixture. During the other session (CON), each participant only removed his helmet during breaks longer than two minutes. Thermoregulatory and perceptual variables were measured throughout. **RESULTS:** No significant differences existed between COOL and CON for gastrointestinal temperature (COOL =  $38.0 \pm 0.5^\circ\text{C}$ , CON =  $38.1 \pm 0.5^\circ\text{C}$ ), mean weighted skin temperature (COOL =  $35.5 \pm 0.7^\circ\text{C}$ , CON =  $35.6 \pm 0.7^\circ\text{C}$ ), or heart rate (COOL =  $124 \pm 26$  bpm, CON =  $125 \pm 26$  bpm). COOL significantly improved whole body thermal sensation compared to CON (COOL: Q1 = 4 [4-5], Q2 = 5 [4-5], Q3 = 5 [4-5], Q4 = 5 [4-5]; CON: Q1 = 6 [6-6], Q2 = 6 [5-6], Q3 = 6 [5-6], Q4 = 7 [6-7]; median [interquartile range]). COOL similarly benefitted thermal comfort. **CONCLUSIONS:** These data confirm the sensitivity of the face and head to cooling stimuli and reinforce their influence over whole body thermal sensation and comfort during exercise in the heat. Moreover, these data indicate a cooling hood covering the cheeks, forehead, head, and neck can significantly improve thermal perception during exercise in the heat without influencing classic thermoregulatory measures.

532 Board #6 May 29 1:00 PM - 3:00 PM

### Precooling's Effects on American Football Skills

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Precooling (i.e., cooling before exercise, PC) with cold-water immersion (CWI) may help reduce the risk of exertional heatstroke (EHS) in American football athletes. However, implementation of PC would likely be low if it impaired American football performance. **PURPOSE:** We investigated PC effect on eight American football skills. **METHODS:** Twelve physically-active men ( $24 \pm 2$  y, mass =  $85.5 \pm 6.3$  kg, height =  $181.8 \pm 8.1$  cm) completed this randomized, crossover, counterbalanced study.

Participants practiced each skill until proficient and then completed two testing days outdoors (wet bulb globe temperature =  $19.3 \pm 4.1^\circ\text{C}$ ). On testing days, participants were precooled for 15 minutes using CWI ( $10.1 \pm 0.3^\circ\text{C}$ ) or not. They donned an American football uniform and completed multiple bouts of 40-yard dash, vertical jump, broad jump, agility test, dynamic (i.e., catching while running) and stationary catching, throwing distance, and throwing accuracy. Rectal temperature ( $T_{\text{rec}}$ ) was measured before, during, and after precooling and every 5 minutes during skill testing. MANOVA and dependent t-tests identified differences between conditions for football skill data. Repeated measures ANOVA and Tukey-Kramer post-hoc tests identified differences in  $T_{\text{rec}}$  between conditions over time. **RESULTS:** Data are means and standard deviations. Cohen's effect sizes (ES) were calculated when significant differences occurred. PC did not affect vertical jump, broad jump, agility, dynamic or stationary catching, or throwing distance ( $P \geq 0.13$ ). PC impaired 40-yard dash time (PC =  $5.72 \pm 0.53$  s, Control =  $5.31 \pm 0.34$  s;  $P = 0.03$ , ES = 1.2) and throwing accuracy (PC =  $0.9 \pm 0.2$  points, Control =  $1.3 \pm 0.3$  points;  $P = 0.001$ , ES = 1.4). On average,  $T_{\text{rec}}$  was  $0.58 \pm 0.35^\circ\text{C}$  lower during skills testing following PC and statistically differed from control from minute 10 to the end of testing ( $\sim 35$  minutes;  $P < 0.05$ , ES  $\geq 1.2$ ). **CONCLUSION:** PC may be a useful strategy to prevent EHS in American football players since it lowered  $T_{\text{rec}}$  without affecting most American football skills. By lowering  $T_{\text{rec}}$ , PC would prolong the time it would take for an athlete's body core temperature to become dangerous (i.e.,  $> 40.5^\circ\text{C}$ ). If PC is implemented, coaches should alter practice so throwing accuracy and speed drills occur after an athlete's body core temperature returns to normal.

533 Board #7 May 29 1:00 PM - 3:00 PM

### An Ice Vest Limits the Rise in Core Temperature During a Rugby Sevens Warm-up

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(No relevant relationships reported)

**Purpose:** Determine how a cooling vest worn during a warm-up could influence selected performance [counter movement jump (CMJ)], physical (GPS metrics) and psycho-physiological (body temperature and perceptual) variables. **Methods:** In a randomized crossover design, twelve elite male World Rugby Sevens athletes completed an outdoor (WBGT:  $23\text{-}27^\circ\text{C}$ ) match-specific externally-valid 30 min warm-up wearing a phase change cooling vest (VEST; also worn for 70 min prior-to warm-up) and without (CONTROL), on separate occasions 7 days apart. CMJ was assessed before and after the warm-up, with GPS indices and heart rate monitored during the warm-ups, whilst core temperature ( $T_c$ ; ingestible telemetric pill;  $n = 6$ ) was recorded throughout the experimental period. Measures of thermal sensation (TS) and comfort (TC) were obtained pre- and post-warm-ups, with rating of perceived exertion (RPE) taken post-warm-ups. **Results:** Athletes in VEST had a lower  $\Delta T_c$  from pre-warm-up to post-warm-up [effect size (ES)  $\pm 90\%$  confidence limit;  $-1.54; \pm 0.62$ ] and  $T_c$  peak ( $-0.7^\circ\text{C}$  lower on average) at the end of the warm-up ( $-1.59; \pm 0.64$ ) compared to CONTROL. Athletes demonstrated a decrease in  $\Delta TS$  ( $-1.59; \pm 0.72$ ) and  $\Delta TC$  ( $-1.63; \pm 0.73$ ) in VEST compared to CONTROL, pre- to post-warm-up. Furthermore, athletes in VEST had a lower post-warm-up RPE compared to CONTROL ( $-1.01; \pm 0.46$ ). Changes in CMJ and GPS indices were trivial between conditions (ES  $< 0.2$ ). **Conclusions:** Wearing the vest prior-to and during a warm-up can elicit favorable alterations in physiological ( $T_c$ ) and perceptual (TS, TC and RPE) warm-up responses, without compromising the utilized warm-up characteristics or physical performance measures. Supported by Aspire Zone Foundation (AZF; Doha, Qatar) funding.

**B-09 Thematic Poster - Ergogenic Aids**

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-102A

**534 Chair: Craig Sale, FACSM. Nottingham Trent University, Nottingham, United Kingdom.**

(No relevant relationships reported)

**535 Board #1 May 29 1:00 PM - 3:00 PM  
β-Alanine Supplementation Reduces Anxiety and Increases Neurotrophin Expression in both Young and Older Rats**

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**PURPOSE:** The effect of 30 days of β-alanine (BA) supplementation (100 mg·kg<sup>-1</sup>) on behavioral response, expression of brain-derived neurotrophic factor (BDNF), neuropeptide Y (NPY) and markers of inflammation was examined in both young (4 months) and older (14 months) rats.

**METHODS:** Animals were assigned to either a control group in which young (YC) or older (OC) rats were fed regular food and water or a β-alanine group, in which rats were fed regular food and provided β-alanine in their water (YBA or OBA, respectively). Behavior measures were conducted following the 30-day supplementation period, which included spatial learning, memory and an anxiety index. Hippocampal expressions of BDNF, NPY, glial fibrillary acidic protein, NF-κB p50 and p65 subunits, TNFα and cyclooxygenase-2 were also analyzed.

**RESULTS:** Learning ability was reduced (p=0.001) and anxiety index higher (p=0.001) in older compared to young rats. Similarly, BDNF and NPY expressions were reduced, and all inflammatory markers were elevated (p's<0.05) in the older animals. β-alanine increased BDNF expressions in the CA1 (p=0.003) and CA3 (p<0.001) subregions of the hippocampus. BDNF expression for YBA was also significantly greater than YC in CA3. Learning for young animals fed β-alanine was significantly better than all other groups. Significant reductions in anxiety were noted in both older and younger rats fed β-alanine compared to age-matched controls.

**CONCLUSIONS:** Results indicated that β-alanine ingestion in both young and older rats was effective in attenuating anxiety and augmenting BDNF expression in the hippocampus.

**536 Board #2 May 29 1:00 PM - 3:00 PM  
The Effects of Two Multi-Ingredient Pre-Workout Supplements on Endurance Capacity and Anaerobic Cycling Performance**

Meaghan E. Beckner<sup>1</sup>, Brian J. Martin<sup>1</sup>, Alexis A. Pihoker<sup>1</sup>, Matthew E. Darnell<sup>1</sup>, Alicia L. Kjellsen<sup>1</sup>, Paul J. Arciero, FACSM<sup>2</sup>, Mita T. Lovalekar<sup>1</sup>, Kim Beals<sup>1</sup>, Shawn D. Flanagan<sup>1</sup>, Bradley C. Nindl, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Skidmore College, Saratoga, NY.  
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Reported Relationships: M.E. Beckner: Industry contracted research; Isagenix International LLC.

Multi-ingredient pre-workout supplements (MIPS) have become an increasingly popular ergogenic aid among fitness enthusiasts. Previous research has primarily focused on the effectiveness of individual ingredients, rather than the combination. **PURPOSE:** To examine the effectiveness of two MIPS, one with beta-alanine and caffeine (BAC) and one without (NBAC), vs. placebo (PLA) on anaerobic performance and endurance capacity. **METHODS:** Twenty-eight exercise-trained individuals (15 men, 13 women, 24.3 ± 4.9 years, 173.6 ± 9.2 cm, 74.7 ± 15.5 kg) participated in a randomized, counterbalanced, double-blind, placebo controlled cross-over study to assess anaerobic power and capacity via Wingate (WAnT<sub>AP</sub> and WAnT<sub>AC</sub>), and aerobic endurance via cycle VO<sub>2peak</sub>. On three separate occasions (3-7 days between trials) subjects completed vertical jump (VJ), 30-second Wingate test and VO<sub>2peak</sub> test 30 minutes after ingestion of BAC, NBAC, or PLA. WAnT<sub>AP</sub> and WAnT<sub>AC</sub> were calculated as the peak and average power relative to body mass, respectively. Following a 10 minute walking recovery, subjects completed the cycle VO<sub>2peak</sub> test. Blood lactate was collected within 5 minutes post WAnT (BLA<sub>WAnT</sub>), and VO<sub>2peak</sub> (BLA<sub>VO2</sub>). Following tests for normality, outcome variables were compared between supplements using one-way repeated measures ANOVA or Friedman test (alpha=0.05) and Bonferroni adjusted pairwise comparisons as appropriate. **RESULTS:** There was a significant

effect of treatment on WAnT<sub>AP</sub> (p=0.016). WAnT<sub>AP</sub> was higher in BAC (10.9 ± 1.4 W/kg) and NBAC (10.8 ± 1.2 W/kg) compared to PLA (10.5 ± 1.2 W/kg) (p = 0.018 and p = 0.014, respectively). WAnT<sub>AC</sub> was significantly different across supplements (p=.043), but post hoc pairwise comparisons were not significant. BLA<sub>WAnT</sub> was higher with BAC (17.7 ± 3.5 mmol) and NBAC (17.4 ± 3.2 mmol) compared to PLA (15.3 ± 3.3 mmol) (p = 0.028 and p = 0.033, respectively). BLA<sub>VO2</sub> was higher with BAC (12.7 ± 5.9 mmol) compared to NBAC (9.9 ± 2.4 mmol, p < 0.001) and PLA (9.7 ± 2.8 mmol, p < 0.001). No significant differences were observed in VO<sub>2peak</sub> or VJ. **CONCLUSION:** MIPS demonstrate the potential to augment production of anaerobic power during a Wingate cycle test, accompanied by higher blood lactate accumulation. Improvements may be less apparent in vertical jump type movements or prolonged endurance exercise.

**537 Board #3 May 29 1:00 PM - 3:00 PM  
Acute Capsaicin Supplementation Improves 400 and 3000 Meters Running Time-trial Performance in a Distance-dependent Way**

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(No relevant relationships reported)

Ergogenic effect of capsaicin has been shown in middle-distance time trial (1500 meters) but not in repeated maximal sprints indicating the need of explore exercises with different metabolic demands. **PURPOSE:** The purpose of this study was to investigate the acute effect of capsaicin supplementation on short (400 m) and middle distance (3000 m) running time-trial performance, maximum heart rate and rate of perceived exertion in physically active adults. **METHODS:** Twelve physically active men (age = 28.6 ± 5.4 y) completed four randomized, double-blind trials: Capsaicin condition (12 mg) or a placebo condition. Forty-five minutes after supplement consumption, the participants performed a randomized 400- or 3000-meters running time trial. Time (in seconds) was recorded. Heart rate was analyzed at rest and immediately post-exercise, and the rate of perceived exertion (RPE) was collected immediately after exercise. The effect of capsaicin on time-trial performance, maximum heart rate and rate of perceived exertion during short (400 m) and middle distance (3000 m) running were analyzed via a Paired t test. In addition, the effect size (ES, 90% confidence interval [CI]) and magnitude-based inference statistics in the selected variables were calculated. **RESULTS:** For 400 m time-trial (Capsaicin = 66.4 ± 4.2 sec vs Placebo = 67.1 ± 4.8 sec, t = 2.250, p = 0.046) and 3000 m time-trial (Capsaicin = 876.2 ± 76.1 sec vs Placebo = 905.1 ± 73.3 sec, t = 2.848, p = 0.016) the time in seconds was significantly lesser in the capsaicin compared to placebo. Capsaicin showed a likely small improvement of performance in the 3000 m (d = 0.40, IC 90% = -0.60 to -0.14) and likely trivial in the 400 m (d = 0.13, IC 90% = -0.24 to -0.03). There was no statistically significant difference for the maximum heart rate (400m: p = 0.114; 3000m: p = 0.319) and RPE (400m: p = 0.615; 3000m: p = 0.438). **CONCLUSION:** In summary, acute capsaicin supplementation improved 400 m and 3000 m running time-trial performance in a distance-dependent way without modifying RPE and maximum heart rate in physically active adults. Furthermore, the present study showed a meaningful improvement in the performance during 3000 m running time-trial.

**538 Board #4 May 29 1:00 PM - 3:00 PM  
Acute Supplementation with Caffeine Improves Strength and Increases Metabolic Stress After a Maximal Strength Test**

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(No relevant relationships reported)

**BACKGROUND:** Caffeine has dose-dependent benefits on endurance, but the effect of different doses of caffeine on strength are inconclusive. **PURPOSE:** We aimed to analyze the acute effect of different doses of caffeine on strength and metabolic stress in recreationally trained men. **METHODS:** The effect of different doses of caffeine on strength, creatine phosphokinase (CPK), lactate dehydrogenase (LDH), and uric acid (AU) were assessed in 17 recreationally active young adults (19.2 ± 2.5 yrs of age), who performed three tests, separated by 14 days between trials. Day one involved collection of baseline data and brief explanation of the strength test protocol.

The protocol used to analyze the effect of different doses of caffeine on strength was examined by three different exercises (bench press (BP); deadlift (DL); and squats (SQ) following a 10 RM test protocol. Blood samples were collected immediately upon arrival to the laboratory, followed by consumption of a standardized isocaloric shake along with capsules containing different doses of caffeine: 6mg • kg<sup>-1</sup> (CF1), 8mg • kg<sup>-1</sup> (CF2), or placebo (CG). Another blood sample was collected 45 minutes after caffeine/placebo consumption and immediately after the execution of each exercise. The supplementation followed a double-blind, randomized model. RESULTS: The strength on BP, DL and SQ statistically improved between CG and CF2 (BP 98.5 ± 3.2 to 106.7 ± 2.7; DL 123.2 ± 6.5 to 138.3 ± 9.1; SQ 116.4 ± 7.9 to 135.1 ± 5.7 p=0.01); no other statistical differences were observed for strength outcomes. CPK statistically improved in CF2 in comparison to CF1 and CG one hour after strength tests (198.1 ± 10.1 U/L to 171.8 ± 7.4 U/L and 198.1 ± 10.1 U/L to 169.4 ± 11.2 U/L with p=0.001). The LDH levels were significantly higher in CF2 after the third exercise compared to CG and CF1 (229.1 ± 8.3 U/L to 179.3 ± 11.4 U/L and 229.1 ± 8.3 U/L to 229.1 ± 13.2 U/L with p=0.001). AU levels were significant higher in CF2 at 60 minutes posttest compared to GC (7.1 ± 0.8 mg/dL to 5.5 ± 0.6 mg/dL with p=0.01). CONCLUSION: An 8 mg • kg<sup>-1</sup> dosage of caffeine seems to be more effective than 6 mg • kg<sup>-1</sup> and placebo for improving strength levels on BP, DL and SQ. In addition, higher doses of caffeine increased LDH and uric acid concentrations compared to other treatments, which may imply a higher oxidative stress condition.

**539 Board #5 May 29 1:00 PM - 3:00 PM**  
**Omega-3 Supplementation Does Not Impair Torque and Power Improvements Following 8 Weeks Eccentric Quadriceps Training**

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Individuals who are unaccustomed to resistance exercise experience greater levels of exercise-induced muscle soreness, this can deter individuals from completing an exercise programme and improving strength and power. To alleviate the symptoms, they may consume Non-steroidal anti-inflammatory drugs (NSAIDs). Evidence suggests NSAIDs blunt muscle protein synthesis (Trappe *et al.*, 2002) and attenuate strength and muscle hypertrophic adaptations from resistance training (Lilja *et al.*, 2018), negating the effects of the exercise. Omega-3 supplementation has been suggested as an alternative to NSAIDs but the impact of Omega-3 on resistance training is inconclusive. PURPOSE: To determine the effects of omega-3 supplementation on eccentric training-induced increases in torque and power. METHODS: Nine physically active but non-resistance trained males (29 ± 9 years) were pair matched for isometric and eccentric quadriceps strength and randomly assigned, in a double-blind manner, to either omega-3 (5.1g/d) or olive oil (6.0g/d) supplementation for 3 weeks prior to and for 8 weeks during eccentric training. Performance measures of peak torque (isometric, concentric, eccentric) and jump height were conducted before and after 8 weeks of training. Supervised training consisted of maximal eccentric quadriceps contractions on an isokinetic dynamometer at 60°s<sup>-1</sup> through 80° range of motion. Two training sessions were conducted per week, with a minimum of 48 hours recovery between sessions. Number of repetitions and sets were increased over the 8 weeks. RESULTS: Following 8 weeks of eccentric training, peak eccentric torque significantly increased by 40 ± 56 Nm in omega-3 group and 51 ± 52 Nm in olive oil group, with no differences between groups (p > 0.05). Both groups also significantly increased their maximal isometric torque (p = 0.02); omega-3 group increased by 21 ± 10 Nm and olive oil group increased by 23 ± 30 Nm, with no differences between groups (p > 0.05). There was no main effect of training on peak concentric torque (p > 0.05). Jump height increased by 1.0 ± 1.9 cm in the omega-3 group and decreased by 0.03 ± 1.33 cm in the olive oil group, with no difference between groups (p > 0.05). CONCLUSIONS: Omega-3 supplementation does not impair or augment eccentric training-induced increases in torque or power in young males.

**540 Board #6 May 29 1:00 PM - 3:00 PM**  
**The Effect of Beetroot Supplementation on High Intensity Functional Training Performance**

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 (No relevant relationships reported)

Nitrate supplementation has been shown to improve athletic performance for short-duration, vigorous activity, as well as long-duration, aerobic activity. As an antioxidant, nitrates have the ability to reduce oxidative stress on exercising muscles, which is thought to help maintain energy metabolism, therefore, decreasing fatigue. PURPOSE: The purpose of this research was to explore the effects of beetroot nitrate supplementation on performance during a baseline CrossFit® workout. METHODS:

Twenty current CrossFit® participants (25±6.5 years, 175.17±8.1cm, 84.94±12.09kg), who attended CrossFit® classes at least 3 days per week for the past 3 months, performed a benchmark performance test, "Nancy" (5 rounds of 15 overhead squats with a 95lb (for males)/65lb (for females) barbell followed by a 400m run). In a randomized order, 72 hrs apart, participants were tested under a control session and once after consuming 2.4oz beetroot nitrate supplement, Beet It®, 2 hours prior to beginning the assigned workout. For both workouts, time to completion, pre- and post-exercise blood lactate levels, RPE, and pre-, during, and post-exercising heart rates were measured. RESULTS: No significant difference (p<0.05) between the control (15.50±3.21 min) and supplement (15.88±3.43 min) performance on time to completion. Post-exercise blood lactate (11.14±2.84 mmol/dL) was not significantly different (p< 0.05) than the control (12.00±2.53 mmol/dL). Additionally, mean RPE for BR supplement (14.78±2.50) was not significantly different (p < 0.05) than the control (14.92±2.12). CONCLUSIONS: The findings show no improvement in performance following nitrate supplementation. These findings may have been caused by the duration and intensity of the benchmark workout which included both anaerobic and aerobic components, unlike previous research that found relationships between beetroot nitrates and performance of aerobic and anaerobic exercises alone.

**541 Board #7 May 29 1:00 PM - 3:00 PM**  
**Potato Ingestion as an Effective Race Fuel to Improve Cycling Performance in Trained Cyclists**

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 (No relevant relationships reported)

Carbohydrate (CHO) ingestion is an established strategy to improve endurance performance. Race fuels should not only sustain performance, but also be readily digested and absorbed and replenish electrolytes. Potatoes are a cost-effective option that fulfills these criteria; however, their impact on endurance performance remains unexamined. PURPOSE: Compare the effects of potato purée (POT) ingestion during endurance cycling on subsequent performance versus commercial CHO gel (GEL) or a control (water, CTL). METHODS: Ten trained cyclists (28.2±5.6y; 70.1±7.4kg; 1.7±0.1m; 62.7±9.3mL/kg/min) consumed a standardized breakfast then performed a 2h cycling challenge (60-85%VO<sub>2max</sub>) followed by a time trial (6kJ/kg body mass) while consuming POT, GEL, or CTL in a randomized-crossover design. POT, GEL and CTL were administered with U-[<sup>13</sup>C]<sub>6</sub>glucose for an indirect estimate of gastric emptying rate. Repeated blood samples were collected. RESULTS: Time trial performance significantly improved (p<0.01) with POT (32.2±1.9min) and GEL (32.4±1.9min) versus CTL (38.6±1.9min); no difference between POT and GEL was observed (p=1.00). Post challenge blood glucose concentrations were lower (p<0.01) with CTL (77.9±4.2mg/dL) versus POT (95.5±4.4mg/dL) and GEL (95.6±4.4mg/dL). Similar results (p<0.001) were observed post time trial for blood glucose concentrations (CTL, 68.5±4.2 mg/dL; GEL, 97.5±4.2mg/dL; POT, 92.0±4.2mg/dL). No difference (p=0.88) in blood glucose concentrations were observed between GEL or POT conditions at both time points. Post challenge, blood lactate concentrations were higher (p=0.005) with GEL (5.1±0.4mmol/L) versus POT (3.4±0.4mmol/L). Blood U-[<sup>13</sup>C]<sub>6</sub>glucose enrichments were not different between GEL or POT (p>0.05). CONCLUSION: Potatoes serve as a viable alternative to commercial gels by sustaining performance and blood glucose concentrations during endurance cycling events in trained cyclists.

**542 Board #8 May 29 1:00 PM - 3:00 PM**  
**Post-exercise And Pre-sleep Protein-polyphenol Supplementation Improves Recovery Following Muscle-damaging Eccentric Exercise: Preliminary Findings.**

Tom S. O Jameson<sup>1</sup>, George F. Pavis<sup>1</sup>, Marlou L. Dirks<sup>1</sup>, Benjamin T. Wall<sup>1</sup>, Catherine Mikus<sup>2</sup>, Nima Alamdari<sup>2</sup>, Francis B. Stephens<sup>1</sup>. <sup>1</sup>University of Exeter, Exeter, United Kingdom. <sup>2</sup>Beachbody LLC, Santa Monica, CA.  
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 (No relevant relationships reported)

Purpose Eccentric contraction (EC) induced muscle damage is characterised by weakened force production, increased soreness and elevated plasma creatine kinase (CK). Recovery rate is likely to be dependent on muscle remodelling, which may be influenced by dietary protein and polyphenol availability. We investigated if consuming protein-polyphenol drinks post-exercise and before bed improved recovery of knee extensor function and reduced soreness following a bout of EC.

**Methods** In a randomised, parallel groups, placebo controlled double blind design, 18 healthy males and females ( $22 \pm 1$  y; BMI:  $24.0 \pm 0.9$  kg·m<sup>-2</sup> ( $\pm$  SEM)) consumed a controlled isocaloric diet (1.2 g·kg<sup>-1</sup> protein) for 7 days before and after a single bout of 300 maximal unilateral quadriceps EC, in combination with either post-exercise (20 g whey, casein and pea protein blend and 650 mg pomegranate extract) and pre-bed (20 g casein protein and 480 mg tart cherry extract) drinks (Beachbody LLC) (PRO;  $n = 9$ ; 4 females), or isocaloric maltodextrin placebos (PLA;  $n = 9$ ; 3 females). Total isokinetic work over 30 maximal knee extensions (TW), peak isometric torque (PT) and muscle soreness (visual analogue scale (VAS) and pressure pain threshold (PPT)) were measured relative to the contralateral control limb (%con) before and every 24 h for 7 d following EC, as was CK. Data were analysed using two-way ANOVAs.

**Results** EC caused a maximum decline in TW in PLA after 48 h to  $68 \pm 6$  %con ( $P < 0.001$ ) which remained below baseline until 120 h ( $P < 0.05$ ). Conversely, TW in PRO was reduced at 24 h only (to  $89 \pm 5$  %con;  $P < 0.05$ ) and was restored thereafter. PT decreased following EC ( $P < 0.001$ ) and was significantly lower in PLA compared with PRO at 48 h ( $69 \pm 5$  vs  $107 \pm 13$  %con, respectively) and 96 h ( $76 \pm 7$  vs  $110 \pm 14$  %con, respectively). Muscle soreness in both groups peaked within 72 h of EC ( $P < 0.05$ ), but *vastus medialis* PPT was attenuated at 72 h in PRO compared to PLA ( $102 \pm 3$  vs  $88 \pm 3$  %con, respectively;  $P < 0.05$ ). Plasma CK rose > 30-fold from 96 to 120 h ( $P < 0.01$ ), and was similar between groups ( $P > 0.05$ ).

**Conclusion** Consumption of commercially available post-exercise and before bed protein-polyphenol beverages accelerated recovery of skeletal muscle function following EC-induced muscle damage, potentially due to improved protein turnover and remodelling.

Supported by a Beachbody LLC (USA) grant.

## B-10 Thematic Poster - Hormones and Obesity

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-102B

**543 Chair:** Jody L. Clasey, FACSM. *University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

**544 Board #1** May 29 1:00 PM - 3:00 PM

### Post Meal Hypoglycemia With and Without Exercise in Non-Obese and Obese Individuals.

Jay W. Porter<sup>1</sup>, Ryan Pettit-Mee<sup>1</sup>, Sean Ready<sup>1</sup>, Nathan C. Winn PhD<sup>1</sup>, Anand Chockalingam MD<sup>2</sup>, Guido Lastra Gonzalez MD<sup>2</sup>, Jill A. Kanaley PhD, FACSM<sup>1</sup>. <sup>1</sup>University of Missouri, Columbia, MO. <sup>2</sup>University of Missouri School of Medicine, Columbia, MO. (Sponsor: Jill A Kanaley, FACSM)  
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(No relevant relationships reported)

**PURPOSE:** Hypoglycemia (<70 mg/dL) during exercise has been observed in some individuals when exercise is preceded by carbohydrate ingestion. Counterregulatory responses normally maintain plasma glucose concentrations to prevent hypoglycemic events in healthy adults. The degree to which hypoglycemia is observed across health statuses in response to an evening meal plus moderate intensity exercise is unknown. The purpose of this study was to examine glucose variability when a dinner meal was followed by moderate exercise in lean and obese individuals, and to establish if transient hypoglycemia occurs during exercise at a time of day when glucose tolerance is poorer. **METHODS:** Obese (OB) and non-OB adults completed 2 study conditions: dinner meal only (NOEX) and meal + exercise (EX) 2 h post meal. Blood samples were collected prior to the meal and for 5 h post meal for blood glucose (BG). The meal contained 10 kcal/kg (40% CHO, 35% FAT, 25% PRO). EX was 45 minutes of 55% of VO<sub>2peak</sub>. RM ANOVA was utilized for analyses. **RESULTS:** 21 adults (5 Male, 16 Female) completed both conditions. Groups consisted of 8 Non-OB and 13 OB. Peak BG conc. was similar between groups and conditions (Non-OB: NOEX  $168.6 \pm 9.8$ , EX  $153.9 \pm 10.2$  mg/dL; OB: NOEX  $158.3 \pm 7.7$ , EX  $166.2 \pm 8.0$  mg/dL). BG nadir was different by group ( $p = 0.015$ ) and condition ( $p < 0.001$ ) (Non-OB: NOEX  $58.0 \pm 3.7$ , EX  $44.3 \pm 3.0$  mg/dL; OB: NOEX  $67.1 \pm 2.9$ , EX  $55.9 \pm 2.3$  mg/dL). Delta (peak-nadir) was similar between groups and conditions (Non-OB: NOEX  $110.6 \pm 10.6$ , EX  $109.5 \pm 9.1$  mg/dL; OB: NOEX  $92.4 \pm 8.3$ , EX  $110.3 \pm 7.1$  mg/dL). Seven Non-OB and 8 OB experienced hypoglycemia during NOEX, while 8 Non-OB and 12 OB experienced hypoglycemia with EX. Non-OB subjects experienced hypoglycemia during NOEX from time 165-225 min. EX shifted this hypoglycemic period earlier by 30 min. OB experienced hypoglycemia during EX from time 150-165 min post meal consumption, overlapping with the exercise session. **CONCLUSIONS:** Very low BG levels are seen following a modest carbohydrate dinner meal in healthy and obese participants, suggesting a previously unappreciated response to exercise. All subjects

remained asymptomatic throughout hypoglycemic periods, alluding that many adults may unknowingly experience low BG values even when exercise begins 2 h post meal. **SUPPORT:** NIH RO1DK101-43-01A1 <!--EndFragment-->

**545 Board #2** May 29 1:00 PM - 3:00 PM  
**Population And Sex Differences In The Associations Between Igf-1, Protein Consumption, And Lean Mass**

Lee Weidauer, Tianna Beare, Teresa Binkley, Maggie Minett, Bonny Specker. *South Dakota State University, Brookings, SD.* (Sponsor: Dr. Matthew Vukovich, FACSM)

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(No relevant relationships reported)

**Purpose:** Protein intake and IGF1 concentrations are two factors that have been implicated as having a positive effect on lean mass (LM); however, the relationship of both protein intake and circulating IGF1 on LM is not well understood. The purpose of this study was to determine the contributions of IGF1 and protein intake on LM and to determine if these associations are similar in Hutterites (H) (self-sufficient, farming, Anabaptist group) and non-Hutterites (NH), as well as in males and females.

**Methods:** 307 adults (118 H and 54 NH females, 75 H and 60 NH males) aged 20-66 years had body composition measured using DXA, serum (fasted) IGF1 concentrations and protein intake (by FFQ). Correlations were used for bivariate analyses and multivariate modeling was used to determine whether relationships between LM and IGF1 and LM and protein intake were similar in both sexes and populations (sex-by-IGF1, and sex-by-protein, population-by-IGF1, population-by-protein interactions) controlling for age, height, and fat mass.

**Results:** IGF1 correlated with protein intake in NH ( $r = 0.27$ ,  $p = 0.004$ ), but not in H ( $r = -0.01$ ,  $p = 0.9$ ); there was no correlation between circulating IGF1 and protein consumption in females ( $r = 0.12$ ,  $p = 0.1$ ) or males ( $r = 0.01$ ,  $p = 0.1$ ). LM was not correlated with IGF1 in NH ( $r = 0.09$ ,  $p = 0.3$ ) or H ( $r = -0.11$ ,  $p = 0.1$ ); LM was correlated with IGF1 in males ( $r = 0.21$ ,  $p = 0.02$ ) but not females ( $r = 0.02$ ,  $p = 0.8$ ). LM was positively correlated with protein intake in NH ( $r = 0.44$ ,  $p < 0.01$ ) and H ( $r = 0.44$ ,  $p < 0.01$ ), and in males ( $r = 0.33$ ,  $p < 0.01$ ) but not females ( $r = 0.02$ ,  $p = 0.8$ ). Greater LM was not associated with age ( $\beta = -0.04$ ,  $p = 0.09$ ), but was associated with greater fat mass ( $\beta = 0.51$ ,  $p < 0.001$ ), being taller ( $\beta = 0.49$ ,  $p < 0.001$ ), being male ( $\beta = 15.4$ ,  $p < 0.001$ ), and consuming more protein ( $\beta = 0.02$ ,  $p = 0.02$ ). None of the interactions were significant indicating that the relationships between LM and IGF1 and protein intake are similar for both populations and sexes.

**Conclusions:** Results from this study indicate that protein intake is an important factor in maintaining LM and is independent of IGF1 concentrations. These data support previous studies indicating that manipulating IGF1 concentrations to improve LM may be ineffective and that individuals attempting to gain LM should focus on ensuring that adequate protein is being consumed.

**546 Board #3** May 29 1:00 PM - 3:00 PM  
**Changes in Metabolic Hormones and Their Associations With Cancer-Related Fatigue in Cancer Survivors**

Po-Ju Lin<sup>1</sup>, Michelle C. Janelins<sup>1</sup>, Eva Culakova<sup>1</sup>, Julia E. Inglis<sup>1</sup>, Ian R. Kleckner<sup>1</sup>, Luke J. Peppone<sup>1</sup>, Charles E. Heckler<sup>1</sup>, Laura J. P. Feldman<sup>2</sup>, Joan Long<sup>3</sup>, Jeremy Deutsch<sup>4</sup>, Karen M. Mustian<sup>1</sup>. <sup>1</sup>University of Rochester Medical Center, Rochester, NY. <sup>2</sup>Metro Minnesota Community Oncology Research Consortium, St. Louis Park, MN. <sup>3</sup>Cancer Research Consortium of West Michigan NCORP, Grand Rapids, MI. <sup>4</sup>Wichita NCORP, Wichita, KS.

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(No relevant relationships reported)

Cancer-related fatigue (CRF) is the most common toxicity experienced by patients with cancer, particularly in patients with metabolic syndrome. Metabolic syndrome is associated with dysregulated metabolic hormones such as decreased ghrelin and increased insulin levels. Whether changes in serum metabolic hormones are associated with changes in CRF is unknown.

**PURPOSE:** To assess changes in serum metabolic hormones and their associations with CRF in cancer survivors after 4 weeks of behavioral interventions.

**METHODS:** We selected 36 cancer survivors (age  $56.4 \pm 1.87$  years) based on changes in CRF, regardless of intervention assignments, from an ongoing randomized controlled trial. Twenty-four survivors reported having no change/improved CRF (IMPV) and 12 survivors reported having worsened CRF (DECL). CRF and serum metabolic hormones (ghrelin, insulin, glucagon, leptin, PP) were assessed by Multidimensional Fatigue Symptom Inventory (MFSI) and a Luminex Multiplex Immunoassay, respectively, at pre- and post- intervention. T-tests and ANCOVAs were used to evaluate within- and between-group differences, respectively. Spearman's rank correlation was used to examine the associations of metabolic hormones with MFSI.

**RESULTS:** Changes in ghrelin were significantly different between groups ( $p = 0.02$ ): serum ghrelin level was increased in the IMPV group ( $11.8 \pm 2.19$  pg/mL) but it was

decreased in the DECL group ( $-8.0 \pm 5.93$  pg/mL) from pre- to post-intervention. Changes in MFSI were negatively correlated with changes in serum ghrelin levels ( $r = -0.32$ ,  $p = 0.06$ ), indicating that increased serum ghrelin level is associated with improvements in CRF. No within- or between-group differences in other tested metabolic hormones nor their associations of CRF were found.

**CONCLUSIONS:** These exploratory findings suggest a potential association between increases in serum ghrelin and improvements in CRF among cancer survivors. Studies with larger sample sizes are needed to further establish the associations of metabolic hormones and CRF.

Supported by NCI UGCA 189961, R25 CA102618.

547 Board #4 May 29 1:00 PM - 3:00 PM

### Improved Immune Profile Accompanying Increased Fitness Following an Exercise Intervention Among Overweight Older Women

Emily C. LaVoy<sup>1</sup>, Mahmoud T. Elzayat<sup>1</sup>, Maria Cardenas<sup>2</sup>, Michael M. Levitt<sup>3</sup>, Carmen A. Cook<sup>3</sup>, Melody D. Phillips, FACSM<sup>3</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>Emory University, Atlanta, GA. <sup>3</sup>Texas Christian University, Fort Worth, TX.

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(No relevant relationships reported)

Aging is associated with a decrease in naïve T cells and an increase in late differentiated T cells, an immune profile associated with increased inflammation and decreased protection against illness. Physical fitness appears to delay the appearance of the aging immune profile, but this has only been examined cross-sectionally.

**PURPOSE:** To assess longitudinally whether increasing fitness can increase naïve T cells and decrease late differentiated T cells in older overweight women. **METHODS:** 16 women (63±5 years) completed 36 exercise training sessions over 14 weeks.

Training occurred 3 days a week and consisted of supervised strength training and walking. 9 women (66±5 years) participating in a health education class meeting 24 times over the same period served as controls. Blood was sampled before and after the interventions and analyzed by flow cytometry. Changes in fitness and lymphocyte subpopulations were assessed by maximum likelihood linear mixed models.

**RESULTS:** The training group decreased gynoid fat (pre:  $51 \pm 0.8\%$ , post:  $49.2 \pm 0.8\%$ ;  $p < 0.05$ ) and increased strength (8RM leg press pre:  $145.6 \pm 11$  lbs, post:  $200 \pm 12$  lbs,  $p < 0.001$ ; 8 RM chest press pre:  $60 \pm 3$  lbs, post:  $84.4 \pm 3.7$  lbs,  $p < 0.001$ ); there was a trend for increased VO<sub>2</sub>max (pre:  $21.6 \pm .97$  ml/kg/min, post:  $24.1 \pm 1.3$  ml/kg/min;  $p = 0.62$ ). No differences in body composition or performance were observed in controls (all  $p > 0.05$ ). The training group increased the proportion of naïve (CD45RA+CD62L+) CD8 T cells (pre:  $23.9 \pm 2.9\%$ , post:  $27.8 \pm 3.2\%$ ,  $p < 0.05$ ) and T memory stem cells (pre:  $3.3 \pm 0.7\%$ , post:  $4.4 \pm 0.7\%$ ,  $p < 0.05$ ). No changes were observed in high differentiated T cell subsets, or in any immune phenotype of controls (all  $p > 0.05$ ).

**CONCLUSIONS:** Improvements in fitness following a supervised 14 week resistance and aerobic exercise intervention amongst overweight older women is accompanied by an increase in naïve and memory stem CD8 T cells. This suggests the immune system is modifiable with fitness, even at older age.

548 Board #5 May 29 1:00 PM - 3:00 PM

### Obesity, Physical Activity, And Sedentary Behavior, Not Diet, Predict Low Testosterone Status in Men

Trevor J. Dufner<sup>1</sup>, John S. Fitzgerald<sup>1</sup>, James N. Roemmich, FACSM<sup>2</sup>, Patrick B. Wilson<sup>3</sup>. <sup>1</sup>University of North Dakota, Grand Forks, ND. <sup>2</sup>Grand Forks Human Nutrition Research Center, USDA, Grand Forks, ND. <sup>3</sup>Old Dominion University, Norfolk, VA. (Sponsor: James N Roemmich, FACSM)

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(No relevant relationships reported)

Hypogonadism (serum testosterone concentration  $< 300$  ng·dL<sup>-1</sup>) has been associated with poor health in men. The current treatment for hypogonadism—testosterone replacement therapy—is expensive, may produce adverse effects and its long-term safety is unknown.

**Purpose:** To identify nutritional and physical activity predictors of low serum testosterone status in men using the National Health and Nutrition Examination Survey (NHANES), a nationally representative sample of the United States.

**Methods:** A secondary analysis of cross-sectional data from 2011-2012 NHANES was carried out to examine the associations between weight status, dietary intakes, physical activity and serum testosterone concentrations; 1,933 adult men were included in the study after exclusion for missing and unreliable data. Nutrient intakes from foods and supplements were assessed using 24-hour recall via the 5-step Automated Multiple Pass Method. Participants self-reported typical weekly physical activity and daily sitting time. Body mass index (BMI), age, race, relationship status, education, and smoking behavior and serum testosterone concentration were assessed during

mobile exam center visits. Logistic regression was used to identify predictors of low testosterone status (lowest quartile;  $204 \pm 4$  ng·dL<sup>-1</sup>). Sampling weights were utilized in the analyses to account for the complex sampling design.

**Results:** Overweight and obese men had greater odds (2.10, 95% CI 1.17-3.78; 5.23, 95% CI 3.12-8.76) of low testosterone. Men reporting any vigorous physical activity, either recreational or work-related, had lower odds (0.42, 95% CI 0.28-0.64; 0.56, 95% CI 0.33-0.98) of low testosterone, whereas sitting time was associated with greater odds (1.05, 95% CI 1.02-1.08). None of the dietary variables were statistically significant predictors of low testosterone status in the logistic regression model (all  $p > 0.153$ ).

**Conclusion:** BMI, vigorous physical activity and sitting time were independently associated with low testosterone status and appear to be candidates for lifestyle interventions. Future research should examine the effectiveness of weight loss interventions employing dietary, sedentary behavior, and physical activity modification to increase testosterone in overweight/obese men with low testosterone status.

549 Board #6 May 29 1:00 PM - 3:00 PM

### Energy Availability is Predictive of LH Pulse Frequency Across a 3-month Diet and Exercise Trial

Kristen J. Koltun, Mary Jane De Souza, FACSM, Nancy I. Williams, FACSM. Penn State University, University Park, PA.

(No relevant relationships reported)

Exercising women are at risk for low energy availability (EA). Restricting EA to 20 kcal/kgLBM/d for 5 days reduces LH pulse frequency, but it's unclear how low EA over a longer duration affects LH. Slowed LH pulse frequency reflects reproductive axis suppression and is linked to menstrual disturbances. We showed that daily EA over a 3 month diet and exercise intervention predicted the frequency of menstrual disturbances, but the relation between low EA and upstream LH pulse dynamics is unclear. **PURPOSE:** To determine if reductions in EA due to diet and exercise over a prolonged period are related to LH pulse frequency in premenopausal, previously sedentary women. **METHODS:** This was a randomized controlled trial consisting of a 3 month controlled diet and supervised exercise program (5d/wk) leading to moderate weight loss. EA was calculated by measured energy intake (kcal) and recorded exercise energy expenditure (kcal) normalized to fat free mass (kgFFM). EA was measured daily and averaged during baseline and each of 3 intervention menstrual cycles. Blood samples were obtained via intravenous catheter every 10 min for 24hr in the early follicular phase prior to the intervention ( $n=16$ ) and after 3 months of diet and exercise ( $n=14$ ). Samples were assayed for LH via Immulite. LH pulse dynamics were assessed by Cluster. Paired t-tests compared Pre-Post differences. A linear mixed model was used to determine if EA predicts LH pulse frequency in the same or subsequent menstrual cycle.

**RESULTS:** Subjects were  $20 \pm 1$  yrs old,  $165 \pm 1$  cm tall, and weighed  $58.4 \pm 1.1$  kg. Average weight loss was  $3.1 \pm 0.6$  kg ( $p < 0.001$ ). LH pulse frequency was  $0.81 \pm 0.06$  pulses/hr prior to the intervention and  $0.63 \pm 0.08$  pulses/hr after ( $p = 0.047$ ). Average EA in the Pre cycle was  $38.6 \pm 1.8$  kcal/kgFFM/d and  $27.9 \pm 2.1$  kcal/kgFFM/d during Post ( $p < 0.001$ ). EA measured within a menstrual cycle was a significant positive predictor ( $p = 0.011$ ) of LH pulse frequency in the same or subsequent cycle. Specifically, for every 1 kcal/kgFFM/d increase in EA, LH pulse frequency increases by 0.014 pulses/hr. **CONCLUSIONS:** EA is a positive predictor of LH pulse frequency within the same or subsequent menstrual cycle. To prevent suppression of the reproductive axis, EA should be maintained at optimal levels, as a reduction in EA from 38 to 28 kcal/kgFFM/d suppresses LH pulse frequency by 19%.



**B-11 Free Communication/Slide - Resistance Training**

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-202C

**550 Chair:** Kevin R. Ford, FACSM. *High Point University, High Point, NC.*

(No relevant relationships reported)

**551 May 29 1:00 PM - 1:15 PM Ground Reaction Force Characteristics In Power Cleans With And Without The Double Knee Bend Technique**

Alexander M. Carnall, Jake A. Melaro, Douglas W. Powell, FACSM. *University of Memphis, Memphis, TN.* (Sponsor: Douglas W Powell, FACSM)

(No relevant relationships reported)

**INTRODUCTION:** Muscular power (i.e. muscular force x shortening velocity) is arguably the most important physical quality an athlete can possess. Many athletes use power cleans to improve muscular power but are not taught to use a double knee bend (DKB). The DKB is used by competitive weightlifters to increase muscular power produced in the second pull of the power clean exercise. Thus, athletes using power cleans to improve muscular power without using the DKB may not experience optimal benefit from the exercise. **PURPOSE:** To determine differences in ground reaction force characteristics between a power clean from the floor both with, and without, the use of a DKB in athletes with weightlifting experience. **METHODS:** Six participants with weightlifting experience each performed three power cleans with and without a DKB at 80% of their self-reported one-repetition maximum. Ground reaction forces (GRFs) were captured using two force platforms (1200Hz). Commercially available biomechanical analysis software was used to calculate concentric impulse ( $IMP_{CON}$ ), peak vertical ground reaction force ( $VGRF_{PEAK}$ ), and rate of force development (RFD) in the second pull for each trial. Paired samples t-tests were used to compare dependent variables in each condition: DKB and NO DKB. Cohen's *d* estimates of effects size were used to determine meaningful differences. **RESULTS:** RFD was greater in the second pull of the power clean when a DKB was used ( $p < .001$ ,  $d = 2.25$ ; DKB:  $6922 \pm 1664$ ; NO DKB:  $4710 \pm 277$  N/s).  $IMP_{CON}$  was lower in the DKB condition ( $p < .001$ ,  $d = 1.09$ ; DKB:  $146 \pm 28.8$  N\*s; NO DKB:  $174 \pm 36.6$  N\*s), and no differences were observed in  $VGRF_{PEAK}$  ( $p = 0.375$ ,  $d = 0.15$ ; DKB:  $1607 \pm 221$  N; NO DKB:  $1582 \pm 169$  N). **CONCLUSIONS:** Although no differences were observed in  $VGRF_{PEAK}$  and  $IMP_{CON}$  was reduced, RFD was significantly greater in the second pull with the DKB. These data suggest that DKB may enhance the training stimulus by enabling the athlete to produce comparable peak forces in shorter time periods by increasing muscular shortening velocity. This may be due to a positional optimization of muscular length-tension properties in the hip, knee, and ankle extensor musculature uniquely offered by utilizing a DKB technique.

**552 May 29 1:15 PM - 1:30 PM Modulation Of Corticospinal Excitability and Short Intracortical Inhibition During Different Levels Of Voluntary Contraction In Untrained And Chronically Resistance Trained Individuals.**

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(No relevant relationships reported)

**PURPOSE:** To investigate central nervous system (CNS) excitability modulation in chronic resistance trained and untrained participants by assessing 1) short intracortical inhibition (SICI) and 2) motor evoked potential (MEP) of the biceps brachii, during different voluntary contraction intensities.

**METHODS:** 12 participants, 6 untrained ( $30 \pm 1.4$  years) and 6 chronic resistance trained ( $29.6 \pm 7.5$  years), completed one experimental session during which three blocks of contractions were performed. Each block included 10 brief (7s) elbow flexors isometric contractions at the intensity of 15, 25 or 40 % of maximum voluntary contraction (MVC). Prior to the contractions: 1) elbow flexors MVC, 2) maximal compound muscle action potential (Mmax) in the biceps brachii during a 5% MVC elbow flexion contraction and 3) active motor threshold at the three different contraction intensities were recorded. A total of 60 MEPs, evoked by transcranial magnetic stimulation (TMS), were assessed from biceps brachii muscle of the dominant arm during the three different contraction intensities.

**RESULTS:** 1) MVC force of the chronic resistance trained group was 33 % higher ( $p \leq -0.001$ ) than the untrained group. 2) The chronic resistance trained group had lower AMTs at all contraction intensities ( $p \leq -0.03$ ,  $p \leq -0.01$ ,  $p \leq -0.08$  for the 15 %, 25 % and 40 % of MVC, respectively) compared to the untrained group. 3) MEP amplitude (normalized to Mmax) did not differ between the two groups. 4) During 25 % of MVC, the untrained group exhibited decreased SICI in comparison to the chronic resistance trained group (SICI:  $78 \pm 13\%$  vs.  $97 \pm 9\%$  of test pulse;  $p \leq -0.01$ , respectively). During 40 % of MVC, the untrained group also exhibited decreased SICI in comparison to the chronic resistance trained group (SICI:  $86 \pm 14\%$  vs.  $102 \pm 11\%$  of the test pulse;  $p \leq -0.03$ , respectively). SICI did not differ between groups at 15 % MVC ( $p \leq -0.30$ ).

**CONCLUSION:** Based on the results, chronic resistance training significantly reduces SICI at stronger contraction intensities compared to no training. The significant reduction in inhibitory outputs suggest the presence of an adaptive process of facilitatory network activation, which can cancel out the SICI, to increase corticomotor drive to the exercised muscle following a long period of resistance training.

**553 May 29 1:30 PM - 1:45 PM Patellofemoral Joint Loading While Squatting To Different Depths Using High and Low Bar Positions**

William Goodman, Christopher Casillas, James Becker. *Montana State University, Bozeman, MT.*

(No relevant relationships reported)

In high bar (HB) squats, the bar is placed just inferior to C7 while in low bar (LB) squats the bar is placed across the inferior scapular spine. These different positions change the moment arm of the weight relative to the knee joint, and thus potentially alter knee extensor moments and patellofemoral (PF) joint loading. **PURPOSE:** Examine how knee extensor moments (pKEM) and PF joint reaction forces (PFJRF) and stresses (PFJS) change when squatting to above parallel (AP), parallel (P), and below parallel (BP) depths using HB and LB positions. **METHODS:** 20 individuals (sex: 10M/10F; age:  $23.0 \pm 2.8$  years) participated in this study. On day one, a one repetition maximum (1RM) was measured. On day 2 participants performed squats using 70% 1RM to AP, P, and BP depths using both HB and LB. Motion capture and two force plates were used to record whole body kinematics and ground reaction forces, respectively. pKEMs were calculated using inverse dynamics while PFJRF and PFJS were calculated using a model incorporating knee angles, extensor moments, and estimates of PF contact area. Effects of depth and bar position were evaluated using 3x2 repeated measures ANOVAs. **RESULTS:** For pKEMs, there was a main effect of depth ( $p = .047$ ), with pKEMs being lower at P than either AP ( $p = .044$ ) or BP ( $p = .030$ ) depths. For PFJRF there was a significant depth by load interaction ( $p = .024$ ). For both HB and LB positions, PFJRF was lower at BP compared to the AP ( $p = .001$ ) depths. However, when using LB position PFJRF was also lower at P than AP ( $p < .001$ ) depth. There were no differences in PFJS between depths ( $p = .675$ ) or bar positions ( $p = .191$ ). **CONCLUSION:** Individuals can squat to parallel or deep depths with their preference of bar position without increasing PFJS or PFJRF. However, squatting to parallel may be preferred as pKEM are lowest at this depth.

Table 1: Peak Knee Extensor Moments (pKEM), Peak Patellofemoral Joint Reaction Force (PFJRF), Peak Patellofemoral Joint Stress

	pKEM (Nm)		PFJRF (BW)		PFJS (MPa)	
	HB	LB	HB	LB	HB	LB
AP	100.9 ± 40.5*	102.8 ± 41.9*	17.9 ± 4.2*	18.9 ± 4.4*	7.9 ± 8.5	8.4 ± 5.6
P	96.6 ± 38.3*	96.5 ± 37.9*	17.1 ± 4.7	16.5 ± 4.2	10.4 ± 9.9	7.9 ± 9.6
BP	101.8 ± 41.8*	103.3 ± 45.5*	18.4 ± 4.3*	15.9 ± 4.4*	8.8 ± 10.4	7.0 ± 5.9

\*Indicates that pKEMs were significantly different. †Indicates that PFJRF were significantly different. ‡Indicates that LB PFJRF were significantly different. §Indicates that at AP bar positions were significantly different. All significance levels were  $\alpha = 0.05$ .

**554 May 29 1:45 PM - 2:00 PM Strength Training Effects on Force Production and Drive Distance in Female Golfers: A Pilot Study**

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(No relevant relationships reported)

Strength training (ST) by golfers is a relatively recent phenomena, gaining popularity only over the last two decades. Thus, little quantitative research exists on its benefits. Previous research provides support for golf performance gains, primarily club head speed, following ST. It has also been reported that vertical jump height is positively correlated to vertical thrust during a golf swing with a driver, which positively impacts carry distance of the golf ball. However, there is a paucity of research describing the vertical ground reaction force (vGRF) generated during a golf swing and the relationship of said force to the carry distance of the golf ball.

**Purpose:** 1) To evaluate if there is a relationship between vGRF produced and drive distance (DD) of the golf ball during a swing with a driver. 2) To determine if an

8-week ST program geared toward increasing vertical jump height affects vGRF and DD. 3) To evaluate the methodology for feasibility with a larger, more diverse population in future studies.

**Methods:** Participants were six female athletes ( $n=6$ ) from a NCAA Division III varsity golf team ( $19.3 \pm 1.4$  years). Data was collected before and after an 8-week ST program focused on increasing vertical jump height. Participants completed two 45-minute ST sessions/week under the supervision of a certified strength and conditioning coach. Exercises included squats, broad jumps, box jumps, lunges with and without rotations, and sprints. vGRF was measured on force plates during the downswing phase of the golf swing with a driver and DD was measured with a golf launch monitor. Vertical jump height and measures of lower extremity and core strength were also collected.

**Results:** The correlation between vGRF and DD was weak ( $r = -0.03$ ,  $p = 0.74$ ). There were no significant differences between pre and post vGRF ( $25.3 \text{ N} \pm 32.8 \text{ N}$ ,  $p = 0.12$ ) nor DD ( $-3.7 \text{ m} \pm 11.6 \text{ m}$ ,  $p = 0.47$ ) within subjects.

**Conclusion:** The golf swing is an intricate maneuver with numerous factors impacting ball flight and distance. It is likely that other factors such as club head speed and angle of attack have a greater influence on DD than vGRF. Further research with larger and more diverse populations may determine whether or not significant relationships exist between ST, vGRF production, and golf swing performance. The methodology has been deemed feasible for future studies.

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### Poor Pelvic Control During A Knee Lift Test Is Associated With Increased Risk Of Knee Injuries

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(No relevant relationships reported)

**PURPOSE:** To investigate whether deficits in stance leg, hip and pelvic stability during a standing knee lift test are associated with increased risk of non-contact knee and ankle injuries in youth team sports.

**METHODS:** At baseline, 263 basketball and floorball players (age range 12–21 y.) participated in a standing knee lift test using 3-dimensional motion analysis. The test was a modified version of the Trendelenburg test to assess stance leg and hip stability. Two trials per leg were recorded from each participant and mean value was used in the analysis. The biomechanical variables calculated were peak anterior pelvic tilt angle (APT) and peak lateral pelvic drop angle (LPD). The APT and LPD were categorized into two groups using the median of the cohort: low group (values less than median value) and high group (values larger than median). All new non-contact knee and ankle injuries, as well as match and training exposure, were then recorded for 12 months. Cox regression models were used to calculate hazard ratios (HRs) and 95% CIs.

**RESULTS:** A total of 16 new non-contact knee injuries (of which eight were ACL ruptures, all affecting female players) and 36 new non-contact ankle injuries were registered during the study period. Athletes displaying high lateral pelvic drop angles were at increased risk of knee injuries (adjusted HR for high versus low group 4.22; 95% CI 1.34–13.3). A borderline significant ( $p=0.05$ ) association was found between high lateral pelvic drop angles and ACL injury risk in female athletes (adjusted HR for high versus low group 8.14; 95% CI 0.97–68.6). No potential ankle injury risk factors were found. A receiver operating characteristic curve analysis for the LPD and knee injuries showed an area under the curve of 0.60, which indicates poor combined sensitivity and specificity of the test.

**CONCLUSIONS:** Poor pelvic control, with increased lateral pelvic drop, is associated with increased risk of non-contact knee injuries among young team sport players. However, the knee lift test cannot predict non-contact knee injuries in youth team sports.

Supported by the Finnish Ministry of Education and Culture, and Competitive State Research Financing of the Expert Responsibility area of Tampere University Hospital (Grant 9S047).

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### Effects of Foot Instability Variations on Muscle Activation during Front Plank Exercise

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(No relevant relationships reported)

Adding instability is a common method of increasing the difficulty of an exercise. Front plank exercise is often performed with various instability types and levels; however, how induced instability influences muscle activation during front plank is not well-understood.

**PURPOSE:** To examine how 4 different foot stability variations of front plank influence activation of 5 different muscles.

**METHODS:** 19 physically active, healthy individuals (8 males, 11 females; age  $39 \pm 16.0$  years; height  $1.68 \pm 0.1 \text{ m}$ ; mass  $75 \pm 17.51 \text{ kg}$ ) performed each of 4 plank variations in a randomized order. The foot stability was modified by placing the feet: 1) on a level, stable floor (FLOOR); 2) on an elevated stable step (STEP); 3) in elevated suspension straps (SUSPEND); 4) on a rubber dome (DOME). STEP, SUSPEND and DOME were height-matched for foot placement. Electromyography of 5 muscles, rectus abdominis (RA), external oblique abdominis (EO), rectus femoris (RF), serratus anterior (SA) and erector spinae (ES) during front plank with 4 different foot stability conditions was examined and normalized as % maximal voluntary isometric contraction (%MVIC). Foot stability variation effect on normalized average muscle contraction of 5-second static plank trials was assessed using one-way repeated measure ANOVA and Friedman test for normally and non-normally distributed data respectively.

**RESULTS:** SUSPEND was associated with greater muscle activation than DOME in RF ( $43.2 \pm 25.8$  vs.  $32.9 \pm 25.9$  %MVIC),  $p < 0.05$ ) and in RA ( $39.5 \pm 18.2$  vs.  $30.3 \pm 18.5$  %MVIC,  $p < 0.05$ ). Compared to FLOOR, SUSPEND was associated with higher activation of SA ( $57.2 \pm 27.5$  vs.  $48.2 \pm 23.1$  %MVIC,  $p < 0.05$ ) and ES ( $8.9 \pm 4.3$  vs.  $7.5 \pm 3.4$  %MVIC,  $p < 0.05$ ).

**CONCLUSIONS:** Plank with suspended feet increased average activation of muscles used in the front plank. The use of RF and RA increased primarily due to foot instability induced by suspension, and the activation of SA and ES increased with combination of instability and increased weight distribution to the upper body.

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### Gender Comparisons of Muscle Activation Patterns Across Handle Types During Seated Row Exercise

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Muscular responses and performance during resistance exercise can be affected by handle design and wrist/forearm positioning. **PURPOSE:** To compare the electromyographic (EMG) responses during seated row exercise in the Biceps Brachii (BB), Latissimus Dorsi (LD), and Flexor Carpi Radialis (FCR), using a neutral forearm positioning (NF) handle versus a Wrist flexed positioning (WF) handle. **METHODS:** The protocol was performed on a cable machine by 10 males ( $21.6 \pm 1.2$  yrs) and 10 females ( $21.7 \pm 2$  yrs) with prior resistance training experience ( $5.0 \pm 2.5$  yrs). Participants completed a one-repetition maximal lift (1-RM) followed by one set at 85% 1-RM until failure, using both handle types in randomized order. Root mean square EMG ( $EMG_{RMS}$ ) from the BB, LD, and FCR were normalized to the 1-RM values. Two-way repeated measures ANOVA was used to analyze EMG differences for each muscle group between genders and handle types. **RESULTS:** The 1-RM lifts were significantly greater ( $p < 0.05$ ) with the WF handle ( $90.2 \pm 30.6 \text{ kg}$ ) versus the NF handle ( $87.8 \pm 30.4 \text{ kg}$ ). There were significant differences ( $p < 0.05$ ) between genders for the 1-RM lifts across both handle types. However, there were no significant differences between handles for the total number of repetitions completed (NF  $11.9 \pm 3.6$ ; WF  $11.2 \pm 2.4$ ). Although there was a trend ( $p < 0.07$ ) for BB EMG activity between the genders, there was no significant difference in the EMG amplitudes between the LD and FCR for either gender or handle type.

**CONCLUSION:** These findings showed significantly higher maximal lifts with the WF handle type, but non-significant EMG differences in the BB, LD and FCR between genders and across handle types. This indicates similar muscle activation patterns. The possible mechanisms for the 1RM differences may be related to actin and myosin overlap of the forearm flexors, ergonomic factors such as grip comfort and differences in handle contact surface area.

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### Modified Supine Bridge Alters Muscle Coordination Patterns

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Contributions of mono- and bi-articular hip extensor muscles while performing single leg supine bridge (SLB) and modified single supine bridge (mSLB) is not quite clear. To identify hip extensor muscles activation patterns among different unilateral-bridges, could be a key point for hip extensor strength and rehabilitation trainings. **PURPOSE:** To compare hip extensor muscles activation patterns during performing SLB and mSLB.

**METHODS:** We have recruited healthy collegiate students for the project. Participants signed an informed consent form before data collection. They have performed SLB and mSLB at a constant pace (~2s up and ~2s down). mSLB was performed unilaterally with the exercise leg placed up on a box of 40 cm in height. Surface electromyography (sEMG) of the right gluteus maximus (Gmax), biceps long head (BFL), and semitendinosus (STN) muscles was recorded using a wireless surface electromyography system. Peak RMS sEMG of each muscle during SLB define as 100% and used as the base of comparison with that of mSLB. On- and off-set of sEMG bursts threshold were defined as 10% of the peak value. One-tailed paired-test was used for statistic examination. Alpha value was set at 0.05.

**RESULTS:** The peak RMS of Gmax, BFL and STN sEMG while performing mSLB were 82.1±21.4, 141.5±36.4, and 155.0±2.5, respectively. The peak magnitude of the hamstring muscle activations were greater, although peak Gmax activity was lower ( $p<0.05$ ), while performing mSLB than that of SLB ( $p<0.05$ ). Muscle activation burst duration of BFL was 1.6±0.7s longer while performing mSLB than that of SLB ( $p<0.05$ ). Muscle activation burst durations of STN (3.82±0.58s) and Gmax (3.53±1.72s) were (0.42±0.50s) and Gmax (0.47±0.44s) shorter than that of mSLB ( $p<0.05$ ).

**CONCLUSIONS:** Comparing to SLB, mSLB increased bi-articular hip extensor (BFL and ST) muscle activation level while reduced mono-hip extensor (Gmax) activation level accompanied by prolonged BFL activities and shortened Gmax/St activation durations.

## B-12 Free Communication/Slide - Skeletal Muscle Basic Science

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-306

**559 Chair:** Graham R. McGinnis. *University of Las Vegas Nevada, NV.*

(No relevant relationships reported)

## 560 May 29 1:00 PM - 1:15 PM Sites of Disruption in Dystrophic Muscle Following Eccentric Contractions

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**PURPOSE:** Dystrophin is responsible for maintaining plasmalemmal integrity and cellular homeostasis. A key feature of skeletal muscle that lacks dystrophin, as in the mdx mouse model for Duchenne muscular dystrophy (DMD), is a heightened sensitivity to eccentric (ECC) contraction-induced strength loss. However, the mechanisms responsible for the exaggerated loss of strength in dystrophic muscle have yet to be fully established. The purpose of this study was to determine possible sites within mdx muscle that are disrupted following ECC contractions. **METHODS:** Male wildtype and mdx mice (n = 8 per group) were chronically implanted with stimulating electrodes on the left common peroneal nerve and EMG electrodes on the left tibialis anterior (TA) muscle. The left anterior crural muscles (TA and extensor digitorum longus; EDL) of anesthetized mice performed 50 maximal ECC contractions. In vivo peak dorsiflexion torque and M-wave root mean square (RMS) were measured prior to and immediately after the ECC contractions. Following the in vivo assessment, the EDL was removed and ex vivo peak isometric force and caffeine-induced force were analyzed. **RESULTS:** Peak torque and force in wildtype mice were reduced 36 ± 4 and 28 ± 4% ( $p \leq 0.001$ ) following the ECC contractions, while no changes were observed in M-wave RMS (10 ± 2%;  $p = 0.49$ ) or caffeine-induced force (10 ± 4%;  $p = 0.20$ ). To the contrary, both M-wave RMS and caffeine-induced force were reduced in mdx muscle (60 ± 4 and 58 ± 5;  $p \leq 0.001$ ), and corresponded to reductions of 60 ± 2 and 67 ± 8% ( $p \leq 0.001$ ) in peak torque and force. **CONCLUSIONS:** On the basis of the disproportional reductions in strength measured in vivo and ex vivo (36 and 28%, respectively) compared with that of in vivo M-wave RMS (10%) and ex vivo caffeine-induced force (10%), we confirm that ECC contractions uncouple the plasmalemma from the ryanodine receptors (RyRs) in wildtype muscle. However, in mdx muscle, in vivo peak torque and M-wave RMS in addition to ex vivo force and caffeine-induced force were all reduced to a similar degree (58-67%), indicating that various sites were disrupted immediately following the injury. These data indicate strength loss in wildtype and mdx mice differ, in that plasmalemmal function and sites at or distal to the RyRs may all be impaired in dystrophic muscle following ECC contractions.

**561 May 29 1:15 PM - 1:30 PM**

## The Effects of High Intensity Interval Training on Autophagy in Soleus Muscle of Rats

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(No relevant relationships reported)

**PURPOSE:** The aim of this study was to investigate the impacts of the high intensity interval training (HIIT) on basal autophagy in soleus muscle of rats. **METHODS:** Nine months old, male Wistar rats were randomly divided in 3 groups: control group (C group, n = 18, sedentary), traditional moderate-intensity continuous training (MICT) group (M group, n = 19, 50-min moderate intensity continuous running at 60% VO<sub>2</sub>max) and high intensity interval training (HIIT) group (H group, n = 19, 6 bouts × 3 min running at 80% VO<sub>2</sub>max interspersed with 6 bouts × 3min active recovery at 40% VO<sub>2</sub>max with a 7-min warm-up and cool down at 60% VO<sub>2</sub>max). Before the intervention, a total of 8 rats were killed as the baseline. At the 4<sup>th</sup> and 8<sup>th</sup> week, 8 rats of each group were killed 24 h after the last exercise. The test of VO<sub>2</sub>max, the observation of autophagosome by transmission electron microscope (TEM) and the expression of autophagy-related proteins by western blot were assayed at three time points: baseline, 4<sup>th</sup> and 8<sup>th</sup> week after the intervention. Statistical significance was tested by two-way ANOVA. **RESULTS:** In the 4<sup>th</sup> week of intervention, compared to the C group, only H group resulted a 30% increase in VO<sub>2</sub>max (2732.85±135.43 vs. 2103.53±135.43,  $P<0.01$ ), a 82% increase in the number of autophagosomes (0.50±0.04 vs. 0.28±0.04,  $P<0.05$ ), a 25% increase in the expression of LC3II (1.62±0.10 vs. 1.29±0.10,  $P<0.05$ ), no change in the LC3II/LC3I; M group and H group resulted a 38% and 18% decrease respectively in the expression of P62 (0.75±0.05 vs. 0.99±0.05 vs. 1.21±0.05,  $P<0.001$ ,  $P<0.01$ ). In the 8<sup>th</sup> week, compared to the C group, only H group resulted a 30% increase in VO<sub>2</sub>max (2830.46±135.43 vs. 2182.30±135.43,  $P<0.05$ ), a 62% increase in the number of autophagosomes (0.53±0.04 vs. 0.33±0.04,  $P<0.05$ ), a 25% increase in the expression of LC3II (1.79±0.10 vs. 1.43±0.10,  $P<0.05$ ); a 31% increase in the LC3II/LC3I (2.33±0.12 vs. 1.77±0.12,  $P<0.01$ ); M group and H group resulted a 26% and 30% decrease respectively in the expression of P62 (0.89±0.05 vs. 0.84±0.05 vs. 1.20±0.05,  $P<0.001$ ,  $P<0.001$  respectively). There was no significant change in the expression of ULK1<sup>Ser757</sup> and Beclin-1 in all groups across the training period. **CONCLUSION:** An engagement in HIIT might promote the basal autophagy activity and autophagy flux, with prominent effects for HIIT than MICT.

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## Bovine Milk Exosome Depletion Affects Skeletal Muscle and Liver in Young Growing Rats

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(No relevant relationships reported)

Exosomes are extracellular vesicles that carry 'cargo', such as microRNA, which may interact with different tissues and regulate cellular signaling pathways. **PURPOSE:** To determine the effects of exogenous bovine exosomes on the liver and skeletal muscle in young, growing rats. **METHODS:** Twenty-eight-day Fisher 344 rats were provided a milk-based diet that either contained exosomes (EXO+, n=12) or was exosome depleted via sonication (EXO-, n=12) for four weeks. Following the intervention, the liver and gastrocnemius were removed and measurements of respiratory control ratio (RCR), reactive oxygen species emission (ROS), antioxidant levels, cross sectional area (CSA), total RNA, and transcriptomics were performed. Except for transcriptomic data, independent samples t-tests were performed between diet groups and statistical significance was set at  $p<0.05$ . For transcriptomic data, all annotated transcripts with FPKM scores >1.0 were analyzed between groups and any score exceeding a fold-change cut-off >1.5 fold ( $p<0.01$ ) were considered meaningful. **RESULTS:** There was no significant change in mitochondrial volume in either the liver ( $p=0.707$ ) or gastrocnemius ( $p=0.724$ ), however the liver had increased state 3 and state 4 in the EXO- treated group ( $p=0.040$  and  $p=0.009$ ) with complex I substrates. No significant differences were detected in liver antioxidant protein levels or oxidative damage markers ( $p>0.050$ ). There was an increase in GPX protein levels in gastrocnemius in the EXO- rats ( $p=0.020$ ), which may explain the significant decrease in ROS emission ( $p=0.016$ ). No significant change was observed in gastrocnemius mitochondria respiration ( $p>0.050$ ). Interestingly, gastrocnemius CSA and total RNA significantly increased in EXO- group ( $p=0.018$  and  $p=0.001$ ). Further analysis of the diet verified sonication decreased exosomes, however RNA was enriched per particle by >7.5

fold. **CONCLUSION:** An exosome depleted diet affects liver and skeletal muscle parameters and resulted in increased muscle hypertrophy. These changes may be due to the enhanced mRNA nature of the EXO- diet. Supported by AU IGP Grant; NIFA 2015-67017-23181 and 2016-67001-25301; NIH 1P20GM104320; Gates Foundation, Gerber Foundation; PureTech Health, Inc. JZ serves as a consultant for PureTech Health, Inc.

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### Resolvin E1 Attenuates Inflammatory Induced Muscle Atrophy In Human Derived Muscle Cells

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**Purpose** Loss in skeletal muscle size and function is a common debilitating comorbidity in an array of chronic disease states as well as during the ageing process. This can lead to a loss of physical activity and ability to perform everyday tasks, leading those affected into a downward spiral of muscle loss and inactivity which has been strongly linked to increased rates of morbidity and mortality. Many factors have been linked to induce such processes, one of which is inflammation, with therapeutic research looking for ways to resolve chronic inflammation to subsequently alleviate related muscle atrophy. Resolvin E1 (RvE1) is a specialised pro-resolving lipid mediator, derived from the metabolism of the omega-3 fatty acid EPA, which has shown to have beneficial pro-resolving properties in an array of cell types, including our previous work in immortalised skeletal muscle cell lines. **Method** This set of experiments cultured human derived skeletal muscle cells from healthy control participants (n = 6). Once differentiated, myotubes were exposed to Lipopolysaccharide (LPS) in the presence or absence of RvE1 (100ng/ml) and compared with a control condition. Post exposure, myotubes were harvested for gene expression and intracellular protein analysis. From the same experiment, wells were also fixed and stained for immunocytochemistry analysis of myotube size and number. **Results** Our work indicates beneficial pro-resolving properties of RvE1 in human skeletal muscle cells. RvE1 was seen to attenuate LPS induced inflammatory related gene expression of both IL-6 (LPS 7.82 ± 0.52 vs. RvE1 3.93 ± 0.32, p = 0.015) and MCP-1 (LPS 21.45 ± 0.92 vs. RvE1 17.31 ± 0.52, p = 0.023) leading to an alleviation in downstream endotoxin induced myotube atrophy (µm) (LPS 20.29 ± 1.36 vs. RvE1 28.76 ± 1.13, p = 0.003). **Conclusion** Preliminary evidence suggests that RvE1 may induce its effects through the inhibition of classical canonical inflammatory signalling. Our novel findings provide initial rationale for further investigation of RvE1 as a naturally occurring nutritional therapeutic in chronic conditions characterised with a degree of inflammatory induced skeletal muscle atrophy.

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### Concurrent Exercise of the Arm Extensors Modulates Anabolic Signaling and Gene Expression for Ribosome Biogenesis

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(No relevant relationships reported)

**PURPOSE:** As most concurrent exercise studies to date have focused on lower-limb muscles, this study explored the acute molecular response to concurrent exercise of the arm extensors. Specifically, the effects of a preceding bout of aerobic exercise (AE) on subsequent anabolic signaling and ribosome biogenesis response to resistance exercise (RE) were explored. **METHODS:** Eleven moderately trained men (28 ± 5 years, 181 cm ± 6 cm, 81 ± 8 kg) performed a unilateral bout of arm extensor aerobic exercise (~45 min) in a seated isokinetic dynamometer. Subsequently, unilateral resistance exercise (4 sets of 7 reps) was performed for both arms using flywheel technology. Thus, one arm was subjected to RE alone, while the other arm performed consecutive bouts of AE and RE interspersed by 15 min recovery. Peak power (merged across concentric and eccentric actions) was assessed during the resistance exercise bout. Muscle biopsies were taken from the m. triceps brachii of each arm immediately before, 15 minutes and 3 h after the RE bout. Muscle samples were assessed for gene (q-PCR) and protein (immunoblotting) expression of markers involved in the regulation of muscle hypertrophy and ribosome biogenesis. **RESULTS:** The AE bout resulted in reduced (~24%) power performance during the subsequent RE bout (P < 0.05). Gene expression of MuRF-1, atrogin-1, and PGC-1α were significantly greater in AE+RE compared to RE (arm x time interactions P < 0.05). Myostatin expression decreased in both AE+RE and RE (main effect of time P < 0.05). Phosphorylation of AMPK increased (2.5-fold), and 4E-BP1 decreased (0.5-fold), after the AE bout (arm x time interactions, P < 0.05). Phosphorylation of P70S6K remained unaltered.

Gene expression of c-Myc and 45S pre-rRNA (ITS) increased with exercise and was greater in AE+RE compared with RE alone (main effect of time and arm P < 0.05). Polr1b expression increased in both AE+RE and RE (main effect of time P < 0.05). **CONCLUSION:** The results suggest that post-exercise translational signaling could be compromised by prior aerobic exercise. In contrast, concurrent exercise of the arm extensors accentuates the expression of key regulators of ribosome biogenesis and promotes rDNA transcription.

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### The Skeletal Muscle Transcriptome Signature of 84-day Bed Rest and its Reversal by Resistance Exercise

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(No relevant relationships reported)

**PURPOSE:** Given the poor understanding of the molecular mechanisms regulating skeletal muscle alterations to long-term unloading/microgravity, this study assessed the transcriptomic changes to 84 days of bed rest, and the potential of high-intensity, low-volume resistance exercise (RE) to counteract the bed rest signature. **METHODS:** Healthy men (age range 26-41 yr) were randomized to perform 84-d bed rest with (BRE; n=9) or without (BR; n=12) concurrent RE targeting the knee extensors (i.e. supine squat; 4 sets of 7 maximal concentric-eccentric repetitions every third day) employing Yo-Yo iso-inertial flywheel technology offering eccentric overload. Biopsies from m. vastus lateralis were obtained from all subjects before and after bed rest. The muscle specimens were used to conduct a DNA microarray analysis. **RESULTS:** Three hundred thirty-five probesets were down- and 315 were upregulated after bed rest at a false discovery rate of 0.01. Amongst the downregulated genes, ontologies related to muscle structural and contractile components, and acetylcholine receptors, were highly enriched. Yet, the ontology most substantially affected by bed rest, with 109 genes downregulated, was the mitochondrion. Although RE normalized a large portion of the transcripts affected by bed rest, genes that were upregulated after bed rest were less likely to become normalized by BRE. The greatest counteracting effect of RE was noted in genes belonging to the mitochondrion. This ontology was even slightly elevated by exercise compared with the baseline signature in BRE (Pre-Post within BRE; P<0.05, interaction BR-BRE; P=2e-78). A group of upregulated transcripts were not affected by RE. These genes are involved in transcriptional regulation, and DNA and chromatin stability. **CONCLUSIONS:** Long-term bed rest has a profound effect on muscle mass and function. Our data indicate that such changes are driven by alterations in molecular pathways regulating muscle structure, contractile properties, neuromuscular junction, and importantly, the mitochondrion. This particular RE regimen appears to counteract, and even reverse, selected transcriptomic modifications induced by long-term bed rest. Yet, some genes modulated by bed rest were resistant to RE and thus represent the residual signature of bed rest induced muscle atrophy.

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### Lifelong Deficiency in Ulk1-Mediated Autophagy Precipitates Skeletal Muscle Aging

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(No relevant relationships reported)

Autophagy is a cellular recycling mechanism critical for maintaining cellular homeostasis because it degrades dysfunctional organelles and proteins. Insufficient autophagy is implicated in the pathophysiology of a plethora of diseases (i.e. Type 2 diabetes, obesity, and sarcopenia) and in the process of aging across many cell types. Ulk1 is an autophagy-related protein kinase that initiates autophagy and may be particularly critical for maintaining skeletal muscle cellular homeostasis throughout life. **PURPOSE:** To investigate muscle health and function in an aging mouse model with a lifelong deficiency of Ulk-1-mediated autophagy. **METHODS:** Longitudinal measurements of *in vivo* ankle dorsiflexion torque of muscle-specific Ulk1 knockout mice (Ulk1 KO) and their littermate controls (LM) were performed beginning at 12 months of age. At age 22 months, mice were administered a glucose tolerance test (GTT), followed by *in vitro* force testing of the extensor digitorum longus (EDL) and soleus (SOL) muscles. Mice were then sacrificed and mitochondrial function was measured via oxygen consumption rates of permeabilized muscle fibers from the gastrocnemius muscle. **RESULTS:** Body mass did not change throughout the longitudinal force measurements (p=0.58). Ulk1 KO mice experienced a greater reduction in *in vivo* ankle dorsiflexion torque from age 12 months to age 22 months compared to LM mice (-50% vs. -36%, p=0.026). *In vitro* peak-isometric force of isolated EDL muscles was less in Ulk1 KO mice (p=0.035) compared to LM mice, but there was no difference in isolated SOL muscle force between genotypes suggesting an accelerated aging phenotype in predominantly fast-twitch muscle fibers. There was no difference in the GTT between genotypes (p=0.1). Interestingly, mitochondrial respiration was greater in the Ulk1 KO mice when normalized to muscle fiber mass

( $p=0.001$ ). This may reflect an accumulation of mitochondria due to Ulk1-mediated autophagy insufficiency, or an undetermined compensatory adaptation affecting mitochondrial function. **CONCLUSIONS:** A lifetime of insufficient Ulk-1-mediated autophagy exacerbates age-related skeletal muscle contractile dysfunction and may alter mitochondrial quality and/or quantity.

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### A Crtc2/Creb1-mediated Molecular Mechanism for the Beneficial Effects of Exercise on Weight Loss

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(No relevant relationships reported)

Exercise is one of the few behavior modifications that enable long-term weight loss through unknown mechanisms. High-intensity exercise (HIE) induces norepinephrine and calcium signaling, which together, stimulate the Crtc2 coactivator to activate the Creb1-mediated transcriptional program in skeletal muscle. We previously demonstrated that Crtc2 activation drives an adaptive anabolic transcriptional response that includes hypertrophy and enhanced exercise performance (Bruno et al. EMBO J. 2014). **PURPOSE:** Here, we examined the role of skeletal muscle-selective Crtc2/Creb1 signaling in the metabolic response to weight loss. **METHODS:** Crtc2 was selectively overexpressed in skeletal muscle using a doxycycline-inducible transgene. 18-week old, naturally obese control or Crtc2 transgenic (Tg) mice were treated with doxycycline for 2 weeks and then subjected to 8 cycles of alternate day fasting (ADF). **RESULTS:** Compared to control Tg mice, which lost lean body mass ( $p = 0.02$ ), Crtc2 Tg mice lost more weight over time (Crtc2,  $p = 0.013$ ; Crtc2 x Time,  $p = 0.00015$ ) through a selective loss of fat body mass ( $p = 0.004$ ). This effect was due to higher energy expenditure during fasting (1 kcal/hr,  $p < 10^{-15}$ ), and was associated with improved glucose tolerance (Crtc2,  $p = 0.037$ ; Crtc2 x Time,  $p = 0.0023$ ) and insulin sensitivity ( $p = 0.012$ ), increased fatty acid oxidation ( $p = 0.05$ ) and mitochondrial DNA content, and upregulation of Pgc-1 $\alpha$  and cytochrome C expression. **CONCLUSION:** This work reveals Crtc2/Creb1 signaling as a key driver of both anabolic and metabolic adaptations in skeletal muscle and explains how HIE facilitates successful weight loss by preventing the lowering of sympathetic tone, which reduces metabolic rate during fasting. During ADF-induced weight loss, the Crtc2/Creb1-mediated transcriptional program in skeletal muscle upregulates mitochondrial biogenesis to provide the excess energetic capacity required to maintain a higher metabolic rate and selectively burn fat.

## B-13 Free Communication/Slide - Testing and Measurement

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-105B

568 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relevant relationships reported)

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### Accuracy of the Cosmed K5 Portable Metabolic System

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(No relevant relationships reported)

The Cosmed K5 is the latest generation of Cosmed portable metabolic systems. Similar to previous generations of the Cosmed devices, the K5 measures oxygen consumption ( $VO_2$ ) and carbon dioxide production ( $VCO_2$ ) on a breath-by-breath (BxB) basis. New to the K5 is the ability to measure  $VO_2$  and  $VCO_2$  using a dynamic mixing chamber (MC) mode that uses micro-proportional sampling. **PURPOSE:** The purpose of this study was to assess the accuracy of the Cosmed K5 MC and BxB modes against the criterion Douglas bag (DB) method. **METHODS:** Eleven healthy males (mean age $\pm$ SD, 33.5 $\pm$ 6.3 yrs) had their metabolic variables measured at rest (17 min) and during cycling at 50, 100, 150, 200, and 250 W (13 min at each work rate). Within each stage, steady-state metabolic variables were measured using three systems (DB, BxB, MC), with the order varied to account for possible order effect. During each stage the participant was connected to the first system for the first four minutes to reach steady state, followed by collection periods of 5-min (DB) or 3-min (MC and BxB) for

the resting condition, or 2-min each for all cycling intensities. The collection periods for the second and third systems were preceded by a washout of 1-3 min. Repeated measures ANOVAs were used to compare metabolic variables measured by each system for rest and each cycling work rate. **RESULTS:** For ventilation ( $V_E$ ) and  $VO_2$ , the K5 MC and BxB modes were not significantly different from the DB  $V_E$  and  $VO_2$  at rest or any cycling work rate ( $p \geq 0.05$ ). Across all stages, the  $VO_2$  from the K5 MC and BxB modes were within 0.09 L/min of the DB  $VO_2$ . Compared to DB values,  $VCO_2$  was significantly underestimated by the K5 MC mode at 150W (mean difference, -0.17 L/min) and by the K5 BxB mode at 200W (-0.17 L/min) and 250 W (-0.40 L/min, all  $p < 0.05$ ). K5 MC and BxB respiratory exchange ratio (RER) values were significantly lower than DB RER across most work rates by 0.04 to 0.09 ( $p < 0.05$ ). When comparing the K5 MC and BxB modes to each other,  $V_E$ ,  $VO_2$ ,  $VCO_2$ , and RER were similar at rest and across all cycling intensities. **CONCLUSION:** These findings suggest that the Cosmed K5 portable metabolic system MC and BxB modes are acceptable for measuring  $VO_2$  during rest and across a wide range of exercise intensities.

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### Agreement between Deuterium Oxide and Bioimpedance Spectroscopy Measures of Total Body Water

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Reported Relationships: **Z. Cicone:** Industry contracted research; ImpediMed, Inc..

The inclusion of total body water (TBW) into body composition analyses improves the accuracy of measures. However, the criterion method using deuterium oxide dilution ( $D_2O$ ) is impractical for clinical settings.

**PURPOSE:** The purpose of this study was to compare TBW estimates from two commercial bioimpedance spectroscopy (BIS) devices against  $D_2O$ .

**METHODS:** 89 subjects (64% female; age: 18 to 82 years; body mass index [BMI]: 18.0 to 39.5 kg/m<sup>2</sup>) had TBW determined via  $D_2O$  and whole-body BIS using two devices: a standard supine BIS device (BIS<sub>sup</sub>), and a new commercial standing BIS device (BIS<sub>new</sub>). Agreement between TBW from  $D_2O$  and the two BIS devices was determined using the Bland-Altman method.

**RESULTS:** Mean differences between  $D_2O$  and BIS devices were significantly greater than zero ( $p < 0.05$ ), however the magnitudes of the differences were small (Cohen's  $d < -0.20$ ) and both devices were highly correlated with  $D_2O$  (Pearson's  $r > 0.90$ ,  $p < 0.01$ ). Bias and limits of agreement (bias $\pm$ 1.96\*SD) for BIS<sub>sup</sub> (-1.5 $\pm$ 5.7) and BIS<sub>new</sub> (-0.7 $\pm$ 5.8) were small and relatively tight. The BIS devices were strongly correlated with each other ( $r = 0.99$ ).

**CONCLUSIONS:** The results of this study demonstrate that both the standard and new BIS devices measured TBW with minimal bias and tight limits of agreement compared to  $D_2O$ . These findings support the use of both the standard and new BIS device as a surrogate of  $D_2O$  for the assessment of TBW in adults across a wide range of both age and BMI.

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### Exercise Testing Protocol Matters: Sub-maximal and Maximal Measures Before and After Marathon Training

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(No relevant relationships reported)

Maximal and sub-maximal physiological testing can assess aerobic variables important in running performance. We compared two protocols to demonstrate the impact of protocol on measures of maximal ( $VO_{2MAX}$ ) and submaximal aerobic variables: energy cost of running (ECR), oxygen cost of running (OCR), and substrate utilization, assessed with respiratory exchange ratio (RER). **PURPOSE:** To compare two physiological testing protocols before and after marathon training. **METHODS:** Recreational runners ( $n=111$ ; 72% female; ages 21.2 $\pm$ 1.6) enrolled in a marathon training class participated in the study. Subjects ran a 2-mile time trial (2MI) on a 200m indoor track, followed by laboratory testing 1-2 weeks later, both prior to and after 18 weeks of training for a marathon race. Testing included a sub-maximal 6-minute treadmill run at 75% of 2-mile velocity followed by a graded exercise test to assess  $VO_{2MAX}$ . The final 5 minutes of the 6-minute run were averaged for analysis of ECR, OCR, and RER. For post-testing one cohort ( $n=54$ ) had the treadmill velocities adjusted to their current 2MI ability (ADJ) while another cohort ( $n=57$ ) repeated the pre-test velocities (REP). Repeated measures ANOVA was used to assess the effect of testing protocol on ECR, OCR, RER, and  $VO_{2MAX}$ . **RESULTS:** Subjects improved in 2MI with training (16.3 $\pm$ 2.0, 15.0 $\pm$ 2.0 min;  $p < 0.001$ ), with no group-by-time interaction. RER decreased with training ( $p = 0.02$ ). There was an effect of protocol

on RER ( $p=0.02$ ): ADJ did not change but REP decreased ( $0.90\pm 0.05$ ,  $0.86\pm 0.05$ ;  $p\leq 0.001$ ). There were no changes in ECR, but there was a trend towards an effect of protocol ( $p=0.085$ ) with an increase in ECR for ADJ and a decrease for REP. There was an effect of protocol on OCR ( $p\leq 0.001$ ): REP did not change whereas ADJ increased ( $32.3\pm 4.6$ ,  $35.7\pm 4.5$  mL $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ). There was a trend toward an increase in  $VO_{2MAX}$  with training ( $p=0.064$ ), and an effect of protocol ( $p\leq 0.001$ ), with ADJ increasing in  $VO_{2MAX}$  ( $49.2\pm 6.8$ ,  $52.2\pm 6.6$  mL $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ) and no change in REP. **CONCLUSIONS:** Marathon training decreases RER during moderate exercise at the same absolute but not relative velocity. Changing the speed of the exercise testing protocol to reflect current running ability helps detect changes in aerobic capacity ( $VO_{2MAX}$ ), but may mask changes in sub-maximal running variables such as ECR, OCR, and RER.

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### The Exercise Response In Blood Flow Restriction Training Varies As A Function Of Cuff Type

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(No relevant relationships reported)

**PURPOSE:** Blood flow restriction (BFR) training is a popular method to induce muscle hypertrophy. Both conventional blood pressure cuffs and devices specifically developed for BFR are used to achieve vascular occlusion/BFR. However, it is unknown if the training response differs depending on the cuff type. This study elucidated the acute effects and the safety of exercising with a medical blood pressure cuff (MC) and a BFR cuff (BFR-C). **METHODS:** Ten healthy individuals ( $30\pm 8$  years, 5 ♀) completed three sessions of unilateral low-intensity resistance exercise (30% 1RM) of the knee extensors. In the first session, wearing a BFR-C, the participants performed three sets until maximal exhaustion. In the two other conditions (order selected randomly), the same workload (sets & repetitions) was used for a training session with a MC and without any BFR. Pre and post-intervention, blood lactate, thigh circumference, pressure pain threshold, tissue stiffness and elasticity were measured. During exercise, heart rate, subjective discomfort and fatigue were documented. Twenty-four, 48 and 72 hours after training, muscle soreness was assessed. To judge safety, the pressure [mmHg] needed to provoke full occlusion at rest was determined with Doppler sonography. Differences between conditions were detected by means of Friedman tests including adjusted post hoc Conover comparisons. **RESULTS:** Both, BFR-C (+49%,  $p=.03$ ) and MC (+29%,  $p=.03$ ) induced greater lactate concentrations than the no-BFR control. Compared to the other conditions, BFR-C resulted in higher values for exercise heart rate (+3% vs MC,  $p=.015$ , +3% vs. no-BFR,  $p=.015$ ) as well as muscle soreness after 24 hours (+81% vs MC,  $p=.012$ , +150% vs. no-BFR,  $p=.004$ ). 72 hours post training, soreness was still increased in BFR-C (+3.5 pts on NRS vs. no-BFR,  $p=.045$ ). Similarly, BFR-C elicited stronger fatigue sensations (+36%, vs. no-BFR,  $p=.005$ ). Ultrasound examinations revealed that MC could generate a full occlusion while BFR-C did not entirely obstruct blood flow as long as the normal scale was not exceeded. **CONCLUSIONS:** Although BFR-C seems to provide a stronger exercise stimulus than MC, it may be a better choice regarding exercise safety. This finding may particularly be of value if applying the method in elderly/untrained persons or individuals with chronic disorders.

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### Influence of Testing Sequence on an Adult's Ability to Achieve Maximal Aerobic and Anaerobic Power

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(No relevant relationships reported)

**PURPOSE:** To examine how testing sequence affects an adult's ability to achieve maximal aerobic and anaerobic power during a single assessment visit. **METHODS:** Fifty-three adults (31 women, 22 men;  $21.9\pm 1.6$  years) participated in this investigation. All subjects were tested on three separate occasions. Participants completed two baseline visits (Visits 1 and 2) consisting of either a  $VO_{2max}$  or WAnT in a randomized counterbalanced order. Participants then completed an experimental visit (Visit 3) which consisted of both a  $VO_{2max}$  and WAnT in randomized order (Group A: WAnT/ $VO_{2max}$ ; Group B:  $VO_{2max}$ /WAnT) with 20 minutes of rest between tests. Mixed model ANOVAs with Bonferroni post hoc analyses compared baseline (Visits 1 or 2) and experimental (Visit 3) exercise test performance between and within groups for both relative  $VO_{2max}$  and absolute peak power. **RESULTS:** No significant main or interaction effects were observed for relative  $VO_{2max}$  at baseline and experimental visits when comparing Group A ( $42.9\pm 7.2$  ml/kg/min and  $42.0\pm 8.0$  ml/kg/min, respectively) and Group B ( $40.9\pm 8.6$  ml/kg/min and  $41.2\pm 8.2$  ml/kg/min, respectively). Similarly, no significant main or interaction effects were observed for absolute peak power at baseline and experimental visits when

comparing Group A ( $747.7\pm 229.4$  W and  $742.7\pm 221.3$  W, respectively) and Group B ( $747.7\pm 229.4$  W and  $742.7\pm 221.3$  W, respectively) ( $681.7\pm 209.0$  W and  $690.2\pm 197.6$  W, respectively).

**CONCLUSIONS:** Our findings indicate that testing sequence had no effect on achievement of maximal aerobic and anaerobic power. Researchers and clinicians can include  $VO_{2max}$  testing and a WAnT during the same visit with 20 minutes of rest without compromising maximal performance.

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### Effects Of Honest And Dishonest Pre-exercise Placebo Ingestion On $VO_{2}$ Peak And Isometric Handgrip Performance

Jessica Moon<sup>1</sup>, Christian Espitia<sup>2</sup>, Landon Hiebert<sup>2</sup>, Christopher A. Fahs<sup>2</sup>, Lindy M. Rossow<sup>2</sup>. <sup>1</sup>Lindenwood University, St. Charles, MO. <sup>2</sup>Lindenwood University Belleville, Belleville, IL.

(No relevant relationships reported)

Pre-exercise consumption of placebo has been shown to improve resistance and endurance exercise performance. However, the effects of placebo ingestion on graded exercise test performance have not been widely reported in the literature. **PURPOSE:** The purpose of this study was to examine the effects of honest (subjects were told they were consuming placebo) or dishonest (subjects were told they were consuming a pre-workout supplement) placebo ingestion on  $VO_{2peak}$  values determined during a maximal treadmill graded exercise test. A secondary purpose of this study was to examine the effects of placebo consumption on isometric handgrip performance. We hypothesized that pre-exercise ingestion of both placebo conditions would result in increased  $VO_{2peak}$  and handgrip performance compared to control. **METHODS:** 28 males ( $178.4\pm 6.94$  cm,  $83.3\pm 14.8$  kg,  $22.6\pm 2.3$  yrs.) and 13 females ( $166.4\pm 8.49$  cm,  $73.6\pm 20$  kg,  $26.4\pm 11$  yrs.) participated in this study. In a randomized, cross-over design, subjects performed treadmill  $VO_{2peak}$  and isometric handgrip testing after consumption of honest placebo (HP) or dishonest placebo (DP). In addition, a third baseline trial (CON) was performed to establish performance values that were unaffected by a perceived placebo effect due to supplementation. All outcomes were assessed for normality using the Shapiro-Wilks test. When assumptions of normality were violated, log transformations were computed. However, transformations did not improve model assumptions. Therefore, non-transformed data is reported. One-way ANOVAs were used to analyze  $VO_{2peak}$  and handgrip strength data across conditions. Alpha was set at 0.05 prior to all analyses. **RESULTS:** Significant between-groups differences ( $p < 0.05$ ) were not detected for relative  $VO_{2peak}$  (CON =  $46.2\pm 9.3$  mL/kg/min; HP =  $46.7\pm 10$  mL/kg/min; DP =  $46.6\pm 9.6$  mL/kg/min) or for maximal handgrip strength (CON =  $43\pm 9.6$  kg; HP =  $44.1\pm 12.4$  kg; DP =  $43.4\pm 12.1$  kg). **CONCLUSION:** Administration of honest or dishonest placebo immediately prior to  $VO_{2peak}$  and handgrip testing had no effect on performance compared to control. The  $VO_{2peak}$  and isometric handgrip tests were found to be robust exercise tests not significantly influenced by perceived pre-workout supplement consumption.

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### Using a Stretch Sensor to Evaluate Muscle Contraction Timing During a Neuromuscular Control Screening Activity

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Reported Relationships: S.E. Linderman: Salary; figur8, Inc.

**PURPOSE:** Stretch sensors are wearable devices that when applied over a muscle group, can measure the physical output of muscle deformation resulting from a muscle contraction. Electromyography (EMG) is the clinical standard for assessing the electrical signal identifying muscle activation. The well-established challenges in EMG data collection and analysis methods limit utility for wearable wide-spread neuromuscular control screening. The purpose of this study was to investigate the ability of stretch sensors to detect timing patterns of muscle contraction and compare time events to those collected through traditional clinical EMG.

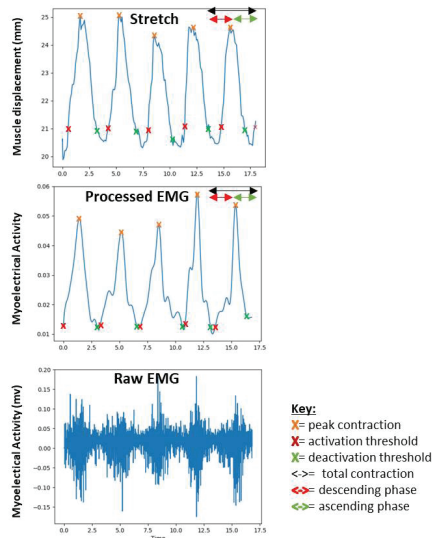
**METHODS:** 4 healthy subjects (mean age:  $23.29\pm 3.45$  y) completed 5 repetitions of a unilateral partial squat with a stretch sensor and an EMG unit simultaneously applied to the dominant leg quadriceps muscle. Paired T-test and linear regression analyses assessed differences in key muscle contraction time events (Figure 1) for the stretch sensor (SS) and EMG.

**RESULTS:** Relative times of peak contraction ( $r^2=0.99$ , mean relative error (RE)=0.04), activation ( $r^2=0.98$ , RE=0.14), and deactivation ( $r^2=0.92$ , RE=0.35) displayed excellent correlation between the EMG and SS. Duration of ascent ( $p=0.103$ , EMG:  $1.14\pm 0.46$  s, SS:  $1.36\pm 0.27$  s) and descent ( $p=0.079$ , EMG:  $1.38\pm 0.49$  s, SS:  $1.14\pm 0.37$  s) squat phases and total contraction time ( $p=0.95$ , EMG:  $2.55\pm 0.83$  s, SS:

2.49 ± 0.30 s) did not differ significantly between EMG and SS. Average within-subject variation was not significantly different for EMG timing of ascent ( $p=0.56$ ) and descent ( $p=0.15$ ) phases, and total contraction ( $p=0.08$ ).

**CONCLUSIONS:** Our findings reveal similarities in time signatures between SS and EMG for assessing quadriceps activation during a standard neuromuscular screening activity. This suggests the potential for utility of SS evaluation of muscle activation timing.

This study was supported in part by figur8 Inc



**Figure 1:** Example of relative muscle contraction timing for stretch sensor and EMG signals during a repeated partial squat task.

A 6<sup>th</sup> order low-pass Butterworth filter (3 Hz) and rectified TKEO function were applied to raw EMG data. Threshold of activation/deactivation was defined as 3 standard deviations of a resting calibration trial.

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### Estimation of Running and Cycling $VO_2$ max Using the Heart Rate Ratio Method

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(No relevant relationships reported)

Although the direct measurement of  $VO_2$ max during an exercise test provides the most accurate assessment of cardiorespiratory fitness, estimates of  $VO_2$ max are often more practical. Prior research suggests that  $VO_2$ max obtained during a treadmill maximal graded exercise test can be accurately estimated in men using the Heart Rate Ratio Method. This method estimates  $VO_2$ max using the following equation:  $VO_2$ max (mL/kg/min) = (HRmax / HRrest) x 15. The validity of this equation to estimate  $VO_2$ max has not been established in women or in other modes of exercise, such as cycling.

**PURPOSE:** This study compared  $VO_2$ max values measured during running and cycling to estimates of  $VO_2$ max using the Heart Rate Ratio Method in 42 men and women. **METHODS:** Resting metabolic rate (RMR) and  $VO_2$ max on the treadmill and cycle ergometer were measured on 21 men and 21 women between 19-39 years of age. Each subject's running and cycling  $VO_2$ max was estimated using the Heart Rate Ratio Method and their resting HR measured during the RMR test and their actual maximal HR achieved during the maximal exercise tests. **RESULTS:** The average running and cycling  $VO_2$ max values for males ( $54.2 \pm 7.1$ ;  $50.0 \pm 8.9$  mL/kg/min) were higher ( $p<0.0001$ ) than in females ( $43.4 \pm 5.8$ ;  $39.8 \pm 7.4$  mL/kg/min), respectively. Resting HR values for males ( $55 \pm 7$  bpm) and females ( $57 \pm 6$  bpm) were similar as were the maximal HR values during running ( $186 \pm 12$ ;  $190 \pm 12$  bpm) and cycling ( $181 \pm 11$ ;  $184 \pm 13$  bpm), respectively. The estimates of running and cycling  $VO_2$ max under-predicted actual values in males ( $-2.9 \pm 8.0$ ;  $-0.26 \pm 7.8$  mL/kg/min) and overestimated actual values in females ( $7.3 \pm 7.9$ ;  $9.3 \pm 8.2$  mL/kg/min), respectively. There was a significant gender effect in the prediction of  $VO_2$ max using the Heart Rate Ratio Method. Regression and Bland Altman analysis for treadmill running yielded an  $R^2 = 0.076$ , an SEE = 8.19, and a 95% limits of agreement (LOA) of  $\pm 18.46$  mL/kg/min. Likewise, regression and Bland Altman analysis for cycling yielded an  $R^2 = 0.18$ , an SEE = 8.85, and a 95% LOA =  $\pm 18.24$  mL/kg/min. **CONCLUSION:** The high SEE and LOA precludes this method for predicting running and cycling  $VO_2$ max. Gender differences in maximal HR and  $VO_2$ max are not accounted for in predictions of  $VO_2$ max using the Heart Rate Ratio Method.

## B-14 Clinical Case Slide - Oncology

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM  
Room: CC-304E

577 **Chair:** Holly Benjamin, FACSM. *University of Chicago, Chicago, IL.*

(No relevant relationships reported)

578 **Discussant**

Allison Betof Warner. *Memorial Sloan Kettering Cancer Center, New York, NY.*

(No relevant relationships reported)

579 **Discussant**

Jason L. Blackham. *Intermountain Healthcare, Ogden, UT.*

(No relevant relationships reported)

580 May 29 1:00 PM - 1:20 PM

### Decreased Movement Of Right Arm In A Non-verbal Child

Eric M. Bankert, Scott Annett, Vicki R. Nelson. *Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, SC.* (Sponsor: Kyle J. Cassas, FACSM)  
Email: EBankert@ghs.org

(No relevant relationships reported)

#### HISTORY:

A 4 y/o non-verbal male with Rubinstein-Taybi syndrome presented for poor motion of his right arm. The patient was noted to become fussy when his parents put his shirt on that morning and when they tried to move his right arm. There were no known injuries, trauma, fever, or recent illness. Birth history was unremarkable. He had a tethered cord release in his first year of life. At baseline he uses all extremities and can crawl but not walk.

#### PHYSICAL EXAMINATION:

T 97.9F BP 104/80 HR 115

Well appearing, nonverbal and wheelchair-dependent male. No ecchymosis or significant erythema to the right arm. Limited active and full passive ROM of right shoulder, elbow and wrist with fussiness noted on manipulation. No focal tenderness noted. 2/4 MSR in bilateral upper and lower extremities.

#### DIFFERENTIAL DIAGNOSIS:

1. Radial Head Subluxation
2. Non-accidental Trauma - fracture or dislocation
3. Osteomyelitis
4. Septic Arthritis
5. Tumor/Malignancy

#### TESTS AND RESULTS:

R Shoulder and Elbow XRs: No fracture or soft tissue abnormality seen

CRP 41.7 mg/L, ESR 44 mm/hr, Blood culture No growth

MRI of Right Humerus: Effusion with surrounding enhancement in the right shoulder; subtle changes in the metaphysis of the right humerus with periosteal edema and enhancement

#### FINAL WORKING DIAGNOSIS:

Pre-B cell Acute Lymphoblastic Leukemia

#### TREATMENT AND OUTCOMES

1. The patient underwent manual reduction of possible radial head subluxation, which was felt to be successful with improved ROM of the elbow. However, symptoms returned within a day.
2. Labs and imaging were concerning for infection and he was admitted for surgical wash-out of right shoulder and sent home on prolonged IV antibiotics.
3. He developed contralateral shoulder symptoms with prolonged fever and left shoulder MRI showed similar findings.
4. After multiple wash outs and rounds of IV antibiotics, Flow Cytometry was noted to be positive for Pre-B cell acute lymphoblastic leukemia, so patient was started on appropriate chemotherapy regimen and is currently in the maintenance phase.
5. This case demonstrates the difficulty in pediatrics of identifying the cause of medical issues in patients who are non-verbal, as well as the vast differential diagnoses possible in children with musculoskeletal complaints. It also highlights the need for close follow up to resolution of symptoms.

581 May 29 1:20 PM - 1:40 PM

**The Use Of Individualized Exercise Prescription To Target Oxidative Metabolism In A Stage Iv Colorectal, Metastatic Cancer Patient**Inigo San-Millan. *University of Colorado School of Medicine, Aurora, CO.*

Email: isanmillan@gmail.com

(No relevant relationships reported)

**HISTORY:** A 42 year-old male was diagnosed with stage IV colorectal, metastatic cancer. In 2017 (2 years post-diagnosis) he came to our laboratory seeking exercise advice. He had received 56 rounds of chemotherapy without signs of remission. He also exercised on the bike 4-5 days/week with a duration of 1-3h/session. **PHYSICAL EXAMINATION:** He performed an incremental cardiopulmonary cycling exercise test. O<sub>2</sub> consumption, blood lactate (BLa) as well as fat and carbohydrate oxidation rates (FATox/CHOox) were measured to assess cardiopulmonary and mitochondrial function. Both his FATox and lactate clearance capacity were poor, suggesting poor mitochondrial function despite exercising 4-5 days/week. He was given an individualized exercise prescription program for 3 months with the same amount of days and hours/week but with specific exercise intensities based on his individual metabolic parameters with the aim to improve oxidative metabolism to try to target the glycolytic phenotype of cancer (Warburg Effect). During the course of this exercise program he continued with chemotherapy. **TESTS AND RESULTS:** 3 months after the individualized exercise program he returned to the lab for re-evaluation. Significant increases in oxidative metabolic capacity at different exercise intensities were observed: -At 115, 150 and 190 Watts his FATox significantly increased (0.11g·min<sup>-1</sup> vs 0.29g·min<sup>-1</sup>; 0.06g·min<sup>-1</sup> vs 0.25g·min<sup>-1</sup> and 0.0g·min<sup>-1</sup> vs 0.25g·min<sup>-1</sup> respectively). - Significant decreases in (BLa) were observed at 115, 150, 190 and 235 Watts (2.0 mmol·L<sup>-1</sup> vs 1.0 mmol·L<sup>-1</sup>; 2.6mmol·L<sup>-1</sup> vs 1.4 mmol·L<sup>-1</sup>; 4.4 mmol·L<sup>-1</sup> vs 2.2 mmol·L<sup>-1</sup> and 9.7 mmol·L<sup>-1</sup> vs 4.6 mmol·L<sup>-1</sup> respectively) **FINAL/WORKING DIAGNOSIS:** The patient's cardiovascular and oxidative capacity significantly improved after 3 months of individualized exercise program. **TREATMENT AND OUTCOMES:** One month later, he performed a new PET scan showing remission and no evidence of cancer. **CONCLUSIONS:** This case shows a novel approach to individualize exercise prescription in cancer patients to try to elicit improvements in oxidative metabolism to counteract the glycolytic phenotype of many cancers. The mechanisms for this metabolic reprogramming could be a possible crosstalk between skeletal muscle and cancer cells via exosomes could be a possible explanation.

582 May 29 1:40 PM - 2:00 PM

**Hand Mass in an Active Military Personnel**Benjamin Tan, Daniel Montero. *Mayo Clinic Hospital, Jacksonville, FL.* (Sponsor: George Pujalte, FACSM)

(No relevant relationships reported)

**History:**

A previously healthy 21 year-old male, right-hand dominant, presented into sports medicine clinic with a right thumb mass that had been present for approximately a year and a half. Over this period, the mass had grown slowly but had since stabilized. He denied any associated sensitive pain or dysfunction. He presented due to concern regarding the size of the mass, and because it was interfering with tasks related to his physical training and duties in the Air National Guard.

**Physical Exam:**

Generally healthy-appearing, muscular but thin-built, gentleman in no acute distress. Evaluation of the hand showed an obvious mass on the dorsal aspect of the right first interphalangeal (DIP) joint that was elevated by approximately 3mm and measured 17 mm x 5 mm. It was non-tender to palpation. It did not affect flexion or extension of the right DIP joint. However, it did not transilluminate by penlight. It felt firm on exam.

**Differential Diagnoses:**

Ganglion cyst of distal interphalangeal joint

Epidermoid cyst

Giant cell tumor

**Tests and Results:**

Ultrasound briefly performed showed echogenicity and no obvious free fluid within or surrounding the mass. X-rays revealed rounded a soft tissue density overlying the dorsum of the thumb's interphalangeal joint. No radiopaque foreign object was present. No adjacent periosteal reaction or osseous destructive changes were noted. Magnetic resonance imaging (MRI) revealed an enhancing, soft tissue mass measuring 13 mm x 9 mm x 6 mm, along the dorsal aspect of the right thumb at the interphalangeal joint, most compatible with a giant cell tumor, associated with the extensor pollicis longus tendon sheath.

**Final Working Diagnosis:**

Giant cell tumor, rarely seen on the thumb (2% of cases occur within the hand)

**Treatment and Outcomes:**

Patient shortly underwent a surgical excision of the giant cell tumor which revealed intraarticular extension into the interphalangeal joint of the right thumb. Pathology confirmed the diagnosis.

Patient was doing well as of this writing, with no pain or range of motion restriction after surgery

Given reports of recurrence of giant cell tumors, follow-up was recommended in the event that the mass recurred or was noted in other locations.

583 May 29 2:00 PM - 2:20 PM

**A Pheochromocytoma in an Elite Collegiate Athlete**Pierre L. Viviers, FACSM<sup>1</sup>, Craig Thompson<sup>1</sup>, Glen Hageman<sup>2</sup>, Wayne Derman<sup>1</sup>. <sup>1</sup>Stellenbosch University, Stellenbosch, South Africa. <sup>2</sup>Sharks Medical, Durban, South Africa.

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(No relevant relationships reported)

**HISTORY:** A 22-Year-old rugby union player presented to the Sports Medicine clinic complaining of a sore throat and skin rash over his back and upper arms for the past week. Further symptoms included rhinorrhoea and dry cough for the previous week, feeling "hot" (especially at night) and constant fatigue. The occurrence of these symptoms coincided with a regional measles outbreak. The clinical symptomatology persisted at subsequent visits over a period of 12 months and ranged from diarrhoea, skin rash, dry cough, headaches, anxiety, night sweats, rapid heart rate and exercise intolerance. Despite follow-up visits when he was asymptomatic, constant weight loss occurred over the period since he first presented. Except for weight loss and a single blood pressure reading of 135/90mmHg previously his medical history was uncompromised. He had a history of various sport related musculoskeletal injuries and there was no family history of note. **PHYSICAL EXAMINATION:** At initial physical examination athlete was afebrile, HR 100 b/min with a blood pressure reading of 110/60mmHg. Palpable tender occipital lymph nodes were present. Except for the non-purulent pharyngitis and maculopapular rash over the back and upper arms, the remainder of systemic physical examination was normal. Although normal or low BP measurements were recorded occasionally, he remained tachycardic and BP mildly elevated (135/90 mmHg) with the skin rash located over the trunk at most visits. **DIFFERENTIAL DIAGNOSIS:** Viral infection (measles, rubella, coxaci, EBV), Viral infection unspecified, Hyperthyroidism, Pulmonary tuberculosis, Vasomotor response to immune activation, Essential Hypertension, Pheochromocytoma. **TEST AND RESULTS:** FBC's-normal, ESR-normal, CRP-normal, Rubella/Measles IGM (-), s-Urea(7.7mmol/L), s-Creatinine(108µmol/L), S-ALKP(136µmol/L), s-GGT(140µmol/L), S-ALT(101µmol/L), Coxaci-B AB (+), EBV(+), U-VMA-24hrs (50112 nmol/L), MIBG Scan negative(left) indicated a left adrenal gland mass, CT Abd (Triphasic)-well defined mass left adrenal gland **FINAL WORKING DIAGNOSIS:** Benign pheochromocytoma-left adrenal gland **TREATMENT AND OUTCOMES:** Laparoscopic adrenalectomy (left), Uncomplicated post operative recovery, Full return to sport

584 May 29 2:20 PM - 2:40 PM

**Anaplastic Oligodendroglioma: Impacts Of Aerobic And Flexibility Training On Physiological, Psychosocial, And Cognitive Function**Brent M. Peterson<sup>1</sup>, Alyse P. Brennecke<sup>2</sup>, Daniel Y.K. Shackelford<sup>3</sup>, Jessica M. Brown<sup>3</sup>, Reid Hayward<sup>4</sup>. <sup>1</sup>Biola University, La Mirada, CA. <sup>2</sup>University of Colorado Denver Anschutz Medical Campus, Aurora, CO. <sup>3</sup>Carroll University, Waukesha, WI. <sup>4</sup>University of Northern Colorado, Greeley, CO. Email: brent.peterson@biola.edu

(No relevant relationships reported)

**HISTORY:** A 44-year old female diagnosed with class III anaplastic oligodendroglioma with 1p19q genetic co-deletion who underwent a left-frontal craniotomy, chemotherapy, and radiation prior to starting an exercise-based cancer rehabilitation program. During initial assessments, she qualified and was enrolled in an ongoing research study examining the impacts of aerobic and flexibility training on cognitive function. **CLINICAL EXAMINATION:** Comprehensive physical, psychosocial, and cognitive assessments were completed pre and post training (36-session intervention). **DIFFERENTIAL DIAGNOSIS:** 1. Brain Metastases 2. Seizure Disorders 3. Glioblastoma Multiforme **TESTS AND RESULTS:** Sought medical assistance following grand mal seizures. Magnetic resonance images (01/15/2013) revealed infiltrative lesions on the anterolateral aspect of the left frontal lobe which measured at approximately 4.6cm x 3.3cm in the axial plane - involved cortex and subcortical white matter Patient underwent craniotomy (01/24/2013) Pathology confirmed grade III anaplastic oligodendroglioma - positive: 1p36 and 19q13 sequence deletions - negative: epidermal growth factor receptor sequences, tumor suppressor gene phosphatase - negative for the loss of the tumor suppressor gene phosphatase and tensin homolog sequences Follow-up (02/12/2013) the patient was awake, alert, and oriented, but physically fatigued New presentations: - blurred visual acuity (left eye), ambulation and postural difficulty, lower right extremity weakness, continual word aphasia with speech interruption **FINAL/WORKING DIAGNOSIS:** Class III anaplastic oligodendroglioma with 1p19q genetic co-deletion; referred to the University of Northern Colorado Cancer Rehabilitation Institute



and recommended participation in study **TREATMENT AND OUTCOMES:** 1. Procarbazine, Lomustine, and Vincristine Sulfate (PCV) chemotherapeutic (6x) with ionized radiation (46Gy followed by 14Gy boost to resection site and G2/FLAIR regions) - temozolomide added as adjuvant to radiation 2. Patient completed 36 sessions of aerobic and flexibility training 3. Improvements observed in physiological, psychosocial, and cognitive variables 4. Patient then made a positive transfer into a standard exercise-based cancer rehabilitation program

**585** May 29 2:40 PM - 3:00 PM

### Stomach Cancer - Physical and Functional Tests

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(No relevant relationships reported)

**HISTORY:** A 53-year-old female patient (Body mass = 71.30 kg; Height; 1.58 m; BMI = 28.74 kg / m<sup>2</sup>) from the Mato Grosso Cancer Hospital in Cuiabá, Brazil, with stomach cancer, reported stomach pain for at least 12 months, with no improvement in the use of proton pump inhibitors (omeprazole) and/or antacids (sodium bicarbonate). She reported vomiting and increasing pain after consuming beer and using tobacco. The patient denied having decreased body weight over the last six months. Abdominal distension was reported.

**PHYSICAL EXAMINATION:** Clear awareness, without edema, afebrile, normal blood pressure SARC-F questionnaire: score = 4 (tendency for sarcopenia).

#### DIFFERENTIAL DIAGNOSIS:

1. Reported muscle strength loss
2. Needed help to walk and lift chair
3. Could not climb stairs

#### TEST AND RESULTS:

Tomography of the whole abdomen:  
— wall thickening of the gastric antrum  
Pathological stage:

— T<sub>3</sub> N<sub>2</sub> M<sub>1</sub>

Functional evaluation:

— Handgrip test: mean of 30 kg.f in both hands (good); 30-second elbow flexion test: 13 repetitions (good); 30-second chair stand test: 11 repetitions (adequate); Timed Up and Go test: 9 seconds (low risk of falls); Walking speed test: 1m / sec (adequate); 2-minute walk test: 109 knee elevations (good functional capacity)

#### FINAL/WORKING DIAGNOSIS:

Locomotor difficulties were diagnosed through the physical/clinical examination and there was a tendency for sarcopenia; on the other hand, the physical tests did not corroborate this information and did not independently confirm physical incapacity prior to the total gastrectomy

#### TREATMENT AND OUTCOMES:

1. Total gastrectomy.
2. Need to develop physical/functional tests to be applied, specifically, in cancer patients, regardless of tumor type.
3. Currently available physical tests were developed for an elderly population, which may compromise the interpretation of the results obtained (low specificity and sensitivity).
4. Prescription of physical exercises (as a non-pharmacological treatment) for patients with stomach cancer should begin before surgery, because the current patient presented, in advance, with locomotor difficulties.
5. The SARC-F questionnaire seems to be a good tool to detect sarcopenia in a patient with stomach cancer, although it also requires future adaptations for this purpose.

## B-15 Clinical Case Slide - Shoulder

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM

Room: CC-305

**586** **Chair:** Cheri Blauwet. *Harvard Medical School, Boston, MA.*

(No relevant relationships reported)

**587** **Discussant**  
Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Fontana, CA.*

(No relevant relationships reported)

**588** **Discussant**  
Mederic M. Hall. *University of Iowa Sports Medicine, Iowa City, IA.*

(No relevant relationships reported)

**589** May 29 1:00 PM - 1:20 PM

### Severe Shoulder Pain in a Healthy Adolescent Child

Ashkan Alkhamisi, M.D., J. Parker Chapman, M.D., Laurel Blakemore, M.D., Jason Zaremski, M.D., FACSM. *University of Florida, Gainesville, FL.*

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(No relevant relationships reported)

#### HISTORY:

A 12-year-old child presented to sports medicine clinic with his grandfather for evaluation of 4 days of diffuse left shoulder and upper arm pain. Pain developed hours after holding onto a rope while tubing in a lake. He denies being thrown off the tube or shoulder pain while riding. Pain was 4/10 pain at rest and 9/10 pain with movement. Pain gradually worsened over previous past 4 days. He denied any previous injury to the left arm or shoulder. He denied any numbness, or tingling of the left arm. He denied any changes in vision, headaches, chest pain, shortness of breath, or rashes. Of note, he went to the ED two days prior due to subjective fevers and diagnosed with a viral upper respiratory infection.

#### Physical Exam:

Vitals signs were normal. He was distressed and tearful. He had no tenderness and full range of motion (ROM) of his cervical spine. There was diffuse left sided tenderness over the sternum, ribs, mid-humerus, biceps, upper trapezius, and rhomboids. Pain with active and passive ROM of the elbow and shoulder. Shoulder strength was limited due to pain. Sensation was intact throughout the left upper extremity. No skin discoloration, breaks, or increased warmth of the left arm or shoulder.

#### Differential Diagnoses:

1. Rotator cuff tendinopathy
2. Shoulder dislocation and/or glenoid labral tear
3. Occult Humerus fracture
4. Infection

#### Initial Test and results:

Left shoulder and humerus radiographs were normal. Due to the disposition of the patient, the patient and his family were advised to go to the pediatric ER. A work-up revealed a normal WBC count, and an elevated CK and CRP. Urine and blood cultures were positive for MSSA. MRI of the shoulder and elbow revealed osteomyelitis of left scapular body with left periscapular abscess. Pediatric Orthopedic Surgery was then consulted and performed an incision and drainage (I&D) of the left supraspinatus, infraspinatus, and subscapularis abscesses.

#### Final Diagnosis:

Acute MSSA osteomyelitis of left scapula with left periscapular abscess

#### Treatments and Outcomes:

After surgical I&D, the patient clinically improved over a two-week hospital course and discharged after 4 weeks of IV antibiotics. He was then transitioned to oral antibiotics for an additional 8 weeks. At the 8-week clinical follow-up there was a complete resolution of shoulder and upper extremity pain.

590 May 29 1:20 PM - 1:40 PM

**Treatment of Neurogenic Thoracic Outlet Syndrome in a Professional Baseball Pitcher with Soft Tissue Technique**Jean-Paul Lucke. *Rothman Orthopaedic Institute, Philadelphia, PA.*

Email: Jean-Paul.Lucke@rothmaninstitute.com

(No relevant relationships reported)

**HISTORY:** A 28-year-old male, left hand dominant professional baseball pitcher, with a several year history of persistent left upper extremity numbness presented with increased pain and numbness of the elbow and forearm after throwing a pitch.

**PHYSICAL EXAMINATION:** On physical examination, the patient had decreased cervical range of motion with hypertonicity and tenderness of the supraclavicular fossa. Spurling's maneuver was negative and his shoulder and elbow had full range of motion and strength. There was no significant laxity or pain with valgus stress of the elbow and his wrist and intrinsic hand muscle strength was intact. Skin was intact without discoloration or edema. Tinel's was negative at the cubital and carpal tunnel, however, his sensation was slightly diminished throughout the ulnar nerve distribution. Roos and Adson tests were positive. **DIFFERENTIAL DIAGNOSIS:** UCL tear, Flexor pronator strain, ulnar neuritis, cervical radiculitis, thoracic outlet syndrome

**TEST AND RESULTS:** Radiographic evaluation included views of the left elbow and cervical spine which were unremarkable. An MR arthrogram of the elbow was negative for any significant pathology.

**FINAL WORKING DIAGNOSIS:** Acute on Chronic Neurogenic Thoracic Outlet Syndrome

**TREATMENT AND OUTCOMES:** Access to formal physical therapy was limited. The patient's pain and numbness persisted despite oral medications and daily treatment by the athletic trainer so he was referred to the team chiropractor. During the initial chiropractic treatment, which consisted of trigger point release and stretching applied to the anterior scalene musculature and cervical distraction manipulation, the patient experienced a sudden and complete resolution of his pain and numbness. He remained symptom free for the rest of the season.

591 May 29 1:40 PM - 2:00 PM

**Abnormal Anatomical Etiology and the Resultant Bilateral Thoracic Outlet Syndrome: An Exploration Case Report**Jennifer Rizzo<sup>1</sup>, Brent M. Peterson<sup>2</sup>. <sup>1</sup>*Concordia University Irvine, Irvine, CA.* <sup>2</sup>*Biola University, La Mirada, CA.*

Email: jennifer.rizzo@cu.edu

(No relevant relationships reported)

**HISTORY:** 32-year-old healthy female presented to the vascular surgeon for right arm pain (pn) and a hand tremor. She was a mesomorph with forward head posture and was a volleyball athlete and triathlete.

**PHYSICAL EXAMINATION:**

Patient reported years of pn and disfunction with no mechanism of injury. Symptoms began as stabbing pn 8/10 along right ulnar and radial nerves. Pn increased when the arms were unsupported. Right hand tremor increased with ADLs, and arm above 100 degrees. Feeling of heaviness and tingling in the arms impaired sleep and decreased effective grasping of objects causing patient to often drop things. Left arm pn 6/10 in trapezius, radiated to the forearm. Trapezius felt as if it needed to be stretched, but stretching increased pn 7/10. Pn was felt in the jaw and teeth 5/10 and the ear had a "cloudy" sensation. Patient had three root canals yet the facial pn persisted.

**DIFFERENTIAL DIAGNOSIS:**

Paget-Schroetter syndrome

Rotator Cuff injury

Multiple Sclerosis

**TEST AND RESULTS:**

MRA right shoulder:

-Labrum tear, infraspinatus atrophy, rotator cuff tear. Suprascapular nerve laceration with maximal involvement of infraspinatus

MRI c-spine:

-Minor arthrosis, slightly desiccated discs with no bulging at C5-C6

X-ray c-spine:

-No cervical ribs or narrow facets

MRI brain:

-No multiple sclerosis

Electromyography:

-Infraspinatus atrophy

Special Tests - Adson, Allen, Military Brace:

-Absent bilateral pulse

DASH score:

-Significant ADL impairment

Lidocaine muscle block, scalenes and right pec minor:

-Patient reported 50% decrease in pn

MRI bilateral brachial plexus:

-Post-surgical edema, asymmetrically large right jugular vein, pec minor and subclavian muscle atrophy with scarring at SC joint. Brachial plexus matted in scalene compartment; left side normal

**FINAL/WORKING DIAGNOSIS:**

Bilateral TOS with right pec minor impingement

**TREATMENT AND OUTCOMES:**

1.

Sx 1: Subtotal resection of subclavius, scalenes, resection of scalene minimus, division of pec minor, brachial plexus neurolysis, and subclavian artery lysis

2.

Sx 2: Subtotal resection of subclavius, scalenes, brachial plexus neurolysis, and subclavian artery lysis

3.

Sx 3: Scaleneotomy of right scalenes and scar tissue removal

4.

Paralyzed right diaphragm from surgery complication

5.

Patient reports 75% improvement on right, 90% improvement on left.

592 May 29 2:00 PM - 2:20 PM

**Shoulder Injury - Weightlifting**Andrew G. Cheung. *John Muir Health, Walnut Creek, CA.*

(Sponsor: Mark Lavallee, MD, FACSM)

Email: andrewcheungdo@gmail.com

(No relevant relationships reported)

**History:** 27-year-old male weightlifter with history of left UCL sprain and chronic bilateral partial-thickness supraspinatus tears was training for the 2017 FISU Summer World University Games in Taipei, Taiwan at the end of August 2017.

He was finishing his training session with pull-ups, when he felt a tearing sensation in his left anterior shoulder during the eccentric portion of the pull-up, with pain with flexion of that shoulder and tenderness to the area. Two days later, he felt a pop in his left anterolateral arm when he caught an 88 kg snatch slightly forward. He did not have any pain at that time and stopped his training session that day.

**Physical Examination:**

Left arm: Neurovascularly intact. Mild tenderness to palpation over bicipital groove.

"Popeye" deformity of proximal lateral biceps without ecchymosis or significant tenderness, accentuated by active flexion of the forearm.

**Differential Diagnosis:**

1. Rupture of the left biceps brachii long head proximal tendon

2. Partial thickness tear of the left biceps brachii distal tendon

3. SLAP tear of the left shoulder

4. Exacerbation of left elbow UCL injury

**Tests and Results:** Patient was sent 2 days later for ultrasound, which showed disordered muscle fibers and fluid collection over the area of the left proximal biceps deformity. Proximal biceps long head tendon not directly visualized in the bicipital groove on ultrasound.

**Final Working Diagnosis:** Rupture of the left biceps brachii long head proximal tendon

**Treatment and Outcomes:** Over the following month, the patient was seen by a physical therapist twice a week for manual therapy, including ice, compression, e-stim, and therapeutic ultrasound to the area in an effort to prevent potential myositis ossificans. Throughout this period, the patient continued to have intermittent left anterior arm pain while training, worse with snatches and other barbell exercises involving a wide grip; he continued to train at lighter weights, avoiding snatching more than 60% of his maximum in this period. Given the time proximity to competition, the patient decided against surgical evaluation. In competition, he snatched 99 kg (just 2 kg under his best), clean and jerked 125 kg (also 2 kg under his best), and had no significant discomfort or pain.

593 May 29 2:20 PM - 2:40 PM

**Scapular Winging II - A New Approach**Kevin M. Mullins, Brian A. Davis, FACSM. *University of California, Davis, Sacramento, CA.* (Sponsor: Brian A. Davis, FACSM)

(No relevant relationships reported)

**HISTORY:** A 62-year-old woman sustained a right shoulder injury after falling onto an outstretched arm. Initial workup with essentially normal cervical x-rays, MRI, and shoulder x-rays. On shoulder MRI mild increased T2 signals at insertion sites of supraspinatus and long head biceps. NCS for median/ulnar nerves and EMG of deltoid, infraspinatus, serratus anterior and rhomboid major were normal. She was treated with a subacromial corticosteroid injection and therapy without improvement.

**EXAM:** On inspection decreased bulk in right trapezius, rhomboids and supraspinatus. No palpation tenderness. Full passive ROM. Right scapular hike with abduction greater than 90 degrees and loss of adduction control of scapula into anterior/superior supraclavicular region. Active shoulder abduction pain limited to 54 degrees when

standing, but full 170 degrees when supine. Right trapezius strength 4/5, remaining muscles 5/5 with scapula stabilized. Sensation intact and impingement maneuvers negative.

**DIFFERENTIAL:** 1. Spinal accessory nerve lesion. 2. Long thoracic nerve lesion. 3. Supraspinatus tendinopathy. 4. Long head biceps tendinopathy. 5. Adhesive capsulitis.

**RESULTS:** NCS: Normal left spinal accessory nerve CMAP to trapezius, abnormal right spinal accessory nerve with decreased amplitude and onset latency compared. EMG: Normal right deltoid, infraspinatus, serratus anterior, rhomboid major but abnormal right upper/middle trapezius findings with increased insertional activity, fibrillation potentials, positive sharp waves, polyphasic MUAPs and reduced recruitment.

**DIAGNOSIS:** Right incomplete spinal accessory neuropathy

**OUTCOME:** Custom anterior-wrapped to posterior shell scapular stabilization brace fabricated. Once donned, improvement in abduction/flexion ROM quantified utilizing the Microsoft Kinect Motion Analysis. However, there was decrease in cross body adduction, and poor compliance long term due to weight and bulk. An updated lighter weight orthosis was fabricated, including a primary dynamic force strap for anteriorly directed pressure with a scapula plate shield intended to provide a superiorly directed force. The newer materials and design have provided significant improvement in function and compliance, indicating future treatment options for spinal accessory neuropathy.

**594** May 29 2:40 PM - 3:00 PM  
**Shoulder Injury - Rower**

Rahul Khapekar. *Advocate Lutheran General Hospital, Park Ridge, IL.* (Sponsor: Mark Hutchinson, FACSM)  
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(No relevant relationships reported)

**HISTORY:** A 64-year-old expert male rower presented with persistent overhead weakness for 27 months of his right shoulder. He initially felt pain when lowering his arm after placing his canoe on top of his car. Patient denied any acute popping, tearing or swelling. After failed alternative treatments, patient completed MRI shoulder showing full thickness supraspinatus tear and subsequently underwent arthroscopic repair. Despite adherence to physical therapy, patient reported persistent weakness with overhead activity. After an MR arthrogram showed massive supraspinatus re-tear without labral pathology, patient obtained a second opinion at which time he was instructed that he has an "unrepairable torn rotator cuff". **PHYSICAL EXAMINATION:** On inspection of his right shoulder, there is marked atrophy superior and inferior to spine of scapula. Patient has excellent functional ROM actively with significantly limited ROM when shoulder is stabilized - he is able to abduct to 100° and forward flex to 110°. Empty can, drop arm, lift off and belly press test are positive. Labral testing is negative and there is full ROM of neck. There is adequate deltoid musculature with equal sensation bilaterally. Patient has significant winging of scapula in all planes of motion. **DIFFERENTIAL DIAGNOSIS:** 1. Massive rotator cuff tear 2. Acromioclavicular joint arthritis 3. Glenohumeral joint arthritis **TEST AND RESULTS:** EMG: no deltoid denervation with carpal tunnel findings XR: glenohumeral and AC joint arthritic changes MRI right shoulder w/o contrast: massive rotator cuff (supraspinatus and subscapularis) tear **FINAL WORKING DIAGNOSIS:** Chronic right massive rotator cuff tear without deltoid denervation

**TREATMENT AND OUTCOMES:** 1. Physical therapy 2. No reverse total shoulder arthroplasty indicated given no pain 3. Resume all activities as tolerated, may resume kayaking and canoeing

**B-16** Rapid Fire Platform - Physical Activity and Health in 2019: An Expansive Snapshot

Wednesday, May 29, 2019, 1:00 PM - 2:20 PM  
Room: CC-Hall WA2

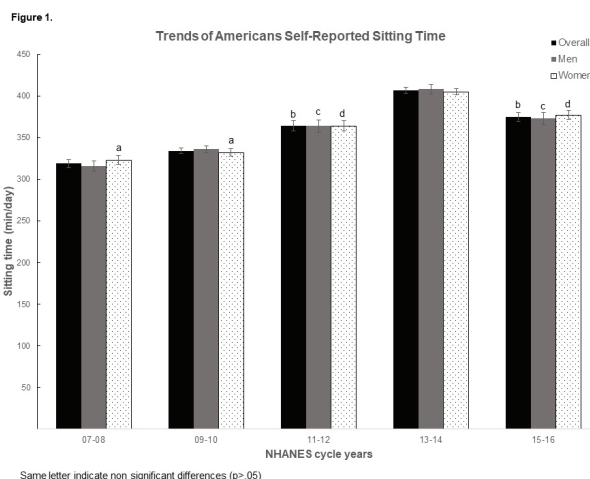
**595** **Chair:** Geoffrey Whitfield. *Centers for Disease Control and Prevention, Atlanta, GA.*  
(No relevant relationships reported)

**596** May 29 1:00 PM - 1:10 PM  
**10-year Trends in Americans Sedentary Behavior (Sitting).**

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Sedentary behavior is recognized as a detrimental behavior to one's health.

**PURPOSE:** To describe 10-year trends in Americans sitting time. **METHODS:** Data from 5 cycles (2007-2016) of the National Health and Nutrition Examination Survey (NHANES) were used in this analysis. During the 07-08 NHANES cycle, participants were asked: "How much time do you usually spend sitting or reclining on a typical day?" For the following NHANES cycles (09-16), participants were asked: "How much time do you usually spend sitting on a typical day?" Mean sitting time for the overall sample and for each sex separately were quantified. Regression analyses accounting for the complex, multi-stage design of NHANES were conducted to examine for linear trends and mean differences in sitting time between cycles. **RESULTS:** 26,771 participants (51.5% females, 20 years of age or older) provided sitting time data for all cycles. Data are presented in Figure 1. Significant positive linear trends across cycles were observed for the overall sample and for each sex separately (all p<.001). For the overall sample and men, mean sitting time was significantly higher at each successive cycle between 07-08 to 13-14. During 15-16 cycle, mean sitting time was significantly lower than 13-14 but not different from 11-12 for the overall sample (p=.16) and men (p=.34). For women, sitting time trends were similar to those observed among the overall sample and men with the exception that the 07-08 and 09-10 cycles were not significantly different from each other (p=.30). **CONCLUSIONS:** Americans' average self-reported sitting time increased between 2007 and 2014. 2016 data showed lower sitting time compared to 2014. Future NHANES waves will help determine whether Americans sitting time has reached a peak or if 2016 data were an exception.



597 May 29 1:10 PM - 1:20 PM

**Effects of an Acute Physical Activity Intervention on Classroom Behavior in Off-Task Preschoolers**

Sarah Burkart, Christine W. St. Laurent, Sofiya Alhassan, FACSM. *University of Massachusetts Amherst, Amherst, MA.*  
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(No relevant relationships reported)

Evidence suggests that physical activity (PA) may improve classroom behavior in elementary school children. Further, studies have shown that the most off-task children may exhibit greater benefit from acute bouts of PA. However, limited data exists in preschoolers. **PURPOSE:** To examine baseline relationships between PA and classroom behavior, and to identify if the most off-task preschoolers responded differently to PA compared to those least off-task. **METHODS:** Participants (n=31, age=3.8±0.8 years, 61% male) attended a university-based preschool. In week one of this two-week pilot study, children engaged in their typical curriculum. Week two included daily short bouts of PA that were integrated into early learning standards. PA was assessed with accelerometers worn on the lower back during preschool attendance. Trained researchers conducted weekly 10-minute classroom observations to quantify children's classroom behavior [active engaged time, (AET); passive engaged time, (PET); off-task motor, (OFT-M); off-task verbal, (OFT-V); off-task passive, (OFT-P)] using the Behavioral Observation of Students in Schools (BOSS) tool. Spearman correlations were used to examine baseline relationships between PA and classroom behavior variables. To test if children with high off-task behavior (HIGH) responded differently to PA compared to children with low off-task behavior (LOW), participants were categorized into tertiles based on baseline off-task behavior and groups were compared using *t*-tests. **RESULTS:** A negative correlation was observed between light intensity activity (min/day) and AET at baseline ( $r=-0.44, p=0.02$ ). No other significant relationships were observed. However, when classroom behavior following PA in the most off-task children was examined, improvements were observed in OFT-M (HIGH=-36.5±5.4%, LOW=10.5±5.7%;  $p=0.0001$ ), OFT-V (HIGH=-16.7±2.8%, LOW=5.7±3.3%;  $p=0.0004$ ), and OFT-P behaviors (HIGH=-19.6±7.6%, LOW=12.0±7.1%;  $p=0.01$ ). **CONCLUSION:** Initial evidence for PA to improve classroom behavior among children who exhibited greater off-task behavior was observed and is consistent with previous findings. Future work should build on this acute study and examine chronic PA to limit classroom off-task behaviors. Supported by: NASPEM Marco Cabrera Student Research Award

598 May 29 1:20 PM - 1:30 PM

**Improving Research Dissemination and Reach: Impact of a Daily Twitter Campaign in Exercise Oncology**

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Approaches to communicating health research has changed with the widespread adoption of digital and social media platforms. Knowledge exchange and research dissemination can now occur at exponential rates compared to traditional methods, providing an opportunity for improved research understanding, impact and implementation. However, it is unclear how effective scientists have been at using digital platforms for knowledge translation. The use of Twitter as a dissemination tool may prove to be an effective strategy to enhance the reach and impact of research and assist with implementation of exercise into healthcare.

**PURPOSE:** To understand the engagement and reach of a daily academic-delivered twitter campaign focused on disseminating scientific publications specific to exercise oncology.

**METHODS:** The Clinical Exercise Physiology Lab at the University of British Columbia (@CEPL\_UBC) delivered a #365papers Twitter campaign that posted one academic paper daily specific to exercise oncology. The first 9-months of this digital campaign were analyzed in 3-months periods (first, middle, last) to understand the project reach, using Twitter metrics (engagements and impressions) and Altmetric attention scores.

**RESULTS:** Overall, 499,899 impressions and 16,741 engagements occurred from 1 January 2018 to 30 September 2018 from 273 exercise oncology article posts. Average engagement rate increased by 35% from the first period compared to the last period (3.1 to 4.2%,  $p<0.001$ ). Link clicks per daily article averaged 23.1 ±25.9 and ranged from 0 to 227 clicks. Followers increased by 296% from 229 to 677 users ( $p<0.01$ ) and were predominantly female (64%) from 39 countries including United States (24%), Canada (23%), United Kingdom (23%) and Australia (10%). Altmetric attention scores indicate 76% of articles had engagement scores in the top 25% of all research outputs and high attention scores compared to outputs of the same age (85% ±12.4) and source (84% ±13.2).

**CONCLUSIONS:** A daily exercise oncology twitter campaign was able to engage a broad international audience and provide high levels of reach, indicating that this may be an effective strategy for communication and dissemination of exercise research.

599 May 29 1:30 PM - 1:40 PM

**Increasing Non-Exercise Physical Activity With Training Reduces Chance Of Non-Response To Exercise**

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(No relevant relationships reported)

Evidence of cardiorespiratory fitness (CRF) non-response is growing in both clinical and exercise training studies. Along with aerobic training, an increase in non-exercise physical activity may reduce CRF non-response contingency. **PURPOSE:** To determine if increases in non-exercise physical activity mitigates CRF non-response to exercise training among sedentary, overweight/obese adults. **METHODS:** Thirty-six adults (age: 54.19±7.14 years; BMI: 35.83±4.66 kg/m<sup>2</sup>; 77.8% female) were assessed from a previous exercise study (>70% adherence to 4 weekly sessions across 24 weeks). Participants were randomized to an aerobic training group or an aerobic training and increasing non-exercise physical activity group (increase 1,000 to 3,000 steps per day from baseline). Both groups performed the same supervised aerobic training (50-75% VO<sub>2</sub> max) for 24 weeks at a dose of 12 kcals per kg per week. CRF non-response was determined via calculated delta ( $\Delta$ ) values (follow-up minus baseline values) for absolute VO<sub>2</sub> max (L/min) and participants were categorized as non-responders via technical error (TE) ( $\Delta<0.71$  L/min) and classical measures ( $\Delta<0$  L/min). Pearson Chi-square test of independence was conducted for categorical variables (i.e. responders vs. non-responders) in TE and classical non-responders, separately. A binary multivariable logistic regression was used to estimate odds of CRF non-response based on baseline demographic factors (age, race, BMI, fitness, waist circumference). **RESULTS:** Participants increasing non-exercise physical activity with aerobic training were significantly more likely to increase CRF based on TE analysis,  $\chi^2(2, N=36)=10.99, p=.004$ , compared to aerobic training alone. Whereas, classic non-response did not show a significant relationship  $\chi^2(2, N=36)=2.77, p=.251$ . Baseline age ( $p<.05$ ) was a significant predictor of TE response, while baseline BMI ( $p<.05$ ) was a significant predictor for classic response. **CONCLUSION:** Increasing non-exercise physical activity concurrent with aerobic training may improve likelihood of increasing CRF and, thus, reduce risk of cardiovascular disease and mortality. Supported by a grant from the American Heart Association (13SDG17140091).

600 May 29 1:40 PM - 1:50 PM

**Trainability Genes Provide Answers To The Cardiorespiratory Fitness Deficit In Childhood Acute Lymphoblastic Leukemia Survivors.**

Maxime Caru<sup>1</sup>, Kateryna Petrykey<sup>1</sup>, Mariia Samoilenko<sup>1</sup>, Simon Drouin<sup>1</sup>, Valérie Lemay<sup>1</sup>, Laurence Kern<sup>2</sup>, Lucia Romo<sup>2</sup>, Patrick Beaulieu<sup>1</sup>, Pascal St-Onge<sup>1</sup>, Laurence Bertout<sup>1</sup>, Geneviève Leafebvre<sup>3</sup>, Caroline Leverdiere<sup>1</sup>, Gregor Andelfinger<sup>1</sup>, Maja Krajcinovic<sup>1</sup>, Daniel Sinnett<sup>1</sup>, Daniel Curnier<sup>1</sup>. <sup>1</sup>*Sainte-Justine University Hospital, Montreal, QC, Canada.* <sup>2</sup>*University of Paris Nanterre, Nanterre, France.* <sup>3</sup>*University of Quebec in Montreal, Montreal, QC, Canada.*  
Email: maxime.caru@umontreal.ca  
(No relevant relationships reported)

**PURPOSE:** As the survival rate of acute lymphoblastic leukemia continues to improve, it has been shown that survivors' exposure to chemotherapeutic agents leads to multiple long-term side effects. Thus, the decrease in the cardiorespiratory fitness of childhood acute lymphoblastic leukemia (ALL) survivors may be due to their cardiovascular response to the chemotherapeutic agents. The first aim of this study was to determine whether cardiorespiratory fitness and physical activity levels were lower among survivors than control subjects, while the second aim was to reported associations between genetic variants and cardiorespiratory fitness in survivors. **METHODS:** Cardiorespiratory fitness (VO<sub>2</sub>peak) and moderate to vigorous physical activity (MVPA) were compared between childhood ALL survivors (N=221) and control subjects (N=825). We performed whole-exome sequencing in survivors (N=239). Germline variants (both common and rare) in a selected set of genes (N=238) were analyzed for an association with cardiorespiratory fitness. **RESULTS:** A difference of 9.2mL·kg<sup>-1</sup>·min<sup>-1</sup> for VO<sub>2</sub>peak between survivors and control subjects was observed. For an identical level of MVPA, the increase in VO<sub>2</sub>peak was different between the both studied cohorts. Also, the VO<sub>2</sub>peak decreased more rapidly with age among survivors, especially in females. Genetic association analyses showed that the common variant in the TTN gene was significantly associated with a

low cardiorespiratory fitness level, while the LEPR, IGF1 and ENO3 genes were significantly associated with a low cardiorespiratory fitness level in female survivors. Positive associations between the cardiorespiratory fitness level and trainability genes were mainly observed in females.

**CONCLUSIONS:** For an identical level of MVPA in both survivors and control subjects, the cardiorespiratory fitness was significantly lower in survivors, which can be associated with variants in genes related to subjects' trainability. These findings could allow better follow-ups tailored to survivors' genetic profile and cardiorespiratory fitness. This study has important implications for survivors, physicians and researchers, which could help reduce at least some of the burden of long-term adverse effects of treatments.

601 May 29 1:50 PM - 2:00 PM

### Physical Activities in Northern Song Dynasty (906-1127), China: A Painting Analysis

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(No relevant relationships reported)

“Qingming Shanghe Tu, 清明上河图” (Painting of “Along the River during the Qingming Festival”) is a historical Chinese painting collected in Palace Museum, Beijing, China. Painted around 1101-1108 by artist Zeduan Zhang (1085-1145), this 24.8 cm x 528 cm painting captures the daily life of people and the landscape of the capital Bianjing of North Song Dynasty. Together, a total of 814 persons were included in the painting revealing the lifestyle and activities of all levels of the society then. Thus, it provides a golden opportunity to study physical activity (PA) pattern of people in China about 900 years ago.

**PURPOSE:** To examine people's PA pattern in North Song Dynasty, China through analyzing a historical painting.

**METHOD:** After each person in the painting was numbered, they were coded by their age category, sex, activity engaged (using 2011 Compendium PA codes when apply), activity context, if labor-saving means was used, etc. The coded information was then analyzed using descriptive statistics.

**RESULTS:** Except for very few female adults and young children and two older adults, most of persons in the painting are male adults, reflecting the male-centered culture then. Most of PA, due to likely the painting was used to record activities related to a major festival, are recreation (miscellaneous) - standing; only one person is running; a few fast walking; many sitting either on chairs or on the ground; and none was doing traditional Chinese exercise. Some labor-saving efforts were already made then, e.g., using donkeys or cows to pull carriage, horses for riding and one case camels for carrying goods. Meanwhile, human power was still the most important source of mechanical energy then, e.g., rowing or pulling boats, carry persons using sedan chair, pushing wheelbarrow for transportations etc. Most noticeable and frequent human power activities are carrying heavy goods on men's shoulders directly or through a carry pole.

**CONCLUSION:** It was noticed that labor-saving efforts were already made in a well-developed civilization society about 900 years ago in China although human power was the major source of mechanical energy then. Painting analysis of ancient paintings and graphics provides a unique and useful means to understand the evolution of human PA.

602 May 29 2:00 PM - 2:10 PM

### A Spring in Your Step: Exercise Training Increases Stretch-Shortening Cycle Potentiation and Walking Economy

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(No relevant relationships reported)

**PURPOSE:** Our objectives were to: (1) examine the effects of combined strength and aerobic training program on stretch-shortening cycle potentiation (SSCP) and net  $\dot{V}O_2$  (inverse of walking economy) among older women and; (2) determine the relationship between SSCP and relative exercise intensity on walking economy. **METHODS:**

Participants were 93 postmenopausal women (60-74 years), 67 of which completed 16 weeks of supervised strength and aerobic training. Participants were randomized into one of three groups: 1 d·wk<sup>-1</sup> of resistance training and 1 d·wk<sup>-1</sup> of aerobic training; 2 d·wk<sup>-1</sup> of resistance training and 2 d·wk<sup>-1</sup> of aerobic training or; 3 d·wk<sup>-1</sup> of resistance training and 3 d·wk<sup>-1</sup> of aerobic training. Body composition (DXA), peak  $\dot{V}O_2$  uptake on a cycle ergometer, concentric velocity during a counter-movement leg press throw (CM: 100% of body weight), concentric velocity during a static leg press throw (CO: 100% body weight), SSCP (difference between CO and CM), and net  $\dot{V}O_2$  while

walking at 2 mph were measured before and after the training. Net  $\dot{V}O_2$  was calculated by subtracting resting  $\dot{V}O_2$  from steady-state  $\dot{V}O_2$  during flat ground walking at 2 mph. A paired samples *t*-test was used to determine differences in measures before and after exercise training. Multiple linear regression of baseline measures was used to determine associations of walking economy adjusted for SSCP and relative exercise intensity (% peak  $\dot{V}O_2$ ) during the walking task. **RESULTS:** Among all participants, body weight did not significantly change (-0.4 kg,  $p = .067$ ), however, percent body fat decreased (-1.3%,  $p < .001$ ). All groups increased peak  $\dot{V}O_2$  (+1.2 mL·kg<sup>-1</sup>·min<sup>-1</sup>,  $p = .002$ ). In the 2 d·wk<sup>-1</sup> group ( $n = 24$ ) mean CM velocity increased ( $p = .004$ ), but mean CO velocity did not change ( $p = .711$ ). Mean SSCP increased ( $p = .048$ ), while net  $\dot{V}O_2$  during the walk task decreased ( $p = .002$ ). Linear regression analysis showed SSCP and relative exercise intensity were independently related to net  $\dot{V}O_2$  while walking at 2 mph ( $r = 0.54, p < .001$ ;  $r = -0.21, p = .047$ ; respectively). **CONCLUSION:** These results reveal exercise training in older women, not only increases walking economy, but increases SSCP. Multiple regression reveals SSCP is associated with walking economy independent of relative exercise intensity among older women.

603 May 29 2:10 PM - 2:20 PM

### Differences in Sleep Quality and Adherence to Energy Intake and Physical Activity Recommendations during an 18-Month Behavioral Weight Loss Intervention

Seth A. Creasy, Danielle M. Ostendorf, Jill L. Kaar, Jaron Arbet, Laura Grau, Zhaoxing Pan, Holly R. Wyatt, Daniel H. Bessesen, Edward L. Melanson, FACSM, Victoria A. Catenacci. University of Colorado Denver, Aurora, CO. (Sponsor: Edward L. Melanson, FACSM)

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(No relevant relationships reported)

**PURPOSE:** Long-term adherence to EI and PA recommendations during a behavioral weight loss interventions is difficult. It is possible that short sleep duration and/or poor sleep quality makes adherence to these recommendations challenging. In this analysis, we explored the association between sleep duration and sleep quality and adherence to EI and PA recommendations during an 18-month behavioral weight loss intervention.

**METHODS:** Adults ( $n=104$ , age: 18-55 years, BMI: 27-42 kg·m<sup>-2</sup>) were enrolled in a behavioral weight loss program. Participants were prescribed a calorie-restricted diet (1200-1900 kcals/day) and were instructed to complete  $\geq 300$  min of moderate to vigorous physical activity (MVPA) per week. In this post-hoc analysis, participants were grouped based on adherence to EI (measured using 3-day food records) and PA (measured using the SenseWear armband) recommendations at 18-months. Adherence to the EI recommendation was defined eating  $\leq$  individually prescribed calories determined using a validated prediction equation at 18 months. Adherence to the PA recommendation was defined as accumulating  $\geq 300$  min/week of MVPA in bouts of  $\geq 10$  min at 18 months. Sleep duration, sleep onset latency (SOL), wake after sleep onset (WASO), and sleep efficiency were calculated at baseline and 18 months using the armband.

**RESULTS:** Individuals who were adherent to both the EI and PA recommendations had significantly lower WASO at baseline (65.7 $\pm$ 11.2 min) compared to non-adherent individuals (82.9 $\pm$ 49.1 min;  $p < 0.05$ ). Individuals who were adherent to only the EI recommendation had significantly lower WASO (61.0 $\pm$ 30.7 min) at baseline compared to those who did not meet the EI recommendation (81.5 $\pm$ 44.0 min;  $p < 0.05$ ). Individuals who were adherent to only the PA recommendation had significantly lower SOL (37.0 $\pm$ 21.1 min) at baseline compared to individuals who did not meet the PA recommendation (44.2 $\pm$ 28.4 min;  $p < 0.05$ ). There were no differences in sleep duration or sleep efficiency between any of the groups.

**CONCLUSIONS:** Sleep quality at the beginning of an 18-month weight loss intervention may influence adherence to EI and PA recommendations during the behavioral intervention. Future behavioral weight loss interventions may be improved by focusing on improving sleep quality in addition to EI and PA.

**B-36 Thematic Poster - Acute and Predicted Physiological Responses to Altitude**

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-101B

**673 Chair:** Billie K. Alba. *USARIEM, Natick, MA.*  
*(No relevant relationships reported)*

**674 Board #1 May 29 3:15 PM - 5:15 PM**  
**Resting Heart Rate Variability at Sea Level does not Predict Arterial Desaturation or Ventilatory Responses to Acute Hypoxia Exposure**

Grace K. Becker, T. Hunter Embry, Kelsey J. Short, Kenneth W. Kambis, M. Brennan Harris. *William & Mary, Williamsburg, VA.* (Sponsor: Joseph W. Starnes, FACSM)  
*(No relevant relationships reported)*

Acute exposure to hypoxia results in a stress response categorized by sympathetic dominance, resulting in increased ventilation to prevent arterial desaturation. Heart rate variability (HRV) can be used as an estimation of overall stress and provides understanding of the balance between sympathetic and parasympathetic autonomic regulation. **PURPOSE:** The purpose of this study was to determine whether resting heart rate variability at sea level is correlated with arterial desaturation and respiratory responses to acute normobaric hypoxia exposure equivalent to an altitude of 3500 meters. **METHODS:** Resting HRV, %SpO<sub>2</sub>, and respiratory rate was measured in 24 male and female subjects at sea level for 15 minutes. HRV was measured using Firstbeat Bodyguard2 and included RMSSD, High Frequency (HF), and Low Frequency (LF) components. Subjects then returned for a subsequent visit and resting HRV, SpO<sub>2</sub> and respiratory rate were measured at rest in a normobaric hypoxic chamber (Colorado Altitude Training) set at either 3500 meters or sea level for control subjects. Correlation analysis using RStudio was performed. **RESULTS:** No significant correlation was observed between HRV in the time domain (RMSSD) and %SpO<sub>2</sub> at rest ( $r=0.26$ ,  $p=0.39$ ), %SpO<sub>2</sub> during exercise ( $r=-0.15$ ,  $p=0.62$ ), or respiratory rate during rest ( $r=0.42$ ,  $p=0.15$ ) when exposed to hypoxia. No significant correlation was observed between HRV in the frequency domain (LFHF Ratio) and %SpO<sub>2</sub> at rest ( $r=-0.10$ ,  $p=0.74$ ), %SpO<sub>2</sub> during exercise ( $r=-0.18$ ,  $p=0.53$ ), or respiratory rate during rest ( $r=-0.39$ ,  $p=0.19$ ) when exposed to hypoxia. **CONCLUSION:** Although exposure to acute hypoxia exerts a physiologic stress response, HRV as a measure of overall stress and the balance of sympathetic and parasympathetic balance does not seem to be predictive of the change in %SpO<sub>2</sub> or respiratory rate.

Supported by The Doug Morton/Marilyn Brown Endowment for Biomedical Research, The Foundation for Aging Studies and Exercise Science Research, and The Borgenicht Program.

**675 Board #2 May 29 3:15 PM - 5:15 PM**  
**Biological Variation of Resting Ventilation and its Diagnostic Accuracy for Acute Mountain Sickness at Altitude**

Kirsten E. Coffman, Samuel N. Cheuvront, FACSM, Robert W. Kenefick, FACSM. *U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.* (Sponsor: Robert W Kenefick, FACSM)  
*(No relevant relationships reported)*

Individuals who develop acute mountain sickness (AMS) upon exposure to high altitude (HA) exhibit differential responses in resting measures of minute ventilation ( $V_E$ ) and end-tidal partial pressure of carbon dioxide ( $P_{ET}CO_2$ ). **PURPOSE:** To determine the biological variation and diagnostic potential of ventilatory parameters in association with AMS. **METHODS:** We performed a retrospective analysis via the Mountain Medicine Database of 22 studies completed by the U.S. Army Research Institute of Environmental Medicine ( $N = 424$ ). First, we determined the biological variation of resting measures of ventilation and defined the accompanying static and dynamic thresholds that indicate a significant deviation from normal at sea level (SL). Second, the diagnostic accuracy of ventilatory measures for AMS development was assessed at HA (4300 m). **RESULTS:** Resting measures of ventilation demonstrated substantial variability within (range 0.4 - 7.7%) and between (range 1.0 - 24.5%) subjects. Based on the index of individuality (II), end-tidal partial pressure of oxygen ( $P_{ET}O_2$ ) and respiratory exchange ratio (RER) may be useful in the static assessment of physiological deviations from normal ( $II = 0.57$  and  $0.60$ , respectively) at HA. Based on the index of heterogeneity (IH),  $P_{ET}O_2$  and peripheral oxygen saturation ( $SpO_2$ ) may be useful in the dynamic assessment of deviations from normal ( $IH = 1.91$  and  $0.41$ , respectively) at HA. RER and  $SpO_2$  showed significant diagnostic accuracy in

the static assessment of AMS (sensitivity/specificity = 53/86 and 24/96, respectively). Ventilatory efficiency for oxygen ( $V_E/VO_2$ ), RER, and  $SpO_2$  showed significant diagnostic accuracy in the dynamic assessment of AMS (sensitivity/specificity = 72/54, 53/74, and 25/98, respectively). Among all measures, RER showed the greatest Youden's Index, a value indicative of the combined sensitivity and specificity of a given predictor (static: 39, dynamic: 28). **CONCLUSION:** Many resting ventilation measures do not demonstrate potential for AMS prediction. However, the few measures identified as potential predictors of AMS following SL biological variation analysis also demonstrated the greatest diagnostic power for AMS at HA. RER shows particular promise as a potential AMS prediction tool. **DISCLAIMER:** Author views not official US Army or DOD policy.

**676 Board #3 May 29 3:15 PM - 5:15 PM**  
**Arterial Desaturation during Moderate Aerobic Exercise in Hypoxia is Positively Correlated to VO<sub>2</sub> Peak at Sea Level in Men and Women**

Thomas H. Embry, Grace K. Becker, Kelsey J. Short, Kenneth W. Kambis, M. Brennan Harris. *William & Mary, Williamsburg, VA.*  
*(No relevant relationships reported)*

Predicting responses to acute hypoxia based on physiologic measures at sea level may be valuable in anticipating adverse responses to acute hypoxia. **PURPOSE:** The purpose of this study was to determine the arterial saturation response in men and women (18-33 years old) of varying fitness levels, at a normobaric altitude of 3500 meters. **METHODS:** 91 subjects (54 women, 37 men) completed a VO<sub>2</sub> peak test on a stationary exercise bike at sea level; to determine aerobic fitness (range 27.7-72.2 ml/kg/min). Each subject then performed an 8-10-minute bout of cycling in normobaric hypoxia corresponding to 3500 meters at 65% of their maximal heart rate at VO<sub>2</sub>peak (sea level). **RESULTS:** VO<sub>2</sub>peak was positively correlated with decreased oxygen saturation during exercise at normobaric hypoxia corresponding to 3500 meters. For women ( $n=54$ ), a greater predictive response was observed with a linear model depicting a strong positive correlation between VO<sub>2</sub> peak and oxygen desaturation in hypoxia ( $r = 0.1643$ ,  $p = 0.001028$ ). For men ( $n=37$ ), a predictive response was also observed with a linear model that was slightly less significant compared to women subjects ( $r = 0.1139$ ,  $p = 0.04412$ ). Furthermore, a relationship between average oxygen saturation difference (resting SpO<sub>2</sub> minus exercise SpO<sub>2</sub>) at normobaric altitude, and VO<sub>2</sub> peak at sea level in women subjects ( $r=0.1855$ ,  $p=0.01719$ ) was observed. **CONCLUSION:** These results demonstrate that increased VO<sub>2</sub> peaks in individuals at sea level, is predictive of higher arterial oxygen desaturation during exercise, in normobaric altitude (3500m), especially in women which may make them more susceptible to adverse responses to acute altitude exposure. Supported by The Doug Morton/Marilyn Brown Endowment for Biomedical Research, The Foundation for Aging Studies and Exercise Science Research, and The Borgenicht Program.

**677 Board #4 May 29 3:15 PM - 5:15 PM**  
**Variability in Human Plasma Volume Responses during High-Altitude Sojourn**

Andrew J. Young, FACSM, Claire E. Berryman, Scott J. Montain, FACSM, Beth A. Beidleman, Stefan M. Pasiakos, FACSM, J. Phillip Karl. *US Army Research Institute of Environmental Medicine, Natick, MA.*  
*(No relevant relationships reported)*

Hematocrit (Hct) and hemoglobin concentrations (Hb) rapidly increase when sea-level (SL) residents ascend to high altitude (HA) due to a decrease in plasma volume (PV), generally but not universally, attributed to changes in oncotic pressure. The  $\Delta PV$  at HA varies, depending on exposure duration and elevation, and sojourner age, sex and SL red cell mass. A quantitative model for predicting individual PV changes (% $\Delta PV$ ) over the first 7d at HA was recently published (Beidleman et al., 2016). That model, developed from measurements of those parameters and the measured % $\Delta PV$  in 393 HA sojourners, was internally cross-validated using boot-strap resampling, but has not been validated against an independent sample of sojourners, or for sojourns >7d in real world conditions, e.g. energy deficit (ED). **PURPOSE:** To compare measured % $\Delta PV$  with % $\Delta PV$  predicted by the model in 17 young, healthy, male, SL natives sojourning 21 d at HA and consuming a diet designed to elicit 40% ED. **METHODS:** Hct, Hb and total circulating protein (TCP) measured in blood of fasting participants at SL and after living 2, 7, 13 and 19 d (HA2, HA7, HA13 & HA19, respectively) at 4300m were used to calculate % $\Delta TCP$  and % $\Delta PV$  from SL. Correlations between % $\Delta PV$  and % $\Delta TCP$  were calculated, and means and individual values of measured % $\Delta PV$  were compared to predicted % $\Delta PV$ . **RESULTS:** Body mass loss was 8 kg by d21 at HA, but body mass loss was not associated with % $\Delta PV$  or % $\Delta TCP$  on HA2, 7, 13 or 19. Mean [95%CI] measured % $\Delta PV$  on HA2, 7, 13 and 19 were -2.5 [-8.2, 3.1], -11.0 [-16.6, -5.5], -11.7 [-15.9, -7.4], and -16.8 [-22.2, -11.3], respectively. % $\Delta PV$  and % $\Delta TCP$  were positively correlated ( $P < 0.001$ ) at HA2, 7, 13 & 19 ( $r^2 = 0.77$ , 0.88, 0.78, 0.89, respectively). The model over-predicted mean [95% CI] decrease

in %ΔPV on HA2 (-12.5 [-13.9, -11.1]) and HA7 (-21.5 [-23.9, -19.1]), accurately predicted the mean decrease on HA13 (-14.3, [-20.0, -8.7]), and predicted a mean increase in %ΔPV on HA19 (12.4 [-5.0, 29.8]). On HA2, 7, 13 and 19 only 2, 2, 6 and 1, respectively, of 17 individual measures of %ΔPV were within 95% CI for predicted %ΔPV. **CONCLUSION:** These observations indicate that human PV responses to HA exposure are oncologically mediated, vary considerably among individuals, and available quantitative models require further refinement to reliably predict %ΔPV exhibited by individual HA sojourners.

**678 Board #5 May 29 3:15 PM - 5:15 PM**  
**Resting and Submaximal Exercise Hemodynamic Changes When Sea Level Individuals Are Exposed to Altitude (11,237ft)**

Holley Sirois<sup>1</sup>, Gabriel Tilton<sup>1</sup>, Thomas Bresnahan<sup>1</sup>, Jordan Stebbins<sup>1</sup>, Parker Nally<sup>1</sup>, Juleah Heath<sup>1</sup>, Lee Spahr<sup>1</sup>, Spencer Bourassa<sup>1</sup>, Corey Young<sup>1</sup>, Melissa Benton<sup>2</sup>, Andrew Subudhi<sup>2</sup>, Paul Visich<sup>1</sup>. <sup>1</sup>University of New England, Biddeford, ME. <sup>2</sup>University of Colorado, Aurora, CO.  
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 (No relevant relationships reported)

Hypertension is a major risk factor for cardiovascular disease, and is present in 46% of the US adult population. An increase in one's blood pressure (BP) (~10mmHg) has been observed when individuals are exposed to altitude for 10-12 months. Less is known of the acute effect on BP in young healthy individuals when exposed to altitude. **PURPOSE:** The purpose of this study was to observe BP changes during rest and submaximal exercise in normotensive sea level (SL) individuals after 24 and 96 hours of altitude exposure (11,237ft). **METHODS:** Nine college students were asked to participate in five trials. Trials 1&2 determined their VO<sub>2</sub>max and 60% HRR workload (WL) at SL, respectively. Trials 3-5 assessed BP, O<sub>2</sub> saturation, heart rate and double product (DP = ((SBP\*HR)/100)) during rest and submaximal exercise. Trial 3 was completed at SL and trials 4&5 were completed at 11,237ft after 24 and 96 hours of altitude exposure. **RESULTS:** 5 males and 4 females; age=21.9±1.4 y; weight=72.3±14.3 kg; height=174.2±6.1 cm; VO<sub>2</sub>max=43.6±8.3 ml/kg/min, completed the study. Oxygen saturation decreased (p=0.00) during rest and exercise at 24h (89±1.68, 82±2.5%) and 96h (90.3±0.75, 83.6±0.21%) vs SL (97.7±0.45, 95.8±0.82%), respectively. Heart rate increased at rest (p=0.00) and exercise (p<0.05) at 24h (77.2±7.9, 160.5±3.6 bpm) and 96h (73.5±10, 155.5±2.2 bpm) vs SL (65.9±8.5, 139±1.8 bpm), respectively. Resting SBP increased (p<0.05) at 24h (119.5±9.5 mmHg) and 96h (122.2±11.6 mmHg) vs SL (115.9±10.9 mmHg). Resting DBP increased (p<0.05) at 24h (78.5±8.5 mmHg) and 96h (80.5±8.9 mmHg) vs SL (71.3±9.6 mmHg). Exercise SBP increased (p<0.05) at 96h vs SL (160.6±15.6 to 153.4±16.5 mmHg), respectively. Double product increased during rest (p=0.00) and exercise (p<0.05) at 24h (91.4±9.6, 254.2±8.2) and 96h (91±12.5, 249.6±10) vs SL (77±10, 214.4±10), respectively. **CONCLUSION:** These results demonstrate that when sea level individuals are acutely exposed to altitude (11,237ft), there is a significant decrease in O<sub>2</sub> saturation, and a significant increase in HR, BP and DP after 24h and up to 96h. These hemodynamic changes are tolerable in young healthy individuals, but could be concerning in individuals with documented or latent CVD.

**679 Board #6 May 29 3:15 PM - 5:15 PM**  
**Hypoxic Cerebrovascular Reactivity Does Not Predict Cognitive Function in Mt. Everest Basecamp Trekkers**

Jacob P. DeBlois<sup>1</sup>, Wesley K. Lefferts<sup>2</sup>, Taylor S. Harman<sup>1</sup>, Kevin S. Heffernan<sup>1</sup>, Trevor A. Day<sup>3</sup>, Tom D. Brutsaert<sup>1</sup>. <sup>1</sup>Syracuse University, Syracuse, NY. <sup>2</sup>University of Illinois, Chicago, IL. <sup>3</sup>Mount Royal University, Calgary, AB, Canada.  
 (No relevant relationships reported)

Cognitive function may be negatively impacted at high-altitude, which has important implications for decision making in such environments. The ability to predict changes in cognitive function at high-altitude may safeguard against potential adverse events in both novice and experienced high-altitude trekkers. Hypoxia results in compensatory increases in cerebral blood flow to maintain oxygen delivery. An inability to increase blood flow in this setting may contribute to cognitive performance at high-altitude. Cerebral reactivity to hypoxia at low-altitude may thus be a useful predictor of cognitive performance at high-altitude. **PURPOSE:** Determine if hypoxic reactivity of middle cerebral artery (MCA) mean blood velocity (V<sub>m</sub>) at low-altitude predicts changes in cognitive function on a trek to Mt. Everest Basecamp. **METHODS:** 17 Mt. Everest Basecamp trekkers (n = 8 females; age = 26 ± 13 yrs; body fat = 19.5 ± 6.5%) underwent a 10-day trek from Kathmandu, Nepal to Gorak Shep, Nepal. Cerebral reactivity testing occurred at low-altitude (116 m). V<sub>m</sub> of the left MCA was determined via transcranial Doppler under normobaric normoxia (NN, ~21% FiO<sub>2</sub>) and hypoxia (NH, ~10% FiO<sub>2</sub>). Each condition lasted 4 min. V<sub>m</sub> was measured between 2.5 and 3.5 min and the average V<sub>m</sub> over the 1-min period was used for analysis. Change in V<sub>m</sub> was calculated as ΔV<sub>m</sub> = V<sub>m</sub>NH - V<sub>m</sub>NN. Cognitive function was assessed as accuracy and reaction time (RT) on a working memory task (2-back number matching task)

performed at NN (116 m) and hypobaric hypoxia (HH; Gorak Shep, Nepal 5,160 m). Changes in cognitive function were calculated as the change in accuracy and RT from NN to HH. **RESULTS:** Accuracy was reduced at HH compared with NN (9.8 ± 10.0% reduction; p = 0.001) while RT was faster (0.06 ± 0.08 s faster; p = 0.007). Univariate regression analysis showed that ΔV<sub>m</sub> did not predict changes in accuracy (β = -0.064, p = 0.807) or RT (β = 0.341, p = 0.181) at HH. **CONCLUSIONS:** Cognitive function was reduced at high-altitude hypoxia, as is consistent with previous work. Changes in MCA V<sub>m</sub> during a hypoxic reactivity test at low-altitude did not relate to changes in cognitive function with ascent to high-altitude. Hypoxic cerebral reactivity tests at low-altitude may not be suitable for predicting high-altitude cognitive function.

**680 Board #7 May 29 3:15 PM - 5:15 PM**  
**Effects of High-Altitude Hypoxia on Neurovascular Coupling During Cognitive Activity**

Wesley K. Lefferts<sup>1</sup>, Jacob P. DeBlois<sup>2</sup>, Trevor A. Day<sup>3</sup>, Jan E. Soriano<sup>4</sup>, Leah Mann<sup>3</sup>, Zahrah Rampuri<sup>4</sup>, Brittany Herrington<sup>3</sup>, Scott Thrall<sup>3</sup>, Jordan Bird<sup>3</sup>, Kevin S. Heffernan<sup>2</sup>, Tom D. Brutsaert<sup>2</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>Syracuse University, Syracuse, NY. <sup>3</sup>Mt Royal University, Calgary, AB, Canada. <sup>4</sup>University of Calgary, Calgary, AB, Canada. (Sponsor: Bo Fernhall, FACSM)  
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 (No relevant relationships reported)

Neurovascular coupling (NVC) describes the ability to deliver continuous, non-pulsatile blood flow to working regions of the brain. NVC during visual stimulation appears maintained in posterior cerebral blood vessels under high-altitude hypoxic conditions. It is unknown, however, if high-altitude hypoxia impairs NVC in frontal regions of the brain undergoing cognitive activation. **PURPOSE:** Examine the effect of high-altitude hypoxia on NVC by measuring anterior (ACA) and middle cerebral artery (MCA) hemodynamic responses to sustained cognitive activity (Stroop task). **METHODS:** Nine adults (23 ± 7 yr, 23.5 ± 2.4 kg/m<sup>2</sup>, 4 female) underwent simultaneous, continuous, bilateral measurement of ACA and MCA mean velocity and pulsatility index (PI) via transcranial Doppler during a 3-min Stroop task at 1400m, 3440m, and 4240m. Mean arterial pressure and arterial oxygen saturation were assessed via oscillometric cuff and pulse oximetry at rest and during the Stroop task. **RESULTS:** Blood pressure increased, MCA and ACA PI, and arterial oxygen saturation decreased with high-altitude hypoxia (p<0.05). Cognitive activity resulted in similar increases in MCA and ACA mean velocity and arterial oxygen saturation, and decreases in MCA PI (p<0.05) at all altitudes. No significant high-altitude hypoxia by Stroop interactions were detected, indicating NVC was similar with increasing high-altitude hypoxia. **CONCLUSION:** Our data suggest high-altitude hypoxia does not disturb compensatory increases in mean velocity and reductions in pulsatility in vessels feeding the frontal regions of the brain during cognitive activity. These data agree with a growing body of evidence that NVC is maintained in hypoxic environmental conditions.

Table 1: Cerebrovascular hemodynamics at rest and during activation (mean ± SD).

	1400m		3440m		4240m	
	Rest	Stroop	Rest	Stroop	Rest	Stroop
SPO <sub>2</sub> (%) <sup>a,b</sup>	94±2	96±1	88±3†	89±3†	85±2*‡	86±1*‡
Mean pressure (mmHg) <sup>a</sup>	84±8	85±9	87±4†	89±11†	95±7*‡	98±7*‡
<b>MCA</b>						
PI <sup>a,b</sup>	0.93±0.08	0.86 ± 0.06	0.80±0.12	0.76±0.10	0.83±0.12	0.78±0.10
V <sub>m</sub> (cm/s) <sup>b</sup>	64±10	67±11	65±10	68±9	65±12	70±11
<b>ACA</b>						
PI <sup>a</sup>	1.07±0.17	0.96±0.14	0.83±0.12†	0.81±0.12†	0.87±0.17	0.84±0.12
V <sub>m</sub> (cm/s) <sup>b</sup>	55±9	58±11	56±15	58±17	54±15	56±14

MCA, middle cerebral artery; ACA, anterior cerebral artery; SPO<sub>2</sub>, arterial oxygen saturation; MP, mean pressure; PI, pulsatility index; V<sub>m</sub>, mean velocity. †p<0.05 effect of Stroop, ‡p<0.05 effect of high-altitude hypoxia, \*p<0.05 vs 1400m, †p<0.05 vs 3440m

**681** Board #8 May 29 3:15 PM - 5:15 PM  
**The Effects of Hypoxia on Cerebral Blood Flow Velocity and Hemodynamics during Ergometer Bicycle Exercise**

Seongdae Kim<sup>1</sup>, Hee-Hyeok Lee<sup>1</sup>, Sangho Kim<sup>2</sup>, Moon-Hyun Hwang<sup>3</sup>, Ilgyu Jeong<sup>1</sup>. <sup>1</sup>Hannam University, Daejeon, Korea, Republic of. <sup>2</sup>Korea University, Sejong, Korea, Republic of. <sup>3</sup>Incheon National University, Incheon, Korea, Republic of.  
 (No relevant relationships reported)

The cerebral blood flow velocity (CBFV) response to acute hypoxia during exercise has been known to increase. But, how hemodynamics might respond to exercise in hypoxic condition and be associated with the change of CBFV remains unclear. **PURPOSE:** To determine the effects of hypoxia on CBFV and hemodynamics during bicycle ergometer exercise. **METHODS:** In a randomized, double-blind, crossover study, Twelve healthy volunteers (22.1±0.6yrs) were asked to perform the bicycle ergometer exercise three times in two hypoxic (3150m and 1900m altitudes) and control (sea level) condition with a week interval, respectively. Exercise intensity was set initially at 50W and increased by 25W every 2 minutes to 125W. Acute normobaric hypoxic condition corresponding to the altitudes of 3150m and 1900m was maintained using low oxygen gas mixture for the whole procedure of 40 minutes. CBFV in middle cerebral artery (MCA) were measured at rest 15 minutes, 5 and 10 minutes during exercise, 10 minutes recovery using transcranial-Doppler sonography. Non-invasive electrical cardiometry was used to obtain cardiac output (CO), thoracic fluid content (TFC) and flow time corrected (FTC). All data were analyzed using two-way ANOVA with repeated measures and Pearson's correlation. **RESULTS:** CBFV in MCA in 3150m and 1900m was significantly higher than in control condition at 10 minutes during exercise (110±28 and 99±25 vs. 75±18 cm/s, p<.05). Heart rate (HR) in 3150m was significantly higher than in 1900m and control condition at 10 minutes during exercise (163±10 vs. 154±6 and 152±8 bpm, p<.05). TFC in 3150m and 1900m was significantly lower than in control condition at 10 minutes during exercise (27±1 and 26±1 vs. 30±2, p<.05). FTC in 3150m and 1900m was significantly lower than in control condition at 10 minutes during exercise (240±20 and 254±16 vs. 265±18 ms, p<.05). However, CO and stroke volume (SV) were not significant different between three conditions. **CONCLUSIONS:** These results suggest that exercise in normobaric hypoxic condition might increase CBFV, which might be independent of hemodynamic changes.

**B-37** Thematic Poster - New Findings in Physical Activity Assessment

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
 Room: CC-102A

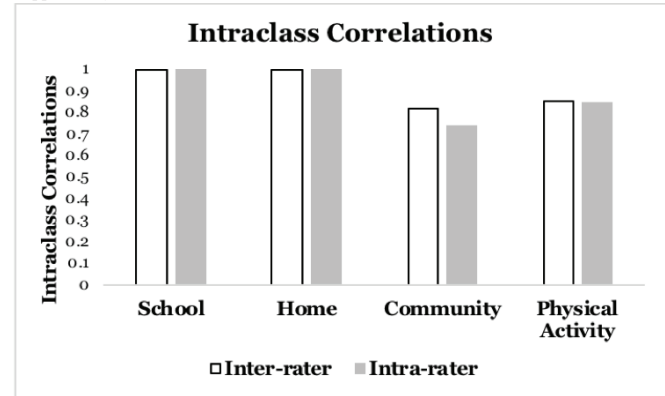
**682** Chair: Nicholas Wareham. *Institute of Metabolic Science, Cambridge, United Kingdom.*  
 (No relevant relationships reported)

**683** Board #1 May 29 3:15 PM - 5:15 PM  
**Free-Living Accelerometer Calibration: A Novel Direct Observation System**

Melanna F. Cox, Greg J. Petrucci, Robert T. Marcotte, Brittany R. Masteller, John Staudenmayer, Patty S. Freedson, FACSM, John R. Sirard, FACSM. *University of Massachusetts, Amherst, MA.* (Sponsor: John R. Sirard, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** To develop a direct observation (DO) system to serve as a criterion measure for model calibration using free-living (FL) accelerometer data. **METHODS:** Ten participants (19.4±0.8 yrs) were video-recorded during four, 1-hr FL sessions in different settings: school, home, community and physical activity (PA). For each setting, 10-min clips from three, randomly selected sessions were extracted and coded by a criterion coder and assistant coders (ACs) using the Observer XT software (Noldus, Wageningen, the Netherlands). Coders identified the movement/body position and four modifiers: locomotion (yes or no), activity type (e.g. reading), MET value, and intensity category. For intra-rater agreement, the criterion coder coded all 12 videos twice, separated by at least one week. For inter-rater agreement, all 12 videos coded by each AC were compared to the criterion coder. Intraclass correlation coefficients (ICCs) were calculated to assess agreement of intensity category for intra- and inter-rater comparisons. **RESULTS:** Intra-rater agreement ranged from 91% to 100% across all variables in all four settings. Inter-rater agreement between the criterion coder and the ACs ranged from 88±3.5% to 100±0% across all variables in all four settings. As shown below, ICCs for intensity category ranged from 0.74-1.00

and 0.81-1.00 for intra- and inter-rater comparisons, respectively. **CONCLUSION:** The DO system is reliable and feasible to serve as a criterion measure of FL physical activity in young adults. The DO system can serve as a standardized instrument to develop accelerometer models for estimating PA and sedentary behavior in FL settings. Supported by: NIH NIDDK 1R01DK110148-01



**684** Board #2 May 29 3:15 PM - 5:15 PM  
**Reliability Analysis of the COSMED K5 Portable Metabolic System**

Lindsey E. White, Jacob P. DeBlois, Tiago V. Barreira. *Syracuse University, Syracuse, NY.*  
 (No relevant relationships reported)

Increased energy expenditure via physical activity has been shown to improve health outcomes. It is difficult to measure energy expenditure and physical activity outside the laboratory. **PURPOSE:** To determine the reliability of the COSMED K5 portable metabolic system. **METHODS:** 27 (n = 14 females) healthy adults (27 ± 5 yrs; 21.0 ± 8.2% body fat) completed a treadmill walking protocol. Participants completed 3 identical trials of 5-min stages that included standing and 6 walking speeds from 1.5 to 4.0 mph in 0.5 mph increments, with a 2-min rest between stages for a total of 47 minutes. Visit 1 consisted of wearing the K5 system. During visit 2 (1-7 days later), participants wore the K4 and K5 systems in a randomized, counter-balanced order. Oxygen consumption (VO<sub>2</sub>, ml·min<sup>-1</sup>), carbon dioxide production (VCO<sub>2</sub>, ml·min<sup>-1</sup>), ventilation (V<sub>e</sub>, L·min<sup>-1</sup>), metabolic equivalents (METs), respiratory exchange ratio (RER), and energy expenditure (EE, kcal·min<sup>-1</sup>) were recorded breath-by-breath and averaged from minutes 2.5 to 4.5 from each stage for analysis. Reliability of the K5 was determined using an intraclass correlation coefficient (ICC) and coefficient of variation (CV). **RESULTS:** As shown in Table 1, the ICC for standing ranged from 0.26-0.75 and CV ranged from 4.0-11.0%. During walking, ICC ranged from 0.41-0.88 and CV from 3.0-8.0%.

**Table 1. Reliability of COSMED K5 in standing and at various walking speeds**

Variable		Standing	1.5 mph	2.0 mph	2.5 mph	3.0 mph	3.5 mph	4.0 mph
VO <sub>2</sub>	ICC	0.47	0.64	0.72	0.76	0.76	0.78	0.85
	CV (%)	11.0 ± 9.0	8.0 ± 5.0	6.0 ± 6.0	7.0 ± 5.0	7.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0
VCO <sub>2</sub>	ICC	0.53	0.50	0.64	0.67	0.73	0.75	0.80
	CV (%)	11.0 ± 9.0	8.0 ± 6.0	7.0 ± 7.0	7.0 ± 6.0	6.0 ± 5.0	7.0 ± 5.0	7.0 ± 5.0
V <sub>e</sub>	ICC	0.75	0.74	0.80	0.77	0.79	0.83	0.88
	CV (%)	10.0 ± 7.0	6.0 ± 5.0	6.0 ± 6.0	6.0 ± 5.0	5.0 ± 4.0	4.0 ± 3.0	4.0 ± 3.0
METs	ICC	0.65	0.54	0.56	0.65	0.66	0.74	0.82
	CV (%)	11.0 ± 8.0	8.0 ± 5.0	6.0 ± 6.0	7.0 ± 5.0	6.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0
RER	ICC	0.26	0.41	0.55	0.49	0.44	0.62	0.80
	CV (%)	4.0 ± 3.0	4.0 ± 3.0	3.0 ± 2.0	4.0 ± 3.0	4.0 ± 3.0	5.0 ± 3.0	6.0 ± 4.0
EE	ICC	0.50	0.62	0.71	0.74	0.75	0.78	0.84
	CV (%)	11.0 ± 9.0	8.0 ± 5.0	6.0 ± 6.0	6.0 ± 5.0	6.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0



**CONCLUSIONS:** The K5 provided reliable measures of  $\dot{V}O_2$ ,  $\dot{V}CO_2$ ,  $\dot{V}_e$ , METs, RER, and EE across a variety of walking speeds, with higher reliability noted at 3.0-4.0 mph. Future studies should examine the reliability of the K5 during running and other activities.

**685 Board #3 May 29 3:15 PM - 5:15 PM**  
**Free-living Evaluation Of Laboratory-based Machine Learning Algorithms For Activity Classification In Preschool Children**

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 (No relevant relationships reported)

Machine learning (ML) classification models for accelerometer data are a potentially more accurate method to measure physical activity in young children than conventional cut-point methods. However, existing algorithms have been trained on laboratory-based activity trials. To our knowledge, no studies have evaluated the performance of classification algorithms trained on structured activity trials for preschool-aged children under free-living conditions, and none have used fine-grained video-based direct observation to evaluate algorithm performance.

**Purpose:**

To evaluate the performance of hip and wrist Random Forest (RF) and Support Vector Machine (SVM) activity classification algorithms for preschool-aged children (Trost et al. 2018) under free-living conditions.

**Methods:**

31 children (4.0 ± 0.9 yrs) were video recorded using a GoPro during a 30-minute unstructured active play session in a park while wearing an ActiGraph GT3X+ accelerometer on their right hip and non-dominant wrist. Direct observation was used to continuously code ground truth activity type and activity class using the Noldus Observer XT. Algorithm performance was assessed using overall accuracy and confusion matrices were generated to summarize class-level classification accuracy.

**Results:**

Accuracy for the hip and wrist RF algorithms was 69.4 (95% CI:67.4 – 71.2), and 59.1 (95% CI:57.1-61.1), respectively. Accuracy for hip and wrist SVM algorithms was 66.4 (95% CI:64.4 – 68.3), and 59.3 (95% CI:57.3 – 61.3), respectively. Classification was moderate for sedentary (71-77%), poor-moderate for light activity and games (58-79%), and moderate-good for moderate to vigorous activity and games (71-84%) and running (66-75%). Classification for walking (9-15%) was poor. When 15-sec windows with multiple activities were excluded from analysis, overall accuracy was improved by 8-10%. Prediction of walking improved by 19-34%.

**Conclusion:**

The accuracy of laboratory-based activity classification algorithms for preschool-aged children was attenuated when tested on new data collected under free living conditions. Future studies should develop and evaluate the performance of activity classification algorithms trained on accelerometer data collected under true free-living conditions.

**686 Board #4 May 29 3:15 PM - 5:15 PM**  
**Insights On Free-living Sedentary Behavior Estimates Using A Hip- Or Wrist-worn Accelerometer**

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 (No relevant relationships reported)

**PURPOSE:** The primary purpose was to validate existing methods to estimate sedentary behavior (SB) under free-living conditions using ActiGraph GT3X+ accelerometers (AG). The secondary purpose was to identify method-specific systematic errors that result in the misclassification of SB. **METHODS:** Forty-eight participants (age:20.4±1.3 years, 45.8% male) were video-recorded during four 1-hour sessions in different settings (home, community, school, environment) while wearing an AG on the right hip and non-dominant wrist. Videos were coded for postural orientation and activity type (e.g. walking). Observed time in sitting and lying postures were classified as SB (criterion measure). Twelve methods were applied to hip and wrist accelerometer data to estimate time spent in SB (see Figure 1). Repeated measures linear mixed models were used to estimate method bias (estimate - criterion SB) and a 95%CI around the bias. **RESULTS:** On average, participants spent 34.1 of the 57.2 minutes/session in SB. Four of the hip methods were unbiased (Soj1x, Soj3x, CPM100, CPM150), however SB was underestimated using CPM200vm (-5.5 minutes, 95%CI: -7.1, -3.8) and overestimated using ENMO47.4 (12.2 minutes, 95%CI: 9.9, 14.5). For the wrist, Sed Sphere was the only unbiased method. SB was overestimated using ENMO44.8 (3.7 minutes, 95%CI: 1.8, 5.5) and underestimated using Wrist RF, CP15s376vm, Wrist TR, and CPM1853vm, ranging from -9.5 to

-5.7 minutes. The majority of misclassified SB occurred during standing or sitting behaviors (67.0-96.7%). **CONCLUSION:** Accurate estimates of SB from a hip-worn AG can be achieved using either simpler count-based approaches (CPM100, CPM150) or machine learning models (Soj1x, Soj3x). Only the Sedentary Sphere may be suitable to estimate SB from the non-dominant wrist. Future work to distinguish standing from SB may lead to improvements in estimating SB. Supported by NIH NIDDK 1R01DK110148

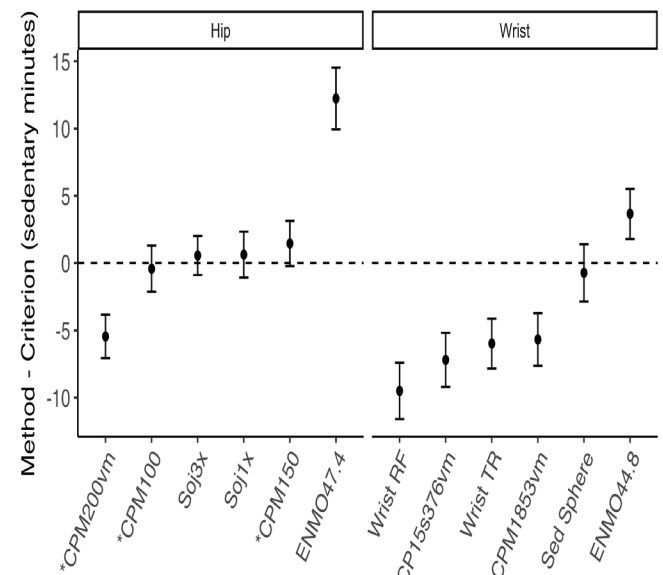


Figure 1: Mean bias and 95%CI for hip- and wrist-method estimated time spent in sedentary behavior. \* indicates method was applied to low-frequency extension processed accelerometer data

**687 Board #5 May 29 3:15 PM - 5:15 PM**  
**Using A Thigh Worn Accelerometer To Identify Periods Of Seated Car Travel**

Kate Lyden<sup>1</sup>, Craig Speirs<sup>1</sup>, David Loudon<sup>1</sup>, Cami Christopher<sup>2</sup>, Rachel Barnett<sup>2</sup>, Julian Martinez<sup>2</sup>, Mami Takeda<sup>2</sup>, Sarah Keadle<sup>2</sup>. <sup>1</sup>PAL Technologies, Glasgow, United Kingdom. <sup>2</sup>California Polytechnic State University, San Luis Obispo, CA.  
 Reported Relationships: K. Lyden: Consulting Fee; PAL Technologies.

Thigh inclination has been shown to be a highly specific discriminator between upright and seated activities. During periods of sitting, the background noise in the acceleration signal can provide important contextual information about the seated behaviour.

**PURPOSE** The purpose of this study was to develop and validate a simple algorithm to distinguish periods of seated car travel. The algorithm is based on the premise that during seated car travel, 1) body-worn accelerometers register a background level of external dynamic acceleration due to forces generated by the road surface and car engine and 2) leg movements are restricted due to the spatial constraints of the car. **METHODS** Participants (n=26, mean age=30.5yrs, 16 female, 20 male) were directly observed in their free-living environment on two separate occasions, for two hours each. Raw accelerometer data were summarized in 15-second epochs and synced with direct observation video. Using knowledge based on *a priori* observations of car travel, four features of the accelerometer signal were extracted from periods of sitting and tested 1) median vector magnitude (VM), 2) lower VM decile, 3) maximum VM and 4) range of inclination angles. Parameter constants were chosen based on grid search methods with the objective of maximizing positive and negative predictive value (PPV, NPV). **RESULTS** Threshold constants identified included 1) median VM < 500, 2) lower VM decile > 5, 3) maximum VM < 5000 and 4) inclination angle range < 40. 100% of car travel events were correctly identified, with a single false positive (1%). PPV and NPV were 95.5% and 100%, respectively. **CONCLUSION** Using a thigh worn accelerometer, seated behaviours can be identified as car travel or not. Importantly, acceleration features pertaining to both the inclination angle and vector magnitude were needed to optimize classification accuracy.

**688** Board #6 May 29 3:15 PM - 5:15 PM  
**Automatic Segmentation of Walking Strides in Wearable Accelerometry Data with Adaptive Empirical Pattern Transformation**

JACEK K. URBANEK<sup>1</sup>, Marta Karas<sup>2</sup>, William Fadel<sup>3</sup>, Marcin Straczakiewicz<sup>4</sup>, Jaroslaw Harezlak<sup>4</sup>, Ciprian Crainiceanu<sup>2</sup>.  
<sup>1</sup>Johns Hopkins School of Medicine, BALTIMORE, MD. <sup>2</sup>Johns Hopkins School of Public Health, BALTIMORE, MD. <sup>3</sup>Indiana University, Indianapolis, IN. <sup>4</sup>Indiana University Bloomington, Bloomington, IN.  
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 (No relevant relationships reported)

Quantifying gait parameters and ambulatory monitoring of changes in these parameters has become increasingly important for epidemiological and clinical studies. Wearable accelerometers provide objective high-density measurements of human gait dynamics through recording of acceleration. Many studies use accelerometry to objectively measure physical activity using the activity counts, vector magnitude, or number of steps. These measures use just a fraction of the information in the raw accelerometry data as they are typically summarized at the minute level. To address this problem, we focus on raw, sub-second level accelerometry data and define a set of gait characteristics based on these data. Additionally, to overcome the analytical challenges of these complex and voluminous data we develop automatic and unsupervised methodology for precise segmentation of stride patterns. **PURPOSE:** We propose Adaptive Empirical Pattern Transformation (ADEPT) and maximization-tuning procedure for automatic identification of individual walking strides from raw accelerometry data that uses data-derived baseline patterns, representing a population-specific strides. **METHODS:** Data were collected as a part of the study on Identification of Walking, Stair Climbing, and Driving Using Wearable Accelerometers, funded by the Indiana University CTSI grant and conducted at the Department of Biostatistics, RM Fairbanks School of Public Health at Indiana University. The study enrolled 32 healthy participants between 23 and 52 years of age. Participants wore accelerometers on a wrist, hip and both ankles during a 450-meter outdoor walk. **RESULTS:** ADEPT yields results that are in most cases visually indistinguishable from manual segmentation and reduces strides segmentation time radically. The average absolute deviation of estimated stride duration across study participants was 4.74, 1.42, 1.28 and 1.31 percent, for wrist, hip and both ankles respectively. **CONCLUSIONS:** Our results indicate that the errors are small relative to the signal for all body locations suggesting that ADEPT is a robust and universal tool for segmentation of strides in accelerometry data.

**689** Board #7 May 29 3:15 PM - 5:15 PM  
**Development And Testing Of An Integrated Score For Physical Behaviors**

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 (No relevant relationships reported)

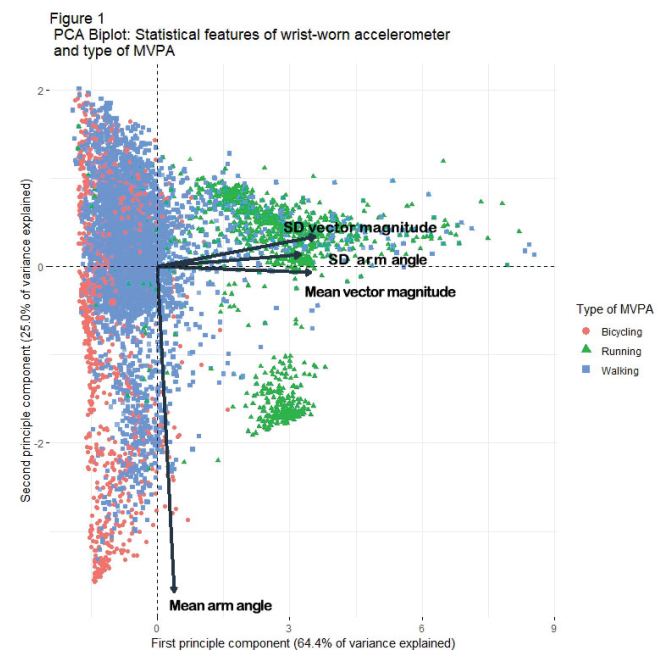
There is expanding interest in the 24-hr activity cycle in relation to health outcomes, creating a need for new statistical approaches to analyze the joint effects of distinct but inter-related physical behaviors (e.g., exercise, sitting time, sleep). **PURPOSE:** To develop and test an integrated physical behavior score (PBS) in relation to all-cause and cause specific mortality. **METHODS:** NIH-AARP Diet and Health Study participants (N=163,016) completed a questionnaire (2004-2006) asking about time spent in five exercise and non-exercise physical activities, two sedentary behaviors (television and non-television), and sleep. In half of the sample, we used shape constrained additive regression to model the relationship between each behavior and survival. Maximum logit scores from each of the eight behavior-survival functions were summed to produce a PBS that was proportionally rescaled to range from 0-100. We examined predictive validity of the PBS in the other half-sample using Cox Proportional Hazards models after adjustment for covariates for all-cause and cause-specific mortality. **RESULTS:** In the testing sample, over an average of 6.6y of follow-up, 8,732 deaths occurred. We found a strong graded decline in risk of all-cause mortality across quintiles of PBS (Q5 vs Q1 hazard ratio [95%CI] = 0.53 [0.49, 0.57]). Risk estimates for the PBS were higher than any of the components in isolation. Results were similar but stronger for cardiovascular disease (Q5 vs Q1 = 0.42 [0.39, 0.48]) and other mortality (Q5 vs Q1 = 0.42 [0.36, 0.48]). The relationship between PBS and mortality was observed in stratified analyses by median age, sex, BMI and health status. **CONCLUSIONS:** Although widespread in other areas of epidemiology, this is one of the first attempts to characterize integrate multiple distinct physical behaviors into

a single composite score. In a large sample of US adults, we showed this score has strong predictive validity for both men and women. Future research is needed to test this approach in an independent sample. Supported by the National Institutes of Health U01-CA057030 and the Intramural Research Program.

**690** Board #8 May 29 3:15 PM - 5:15 PM  
**Estimating Free-living Physical Activity Using A Wrist-worn Actigraph Accelerometer: Can It Be Done?**

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 (No relevant relationships reported)

**PURPOSE:** Determine the accuracy of wrist-worn ActiGraph GT3X+ accelerometer (AG) data processing models and examine relationships among model features and type of MVPA. **METHODS:** Forty-eight participants (20.4 ± 1.3 years, 45.8% male) wore an AG on their non-dominant wrist during four, 1-hour sessions in free-living settings. Sessions were video-recorded and coded using a direct observation (DO) system that provided criterion measures for minutes and type of MVPA. Four previously developed AG processing models were applied to estimate MVPA minutes: raw acceleration and arm angle cut-point (sed-sphere), Euclidean norm corrected for gravity cut-point (ENMO), random forest (RF) and decision tree (DT) models. Mixed models were used to assess the difference between model estimated and DO measured MVPA minutes. Principle components analysis (PCA) was used to examine features of the AG data that were associated with MVPA. **RESULTS:** DO identified 12.8 minutes of MVPA/session. Sed-sphere was the only model to accurately estimate MVPA minutes (bias [95% confidence interval] = 1.0 [-0.4, 2.5] minutes). MVPA was overestimated using RF and DT (5.9 [3.3, 8.5] and 4.0 [2.4, 5.6] minutes, respectively) and ENMO significantly underestimated MVPA minutes (-10.7 [-12.9, -8.4] minutes). PCA showed that two principle components account for 89.4% of the variance in MVPA type (64.4% and 25.0%, respectively; Figure 1). The first principle component placed equal weight on three features (mean, standard deviation of acceleration vector magnitude and standard deviation of arm angle) while the second loaded on mean arm angle. **CONCLUSIONS:** Sed-sphere was the only model to accurately estimate minutes of MVPA. PCA indicates that arm angle estimates aspects of MVPA beyond acceleration vector magnitude, and future research should use that feature. Supported by NIH NIDDK R01DK110148



**B-38 Thematic Poster - Special Needs**

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-102B

**691 Chair:** Jennifer Lee Trilk, FACSOM. *University of South Carolina School of Medicine Greenville, Greenville, SC.*  
(No relevant relationships reported)

**692 Board #1** May 29 3:15 PM - 5:15 PM  
**A Fit 5 Program for Adults with Developmental Disabilities in a Day Program**

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(No relevant relationships reported)

ACSM Scientific Abstract Submission 2019

**PURPOSE:** Fit 5 is a resource published by Special Olympics that provides instruction for making healthy choices including exercise, diet, and hydration. The purpose of this study was to examine the effectiveness of the Fit 5 program at improving the health of persons with developmental disabilities when promoted through a community day program. **METHODS:** Individuals with developmental disabilities were invited to participate in a weekly fitness program that utilized the Fit 5 resources at their community day program. Participants were given a Fit 5 booklet that provided instruction on making healthy choices. Participants attended one 45-minute group exercise session per week for a total of six weeks. Exercise sessions included Level 1 and Level 2 exercises from the Fit 5 resource and targeted aerobic endurance, muscular fitness, flexibility, and balance. At each group exercise session, participants submitted a weekly record of their exercise, diet, and hydration and were prompted to continue healthy behaviors. A pre-test/post-test design was used. Exactly one week before (pre-test) and one week after (post-test) the 6-week intervention, waist circumference, total modified push-ups performed, and total modified curl-ups performed were recorded for each participant. Repeated measures MANOVA was used to test the effect of time (pre-test, post-test) on the measures of waist circumference, total push-ups, and total curl-ups in order to evaluate the effectiveness of the intervention for improving body composition and muscular fitness. **RESULTS:** 18 individuals (Mean age: 43 ± 19; 11 females) have participated in the intervention to date. Pillai's trace repeated measures MANOVA revealed a significant difference between measures of fitness on the pre-test and post-test ( $F_{(df=3,13)} = .582; p < .01, \eta^2 = .58$ ). The total curl-ups ( $p < .001$ ) performed increased between the pre-test (15+11) and post-test (23+13). Neither total push-ups performed nor waist circumference was significantly changed by the intervention ( $p > .05$ ). **CONCLUSIONS:** A 6-week intervention using the Fit5 resources was effective at improving muscular fitness for persons with developmental disabilities within a local community day program.

**693 Board #2** May 29 3:15 PM - 5:15 PM  
**Feasibility of a 6-week Handcycling High Intensity Interval Training Program for Spinal Cord Injury**

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(No relevant relationships reported)

**PURPOSE:** Spinal cord injury (SCI) can be debilitating to one's health, functional capacity, and quality of life. Specifically, SCI contributes to an elevated risk of preventable cardiometabolic and hypokinetic diseases. Many individuals with SCI have low levels of fitness due to barriers including lack of time, accessible equipment and awareness of exercises that are safe and effective. Using an indoor stationary handcycle to perform a high-intensity exercise program (HIIT) could be a time-efficient and accessible means of improving fitness. The primary aim of this study was to determine adherence, acceptance and fitness outcomes of a 6-week HIIT program for non-ambulatory persons with SCI.

**METHODS:** Three men with SCI have completed the study to date (Table). At baseline, S2 did not participate in regular physical activity (PA). S1 and S3 participated in 1-3 hours of PA 2 times/week. Participants completed a baseline and post graded exercise test. The HIIT program consisted of 2, 25 min supervised at-home sessions (2-3 min warm-up, 10, 1:1 min work/recovery phases at 90% peak power output (PPO) and 0-20% PPO and 2-3 min cool-down). Real-time power, heart rate (HR), cadence and velocities were recorded via sensors and an app (Garmin Connect). **RESULTS:** Subjects completed all 12 sessions and 10 bouts with the exception of S2 (7/10 and 8/10 bouts for sessions 1 and 4). S2 performed 3 unsupervised sessions

verified via the app. Fitness outcomes were not apparent for S2 and S3 while S1 showed increases in VO<sub>2</sub> (16.0 to 17.1 ml/kg), minute ventilation (37.9 to 42.0 ml/kg), and tidal volume (1.2 to 1.5 L) peaks after training.

Table: Baseline and training data averaged over the 12 sessions (work phases)

Subject	Age, SCI level, Years Post Injury	Baseline HR	Baseline PPO	HR Beats/min	Power Watts	Cadence Rev/min
S1	58, L5/S1, 24	89	50	85 (3)	51.8 (6.0)	57 (5)
S2	17, C5, 2	133	50	100 (3)	41.4 (4.5)	51 (13)
S3	30, C5/C6, 15	100	40	102 (3)	29.0 (2.8)	59 (5)

**CONCLUSION:** Feasibility was demonstrated by excellent adherence and remote monitoring of compliance with HIIT intensities. A greater number of weekly sessions and/or a longer training period are likely to lead to improvements in fitness parameters.

**694 Board #3** May 29 3:15 PM - 5:15 PM  
**Physical Activity, Sleep, And Stereotypic Behaviors In Youth With Autism Spectrum Disorder**

Justine M. Renziehausen, Paola M. Rivera, Baker M. Kayla, Nicholas A. Leahy, Jeanette M. Garcia. *University of Central Florida, Orlando, FL.*  
(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to compare the associations between moderate-to vigorous physical activity (MVPA), sedentary behavior (SB), sleep quality, and stereotypic behaviors in children with Autism Spectrum Disorder (ASD). **METHODS:** Activity levels and sleep quality were measured in 16 children with ASD (ages 8-17) using Actigraph GT9X Accelerometers. All participants wore the device on their non-dominant wrist for a period of seven days and nights. Parents completed the Aberrant Behavior Checklist (ABC) which examined child irritability, stereotypic behaviors, hyperactivity, inappropriate speech, and lethargy. Spearman correlations were used to examine associations between minutes of MVPA, sleep duration, and adverse behaviors.

**RESULTS:** Greater levels of MVPA were correlated with less stereotypic behaviors ( $r = -.62, p = .02$ ). Although they did not quite reach statistical significance, trends were seen for the associations between 1) longer sleep duration and lower ratings of hyperactivity ( $r = -.43, p < .1$ ); and 2) greater amounts of SB and higher ratings of lethargy ( $r = .4, p < .1$ ).

**CONCLUSIONS:** Adequate duration of sleep and participation in MVPA may be linked with fewer adverse behaviors in children with ASD. Future studies should examine larger samples of children with ASD over a longer duration to better determine causal mechanisms that may explain these associations between MVPA, sleep habits and ASD-related behaviors.

**695 Board #4** May 29 3:15 PM - 5:15 PM  
**Comparison of Energy Expenditure in Wheelchair Users During Active Video Gaming with Adapted Game Controllers**

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(No relevant relationships reported)

Active video gaming (AVG) options are limited for individuals with mobility impairments due to inaccessibility of the gaming controllers. Two gaming controllers (Wii Fit balance board and gaming mat) were recently adapted for individuals with physical disabilities ([www.rectech.org](http://www.rectech.org)), thereby providing increased opportunities for AVG play. **PURPOSE:** To compare energy expenditure in persons with mobility impairment during seated AVG play using an adapted Wii Fit balance board (WFBB) and adapted gaming mat. **METHODS:** During the first lab visit, demographic data were collected, and participants completed a game play familiarization period. During the next two lab visits, metabolic data (COSMED) were collected during a 20-minute baseline, followed by two 10-minute bouts of game play. During one visit, participants played select Wii Fit Plus games on the adapted WFBB and during the other visit Active Life Explorer and Outdoor Challenge games were played on the adapted gaming mat. For all AVGs participants played seated. The adapted WFBB was designed so that the player could wheel onto the platform. For play using the adapted gaming mat, the mat was placed on a height-adjustable table. A paired sample t-test was computed to compare mean energy expenditure during game play on the adapted WFBB and gaming mat. **RESULTS:** Sample included 26 participants, 16 men, mean age 37.50 ± 12.77 yrs. All participants utilized a wheelchair for mobility and daily activities. Mean energy expenditure (METs) during game play was significantly greater

( $p < .05$ ) on the adapted WFBB ( $2.24 \pm 0.68$  kcal/kg/hr) as compared to the gaming mat ( $1.99 \pm 0.68$ ). **CONCLUSION:** The adapted WFBB and gaming mat provided an opportunity for persons with mobility impairments, specifically wheelchair users, to engage in AVG. Although mean MET values achieved during AVG represented light intensity exercise, several participants ( $n = 12$ ) achieved moderate intensity (3-4 METs) on at least one game set. Factors not accounted for that may have influenced exercise intensity include game selection, limited familiarization, and discomfort wearing the COSMED system. Adapted controllers for AVG play provide a viable option for increasing leisure-time physical activity in persons with mobility impairments. Supported by NIDLRR grant 90RE5009-01-00.

**696** Board #5 May 29 3:15 PM - 5:15 PM  
**Prediction of Energy Expenditure from Accelerometers during Physical Activity in Adults with Down Syndrome: The Effect of Accelerometer Placement**

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(No relevant relationships reported)

**INTRODUCTION:** For accurate physical activity assessment with accelerometers in adults with Down syndrome (DS), there is a need to examine if the relationship between the rate of oxygen uptake ( $\dot{V}O_2$ ) and output from hip- and wrist-worn accelerometers across different activities and sedentary behaviors is different between adults with and without DS. In this study, we examined this question and we also evaluated the accuracy of hip- and wrist-worn accelerometers in estimating the  $\dot{V}O_2$ . **METHODS:** The sample included 16 adults with DS (10 men; age  $31 \pm 15$  years) and 19 adults without DS (10 men; age  $24 \pm 6$  years). We measured  $\dot{V}O_2$  with a portable spirometer (K4b<sup>2</sup>, Cosmed) and accelerometer output (Vector Magnitude [VM]) with a hip- and a wrist-worn accelerometer (wGTX-BT, Actigraph). We used multi-level regression to predict  $\dot{V}O_2$  from VM and group. Additional predictors included body mass index (BMI), age, height, weight, and sex. We evaluated the accuracy of the prediction with the absolute percent error and Bland-Altman plots.

**RESULTS:** For both the hip and the wrist accelerometer, VM and group were significant predictors of  $\dot{V}O_2$  ( $p \leq 0.021$ ). However, when BMI was added to the models, BMI was a significant predictor and DS was no longer significant for both accelerometer models. The final models included Vector Magnitude and BMI ( $p \leq 0.001$ ;  $R^2 = 0.78$  and  $0.57$ , for hip and wrist accelerometer model, respectively). For the hip accelerometer, absolute percent error across all tasks and for both groups combined was  $22.5 \pm 27.4\%$ , whereas, for the wrist accelerometer, error was  $37.8 \pm 38.0\%$ . Absolute percent error across tasks combined and for each task separately did not differ between groups. The Bland-Altman plots indicated nearly zero mean error for both groups. However, error had somewhat greater 95% confidence intervals for the wrist- than the hip-accelerometer models.

**CONCLUSION:** Adults with DS have different  $\dot{V}O_2$  to VM responses, but this is due to their higher BMI. Predictability of  $\dot{V}O_2$  from accelerometer output is better for a hip- than a wrist-worn accelerometer. These results may help advance physical activity assessment for adults with DS.

**697** Board #6 May 29 3:15 PM - 5:15 PM  
**Comparing Gross Efficiency Between Rigid And Hydraulic Prosthetic Ankles During Graded Treadmill Walking**

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(No relevant relationships reported)

Recent advancements have led to the development of prosthetic ankles that actively plantar and dorsiflex using hydraulics during walking. In theory, hydraulic ankles allow for more efficient locomotion due to the increased ROM, but these ankles are often heavier than rigid ankles. It is unclear if the increased ROM leads to decreased oxygen consumption during graded walking. **PURPOSE:** To determine which type of ankle prosthesis, a rigid ankle (RA) or a hydraulic ankle (HA) is most efficient when walking uphill. **METHODS:** A female transfemoral amputee (age = 56 y, height = 173 cm, body mass = 77.8kg) walked on a treadmill set at  $4.02 \text{ km} \cdot \text{h}^{-1}$ , 5% grade, for six min using two types of ankles. A total of four trials were completed in a counterbalanced fashion, with a 15 min recovery between trials. The subject was accustomed to wearing a rigid prosthetic, so a one week acclimation period to walking in the HA was allowed before testing. Expired gases were collected using open-circuit spirometry and gas analysis was completed using a metabolic measurement system. Gross efficiency (GE) was calculated in  $\text{ml} \cdot \text{km}^{-1} \cdot \text{min}^{-1}$ , and averaged over the two trials. Percent differences were compared between prostheses and trials. **RESULTS:** The HA weighed 0.4kg more than the RA. Compared to RA (average GE =  $184 \text{ ml} \cdot \text{km}^{-1} \cdot \text{min}^{-1}$ ), GE was 7.2% (+6.4% trial 1, +8.2% trial 2) less when using a HA (average GE =  $197 \text{ ml} \cdot \text{km}^{-1} \cdot \text{min}^{-1}$ ). **CONCLUSIONS:** Walking uphill using a HA incurs a greater O<sub>2</sub> cost than does

walking with a RA. The greater mass of the HA may explain the lower GE observed during graded treadmill walking. Longer familiarization with HA may improve GE during walking.

**698** Board #7 May 29 3:15 PM - 5:15 PM  
**Feasibility and Effectiveness of Community-Based Virtual Reality Group Exercise Training in Persons with Spinal Cord Injury**

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(No relevant relationships reported)

Persons with spinal cord injury (SCI) are at an increased risk of physiological morbidity compared to their ambulatory counterparts in whom well-established, beneficial correlations exist between exercise, cardiorespiratory health and body composition. Furthermore, SCI who participate in sport may have reduced risk of physiological morbidity than SCI who are sedentary. **PURPOSE:** This pilot study was two-fold: 1) to determine whether differences exist in cardiorespiratory health and body composition between SCI athletes (ATHL) and sedentary SCI (SED), and 2) to determine whether an 8-week handcycling exercise training program is feasible in an SED SCI population, and if improvements in cardiorespiratory fitness and body composition occur. **METHODS:** Twenty-seven SED and six ATHL were recruited to participate in the study. All SCI completed a graded hand cycling maximal exercise test for cardiorespiratory fitness ( $\dot{V}O_{2\text{max}}$ ) and body composition testing (iDEXA). SED participants were then randomized into a virtual reality intervention (VR) or waitlist (WL) group (e.g. offered VR after 8 weeks of WL). The intervention consisted of an 8-week community-based VR group hand cycling exercise training with a USA level 1 coach two days/week. Pre-post outcomes were measured in each group. **RESULTS:** Thirty-three SCI were recruited to participate (SED  $n=27$ ; ATHL  $n=6$ ). All ATHL and 17 SED participants (VR=9, WL=8) completed study protocol, with 10 (VR=1 and WL=9) lost to follow up. One participant was dropped from analysis due to not giving a full effort during testing as determined by investigators. ATHL had 23 physiological and anthropometric variables that were significantly different ( $p \leq 0.01$ ) compared to SED including higher  $\dot{V}O_{2\text{max}}$  ( $19.1 \text{ ml/kg/min}$ ), lower BMI ( $-4.6 \text{ kg/m}^2$ ), and lower total body fat percentage ( $-10.4\%$ ).  $\dot{V}O_{2\text{max}}$  increased 16% in VR and 9% in WL, which was not statistically different. **CONCLUSION:** This study demonstrates the feasibility of a hand cycling program in SCI. ATHL had better outcomes associated with long term health compared to their SED counterparts. Though no significant changes were noted in VR compared to WL, changes in  $\dot{V}O_{2\text{max}}$  may be clinically relevant. A larger sample size or longer training period may be needed to observe significant differences in physiological health in an SED SCI population.

**699** Board #8 May 29 3:15 PM - 5:15 PM  
**Effects Of Virtual Reality On Pain And Fatigue In Individuals With SCI**

Daniel Azurdia, Angelica Alberto, Travis Watkins, Isabel Lorimer, Mercedes Fernandez, Mai Jara, Danica Tolentino, Ovande Furtado, Taeyoung Jung. *California State University, Northridge, Northridge, CA.*

(No relevant relationships reported)

**Background:** Pain and fatigue are among the most commonly reported barriers to exercise for individuals with spinal cord injury (SCI). Previous studies have documented virtual reality's (VR) pain and fatigue reducing properties. However, no study has investigated the benefits of using VR for reducing pain and fatigue during exercise in individuals with SCI. **Purpose:** To investigate the effects of using VR during exercise on perceptions of pain and fatigue in individuals with SCI. **Methods:** A total of 18 individuals with traumatic SCI (aged  $43.29 \pm 17.5$  years) participated in this repeated measure comparative study. Three visits were required from each participant. Baseline data was collected during the first visit. The following two visits consisted of a 6-minute exercise test using arm ergometry. Participants were randomly assigned to an exercise condition, either VR or non-VR. Participants rated their pain and fatigue using visual analogue scales and qualitative data was collected following the completion of the exercise test. Dependent variables included pain and fatigue. **Results:** Repeated measures ANOVA showed statistically significant improvements in pain and fatigue scores. VR sessions decreased pain and fatigue by 34% and 36% respectively, as compared to the non-VR exercise sessions. All  $p$  values were  $p < .05$ . In addition, three higher order themes emerged from qualitative analysis, positive psychological impact, positive physiological impact, and virtual reality enhancing exercise experience. **Conclusion:** Our results indicate that exercise in combination with VR can be effective in reducing pain and fatigue in individuals with SCI.

**B-39 Free Communication/Slide - Adolescent and Young Adult Female Athlete**

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-202C

**700 Chair:** Nancy I. Williams, FACSM. *Pennsylvania State University, State College, PA.*  
(No relevant relationships reported)

**701 May 29 3:15 PM - 3:30 PM**  
**Assessment of Sport Specialization and Menstrual Dysfunction in High School Athletes During Pre-season Screening**

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Sport specialization and menstrual dysfunction (MD) are of concern for high school athletes as they may contribute to sports injury. Limited evidence exists on the extent of sport specialization and prevalence of MD assessed at pre-season screening. **PURPOSE:** The objectives of this study were to 1) determine the prevalence of sport specialization and MD, and 2) determine if sport specialization and MD are higher in team/ball sports than individual sports. **METHODS:** Seven hundred ninety-two (250 females, 542 males) athletes from 14 San Diego high schools participated in a pre-season screening clinic. The athletes completed a questionnaire regarding sport specialization, sport type (individual vs. team/ball sport), menstrual health. Sport specialization was determined by the athletes' responses to 1) declared a primary sport, 2) quit other sports to focus on primary sport, and 3) trained >8 months/year in primary sport in the past year. Scores of 0-1 were considered low specialization, and scores of 2 and 3 indicated moderate and high sport specialization, respectively. MD was defined as  $\leq 9$  menstrual periods reported in the past year. **RESULTS:** Overall, 54.8% of the athletes were classified as low sport specialists, 38.4% as moderate sport specialists, and 6.8% as high sport specialists. Golf (42.9%), swimming/diving (18.8%), and tennis (15.8%) had the greatest percent of high sport specialization. High sport specialization was almost two times (OR=1.81, 95% CI: 0.9-3.4;  $p=0.07$ ) greater among those whose primary sport was an individual sport (10.0%) than athletes participating in a team/ball sport (6.0%). Females (9.2%) were twice as likely (OR=1.94, 95% CI: 1.1-3.5;  $p=0.02$ ) to highly sport specialize than males (5.7%). Twenty-four (9.7%) female athletes reported MD. Tennis (33.3%), cross-country (15.8%), and swimming (14.3%) had the highest percent of MD. Although a non-significant trend, females who reported MD were twice as likely (OR=2.01, 95% CI: 0.9-4.9;  $p=0.10$ ) to participate in an individual sport (14.5%) as their primary sport than those whose primary sport was a ball/team sport (7.6%). **CONCLUSIONS:** Females were more likely to sport specialize than males. High sport specialization was most common among individual-type sports.

**702 May 29 3:30 PM - 3:45 PM**  
**Association Between Sport Specialization and Low BMD Among Female High School Distance Runners**  
Mitchell J. Rauh, FACSM<sup>1</sup>, Michelle T. Barrack<sup>2</sup>, Adam S. Tenforde<sup>3</sup>, Michael D. Rosenthal<sup>1</sup>, Jeanne F. Nichols, FACSM<sup>4</sup>.  
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Sport specialization has become increasingly common and has been related to sports injury and menstrual dysfunction among female high school distance runners. The association between sport specialization and low bone mineral density (BMD) is poorly described in this population. **PURPOSE:** To determine the association between sports specialization and low BMD in female high school distance runners. **METHODS:** Participants consisted of 64 female runners (age  $15.6 \pm 1.4$ y), not currently on birth control medication, who competed in interscholastic cross-country and distance track events in southern California. Each runner completed a survey on sport participation and menstrual function, and had her height and weight measured.

Each runner's spine and hip BMD were assessed using DXA, standardized to BMD Z-score by age and sex normative values. Sport specialization classifications were: low specialization (distance running sport(s) for  $\leq 8$  months/year and participation in  $\geq 1$  other non-running high school sports); moderate specialization (only distance running sport(s) for  $\leq 8$  months/year, or participation in distance running sport(s)  $\geq 9$  months/year and  $\geq 1$  other non-running sports); and high specialization (participation in distance running sport(s) for  $\geq 9$  months/year and no other sports. Multivariable logistic regression was performed to determine the adjusted odds ratio (OR) and 95% confidence interval (CI), adjusting for BMI and gynecological age. **RESULTS:** Overall, 21.9% of the runners were high sport specialists, and 37.5% and 40.6% were moderate and low sport specialists, respectively. Twenty-three (35.9%) runners had low BMD (Z-score  $< -1.0$ ). After adjusting for gynecological age and BMI, high sport specialists were five times more likely (OR=5.4, 95% CI: 1.3-23.3;  $p=0.02$ ) to have low BMD than low sport specialists. **CONCLUSIONS:** Our findings indicated that high sport specialization was associated with low BMD among female high school distance runners. Further investigation of this association is warranted as low BMD has been related to increased risk of stress fracture.

**703 May 29 3:45 PM - 4:00 PM**  
**The Relationship between Bone Mineral Accrual and Changes of Body Composition in Competitive Girl Runners**  
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Low bone density is a complication of a long-term strict weight control during adolescence in women. **PURPOSE:** To assess whether decrease in percent body fat (%BF) is associated with an impaired bone mineral accrual in girl runners. **METHODS:** Consecutive 22 freshmen girl runners (15y/o, 158cm, 45kg) during 7 years in competitive high school teams were evaluated over 2 years of training. DXA was performed at the preparatory phase (baseline) and repeated after  $23 \pm 2$  months (follow-up). The runners were divided into 2 groups; negative (DEC,  $n=11$ ) or positive (GAIN,  $n=11$ ) changes of %BF ( $\Delta\%$ BF) during the period. The effect of the period and the group on the changes in bone mineral content (BMC) and density (BMD) of total body less head and z-score were analyzed by 2-way repeated measures ANOVA. As for lean soft tissue mass (LSM) and fat mass (FM), paired t-test was used to compare between baseline and follow-up. Bivariate correlation analysis was used to examine the relationship between bone mineral accrual ( $\Delta$ BMC and  $\Delta$ BMD) and  $\Delta\%$ BF as well as the changes of FM ( $\Delta$ FM) and LSM ( $\Delta$ LSM). Written informed consent was obtained from the runners and their parents.  $P < 0.05$  was considered as statistically significant. **RESULTS:** %BF changed from 17.4 to 14.3 (DEC) and 15.0 to 18.4 % (GAIN). The period had significant effects on BMC, BMD, and z-score without interactions. Contrast showed significant increases in those variables, while the group of  $\Delta\%$ BF had no significant effect, indicating the values of DEC and GAIN were similarly increased; 1.57 to 1.64 and 1.66 to 1.77 kg, 0.98 to 1.00 and 1.00 to 1.03 g/cm<sup>2</sup>, and -0.25 to -0.20 and 0.04 to 0.22, respectively. The DEC runners gained LSM (34.2 to 36.1 kg) and reduced FM (7.7 to 6.4 kg) significantly, while the GAIN runners significantly increased FM (6.9 to 9.0 kg) without LSM change (36.6 to 37.0 kg). Neither  $\Delta\%$ BF nor  $\Delta$ FM, but  $\Delta$ LSM was significantly correlated with  $\Delta$ BMC ( $r=0.45$ ) and  $\Delta$ BMD ( $r=0.55$ ). **CONCLUSIONS:** Bone mineral was equally accrued among the runners of which %BF increased or decreased, where the accretion was associated with LSM gain. Competitive distance runners would develop leanness by not only losing FM but also gaining LSM (i.e., skeletal muscle) along with long-term exercise training. This would ameliorate an impairment of bone mineral acquisition by strict weight control.

**704 May 29 4:00 PM - 4:15 PM**  
**Examination of Energy Availability and Injury Prevalence in Collegiate Dancers**  
Kenya Moore<sup>1</sup>, Toni M. Torres-McGehee<sup>1</sup>, Erin M. Moore<sup>2</sup>, Elena Burrus<sup>1</sup>, Kelly Pritchett<sup>3</sup>, Susan Anderson<sup>1</sup>.  
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(No relevant relationships reported)

Performing arts is an emerging population in the realm of sports medicine. Health care professionals must first understand the types of demands placed on dancers including risks associated with the Female Athlete Triad (Triad; low energy availability [LEA], reproductive hormonal disruption, and compromised bone mineral density [BMD]). **Purpose:** Examine the relationship between energy availability (EA) & musculoskeletal injuries, nutritional behaviors (carbohydrates [CHO] and protein [PRO]), and prevalence of eating disorders/disordered eating (ED/DE) amongst female collegiate dancers.

**Methods:** A cross-sectional design of 26 female college ballet & contemporary dancers (age:  $20.5 \pm 3.6$ , weight:  $56.4 \pm 7.0$  kg, height:  $165.2 \pm 6.9$  cm) was conducted at a local university. Dancers completed 1 week of dance classes/rehearsals and data collection included: anthropometric data, questionnaires (e.g., demographics, health history, Eating Disorder Inventory-3, RMR, a 7-day food log to measure dietary energy intake (EI) and wore a SenseWear armband to calculate exercise energy expenditure (EEE).

**Results:** Overall, 69.2% (n=18) were at risk for LEA ( $< 30$  kcal/kg/FFM) and none were at risk for low BMD. Energy needs assessments measured: RMR ( $1155 \pm 206.54$  kcals), EI ( $1473.9 \pm 321.5$  kcals), and EEE ( $884.7 \pm 324.8$  kcals). Macronutrient profile included: 100% (n=26) below the recommended CHO and 73.1% (n=19) were below PRO, and fat was within limits. There were 88.5% (n=23) dancers with elevated ED/DE risks. Retrospective injuries demonstrated: 96.2% (n=25) dancers self-reported a previous dance related injury, 15.4% (n=4) were previously diagnosed and treated for a stress fracture, and during their current dance season 61.5% (n=16) of dancers were diagnosed with an injury. Of those diagnosed within the current season, 34.6% (n=9) presented with LEA and 19.2% (n=5) had ED risk.

**Conclusion:** Overall, there were high occurrences of LEA & injuries among dancers. LEA and Triad symptoms diminish musculoskeletal integrity, thus negatively affecting overall health. Primarily, dancers' LEA was due to diet restriction (low CHO and PRO). Understanding more about the effects LEA and the Triad have on dancers will aid clinicians in treating injuries, maintaining nutritional balance, and improving the health of performers.

705 May 29 4:15 PM - 4:30 PM

### How are Adolescent Ballet Dancers' Eating Attitudes Related to Social Media Viewing Habits?

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(No relevant relationships reported)

Social media has a great impact on adolescent's behavior. Since many young ballet dancers spend many hours on dance websites, they may adopt unhealthy eating attitudes and behaviors that are depicted on-line. **Objective:** The purpose of this descriptive study was to evaluate dancers aged 10-16 years in Northeastern Pennsylvania (NEPA) to determine if there was a relationship between social media exposure and disordered eating attitudes. **Methods:** Participants included 39 white adolescent female dancers ( $13.7 \pm 1.8$  years) from five dance studios in Northeastern Pennsylvania who completed the Children's Eating Attitude Test (ChEAT-26) and the Questionnaire of Exposure and Reinforcement Through Facebook (QERF) to assess eating attitudes and social media viewing practices. Data were analyzed using descriptive statistics and Pearson correlations. **Results:** Mean time spent dancing each week was  $6.2 \pm 2.0$  hours. Mean ChEAT-26 score was  $20.8 \pm 15$ . Over one-third (36%) of the dancers scored 20 or above indicating disordered eating attitudes and/or behaviors. Mean QERF score was  $26.5 \pm 5.7$ . 87.5% of the dancers scored 23 or greater out of a possible 45, exposure to social media. Mean time spent on Facebook was  $4.7 \pm 2.8$  hours per week, while mean time spent on Facebook looking at dance websites was  $1.3 \pm 1.2$  hours per week. Although we did not observe a significant relationship between ChEAT and QERF, there was a trend ( $r=.27$ ,  $p=.10$ ); as social media exposure increased, disordered eating attitudes and behaviors also increased. **Conclusions:** Adolescent dancers are at risk of developing unhealthy eating attitudes and behaviors. Their substantial exposure to social media, especially on dance websites, may play a role in accelerating problematic eating patterns. Since limiting young dancers' social media exposure may well be problematic, parents, dance teachers, nutritionists and other health professionals must become aware of these issues and should consider interventions that model positive eating attitudes and behaviors.

706 May 29 4:30 PM - 4:45 PM

### Surgical Outcomes of Os Trigonum Syndrome in Dancers

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(No relevant relationships reported)

**PURPOSE:** Management of ankle pain in dancers can be challenging due to the complex demands placed on their ankles and feet. Despite the prevalence of ankle pain or injuries in this population, literature on the outcomes of surgical approach is limited. The hypothesis of this study was that dancers return to their previous level of activity following open excision of a symptomatic os trigonum syndrome. **METHODS:** We followed 54 ankles (44 patients, 91% female, mean age 18.2 years) in patients who underwent surgery for posterior impingement. Dance style varied across patients but was largely ballet and included many professionals. All patients completed a specific rehabilitation protocol prior to surgical discussions and eventual excision of the os trigonum was done through an open approach. All patients then

committed to a specific rehabilitation program and gradually returned to dance. Outcomes were evaluated with the Veterans Rand 12 Item Health Survey (VR-12) Mental and Physical Scores, Foot Function Index-Revised (FFI-R), Visual Analog Scale (VAS) scoring, and patient satisfaction preoperatively and postoperatively. This study was conducted in compliance and approved with a local Institutional Review Board (IRB). **RESULTS:** Most recent follow-up was a mean 32.3 months with data collected across a range of 6 weeks to 8 years post-operative. Between pre-operative and most recent postoperative follow-up, there was no significant difference in VR-12 Mental Scores (mean scores of 55.4 and 53.9), however Physical Scores increased 37.8 to 51.2, respectively. Significant improvement was also seen in both the FFI-R cumulative score (63.2 to 42.4) and VAS (54% to 17%). Major complications included transient sural nerve paresthesia and scar tissue buildup that resolved over time. Overall, patients were extremely satisfied with their result (82.7% post-operative satisfaction). **CONCLUSIONS:** An open os trigonum excision is fairly simple, has a low complication rate, and proves to have a high success rate in returning athletes back to their sport of choice. In this study, dancers of varying level and primary style improved significantly according to various clinical measures and maintained thriving postoperative careers. Successful return to dancing relied greatly on well-structured physical rehabilitation therapy.

707 May 29 4:45 PM - 5:00 PM

### Comparison of Total Body Composition and Bone Mineral Density Measures in Female Collegiate Athletes

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(No relevant relationships reported)

Body composition and bone mineral density (BMD) are important factors in sport performance and the overall short and long-term health of athletes. Despite this function, few investigations to date have documented total body composition in female collegiate athletes. Further, we are unaware of any studies examining both total body composition and BMD in this population. **PURPOSE:** To generate descriptive data for total body composition and BMD in a large sample of female collegiate athletes using dual X-ray absorptiometry (DXA) and examine differences between 10 competitive sports. **METHODS:** A total of 211 female collegiate athletes ( $19 \pm 1$  yrs;  $167.8 \pm 8.9$  cm;  $45.9 \pm 6.1$  kg; 2.4% Asian, 15.2% Black, 1.4% Hispanic, 80.6% White, 0.5% Other) underwent DXA: basketball (BB; n=22), cross country (CC; n=11), field hockey (FH; n=25), gymnastics (GYM; n=23), lacrosse (LAX; n=42), soccer (SOC; n=27), swimming (SW; n=27), tennis (TN; n=11), track (field only); (TR; n=7), and volleyball; (VB; n=16). Descriptive statistics were calculated for total body fat percentage (BF%), and BMD. Differences in total BF% and BMD between sports were examined using a one-way Welch's ANOVA test. Post-hoc testing was completed using the Games-Howell test. **RESULTS:** The mean total BF% was  $27.8 \pm 5.1$  (range: 23.0 - 37.5%) while BMD was  $1.30 \pm 0.11$  g/cm<sup>2</sup> (range: 1.17 - 1.45 g/cm<sup>2</sup>); TR had the highest BF% ( $37.5 \pm 5.5$ ), followed by TN ( $31.1 \pm 4.0$ ) and LAX ( $29.3 \pm 3.8$ ), CC ( $23.0 \pm 6.0$ ) and GYM ( $23.5 \pm 2.9$ ) had the lowest. For BMD, TR had the highest ( $1.45 \pm 0.07$  g/cm<sup>2</sup>), followed by BB ( $1.40 \pm 0.12$  g/cm<sup>2</sup>) and VB ( $1.36 \pm 0.10$  g/cm<sup>2</sup>); CC ( $1.17 \pm 0.07$  g/cm<sup>2</sup>) and SW ( $1.22 \pm 0.06$  g/cm<sup>2</sup>) had the lowest. Group mean differences in BF% ( $p < 0.001$ ;  $\omega^2 = 0.26$ ) and BMD ( $p < 0.001$ ;  $\omega^2 = 0.35$ ) were observed between teams. Specifically, GYM had lower BF% than BB, FH, LAX, SOC, SW, TN, and TR (mean difference range: -4.0 to -13.9%, all  $p < 0.05$ ). CC had lower BMD than BB, FH, GYM, LAX, SOC, TR, and FH (mean difference range: -0.11 to -0.28 g/cm<sup>2</sup>, all  $p < 0.01$ ). **CONCLUSION:** Total body composition and BMD measures varied across female collegiate sports. These findings may assist sports medicine and strength and conditioning practitioners with identifying appropriate goal values for BF% and BMD in female collegiate athletes across various sports.

708 May 29 5:00 PM - 5:15 PM

### Awareness of the Female Athlete Triad in NCAA Cross Country Coaches

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(No relevant relationships reported)

The Female Athlete Triad is a pervasive, multifactorial morbidity amongst collegiate female athletes, particularly those participating in endurance sports. Cross country coaches' awareness of the Triad within all NCAA divisions is unknown. **PURPOSE:** To assess National Collegiate Athletic Association (NCAA) cross country coaches' awareness of the Triad components. **METHODS:** Ninety-nine Division I-III NCAA compliance officers were sent an email containing a request to disseminate a web-based survey to cross country coaches in their respective conferences. The web-

linked instrument included: a study synopsis; an informed consent statement, and; the IRB-approved survey tool. Reminder emails were sent approximately two months after the original participation request. Statistical analysis, using JMP software, included frequency distributions and chi-square tests for categorical association. Significance level was set at  $p < 0.05$ . **RESULTS:** Coaches ( $n = 143$ ; mean age =  $40.7 \pm 11.9$  years; mean coaching experience =  $14.1 \pm 10.3$  years) from 45 conferences participated; 74% of respondents were male. All NCAA Divisions were equitably represented (I = 29.7%, II = 35.5%, III = 34.8%). While respondent majorities: coached male and female athletes (82.1%); reported they were familiar with the Triad (73.4%), and; felt comfortable/very comfortable discussing diet (87.6%) and menstruation (65.6%) with female athletes, only 54% correctly identified all three Triad components (re: low energy availability, amenorrhea, low bone mineral density). Female coaches, however, were more comfortable than male coaches discussing menstrual issues ( $X^2 = 94.7$ ,  $p < 0.001$ ). When compared to the other divisions, Division I coaches were more likely to: have Triad awareness ( $X^2 = 10.1$ ,  $p < 0.05$ ), and; have athletes with access to registered dietitians ( $X^2 = 16.5$ ,  $p < 0.01$ ) and sports psychologists ( $X^2 = 18.0$ ,  $p < 0.01$ ). **CONCLUSION:** A slim majority of NCAA cross country coaches demonstrated comprehensive understanding of Triad components, but; resource disparities to effectively address the Triad exist between the NCAA divisions. Future research should examine how to increase coaches' Triad awareness and education, and; optimize resources across NCAA divisions to reduce the negative outcomes associated with this common morbidity.

## B-40 Free Communication/Slide - Behavioral Approaches to Increasing Physical Activity

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-105B

709 **Chair:** John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.*

(No relevant relationships reported)

710 May 29 3:15 PM - 3:30 PM

## A Comparison Between Physician and Patient Perceptions Regarding Barriers to Exercise

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(No relevant relationships reported)

**PURPOSE:** To compare physician vs patient perceptions regarding barriers to exercise, preferred physical activities, and amount of time spent exercising. **METHODS:** A survey was given to patients and their physicians at a family medicine residency clinic. The survey consisted of a Likert scale of barriers to exercise, a checklist of preferred exercise activities, and the amount of exercise their patients engaged in. Barriers to exercise were categorized as motivational, physical, or external barriers. **RESULTS:** Physicians consistently overestimated the importance of external barriers to exercise ( $t = -2.38$ ,  $df = 19.473$ ,  $p\text{-value} = .0275$ ) when compared to their patients (e.g. "There are no facilities in my area.", "It's too dangerous in my area"). Residents also consistently overestimated the importance of internal motivational barriers ( $t = -2.2355$ ,  $df = 18.77$ ,  $p = 0.03774$ ). ("I hate to fail, so I will not start.", "Exercise is boring"). There was an 80% correlation between the activities physicians predicted their patients enjoyed and what patients actually endorsed enjoying. Physicians predicted 54% less exercise than that endorsed by their patients. **CONCLUSIONS:** Our data show that physicians overestimate their patients' external and motivational barriers to exercise. This suggests an opportunity for physicians to enhance motivational interviewing by reducing their focus on external and motivational barriers. Physicians were excellent predictors of the exercise modalities preferred by their patients but significantly underestimated the amount of exercise endorsed by their patients, suggesting a missed opportunity to acknowledge patient efforts towards a healthy lifestyle. **SIGNIFICANCE:** Exercise prescriptions and motivational interviewing are the two most effective tools physicians have to increase physical activity in their patients. Our study and survey can be a template to facilitate and enhance this discussion.

711 May 29 3:30 PM - 3:45 PM

## Physical Activity Promotion: Content Analysis of Nationally Representative Elementary School Websites

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(No relevant relationships reported)

School choice legislation has increased the number of public charter schools and about 7000 were licensed in DC and 44 states in 2018. Health authorities advocate that schools provide diverse physical activity (PA) programs to enable students accrue at least 50% of their daily recommended 60 min of moderate-to-vigorous physical activity (MVPA). School websites have great potential to provide information about PA and be a catalyst for students participating in school PA programs. Investigations of websites relative to PA are rare, and no studies assessing the PA content of charter school websites have been published. **PURPOSE:** To complete a quantitative content analysis of PA-related information on the websites of U.S. charter elementary schools. **METHODS:** During spring 2018 we conducted a content analysis of a stratified random sample of U.S. charter elementary schools ( $n=759$ ) for information specific to PA. **RESULTS:** Nearly all schools (97%) had a functioning website, but these rarely mentioned PA program opportunities: PE (34.1%), PA clubs (13.7%), interscholastic sports (9.1%), recess (7.9%), and intramurals (5.5%). No website identified all 5 program types and 52.0% did not mention their school provided a PA program at all. Information on PE was scarce. Only 7.1% of sites mentioned a PE curriculum and only 2.8% and 2.0%, respectively, mentioned its sequence or content. A PE teacher was mentioned on 37.4% of websites, but only 6.1% indicated he/she had specialist PE training. Only 4.6% of sites identified PE frequency and only 2.7% mentioned lesson length. Similarly, only 7.9% of websites mentioned recess. There were no significant associations between school age, size, or type (i.e., elementary vs. elementary/middle combination) with websites mentioning PE, having a PE teacher, or offering one or more PA programs. **CONCLUSIONS:** This is the first study to complete a quantitative content analysis of information about PA programs on the websites of a nationally representative sample of elementary charter schools. Results show that PE and PA is essentially ignored on elementary charter school websites across the country. As they are public "windows" designed to convey important information to constituents, we recommend all schools assess their websites to ensure they provide comprehensive messaging about PA.

712 May 29 3:45 PM - 4:00 PM

## Generating and Applying a Physical Activity Model for an Underserved Community: A Mixed Methods Approach

Kori Hahn, Kara Hamilton, Shewanee Howard-Baptiste, Melissa Powell, Mia Faragalli, Gregory Heath, FACSM. *The University of Tennessee Chattanooga, Chattanooga, TN.* (Sponsor: Gregory Heath, FACSM)  
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Physical activity (PA) determinants differ depending on the population being studied. **PURPOSE:** A PA predictive model for an underserved community was generated and further insight of the results were gained by conducting focus groups with parents and school staff. **METHODS:** Previous literature was used to identify PA predictors and to form constructs of a survey. The survey was given to 35 families at a school-based event. Cronbach's alpha was used to assess construct reliability, and a stepwise regression was run to determine predictors. Significant predictors were presented and discussed with community focus groups. **RESULTS:** Parental PA support ( $a=.9$ ), parental perceived barriers ( $a=.8$ ), parental dietary intake ( $a=.8$ ), PA beliefs ( $a=.6$ ), screen time ( $a=.6$ ), and gender were included in a forward stepwise regression. The overall model was significant ( $p=.001$ ), where parental support of PA ( $B=.567$ ,  $p=.024$ ), gender ( $B=.462$ ,  $p=.010$ ), and PA beliefs ( $B=.579$ ,  $p=.016$ ) were significant predictors of PA. **CONCLUSION:** This innovative approach enabled community participants to prioritize their actions more efficiently in addressing the most pressing determinants contributing to low levels of physical activity among their children. These results will contribute significantly to the design of a subsequent physical activity intervention among community children and their families.

713 May 29 4:00 PM - 4:15 PM

**Variations in Preschoolers' Physical Activity Across the School Year**Connie L. Tompkins, Erin K. Shoulberg, Lori E. Meyer, Caroline Martin, Allison Krasner, Marissa Dennis, Betsy Hoza. *University of Vermont, Burlington, VT.*

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(No relevant relationships reported)

**PURPOSE:** To examine variations and sex differences in preschoolers' physical activity (PA) across the school year, with and without a PA intervention

**METHODS:** The *Kiddie CATs on the Move* PA curriculum was implemented in preschools over 22-weeks, 2-3 times per week by classroom teachers and college students enrolled in a service-learning course. Accelerometry was used to measure PA during the school day at 5 time points across the year [2 Baseline (Fall, Winter), 3 Intervention (Fall, Winter, Spring)]. A total of 68 children ( $M_{age} = 4.15 \pm 0.6$ , 33 males, 35 females) with  $\geq 2$  days of valid data at each time point were included in analyses. Minutes per hour of moderate-to-vigorous (MVPA) and total PA (light + MVPA) were calculated. Paired-samples *t*-tests were used to compare sex differences at each time point. A series of 5 (time) x 2 (sex) mixed model ANOVAs were used to examine PA across assessments and whether or not patterns of change in PA varied by sex.

**RESULTS:** Boys engaged in significantly more total PA than girls only during the Winter Baseline assessment ( $17.3 \pm 4.0$  vs  $15.0 \pm 4.8$  min/hr,  $p < 0.04$ ). Boys engaged in significantly more MVPA (min/hr) than girls during the Fall Baseline ( $9.6 \pm 2.4$  vs  $8.3 \pm 2.7$ ,  $p < 0.04$ ), Fall Intervention ( $10.2 \pm 3.1$  vs  $8.7 \pm 2.8$ ,  $p < 0.04$ ) and Winter Baseline ( $9.2 \pm 2.5$  vs  $7.4 \pm 2.9$ ,  $p < 0.01$ ). For the combined sample, total PA,  $F(4, 264) = 6.81$ ,  $p < 0.001$ , and MVPA,  $F(4, 264) = 9.43$ ,  $p < 0.001$ , varied across the time points. Total PA (min/hr) was significantly higher at all intervention time points compared to winter baseline ( $17.2$ ,  $17.4$ ,  $17.9$  vs  $16.1$ ,  $ps < 0.01$ ) and spring intervention also significantly higher than fall baseline ( $17.9$  vs  $16.9$ ,  $ps < 0.01$ ). MVPA (min/hr) was significantly higher at all intervention time points compared to winter baseline ( $9.4$ ,  $9.1$ ,  $9.8$  vs  $8.3$ ,  $p < 0.05$ ) and spring intervention was significantly higher than fall baseline MVPA ( $9.8$  vs  $8.9$ ,  $p < 0.01$ ). The pattern of change in PA across assessments did not vary based on child sex.

**CONCLUSIONS:** Findings highlight the importance of structured programs to promote preschoolers' PA, especially during winter months when PA appears to decline. Although there were no sex differences in the pattern of PA change for boys and girls, girls consistently engaged in less PA than boys during the year and future work should examine factors related to this sex difference.

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**Supporting Physical Health Of Black Male Faculty Through A Wellness-integrated Professional Development Program: FIT Leaders**Emily R. Martini<sup>1</sup>, Turhan Carol<sup>1</sup>, Carl M. Maresh, FACSM<sup>1</sup>, Joshua J. Joseph<sup>2</sup>, David A. Delaine<sup>1</sup>. <sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>The Ohio State University Wexner Medical Center, Columbus, OH. (Sponsor: Carl M. Maresh, FACSM) Email: martini.36@osu.edu

(No relevant relationships reported)

**Purpose:** An intervention strategy examining the integration of professional development and wellness for black male faculty at an R1 university was conducted. The intervention was directed at supporting the retention and academic promotion of black male faculty through minimizing the impact of culturally relevant physical (i.e., hypertension, obesity) and cognitive (i.e. John-Henryism, social isolation, discrimination, etc.) challenges. The implications on the physical health of the participants are presented here. **Method:** A 24-week intervention brought together black male faculty of differing ranks at a university fitness center twice per week. Each session included a 45 min trainer lead exercise session followed by a 30 min semi-guided discussion on culturally relevant professional development topics. A series of assessments implemented in a pre-/post-structure around the intervention included cardiovascular measures including central aortic pressure, brachial blood pressure (BP) and carotid-femoral pulse wave velocity (cf-pwv) measured via the Sphygmocor Xcel Device, body composition via BodPod, strength and cardiorespiratory fitness via graded exercise treadmill test. Pre-post analyses using paired T-tests were performed using STATA 13.4. **Results:** Among 9 participants the mean age was  $40.4 \pm 4.1$  years. Cardiovascular measures improved including Aortic Systolic Pressure  $123 \pm 11$  vs  $117 \pm 12$  mmHg,  $p=0.007$ ; Brachial systolic BP  $136 \pm 10$  vs  $128 \pm 12$  mmHg,  $p=0.002$ ; Brachial diastolic BP  $87 \pm 10$  vs  $84 \pm 10$ ,  $p=0.057$ ; and Cf-pwv  $8.3 \pm 1.4$  vs  $6.9 \pm 0.6$  m/s ( $n=6$ ,  $p=0.007$ ). Adiposity measures improved including body mass index  $29.6 \pm 5.0$  vs  $29.0 \pm 4.9$  kg/m<sup>2</sup>,  $p=0.014$ ; waist circumference  $96.6 \pm 11.8$  vs  $93.4 \pm 12$  cm,  $p < 0.001$ ; and body fat percentage  $26.9 \pm 7.7$  vs  $23.4 \pm 7.6$ %,  $p=0.005$ . Max chest press improved from  $174.4 \pm 52.1$  vs  $191.4 \pm 45.9$  lbs,  $p=0.008$ . There were no improvements in cardiorespiratory fitness, highest VO<sub>2</sub>max  $37.1 \pm 7.4$  vs

$37.5 \pm 6.9$  ml/kg/min ( $n=7$ ),  $p=0.801$ . **Conclusion:** Changes in the physical health of participants indicate that this intervention shows promise for supporting the physical wellness of black male faculty in parallel with culturally relevant leadership support.

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**Effects Of A National School Intervention Programme On The Levels Of Physical Activity**Fernando Rodríguez-Rodríguez<sup>1</sup>, Carlos Cristi-Montero<sup>1</sup>, José Castro-Piñero<sup>2</sup>. <sup>1</sup>PONTIFICIA UNIVERSIDAD CATÓLICA DE VALPARAÍSO, VIÑA DEL MAR, Chile. <sup>2</sup>UNIVERSIDAD DE CÁDIZ, CÁDIZ, Spain. (Sponsor: Alvaro Gurovich, FACSM) Email: fernando.rodriguez@pucv.cl

(No relevant relationships reported)

Since the school context greatly influences children and youth and can ensure that a large number of school children participate in activities and maintain active behaviors during the school day.

**PURPOSE:** The aim of this study was to compare the level of physical activity during the school day of a group of children participating in the school intervention program in comparison to a control group.

**METHODS:** A randomized sample of 154 school children (7-11 y) was obtained out of the Integral Sports Schools of the National Sports Institute of Chile, (70 intervention group; 84 control group), all belonging to socioeconomic vulnerable public schools. The program is structured as a comprehensive sports practice workshop with a duration of 90 min/session and performed three times/week. Each session develops activities to strengthen the skills for life and healthy lifestyles, and children experience a wide range of pre-sports and sports activities. Physical activity levels were recorded continuously with triaxial accelerometers during the school day, recess, physical activity session (PA) or physical education session (PE), and lunch. A value of  $p < 0.05$  was defined as statistically significant in Student's *t*-test.

**RESULTS:** Fifty per cent of the children in the intervention group complied with the recommendations of moderate-to-vigorous physical activity (MVPA), vs. 22.7% of the control group. During the first recess, the MVPA time of the control group was double that of the intervention group ( $p < 0.001$ ), where the recommendations of MVPA were not met, but at lunch it was possible to add important minutes of physical activity. None of the groups complied with the recommendations for steps in the PA or PE. During the PA, sedentary time was less and MVPA was greater in the intervention group (Table 1).

**CONCLUSIONS:** It was concluded that although the MVPA in recesses and lunchtime was greater in the control group, the activity in the PA of intervention group was greater and contributed more MVPA to the school day. This highlights the role of physical education classes in meeting MVPA's daily recommendations.

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**Acceptability of a Walking Intervention Among Inactive Adults Using a Smartphone-Based Gaming Application**Jason R. Bentley<sup>1</sup>, Zakkoyya H. Lewis-Trammell<sup>2</sup>, Maria C. Swartz<sup>1</sup>, Elizabeth J. Lyons<sup>1</sup>. <sup>1</sup>University of Texas Medical Branch, Galveston, TX. <sup>2</sup>Loyola Marymount University, Los Angeles, CA.

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(No relevant relationships reported)

Routine physical activity and maintenance of a normal body mass are critical for cardiovascular health. However, most adults do not meet the ACSM recommendations for physical activity. Previous research has shown that adding video games to traditional exercise programs may increase adherence. In recent years, smartphones allow much of the population to utilize games while engaging in exercise, particularly walking, and have a great potential for public health impact. **PURPOSE:** This study tested the acceptability of a 12-week walking intervention that used an active game delivered on a smartphone among community-dwelling adults. **METHODS:** Forty adults were randomized to receive the intervention or a wait list control. The 20 randomized to the intervention (18 females, age  $46.9 \pm 13.4$  years, BMI  $33.1 \pm 9.37$  kg/m<sup>2</sup>, 70% Caucasian) chose an activity goal starting at  $\geq 60$  mins/week, increasing it over the 12-week duration to  $\geq 150$  mins/week. They were instructed to use the smartphone game "Zombies, Run!" while walking due to its popularity and low-cost, and received weekly brief phone counseling to assist with adjusting goals, problem solving, and relapse prevention. Acceptability of the intervention was determined using satisfaction scales that evaluated the smartphone interface, game application, and technical issues; a Likert-scale rating of  $> 4$  (from 1 to 5) was the threshold for acceptability. **RESULTS:** Satisfaction of the smartphone hardware was  $4.25 \pm 0.63$ , with 2 participants indicating that the device was overly complicated; satisfaction of the gaming application was  $4.37 \pm 0.75$ , although 2 participants found the zombie game disinteresting; and, avoidance of technical issues was  $4.11 \pm 0.74$ , with 2 participants reporting problems with either the game or device. **CONCLUSION:** Among our target population, a smartphone-based gaming intervention was acceptable over a 12-week walking program. This intervention has the potential to be a valuable



tool in promoting routine physical activity among a large population of individuals who desperately need a lifestyle modification, although adding alternate game choices may be beneficial in future studies. Supported by American Heart Association grant #13BGIA17110021.

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**Use of Wearable Technology and Social Media to Improve Physical Activity and Dietary Behaviors among College Students: A 12-week Randomized Pilot Study**

Zachary C. Pope, Daheia J. Barr-Anderson, FACSM, Beth A. Lewis, Mark A. Pereira, Zan Gao, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Zan Gao, FACSM) Email: popex157@umn.edu

(No relevant relationships reported)

**PURPOSE:** Evaluated efficacy of combining smartwatch use and a theoretically-based, social media-delivered health education intervention on improving college students' (CS) health behaviors/outcomes relative to a comparison arm. Intervention use/acceptability were also assessed.

**METHODS:** Thirty-eight CS (28 female;  $M_{age} = 21.5 \pm 3.4$  years) participated in this two-arm randomized 12-week pilot trial. After screening, participants were randomized into two groups: (a) experimental: consisted of Polar M400 use and a twice-weekly theory-based Facebook-delivered health education intervention; or (b) comparison: enrolled in separate, but content-identical, Facebook group. ActiGraph Link accelerometers and the National Cancer Institute's ASA24 food recall measured PA and dietary behaviors, respectively. Health-related Social Cognitive Theory and Self-Determination Theory psychosocial constructs were measured using psychometrically-validated questionnaires while the YMCA 3-Minute step test and bioelectrical impedance assessed cardiorespiratory fitness and body fat percentage, respectively. **RESULTS:** Only whole grain consumption differed between groups at baseline,  $t = 2.3, p = 0.03$ . For PA, a trend toward a significant main effect for time was observed for moderate-to-vigorous PA,  $F(2, 72) = 2.6, p = 0.08$ ; partial eta-squared = 0.07, with experimental and comparison groups demonstrating 4.2- and 1.6-minute/day increases, respectively, at 6 weeks. For secondary outcomes, both groups demonstrated non-significantly decreased weight from baseline to 12 weeks (experimental: -0.6 kg; comparison: -0.5 kg). Further, significant main effects for time were observed for self-efficacy, social support, and intrinsic motivation (all  $p < 0.01$ ; partial eta-squared: 0.18-0.38) as both groups improved over time. Finally, both groups demonstrated lower daily caloric consumption over time (experimental: -41.0 calories; comparison: -143.3 calories). Intervention adherence was high (~86%), with participants implementing health education tips at least once weekly.

**CONCLUSIONS:** While both arms demonstrated initial efficacy in improving CS health outcomes, observations did not indicate the experimental intervention as more efficacious than comparison. Future research warranted.

**B-41 Free Communication/Slide - Exercise and Cardiovascular Risk Factors**

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-105A

718 **Chair:** Bradley Fleenor. *Ball State University, Muncie, IN.*

(No relevant relationships reported)

719 May 29 3:15 PM - 3:30 PM

**Ambulatory Central Blood Pressure Over 24 Hours Following Intermittent Vs. Continuous Moderate Intensity Exercise**

McKenzie A. Williams, Erika Silva, Nicholas Carlini, Brandon Kistler, Bradley Fleenor, Matthew Harber, FACSM. *Ball State University, Muncie, IN.* (Sponsor: Matthew Harber, FACSM)

(No relevant relationships reported)

Ambulatory blood pressure (BP) derived from the large central arteries has been shown to be a better predictor of cardiovascular events and mortality compared with peripheral ambulatory brachial blood pressure. Currently, however, it is unknown if exercise, either intermittent or continuous bouts, influence ambulatory central BP.

**PURPOSE:** To examine the ambulatory central blood pressure response over 24 hours following a moderate intensity intermittent (MII) bout of aerobic exercise compared to a moderate intensity continuous (MIC) bout. **METHODS:** Eight, non-hypertensive males (61.5±2.4yrs) performed three trials in a randomized order: control, MII (3X10

minutes at 50-60%heart rate reserve (HRR) with 5 minutes of seated rest), and MIC (30 minutes continuous at 50-60% HRR). Total work performed during the exercise trials was matched. Ambulatory brachial and central hemodynamics (Suntech Oscar 2 with SphygmoCor) were averaged over 24 hours, and divided by time of day (Morning, Afternoon, Evening, and Nighttime) and compared among each trial.

**RESULTS:** No differences ( $P > 0.05$ ) between CON, MII, and MIC were observed for any variable. Brachial and central hemodynamic variables were lower ( $P < 0.05$ ) during Nighttime (Nt) compared to other times of day, independent of trial. Brachial SBP was lower ( $P < 0.05$ ) during Nt (120.5±4.5 mmHg) compared to morning (Mn, 131.6±5.6 mmHg); afternoon (An, 132.3±5.2 mmHg) and evening (Evn, 134.4±5.3 mmHg). Central SBP was lower during Nt (112.7±4.4 mmHg) compared to morning (Mn, 120.8±4.9 mmHg); afternoon (An, 119.3±4.5 mmHg) and evening (Evn, 123.0±4.5 mmHg). **CONCLUSION:** An acute bout of moderate intensity exercise in accordance with the physical activity guidelines, independent of delivery mode (continuous or intermittent), did not influence 24 hour ambulatory brachial or central hemodynamics in middle-aged and older men. Moreover, we show that reductions in central hemodynamics during night time hours (i.e., dipping) is not compromised after exercise. Future work should explore different exercise parameters to better understand the influence of acute exercise on ambulatory central hemodynamics.

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**Maximal Exercise Blood Pressure and Glycemic Responses: Association with Resting Parameters in Healthy Young Adults.**

Manuela Zanoletti-Mannello, Juan C. Cárdenas-Arciniegas, Sebastián C. Cortés-Rosero, Julio C. Bermúdez-Muñoz, Maritsabel Ruiz-Molina, Manuel A. Cárdenas-Romero. *Pontificia Universidad Javeriana, Bogotá, Colombia.*

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(No relevant relationships reported)

Hypertension and hyperglycemia are known components of the metabolic syndrome. Massive adrenergic stimulation during high-intensity exercise has been associated to high blood pressure (BP) and blood glucose concentration. The predictive value of exercise-induced hypertension is an area of active research. An exaggerated and persistent hyperglycemia induced by intense exercise has been described in type-1 diabetics. For healthy subjects is not clear if BP and glycemic responses during maximal exercise are correlated with resting BP and glycemic values within the span of normal range.

**PURPOSE:** To find the association between resting and maximal exercise BP and glycemic responses in healthy young adults.

**METHODS:** An exploratory analysis was conducted on 145 young adults (63 female) aged 18-25 deemed healthy by medical and anthropometric evaluation (body mass index 18.4 - 24.9) as well as laboratory tests, including a complete metabolic profile. All subject had normal resting BP, glycated hemoglobin A1c (HbA1c) and fasting glucose concentration (FG) values. On a separate day subjects performed a maximal ramp cardiopulmonary exercise test (CPET) on a cycle ergometer; capillary blood glucose concentration (cBG) and BP were measured every 2.5 minutes. Pearson product-moment correlations between resting and exercise parameters were assessed with a significance level  $< 0.05$ . Separate analysis were made for males and females. **RESULTS:** The analysis for the female group is presented: at maximal workload, cBG was correlated with HbA1c ( $r = 0.29, p = 0.016$ ) while diastolic BP was correlated with resting diastolic BP ( $r = 0.26, p = 0.034$ ). Overall, maximal cBG was correlated with HbA1c ( $r = 0.27, p = 0.025$ ) and FG ( $r = 0.27, p = 0.026$ ) and maximal systolic BP was correlated with resting systolic BP ( $r = 0.27, p = 0.0009$ ).

**CONCLUSIONS:** For healthy young females BP and glycemic parameters at rest were positively associated with cBG and BP responses at or near maximal workloads during CPET. In otherwise healthy adults with resting BP and BG values in the upper limit of normal, acute intense exercise could play a role unmasking early subclinical cBG and BP changes in the metabolic syndrome continuum. The predictive and prognostic role of these findings remains to be determined.

Supported by COLCIENCIAS Grant number 120356934972, 713-2013.

721 May 29 3:45 PM - 4:00 PM

**Ambulatory Blood Pressure Reduction In Response To Supramaximal Interval Exercise; Interactions With Antihypertensive Medication.**

Miguel Ramirez-Jimenez, Felix Morales-Palomo, Juan F Ortega, Ricardo Mora-Rodriguez. *UNIVERSIDAD DE CASTILLA-LA MANCHA, Toledo, Spain.*

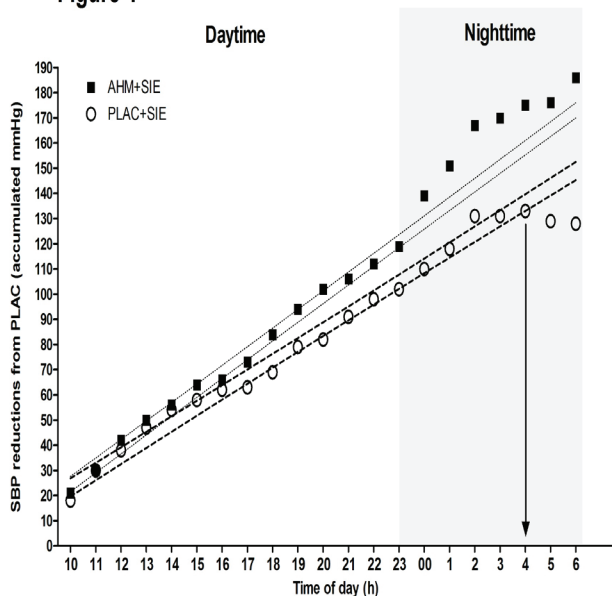
Email: miguel.ramirez@uclm.es

(No relevant relationships reported)

Metabolic Syndrome (MetS) increases the risk of cardiovascular and all-cause mortality. High blood pressure is the most frequent factor of MetS. General guidelines for hypertension recommend both pharmacological and exercise treatment while their combined effects on blood pressure have not been thoroughly explored yet. **Purpose:**

To compare the blood pressure (BP) response to a bout of supramaximal aerobic interval exercise (SIE) alone or in combination with antihypertensive medication in MetS hypertensive patients. **Methods:** Twelve patients chronically medicated with angiotensin II receptor 1 blockade antihypertensive medicine (AHM), underwent 3 trials separated by 1 week in a randomized order: *a)* control trial without exercise and substituting their AHM by a placebo (PLAC); *b)* placebo medicine and a morning bout of SIE (PLAC+SIE) and *c)* combining AHM and exercise (AHM+SIE). Acute and ambulatory blood pressure responses were measured for 21-h after treatments. Repeated-measures crossover, double-blind, placebo randomized design was used. **Results:** Acutely (i.e., 20 min after treatments), systolic blood pressure (SBP) were reduced similarly after PLAC+SIE (-9.7 ± 6.0 mmHg, P<0.001) and AHM+SIE (-10.4 ± 7.9 mmHg, P=0.001). Chronically, (21-h following treatments) SBP remained reduced after PLAC+SIE (125 ± 12mmHg, P=0.022) and AHM+SIE (122 ± 12 mmHg, P=0.013) in comparison to PLAC (132 ± 16 mmHg). The BP reduction in PLAC+SIE faded out at 4 a.m., whilst in AHM+SIE continued over the complete measurement period (Figure 1). At nighttime BP reduction was larger in AHM+SIE than PLAC+SIE (-5.6 ± 4.0 mmHg, P=0.006). **Conclusion:** Our data show that a bout of supramaximal aerobic interval exercise in combination with antihypertensive medication in the morning elicits a sustained blood pressure reduction that lasts at least 21-h. Exercise potentiates the effects of antihypertensive medicine reducing blood pressure longer and at a larger magnitude than exercise alone.

Figure 1



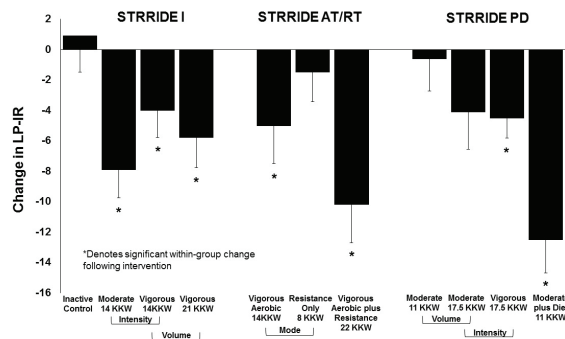
722 May 29 4:00 PM - 4:15 PM  
**Cardiorespiratory Fitness & Healthy Vascular Aging**  
 Nicholas A. Carlini, Matthew P. Harber, FACSM, Bradley S. Fleener. *Ball State University, Muncie, IN.*  
*(No relevant relationships reported)*

Healthy Vascular Aging (HVA), defined as carotid femoral pulse wave velocity (cfPWV; arterial stiffness) <7.6 m/s and absence of hypertension in adults ≥50 years of age, is associated with lower incidence of cardiovascular disease (CVD). Higher cardiorespiratory fitness (CRF) is associated with lower CVD mortality; however, the relation between HVA and CRF has not been examined. **PURPOSE:** To determine the relation between HVA and CRF in an apparently healthy adult population. **METHODS:** One hundred and one individuals (54M/47F) with a mean age of 63.5 ± 0.8 years and body mass index (BMI) of 28.3 ± 0.5 kg/m<sup>2</sup> underwent measures of vascular hemodynamics (cfPWV; resting blood pressure, BP), CRF (VO<sub>2max</sub>), and traditional CVD risk factors. Participants were divided into either the HVA or no-HVA groups based on the resting cfPWV and BP values and medication status. Data were analyzed with unpaired t-tests and Pearson correlations. **RESULTS:** HVA was present in 25% (n=25) of the subjects, while 75% (n=76) had no-HVA. Compared to no-HVA, HVA were younger (59.7 ± 1.8 vs. 64.7 ± 0.9 years, p<0.05), had lower cfPWV (6.7 ± 0.1 vs. 8.5 ± 0.1 m/s, p<0.05) and systolic BP (111.2 ± 2.5 vs. 117.6 ± 1.5 mmHg, p<0.05). CRF was not different between groups (27.2 ± 1.4 vs. 25.2 ± 0.8 ml/kg/min, p>0.05), but age and sex adjusted CRF percentiles according to the Fitness Registry and Importance of Exercise National Database (FRIEND) demonstrated greater CRF in HVA vs. no-HVA (62% ± 5.7 vs. 47% ± 3.0, p<0.05). HVA compared with no-HVA had lower (p<0.05) BMI (26.3 ± 1.1 vs. 29.0 ± 0.6 kg/m<sup>2</sup>, p<0.05), waist circumference (88.9 ± 2.8 vs. 98.5 ± 1.6 cm, p<0.05), and blood glucose (91.8 ± 2.1 vs. 103.4 ±

2.6 mg/dL, p<0.05). cfPWV (r=-0.3406) and bSBP (r=-0.3202) were both inversely correlated with the FRIEND percentiles (p<0.05, both). **CONCLUSIONS:** Our findings indicate HVA is associated with greater CRF. These data support the notion for lower CVD-related mortality with higher levels of CRF may be attributable, in part, to HVA.

723 May 29 4:15 PM - 4:30 PM  
**The Differential Effects Of Amount, Intensity, And Mode Of Exercise Training On A Novel Lipoprotein Multimarker Of Insulin Resistance**  
 Leanna M. Ross<sup>1</sup>, Cris A. Slentz<sup>1</sup>, Irina Shalaurava<sup>2</sup>, Margery A. Connelly<sup>2</sup>, James D. Otvos<sup>2</sup>, Connie W. Bales<sup>1</sup>, Joseph A. Houmard, FACSM<sup>3</sup>, William E. Kraus, FACSM<sup>1</sup>. <sup>1</sup>Duke University Medical Center, Durham, NC. <sup>2</sup>Laboratory Corporation of America Holdings (LabCorp), Morrisville, NC. <sup>3</sup>East Carolina University, Greenville, NC.  
*(No relevant relationships reported)*

**Purpose** To examine the effects of amount, intensity, and mode of exercise training on Lipoprotein Insulin Resistance Index (LP-IR; a relatively new spectroscopic multimarker of insulin resistance) across 10 exercise interventions from the STRRIDE studies. **Methods** A total of 531 men and women with dyslipidemia [STRRIDE I (n=222) and STRRIDE AT/RT (n=142)] or prediabetes [STRRIDE-PD (n=167)] were randomized to either control group or one of 10 exercise interventions, which ranged from doses of 8-22 kcal/kg/week (KKW); intensities of 50-75% VO<sub>2peak</sub>; and durations of 6-9 months. Two groups included resistance training and one group included dietary intervention (weight loss goal of 7%). Fasting blood samples were obtained at both baseline and 16-24 hr after the final exercise bout. NMR spectroscopy was performed at LabCorp to determine LP-IR score, which is comprised of six lipoprotein subclass and size parameters. LP-IR score ranges from 0 (most insulin sensitive) to 100 (most insulin resistant). Paired t-tests determined post- minus pre-intervention change score significance within groups (p<0.05). Study-specific ANCOVA determined differences between groups. **Results** The inactive control group did not significantly change LP-IR. After training, seven of the 10 exercise groups significantly improved LP-IR, ranging from -4.0 ± 7.6 to -12.5 ± 14.2. The figure displays change scores across all groups. The Aerobic plus Resistance group resulted in significantly greater change than the Resistance only group in STRRIDE AT/RT. The Moderate plus Diet group had significantly greater LP-IR change than all other groups in STRRIDE-PD. **Conclusion** On average, STRRIDE interventions improved LP-IR. Our results provide compelling evidence that adding resistance to aerobic training elicits a synergistic training effect on LP-IR. In individuals with prediabetes, incorporating dietary intervention with aerobic training results in the most robust LP-IR improvement.



724 May 29 4:30 PM - 4:45 PM  
**Effect of Aerobic Exercise on Blood Glucose and CVD Risk in Glucose Metabolism Disorders People**  
 Yan Wang, Shousheng Xu, Xuemei Li, Juan Wang, Zhengzhen Wang, FACSM. *Beijing Sport University, Beijing, China.*  
 (Sponsor: Zhengzhen Wang, FACSM)  
*(No relevant relationships reported)*

It's essential for glucose metabolism disorders people to monitor the change of blood glucose, heart rate (HR), systolic blood pressure (SBP) during and after exercise in order to prevent hypoglycemia and CVD risks. **PURPOSE:** To determine blood glucose after aerobic exercise in glucose metabolism disorders people, and to monitor recovery of HR and SBP. **METHODS:** By PAR-Q and OGTT, 58 subjects were divided

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into : normal glucose metabolism group (N,n=18), impaired fasting glucose (IFG) group (PD,n=20), and diabetes group (D,n=20). Everyone completed 30-minute cycle ergometer at 45%-55%HR. According to assessment standard of HR recovery and abnormal standard of SBP increasing during exercise, the CVD risk was judged. All subjects were provided the same amount diet, and exercise began just after one hour of the meal. All wrote consent, and the study was approved by the ethical committee of BSU. **RESULTS:** (1) Compared with blood glucose at the beginning of the exercise, the decreased amount of PD and D were bigger than N's (At the moment of finishing exercise, blood glucose of N, PD and D decreased respectively  $2.19 \pm 1.25$  mmol/L,  $3.59 \pm 1.47$ ,  $3.19 \pm 2.02$ ; at 1h-point after exercise,  $1.31 \pm 1.25$ ,  $2.29 \pm 2.63$ ,  $2.66 \pm 2.57$ ; at 2h,  $2.11 \pm 1.31$ ,  $3.72 \pm 1.77$ ,  $4.66 \pm 2.47$ ,  $P < 0.05$ .) (2) The fluctuation of blood glucose in PD and D were much sharper than N's when the data of seven time-point samples were calculated ( $1.62 \pm 0.53$ ,  $1.96 \pm 0.73$ ,  $1.11 \pm 0.44$ ,  $P < 0.05$  and  $P < 0.01$ ), and the seven time-points followed as fasting glucose, 1h after meal, the moment just finishing exercise, 15min, 30min, 1h, 2h in turn. (3) As to N, PD, D's HR, the incidences of abnormal recovery at the 1st minute after exercise were 6.7%, 13.3%, 13.3% respectively, and the incidences of SBP abnormal increase during exercise were 20%, 33.3%, 60%. **CONCLUSIONS:** (1) The study found blood glucose of healthy or glucose metabolism disorders people after aerobic exercise changed regularly: decreased remarkably at the end of exercise, and then increased gradually with its peak at 30min, recovering almost entirely at 2h-point. (2) IFG subjects benefited more in blood glucose from 30min aerobic exercise than diabetes. (3) The CVD risk of exercise for diabetes patients was higher than that for IGR people and healthy ones. Supported by Research on Prevention and Control of Major CNCD (2016YFC1300202).

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### Differences in Daytime vs. Night-time Travel Stress and Recovery as Measured by Heart Rate Variability

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(No relevant relationships reported)

**Purpose:** Air travel over several time zones causes disruption of circadian rhythms resulting in disorientation, nausea, gastrointestinal distress and difficulty concentrating. This may compromise health and decrease performance in travelling athletes. Heart rate variability (HRV) used to assess autonomic cardiac control may be an indicator of jetlag. This case study investigated trans-meridian travelling effects on the autonomic nervous system (ANS) by measuring time domain (RMSSD), high frequency domain (HF) and autonomic balance (LF/HF) indicators. **Methods:** A recreational athlete was monitored on tour from South Africa (SA) to New Zealand (NZ) for 28 days. HRV measurements were averaged over 3 days/nights and reported as means (SD): a) after a 18 hour flight from SA, b) after 1 week in NZ, c) after 2 weeks in NZ, d) upon return to SA. **Results:** Active daytime vagal cardiac influence showed a return to normal/higher values measured after 2 weeks of arrival in Auckland, with a marked decline directly upon return to SA; RMSSD (ms): a) 45.63 (23.88), b) 62.90 (32.20), c) 67.00 (40.06) and upon return to SA d) 43.50 (25.75); HF ( $\text{ms}^2$ ): a) 613.33 (366.11), b) 1164.00 (632.90), c) 1324.50 (795.30) and upon return to SA d) 834.33 (849.58). However, night time measurements indicated a decrease of the vagal control set point. RMSSD (ms): a) 52.37 (26.93), b) 50.55 (29.29), c) 46.80 (27.02) and upon return to SA d) 36.07 (18.12); HF ( $\text{ms}^2$ ): a) 829.33 (471.39), b) 772.50 (451.86), c) 530.00 (309.22) and upon return to SA d) 336.00 (179.77). Daytime autonomic balance (LF/HF) followed the same pattern, returning to lower/normal values after 2 weeks in NZ, and upon homecoming values reversed, signalling a new stress response due to the return flight: a) 3.66 (1.97), b) 2.83 (1.66), c) 2.71 (1.59) and finally d) 7.64 (4.50). Night time LF/HF values had small increases during the first 2 weeks with a stress response upon return to SA: a) 2.81 (1.62), b) 2.83 (1.66), c) 3.25 (1.88) and d) 6.40 (3.39). **Conclusion:** Reduced daytime vagal control improved with time (i.e. ANS adaptation) following international travel, illustrating the potential for HRV quantification as a jetlag marker. A novel finding is that during periods of travel it appears if autonomic cardiac control, as measured by HRV during daytime, differs to the nocturnal response.

726 May 29 5:00 PM - 5:15 PM

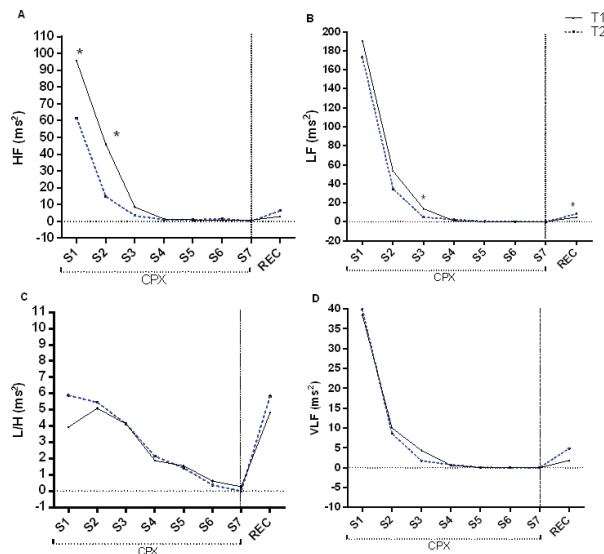
### Autonomic Modulation Adjustments In Two Different Ergometric Tests In Young Adults

Giovanna Lima de Oliveira, Vanessa Ferrari da Fonseca, Beatriz Pozzolo, Amanda Archeleiga Guedes, Adriana Hernandez Marques, Taís Capucho Santos, Fernanda Panacioni, Aurezo Mocelin, Renata Labronici Bertin, Anderson Zampier Ulbrich. *UFPR, Curitiba, Brazil.*

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(No relevant relationships reported)

An inadequate position while performing an ergometric test (ET), specifically by grasping tightly the front or side rails, can lead to a misinterpretation of a person's physical capacity and hemodynamic responses. **PURPOSE:** This study has compared heart rate variability (HRV) kinetics throughout an ET executed in two different positions. Wherefore, was tested the hypothesis of an overestimated autonomic dynamic in ET while performed in an incorrect position. **METHODS:** Thirty-five undergraduates ( $21.08 \pm 2.98$  years old) of both sexes, volunteered to undertake two treadmill ET on *Ellestad* protocol, in non-consecutive days. The first test (T1) was performed in an inadequate position and, after seven days, the second test (T2) without holding the front or side rails of the treadmill. Autonomic function was measured by HRV during both tests and resting. Repeated comparisons of HRV variables on each stage of *Ellestad* protocol on ET were performed with *two way* ANOVA and multivariate linear regression, considering *P* values of  $< 0.05$ . **RESULTS:** Estimated value of peak oxygen uptake ( $\text{VO}_2$ ) was 22.4% higher in T1 ( $P < 0.0001$ ) when compared to T2. Overall, parasympathetic pathway was deactivated earlier in T2 than in T1, showed by NNxx ( $P < 0.005$ ) and HF ( $P < 0.05$ ). In stage two, mean values of HF in T2 corresponded to 32% of values in T1 ( $P < 0.048$ ). Stage three presented a difference of 60% ( $P < 0.014$ ) in LF between means reached in T1 and T2. An association of LF and  $\text{VO}_2$  was verified in early stages of both ET's. Each increase of one  $\text{ms}^2$  in LF added up 0,013ml.kg.min in  $\text{VO}_2$  mean. **CONCLUSION:** When performed on the right positioning, the duration of the test is closer to real effort undertaken. Parasympathetic component stays activated for a longer period when the person grasps the rails of the treadmill because maximum effort is reached later.



**Figure 1.** HRV frequency domain components dynamic during both ETs. Graphic analysis in each stage of T1 and T2 for: (A) high frequency component (HF), (B) low frequency component, (C) LF/HF and (D) very low frequency component (VLF). Values are expressed in means in each stage for both tests. CPX is cardiopulmonary exercise, without recovery, REC is recovery time of 3 minutes; S1: stage one; S2: stage two; S3: stage three; S4: stage four; S5: stage five; S6: stage six; S7: stage seven. \* $P < 0.05$

**B-42 Clinical Case Slide - Hip and Thigh I**

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM  
Room: CC-304E

**727 Chair:** Aaron Rubin, FACSM. *Kaiser Permanente, Fontana, CA.*

(No relevant relationships reported)

**728 Discussant**

Peter Gerbino, FACSM. *Monterey Sports Medicine, Monterey, CA.*

(No relevant relationships reported)

**729 Discussant**

Melody Hrubes. *UIC Sports Medicine, Chicago, IL.*

(No relevant relationships reported)

May 29 3:15 PM - 3:35 PM

**Buttock Pain - Cross Country Skier**

Jake H. Reisner, Elena J. Jelsing. *Mayo Clinic, Rochester, MN.*  
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(No relevant relationships reported)

**HISTORY:** A 32 year old male cross country skier presented with a multi-year history of right posterior “deep” buttock pain. He endorsed associated radiation down his posterior right thigh, leg and into the plantar foot. He described “burning” and “tingling” that increased with prolonged sitting and standing. Surgical history was significant for bilateral hip arthroscopic surgeries for femoral acetabular impingement. He denied any significant weakness or change in bowel/bladder function.

**PHYSICAL EXAMINATION:** Exam revealed right toe flexor weakness. Straight leg raise reproduced his right lower limb and buttock pain. Reflexes were physiologic and symmetric. Hip range of motion was full and pain free. Intraarticular provocative maneuvers were negative. He had tenderness to palpation of his deep hip external rotators. FABER’s test and passive piriformis stretch reproduced his right buttock and lower limb symptoms.

**DIFFERENTIAL DIAGNOSIS:**

S1 Radiculopathy  
Sacroiliac Joint Dysfunction  
Piriformis Syndrome  
Hip Osteoarthritis  
Proximal Hamstrings Tendinopathy  
Ischiofemoral Impingement Syndrome

**TEST AND RESULTS:** Lumbar spine x-rays showed anterolisthesis of L5 on S1 with associated disc space narrowing and MRI showed paracentral disc protrusion at L5-S1 effacing the right S1 nerve root. Electromyogram showed evidence of a chronic, inactive right S1 radiculopathy. Ultrasound of the right hip identified a small nerve fascicle, separate from the sciatic nerve, appearing to pierce the piriformis muscle. MRI of the pelvis with lumbosacral plexus protocol demonstrated the sciatic nerve coursing deep to the right piriformis muscle and identified the right S2 nerve root coursing through the piriformis muscle.

**FINAL WORKING DIAGNOSIS:**

Piriformis syndrome resulting in active, compressive, right S2 neuritis  
Superimposed, chronic, inactive right S1 radiculopathy

**TREATMENT AND OUTCOMES:**

Extensive PT with plateau in improvement.  
No relief with right S1 selective nerve root block.  
Ultrasound guided piriformis corticosteroid injection provided temporary relief of buttock pain.  
Ultrasound guided sciatic nerve hydrodissection coupled with neural flossing provided several months of relief and allowed the patient to return to cross country skiing.  
Surgical referral for consideration of piriformis release.

731 May 29 3:35 PM - 3:55 PM

**A Simple Leg Injury? - World Champion Super-Heavyweight Weightlifter**

David Cole<sup>1</sup>, Ryan Rompolo<sup>2</sup>, Mark E. Lavallee, FACSM<sup>1</sup>. <sup>1</sup>York Hospital - WellSpan Health, York, PA. <sup>2</sup>Franciscan Health Sports Medicine, Lafayette, IN. (Sponsor: Mark E. Lavallee, FACSM)  
(No relevant relationships reported)

**HISTORY:** A 41-year-old male Bulgarian was lifting in a Masters Championship in Barcelona in the 105+kg weight class. The first series was the snatch with his first attempt at 115 kg (254 lbs) going well and without pain. On his second attempt at 121 kg (267 lbs) he experienced some anterior left thigh pain. He attempted the third at 126 kg (278 lbs) unsuccessfully. After a short break he attempted the clean and jerk series first at 145 kg (320 lbs) and had a good lift. He attempted his second clean and jerk at 150 kg (331 lbs) at which point his pain increased and he forfeited the last attempt. Overnight at his hotel his pain intensified, and he sought care at a local ER. He was subsequently discharged with no imaging, intervention, or treatment plan. The following morning, he presented to the event medical tent with worsening pain, swelling and difficulty with bearing weight on his left lower extremity. **PHYSICAL EXAMINATION:** Appreciable difference in thigh size, no erythema with mild lacey bruising over left knee and distal to the knee joint. Right thigh measuring 65cm and left thigh measuring 72cm. Marked tenderness to palpation over the superior quad tendon and over the bodies of the rectus femoris and vastus lateralis. Limited hip and knee flexion, with endorsed pain in anterior thigh and superior aspect of patella. Sensation intact, Palpable femoral, DP, PT pulses. **DIFFERENTIAL DIAGNOSIS:** 1. Quadriceps hematoma 2. Superior patella avulsion fracture 3. Quadriceps tendon tear 4. Morel-Lavallee Lesion 5. Evolving thigh compartment syndrome **TEST AND RESULTS:** Plain film showed superior pole avulsion fracture of the left patella and soft tissue swelling suggestive of hematoma. MRI obtained 4 days following evaluation indicated significant diffuse edematous changes of muscle and fascia with interstitial hematoma and evidence of muscle body rupture of the vastus lateralis **FINAL/WORKING DIAGNOSIS:** Left vastus lateralis rupture with avulsion fracture of the superior pole of the patella **TREATMENT/OUTCOMES:** Sent back to ER, radiograph obtained, placement in a long leg splint and LMWH given. Inability to obtain better imaging in Spain due to cost. Orthopedic evaluation upon return to Bulgaria within 4 days of injury with subsequent MRI. Patient treated conservatively with rehab and no surgical intervention.

732 May 29 3:55 PM - 4:15 PM

**Left Anterior Hip and Groin Pain-Rowing**

Jeffrey Smith, Kentaro Onishi. *UPMC, Pittsburgh, PA.* (Sponsor: Brian Davis, FACSM)  
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(No relevant relationships reported)

**HISTORY**

21 year old female division I rower with history of left L5 radiculopathy s/p L5-S1 microdiscectomy and foraminotomy presented with a 3 month history of dull, deep, aching anterior hip pain radiating into the groin, provoked by hip flexion, prolonged sitting, and rowing. Her symptoms started after a 15 mile row. She complained of quadriceps weakness worsening over the past month. She tried NSAIDs, heat, ice, and stretching without success. A separate provider ordered EMG/NCS for radiculopathy workup, which showed an L5 radiculopathy, but did not investigate the rectus femoris, medial femoral cutaneous nerve or saphenous nerve.

**PHYSICAL EXAMINATION**

Atrophy of the quad musculature. No gait abnormalities. She was nontender to palpation at the greater trochanter, ischial tuberosity, piriformis, and quadratus femoris. Active and passive ROM of hip was full and not painful. Strength was 5/5 except knee extension was 4/5. Sensation intact in all dermatomes of lower extremity. Negative log roll test. Positive Stinchfield, femoral nerve stretch and Tinel’s over anterior hip reproducing pain. Straight leg raise produced posterior leg and back pain. FABER and FADIR produced anterior hip pain.

**DIFFERENTIAL DIAGNOSIS**

1. Acetabular labral injury
2. Femoral neuropathy
3. High lumbar spinal stenosis
4. High lumbar disc herniation
5. External Iliac artery fibrosis

**TEST AND RESULTS**

Lumbar MRI: no abnormalities at L1-L4, scar tissue at L5-S1 causing mild flattening of the S1 nerve root and a shallow disc bulge at L4-L5 with no canal or foraminal stenosis

Pelvic MRI: no compressive lesions in the lumbosacral plexus and no labral injury  
Diagnostic ultrasound of the anterior hip: negative based on a complete ultrasound following AIUM protocol

**FINAL/WORKING DIAGNOSIS**

Labral injury vs femoral neuropathy, chronic L5 radiculopathy  
**TREATMENT AND OUTCOME**

Initial treatment was a diagnostic ultrasound guided (USG) intraarticular hip injection with local anesthetic with no response. This was followed by an USG femoral nerve diagnostic hydrodissection with lidocaine that provided short term relief. 1 week later, she received an USG femoral nerve hydrodissection with 15cc of D5W and sent for femoral nerve focused therapy. At 3 month follow up she had relief of her symptoms. She is now assistant coach for the rowing team with no symptoms.

**733** May 29 4:15 PM - 4:35 PM

**Acute Proximal Posterior Thigh Pain in a Division 1 Women's Soccer Player**

Alyssa Neph, Steven Schaaf, Kentaro Onishi. *UPMC, Pittsburgh, PA.* (Sponsor: Brian Davis, FACSM)  
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(No relevant relationships reported)

**HISTORY:** A 22-year-old female soccer player for a Division 1 College team with a previous history of contralateral hamstring injury a year ago presents to the training room with acute onset left posterior thigh pain. She was seen in the training room 5 days prior with an ache in the posterior thigh. Sideline ultrasound was unremarkable for any abnormality at that time. Pain worsened while performing a drill during practice so she presents for re-evaluation. **PHYSICAL EXAMINATION:** No obvious gait abnormalities. No ecchymosis over posterior thigh. Tender to palpation at left proximal semitendinosus muscle belly but no palpable defect noted. Resisted knee flexion/hamstring activation and reverse plank reproduced pain. Strength was full and symmetric and sensation intact in bilateral lower extremities. **DIFFERENTIAL DIAGNOSIS:** 1. Acute medial hamstring strain/tear 2. Proximal medial hamstring tendinitis 3. Ischial bursitis 4. Adductor strain **TEST AND RESULTS:** Limited training room ultrasound reveals separation in the layers of investing fascia of semitendinosus/biceps femoris interval with sonopalpation tenderness reproducing her concordant symptom at the proximal hamstring region. There were no signs of muscular injuries on ultrasound. **FINAL WORKING DIAGNOSIS:** Acute left proximal semitendinosus/biceps femoris fascia tear without sonographic evidence of muscle strain in a senior soccer player with 3 games left of her career. **TREATMENT AND OUTCOMES:** Using sonographic guidance, 4 cc of autologous conditioned plasma (ACP/PRP) was injected at the site of fascial abnormality. Patient remained prone for 5 minutes following the injection followed by application of ACE wrap for the next 2 hours and use of thigh compression until she was pain free. She was instructed to rest completely for 24 hours with a progressive rehabilitation program to return to play. At 6 days post procedure, she progressed to jogging and warm up exercises with minimal residual pain but was advised to continue to refrain from soccer. At 1-week post procedure she was completely pain free and was cleared to return to play in the game the following day. She then returned as a starter in the last game of the season, 11 days post injection, and even assisted a goal that led to her team's win. She is now 22 days post injury and remains pain free.

**734** May 29 4:35 PM - 4:55 PM

**Right Lateral Hip Injury - Squash**

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(No relevant relationships reported)

**HISTORY**

55 year old elite male squash player felt a sudden onset of hip pain mid match. As he lunged to his left to return a ball, his left leg was in the stance phase and his right leg was in the swing phase, crossing over his body towards his left side. While mid-swing of the right leg, he heard a pop in his right hip and could not bear weight on his right leg. The next day, he began to ambulate with a hiking stick for assistance. He reported to the outpatient sports medicine clinic 10 days after the injury presenting with lateral hip pain described as focal, dull and rated 1/10.

**PHYSICAL EXAMINATION**

5/5 strength in hip flexors, knee flexors and extensors. Tenderness to palpation of the anterior rim of the right iliac crest. No tenderness to palpation of the right PSIS, buttock, or greater trochanter. No pain with passive hip flexion, internal or external rotation. Pain with hip abduction in the side-lying position on the right, worse with the hip extended and with clamshells. Pain with single leg hop on the right. No sign of an antalgic gait.

**DIFFERENTIAL DIAGNOSIS**

Hip osteoarthritis  
Iliopsoas tendonitis  
Trochanter bursitis  
Tear of gluteus medius muscle  
Lumbar paraspinal muscle sprain

**TESTS AND RESULTS**

Right hip radiographs: No acute fracture, mal-alignment or osseous findings. Mild degenerative disease of the visualized lower lumbar space.

Ultrasound focused on the right lateral hip at the iliac crest: Appeared to be a 2 cm x 2 cm partial tear of the right gluteus medius muscle off of the iliac crest.

**FINAL WORKING DIAGNOSIS**

Right gluteus medius partial muscle tear at the attachment to the iliac crest

**TREATMENT AND OUTCOMES**

A non-load bearing mechanism of injury is unusual in this case, which could mean the patient had underlying degenerative changes to the gluteus medius prior to the injury. Physical Therapy (weeks 1-2 after evaluation) - progressive strengthening of hip girdle muscles with no direct gluteus medius muscle activation.

Repeat focused ultrasound at week 4 showed healing of the partial gluteus medius muscle tear.

Physical Therapy (weeks 4-8) - progressive strengthening exercises focusing on dynamic movements of the lower musculoskeletal extremity with a low-intensity return to squash program.

Return to squash matches starting at week 8 and painless hip abduction, extension and dynamic movements required for competitive squash.

**735** May 29 4:55 PM - 5:15 PM

**A Typically Female Hip Issue in a Male Basketball Coach**

Keri L. Denay, FACSM. *University of Michigan, Ann Arbor, MI.*  
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(No relevant relationships reported)

**HISTORY:** 34 year-old male basketball player/coach with left hip pain. Pain anteriolateral for the last month with hip rotation and lying on left. No preceding injury or trauma. No pain at rest. Improves with sitting. No fever, chills, numbness, tingling, radiation, other joint involvement, swelling, erythema, catching, locking. No pertinent medical, surgical, or family history. No medications other than ibuprofen above. Works as a teacher and basketball coach, recreational basketball player. Denies tobacco, alcohol, or drugs.

**PHYSICAL EXAMINATION:** BMI 27. Trendelenburg gait, uncompensated and positive trendelenburg test on left leg standing. Internal rotation of the hip of 15 degrees with mild pain. External rotation of the hip unremarkable. Neurovascularly intact. Mild pain with passive, bent knee internal rotation. No pain with passive, bent knee external rotation. 5/5 strength with resisted straight knee hip flexion with + pain. 5/5 strength with resisted bent knee hip flexion, adduction, and abduction without pain. Negative FABER test for pain but decreased ROM, slightly worse than contralateral. Positive FADIR. Tender only at ASIS and along IT band. Positive Ober's test.

**DIFFERENTIAL DIAGNOSIS:** Osteoarthritis, Inflammatory arthritis, femoroacetabular impingement/labral pathology, fracture, lateral hip pain/gluteus medius tendinopathy and weakness, IT band syndrome, lumbar radiculopathy, infiltrative process/mass.

**TEST AND RESULTS:** X-ray: Decreased bone density within the left femoral head without fracture or mass. This could recommend transient osteoporosis of the hip. MR arthrogram: Subchondral insufficiency fracture in the superior aspect of the left femoral head with significant bone marrow edema in the left femoral head and neck. Small left anterior superior labral tear.

**FINAL WORKING DIAGNOSIS:** Transient osteoporosis of the left femoral head with subchondral insufficiency fracture and anterior, superior labral tear.

**TREATMENT AND OUTCOMES:** Crutches for pain-free guided weight-bearing and pain-free water exercise. 6 weeks after diagnosis, doing pain-free ADLs without difficulty. Physical therapy started. 6 months after diagnosis: x-ray with no fracture seen and improved bone density. Cleared for all activity without restrictions.

**B-43 Clinical Case Slide - Spine I**

Wednesday, May 29, 2019, 3:15 PM - 4:35 PM  
Room: CC-306

**736 Chair:** Joseph Ihm, FACSM. *Shirley Ryan AbilityLab, Chicago, IL.*

*(No relevant relationships reported)*

**737 Discussant**

Oluseun A. Olufade. *Emory University, Johns Creek, GA.*

*(No relevant relationships reported)*

**738 Discussant**

Prakash Jayabalan. *Shirley Ryan AbilityLab/Northwestern University, Chicago, IL.*

*(No relevant relationships reported)*

**739** May 29 3:15 PM - 3:35 PM

**Bilateral Upper Extremity Weakness in a Wrestler**

Kimberly S. Casten, Adam Lewno. *University of Michigan, Ann Arbor, MI.* (Sponsor: Robert Kinningham, FACSM)

*(No relevant relationships reported)*

**HISTORY:** A 19-year-old male college Wrestler with a history of right labral repair presented with 4-month insidious 10/10 neck pain and band-like pain over his shoulders. In the last month he developed bilateral dorsal hand paresthesias with shoulder fatigue while wrestling. After a month off, symptoms would emerge after 2-5 minutes of wrestling and progressively longer. No illness, increase in activity, color changes, temperature differences, loss of dexterity.

**PHYSICAL EXAMINATION:**

General: Well-developed male

Skin: No rashes or lesions

Vascular: Normal pulse and capillary refill

Neuromuscular: Normal muscle bulk and tone. Normal range of motion, strength, deep tendon reflexes, and sensation to light touch and pinprick in the bilateral upper extremities. Positive Tromner reflex bilaterally, otherwise negative special testing of the cervical spine, shoulder, scapula, and neurovascular bundle.

**DIFFERENTIAL DIAGNOSIS:**

1. Cervical Radiculopathy
2. Transient quadriplegia
3. Suprascapular or Axillary Mononeuropathy
4. Brachial Plexopathy
5. Thoracic Outlet Syndrome
6. Myopathy
7. Quadrilateral Space Syndrome
8. Spinal cord injury
9. Cervical facet pathology

**TEST AND RESULTS:**

Cervical MRI identified absent right C5 pedicle with no spinal cord signal abnormality.

C5 and C6 spinal nerve roots were separate with no dural extension

Cervical CT showed no fracture of the right C5 pedicle; likely congenital absence.

Anterior and posterior columns were normal

Cervical radiographs revealed no dynamic instability

Bilateral upper extremity electrodiagnostics were normal with no axillary or suprascapular mononeuropathy, upper trunk plexopathy, or radiculopathy.

**FINAL WORKING DIAGNOSIS:** Congenital absent right C5 pedicle with C6 subluxation

**TREATMENT AND OUTCOMES:**

1. Neurosurgical consultation which confirmed spinal stability with no restriction on sporting activities
2. Progressed from limited sporting activities including aerobic activities without upper body utilization and non-Olympic lower body weight lifting without barbell utilization, to stabilization exercises aimed at cervical musculature, trapezius, deltoids, and rhomboids.
3. Return to sport in process, focusing on Folk style wrestling given less submission and upper extremity rapid force transmission.

**740** May 29 3:35 PM - 3:55 PM

**Back Injury - Crossfit**

Kevin Bonfield. *University of Kentucky, Lexington, KY.*

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*(No relevant relationships reported)*

**HISTORY:** A 31 year old female with obesity s/p gastric sleeve presents with left shoulder pain after an injury sustained performing a power clean during a crossfit session 2 months prior. At the top of the lift she felt a tearing pain between her scapula and spine that radiated all the way down her left arm and felt like numbness and tingling in her small three fingers. She has tried ibuprofen, ice, heat, and cyclobenzaprine which have only mildly improved her pain over the past 2 months. **PHYSICAL EXAMINATION:** Examination revealed a normal appearance to the left shoulder. Palpation noted for tenderness over the left rhomboid, trapezius. Tenderness over spinous process with tenderness at C6-C7 spinous processes. ROM of left shoulder intact with pain elicited on extension, abduction and external rotation. Strength 3/5 with forward flexion, abduction and external rotation. Positive Lift Off test.

**DIFFERENTIAL DIAGNOSIS:** 1. Cervical Radiculopathy 2. Rotator Cuff tear 3. Brachial plexopathy

**TEST AND RESULTS:** Left Shoulder x-ray- No acute findings. Spinal Survey AP/ Lat- Small ossific fragment along posterior aspect of C6 spinous process. Large ossific fragment between the C7 and T1 spinous processes. MRI Thoracic Spine w/ out Contrast- Old 50% compression deformity of T4. Syrinx in the lower thoracic spinal cord centered at T9 level measuring 4cm craniocaudally and 5mm in maximal transverse dimension. NM Bone Scan SPECT- Increased bone uptake at the spinous process of C7 extending between C7 and T1. 15mm well corticated fragment most compatible with healing fracture. C7 spinous process excisional biopsy pathology- Bone and dense peri-osseous soft tissue without significant histological abnormality.

**FINAL WORKING DIAGNOSIS:** C7 vertebral fracture with C7 spinous process ossicle

**TREATMENT AND OUTCOMES:** 1. Surgical Excision of the ossicle complicated by wound dehiscence and surgical site infection necessitating debridement and antibiotic therapy. 2. Cervical collar for 2 weeks weaned out of over the third week. 3. Lifting restriction of less than 10 pounds for 6 weeks. 4. Neck extension exercises out of the collar and isometric exercises. 5. Returned to activities as tolerated 3 months post op from original excision surgery with improvement in strength, range of motion and numbness symptoms.

**741** May 29 3:55 PM - 4:15 PM

**Perplexing Presentation- Preserving Function**

Germaine Herman. *Eskenazi Health System, Indianapolis, IN.*

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*(No relevant relationships reported)*

**History:**

A 60-year-old female with uncontrolled DM II, HTN, hyperthyroidism, tobacco abuse and depression arrived to physical therapy for evaluation of chronic left leg pain and weakness of sudden onset eight months prior. She reported constant pain including unremitting night pain, changes in bowel habits and a twenty five pound weight loss within the last six months. She denied urinary incontinence, night sweats, chills and fevers. She reported left knee buckling, falls, difficulty working as a bartender and completing daily activities. She endorsed non-adherence with medications and marijuana and non-prescription opiate use.

**Physical Examination:**

Examination revealed gross atrophy of the left thigh and left foot drop during gait. Sensation was decreased to light touch and deep pressure along L2-4 dermatomes in the left leg and was normal on the right. Reflexes were absent in L4/5 and S1 bilaterally; she had a negative Hoffman and Babinski bilaterally. Myotomes were 2-/5 proximal and 3+/5 distal to the knee on the left and 4/5 throughout on the right. There was flaccidity throughout the left leg. All other tests of the hip and spine including slump and straight leg raise tests were unremarkable.

**Differential Diagnosis:**

\* Lower motor lesion with systemic etiology

\* Malignancy

**Tests and Results:**

The physical therapist referred the patient back to the primary care physician (PCP) who ordered an abdominal CT and a spinal MRI. The patient was referred back to physical therapy. At re-evaluation one month later the patient presented with progressive motor loss scoring 3-/5 grossly on the right and 2-/5 grossly on the left leg. Sensory deficits extended to both lower extremities. Falls increased to thrice a week forcing patient to discontinue work. The patient was referred back to the PCP who admitted the patient to hospital for further workup. A brain MRI, myositis panel, aldolase, ANA and inflammatory markers were all unremarkable. EMG results revealed lumbosacral polyradiculopathy without evidence of myopathy.

**Final/Working Diagnosis:**

Diabetic Lumbosacral radiculoplexus neuropathy

**Treatment and Outcomes:**

\* Glycemic and pain control were achieved and, after three weeks at an inpatient rehab facility, patient walked with a walker without falls. She returned to work without the walker despite an increase in falls.

742 May 29 4:15 PM - 4:35 PM

### Osteomyelitis After Deadlifting Injury- A Rare Case Of A Burst Abscess

Edmund M. Qiao, Kenneth Vitale. *UCSD School of Medicine, La Jolla, CA.*

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(No relevant relationships reported)

**HISTORY:** 68-yr old male weightlifter presented with 1 mo. L buttock pain, acute onset of popping mid-lift during a deadlift, with radiating vague pain in L buttock. He continued to exercise through pain and 1 wk later pain progressed to severe deep buttock pain and difficulty ambulating. Denied low back pain, radiating thigh/leg symptoms, numbness/tingling, weakness, or bowel/bladder changes. Past hx positive for melanoma (treated in remote past), social hx negative for smoking, drug/alcohol abuse. He initially went to outside facility (only lumbar x-rays taken) without improvement, came in for another opinion with progressive symptoms.

**PHYSICAL EXAMINATION:** Skin normal without warmth, erythema. Vague tenderness in region of L buttock and SI joint. Full lumbar spine and hip ROM. Negative SLR. Mild nonspecific back discomfort with FABER. Normal lower limb neurovascular exam.

**DIFFERENTIAL DIAGNOSIS:** 1. SI Joint Dysfunction 2. Lumbar Radiculopathy 3. Piriformis Syndrome 4. Lumbar or Sacral Compression Fracture 5. Metastatic Cancer 6. Sacroiliitis

**TEST AND RESULTS:** Outside lumbar x-rays negative for fracture, showed minimal degenerative disc changes. We obtained hip/pelvis radiographs showing significant erosions and destructive changes of L SI joint. An urgent MRI showed fluid-filled and widened SI joint, severe inflammatory sacroiliitis with extensive erosions and bone marrow edema, widespread reactive muscle edema (iliacus showing fluid collection/early abscess at SI joint); SI joint aspirate was obtained.

**FINAL WORKING DIAGNOSIS:** septic sacroiliac arthritis with iliaca abscess and secondary osteomyelitis; aspirate grew staphylococcus aureus (MSSA).

**TREATMENT AND OUTCOMES:** The patient had a unique etiology of osteomyelitis not commonly reported. Orthopedics and ID determined he had pre-existing asymptomatic abscess that ruptured. Under the extreme abdominal pressures of deadlifting, they felt abscess burst leading to local spread and secondary osteomyelitis. This case highlights the rapidity and widespread destruction of infectious arthritis and need for awareness and prompt workup. Patient was treated with 6 wks of oxacillin and responded well. He returned to baseline physical activity at follow up; repeat x-rays showed SI joint sclerosis and patient was counseled on SI joint arthritis.

## B-44 Rapid Fire Platform - Distance Running

Wednesday, May 29, 2019, 3:15 PM - 4:35 PM

Room: CC-Hall WA2

743 **Chair:** Clare E. Milner, FACSM. *Drexel University, Philadelphia, PA.*

(No relevant relationships reported)

744 May 29 3:15 PM - 3:25 PM

### Changes in Shock Absorption and Kinematics during a Half Marathon as Measured with Inertial Sensors

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(No relevant relationships reported)

The repetitive impacts of the foot with the ground are hypothesized to be related to overuse injuries in running. Shocks caused by these impacts can be absorbed actively (i.e. muscle contractions) or passively (i.e. bones, tendons and ligaments). When fatigued, shock absorption is expected to shift from active to passive structures, increasing the risk of overuse injuries. Inertial sensors were used previously to quantify running mechanics in a real-world setting.

**PURPOSE:** To investigate shock absorption mechanisms between the tibia and sacrum in trained athletes during different phases of a Half Marathon, using inertial magnetic measurement units (IMUs).

**METHODS:** 8 trained athletes (5M 3F, 32.1±9.2 years, 177.4±8.1 cm, 67.8±7.5 kg) performed a Half Marathon during competition. A total of 8 IMU's (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Parameters of interest included two indicators of impact; peak tibial acceleration (PTA) and peak sacral acceleration (PSA), and the knee angle at midstance (MS). Mean values over 100 strides were calculated bilaterally during three periods in the Half Marathon (1<sup>st</sup> km, halfway and 20<sup>th</sup> km). Paired sample t-tests were used to test for statistical differences in the parameters between the three periods.

#### RESULTS:

Both PTA and PSA increased significantly during a Half Marathon, despite a unilateral increase in knee angle at MS.

#### CONCLUSIONS:

In the first part of the Half Marathon, an increase in PTA did not increase PSA, probably due to an increase in shock absorption by active structures (i.e. unilateral increase in knee angle at MS). During the last part of the Half Marathon shock absorption decreased, resulting in an increased PSA. We speculate that fatigue caused the shock absorption mechanism to shift from active to more passive structures during the last part of the Half Marathon. Future research should determine if shock absorption by passive structures is sufficient to prevent overuse injuries.

Table 1. Mean values ± standard deviation for the selected outcome parameters during different phases of a Half Marathon during competition. PTA = peak tibial acceleration; PSA = peak sacral acceleration; MS = midstance.

	PTA (m/s <sup>2</sup> )		PSA (m/s <sup>2</sup> )		Knee angle at MS (°)	
	Left	Right	Left	Right	Left	Right
1 <sup>st</sup> km	198.6±181.3	145.1±74.3	43.7±34.2	58.1±46.5	44.2±5.3	41.9±4.7
Halfway	264.5±172.5	220.4±104.9	53.3±28.9	66.5±42.5	43.5±8.1	44.0±4.4
20 <sup>th</sup> km	264.7±127.9	233.6±88.9	61.1±38.9	74.5±44.8	44.7±8.3	44.4±4.2
Sign. diff.						
1 <sup>st</sup> km - Halfway	p<0.05	p<0.01	n.s.	n.s.	n.s.	p<0.05
Halfway - 20 <sup>th</sup> km	n.s.	n.s.	n.s.	p<0.05	n.s.	n.s.
1 <sup>st</sup> - 20 <sup>th</sup> km	p<0.05	p<0.01	p<0.05	p<0.05	n.s.	p<0.05

745 May 29 3:25 PM - 3:35 PM

### Differences in Lower Extremity Kinematic Variability between Healthy Runners Classified as Low or High Mileage

Amanda Estep<sup>1</sup>, Steven Morrison<sup>2</sup>, Shane Caswell<sup>3</sup>, Nelson Cortes<sup>3</sup>. <sup>1</sup>Austin Peay State University, Clarksville, TN. <sup>2</sup>Old Dominion University, Norfolk, VA. <sup>3</sup>George Mason University, Manassas, VA.

(No relevant relationships reported)

Evidence suggests that running mechanics may differ between runners based on their weekly mileage; greater weekly mileage (WM) may act as a protective mechanism against injury. While the interaction between coordination patterns and WM has been investigated, interaction between lower extremity (LE) kinematic variability and WM has not. **PURPOSE:** To compare changes in LE kinematic variability between low (LM) and high mileage (HM) healthy runners after a prolonged run. **METHODS:** 23 healthy participants (27.4±7.7 yrs., 1.70±0.11 m, 67.9±15.4 kg, 16.3±5.6 km/week) were included in the LM group, while 12 participants (25.1±6.3 years, 1.71±0.1 m, 65.8±9.4 kg, 46.9±14.5 km/week) were included in the HM group. Participants ran on a treadmill for 30 minutes at a self-selected training pace. 3D kinematic data were collected after 5 minutes of running and again at the end of run at 200Hz using reflective markers placed on the lower body with 6 infrared cameras. Variables of interest included ankle, knee and hip sagittal and frontal plane angles. Standard deviation (SD) and coefficient of variation (CV) were calculated for each dependent variable (DV) at the beginning and end of the run. Approximate entropy (ApEn) was also calculated for each DV at both time intervals. Two repeated measures ANOVAs with time and joint as the within-subject factors and group as the between-subject factor, were used to compare kinematic variability. Post-hoc analyses were conducted for significant interactions. Alpha level was set at 0.05. **RESULTS:** Average running speed for the LM and HM group were 2.5±.3 m/s and 2.9±.4 m/s, respectively. In the sagittal plane, a significant interaction was found between joint and group ( $F_{2,62}=5.5$ ,  $p=.006$ ). Specifically, the HM group demonstrated greater amounts of variability (SD) than the LM group (LM=25.7±3.0; HM=29.5±3.7). No other statistically significant differences were attained.

**CONCLUSIONS:** Kinematic variability differed between the LM and HM groups, but only for the knee in the sagittal plane. Ankle and hip sagittal plane movement was comparable between the LM and HM groups. This may suggest that movement of the ankle and the hip do not differ in response to having to control variability at the knee. When assessing kinematic variability, it is important to consider the weekly mileage of each runner.

746 May 29 3:35 PM - 3:45 PM

**Are Joint Kinetics Proximally Redistributed Following A Long Run In Well-trained Runners?**

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(No relevant relationships reported)

Proximal redistribution of joint work to the hip occurs following intensive running in novice runners [1] and might explain the reduced running economy following prolonged running [2]. These findings in novice might be different in well-trained runners due to their training status. **PURPOSE:** The purpose of this study was to assess if proximal redistribution of joint kinetics following a running bout is observed in well-trained runners. **METHODS:** 14 well-trained male runners with habitual rearfoot strike patterns (76±22km/week) completed 5 running trials at a speed equivalent to ±5% of their long run pace while 3D kinematic and ground reaction force data were collected before and after a treadmill run equal to 25% of weekly mileage (19±6km). Joint powers and work were calculated from these data using Visual3D. Percent contribution of each joint work relative to total lower limb joint work was computed. Paired samples t-tests were used to compare joint kinetics before and after the run (*p* < 0.05). Cohen's *d* effect sizes were computed to assess mean difference magnitudes. **RESULTS:** Peak ankle negative power (Table 1) and hip negative relative work contribution (pre: 14.3±3.6%, post: 15.6±4.5%, *p*=0.041; *d*=0.33) showed significant pre- to post-run effects. Positive ankle (pre: 50.6±6.8%, post: 49.5±7.3%, *p*=0.35; *d*=0.16) and hip relative work (pre: 26.2±10.1%, post: 27.1±8.8%, *p*=0.53; *d*=0.10) were unaffected by the long run in these well-trained male runners. **CONCLUSIONS:** These findings suggest that previously reported distal-to-proximal shift in positive joint work in novice runners following a running bout [1] is not observed in well-trained male runners. This might be the result of chronic training exposure in these trained runners and suggest a preservation of mechanical joint output despite prolonged running exposure. Differences in run type (intense vs steady prolonged run), foot strike, and gender might also be responsible for these differences between studies.

**Table 1.** Peak negative and positive joint powers (W·kg<sup>-1</sup>) before and after the prolonged run (mean±SD).

Joint Kinetic Variables	Pre-Run	Post-Run	p-value	d
Ankle negative power	-8.4±2.0	-7.8±2.1	0.005	0.33
Ankle positive power	10.2±2.8	9.7±2.8	0.12	0.34
Knee negative power	-13.5±2.6	-12.8±2.3	0.16	0.39
Knee positive power	4.4±1.2	4.4±1.1	0.99	0.00
Hip negative power	-3.3±1.9	-3.4±2.1	0.73	0.05
Hip positive power	4.3±1.9	4.5±2.3	0.57	0.10

Notes: %: percent of total lower limb joint negative or positive work.

747 May 29 3:45 PM - 3:55 PM

**Pelvic Motion Differences in Three Different Techniques of Jogging Stroller Propulsion**

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(No relevant relationships reported)

Running with a jogging stroller has become a viable option for exercise in individuals serving as caregivers. Previous research has shown that stroller running leads to altered kinematics, but for many studies, running velocity was not constant between conditions. Some studies have reported altered trunk and pelvic motion during two-handed stroller running. **PURPOSE:** This study compared pelvic motion in all three planes of motion using various methods of pushing a stroller while running. **METHODS:** 13 recreational runners ran behind a Thule Urban Glide 2 jogging stroller suspended over an instrumented treadmill (Bertec, Inc, Columbus, OH). The study measured running in four different conditions: one with the participant's right hand on the handlebar (RH), another with left hand on the handlebar (LH), one with both hands on handlebar (BH), and running without the stroller (CON). The first three conditions were randomized between participants, but the final condition was always performed without the stroller. Biomechanical data were collected with Vicon Nexus 2.3 (Vicon, Inc., Oxford, UK) and processed through Visual 3D (5.0, C-Motion, Inc., Germantown, MD, USA). A repeated measures ANOVA was utilized to compare peak angles of the pelvis in all three planes of motion. **RESULTS:** The pelvis was more anteriorly tilted in the BH condition (25 ± 1.9°) compared to CON (23 ± 1.7°, *p*=0.01), RH (22 ± 2.0°, *p*<0.01) and the LH conditions (24 ± 1.9°, *p*=0.04). In the transverse plane only the LH (5.2 ± 0.75) and CON (5.6 ± 0.83°) conditions were similar. There was more right to left rotation of the pelvis in the BH condition (7.8 ± 0.7°) compared to the CON (*p*=0.02), RH (3.1 ± 0.88°, *p*<0.01) and the LH conditions (*p*=0.02). The RH was different from all other conditions for left to right rotation (*p*<0.01). There were no difference between conditions for pelvic obliquity, motion in the frontal plane, for any

of the four conditions. **CONCLUSIONS:** Running while behind a stroller alters some aspects of pelvic motion when compared with regular running. This is true for both one and two-handed stroller running. Pelvic motion plays a role in many aspects of running and altered mechanics in this region may lead to increased risk for injuries of the low back or lower extremity.

748 May 29 3:55 PM - 4:05 PM

**Immediate Effects of a Textured Insole on Running Biomechanics in Rearfoot Strikers**

Ann-Uriel H. Knausenberger<sup>1</sup>, Matthew F. Moran<sup>1</sup>, Justin C. Wager<sup>2</sup>. <sup>1</sup>*Sacred Heart University, Fairfield, CT.* <sup>2</sup>*New Balance Sports Research Laboratory, Lawrence, MA.*  
(No relevant relationships reported)

Running biomechanics are influenced by footwear and insole properties. The sensorimotor system, specifically subcutaneous plantar receptors, play a role in initiating adaptive gait mechanics. Designed to increase afferent signaling via plantar surface deformation, an insole inlaid with a textured heel-plate (TI) is proposed to precipitate gait changes during running. **PURPOSE:** To compare biomechanical patterns during over-ground running between the TI and a non-textured insole (NI). **METHODS:** Nineteen rearfoot strike runners (24.9 +/- 5.7 yo; 6 M, 13 F) performed twenty, 35-meter running trials under TI and NI conditions. Insole conditions were counter-balanced, and velocity was controlled (±5%). Plantar sensation was assessed using a 3.61g monofilament applied to seven standardized sites. Thirty-six reflective markers (dia.=16-20 cm), affixed bilaterally to lower extremity bony landmarks, were tracked via a 10-camera motion analysis system (120 Hz), and ground reaction forces were collected (1200 Hz). Visual3D and a custom Matlab script were used to determine lower extremity kinematics and kinetic variables. Perceived insole comfort was scored with a visual analogue scale. Dependent variables were analyzed using paired-samples t-tests; for data that violated assumptions, a Wilcoxon signed-rank test was utilized. **RESULTS:** Kinetic measures did not differ significantly between insole conditions; impact peak (NI=1.46±0.58 BW, TI=1.50±0.44 BW, *p*=.74), active peak (NI=2.37±0.16 BW, TI=2.35±0.15 BW, *p*=.28), loading rate (NI=35.9±12.2 BW/s, TI=34.0±13.2 BW/s, *p*=.26), peak braking (NI=-.31±.03 BW, TI=-.32±.06 BW, *p*=.69) and peak propulsion (NI=.27±.05 BW, TI=.27±.04 BW, *p*=.28). A significant increase in ankle internal rotation angle at initial contact was observed in the TI versus NI (NI=5.9 ± 5.9°; TI=7.3 ± 5.9°; *p*=.01, *d*=.24), however, no other significant kinematic differences were detected. NI (mdn=9.0) was rated as significantly more comfortable than TI (mdn=8.0) (*z*=-2.026 *p*=.04). **CONCLUSION:** Because kinematic and kinetic variables did not vary significantly between the TI and NI, the efficacy of the TI as a method of immediately altering running mechanics in a population of rear foot strikers should be further investigated. Insoles provided by: ShoeCue Inc (ShoeCue, Orleans, MA)

749 May 29 4:05 PM - 4:15 PM

**Comparison of Running Gait Kinematics Among College Students With and Without ASD**

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(No relevant relationships reported)

**BACKGROUND:** Autism Spectrum Disorder (ASD) is a developmental disability associated with difficulties in social communication and the presence of repetitive behaviors. Along with social impairments, motor deficits can be identified as another characteristic associated with ASD. Although gait deviations have been looked at in children with ASD, not much is known about how gait deviations may persist in college students with ASD. **PURPOSE:** To compare running gait deviations between college students with and without ASD. **METHODS:** Ten college students participated in this study. Five participants had a diagnosis of ASD (age 21.5±2.9 years) and 5 participants did not have an ASD diagnosis and comprised a healthy control (CON) group (age 24±3.5 years). Each participant performed 3 running trials over a 7.62 meter distance. Kinematic data were collected using a 12-camera 3D motion capture system. Stance and swing phase time, and hip, knee, and ankle angles at initial contact and at toe off were extracted for further analysis. Variables were compared between groups using independent t-tests. As this is a preliminary analysis with a small sample size, significance was set at α<0.10. **RESULTS:** Individuals with and without ASD had similar lower extremity joint angles at initial contact (hip 60.21±13.13° ASD, 53.60±16.07° CON, *p*=0.53; knee 37.10±12.40° ASD, 43.48±3.30° CON, *p*=0.36; ankle 17.66±4.89° ASD, 18.18±6.47° CON, *p*=0.90). The two groups also demonstrated similar knee and ankle angles at toe off (knee 24.51±3.86° ASD, 19.36±4.28° CON, *p*=0.11; ankle -15.74± 6.45° ASD, -13.22±10.32° CON, *p*=0.69), but the ASD group demonstrated less hip extension at toe off (2.97±1.07° ASD, -2.02±4.60° CON, *p*=0.07). The ASD group also demonstrated longer stance phases (0.29±0.03s ASD, 0.23±0.02s CON, *p*=0.02) and shorter swing phases (0.40±0.05s ASD, 0.47±0.05s CON, *p*=0.10) compared to the control group. **CONCLUSION:** The



control group demonstrated more hip extension at toe off, which could suggest greater forward propulsion of the body. Greater propulsion is also associated with shorter ground contact times, and requires greater stability. The ASD group exhibited greater time in stance phase, and less time in swing phase, which could suggest potential balance deficits and less effective running patterns in college students with ASD.

750 May 29 4:15 PM - 4:25 PM

### Stride Frequency Manipulation: Physiological And Perceptual Responses During Backward Running With Body Weight Support

Kenji Masumoto<sup>1</sup>, Daniel Denton<sup>2</sup>, Andrew Craig-Jones<sup>2</sup>, John A. Mercer, FACSM<sup>2</sup>. <sup>1</sup>*Kyushu University, Fukuoka, Japan.* <sup>2</sup>*University of Nevada, Las Vegas, NV.* (Sponsor: Professor John A. Mercer, FACSM)

(No relevant relationships reported)

Manipulation of stride frequency (SF) influences gait mechanics of forward running, regardless of body weight support (BWS). Nevertheless, no research has investigated the influence of a change in SF on physiological and perceptual responses during backward running with BWS.

**PURPOSE:** To investigate influence of a change in SF on physiological and perceptual responses during backward running at different levels of BWS. **METHODS:** Nine participants (33.2 ± 12.1 years) ran forward and backward at 0%BWS, 20%BWS, and 50%BWS conditions on a lower body positive pressure treadmill. The SF conditions consisted of forward and backward running at preferred stride frequency (PSF), PSF+10%, and PSF-10%. Oxygen uptake (VO<sub>2</sub>), heart rate (HR), rating of perceived exertion (RPE), and muscle activity from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius were measured. VO<sub>2</sub>, HR, RPE, and muscle activity from lower extremity were analyzed using a 2 (running direction) x 3 (BWS) x 3 (SF) repeated measures analysis of variance ( $\alpha = 0.05$ ). **RESULTS:** VO<sub>2</sub>, HR, RPE, and muscle activity from the rectus femoris, tibialis anterior, and gastrocnemius were not influenced by the interaction of running direction, BWS, and SF ( $P > 0.05$ ). VO<sub>2</sub>, HR, and muscle activity from the rectus femoris were significantly different between SF conditions ( $P < 0.05$ ). For example, VO<sub>2</sub> and HR during running at PSF+10% were significantly higher than when running at PSF, regardless of running direction and BWS (e.g., 27.4 ± 5.7 ml/kg/min and 24.9 ± 4.3 ml/kg/min in VO<sub>2</sub> for PSF+10% and PSF during forward running at 50%BWS, respectively;  $P < 0.05$ ). However, RPE was not different between SF conditions ( $P > 0.05$ ). **CONCLUSION:** These observations suggest that manipulation of SF (i.e., a 10% change in SF from the PSF) during running may have greater impact on physiological responses than on perceptual responses, regardless of running direction and BWS. Supported by JSPS Grant Number 16K01663.

751 May 29 4:25 PM - 4:35 PM

### Non-Linear Relationship between Footstrike Angle and Vertical Loading Rate during Running

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(No relevant relationships reported)

Footstrike is considered a primary determinant of lower limb mechanics during running. Indeed, vertical loading rates, often a focus of investigations into running-related injuries, are typically found to be lower in forefoot compared to rearfoot strikers fostering the belief that forefoot strike is desirable. However, prior work has shown that foot angle relative to the ground (foot inclination angle (FIA)) is a poor predictor of vertical loading rate when using a linear model, suggesting a more complex relationship is present. **PURPOSE:** To determine if a non-linear model improves the ability to estimate average vertical loading rate (AVLR) from FIA compared to a linear model.

**METHODS:** Whole body kinematics and vertical ground reaction forces (VGRF) were collected for 169 NCAA Division I athletes (96 males) during treadmill running at 2.68, 3.35, and 4.47 m/s. Athletes were healthy at testing, had no history of lower limb surgery, and no bone stress injury within 3 months prior to testing. FIA and AVLR were calculated for 15 strides and averaged across strides for each limb. FIA at initial contact was calculated, with positive and negative FIA indicating a more rearfoot and forefoot position, respectively. AVLR was the VGRF slope over 20-80% of the force from initial contact to impact peak or, when an impact peak was absent, to the force at 30.79% of time to peak VGRF. The relationship between FIA and AVLR was evaluated using linear and non-linear models at each speed.

**RESULTS:** AVLRs were lowest at the extremes of FIA (i.e., -15°, 20°), while greater AVLRs were observed between 5-10°. The non-linear model to estimate AVLR from FIA resulted in an approximate increase in R<sup>2</sup> values of 0.30 above the linear model at all speeds (linear: 0.13, 0.14, 0.12; non-linear: 0.46, 0.39, 0.44, for 2.68, 3.35, and 4.47 m/s, respectively). Model error was reduced in the non-linear models by 30-60 N/kg/s (linear: 165.2, 202.6, 293.4 N/kg/s; non-linear: 130.7, 170.9, 234.9 N/kg/s for 2.68, 3.35, 4.47 m/s, respectively).

**CONCLUSIONS:** AVLR among FIA reflective of forefoot strike was low, but AVLR varied considerably among FIA associated with rearfoot striking, indicating a distinct non-linear relationship. This supports that dichotomous treatment of FIA does not appropriately estimate AVLR and may bias models utilizing AVLR to assess injury risk.

### B-53 Free Communication/Poster - High Intensity Training

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

767 Board #1 May 29 2:00 PM - 3:30 PM

### Effects Of High-intensity Interval Training Vs Sprint Interval Training On Body Composition And Aerobic Power In Healthy Young Women

Paulo Gentil<sup>1</sup>, João Pedro Naves<sup>1</sup>, Ricardo Viana<sup>1</sup>, Ana Cristina Rebelo<sup>1</sup>, Claudio Andre de Lira<sup>1</sup>, Gustavo Pimentel<sup>1</sup>, Patricia Cristina Lobo<sup>1</sup>, Jordana Oliveira<sup>1</sup>, Rodrigo Ramirez-Campillo<sup>2</sup>. <sup>1</sup>*Federal University of Goiás, Goiânia, Brazil.* <sup>2</sup>*Universidad de Los Lagos, Osorno, Chile.*

(No relevant relationships reported)

**PURPOSE:** To compare the effects of two types of interval training, High-Intensity Interval Training (HIIT) and Sprint Interval Training (SIT), on anthropometric measures and cardiorespiratory fitness in healthy young women.

**METHODS:** A randomized clinical trial in which 49 young active women (age, 30.4±6.1 years; body mass index, 24.8±3.1 kg.m<sup>-2</sup>; peak oxygen consumption (VO<sub>2</sub>peak), 34.9±7.5 mL.kg<sup>-1</sup>.min<sup>-1</sup>) were randomly allocated into a SIT or HIIT group. The SIT group performed four bouts of 30 s all-out cycling efforts interspersed with four minutes of recovery (passive or light cycling with no load). The HIIT group performed four bouts of four-minute efforts at 90-95% of peak heart rate (HRpeak) interspersed with three minutes of active recovery at 50-60% of HRpeak. The protocols were performed three times per week (Monday, Wednesday, and Friday) for eight weeks. At baseline and after eight weeks of intervention, waist circumference, skinfolds (triceps, subscapular, suprailiac, abdominal and thigh), body mass and BMI were measured by standard procedures and cardiorespiratory fitness was assessed by cardiorespiratory graded exertion test on an electromagnetically braked cycle ergometer. **RESULTS:** The HIIT and SIT groups improved, respectively, 14.5±22.9% ( $P < 0.001$ ) and 16.9±23.4% ( $P < 0.001$ ) in VO<sub>2</sub>peak after intervention, with no significant difference between groups. Sum of skinfolds reduced 15.8±7.9% and 22.2±6.4% from baseline ( $P < 0.001$ ) for HIIT and SIT groups, respectively, with greater reduction for SIT compared to HIIT ( $P < 0.05$ ). There were statistically significant decreases in waist circumference ( $P < 0.001$ ) for the HIIT (-3.1±1.1%) and SIT (-3.3±1.8%) groups, with no significant difference between groups. Only SIT showed significant reductions in body weight and BMI ( $p < 0.05$ ). No significant difference ( $P > 0.05$ ) was found in dietary intake between the HIIT and SIT groups at baseline and after eight weeks of training.

**CONCLUSIONS:** Eight weeks of HIIT and SIT resulted in improvements in anthropometric measures and cardiorespiratory fitness, even in the absence of changes in dietary intake. In addition, the SIT protocol induced greater reductions than the HIIT protocol in the sum of skinfolds.

768 Board #2 May 29 2:00 PM - 3:30 PM

### Application of High-intensity Interval Training Program of Increased Intensity and Decreased Volume: A Pre-competition Case

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(No relevant relationships reported)

The training effect of track-sprinted cycling largely depends on the completed riding intensity on track or ergometers. Especially before the big events, coaches normally arrange a training plan of gradually decreased volume. Meanwhile, the training intensity should be kept or increased, which is difficult to be achieved.

**PURPOSE:** To investigate the effect of seven high-intensity interval training (HIT) sessions with increased intensity for an elite female track-sprinted cyclist before the Hong Kong track cycling world cup in January 2015. **METHODS:** Seven sessions of HIT on Wattbike Pro cycle ergometer (UK) were completed in continuous three weeks (2 or 3 days interval). Each session included four groups' HIT of 20 s riding and 10 s active recovery with the different group times. The pedalling cadence of 20 s should be kept around 120 rpm, and there were 30 min rest between four groups. The total training volume of sessions declined gradually through the decreased riding

times (40, 32, 32, 32, 28, 24, 24). But the total gear meters of sessions were set to be increased gradually (26m, 27.2m, 27.2m, 27.2m, 27.8m, 28.4m, 28.4m) by adjusting the air brake gear of Wattbike. The power, work and HR were recorded with the sampling rate of 200 Hz. Blood lactate was tested at one and three minutes after each group. **RESULTS:** Except the average cadence (Cavg) of the first session was closed to 120 rpm, other six sessions' Cavg were only around 117 rpm. Although the total work of HIIT sessions were decreased from 266.8 kJ of the first session to the last session's 201.0 kJ. But the average power of each session were increased gradually by 341.2±10.2 W, 369.0±9.2 W, 383.0±18.8 W, 377.1±9.8 W, 408.4±26.9 W, 416.3±9.3 W and 418.1±9.5 W respectively. The average HR only decreased by 6.1% in the second session than the first, and rised to the same level in the next five sessions. Although the post-group BLA increased obviously from the third session, the degree of BLA recovery between 3 min and 1 min increased significantly in the sixth and seventh session. **CONCLUSIONS:** A specific pre-competition training phase with obviously increased intensity should improve the lactate buffer and transportation capacity of blood significantly. The achieved intensity in HIT should be the decisive factor for the improvement of anaerobic exercise capacity.

**769 Board #3 May 29 2:00 PM - 3:30 PM**  
**Effects Of High-intensity Interval Training On Aerobic Capacity And Sleep Quality In Middle-aged Women**

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Middle-aged women often have a tendency to gain weight due to decreased basal metabolic rate and physical activity. In order to make women's elderly life more quality, women's physical fitness in middle age is an issue that needs attention. **PURPOSE:** To investigate the effects of different percentages of critical velocity (CV) training on cardio-pulmonary fitness, body composition, and sleep quality in middle-aged women. **METHODS:** Twenty-four middle-aged women (age: 45.0±7.2 yrs, height: 160.3±5.0 cm, weight: 61.6±7.1 kg, body fat percentage: 38.3±7.1%) participated in the study who were paired by CV to perform high-intensity interval training (HIIT, 130% CV, running 2 minutes with 1 minute recovery, repeated 7 times) or moderate-intensity continuous training (MICT, 90% CV, running 20 minutes) 3 times a week for 12 weeks. Participants were asked to wear the Mi band II 3 weeks before and during the intervention period to record the number of steps and sleep status. **RESULTS:** The body fat percentage (HIIT group: 39.7±4.5% to 38.5±4.7%, MICT group: 36.9±3.2% to 35.7±3.3) and maximal oxygen uptake (HIIT group: 30.7±5.3 to 33.8±5.3 ml/min/kg, MICT group: 30.8±3.5 to 33.3±5.0 ml/min/kg) were significantly improved in both groups ( $p < .05$ ), and there was no difference between the groups ( $p > .05$ ). However, the HIIT group significantly improved the ventilation threshold (26.3±5.6 to 29.5±4.2 ml/min/kg) and increased the proportion of deep sleep (31.1±8.0% to 33.2±9.2%) ( $p < .05$ ). **CONCLUSIONS:** When training time was the same, both HIIT and MICT have significant improvement on body composition and cardio-respiratory fitness, but HIIT can also improve high-intensity exercise ability and sleep quality.

**770 Board #4 May 29 2:00 PM - 3:30 PM**  
**Examining Work-to-Rest Ratios to Optimize Upper Body Sprint Interval Training**

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**PURPOSE:** The primary purpose of this study was to evaluate the effectiveness of upper body sprint interval training (SIT) protocols with varying work-to-rest ratios on both aerobic and anaerobic performance. The secondary purpose was to investigate the changes in metabolic and neuromuscular fatigue thresholds from two weeks of SIT in recreationally active men. **METHODS:** Forty-two recreationally trained men were randomized into one of three training groups [10s work bouts with two minutes of rest (10:2) or four minutes of rest (10:4), or 30s work bouts with four minutes of rest (30:4)] or a control group (CON). Participants underwent six training sessions over two weeks with four to six 'all-out' sprints. During pre- and post-intervention visits, participants underwent a graded exercise test to determine maximal oxygen consumption ( $\dot{V}O_{2peak}$ ) and peak power output (PPO), four constant-work rate trials to determine critical power (CP), anaerobic working capacity ( $W'$ ), and electromyographic fatigue threshold (EMGFT), and an upper body Wingate test to determine peak power (PP), mean power (MP), and total work (TW). An analysis of covariance was performed on all testing measurements collected at post with the associated pre-values used as covariates.

**RESULTS:** There were significant between group differences in post-test absolute  $\dot{V}O_{2peak}$ , with an adjusted pre-test mean of 2.44L·min<sup>-1</sup>, and PPO, with an adjusted pre-test mean of 130.9W. Absolute  $\dot{V}O_{2peak}$  was greater in 30:4 (2.36±0.26L·min<sup>-1</sup>,  $p = .007$ ) and 10:2 (2.53±0.38L·min<sup>-1</sup>,  $p = .036$ ) than CON (2.17±0.34L·min<sup>-1</sup>), and PPO was greater in 30:4 than CON (136±14 vs. 127±22W,  $p = .007$ , respectively). No differences were observed between groups in CP ( $p = .530$ ),  $W'$  ( $p = .900$ ), EMGFT ( $p = .692$ ), PP ( $p = .692$ ), MP ( $p = .290$ ), or TW ( $p = .291$ ).

**CONCLUSION:** SIT protocols with larger work-to-rest ratios appear to have enhanced  $\dot{V}O_{2peak}$  in the upper body over a short-term two-week intervention.

**771 Board #5 May 29 2:00 PM - 3:30 PM**  
**Four Weeks of Low Volume High-Intensity Interval Training Has No Effect On  $VO_{2max}$**

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Previous works assessing the impact of high intensity interval training on  $VO_{2max}$  have offered varying results. **PURPOSE:** To determine the meaningful effects of a short-term high-intensity interval training (HIIT) or continuous training (CET) intervention on  $VO_{2max}$  and the anaerobic capacity through quantification of both the respiratory and haemodynamic responses. **METHOD:** Following local institutional ethical approval, 37 physically active participants undertook 4-weeks of either cycling-based HIIT (age, 17.0 ± 0.5 yrs; height, 173.1 ± 9.2 cm; mass, 62.4 ± 6.9 kg). (8 x 20 s at 170%  $pO_{2max}$  with 10 s recovery) or CET (age, 17.0 ± 0 yrs; height, 173.6 ± 8.7 cm; mass, 69.3 ± 17.0 kg) (30 min at 70%  $O_{2max}$ ) 3 times per week.  $VO_{2max}$ , anaerobic capacity as determined through the maximally accumulated oxygen deficit (MAOD), blood-based markers and haemodynamic responses were assessed pre and post the intervention period.  $VO_{2max}$  and MAOD were evaluated using breath-by-breath open circuit spirometry while haemodynamic responses were monitored using thoracic impedance cardiography. Analysis conducted using both inferential analysis as well as magnitude-based inferences (MBI) and effects sizes (ES). **RESULTS:**  $VO_{2max}$  exhibited a non-significant 4.1% increase ( $P > 0.05$ ) (ES = 0.24) for HIIT with 7.0%  $p = 0.007$  (ES = 0.40, MBI = likely trivial) increase for CET. Haemodynamic responses ( $Q_{max}$ ,  $SV_{max}$ ) displayed non-significant responses for CET and HIIT ( $P > 0.05$ ) while a- $vO_{2dif-max}$  increased from 15.8 ± 4.8 to 18.3 ± 2.9 ml·100 ml<sup>-1</sup>) ( $p = 0.02$ ) (ES = 0.63, MBI = possibly beneficial) following HIIT. MAOD increased by 7.3 ml·kg<sup>-1</sup> for HIIT ( $p = 0.001$ ) (ES = 0.72, MBI = likely beneficial), with CET showing no change ( $p > 0.05$ ). **CONCLUSIONS:**  $VO_{2max}$  is a function of  $Q_{max}$  and a- $vO_{2dif-max}$ , so for a meaningful change to occur in cardiorespiratory fitness there must be a concomitant increase in  $O_2$  delivery. This study demonstrates that a short-term HIIT intervention evokes peripherally mediated responses (a- $vO_{2dif}$ ) and anaerobic substrate utilisation rather than  $O_2$  delivery components. The increase in  $VO_{2max}$  for CET in the absence of haemodynamic responses lends further support to the need for valid quantification of  $VO_{2max}$ .

**772 Board #6 May 29 2:00 PM - 3:30 PM**  
**High-intensity Interval Training In The Heat: A "hotter" Alternative For Promoting Cardiovascular Health And Performance?**

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Chronic heat exposure during exercise, exercise heat acclimation (EHA), and high-intensity interval training (HIIT) both promote positive physiological and performance adaptations; however, it remains unknown if HIIT acts synergistically with EHA compounding the performance benefit of HIIT. **PURPOSE:** To investigate the effects of HIIT and EHA (HIIT+Heat) on cardiovascular function (CV), endurance running performance, and muscle function vs. HIIT alone. **METHODS:** Using a randomized controlled parallel-design, 10 young healthy males and females completed 6 sessions of HIIT (8 x 30s on, 90s off) performed either in the heat (HIIT+Heat, 30°C, 50% RH) or thermoneutral (HIIT, ~20°C, 15% RH) condition. Measures of cardiovascular and muscle function, running performance and economy were measured prior to, and >72hr post, training in a thermoneutral environment. A 5 km time-trial and graded treadmill protocol were conducted to assess for running performance and economy, while power and velocity during maximal vertical jump were used to assess muscle function. CV function was assessed via, heart rate (HR), HR variability (HRV; root mean square of successive differences; RMSSD, and standard deviation of N-N intervals; SDNN), central (cBP), peripheral blood pressure (pBP), and pulse wave velocity (PWV). **RESULTS:** No baseline differences were observed between groups.

No differences in performance improvement ( $-4 \pm 2$  vs.  $-4 \pm 4\%$  in 5km time) or running economy were observed between groups ( $p > 0.05$ ). Resting HR ( $-2 \pm 3$  vs.  $-2 \pm 2\%$ ) and HRV (SDNN  $5 \pm 2$  vs.  $11 \pm 4\%$ ) were improved in both groups but were not different between conditions (HIIT vs. HIIT+Heat,  $p > 0.05$ ). However, cSBP ( $1 \pm 2$  vs.  $-7 \pm 3\%$ ), pSBP ( $-2 \pm 2$  vs.  $-8 \pm 2\%$ ), and PWV ( $0 \pm 1$  vs.  $-6 \pm 3\%$ ) only decreased in the HIIT+Heat (HIIT vs. HIIT+heat, respectively, all  $p < 0.05$ ). Improvements in jump velocity ( $-3 \pm 5$  vs.  $8 \pm 5\%$ ) and power ( $-2 \pm 5$  vs.  $9 \pm 6\%$ ) tended to be greater in HIIT+heat ( $p = 0.08-0.10$ ). **CONCLUSION:** Short term HIIT combined with heat stress did not improve running performance or economy more than HIIT alone, but did significantly improve blood pressure, vascular stiffness, and tended to improve muscle function in thermoneutral conditions. Further work exploring longer training and/or greater heat stress in larger populations, or those with vascular dysfunction, is warranted.

**773 Board #7 May 29 2:00 PM - 3:30 PM**  
**Effectiveness Of HIIT And MICT On Body Weight And Fat% Of Overweight Adults: A Meta-analysis**

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**PURPOSE:** To determine the effectiveness of high-intensity interval training (HIIT) and medium-intensity continuous training (MICT) on body weight and fat% of overweight adults.

**METHODS:** A comprehensive bibliographic search was conducted on the intervention studies of HIIT and MICT on body weight and fat% published in peer-reviewed journals between January 1, 2013 and January 1, 2017. Databases searched included Pubmed, WebScience, Embase and CNKI (Chinese database). Identified studies were analyzed using a meta-analysis so that the effect size of HIIT and MICT interventions can be determined. Risk bias evaluation was used to evaluate the quality of each included study and STATA 13.1 software was used for the analysis.

**RESULTS:** A total of 10 studies involving 233 subjects (100 males, age =  $32.3 \pm 5.9$  yr.) were included in the final analysis. Intervention durations averaged  $10.3 \pm 2.7$  weeks with a mean sample size of  $23.3 \pm 6.5$ . The reduction of body weight by HIIT and MICT was 1.56% and 1.53%, respectively and the reduction of fat% was 4.05% and 4.06%, respectively. Thus HIIT had no better effect in reducing weight (effect size =  $-0.18$ , 95% CI:  $-1.03 \sim -0.66$ ,  $P = 0.67$ ) or fat% (effect size =  $-0.38$ , 95% CI:  $-1.02 \sim -0.27$ ,  $P = 0.25$ ) than MICT. The further subgroup analysis showed that, the more times of HIIT, the larger of the training effect; e.g., the subgroup had "greater than or equal to 48 times" training led a significant difference in reducing body weight (effect size =  $-1.51$ , 95% CI:  $-2.73 \sim -0.29$ ,  $P = 0.016$ ). For fat%, it was found that the longer training period, the more significant effect of HIIT, e.g., in the period of "12 weeks" subgroup, there was a significant marginal significance (effect size =  $-0.73$ , 95% CI:  $-1.49 \sim -0.03$ ,  $P = 0.061$ ).

**CONCLUSION:** While both HIIT and MICT led reduction in body weight and fat%, but there was no significant difference between them. Longer and higher frequency HIIT may be needed to lead a more significant weight and fat% reduction.

**774 Board #8 May 29 2:00 PM - 3:30 PM**  
**Inter-Individual Adaptive Responses to Sprint Interval Training in Recreationally Active Males**

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Sprint interval training (SIT) has emerged as a time efficient alternative to conventional endurance exercise, inducing similar physiological adaptations in both athletic and non-athletic populations. These include both anaerobic adaptations such as those observed during a 30 s Wingate test, and aerobic adaptations such as improved time trial performance. However, the magnitude of such adaptations can vary considerably on an individual level. **PURPOSE:** To investigate the inter-individual variation in response to a 3 week SIT intervention in healthy males.

**METHODS:** Healthy recreationally active ( $\text{VO}_2 \text{ max} < 50 \text{ ml.kg.min}^{-1}$ ) males ( $n=25$ ) participated in a 3 week SIT intervention, comprising 9 exercise sessions. Each SIT session consisted of 4-6 30 s "all out" cycle sprints at a resistance of 7.5 % body mass, interspersed with 4 min active recovery. Participants completed a 30 s Wingate and a 20 min cycle performance test at baseline and 72-96 h following the final SIT session. (Non-)Responders were identified using twice the typical error (TE) of measurement for Wingate peak power (PP;  $2 \times \text{TE} = 1.58 \text{ W.kg}^{-1}$ ), minimum power (MP;  $2 \times \text{TE} = 0.81 \text{ W.kg}^{-1}$ ) and average power (AP;  $2 \times \text{TE} = 0.39 \text{ W.kg}^{-1}$ ), and for mean power during the cycle performance test (CP;  $2 \times \text{TE} = 10.07 \text{ W}$ ).

**RESULTS:** Group level (mean  $\pm$  SD) increases in PP ( $0.9 \pm 1.1 \text{ W.kg}^{-1}$ ), MP ( $0.3 \pm 0.6 \text{ W.kg}^{-1}$ ), AP ( $0.4 \pm 0.4 \text{ W.kg}^{-1}$ ) and CP ( $16.8 \pm 15.6 \text{ W}$ ) were observed (all  $p < 0.05$ ). Non-responders in PP (17/25, 68 %), MP (19/25, 76 %), AP (9/25, 36 %), and CP (10/25, 40 %) were all identified. Adverse responses in AP and MP (1/25, 4 %) were also observed. Global non-responders to SIT were identified (4/25, 16 %), who did not improve any performance measure. All other participants improved at least one performance measure. Of participants that improved CP a large subset (10/15, 67 %) also improved AP, this is the most common response. Interestingly,  $n=4$  participants improved CP in response to SIT without improving any anaerobic variable.

**CONCLUSIONS:** This study's findings indicate significant heterogeneity in the individual adaptations to SIT in measures of anaerobic and aerobic performance. Subsets of responders to multiple performance variables, as well as those who improved aerobic, but not anaerobic performance, were identified, demonstrating the wide range of adaptive responses to SIT.

**775 Board #9 May 29 2:00 PM - 3:30 PM**  
**Six Hit Treadmill Training Sessions Improves Lipid Oxidation and Ventilatory Thresholds Intensities**

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The high-intensity interval training (HIT) has been used as alternative to cardiorespiratory training performed continuously with submaximal intensity and prolong time. **PURPOSE:** The aims of this study were to propose a treadmill HIT protocol and verify the influence of six HIT sessions on intensities of ventilatory anaerobic thresholds (VATs) and substrate oxidation rates during submaximal continuous exercise (SCE). **METHODS:** Fifteen irregularly active men performed incremental treadmill exercise testing followed by submaximal work-rate running for 45min to determine VATs,  $\text{VO}_{2\text{peak}}$ , peak velocity ( $V_{\text{peak}}$ ), and substrate oxidation rates, before and after training period. The training period consisted of six HIT sessions, composed each one of eight sets of 60s running at  $100\%V_{\text{peak}}$  interspersed by 75s recovery, every 48h. **RESULTS:** Our results showed increases in VATs intensities of 4.4% for VAT1 and 8.8% for VAT2, reduction of 12.8% for carbohydrate oxidation (CHOox) and increase of 23.7% for lipid oxidation (LIPox); as a result, the relative energy derived from LIPox was 20.3% higher after the training period.  $V_{\text{peak}}$  was  $\sim 15 \text{ km/h}$ , which produces the relative intensities of  $\sim 84\%V_{\text{peak}}$  e  $\sim 91\%FC_{\text{peak}}$  during the training period. **CONCLUSION:** The proposed protocol promoted similar adaptations and intensities which were described by the literature; but unlike others, it can be applied in irregularly active individuals.

**776 Board #10 May 29 2:00 PM - 3:30 PM**  
**Effects Of High-intensity Strength Training On Muscle Strength Gain And Muscle Hypertrophy In Males And Females: A Meta-analysis**

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High-intensity strength training is known to induce muscle strength gain and muscle hypertrophy. However, there are only few reports on the effects of high-intensity strength training on strength gain and muscle hypertrophy in females. **PURPOSE:** To conduct a systematic review of a meta-analysis to compare changes in strength gain and muscle hypertrophy between males and females after high intensity resistance training.

**METHODS:** To carry out present review, English-language literature searches on PubMed and SPORTDiscus databases were conducted from all time points up until June 2018. Combinations of the following keywords were used as search terms: "training intensity," "strength training," "resistance training," "strength," "muscle hypertrophy." **RESULTS:** Thirty-five articles were included in the meta-analysis. The standardized mean differences for muscle strength gain were 1.27 (95% confidence interval [CI], 0.99-1.55) and 1.16 (95% CI, 0.45-1.87), in males and females, respectively. The standardized mean differences for muscle hypertrophy were 0.73 (95% CI, 0.41-1.05) and 0.33 (95% CI, 0.07-0.60) in males and females, respectively. **CONCLUSIONS:** Our results suggested that high-intensity strength training induces muscle strength gain and increases muscle hypertrophy in both males and females. However, in the case of muscle hypertrophy, females tend to have lower standardized mean difference than males after high-intensity strength training.

777 Board #11 May 29 2:00 PM - 3:30 PM  
**Influence Of Combining Aerobic And High Intensity Interval Training on 400m Performance And Post-exercise Responses.**

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**PURPOSE:** To examine the possible influence of combining aerobic and high intensity interval training (HIIT) on post-exercise responses in 400m in young sprinters. **METHODS:** Fourteen male sprinters (100-200 m) (18.4 ± 0.3 years old; mean ± SE) performed 400m at maximal effort (400mMax), 400m at 90% (400m-90%), and the Cunningham-Faulkner treadmill test (C-F) (12.8 km·h<sup>-1</sup>, 20% inclination to fatigue). Afterwards, participants were divided in 2 equivalent groups of 7 persons each and underwent 6 weeks of either HIIT training two times per week (HIIT), or HIIT and supplementary aerobic training two times per week (Comb). After training, 400mMax was repeated, whereas the 400m-90% was performed at pre-training intensity. Saliva samples for the determination of testosterone (TESTO) and Cortisol (CO) were collected before and 30min after the 400mMax and 400m-90%. Pre and post exercise differences between trials were analyzed using 2-way ANOVA and responses over time by 3-way ANOVA. **RESULTS:** Performance improvement with training in 400mMax (HIIT: 2.6 ± 0.4% vs. Comb: 1.9 ± 0.4%, *p*=0.23) and C-F (HIIT: 15.7 ± 1.3% vs. Comb: 13.9 ± 3.9%, *p*=0.66) was similar between groups. In 400m-90% the TESTO/CO ratio increased after training only in Comb (Pre-Training: 7.0 ± 2.2 vs. Post-Training: 13.4 ± 2.2, *p*=0.045), while CO was higher (*p*=0.016) after training in HIIT (13.6 ± 1.5 ng ml<sup>-1</sup>) compared to Comb (8.4 ± 1.5 ng ml<sup>-1</sup>). Higher hormonal increases (*p*<0.05) with exercise were observed in 400mMax compared to 400m-90% irrespective of training (pre/post training) and type of group (HIIT/Comb). No other hormonal differences were detected between groups. The increase of lactate concentration (post-pre exercise difference) 3 min after 400mMax (Comb: 9.6 ± 0.6 mmol<sup>-1</sup> vs. HIIT: 12.2 ± 0.6 mmol<sup>-1</sup>; *p*=0.04) and C-F (Comb: 12.1 ± 0.4 mmol<sup>-1</sup> vs. HIIT: 15.4 ± 0.5 mmol<sup>-1</sup>; *p*=0.012) was lower after training in Comb compared to HIIT. During the 3-min recovery, mean percentage heart rate was lower (*p*<0.001) in Comb (75 ± 1%) compared to HIIT (80 ± 1%) in 400mMax. **CONCLUSIONS:** Comb training possibly attenuated CO response 30min post-exercise in 400m-90%. Also, the Comb training did not further improve performance in 400mMax and C-F compared to HIIT but probably induced adaptations that facilitated the faster blood lactate and heart rate recovery.

778 Board #12 May 29 2:00 PM - 3:30 PM  
**The Effect Of Varying High-intensity Interval Training Style Warm-ups On Hemodynamic, Power, And Flexibility Responses**

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**PURPOSE:** The purpose of this study was to examine the effectiveness of high-intensity interval training (HIIT) style warm-up on hemodynamic, power, and flexibility responses.

**METHODS:** Twelve male subjects (age: 24.15 ± 3.1 yr. & weight: 78.78 ± 16.83 kg) completed the study. On the first day, initial screening, anthropometric measures, and familiarization with testing procedures were completed. There was a total of 6 randomized testing sessions (separated by at least 48 hours.). The testing sessions were as follows: 3-min warm-up session with 20 sec work followed by 10 sec (C1), 3-min warm-up session with 30 sec work followed by 10 sec (C2), 5-min warm-up session with 20 sec work followed by 10 sec (C3), 5-min warm-up session with 30 sec work followed by 10 sec (C4), 8-min warm-up session with 20 sec work followed by 10 sec (C5), and 8-min warm-up session with 30 sec work followed by 10 sec (C6). The warm-up sessions included timed interval body weight squats. Hemodynamics (heart rate (HR) and systolic (SBP) and diastolic (DBP) blood pressure), a countermovement jump, and flexibility values were recorded before and after warm-up protocols.

**RESULTS:** There was a significant duration\*time interaction for flexibility (*p*<0.01) and vertical jump (*p*=0.02). Flexibility increased from pre to post for 3-min and 5-min warm-up conditions, however, decreased for 8-min warm-up conditions. Vertical jump increased for 3-min conditions and decreased for 5-min and 8-min conditions. There were significant duration main effects for HR (*p*<0.03); time main effects for HR (*p*<0.01), SBP (*p*<0.01), and DBP (*p*<0.01); duration\*time interaction for HR (*p*<0.01) and intensity\*time interaction for SBP (*p*<0.04).

**CONCLUSIONS:** The findings of the study indicate that a 3-min duration of HIIT style warm-up may be enough to physically prepare individuals to improve flexibility and vertical jump. In addition, the data also suggests that the required/recommended duration for a warm-up protocol to prepare the body may be shortened with HIIT style warm-up. Future studies should compare and contrast the efficacy of varying work to rest ratio of HIIT style warm-up with other warm-up protocols to determine the most effective warm-up protocol.

779 Board #13 May 29 2:00 PM - 3:30 PM  
**Performance Recovery In Army Reserve Officer Training Corps Cadets Following A Bout Of High-Intensity Exercise**

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**PURPOSE:** The aims of this study were to determine the time-course for recovery in Army ROTC cadets following a bout of high-intensity exercise, if sex differences for recovery exist, & examine the use of a countermovement jump (CMJ) as a measure of fatigue & muscle damage.

**METHODS:** 10 male (M) & 9 female (F) ROTC cadets performed high-intensity interval resistance (HIIR) exercise using their 10RM for 3 sets of 8 resistance exercises (Chest press, leg press, lat pull, etc.) w/60s work:60s rest. Soreness ratings (100mm VAS) & perceived recovery status (PRS) were recorded prior to performing 5 countermovement jumps (CMJ). RPE (CR10 scale) was taken after each round. Immediately post-exercise, subjects performed 5 more CMJs. Thirty-minutes post exercise, subjects provided session RPE (sRPE). This protocol was used at baseline (BL), 24, 48 & 72 hrs post BL.

**RESULTS:** For M & F subjects, exercise performance was similar w/24, 48, & 72 hrs of recovery & all were > than BL (385.3-419.8 vs. 331.9 reps). CMJ relative peak power was > in M vs. F at all time points (47.2 vs. 33.7 W/kg, respectively) & decreased from pre-to-post at BL only for both M & F cadets (1.1% vs. 1.8%, respectively). Percent change in CMJ performance from pre-to-post did not differ between genders at any time point. Soreness ratings were > at 24H (27.2) versus BL (7.5) and 72H (12.3). Upper body soreness ratings were > than lower body soreness for BL (7.5 c 6.2), 24H (24.3 v 15.1) & 48H (16.8 v 10.1). M & F did not differ in soreness ratings. PRS was moderately correlated (*r* = 0.484, 0.682, 0.503, 0.528)) with soreness ratings for BL, 24H, 48H, & 72H; sRPE did not differ between time points for all subjects (overall  $\bar{x}$  = 8.3±0.7). RPE increased from set 1 to set 3 (7.5 v 8.8, respectively). M & F did not differ in RPE for all sets.

**CONCLUSIONS:** ROTC cadets could recover 24H following a bout of HIIR exercise with no differences between M & F cadets. CMJ performance did not match the change in exercise performance. Soreness patterns were similar for M & F cadets for high-intensity exercise. PRS matched the pattern of soreness indicating it is associated with soreness rather than performance. More work is needed to understand the utility of CMJ for recovery monitoring in this population. Lastly, this type of resistance exercise protocol may be useful for improving muscle fitness in entry-level ROTC cadets.

780 Board #14 May 29 2:00 PM - 3:30 PM  
**Comparing Strength Outcomes Of An 8 Week Hift Interventon Vs 8 Week Traditional Weight Training.**

Jason Sartor. *Kansas State University, Manhattan, KS.*

(No relevant relationships reported)

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High-intensity functional training (HIFT) temporally combines aerobic and resistance exercise at relative high intensity levels. Functional workouts include varied exercises that simulate movements of daily living to improve overall fitness. Traditional weight training (TWT) focuses on progressive sets and repetitions of resistance exercise performed both with free weights and machines. Training includes both multi joint (squat) and single joint (arm curls) exercises to improve strength. With comparison Data of these interventions' individuals can obtain a better understanding of expected fitness outcomes for HIFT and TWT.

**PURPOSE:** To compare effects of HIFT and TWT on power, strength and muscular endurance in college students.

**METHODS:** Participants (n = 95) were enrolled in 8-week TWT or HIFT fitness classes. Baseline and posttest measures were completed by 83 participants (87.4%); TWT: N = 35, age = 22.6 ± 4.11 years, body mass = 78.3 ± 21.4kg; HIFT: N = 48, age = 21.2 ± 3.1 years; body mass = 77.2 ± 14.6kg). After completing a standardized warm-up, participants completed measures testing lower body muscular power (vertical jump), strength (handgrip dynamometer), and muscular endurance (2-minute timed push-ups and 1-minute body weight squats). Within (paired) and between (independent with change scores) samples t-tests were conducted using SPSS 25.

**RESULTS:** Significant improvements were seen for squats in both groups (HIIT +3.9 ± 5.5 reps,  $t = 4.86$ ,  $p < .001$ ; TWT +3.8 ± 5.3 reps,  $t = 4.29$ ,  $p < .001$ ) and push-ups in TWT (+4.3 ± 4.5 reps,  $t = 5.67$ ,  $p < .001$ ). No significant changes were found for power or strength. Independent samples  $t$ -tests revealed no significant differences between groups.

**CONCLUSIONS:** After 8-weeks of either HIIT or TWT participants significantly improved muscular endurance, with no significant differences between groups. More direct measures of strength (e.g., 1 rep max testing) should be examined in future research along with longitudinal changes in fitness comparing different training modalities.

**781** Board #15 May 29 2:00 PM - 3:30 PM

### Effect Of Ethnicity On Change In $VO_{2max}$ And Substrate Oxidation In Response To HIIT

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(No relevant relationships reported)

**Introduction:** About 20% of adults meet the 2008 Physical Activity Guidelines and this lack of physical activity increases individuals' risk of heart disease, stroke, type-2 diabetes, and certain cancers which increases morbidity and all-cause mortality. Typically, moderate intensity continuous training (MICT) is prescribed to clients to improve overall fitness and health status, although a primary barrier to regular physical activity among sedentary individuals is lack of time. An alternative to MICT is high intensity interval training (HIIT) which significantly increases  $VO_{2max}$  and fat oxidation, in turn improving exercise capacity and reducing health risks. One widely ignored aspect of individual response to exercise training is ethnicity, as there are minimal data examining the effect of ethnicity on responses to exercise training. **Purpose:** To determine if ethnicity alters adaptation to low volume HIIT in sedentary women. **Methods:** Inactive, non-obese women (age and  $VO_{2max} = 24.3 \pm 4.1$  yr and  $29.1 \pm 2.1$  mL/kg/min) participated in 9 sessions over a 3-week period of cycling-based HIIT (8-10 1-minute bouts at 85% PPO interspersed with 75-sec recovery at 10% PPO). Participants were Caucasian (C) ( $n=6$ ) or Hispanic (H) ( $n=4$ ). To assess  $VO_{2max}$ , the initial work rate began at 30 or 40 W for 2-min followed by a 15 or 20 W/min increase in power output until volitional exhaustion. To assess substrate oxidation, a 6-min warm up began at 10% PPO and subsequently work rate increased by 10% PPO every 5-min during 4 remaining stages. These variables were measured pre- and post-training. **Results:** Training elicited a HR equal to 88-94% HR<sub>max</sub>. Data showed an increase ( $p=0.016$ ) in  $VO_{2max}$  in C ( $30.5 \pm 1.3$  vs  $32.6 \pm 3.9$  mL/kg/min, +7%) and H ( $27.7 \pm 2.8$  vs  $31.7 \pm 2.6$  mL/kg/min, +14%) with no significant group $\times$ time interaction ( $p=0.35$ ). There was a significant training $\times$ group interaction for fat oxidation ( $p=0.005$ ), carbohydrate oxidation ( $p=0.009$ ), and RER ( $p=0.000$ ). Data showed an increase in the rate of fat oxidation and a reduction in carbohydrate oxidation in response to training which differed based on ethnicity. **Conclusion:** These data show HIIT induces significant increases in  $VO_{2max}$  which are slightly higher in H vs C. In addition, ethnicity seems to mediate changes in substrate metabolism after interval-based exercise.

**782** Board #16 May 29 2:00 PM - 3:30 PM

### High-Intensity Interval Training Does Not Induce Anti-Inflammatory Changes in Healthy Men

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Low-grade inflammation is associated with the risk of various chronic diseases, and the protective effects of a physically active lifestyle may be partially ascribed to the anti-inflammatory effects of exercise. The impact of moderate intensity exercise training on circulating pro-inflammatory molecules has received much attention in recent years. However, there are very few well designed and adequately powered studies on the influence of high-intensity interval training (HIIT) on circulating markers of inflammation. **Purpose:** The purpose of this study was to examine potential changes in plasma concentrations of C-reactive protein (CRP), interleukin-6 (IL6), and soluble interleukin-6 receptor (sIL6r) following four (4w) and eight weeks (8w) of HIIT in healthy men. **Methods:** Healthy, sedentary men participated in a HIIT program three days/week for eight weeks. Training bouts were modeled after the traditional Wingate test, consisting of repeated, 30-second bouts of maximal intensity cycling separated by 4.5 minute rest intervals. Training began with three bouts per day and an additional bout/day was added to the regimen every two weeks, progressing up to six bouts per day in the final two weeks. Plasma concentrations of CRP, IL6, and sIL6r were assessed by ELISA at baseline, 4w, and 8w. Statistical comparisons across the three time points were done using repeated measures ANOVA. Variables that deviated from normality were log transformed prior to analysis. Significance was set to  $p < 0.05$ . **Results:** 21 men (age:  $25 \pm 5$  yrs, BMI:  $26.7 \pm 6.2$  kg/m<sup>2</sup>) completed the study. No significant changes were observed for CRP during training (baseline:  $1.5 \pm 2.3$ , 4w:

$1.0 \pm 1.4$ , 8w:  $2.2 \pm 3.0$  mg/L,  $p > 0.05$ ). Likewise, IL6 (baseline:  $1.4 \pm 1.6$ , 4w:  $1.6 \pm 1.7$ , 8w:  $1.2 \pm 2.2$  pg/ml) and sIL6r (baseline:  $36.2 \pm 23.9$ , 4w:  $27.8 \pm 22.0$ , 8w:  $32.6 \pm 22.2$  ng/ml) did not change with training (all  $p > 0.05$ ). **Conclusion:** Though it has been suggested that HIIT may reduce inflammation, results of the present study do not indicate HIIT influences specific inflammatory mediators in healthy young men. Future research should explore the potential anti-inflammatory benefits of HIIT in different populations and disease states.

**783** Board #17 May 29 2:00 PM - 3:30 PM

### Mots-c Plasma Levels Following A Single Session Of MICT And HIIT

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Acute moderate intensity continuous training (MICT) and high-intensity interval training (HIIT) result in increased mitochondrial transcriptional activity. The mitochondrial open reading frame of the 12S rRNA-c (MOTS-C) is a peptide encoded from mitochondrial DNA. This mitochondrial derived peptide can regulate skeletal muscle glucose uptake and fatty acid beta-oxidation. However, it is not known if MOTs-C concentrations are altered following an acute bout of MICT or HIIT. **PURPOSE:** The present study investigated the effects of acute MICT and HIIT on MOTs-C levels in plasma pre- and 3 hours post-exercise. **METHODS:** Ten recreationally active ( $> 150$  min moderate-vigorous intensity aerobic activity per week  $\geq 1$  year) males ( $n=5$ ; age  $25.2 \pm 1.1$ ,  $VO_{2max}$   $48.0 \pm 4.9$  mL/kg/min) and females ( $n=5$ ; age  $21.6 \pm 3.6$ ,  $VO_{2max}$   $39.4 \pm 7.7$  mL/kg/min) were conveniently recruited for an initial study conducted at the UNM Exercise Physiology Laboratories. The original study, and the current expanded exploration were approved by the institution's Institutional Review Board (IRB). Participants completed a health history, and physical activity history questionnaire. Based on criteria from the American College of Sports Medicine, all participants were considered low-risk. Utilizing a crossover design subjects performed an acute bout of MICT and HIIT exercise on a treadmill. The MICT bout consisted of 60 minutes at 55% of maximum velocity ( $V_{max}$ ) achieved during the  $VO_{2max}$  test and the HIIT trial required two sets of 6 x 1-min bouts at 100%  $V_{max}$ , with 5 minutes recovery at 3 MPH between sets. Trials were conducted at least 72 hours apart in randomized order and in a fasted state. Plasma samples were collected during a previously conducted study and frozen for future analysis. MOTs-C was measured from the previously collected samples obtained pre- and 3 hours post-exercise using an enzyme-linked immunosorbent assay. **RESULTS:** There were no significant changes in plasma MOTs-C ( $p = 0.21$ ) from pre to post-exercise for MICT ( $220.4 \pm 62.9$  vs  $248.4 \pm 45.2$  ng/ml, respectively) or HIIT ( $p = 0.38$ ) ( $227.9 \pm 62.4$  vs  $246.9 \pm 75.9$  ng/ml, respectively). **CONCLUSION:** Our findings show plasma MOTs-C does not increase in response to a single session of MICT or HIIT.

**784** Board #18 May 29 2:00 PM - 3:30 PM

### Effects of Heart Rate Variability Modulation on High Intensity Functional Training Strength Outcomes

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**PURPOSE:** High Intensity Functional Training (HIFT) involves completing concurrent aerobic and resistance training functional movements at high intensity with the goal of increased fitness. We examined the effectiveness of using daily heart rate variability (HRV) status to modulate training intensity and increase performance outcomes. We hypothesized that HRV modulation for HIFT would facilitate strength improvements. **METHODS:** Participants ( $N = 55$ ) were healthy, untrained or recreationally trained adults not participating in a structured exercise program. Participants were randomly assigned to either HIFT ( $n = 29$ , age =  $24.1 \pm 4.1$  years, 41.4% male) or HIFT-HRV ( $n = 26$ , age =  $23.7 \pm 4.5$  years, 53.8% male) groups. Both groups underwent an 11-week training protocol which included: 2-weeks baseline HRV collection, baseline, midpoint, and post-intervention anthropometric and fitness assessments, and 6 weeks of HIFT, 5 days/week. All participants recorded their HRV daily via validated mobile app throughout the study. HIFT-HRV participants' exercise was modulated by reducing rate of perceived exertion based on their daily HRV statuses. Maximal strength was tested using the squat, overhead press, and deadlift in kg at baseline, midpoint, and post-intervention. **RESULTS:** There were no differences in intervention fidelity between groups, which included adherence to HIFT ( $p = .21$ ) and providing daily HRV data ( $p = .75$ ). The HIFT-HRV group had their training modified 17.12 ± 6.75 days. Additionally, one-way RM-ANOVAs indicated significant increases in the squat (HIFT =  $+14.10 \pm 1.63$  kg,  $F = 55.38$ ,  $p < .001$ ; HIFT-HRV =

+13.25 ± 1.77,  $F = 50.87$ ,  $p < .001$ ), overhead press (HIFT = +3.75 ± .93,  $F = 11.82$ ,  $p < .001$ ; HIFT-HRV = +4.37 ± .87,  $F = 10.72$ ,  $p < .001$ ), and deadlift (HIFT = +15.40 ± 2.51,  $F = 28.7$ ,  $p < .001$ ; HIFT-HRV = +15.62 ± 2.75,  $F = 27.7$ ,  $p < .001$ ) within each group. Independent samples *t*-tests showed no differences in strength (p = .41-.99) between groups. **CONCLUSIONS:** Results suggest that HIFT-HRV produced equal increases in strength while having reduced training intensity for over half of the training days. HRV appears to be an effective means of modulating HIFT to increase strength outcomes.

**785** Board #19 May 29 2:00 PM - 3:30 PM

### Differences in Physiological Demands Between Common High-Intensity Interval Training Protocols

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(No relevant relationships reported)

**PURPOSE:** The definition of high-intensity interval training (HIIT) is broad, with no accepted procedure for classifying HIIT protocols with different workloads and work and recovery interval times. Additionally, little is known about the differences in training load and recovery between common HIIT protocols. The purpose of this study was to evaluate the differences in acute physiological demands and perceived difficulty between three common HIIT protocols.

**METHODS:** Eight participants completed the following training sessions on a cycle ergometer in a randomized order, with at least one week between sessions: 4 x [30-sec all-out, 4-min active recovery], 12 x [1-min 100%  $VO_{2max}$ , 1-min 50%  $VO_{2max}$ ], and 4 x [4-min 90%  $VO_{2max}$ , 3-min 60%  $VO_{2max}$ ]. Metabolic variables and HR were measured throughout exercise and 30-min of recovery. Training impulse and session-RPE were also determined.

**RESULTS:** There were significant differences during exercise in total  $O_2$  consumption between the 30-sec and 1-min ( $ES = -3.4$ ,  $p < 0.001$ ), and 30-sec and 4-min ( $ES = -3.4$ ,  $p < 0.001$ ) protocols, average  $VO_2$  between 30-sec and 1-min ( $ES = -2.6$ ,  $p < 0.001$ ) and 30-sec vs. 4-min ( $ES = -1.9$ ,  $p < 0.001$ ) protocols, average HR between 30-sec and 1-min ( $ES = -1.3$ ,  $p = 0.007$ ) and 30-sec and 4-min ( $ES = -1.3$ ,  $p = 0.02$ ) protocols, and blood lactate between 30-sec and 1-min ( $ES = 0.9$ ,  $p < 0.001$ ) and 30-sec and 4-min ( $ES = 1.0$ ,  $p < 0.001$ ) protocols. There was a difference in training impulse between 30-sec and 4-min protocols ( $ES = 1.5$ ,  $p = 0.009$ ). There were no significant differences in peak  $VO_2$  or peak HR attained during the protocols, or in session-RPE reported after the protocols. There were no differences in  $VO_2$  or HR after 5-min or 30-min of recovery. Blood lactate was only significantly higher after 30-min of recovery from the 30-sec compared to the 4-min ( $ES = 1.3$ ,  $p = 0.001$ ) protocol.

**CONCLUSIONS:** These findings show several differences, but also some similarities, in the acute physiological demands from HIIT protocols. However, differences in total metabolic work, average intensity, and training load did not result in differences in  $VO_2$  or HR during recovery or in the perceived difficulty of these protocols. These factors should be accounted for when planning training sessions or research studies, or when interpreting past research.

## B-54 Free Communication/Poster - Running

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

**786** Board #20 May 29 2:00 PM - 3:30 PM

### Relationship Between Running Bio-mechanics, Hip Mobility, And Knee Injury Risk In Division III Runners.

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(No relevant relationships reported)

**Introduction:** Hip mechanics influence foot strike patterns while running (Valenzuela et al., 2015) **Objective:** To observe the relationship between foot strike and sagittal plane passive hip range of motion in runners, as a surrogate for their risk for patellofemoral pain (PFP). **Methods:** Ten participants (20.5 ± 1.75 years) completed FMS testing and were rated by one certified tester. Participants' passive hip flexion and extension ranges of motion (ROM) were measured via goniometry. Then, reflective markers were placed at the lateral knee, lateral malleolus of fibula, and 5th metatarsal to define relative ankle angles. Participants ran at 3 different speeds and were filmed from the sagittal plane on both sides. Angles were analyzed on Dartfish software. **Results:** Hip flexion ( $p = 0.08$ ,  $r = 0.57$ ) and extension ( $p = 0.17$ ,  $r = 0.47$ ) were not significant predictors of dorsiflexion angles. Runners with pain/tightness experienced reduced hip extension ROM by 10.5% and had increased hip flexion ROM by 13.6% than runners without pain/tightness. The deep squat (DS) significantly predicted right hip flexion ( $p = 0.02$ ,  $r = -0.71$ ), but not left ( $p = 0.12$ ,  $r = -0.51$ ). Runners with pain/

tightness scored 1.75 on the DS, which was 12.5% lower than normative values.

**Discussion:** As passive hip sagittal plane ROM increased, the ankle angles increased, indicating a trend towards a more mid-forefoot strike, decreasing stress on the knee. Anterior hip tightness showed to decrease extension ROM, but not flexion ROM. The DS is sensitive to self-reported pain/tightness. **Conclusion:** For DIII runners, passive hip flexion and extension ROM were not significant predictors of foot strike type, runners with pain/tightness had presented changes in hip ROM and lower scores on the FMS DS.

**787** Board #21 May 29 2:00 PM - 3:30 PM

### Lower Extremity Stiffness in Collegiate Distance Runners Pre- and Post-Competition

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(No relevant relationships reported)

During running, the lower extremities are compared to a spring due to their ability to store and release energy. Recent evidence suggests a relationship between increased lower extremity stiffness and enhanced athletic performance, specifically in distance running. Current literature lacks information on the influence of fatigue on leg stiffness across multiple days in response to competition. **PURPOSE:** To determine how leg stiffness in runners was influenced in the 24- and 48-hour period following a cross country race. **METHODS** Twenty-two collegiate cross-country runners (13 M, 9 F, 19.5 ± 1.4 y) were recruited and participated. Leg stiffness was assessed 24h before a race and 24h and 48h post-race. Participants performed three static jumps (SJ) and three countermovement jumps (CMJ) on two force plates (AMTI Optima OPT464508; Watertown, MA; 1000 Hz). During each jump, participants held a dowel across the shoulders to prevent arm swing. Participants then performed a hop test (HT) where they completed 10-s of straight leg maximal hopping in sync with a metronome (2.2Hz). Leg stiffness was calculated, in agreement with previously reported methods, from the vertical ground reaction force of the 5th-7th hop of the HT. Repeated measures ANOVA and post-hoc analysis were used to assess significance ( $p \leq 0.05$ ).

**RESULTS:** A significant main effect was found for SJ height, CMJ height and leg stiffness. Leg stiffness was significantly reduced 24h post-race (pre-race 36.84 ± 4.96  $kN \cdot m^{-1}$ , 24h post 33.11 ± 8.05  $kN \cdot m^{-1}$ ,  $p = 0.05$ ) and then increased significantly from 24h post-race to 48h post-race (36.84 ± 6.88  $kN \cdot m^{-1}$ ,  $p = 0.015$ ). No significant differences were found in post-hoc analysis for CMJ height (pre-race 30.81 ± 5.79 cm, 24h post-race 29.89 ± 6.06 cm, 48h post-race 31.44 ± 6.47 cm,  $p > 0.05$ ) and eccentric utilization ratio (pre-race 1.24 ± 0.10, 24h post-race 1.20 ± 0.10, 48h post-race 1.22 ± 0.10,  $p > 0.05$ ). SJ height increased significantly from 24h to 48h post-race (24h post-race 25.99 ± 5.65 cm, 48h post-race 27.19 ± 5.63 cm,  $p > 0.05$ ). **CONCLUSION:** Following a cross country race leg stiffness significantly declined in a group of collegiate runners 24 hours post-race but returned to baseline 48 hours post-race. Sport scientists and coaches may be able to monitor leg stiffness as a metric to properly prescribe training regimens.

**788** Board #22 May 29 2:00 PM - 3:30 PM

### Physiological Correlates With 300 And 1000 M Performance In U14 Athletes

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(No relevant relationships reported)

#### Physiological correlates with 300 and 1000 m performance in U14 athletes.

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#### Abstract

**PURPOSE:** To determine the contribution of selected field tests physiological parameters with running performance in U14 track athletes.

**METHODS:** Fifteen trained U14 young track and field athletes (12 girls and 3 boys, 12-13 years old) participated in the study. During the first and second visit after anthropometry the athletes performed a 20 m Shuttle Run Test, a RAST (Running Anaerobic Speed Test), a vertical squad jump and a 40 m maximal effort to determine aerobic, anaerobic capabilities and leg explosive strength. The 300 and 1000 m time trial followed. All maximal tests were performed at least three days apart. Pearson's  $r$  and Stepwise Multiple Linear Regression were used for the correlation between maximal  $O_2$  uptake ( $VO_{2max}$ ), velocity at  $VO_{2max}$  ( $vVO_{2max}$ ), maximal heart rate ( $HR_{max}$ ), minimal, maximal and mean relative power output values ( $P_{min_{RT}}$ ,  $P_{max_{RT}}$  and  $P_{mean_{RT}}$ , respectively), squat jump (SJ), maximal running speed ( $V_{max}$ ), body mass (BM), body height (BH), %body fat (%BF) and the time trials 300 (t300m) and 1000 m (t1000m).

**RESULTS:** Univariate relationships showed significant correlations between t1000m and  $VO_{2max}$  (-0.866,  $p < 0.01$ ),  $vVO_{2max}$  (-0.899,  $p < 0.01$ ),  $P_{min_{RT}}$  (-0.519,  $p < 0.05$ ),  $P_{mean_{RT}}$  (-0.568,  $p < 0.05$ ), SJ (-0.606,  $p < 0.05$ ), BM (0.770,  $p < 0.01$ ) and %BF (0.698,  $p < 0.01$ ). Furthermore, t300m significantly correlated with  $P_{max_{RT}}$  (-0.553,

$p < 0.05$ ),  $P_{min_{RT}}$  (-0.579,  $p < 0.05$ ) and  $P_{mean_{RT}}$  (-0.670,  $p < 0.01$ ). Stepwise Multiple Linear Regression showed that the best predictor variables for  $t_{1000m}$  in U14 were  $vVO_{2max}$ ,  $P_{mean_{RT}}$ , BM and  $P_{max_{RT}}$  ( $t_{1000m} = 444.229 - 15.857 * vVO_{2max} - 37.105 * P_{mean_{RT}} + 1.270 * BM + 23.042 * P_{max_{RT}}$ , Adjusted  $R^2 = 0.948$ ,  $P < 0.001$ ,  $SEE = 6.86$  s), while the single predictor variable for  $t_{300m}$  was  $P_{mean_{RT}}$  ( $t_{300m} = 81.805 - 5.276 * P_{mean_{RT}}$ , Adjusted  $R^2 = 0.406$ ,  $P = 0.006$ ,  $SEE = 3.97$  s).

**CONCLUSIONS:** The moderate to high correlations shown in the present study between  $t_{1000m}$  and  $t_{300m}$  and the selected parameters can predict with acceptable accuracy 1000 m and 300 m in young runners and can be used to estimate performance.

**789 Board #23 May 29 2:00 PM - 3:30 PM**  
**Effects of Pulsed Electromagnetic Field Application on Aerobic Performance in Runners During Short-Term Altitude Training**

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(No relevant relationships reported)

Pulsed Electromagnetic Field (PEMF) application increases microcirculation throughout the body and has been shown to be beneficial in clinical populations. In athletic populations, PEMF is used to improve recovery. Altitude training has long been used by endurance athletes to improve sea-level performance. **PURPOSE:** To determine if recovery with PEMF during altitude performance leads to greater improvements in  $VO_{2peak}$  and ventilatory threshold (VT) in cross-country runners. **METHODS:** Fourteen male NCAA cross-country runners (age:  $19.07 \pm 0.92$  y.o.) with initial  $VO_{2peak}$  of  $73.13 \pm 5.65$  ml/kg/min participated in the study. Subjects were randomly assigned either to the PEMF intervention (INT) ( $n=8$ ) or to a control group (CON) ( $n=6$ ).  $VO_{2peak}$  and VT were evaluated using a metabolic cart at sea-level, pre- and post-training. Runners from sea level traveled to high altitude where they lived at 1322m above sea-level for 6 days. Six training sessions were performed at altitudes ranging from  $881.25 \pm 148.87$  m to  $1047.70 \pm 237.29$  m above sea-level with training sessions averaging a duration of  $75.25 \pm 7.04$  mins, speed of  $13.02 \pm 1.60$  kmph and distance of  $16.42 \pm 2.95$  km. Subjects in INT received PEMF application prior to and after training, while subjects in CON did not. **RESULTS:** There was no significant difference in either absolute or relative  $VO_{2peak}$ . A main-effect of time was found for absolute VT ( $p < 0.01$ ), which changed from  $3.35 \pm 0.52$  L/min to  $3.89 \pm 0.55$  L/min, and VT relative to  $VO_{2peak}$  ( $p < 0.01$ ), which changed from  $73.10 \pm 1.60\%$  of  $VO_{2peak}$  to  $87.08 \pm 1.82\%$  of  $VO_{2peak}$ . There was no significant difference between groups for absolute VT ( $p = 0.24$ ) however, the INT group displayed a positive-trend for VT relative to  $VO_{2peak}$  (INT: 18.28%, CON: 9.68%; group\*time  $p = 0.07$ ). Consequently, there was a main effect of time for heart-rate at VT ( $p = 0.02$ ), which changed from  $168.10 \pm 3.25$  bpm to  $175.34 \pm 3.49$  bpm, with no difference between groups (group\*time  $p = 0.11$ ). **CONCLUSION:** While altitude training showed some positive adaptations in cross-country runners, the addition of PEMF did not improve these adaptations significantly. This can be attributed to the short duration of application, since a positive-trend was found for VT relative to  $VO_{2peak}$ . PEMF could have beneficial effects when combined with a longer duration of altitude training.

**790 Board #24 May 29 2:00 PM - 3:30 PM**  
**The Effects of Hip Tightness on Running Mechanics and the FMS Deep Squat in DIII Track & Field Runners**

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(No relevant relationships reported)

**Introduction:** Running requires rapid hip movements. Increasing running speeds place increased loads on hip flexor and extensor muscles (Schache et al., 2011). It is unclear whether Division III track and field athletes with self-reported hip tightness would present altered sagittal plane hip mechanics while running and functional limitations when performing the Functional Movement Screen (FMS) deep squat. **Objective:** To investigate the relationship between hip tightness, as measured by the Functional Movement Screen (FMS) deep squat (DS), and running mechanics, as measured by the peak flexion and extension angles in Division III Track & Field athletes. **Methods:** Ten subjects completed the FMS DS and were filmed from both sides while running on a treadmill at 3 different speeds. Reflective markers were placed on the greater trochanter and lateral epicondyle of the femur. Absolute peak flexion and extension angles were obtained using Dartfish software. **Results:** DS was not a significant predictor of running mechanics. There were moderate positive correlations between peak hip flexion angles and DS. DS scores of 1 were associated with increased hip flexion ROM and decreased extension, especially on the left side. Runners who reported hip tightness had higher

average DS scores. **Conclusion:** Self-reported hip tightness group showed earlier toe-off and increased flexion ROM during swing phase. Differences between groups are greater in hip extension.

Findings also suggest asymmetries in the non-affected side for the tightness group. Future studies could investigate these changes in running mechanics in different planes of motion and injury prevalence in runners with self-reported hip tightness.

**791 Board #25 May 29 2:00 PM - 3:30 PM**  
**Prevalence And Spectrum Of Electrocardiogram Abnormalities In Amateur Marathon Runners**

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(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to assess the prevalence and the spectrum of electrocardiogram (ECG) abnormalities in amateur marathon runners.

**METHODS:** The participants of this study were contestants who participated in Hangzhou marathon (full marathon or half marathon) in 2015 and 2016. 12-lead ECG data of 24,210 amateur marathon runners aged 18-70 were included for analysis. The prevalence of ECG abnormalities were calculated and Chi square test was applied to compare the prevalence between different gender, age, weight status and sports performance groups. Logistic regression was utilized to determine the odds ratios of having certain ECG abnormalities in runners with good performance as compared with the runners with poor performance.

**RESULTS:** Sinus bradycardia and sinus arrhythmia were found in approximate 15% and 5% of participants. Prevalence of left ventricular high voltage, T wave change and right axis deviation are also higher than 1%. Runners with better performance had higher odds ratios to have sinus bradycardia, left ventricular high voltage, right ventricular high voltage and atrioventricular block (AVB).

**CONCLUSIONS:** Sinus bradycardia, sinus arrhythmia and left ventricular high voltage are the most common ECG abnormalities in amateur marathon runners. Sinus bradycardia and ventricular high voltage could be physiological adaptation after long-term marathon training, but ST-T change and axis deviation are not training-related ECG abnormalities.

**792 Board #26 May 29 2:00 PM - 3:30 PM**  
**Running Economy of Highly-Trained Distance Runners in Marathon Racing Shoes compared to Track Spikes**

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(No relevant relationships reported)

Running economy represents a complex interplay of physiological and biomechanical factors that are able to adapt chronically through training or acutely through other interventions such as changes in footwear. The Nike Vaporfly (NVF) shoe was designed for marathon running on the roads and has been shown to improve running economy by ~4% compared to other marathon shoes, however, during track racing distance runners traditionally wear a much lighter shoe with an embedded spike plate around the forefoot. **PURPOSE:** To determine if, and to what extent, the NVF shoes improve running economy compared with established track spikes (SPIKE) and marathon racing shoes (MAR). **METHODS:** 24 highly-trained runners (12 male, 12 female) ran 4x5 min trials on a treadmill while wearing each of the four shoe conditions: NVF, SPIKE, MAR, and the NVF matched in weight to the MAR shoe (NVF+), during three separate visits: (Visit 1) familiarization; (Visit 2) 14 and 18 km·h<sup>-1</sup> run for men, 14 and 16 km·h<sup>-1</sup> for women; (Visit 3) 16 km·h<sup>-1</sup> run for men, 15 km·h<sup>-1</sup> for women plus a  $VO_{2max}$  test for both genders. We measured rates of oxygen uptake ( $VO_2$ ), carbon dioxide production ( $VCO_2$ ) and biomechanical measures (stride rate, contact time, stride length, flight time) were made at each run velocity and shoe condition. Differences in running economy while running in the four shoe conditions over three velocities was assessed using a two-way ANOVA with repeated measures. Multiple regression analyses were used to evaluate potential relationships between changes in biomechanical measures and running economy. **RESULTS:** The NVF shoe improved running economy by  $2.6 \pm 1.3\%$  compared to SPIKE,  $4.2 \pm 1.2\%$  compared to MAR, and  $2.9 \pm 1.3\%$  when matched in weight of the MAR shoe. Among the 24 subjects, the difference in running economy over the four velocities between the NVF and SPIKE shoes ranged from +0.50 to -5.34% and from -1.72 to -7.15% for NVF versus MAR. Correlations between changes in running economy and changes in biomechanical variables were either trivial or small ( $r < 0.27$ ) but unclear. **CONCLUSION:** The NVF enhanced running economy compared to track spikes and marathon shoes and should be considered a viable shoe option for track and road racing.

793 Board #27 May 29 2:00 PM - 3:30 PM  
**Influence of Body Weight, FMS, & Summer Training on Mile Run Performance in Endurance Runners**

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**PURPOSE:** Anthropometrics, summer training volume, and functional movement including unilateral strength, flexibility and coordination have all previously been linked to athletic performance. The purpose of the current investigation was to determine the best predictor of mile time trial performance in division III cross country runners across the variables of body weight, functional movement screen (FSM), and total volume of miles run in the 14 weeks leading up to the start of the cross country season. **METHODS:** 31 subjects (M=22, F=9) aged (20 +/- 2 yrs) on a division III collegiate cross country team were asked to record and report summer mileage each week for the 14 weeks preceding the start of the season. Additionally, FMS tests were conducted on all subjects, as well as body weight measurement within the first week of the season. All subjects also completed a mile time trial run concomitantly. A multiple regression analysis was utilized to determine if FMS score, pre-season mileage, and/or body weight were significant predictors of mile time trial performance. **RESULTS:** The overall regression analysis revealed that FMS, body weight, and summer mileage were significant predictors of mile time trial performance ( $r = .41$ ;  $p < .05$ ). When covaried out, body weight was not significantly ( $p > .05$ ) correlated with mile time trial performance for males or females ( $r = .35$ ,  $r = .27$ , respectively). Summer mileage was statistically significant ( $p < .05$ ) to mile time trial results. Lastly, FMS testing was deemed not significant ( $p > .05$ ) towards mile time trial performance. **CONCLUSIONS:** Summer running volume, as recorded in the 14 week period leading up to the cross country season is the best predictor of performance when compared to anthropometric data as well as functional movement screening. Cross country athletes should focus on utilizing the progressive overload principle to gradually increase running volume over the summer months in order to maximize in season performance.

794 Board #28 May 29 2:00 PM - 3:30 PM  
**The Effect of Plyometric versus Muscular Endurance Training on Cross Country Time Trial Results**

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**PURPOSE:** Traditionally, endurance runners have supplemented aerobic training with muscular endurance training. Recent research has suggested that plyometric training improves running efficiency and endurance performance, and hence may be a more effective option in comparison to muscular endurance training. The purpose of the current investigation was to compare the effect of a plyometric and power intervention to a muscular endurance intervention on running performance in division III male and female cross country runners. **METHODS:** Both plyometric and muscular endurance training groups were assigned using stratified selection based on 2-mile time trial results completed during the first week of cross country practice. Subjects (N=46; M=29, F=17) participated in a 9 week intervention in conjunction with the cross country season. The muscular endurance group participated in exercises with a high repetition, low intensity scheme, while the plyometric/ power group participated in explosive exercises with a low repetition, high intensity scheme. To ensure equal training time, proper technique, and safety, researchers coached both groups during each training session. An unpaired t-test was utilized to determine if significant differences existed in cross country race finish time based on group assignment. **RESULTS:** The unpaired t-test revealed there was no significant difference ( $T = 1.68$ ,  $p > .05$ ) in race time to completion for the plyometric group compared to the muscular endurance group (27:12 +/- 3:08 vs 27:32 +/- 5:40, respectively). **CONCLUSIONS:** The plyometric/ power group was not significantly faster when compared to the muscular endurance group. However, on average the plyometric group was 20 seconds faster when compared to the muscular endurance group. Future interventions may need to be longer than nine weeks in order to elicit significant positive adaptations in endurance running as a result of the supplementation of plyometric training.

795 Board #29 May 29 2:00 PM - 3:30 PM  
**Relationship Between Hemoglobin Saturation and Performance in Collegiate Cross Country Runners**

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**PURPOSE:** Hemoglobin is essential for proper transportation of oxygen in the blood to muscles within the body. This is of especial importance and focus within endurance athletics as effects on performance can vary based on the level of hemoglobin saturation. Previous research mainly focused on the significance of higher hemoglobin levels improving performance, while the significance of negative effects from low levels is still of equal importance. The purpose of this study was to investigate the relationship between hemoglobin saturation and running performance in collegiate division III cross country runners.

**METHODS:** Hemoglobin saturation level was measured by capillary puncture and analyzed with a hemoglobin meter and test cartridges of 34 collegiate cross country runners (11 females, 23 males). Endurance performance was measured by two-mile time trial in minutes. A linear regression analysis was utilized to show the relationship between levels of hemoglobin saturation and time trial performance. Further, a one sample t-test was utilized to compare the averages of males classified with low levels of hemoglobin saturation and those in the normal range.

**RESULTS:** There was no significant correlation between hemoglobin saturation and two-mile time trial performance for both males ( $R = .268$ ;  $p > .05$ ) and females ( $R = .282$ ;  $p > .05$ ). Subjects were also classified as low hemoglobin if values were  $< 12.0$  mg/dL for females, and  $< 13.0$  mg/dL for males. Male subjects classified within the standard levels (mean=10:4870 ± .817599 min) had significantly faster ( $t(15) = -3.126$ ;  $p = .007$ ) two-mile times in comparison to subjects who were below this standard (mean=11:12586 min) with a mean difference of .638860 min.

**CONCLUSIONS:** Hemoglobin saturation levels are important in cross country athletes. The relationship, however, is more important and significant when saturation levels go below the normal range compared to those within the range. Runners categorized as low in hemoglobin saturation see significant decreases in performance for two-mile time trials compared to those in the normal range.

796 Board #30 May 29 2:00 PM - 3:30 PM  
**Functional Movement Screen Scores of Division III Cross-Country and Track and Field Runners**

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(No relevant relationships reported)

The functional movement screen (FMS) is a battery of seven fundamental movement patterns that include the Deep squat (DS), hurdle step (HS), in line lunge (ILL), shoulder mobility (SM), active straight leg raise (ASLR), trunk stability push up (TSPU), and rotary stability (RS) (Cook et al., 2006). FMS tests are scored on a 0 to 3 scale, for a composite score of up to 21 points. **PURPOSE:** To describe the FMS scores of DIII cross-country and track and field athletes and compare them to normative values for experienced distance runners, as reported by Agresta (2014).

**METHODS:** Ten NCAA Division III cross-country and track and field athletes (6 sprinters and 4 distance runners) were screened by one level 1 FMS certified tester. **RESULTS:** Mean DS was 1.9 (SD=0.57), mean HS was 1.7 (SD=0.48), mean ILL was 2.1 (SD=0.57), mean SM was 2.4 (SD = 1.07), mean ASLR was 2.4 (SD=0.84), mean TSPU was 2.6 (SD=0.7), and mean RS was 1.9 (SD =0.32). The mean composite score was 15 (SD = 1.76). When compared to the normative values established by Agresta (2014), DIII runners scored higher on SM by 25%, ASLR by 12.5%, TSPU by 24.2%, RS by 21.1%, and total FMS score by 12.7%. Results were the same for DS and ILL and lower on the HS by 5.9%. **DISCUSSION:** Despite having higher mean scores than the norm, three individuals had composite scores below the suggested threshold of 14 (Kiesel, 2007, Chorba, 2010, Hotta, 2015) and eight participants had scores of one and zero in individual tests, suggesting that the composite score alone is not sensitive enough to capture these asymmetries/imbbalances. Overall scores were higher than the normative values by Agresta (2014), but similar to mean composite values of 16.4 for young adult runners reported by Loudon et al. (2014). **CONCLUSIONS:** The mean composite score for DIII Cross-country and track and field runners was 12.7% higher than the scores for experienced runners in Agresta (2014). Future studies should continue to establish normative values for NCAA DIII cross-country and track and field runners.



**797** Board #31 May 29 2:00 PM - 3:30 PM  
**Can High Intensity Interval Training Effect Division I College 800/1500m Runner's Performance**  
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 (No relevant relationships reported)

HITT is a common training method incorporated for all fitness levels and been shown to improve athlete performance. However, these results were shown in sedentary and recreationally active populations and little research has been done with the Division I collegiate athlete population. **PURPOSE:** This study questioned whether HIIT could increase performance within this level of athletes, specifically middle distance runners (800/1500 m).

**METHODS:** A total of six Division I Collegiate level (800/1500 m) runners completed the study (three males, three female). The participant completed four weeks of HIIT, consisting on two HIIT workouts per week. The HIIT consisted of four 20-s Wingate tests with 4-min recovery between each. Both pre- and post- performance tests were completed, consisting of a run to volitional exhaustion, RPE, HR, which were collected on a treadmill. Stride length and stride frequency, were also measure during a 1500 m time trial on the track.

**RESULTS:** Significant differences were not found for performance pre- and post-training intervention, with respect to time to completion of the 1500 m time trial (pre-intervention:  $5.0 \pm 0.7$  min; post-intervention:  $4.8 \pm 0.5$  min;  $p = 0.23$ ), and time to volitional exhaustion (pre-intervention:  $20.1 \pm 1.2$  min; post-intervention:  $19.7 \pm 1.3$  min;  $p = 0.14$ ). RPE ( $p = 0.64$ ), HR ( $p = 0.09$ ), stride length ( $p = 0.09$ ), and stride frequency ( $p = 0.78$ ), showed no significant changes pre- and post-intervention.

**CONCLUSIONS:** HIIT did not impact 800/1500 m middle distance runner's performance, suggesting it can maintain performance, providing alternative training methods.

**798** Board #32 May 29 2:00 PM - 3:30 PM  
**Telomere Length, Lipid Profile and Body Composition of Master Sprinters and Endurance Runners**  
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**BACKGROUND:** Previous studies have shown that middle-aged Master Athletes have better body composition and lipid profile, as well as longer leukocyte telomeres compared to untrained peers. However, no comparisons were made with markers of biological aging, body composition, and metabolic health among athletes who performed different training regimens through life (ie, sprint / strength vs. resistance training).

**PURPOSE:** The telomere length, lipid profile and body composition were compared in sprinters and endurance runners from Master category.

**METHODS:** Middle-aged master athletes (n=23) with a minimal of 20 yrs of lifelong training in Track and Field were allocated according to their training specificity, being Sprinters (n=12;  $49.41 \pm 9.10$  yr-old) and Endurance Runners (n=11;  $55.45 \pm 7.84$  yr-old). Blood samples were collected after 8-hour fasting. Relative leukocyte telomere length was determined with qPCR analyses (T/S). The serum lipid profile was analyzed using commercial kits and body composition was predicted through skinfold measures.

**RESULTS:** Unpaired T-test revealed no differences between Sprinters vs Endurance athletes regarding to Leucocyte Telomere Length (T/S) [ $1.26 \pm 1.01$  vs.  $1.11 \pm 1.13$  ( $p=0.732$ )], Body Fat (%) [ $12.32 \pm 4.51$  vs.  $13.29 \pm 4.49$  ( $p=0.612$ )], Free Fat Mass (kg) [ $87.68 \pm 4.51$  vs.  $86.70 \pm 4.49$  ( $p=0.612$ )], and lipid profile (mg.dL<sup>-1</sup>) through Triglycerides [ $79.04 \pm 51.28$  vs.  $120.20 \pm 75.81$  ( $p=0.139$ )], HDL [ $93.21 \pm 28.66$  vs.  $70.41 \pm 38.06$  ( $p=0.116$ )], LDL [ $83.53 \pm 76.34$  vs.  $125.59 \pm 58.18$  ( $p=0.155$ )] and Total Cholesterol [ $192.56 \pm 72.85$  vs.  $220.04 \pm 29.02$  ( $p=0.256$ )].

**CONCLUSION:** For master athletes, regarding of whether they were trained lifelong in sprints or endurance, both training models revealed to be similar for the leukocyte telomere length and equally beneficial for lipids profile and body composition.

**799** Board #33 May 29 2:00 PM - 3:30 PM  
**Can Your Face Affect Your Pace? The Impact of Facial Expression on Running Economy**  
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Running economy (RE) is an important performance metric for runners. It is determined by comparing the oxygen cost of steady state exercise at given running speeds across individuals. A recent study examined the physiological impact that facial expressions (smiling and frowning) had on RE compared to more traditional cognitive relaxation techniques. Smiling while running resulted in a 2.8% improvement in RE among a group of recreational adult runners. **PURPOSE:** The purpose of this study was to determine whether facial expression would impact RE in a group of aerobically trained collegiate athletes. **METHODS:** Twenty-four Division III collegiate athletes (females n=14) completed four 6-minute running blocks at 70% of  $\dot{V}O_{2max}$ . The order of bouts was determined using a balanced Latin square design with each participant serving as his/her own control. Participants completed running blocks while smiling (Smile), frowning (Frown), relaxing their hands and upper bodies (Relax), and running as they "normally" would (Control). Cardiorespiratory responses were recorded continuously and participants reported perceived effort (RPE), affective valence (FS), and arousal (FAS) after each condition. Blood lactate was measured at the end of each block. Repeated measures analysis of variance was run on all primary variables with a significance level set a priori at 0.05.

**RESULTS:** There were no significant differences in RE between conditions (Smile  $33.72 \pm 4.4$ , Frown  $34.15 \pm 4.08$ , Relax  $34.17 \pm 4.12$ , Control  $34.16 \pm 3.91$  ml/kg/min,  $p > 0.05$ ). Additionally, unlike previous research, there were no significant differences in RPE during smiling and frowning conditions ( $11.71 \pm 2.56$  vs.  $11.82 \pm 1.97$ ,  $p = 0.71$ ). There were also no significant differences in affective valence, arousal, or blood lactate between all conditions. **CONCLUSIONS:** Among a group of aerobically trained collegiate athletes running at 70%  $\dot{V}O_{2max}$ , smiling does not improve RE. However, future research should be conducted in order to discern what meaningful effect, if any, facial expression could have on psycho-physiological markers associated with running performance across a more diverse population.

**800** Board #34 May 29 2:00 PM - 3:30 PM  
**The Changing Relationship Between Performance and Aging as the Duration of an Ultramarathon Increases**  
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 (No relevant relationships reported)

**PURPOSE:** It is often said that increasing the distance of a race eliminates or reduces the age decline in performance. After, the age of 25 maximal oxygen consumption typically declines by 1% per year. If aging is not associated with impaired performance, it would suggest factors other than aerobic fitness become more important for racing extreme distances. **METHODS:** Data on finishing times, and age of participants was collected from Western States 161 km run (WSE) from 1974 through 2018. Age and mileage completed were collect from Across the Years 6 day race (ATY) from 2011 - 2017. **RESULTS:** From 1974 - 2018, 9310 individual finishes were recorded for the WSE. Mean age was  $42.01 \pm 8.65$  yr with finish times of  $25.57 \pm 3.44$  h. Regression analysis revealed age to be positively associated with finishing times (Finishing Time =  $0.134 * \text{Age} + 19.937$ ), with a significant, weak correlation ( $p < 0.001$ ,  $r = 0.337$ ). From 2011 - 2017 there were 305 performances recorded for the ATY 6 day race. Mean age was  $50.44 \pm 16.36$  yr, and mean distance completed was  $332.90 \pm 197.12$  km. A regression analysis revealed that age was positively associated with distance completed (Distance Completed =  $3.03 * \text{Age} + 179.85$ ), with a significant, but weak correlation ( $p < 0.001$ ,  $r = 0.252$ ). **CONCLUSIONS:** Aging tended to impair performance at the WSE. With every one year increase in age, finishing time tended to increase by 8 min, but it should be noted this association was weak. In contrast, aging was weakly associated with increased performance at ATY 6 day race. For every year increase in age, runners at ATY tended to run an additional 3 miles. This suggests that as the distance or time frame of the race increases beyond some point that age becomes less of a factor in performance. This suggests that that aerobic fitness may play less of a role compared to other factors for performance in a 6 day race, but remains important for a 161 km race.

**801** Board #35 May 29 2:00 PM - 3:30 PM  
**The Isokinetic Muscular Strength Characteristics Of Ultra-endurance Runners**

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Descriptive information on strength characteristics of ultra-marathon runners is currently limited.

**PURPOSE:** To determine the isokinetic (ISO) strength of quadriceps and hamstring muscles for eccentric (ECC) and concentric (CON) muscle actions in ultra-marathon runners in conjunction with the physiological assessment of running economy, fractional utilisation and  $VO_{2max}$ .

**METHODS:** Following local institutional ethical approval, 46 ultra-endurance runners (27 males, 19 females) gave their written informed consent to volunteer in this study (age,  $41 \pm 8$  yrs; height,  $174.3 \pm 9.1$  cm; mass,  $75.8 \pm 13.3$  kg). Each participant took part in at least one of four multi-stage ultra-marathon events: Rovaniemi150 (Finland), Jungle Ultra (Peru), Al Andalus Ultimate Trail (Spain) and Everest Trail Race (Nepal). ISO knee extension (EXT) and flexion (FLEX) peak torques were measured across three angular speeds ( $60^\circ \cdot s^{-1}$ ,  $180^\circ \cdot s^{-1}$ ,  $240^\circ \cdot s^{-1}$ ) during ECC and CON loading for the left (L) and the right (R) leg. Furthermore, running economy, blood lactate responses and  $VO_{2max}$  were assessed during an incremental treadmill test.

**RESULTS:** There were non-significant differences in peak torque for EXT between the L and R leg across all angular speeds for both ECC and CON muscle actions ( $p > 0.05$ ). However, the ECC peak torque was significantly greater in the R FLEX compared to the L for both  $240^\circ \cdot s^{-1}$  ( $114.0 \pm 34.1$  vs.  $105.7 \pm 33.5$  Nm) and  $180^\circ \cdot s^{-1}$  ( $114.6 \pm 37.9$  vs.  $103.2 \pm 37.5$  Nm),  $t(43) = -2.11$ ,  $p = 0.041$  ( $ES = 0.12$ ) and  $t(43) = -2.71$ ,  $p = 0.01$  ( $ES = 0.15$ ), respectively. No other significant differences were observed for peak torque for FLEX. The average ECC peak torques (Nm) across the speeds were R EXT ECC  $203.7 \pm 54.7$ , L EXT ECC  $204.7 \pm 55.4$ , R FLEX ECC  $115.0 \pm 36.6$ , L FLEX ECC  $106.7 \pm 36.8$ . The average CON peak torques (Nm) for both legs at 60, 180 and  $240^\circ \cdot s^{-1}$  were R/L EXT CON-60  $171.6 \pm 43.9$ , R/L EXT CON-180  $121.7 \pm 34.0$ , R/L EXT CON-240  $101.6 \pm 29.4$ , R/L FLEX CON-60  $88.7 \pm 28.6$ , R/L FLEX CON-180  $60.2 \pm 19.3$ , R/L FLEX CON-240  $50.1 \pm 18.3$ , respectively.

**CONCLUSION:** This study provides normative ISO strength data for endurance trained athletes who participate in ultra-marathons offering insight into the balance between EXT and FLEX of the knee. These findings will be of interest to ultra-marathon runners, coaches and exercise physiologists supporting these athletes.

**802** Board #36 May 29 2:00 PM - 3:30 PM  
**Relationship Among Physiological, Perceptual, And Biomechanical Variables During Exercise On A Non-motorized Treadmill In D2 Cross-country Athletes**

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 (No relevant relationships reported)

**PURPOSE:** The purpose of this study was to examine the relationship between physiological, perceptual, and biomechanical variables during exercise on a non-motorized treadmill (NMT) in cross-country athletes.

**METHODS:** Thirteen female cross-country Division II athletes (age,  $20.77 \pm 3.27$  yrs; height,  $161.92 \pm 5.48$  cm; weight,  $55.54 \pm 6.45$  kg) participated in separate familiarization and testing sessions. On day one (familiarization), participants performed a treadmill protocol that consisted of a 5-min warm-up walk, 5-min walk, 5-min run, and 5-min cool-down on the NMT. Participants' velocity was recorded every minute to determine average self-selected pace for walking and running. Day two (testing day) consisted of performing the treadmill protocol with the previously determined velocities. Heart rate (HR), rating of perceived exertion (RPE), oxygen uptake ( $VO_2$ ), vertical GRF (GRFv), horizontal GRF (GRFh), power, and velocity was recorded and steady-state minutes were averaged and used for analysis. Separate Pearson's r correlation analyses were used to determine the relationship among HR, RPE,  $VO_2$ , GRFv, GRFh, power, and velocity.

**RESULTS:** There was a significant strong positive correlation in walking between in HR and velocity ( $r = 0.75$ ;  $p = 0.003$ ), horizontal force ( $r = 0.73$ ;  $p = 0.004$ ), and power ( $r = 0.76$ ;  $p = 0.002$ ). There was a significant positive strong correlation in running between HR and velocity ( $r = 0.76$ ;  $p = 0.002$ ), power ( $r = 0.76$ ;  $p = 0.002$ ). There was a significant positive strong correlation in running between  $VO_2$  and running velocity ( $r = 0.71$ ;  $p = 0.006$ ), GRFh ( $r = 0.69$ ;  $p = 0.008$ ), and power ( $r = 0.72$ ;  $p = 0.005$ ). There was no significant ( $p > 0.05$ ) correlation for all other variables in walking and running conditions.

**CONCLUSIONS:** The results indicate that  $VO_2$  has strong correlations with running velocity, force, and power, and that HR has strong correlations with running velocity and power.  $VO_2$  and HR are indicators of exertion in running conditions. Since the runners were in a steady-state condition, these results suggest that an increase in exertion—indicated by cardiovascular and metabolic responses—also requires an increase in kinetic measures. Because the NMT requires users to self-propel, the results suggest mechanics of running on a curved-NMT may influence physiological responses.

**803** Board #37 May 29 2:00 PM - 3:30 PM  
**Evaluation of Running Performance in Recreationally Active Individuals at Submaximal Speeds: Shod vs. Barefoot Conditions**

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The concept of barefoot running (BFR) is to purposely change foot strike patterns to promote metabolic efficiency, however exposing normally shod runners to BFR may have detrimental effects on overall running performance. **PURPOSE:** The purpose of this study was to evaluate the differences in physiological variables in running performance when individuals were acutely exposed to BFR. **METHODS:** This study consisted of 9 college aged males, ( $22.67 \pm 1.0$  y/o,  $83.68 \pm 9.01$  kg,  $178.36 \pm 4.54$  cm, and  $14.60 \pm 5.27\%$  body fat), who engaged in aerobic exercise at least twice a week with no prior BFR experience. Subjects were blindly asked during each condition to self-select running speeds that they could maintain for 10 min. Variables collected included speed,  $VO_2$ , HR, RER, VE, LRPE, SRPE, and foot pain. **RESULTS:** Data analysis revealed no statistically significant differences in physiological variables between conditions. However significant differences were seen between selected running speed and foot pain. Results indicated that subjects decreased their running speed by .98mph ( $p = 0.004$ ) and experienced greater amount of foot pain ( $+2.11$ ,  $p = 0.02$ ) when in the BFR condition. **CONCLUSIONS:** The findings of this study suggest that acute exposure to BFR may decrease overall running speed during a workout and subjects may also experience a greater amount of foot pain compared to shod running. Caution should be used when introducing the concept of BFR to athletes or recreational runners.

**804** Board #38 May 29 2:00 PM - 3:30 PM  
**Relationship Between Training Load and Intensity and Next Day Resting Heart Rate in Running.**

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Resting heart rate (RHR) is a commonly used indicator used to monitor adaptations in aerobic conditioning. In long distance training, measures such as heart rate and distance covered are used as indicators of intensity and workload to affect changes in aerobic conditioning. However, there appears to be a need for more information on possible interactions between measures of intensity and workload and their effect on RHR as an indicator of adaptation. **PURPOSE:** To examine the relationship between training load (LOAD) and training intensity (INT) on next day RHR. **METHODS:** Seven middle-long distance runners, members of a Division I varsity team participated in the study during a cross country season in the fall. Variables were morning RHR, INT measured using Borg's Ratings of Perceived Exertion 16-point scale and LOAD expressed as miles ran. Variables were recorded by each participant on each training day and were aggregated for a total of 224 data points among the seven participants. Correlation and Multiple Regression analyses were used to examine the relationship between the variables. **RESULTS:** Significant correlations were found between LOAD and INT (.392) and between INT and next day RHR (.200). Multiple Regression found INT contributed significantly to the prediction of RHR yielding the following formula:  $RHR = 47183 + 0.483 * (INT)$ ,  $R^2 = 0.055$ ,  $SEE = 4.722$ .

**CONCLUSIONS:** Although a relationship was found between LOAD and INT it seems that each may have a unique contribution to next day's RHR.

**B-55 Free Communication/Poster - Soccer**

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

**805 Board #39 May 29 2:00 PM - 3:30 PM**  
**Number Of Sprints Performed By Players Of Different Playing Positions During A Soccer Match**

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Soccer is a sport characterized by intermittent efforts and by a variation of intensity between the first and the second half-times of the match. The sprints, actions performed at high speeds and which demand a high energy expenditure, are among the several parameters which can be used to evaluate the performance capacity of the players along a match.

**PURPOSE:** To compare the sprints performed by professional players of different playing positions along Soccer matches. **METHODS:** Twenty-two professional Soccer players (weight = 76.4 ± 5.2 kg; height = 179.9 ± 6.2 cm; BMI = 23.7 ± 1.7 kg/m<sup>2</sup>) participated in the study. The Polar Team Pro® GPS system was used to measure distances and speed of the subjects during the games. The number of sprints at speed above 25 km/h were registered in the first and in the second halves of the matches. Only players who participated during 75% of the total time of each of 10 matches were included in the study. Data normality was tested using the Shapiro-Wilk (p = .714). The Friedman test followed by the post-hoc Tukey were used to analyse the sprints (p < .05). **RESULTS:** The average number of sprints (> 25 km/h) was 13.3 ± 6.4 sprints per game. There was a difference amongst playing positions (Expected P = .039 and Calculated P = .042) and there was a difference between the second half and the total match time. The number of sprints of mid-fielders and forwards, but not of full-backs and half-backs, was reduced in the second half-time. **CONCLUSIONS:** There was a difference in the number of sprints between players of different positions and also a difference between the first and the second half-times. This information may be used by coaches in conducting training sessions and in matches.

Average number of sprints in the 10 matches

Player Position	1st half	2nd half	Total
Full-backs	7	7	14
Half-backs	7	7	14
Midfielders	8	6	14
Forwards	8	7	15

**806 Board #40 May 29 2:00 PM - 3:30 PM**  
**Structured Physical Training Program Reduces Injury Risk Factors Unrelated to Performance Improvements in Soccer Players**

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(No relevant relationships reported)

Physical training programs are designed to improve sport performance. To augment these programs, specific injury prevention protocols can be included. However, structured physical training programs alone could reduce injury risk.

**Purpose:** To determine the effects of a structured offseason training program on physical performance and modifiable LE injury risk factors.

**Methods:** Twenty-three male collegiate soccer players were enrolled (20 ± 1.54 yrs.). Body fat percentage (BF%), aerobic capacity (VO<sub>2</sub>max), vertical jump, anaerobic power (Wingate), bench press (1RM), Y-balance (YB) bilaterally and weight bearing lunge ankle dorsiflexion (WBDF) bilaterally were measured pre and post a 12-week physical training program.

**Results:** Performance measures of BF%, VO<sub>2</sub>max, vertical jump, and Wingate were not significantly different after the 12-week program. Bench press 1RM (177.22 ± 31.44 lb.) was the only statistically significant performance measure (n=9, p=0.02). Right(R) (691.13 ± 81.27 mm) and Left(L) (684.54 ± 85.49 mm) side absolute YB in the anterior-posterior direction (p=0.03) and LWBDF (26.5 ± 8.47°, p=0.05) were statistically different pre to post assessment (n=10). All other YB directions (posterior-medial, posterior-lateral) and RWBDF were not statistically significant. Composite

scores for YB normalized to leg length pre (RYB=82.84 ± 9.64%, LYB=80.63 ± 12.64%) and post (RYB=78.76 ± 26.88%, LYB= 80.53 ± 19.36%) resulted in no significant change.

**Conclusion:** Participants improved some modifiable injury risk factors at the LE (YB, WBDF) and increased upper extremity strength. However, no other performance measures significantly changed. These results indicate structured physical training programs could positively affect injury risk factors, absent of specific injury prevention programming and unrelated to physical performance improvements. Specific physical training programming and its relationship to reduction of injury risk factors requires further research.

**807 Board #41 May 29 2:00 PM - 3:30 PM**  
**Effects of Soccer Kicking Training Using Virtual Reality on Kicking Performance in Boy Soccer Players**

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(No relevant relationships reported)

**Purpose:** Adoption of virtual reality (VR) into sports, games, and educational settings has become popular in recent years, but no evidence regarding VR's effects on athlete's performance has been elucidated. This study evaluated an efficacy of VR soccer kicking training system for kicking performance in young soccer players. **Methods:** A total of 24 experienced boy soccer players enrolling in a elementary school soccer team was recruited for the 6 months study, and divided into two groups; VR training group (VR-G; n=13, 11.8±1.0 yrs, 148±7.5 cm, 39.0±7.9 kg) and outdoor training group (OT-G; n=11, 11.4±3.4 yrs, 152±9.7 cm, 45.2±10.2 kg). Before (M0) and after (M6) the study, they were tested. For the test, they kicked a ball, in which a sensor was installed, to a curtain screen on which targets were marked by a beam. The VR room was sized 12×8 meter. Using the data of ball speed and target hitting accuracy, a scoring point was calculated for kicking accuracy (Ka) and speed (Ks). They were also tested on a soccer field for measurement of kicking accuracy (Kfa). For the test, they practiced twice and kicked 5 times for measurement. During the study, they were trained for two phases; regular and extra training. For the regular training, the team was trained 4 times/week in a soccer field for 120 min/session. For a total of 15 sessions of extra training, OT-G practiced only kicking on the field, while VR-G did in a VR room. **Results:** For VR-G, Ka, Ks, and Kfa increased from 53.6±9.5, 26.1±11.8, and 18.6±14.9 at M0 to 62.9±10.0 (t=-6.138, p<.001), 38.0±13.2 (t=-2.396, p<0.05), and 31.9±16.0 unit (t=-2.442, p<0.05), respectively. For OT-G, Ka, Ks, and Kfa were not changed from 58.8±8.9, 35.9±15.5, and 19.6±13.6 at M0 to 63.1±5.7, 29.1±10.0, 22.2±12.8 unit, respectively. No differences were found in 3 kicking variables at M0 and M6 between two groups. **Conclusion:** The regular soccer training and the extra kicking training improved the kicking speed and accuracy in VR-G, while OT-G maintained their performance. VR soccer kicking training program could be a potential substitutional and additional training model for young soccer players. (This research project was supported by the Spors Promotion Fund of Seoul Olympic Sports Promotion Foundation from Ministry of Culture, Sports and Tourism, project # s072016122016)

**808 Board #42 May 29 2:00 PM - 3:30 PM**  
**Initial Profiling of Division II Soccer Athletes Revealed Minimal Body Composition Changes Throughout Competitive Season**

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(No relevant relationships reported)

Body composition (BC) assessment is a metric utilized in sport performance, yet there is a paucity of BC data profiling NCAA Division II female athletes.

**PURPOSE:** To measure and compare BC data of Division II female soccer athletes during a competitive season thereby developing an initial profile relative to this sport and division. **METHODS:** Subjects (Age: 19.09 ± 1.15 yrs.) consisted of Division II women's soccer athletes (n=22). Body fat percentage (BF%) utilizing air plethysmography [BODPOD, Cosmed] was measured during pre-season and within the penultimate week of the competitive season. Descriptive statistics and dependent t-tests (SPSS version 25.0) were used to analyze data. **RESULTS:** Pre-season data indicated the following team anthropometrics: Height: 165.38 ± 9.05 cm; Weight: 60.02 ± 5.2kg; BMI: 21.64 ± 1.39. Team BF% was 19.99 ± 4.39% with freshman (n=10) BF% recorded at 18.73 ± 5.07% and returners (n=12) at 21.0 ± 3.62%. Latter season weight of 59.80 kg ± 5.09 and BMI of 21.47 ± 1.25 was down slightly. Team BF% increased to 20.27 ± 4.09% with freshman BF% increasing to 20.55% ± 4.90 % while returners decreased to 20.02 ± 3.47%. There were no statistically significant differences in team, freshman, or returners BF% or BMI for both time points assessed. **CONCLUSION:** Team BF% was lower at both assessment points than recently

published data on Division I female soccer athletes (Field et al., 2018). Freshman demonstrated lower BF% than returners initially but returners BF% trended downward at the latter part of the season. Future research should continue to explore physical profile changes over time while expanding sport performance testing metrics to obtain a more comprehensive snapshot of the Division II female soccer athlete. Reference: Field, J. et al. (2018). Comparison of body composition variables across a larger sample of national collegiate athletic association women athletes from 6 competitive sports. *Journal of Strength and Conditioning Research*, 32(9), 2452-2457.

**809 Board #43 May 29 2:00 PM - 3:30 PM**  
**Use Of Muscle Saturation Oxygen As A New Marker Of Fatigue In Female Soccer Players**

Aldo A. Vasquez-Bonilla<sup>1</sup>, Ismael Martinez-Guardado<sup>2</sup>, Jeffrey M. Mjaanes M. Mjaanes, FACSM<sup>3</sup>, Samantha Guerrero-Flores<sup>2</sup>, Rafael Timón<sup>2</sup>, Guillermo Olcina<sup>2</sup>. <sup>1</sup>National Pedagogical University Francisco Morazán, San Pedro Sula, Honduras. <sup>2</sup>University of Extremadura, Cáceres, Spain. <sup>3</sup>Northwestern University, Evanston, IL. (Sponsor: Jeffrey M. Mjaanes, FACSM)  
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According to UEFA, a paucity of relevant studies has led to a significant increased interest in women's soccer research. Additionally, early detection of muscle fatigue could have profound impact on injury prevention and recovery in many sports including soccer. Measurement of muscle oxygen saturation (SmO<sub>2</sub>%) with non-invasive near infrared spectroscopy (NIRS) technology has been investigated as a possible indicator of fatigue, however no clear protocol exists regarding interpretation of NIRS data or its application for training assessment or fatigue detection. **PURPOSE:** To evaluate SmO<sub>2</sub>% kinetics and relate it to markers of fatigue induced by an official match. **METHODS:** 12 female soccer players (age 19 ± 3 years, weight 59.1 ± 5.7 kg, height 1.61 ± 0.05 m, Fat 18.5 ± 3.5%). They were evaluated pre-match (PRE) and 24 hours after an official match (POST). Blood plasma parameters were measured including Blood Urea Nitrogen (BUN), Glutamate-Pyruvate Transaminase (GOT) Lactate Dehydrogenase (LDH), Creatine phosphokinase (CPK), and total hemoglobin (THb). Additional outcomes were assessed including rate of perceived exertion (CR-10 Borg scale), Visual Analog Scale (VAS-pain 1-10), and "Repeated Ability Sprint Test" (RAST) using a portable "Muscle Oxygen Monitor" (MOXY) placed in the gastrocnemius muscle of the dominant leg to measure SmO<sub>2</sub>%. Deoxygenation rate (De-Oxy) and Reoxygenation Rate (Re-Oxy) were calculated. For statistical analysis, T-test, Pearson correlation and mechanical inferential statistics were applied to measure the magnitudes of change. **RESULTS:** Average SmO<sub>2</sub>% during test RAST increased after match ((23 ± 8 vs. 29 ± 8 p < 0.05); Δ% = 19.1%), as well minimum SmO<sub>2</sub>% values (12 ± 8 vs. 21 ± 8 p < 0.05) and maximum values (31 ± 8 vs. 36 ± 8 p < 0.05). Other fatigue markers increased too after match, LDH (282 ± 45 vs. 341 ± 79 IU/L p < 0.05) and VSA pain (3.2 ± 1.7 vs. 5.1 ± 1.7 p < 0.01). It was also found that a higher Re-Oxy correlated with increases in LDH (r = 0.88 p < 0.01), VSA pain (r = 0.61 p < 0.05) and BUN (r = 0.84 p < 0.01). Taken together, the decrease in SmO<sub>2</sub>% was considered as the best performance in the RAST test (r = -0.79 p < 0.01). **CONCLUSIONS:** MOXY monitor can be used as a novel, non-invasive method to identify post-match fatigue in female soccer players through measurement of SmO<sub>2</sub>% kinetics and the rate of reoxygenation.

**810 Board #44 May 29 2:00 PM - 3:30 PM**  
**Effects of Video Feedback on Kicking Performance and Temporal Patterns in U-10 Soccer Players**

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Kicking is a crucial motor skill in soccer. Accuracy and velocity are the two primary factors responsible for kicking performance. Coaches and practitioners design programs with practice sessions in which kicking actions are involved. **PURPOSE:** To examine the effects on kicking performance of different types of extrinsic video feedbacks such as slow-motion video feedback (SMVF) or normal video feedback (NVF), with additional velocity feedback, in comparison with no feedback (NF) was studied in U-10 soccer players. **METHODS:** Thirty male children soccer players (mean age: 8.9 ± 0.8 years) asked to perform series of dynamic soccer kicks. Their kicking performance was measured in terms of accuracy and velocity, and the motor skill pattern variations were assessed in terms of temporal variables of approach time (ATIME), the last step time (LSTIME) and the foot descent time (DTIME). Players performed 4 blocks of 5 kicks with a 30-second rest period and a retention block of 10 kicks 2 days later. **RESULTS:** Results showed significant differences both between the SMVF and NF groups in terms of performance (F<sub>2,27</sub> = 3.97, p < 0.05; η<sup>2</sup><sub>p</sub> = 0.227). SMVF group

significantly improved performance during the practice phase but not in retention. Significant differences of the coefficient of variation (CV) were found in the main temporal variables of the action (F<sub>6,214</sub> = 6.96, p = 0.000; η<sup>2</sup><sub>p</sub> = 0.44). Univariate analysis showed a significant effect of group on LSTIME (F<sub>2,108</sub> = 4.07, p = 0.015; η<sup>2</sup><sub>p</sub> = 0.06) and DTIME (F<sub>2,108</sub> = 16.99, p = 0.000; η<sup>2</sup><sub>p</sub> = 0.16) but not on ATIME (F<sub>2,108</sub> = 1.28, p = 0.30; η<sup>2</sup><sub>p</sub> = 0.16). **CONCLUSIONS:** The type of multimodal feedback (slow motion video and velocity) significantly affects the acute kicking performance in children and its temporal pattern. The present study suggests possible benefits of using slow-motion video feedback in the learning sessions of children soccer players. The accessibility of such technology using low-cost cameras or mobile phones makes this finding especially relevant. Coaches and practitioners can induce significant changes in kicking performances (and other motor skills) and temporal patterns. This study is inconclusive about the retention of these changes and has not studied the transfer in learning.

**811 Board #45 May 29 2:00 PM - 3:30 PM**  
**Lower and Upper Body Muscle Characteristics among Collegiate Baseball and Soccer Players**

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Increased muscular strength in athletes has shown a prolific effect in the development of sports skills including jumping, throwing, sprinting, and change of direction abilities. Sports, such as soccer and baseball, differ largely in specific characteristics needed for success. To date, few studies have reported differences in sports specific skills between these two sports to measure and quantify the neuromechanical capacity. **PURPOSE:** To compare both lower and upper body strength among collegiate baseball (BB) and soccer (SC) players. **METHODS:** In this non-randomized cross-sectional study, 19 baseball and 19 soccer players, age ranges from 18-25 years completed the protocols. Lower body strength and power were assessed by a two-leg press maximal strength test (1RM) and vertical jump test (Just Jump Mat, Tendo Sports Machine), respectively. Upper body strength was assessed by a handgrip (HG) test using handgrip dynamometry (Takei, Japan). **RESULTS:** Independent sample t-test showed BB players (88.05 ± 7.1 kg) were significantly heavier than SC players (72.1 ± 7.2 kg) (p < 0.05). However, weight-adjusted upper body strength and leg power were not significantly different between the two groups. BB players had significantly higher jump height (JH), time in air, and 1RM leg strength compared to SC players (p < 0.05). **CONCLUSIONS:** BB players showed significantly higher lower muscle strength compared to SC players, however no differences were observed for peak power. These results provide a quantitative measure of the performance difference between these two sports, reinforcing the need for further research along with large sample size to assess the possible differences in training effectiveness and inherent characteristics between BB and SC players.

Table 1. Athlete Performance Variables (Adjusted Mean ± SE)

Variables	BB Players (n= 19)	SC Players (n=19)
Time in air (s)**	0.72 ± 0.01	0.64 ± 0.01
Jump Height (inches)**	25.99 ± 0.79	20.10 ± 0.79
Velocity (m/s)	1.42 ± 0.02	1.39 ± 0.02
Power (Watts)	1125.99 ± 25.62	1075.14 ± 25.62
Relative Power (Watts/kg)	13.99 ± 0.31	13.31 ± 0.31
1 RM (Kg)*	355.54 ± 14.88	300.43 ± 14.88
Rt HG (Kg)	44.91 ± 2.36	41.15 ± 2.36
Lt HG (Kg)	42.51 ± 2.20	42.20 ± 2.20

\*Significant p < 0.05; \*\*Significant p < 0.01; Rt, Right; Lt, Left

**812 Board #46 May 29 2:00 PM - 3:30 PM**  
**Performance Implications of Arousal State in Female Collegiate Soccer Players**

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 (No relevant relationships reported)

Arousal, defined as a blend of physiological activation and psychological awareness, prior to collegiate soccer matches may have important implications on performance. How various arousal states are related to measures of sport-specific performance and

the hormone cortisol in and around matches in female collegiate soccer players is largely unknown. **PURPOSE:** To investigate the effect of arousal state on passing performance and salivary cortisol in female collegiate soccer players.

**METHODS:** Eighteen NCAA Division I female soccer athletes (20.2±1.1 y) participated in this study during the spring season. One hour before five competitive matches, the Activation-Deactivation Adjective Checklist (AD-ACL) was administered to assess tension arousal (TA) and energy arousal (EA) using tiredness (Ti), energetic (E), tension (Te), and calmness (C) subscale scores. Salivary samples were collected via synthetic swab placed under the tongue 1 hour before, and 30 minutes after each match. Enzyme-linked immunosorbent assay (ELISA) was used to analyze salivary samples for cortisol. Passing performance was defined as percentage of total attempted passes received by a teammate.

**RESULTS:** Pre-match subscale scores (out of 4, [mean, ±SD]) for the five competitions were: Ti: 1.9±0.8, 1.7±0.9, 1.6±0.6, 1.6±0.8, 1.4±0.5, respectively; E: 2.9±0.6, 3.1±0.7, 3.2±0.4, 3.0±0.6, 3.0±0.6, resp.; Te: 1.7±0.5, 2.1±0.5, 1.9±0.4, 1.7±0.5, 1.7±0.5, resp.; C: 2.1±0.5, 2.0±0.5, 2.0±0.4, 2.0±0.5, 1.8±0.6, resp. Passing performance for the five competitions was 73.6±14.1%, 81.6±9.6%, 79.1±8.6%, 74.6±8.8%, 76.6±12.1%, resp. ( $p > 0.05$ ). Collapsed across matches, Ti and C scores demonstrated negative associations approaching significance with passing performance (both  $p = 0.06$ ,  $r = -0.28$ ); E score was positively associated with passing performance ( $p = 0.04$ ,  $r = 0.30$ ). Collapsed across matches, post-match cortisol was significantly greater than baseline-predicted-values ( $p = 0.03$ ). Percent change in cortisol pre- to post-match in the first match was associated with E score ( $p = 0.04$ ,  $r = 0.72$ ).

**CONCLUSIONS:** Higher energy-arousal states were associated with improvements in passing performance. Cortisol response may be mediated by energy arousal. Future investigations should examine mediating factors of pre-match arousal states.

**813** Board #47 May 29 2:00 PM - 3:30 PM  
**Relative Age Effects In Men's Collegiate Soccer Are Influenced By Nationality, Position, Class, And Success**

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 (No relevant relationships reported)

Relative age effects (RAEs) refer to an unequal birth-date distribution within cohort of individuals, typically due to selection bias. RAEs have been shown to exist in sports, specifically youth soccer and elite professional soccer. However, no study has assessed the prevalence of RAEs at the collegiate level. **PURPOSE:** To evaluate the existence of RAEs in Division I Men's collegiate soccer. Additionally, the study assessed the impact of nationality, position, class, and post-season tournament qualification on the prevalence of RAEs. **METHODS:** Birth-dates from Division I Men's collegiate soccer athletes ( $n=4,082$ ) from the 2017-2018 season were categorized into calendar quarters (CQ1: January-March; CQ2: April-June; CQ3: July-September; and CQ4: October-December) and scholastic quarters (SQ1: September-November; SQ2: December-February; SQ3: March-May; and SQ4: June-August). All athlete birth-date distributions were compared with the expected birth-date distributions for the United States. All data were assessed using  $\chi^2$  goodness of fit tests. **RESULTS:** International-born athletes (INT) displayed a significant ( $p < 0.001$ ) difference in birth-date distribution when assessed with calendar quarters, with an over-representation in CQ1 (31.2±2.8%) and an under-representation in CQ4 (20.0±2.4%). However, American-born athletes (USA) showed a significant difference ( $p < 0.001$ ) in birth-date distribution when assessed with scholastic quarters, with over-representation in SQ1 (27.6±1.6%) and an under-representation in SQ4 (23.0±1.5%). Furthermore, INT showed significant ( $p \leq 0.001$ ) RAEs for midfielders and defenders, while USA showed significant RAEs midfielders ( $p=0.009$ ) and goalkeepers ( $p=0.004$ ). In terms of class, INT had significant ( $p \leq 0.045$ ) RAEs for all classes, while USA had significant RAEs only for freshmen ( $p=0.001$ ) and sophomores ( $p=0.007$ ). All INT had significant ( $p \leq 0.003$ ) RAEs regardless of tournament qualification; however, USA had significant RAEs only for non-tournament teams ( $p < 0.001$ ). **CONCLUSION:** Significant RAEs exist in Division I Men's collegiate soccer; however, the presence of RAEs are influenced by nationality, position, class, and on-field team success. Coaches should be aware of RAEs during the recruitment process to avoid potential selection bias.

**814** Board #48 May 29 2:00 PM - 3:30 PM  
**Influence of Thresholds on GPS Speed Zones and Sprint Determination in Female Collegiate Soccer Players**

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 (No relevant relationships reported)

Use of team sport global positioning system (GPS) to track player movements and determine training load has expanded recently. Following training sessions or games, player velocity is categorized into discrete zones utilizing velocity thresholds (VT).

VT are typically pre-determined by the software provider or modified from previous reports. Currently there is no universally accepted standard for VT in collegiate women's soccer players.

**PURPOSE:** To determine the influence that VT individualization based on maximum speed testing (MST) has on distance covered in speed zones and sprint determination. **METHODS:** Twelve collegiate female soccer players (19.6 ± 0.9 yo, 61.0 ± 6.5 kg, 1.63 ± 0.05m) were recruited and participated. Maximal velocity (MV) was determined via MST on a 37-meter runway with electronic timing gates. GPS data (10Hz) from five games was processed in a custom written Matlab script to determine distance covered in five velocity zones (Z1-5) and total number of sprints completed. The following two sets of VTs were implemented: (1) manufacturer supplied (MS) (0.83, 1.94, 3.06, 4.17, and 5.28 m/s), (2) player specific (PS) (11.8, 27.7, 43.6, 59.4, 75.2 %MV). Paired samples t-tests were conducted to determine significance ( $p \leq 0.05$ ).

**RESULTS:** There were no significant differences for distance covered in any of the five velocity zones when using either MS or PS velocity thresholds (Z1: MS 234.1±95.6m, PS 235.0±103.7m,  $p=0.88$ ) (Z2: MS 1509.4±442.8m, PS 1490.2±472.2m,  $p=0.18$ ) (Z3: MS 1572.3±410.9m, PS 1557.7±379.1m,  $p=0.56$ ) (Z4: MS 1373.2±343.6m, PS 1380.0±367.7m,  $p=0.58$ ) (Z5: MS 260.4±141.1m, PS 274.7±156.6m,  $p=0.42$ ). Number of sprints determined from MS (32.2±14.6) was not significantly different from PS (35.05±17.9) ( $p=0.18$ ).

**CONCLUSIONS:** Distance covered in speed zones and sprint determination from GPS data was not significantly different when using an absolute scale (MS) versus a relative scale (PS) determined from MST. Although aggregate team data did not significantly differ between methods, sport scientists should remain cautious when utilizing an absolute scale. Analysis of individual player differences between methods yielded overestimations >250m for Z5 and an overestimation in the number of sprints completed by >30 for the fastest player when using an absolute scale.

**815** Board #49 May 29 2:00 PM - 3:30 PM  
**Comparison of Performance Measures Between Starters Vs Non-starters in a Division III Women's Soccer Team**

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**INTRODUCTION:** It is widely known that there are physical and physiological differences between members of a collegiate soccer team but less is known regarding the magnitude of those differences between starters (S) and non-starters (NS). Previous research between S and NS players at the NCAA Division I level did not elucidate any differences (Risso et al., 2017), however this might not be the case at other NCAA competition levels. **PURPOSE:** To compare performance measures of S and NS of a NCAA Division III female soccer team. **METHODS:** Performance measures between S and NS of a Division III female collegiate soccer team ( $n=22$ ) were assessed. Data was collected pre-season and consisted of descriptive physical measures (age, height, weight, body fat percentage, fat mass, lean mass) and performance measures (vertical jump, standing broad jump, triple hop, 30-m sprint). All data were analyzed utilizing independent t-tests with significance set at  $p < 0.05$ . **RESULTS:** Findings show that there were no statistical differences between S and NS in any of the descriptive physical measures. Performance measures demonstrated statistically significant differences in vertical jump (S 0.38±0.06 m vs NS 0.31±0.05 m ( $p=0.01$ )); standing broad jump (S 1.78±0.16 m vs NS 1.58±0.17 m ( $p=0.00$ )); standing broad jump right foot (S 1.46±0.14 m vs NS 1.23±0.17 m ( $p=0.00$ )); triple hop left foot (S 4.79±0.45 m vs NS 4.37±0.48 m ( $p=0.04$ )); triple hop right foot (S 4.94±0.48 m vs NS 4.25±0.41 m ( $p=0.00$ )); and change of direction left foot (S 2.64±0.14 sec vs NS 2.77±0.11 sec ( $p=0.04$ )). There were no differences observed in the 30-m sprint times or any of the intervals (0-5, 0-10, or 0-30 m). **CONCLUSION:** In the current study, S and NS did display significant differences in a number of performance measures. Due to these differences, substitutions could have a major impact on team performance; therefore, training considerations may be warranted between S and NS.

**816** Board #50 May 29 2:00 PM - 3:30 PM  
**Correlation between Sprint Tests and Agility 505 Test and Ktest in Elite Young Soccer Players**

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Agility, acceleration, change of direction (COD), deceleration, and sprinting are critical technical skills in soccer. The ability to sprint and quickly change direction are determinants of performance in a soccer game. Sprint performance relative to a new Agility K-test and 505 tests were examined. **PURPOSE:** To examine the relationship between the sprint and agility tests in elite young soccer players. **METHODS:** Elite

Czech young male soccer players (n=29, age=19.5±0.4yrs) volunteered for this study. The KT consisted of the subjects running at maximum speed between cones positioned in a “K” pattern on a field with non-slip running surface. The subjects started and ended running at the intersection of the “K” pattern with two conditions: touching a photocell with the foot (KT\_foot) or a contact switch placed on the top of each cone with the hand (KT\_hand). The 505 COD test allowed subjects a “flying start” with a 10 m run-up before crossing the timing gates, a five-meter sprint, turn 180° either right or left and a final five-meter sprint. Linear sprinting was also tested with subjects sprinting 5 m (S5) and 10 m (S10) from a static position. The subjects performed two trials of each test, and the time of test execution was measured in seconds. Pearson correlation coefficient test was used to correlate two dependent variables, and independent t-test was used to test differences between KT\_hand and KT\_foot. P<.05. **RESULTS:** The correlation tests between dependent variables showed weak to moderate correlations. Specifically, 505\_R vs S5=.45, p<.05; 505\_R vs S10=.49, p<.01; 505\_L vs S5=.11, NS; 505\_L vs S10=.11, NS; KT\_foot vs S5=.34, NS; KT\_foot vs S10=.32, NS; KT\_hand vs S5=.30, NS; KT\_hand vs S10=.41, p<.05. The association between KT\_foot and KT\_hand=.18, NS. T-test showed the significance, t(56)=17.48, p<.01. **CONCLUSION:** Specific “movement strategy” may exist in 505 COD tests due to asymmetries that may exist from the one-side dominant nature of the participants. However, due to multiple direction tested, KT-hand coordination “eye-hand” is faster and a more natural motor pattern than KT-foot. The speed variables exhibited significant heterogeneity. Speed and agility are not dependent; therefore, each component of speed must be considered independently when designing training programs for young soccer athletes.

**817** Board #51 May 29 2:00 PM - 3:30 PM  
**Tensiomyographic And Sprint Assessments Following Different Warmup Protocols In Collegiate Male Soccer Athletes**  
 Chad H. Herring, Michael J. Redd, Tristan M. Starling-Smith, Jeffrey R. Stout, David H. Fukuda. *University of Central Florida, Orlando, FL.*  
*(No relevant relationships reported)*

Tensiomyography (TMG) has been shown to be a non-invasive technique to assess the contractile properties of skeletal muscle which may have application in assessing the effectiveness of warm-up procedures prior to training and athletic competition. **Purpose:** The purpose of this study was to evaluate the effects of three different warm-up protocols on TMG variables and sprint performance in collegiate male soccer athletes. **Methods:** Fifteen collegiate male soccer athletes (age = 20.1±1.3y, height = 176.6±6.9cm, body mass = 78.2±7.8kg, body fat percentage = 12.9±3.6) participated in the study. The three testing days consisted of: pre- and post-TMG assessments; warm-up protocol [dynamic (DYN); plyometrics (PLY); and passing patterns (SOC)]; and two 20-m sprints. Pre- and post-TMG assessments were completed for the biceps femoris (BF) and rectus femoris (RF) of both legs for all participants. The DYN warm-up protocol consisted of a six-minute jog followed by nine minutes of dynamic stretching. The PLY warm-up protocol consisted of a six-minute jog followed by nine minutes of plyometric exercises. The PAS consisted of a five-minute jog followed by a passing pattern drill typically used in advanced soccer athletes termed the “Rondo.” Repeated measures ANOVAs (condition x leg x time) were used to evaluate muscle displacement (Dm) and contraction time (Tc) in the BF and RF. A repeated measures ANOVA was used to evaluate the fastest of the two 20-m sprint times between conditions. **Results:** Results showed no significant interactions for Dm (BF: 2.851 to 3.508mm; RF: 6.793 to 8.253mm) or Tc (BF: 20.04 to 24.00ms; RF: 26.87 to 29.36ms); however, a main effect for time (p=0.035) was found for BF Tc with a significant decrease from pre- (22.24±9.09ms) to post-warmup (20.47±5.01ms). Significant differences (p<0.05) between conditions for 20-m sprint performance were also noted (DYN: 2.76±0.27 s; PLY: 2.64±0.13s; SOC: 2.62±0.15s). **Conclusion:** In collegiate male athletes, the warm-up protocols did not appear to have differential effects on specific TMG variables, while differences in sprint performance were seen. The warm-up procedures decreased Tc as evaluated by TMG; however, further research is needed to examine the influence of this change on performance.

**818** Board #52 May 29 2:00 PM - 3:30 PM  
**Effect Of Excentric Training On Balance And Explosive Strength In Women University Soccer Players**  
 Diana A. Camargo Rojas, John Jarior Rincón Gómez, DANIEL FELIPE URREGO VILLABÓN, LEIDY SOFIA MOLINA RODRIGUEZ, Silvia Lucia Lara Gomez. *Universidad Nacional de Colombia - Bogotá, Bogota, Colombia.*  
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**PURPOSE:** Women’s football has begun to be considered as a potential sport thanks to the performance of sportswomen. For the prevention of injury, the eccentric training appears as part of sports training programs. However, preventive programs do not recognize the characteristics of women, this being the object of this study. Objective.

Determine the effects of an eccentric training on the balance and explosive strength in female soccer players from two universities in Bogotá, Colombia. **METHODS:** Randomized controlled trial, which evaluated the explosive force with the Sargent test and the balance with the Star Excursion Balance Test (SEBT) with the participation of 19 university athletes. The players were randomly distributed among the control group (n = 9) that made the protocol FIFA 11+ and experimental group (n = 10) that made the eccentric exercise protocol. Statistical analysis was performed with SPSS, using comparative statistics between groups like the Student’s T test for related samples. **RESULTS:** Significant changes are shown for the balance variables (p ≤ 0.05), in 15 of the 16 directions, and significant changes in the explosive force (p ≤ 0.05; p = 0.000) of athletes who carried out the training eccentric after 4 weeks of intervention. For the FIFA 11+ group only significant changes were observed (p ≤ 0.05) in 3 of the 16 directions of the SEBT and there were no changes in the Sargent test (p ≥ 0.05, p = 0.141). Therefore, it is verified that the intervention protocol of eccentric training has significant effects on the explosive force, in four weeks of intervention. **CONCLUSIONS:** This study provides evidence on the use of eccentric protocols in amateur soccer players, showing significant changes in the balance and explosive strength, after 4 weeks of training, giving sustenance to introduce eccentric exercises in warm-up programs and injury prevention.

**B-56** Exercise is Medicine®/Poster - EIM - The Elderly and Their Health Problems  
 Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

**819** Board #53 May 29 3:30 PM - 5:00 PM  
**Physical, Cognitive and Dietary Characteristics of Older Women with Declines in Balance and Walking Ability**  
 Yasuo KIMURA<sup>1</sup>, Mamoru Hisatomi<sup>1</sup>, Kazuko Ohki<sup>2</sup>, Junko Kawai<sup>3</sup>, Toshinobu Ikegami<sup>4</sup>, Mieko Shimada<sup>5</sup>, Nobuko kay Hongu, FACSM<sup>6</sup>. <sup>1</sup>*Inst. Fitness & Health Sciences, Toshima, Tokyo, Japan.* <sup>2</sup>*Sugiyama Jogakuenn Univ., Nagoya, Japan.* <sup>3</sup>*Sugiyama Jogakuen Univ., Nagoya, Japan.* <sup>4</sup>*Saga Univ., Saga, Japan.* <sup>5</sup>*Chiba Prefectural Univ. of Health Sciences, Chiba, Japan.* <sup>6</sup>*The University of Arizona, Tucson, AZ 85721-0038, AZ.* (Sponsor: Nobuko Kay Hongu, FACSM)  
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In 2006, new category of motor disorders was established: musculoskeletal ambulation disability symptom complex (MADS). MADS is defined as an increased rise of falls and isolation due to an age-related decline in balance and walking ability. **PURPOSE:** To examine physical, mental and dietary functions of older community-dwellers using balance assessment, physical, and cognitive function tools, and eating habit questionnaire and understand the MADS in older women. **METHODS:** Eighty-six women aged 65 years and over (mean age 71+3 yrs.) participated in this study. The participants completed a demographic questionnaire, one-leg standing time with eyes open (OLS) and timed up-and-go test (TUG). Then, they were divided into two groups according to OLS: G1) longer than 15 sec. (n=61,) and G2) less than 15 sec. (n=25). Following items were measured: hand-grip strength, chair-stand, functional reach, gait speed as physical function, Mini-Mental State Examination (MMSE) and Trail Making Test-A (TMT-A) as cognitive function, and brief-type self-administered diet history questionnaire (BDHQ) as examining eating habits. **RESULTS:** The average time of OLS was significantly different in G1 and G2 (72.7+58.0 and 7.6+ 3.9 sec., p<0.01). Age was significantly different in G1 and G2 (70.2+2.5 vs. 73.2+ 4.4 yrs., p<0.05). The results show that maximal gate speed and TUG was significantly lower in G1 than G2 (1.73+0.24 vs. 1.87+0.28 m/sec., p<0.01) and (6.8+1.1 vs. 7.5+1.5 sec., p<0.01). BDHQ revealed that the consumption of marine products (34.4+43.3 vs. 5.0+2.5 g, p<0.01) and cooked fish (25.7+30.4 vs. 5.6+3.5 g, p<0.01) were significantly higher in G1 than G2. Older adults without MADS consumed more marine products and cooked fish. In ANCOVA adjusting for the age, only TMT-A was significantly different in G1 (86.2+25.2 sec) and G2 (98.4+28.5 sec.), p<0.01. MADS may affect the TMT-A in the older women living in Japan. **CONCLUSIONS:** These results suggest that decline in physical, dietary and cognitive functions may be associated with MADS in older women.

820 Board #54 May 29 3:30 PM - 5:00 PM

**The Effects Of Exercise Training To Frailty Patient During Post-acute Care Hospitalization**Yu-Tsai Tu<sup>1</sup>, Mu- Jung Kao<sup>1</sup>, Chin-Shan Ho<sup>2</sup>. <sup>1</sup>TAIPEI CITY HOSPITAL, TAIPEI, Taiwan. <sup>2</sup>National Taiwan Sport University, Taoyuan, Taiwan.

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In Taiwan, frailty patient can receive post-acute rehabilitative care in hospital after they leave acute care hospital. The post-acute care program is proposed by the Ministry of Health and Welfare in Taiwan for functional recovery of the frailty patient. The post-acute care program including strengthening, flexibility, cardiopulmonary, and balance exercise. **PURPOSE:** To evaluate the functional recovery of the frailty patient in in Taiwan with a two-weeks of regular exercise training. **METHODS:** Twelve frailty elderly (Age: 83.25±5.5 years of age) just leave acute medical care were included in this study. The patient must have one of the underlying diseases include dementia, chronic kidney disease, parkinsonism, and Chronic Obstructive Pulmonary Disease. The therapeutic interventions were regular exercise training including strengthening, flexibility, cardiopulmonary, and balance exercise for two weeks. Before and after intervention, Functional outcome were evaluated. Data collection from multiple variables was conducted using questionnaire and examination including Barthel index, IADL, Clinical Frailty scale, Confusion Assessment Method, and Mini Nutritional Assessment-Short Form. **RESULTS:** The result shows significant improvement in Barthel index, Clinical Frailty scale, and Mini Nutritional Assessment-Short Form ( $p < .05$ ). Among other tests, there is no significant difference. **CONCLUSION:** Two-week exercise training program can improve functional outcome of frailty patient during post-acute care.

821 Board #55 May 29 3:30 PM - 5:00 PM

**Self-reported Exercise Behaviour Can Differentiate Cardio-metabolic Risks In Young, Middle-aged And Older Healthy Adults**Chin L. Lim<sup>1</sup>, Kenneth K.C. Ng<sup>2</sup>, Frankie H.Y. Tan<sup>3</sup>, David J. Stensel<sup>4</sup>, Margaret M.C. Yap<sup>1</sup>, Shuen Y. Lee<sup>1</sup>, Kai D. Fam<sup>1</sup>, Kar L. Chia<sup>1</sup>, Liang Zhong<sup>5</sup>, Stephen F. Burns<sup>6</sup>. <sup>1</sup>Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore. <sup>2</sup>Novena Heart Centre, Singapore, Singapore. <sup>3</sup>Singapore Sports Institute, Singapore, Singapore. <sup>4</sup>Loughborough University, Loughborough, United Kingdom. <sup>5</sup>National Heart Research Institute of Singapore, Singapore, Singapore. <sup>6</sup>National Institute of Education, Nanyang Technological University, Singapore, Singapore.

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**Purpose.** The study aimed to elucidate the effects of age and self-reported exercise behaviour on metabolic risks in clinically healthy participants according to age and exercise behaviour groups (Table 1). The participants were from the Exercise for Life Across Asia (ELIXA) cohort. Active participants reported  $\geq 3 \times 45$  min of moderate to high intensity exercise weekly and sedentary participants reported  $< 1 \times 30$  min of moderate intensity exercise weekly in the last 5 years. **Methods.** The participants performed an oral glucose tolerance test (OGTT), with fasted blood (13 mL) collected at baseline, followed by ingesting 75 g of glucose in a solution, and blood collections at 0.5 h intervals until 2 h. **Results.** Age and exercise behaviour had no significant effects on body mass index, blood pressure, and waist-hip ratio, and fasted blood glucose and lipids (total cholesterol, triglycerides, and high- and low-density lipoproteins), and plasma insulin and non-fasted plasma pro-inflammatory cytokine concentrations. However, the magnitude of increases in plasma insulin and blood glucose concentrations after glucose ingestion were significantly higher in the sedentary than in the active groups over the 2 h OGTT, when all the age groups were combined and in the “Young” group (Table 2). **Conclusion.** In a clinically healthy population, regular exercise can lower metabolic risks, which can increase from young age due to sedentary lifestyle.

**Table 1 Sample sizes in age and exercise behaviour groups**

	Young (18 – 39 Yr old)	Middle-aged (40 – 59 Yr Old)	Older-aged ( $\geq 60$ Yr Old)
Active	YA, n = 33	MA, n = 36	OA, n = 14
Sedentary	YS, n = 28	MS, n = 25	OS, n = 11

Table 2 Mean (SEM) for blood glucose and plasma insulin concentrations at 2-hour time point of the oral glucose tolerance test

Groups	Blood Glucose (mmol/L)	Plasma Insulin (mu/L)
Combined (Sedentary)	6.0 (0.2)**	48.8 (4.6)***
Combined (Active)	5.3 (0.1)	26.8 (2.8)
YS	5.7 (0.3)*	45.6 (5.7)*
YA	4.7 (0.2)	25.5 (4.1)
MS	6.0 (0.4)	38.1 (8.8)
MA	5.6 (0.2)	22.6 (4.0)
OS	7.5 (1.0)	60.9 (11.6)
OA	5.9 (0.4)	43.2 (8.0)

Note: \* =  $p < 0.05$ , \*\* =  $p < 0.01$ , and \*\*\* =  $p < 0.001$  between Active and Sedentary groups

822 Board #56 May 29 3:30 PM - 5:00 PM

**Walking People - Aruku-hito, Community-based Group Exercise Program For Older Adults: Expanding The Reach**Tatuo Doi<sup>1</sup>, Kazuhira Onishi<sup>2</sup>, Shinji Sato<sup>3</sup>, Atuko Fujii<sup>4</sup>, Nobuko Hongu, FACSM<sup>5</sup>. <sup>1</sup>Dynamic Sport Medicine Research Institute, Osaka, Japan. <sup>2</sup>Oval Heart, Japan, Tokyo, Japan. <sup>3</sup>Osaka Sangyo University, Daito-shi, Japan. <sup>4</sup>Izumisano City Office, Izumisano, Japan. <sup>5</sup>The University of Arizona, Tucson, AZ.

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**PURPOSE:** Regular physical activity helps older adults improve their health and enhances overall quality of life. The aim of this study was to determine how the community-based, group exercise program, “Walking People – Aruku-hito” has offered and continues to expand its reach through training health educators for the program in various cities in Japan. **MEHOTDS:** This presentation highlights “Walking People – Aruku-hito” program that was started helping older adults who were the victims of Tohoku earthquake and tsunami that created over 300,000 refugees in Tohoku/Northeast region, Japan in 2011. The contents and resources for reaching older adults, maintaining and expanding the “Walking People – Aruku-hito” program will be presented. **RESULTS:** The “Walking People – Aruku-hito” program started helping sedentary older adults who had limited social activities in a living temporary apartment complex after the loss of their houses. The program teams visited about 400 community-gathering centers, where people who had deeply affected by the Tohoku earthquake and tsunami met regularly. From April 2012 to April 2018, more than 10,000 older adults (65 to 96 years) participated in a supervised workshop. The workshop emphasized 1) benefits of walking, 2) stress-free walking, 3) basic conditionings (strength training, flexibility, balance) for walking, and 4) benefits of habitual daily walking. This tailored physical activity workshop was developed by the joint efforts of community agencies and academic partners. Because of the popularity of the “Walking People – Aruku-hito” program, the workshops have been offered in several regions of Japan with the support of Japan Medical Association and Ministry of Health, Labor and Welfare. Originally, instructors for the program were either certified exercise instructors, nurse practitioners, or physical therapists. Now, the number of instructors is increasing using the Train-the-Trainer approach; the instructors of the program train well-fit older participants who have been helping other participants in the program. **CONCLUSIONS:** The “Walking People – Aruku-hito” program started a community-based program designed for older adults’ specific needs and challenges. With the new supports and existing community resources, the program will be disseminated widely in Japan.

823 Board #57 May 29 3:30 PM - 5:00 PM

**Effects Of Social Network Incentives And Financial Incentives On Physical Activity Among Elderly Women**Ryo Yamashita<sup>1</sup>, Shinji Sato<sup>2</sup>, Ryoichi Akase<sup>3</sup>, Tatsuo Doi<sup>4</sup>, Shigeki Tsuzuku<sup>5</sup>, Toyohiko Yokoi<sup>2</sup>, Shingo Otsuki<sup>2</sup>, Eisaku Harada<sup>1</sup>. <sup>1</sup>Kumamoto Institute of Total Fitness, Kumamoto, Japan. <sup>2</sup>Osaka Sangyo University, Osaka, Japan. <sup>3</sup>Kumamoto Kinoh Hospital, Kumamoto, Japan. <sup>4</sup>Dynamic Sports Medicine Institute, Osaka, Japan. <sup>5</sup>Kumamoto University, Kumamoto, Japan.

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We know that an increase in physical activity improves health. To achieve a behavior change of physical activity, previous studies have used financial incentives. However,

the benefit of the incentive is lost when the intervention ends. Thus, we focused on social network incentives that leveraging the power of peer pressure to regulate behavior.

**PURPOSE:** The main goal is to ascertain whether combining financial incentives with social network incentives can lead to changes in physical activity (steps/day) during and after the intervention.

**METHODS:** We conducted a three month, randomized controlled study using pedometers. The effects of incentives on physical activity maintenance were measured six months post-intervention. The subjects were 39 elderly women over 65 years of age, residing in Kumamoto, Japan. The financial incentive (FI) group received a payment ranging from US\$4.40 to US\$6.20 per month depending on the number of steps taken during the intervention. For the other group, we provided a social network incentive (SNI) in addition to the financial incentive. The SNI+FI group walked in three people to use the power of peer pressure.

**RESULTS:** A two-way ANOVA revealed that in terms of physical activity, there was a statistically significant interaction between group and time ( $p=0.017$ ). The FI group showed no statistically significant improvement in physical activity during the observation period.

**CONCLUSIONS:** Our results suggest that combining financial incentives and social network incentives is more effective than financial incentives alone. Especially, the effect can continue in post-intervention.

**824 Board #58 May 29 3:30 PM - 5:00 PM**  
**Does High-Cadence Cycling Improve Emotional Recognition in Individuals With Parkinson's Disease?**  
 Bryan Dowdell<sup>1</sup>, Sara Harper<sup>2</sup>, Alena Varner<sup>1</sup>, Jin Hyun Kim<sup>1</sup>, Brandon Pollock<sup>3</sup>, Angela Ridgel, FACSM<sup>1</sup>. <sup>1</sup>*Kent State University, Kent, OH.* <sup>2</sup>*The University of Alabama at Birmingham, Birmingham, AL.* <sup>3</sup>*Walsh University, North Canton, OH.* (Sponsor: Angela Ridgel, Ph.D, FACSM)  
 (No relevant relationships reported)

Parkinson's disease (PD) is a progressive neurodegenerative disease that can lead to cognitive dysfunction including deficits in emotional recognition, which is the ability to identify different facial expressions. This deficit has been shown to lead to difficulties in social interaction and communication. High cadence cycling is a unique rehabilitation modality that has been shown to improve motor function in PD, but it is not known how this modality alters cognition. **PURPOSE:** To examine if three bouts of high-cadence cycling improved emotional recognition in individuals with PD. **METHODS:** Individuals with PD (N=20) completed three sessions of high cadence cycling (48 hours apart), on a custom motorized stationary cycle, consisting of a 5-minute warm-up at 50 revolutions per minute (rpm), 30 minutes of high cadence cycling between 75-85 rpm, and a 5-minute cool down. Emotional recognition was assessed using a computerized cognitive assessment battery at baseline and after the three cycling sessions. Individuals with PD in the control group (N=15) did not cycle and just underwent baseline and post testing. The percentage of accurately identified emotions and the average reaction time to correctly select an emotion (emotion bias) was used for the analysis of the overall emotion domain. Z-scores were used for the analysis. Independent samples t-tests were run for the change scores between the intervention and control group. **RESULTS:** Both groups displayed negative z-scores representing an emotional recognition deficit. There was no significant difference between the cycling and control group in the overall emotion domain ( $p=0.76$ ). Cycling resulted in a z-score improvement in the emotion domain by 0.22 while the control group improved 0.14. Cycling did significantly improve "disgust" emotion accuracy compared to the control group ( $p=0.03$ ). **CONCLUSIONS:** Three bouts of high-cadence cycling specifically improved "disgust" emotional recognition compared to the control. However, there was no significant difference between groups in the overall emotion domain. While high-cadence cycling might be a valuable rehabilitation modality for improving motor function in individuals with PD, the efficacy for improving emotional recognition and potentially social interaction is unclear.

**825 Board #59 May 29 3:30 PM - 5:00 PM**  
**Functional Capability, Flexibility, Strength And Quality Of Life In Sedentary Or Trained Elderly Women**  
 OTÁVIO A S MACHADO<sup>1</sup>, BRUNA VIEIRA DE SOUZA<sup>1</sup>, FÁBIO GIANOLLA<sup>1</sup>, LUIZ F. KILLIAN<sup>1</sup>, GIOVANNA A C MACHADO<sup>1</sup>, WALDECIR P. LIMA<sup>2</sup>, RENATA GORJÃO<sup>3</sup>. <sup>1</sup>*FEFISO, SOROCABA, Brazil.* <sup>2</sup>*IFSP, SAO PAULO, Brazil.* <sup>3</sup>*UNICSUL, SAO PAULO, Brazil.*  
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Throughout the last decades the elderly population has been increasing around the world. During the aging process, all physiological systems undergo significant functional changes and sedentary lifestyle has an elevated correlation with this imbalance. The inactivity increases the rate of chronic diseases development. Although any type or amount of physical exercise may discontinue the cellular aging processes,

regular physical exercise can attenuate the decline in physical and functional capabilities observed in elderly. Currently, some of the most encouraged activities in gyms are resistance exercise, weight-bearing training, and hydrogymnastics.

**PURPOSE:** The main objective of this study was to compare the effects of the above-mentioned exercises regarding muscle strength, flexibility, functional capability and quality of life in elderly women. **METHODS:** We evaluated 36 elderly women (age 70.17±5.18 years) separated in four groups in agreement with their physical activity practice: 9 Sedentary (S); 9 Hydrogymnastics (H); 9 Weight-bearing Training (WB); 9 Resistance Training (RT). This was a transversal study, and all exercise practitioners had at least 3 months with 3 days a week of frequency. **RESULTS:** All exercised groups showed a significant difference ( $p<0.05$ ) in relation to S in all measured variables. Among the exercised groups, the RT had greater strength and better functional capability. **CONCLUSION:** Regular physical exercise is important to reduce the deleterious effects of sedentary lifestyle in muscle strength, flexibility, functional capability and quality of life and among the exercises evaluated, RT showed to be a key component of a training program for elderly women.

**826 Board #60 May 29 3:30 PM - 5:00 PM**  
**Effect Of Acute Specific Exercise And Wuqinxi On Hand Function Of Patients With Parkinson's Disease**  
 Tian Wang, Guiping Xiao, Kunchen Jie, Zhenlan Li, Zhen Wang, Jie Zhuang. *Shanghai University of Sport, Shanghai, China.*  
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**PURPOSE:** The aim of the study was to study the improvement of hand movement speed and flexibility in patients with Parkinson's Disease (PD) by an acute exercise of specific exercise and WuQinXi. **METHODS:** This study selected 45 patients with PD (22 males and 23 females) from the PD patients Training Camp of Shanghai University of Sport, and randomly divided 22 patients(11 males and 11 females),age67.17±5.88into Wu Qin Xi intervention group and 23 patients in the specific exercise intervention group(11 males, 12 females),age65.52±5.18. According to the patient's Hoehn-Yahr stage, Wu Qin Xi and specific exercise were divided into three groups: 1-1.5 group, 2-2.5 group, and ≥3 group. Two groups of subjects were given 60 minutes' specific exercise and Wu Qin Xi intervention training. The specific exercise is consisted with several different health-care Qigong, which specifically target at the patients with Parkinson's Disease. The Purdue pegboard test, which has good predictive and concurrent validity. The test data were analyzed by SPSS 24.0. The paired sample t test was used for the pre- test and post-test in the group. p value of <0.05 was adopted. **RESULTS:** After the intervention, the specific exercise group had significantly improved the three scores of Dominant hand, the Both hand and the assembly subtest ( $P<0.05$ ), especially for the patients whose Hoehn-Yahr stage from 1-1.5, these three scores were improved. The patients whose Hoehn-Yahr stage from 2-2.5 only improved in the assembly subtest, and the patients whose Hoehn-Yahr stage ≥3 phase did not significantly increase in either four scores ( $P>0.05$ ). After the intervention, the Wu Qin Xi group showed significant improvement in the Dominant hand, Nondominant hand and assembly subtest ( $P<0.05$ ), especially for the patients whose Hoehn-Yahr stage from 1-1.5, these three scores were improved. There was no significant increase in the four scores in patients whose Hoehn-Yahr stage from 2-2.5 and ≥3 ( $P>0.05$ ). **CONCLUSIONS:** The acute exercise intervention of specific exercise and Wu Qin Xi can improve the speed and flexibility of hand movement in Parkinson's patients. The effect of specific exercise is more obvious for patients whose Hoehn-Yahr stage from 1-1.5.

**827 Board #61 May 29 3:30 PM - 5:00 PM**  
**The Role of 'Exercise Is Medicine' in Asia: Perspectives for the Older Adult Population**  
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Asia is home to the largest older adult population in the world, and the proportion of people aged 65 and over is projected to rapidly grow in all Asian countries. Many chronic diseases and conditions are prevalent in older adults, and regular exercise and physical activity can help prevent and manage many of these conditions. A significant component of Asian cultures is the promotion of active lifestyles, where many older adults would have the opportunity to practice exercise for free or at low cost. However, if seniors have a chronic condition and no previous experience with exercise, it is not always easy to start an exercise routine without specialized information and appropriate instruction. Exercise is Medicine (EIM) was created to help seniors with



chronic diseases to incorporate exercise into their everyday lives. **PURPOSE:** Due to the initial development of EIM within Western cultures and traditions, the purpose our work was to examine how best to adapt, implement, and disseminate EIM for the older adult population in Asia. **METHODS:** From April, 2017 to September, 2018 numerous discussions were held between researchers and practitioners from Asian countries who had between 15 to 30 years of experience in the area of aging and physical activity. Additionally, research articles, reports, and web-sites related to EIM were reviewed and analyzed. Finally, interviews were conducted among EIM personnel in Asia. **RESULTS:** The results have been divided into three sections. The first section provides a historical overview of EIM development in Asia. The second presents an assessment of the potential role of EIM for older adults in Asia. The final section provides a blueprint for the development of an extended concept of EIM as a stimulus for further conversations and discussions among the medical, exercise, and health related communities. **CONCLUSION:** EIM has the potential to play an important role in the prevention and management of chronic diseases in Asia, and improving quality of life among Asian seniors.

**828** Board #62 May 29 3:30 PM - 5:00 PM  
**Effect Of Wu Qi Xin Exercise On The Quality Of Life Of Parkinson's Patients**  
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 (No relevant relationships reported)

**PURPOSE:** To determine the effect of 12-wk Wu Qin Xi exercise intervention on the quality of life of Parkinson's patients.  
**METHODS:** 23 Parkinson (PD) patients (12 men and 11 women; age in 65.65±4.82 yr.) were recruited to participate in a 12 wk Wu Qin Xi, a traditional Chinese exercise, intervention in the Pai Training Camp of Shanghai University of Sport, China. Patients' clinical status was assessed with Unified Parkinson's Disease Rating Scale (UPDRS) parts I-III, and Quality of Life - Disease Questionnaire (PDQ-39). The assessments were conducted before and after the intervention group, which included 120-minute Wu Qin Xi exercises, twice a week for 12-wk. The paired sample t test was used for the pre- and post-test difference. **RESULTS:** A statistically significant pre- and post-test difference were found after the 12-wk Wu Qin Xi intervention: UPDRS score decreased by 23% (p=0.01); UPDRS part I score decreased by 28% (p=0.003); part II decreased by 20% (p=0.004); part III decreased by 24% (p=0.036) and PDQ-39 score decreased by 30% (p<0.001). **CONCLUSIONS:** Wu Qin Xi exercise could improve the quality of life of PD patients.

**829** Board #63 May 29 3:30 PM - 5:00 PM  
**Significant Improvement In Dxa Scores Is Observed With Osteoporotic Patients When High Force, Short Duration Stimulus Is Created**  
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**PURPOSE:** Determine if high intensity short duration forces applied to bone results in improved DXA measures. The relationship between bone geometry and mechanical influences on bone suggests that when significant forces are applied to bone, the compression will stimulate an adaptive response, commonly known as Wolff's Law. However traditional exercise as a treatment for osteoporosis has generally not been able to create the forces needed to stimulate bone growth in a safe and effective manner. **METHODS:** Twenty-six women X age 63 with diagnosis of osteoporosis participated in a one-year study using a novel exercise device that allows bone to adapt to significant forces. A subset (9 individuals) were followed for one additional year after the study concluded. Three independent clinics had identical equipment and protocol. Subjects completed a minimum of 48 sessions once a week over the year. DEXA scans were conducted at the same testing location for both pre-and post-assessments. Subjects self-reported weight, weekly minutes of exercise, diet and prescription medications. **RESULTS:** Of the 26 subjects, 16 individuals demonstrated a significant reduction p<.05 (improvement in bone) in their mean DEXA score, while 6 had no significant change and 4 individuals showed a further degradation. Forces required to significantly improve bone were 2 - 10x multiples of body weight. Of those who continued for an additional year, 6 demonstrated additional improvements p<.05 while 3 were not significantly different. **CONCLUSIONS:** These data suggest that a non-pharmacologic exercise solution is available to individuals diagnosed with osteoporosis. Further study is required with larger sample sizes and more diverse demographics. Additional research is needed to validate this approach as a viable and safe strategy for bone reformation.

## B-57 Free Communication/Poster - Aging and Older Adults

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

**830** Board #64 May 29 3:30 PM - 5:00 PM  
**Improving Functional Capacity And Physical Activity Through Education: Four-year Follow-up Of Parqve Study**  
 José M. Rodrigues da Silva<sup>1</sup>, Marcia Uchoa de Rezende<sup>2</sup>, Tânia Carvalho Spada<sup>3</sup>, Lucila da Silva Francisco<sup>4</sup>, Helenilson Pereira dos Santos<sup>4</sup>, Júlia Maria D'Andréa Greve<sup>3</sup>, Emmanuel Gomes Ciolac<sup>1</sup>. <sup>1</sup>Post-graduation Program in Movement Sciences, São Paulo State University - UNESP, Bauru, Brazil. <sup>2</sup>Faculty of Medicine, University of São Paulo, Institute of Orthopedics and Traumatology, São Paulo, Brazil. <sup>3</sup>Faculty of Medicine, University of São Paulo, Institute of Orthopedics and Traumatology, São Paulo, Brazil. <sup>4</sup>Universidade Guarulhos, Guarulhos-SP, Brazil.  
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**PURPOSE:** The objective of the present study was to analyze what changes the long-term recommendation of regular physical exercises could cause in individuals with knee osteoarthritis (KOA) during 4 years of follow-up.  
**METHODS:** Individuals undergoing care for primary KOA (N = 153; age = 67 ± 2) in the public health system were randomly assigned to either an educational (GI; n = 83) or control group (CG; n = 70). The volunteers were asked to respond to the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC™) for the assessment of pain, function, and quality of life. The short version of the International Physical Activity Questionnaire (IPAQ) (validated in the Brazilian population) was used to assess the level of daily physical activity in all volunteers. Functional capacity was evaluated at baseline (pre), and at 24 and 48 months follow-up, and included the sit-and-reach test, 6-min walk test (6MWT), timed up and down stairs test (TUDST), Timed Up and go test (TUGT), and sit and lift five times test (FTSST). **RESULTS:** The Body mass index (BMI) significantly decreased (3.5%) after 24 and 48 months of follow-up in the GI (P <0.05), while a slight increase was observed in the GC. The GI group presented improved (P <0.001) TUGT (27%) and FTSST (36.5%) performance after 48 months of follow-up. The GC did not change during the same period. In the GI, the total WOMAC score fell by 8.0 points, WOMAC pain decreased by 2.5 points, and WOMAC stiffness decreased by 0.5 point, while being higher in the GC (P <0.001). There was also an increase (P <0.001) in the prevalence of "active" (26.6%) and "very active" (30%), as well as a reduction in sedentary prevalence (12.5%) in the GI during follow-up. No significant improvements were observed in the sit-and-reach, TUDST, and TC6' tests in either group. **CONCLUSIONS:** The results suggest that a program promoting regular physical exercise could be an effective tool to improve physical fitness, functional capacity, quality of life, and level of daily physical activity in individuals with KOA, even over a long period.

**831** Board #65 May 29 3:30 PM - 5:00 PM  
**Intergenerational Multicomponent Training Strategy to Improve Cardiovascular Risk Factors and Quality of Life in Elderly**  
 Raquel Silva, Andreia Pizarro, Joana Carvalho. *Faculty of Sport - University of Porto, Porto, Portugal.*  
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 (No relevant relationships reported)

With the aging process, there are several changes in the body composition, a reduction of the lean mass and a progressive increase of the fat mass (FAT%). The percentage of fat mass (FAT%) and arterial stiffness (cPWV) are shown to be risk factors for the development of cardiovascular diseases, but the association between both is not established, especially during aging. Research shows the main benefits of intergenerational programs in the elderly population reflects a better perception of quality-of-life and prevention of cardiovascular diseases. Purpose: The objective of this study was to analyse the effects of a 6-month intergenerational exercise program on body composition, arterial stiffness and quality of life of elderly users of day-care centers. Methods: This is a randomized clinical study with a sample of 37 individuals (27 intervention group- IG and 10 control group-CG) with a mean age of 76.68±9.96 years attending day centers in Porto. Body composition (FAT%) was evaluated by double-energy bone densitometry (DEXA); Arterial stiffness was measured as carotid-femoral pulse wave velocity (cPWV) using the SphygmoCor device (AtCor Medical, Australia). In brief, sequential and consecutive carotid and femoral pressure waves

were registered with parallel electrocardiogram recording and the quality of life was self-reported in the SF-36 questionnaire, with a scale of 0-100, where a higher score indicates a better quality of life. The pre and post intervention differences were analysed using the Kruskal Wallis test. Results: The %FAT had a decrease of  $1.83 \pm 2.33\%$  with in GI (before =  $38.70 \pm 7.62\%$ ; after =  $36.87 \pm 6.92\%$ ) in relation to CG (before =  $39.92.68 \pm 7.82$ ; after  $41.48 \pm 5\%$ ), ( $p = 0.952$ ). The values of cIPWV increased  $7.34 \pm 3.79$  in IG (before =  $39.50 \pm 13.42$  after  $46.84 \pm 12.74$ ) in relation to GC (before  $42.82 \pm 12.96$ ; after  $45.35 \pm 11.14$ ), ( $p = 0.042$ ) Regarding the self-reported quality of life, there were no significant differences ( $p = 0.176$ ) between GI (before =  $39.50 \pm 13.52$  after =  $46.84 \pm 12.74$ ) and the CG ( $42.82 \pm 12.96$  after  $45.35 \pm 11.14$ ). Conclusion: The results show that an integrational exercise program can reduce arterial stiffness in the elderly when compared to older people not involved in an exercise program.

**832** Board #66 May 29 3:30 PM - 5:00 PM  
**Barriers of Being Active: Differences Between Two Generations**

Benedetta Tosi, Martina Rosselli, Gabriele Mascherini, Cristian Petri, Giorgio Galanti, Pietro Amedeo Modesti. *University of Florence, Florence, Italy.*

(No relevant relationships reported)

**PURPOSE:** Physical inactivity and sedentary behaviors are nowadays included among principal risk factors for cardiovascular disease and mortality and have the highest Population Attributable Fraction, especially for women. Regular exercise reduces the risk of cardiovascular events; these evidences led to new guidelines where 150 min/week of moderate physical activity or 75 min/week of intense physical activity (or a combination of both) are recommended. Physical activity is also included in the seven metrics of AHA's definition of Ideal Health. Furthermore, the worldwide prevalence of childhood obesity has increased over the past three decades with a simultaneous decrease of physical activity. The study aimed to investigate the principal perceived barriers to exercise in young and adult populations.

**METHODS:** "Why Not" was a cross-sectional study conducted in 2018 in a high school (87 students,  $19.1 \pm 0.4$  years old) and in the Rectorate of University of Florence (106 adults,  $48.4 \pm 12.2$  years old). Personal anamnesis and information about the amount of weekly physical activity were collected. Barriers to Being Active Quiz (BBAQ), and Mediterranean Diet Score questionnaires were administered. Weight and height were measured according to standardize protocols.

**RESULTS:** Sedentary habits were present in the 35% of adults and 24% of all students enrolled. Lack of time for exercise was the most frequently reported barrier for adults, followed by lack of energy and laziness. These barriers were well represented in young population too, especially in girls (48% lack of energy and laziness, 39% lack of time) compared with boys (25% lack of energy, 14% laziness, 23% lack of time). Surprisingly, fear for injuries was reported only by men. Prevalence of overweight (BMI > 25 kg/m<sup>2</sup>) was 17% and 42% in adults and 4% and 3.9% among students (woman and men respectively). Mean adherence score of Mediterranean diet was  $34 \pm 5$  among adults and  $32 \pm 5$  among students (score range 0-55) without sex differences. **CONCLUSIONS:** Sport medicine physicians should be aware of the barriers that patients face during exercise prescription and be able to contrast them with useful individual strategies. Analysis of young people life-style habits can help finding social strategies to promote healthy behaviors.

**833** Board #67 May 29 3:30 PM - 5:00 PM  
**Optimal Loads for Power in Young and Old Men and Women Using Plate-Loaded Resistance Machines**

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(No relevant relationships reported)

**PURPOSE:** Power affects quality of life and sports performance across age. Plate-loaded machines are the most common equipment used by recreational lifters; however, no studies have determined the optimal loads that maximize power outputs using this equipment. **METHODS:** Fourteen older men ( $69.4 \pm 6.7$  y), 21 older women ( $69.8 \pm 7.9$  y), 24 young men ( $21.0 \pm 2.2$  y) and 22 young women ( $20.7 \pm 1.5$  y) participated in two sessions of strength and power testing. They performed ten different plate-loaded exercises to determine their maximum dynamic strength (1RM) and peak power output (PP). Power was tested at 40, 50, 60, 70 and 80% 1RM using a linear position transducer. PP was expressed relative to the highest power produced (PP<sub>REL</sub>). **RESULTS:** Significant sex x load interactions were seen for all upper body lifts ( $p < .05$ ). Post hoc analyses showed that for multi-joint upper body exercises, men reached their highest PP<sub>REL</sub> at the low end of the loading spectrum (chest press and seated row: 40-60%1RM; shoulder press: 40-70%1RM), while women's highest PP<sub>REL</sub> was at higher loads (50-70%1RM). For single joint upper body exercises, the biceps curl and triceps extension showed no differences in PP<sub>REL</sub> across loads for men, while women's optimal loads were at 50-80%1RM for both exercises. For shoulder press and

biceps curl there were also age x load interactions ( $p < .05$ ). Younger persons reached PP<sub>REL</sub> at 40%1RM and 50-60%1RM, respectively and older persons at 60-70%1RM and 50-80%1RM, respectively. For lower body exercises, leg press, leg curl and hip abduction showed a significant main effect for load ( $p < .033$ ) with optimal load at 60-70%1RM, 50-70%1RM, and 50-60%1RM, respectively. Hip adduction produced significant age x load ( $p < .031$ ) and sex x load ( $p < .034$ ) interactions. 50-70%1RM was optimal for both age groups, but older persons produced significantly higher PP<sub>REL</sub> at 40%1RM. For load x sex, optimal load was 50-70%1RM for both sexes; however, PP<sub>REL</sub> occurred at 70%1RM for men and 50%1RM for women. Analysis for the calf raise showed a significant age x load interaction ( $p < .001$ ) where PP<sub>REL</sub> was 40-70%1RM for young and 50-80%1RM for older participants. **CONCLUSIONS:** Different optimal load ranges are required for individual plate-loaded exercises depending on age and sex. Younger persons and men optimize power at lower loads than older persons and women.

**834** Board #68 May 29 3:30 PM - 5:00 PM  
**Evidence-based Fall Prevention Program. A 5-year Evaluation.**

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(No relevant relationships reported)

Falls among older adults are common, costly, and preventable. Stay Active and Independent for Life (SAIL) is a public-domain evidence-based program that emphasizes on strength and balance to prevent falls in older adults. **PURPOSE:** To evaluate the physical function of older adults participating in the SAIL program over multiple years.

**METHODS:** Data were collected from multiple locations in Washington State that offer the SAIL program. Physical functioning was assessed using the 8-foot up and go test, the 30-second bicep curl test, and the 30-second chair stand test. A total of one hundred and forty-nine participants completed the baseline assessment. One hundred and forty-three individuals completed the test a year after the baseline assessment, but declined in subsequent years. A paired-sample *t*-test was used to evaluate differences in mobility and strength between baseline and the first year of participation in the SAIL program. A repeated-measures ANOVA was used to evaluate differences in functional assessments among years 1 through 5. Significance was set at  $p < 0.05$ .

**RESULTS:** After one year of participation, all functional assessments were significantly different ( $p < 0.01$ ) compared to the baseline measurements. The 8-foot up and go test improved by  $8.3\%$  ( $7.2 \pm 2.9$  vs.  $6.6 \pm 2.3$ ), the 30-second bicep curl test increased by  $7\%$  ( $17.1 \pm 4.9$  vs.  $18.3 \pm 4.9$ ), and the 30-second chair stand test improved by  $12.2\%$  ( $13.9 \pm 5.2$  vs.  $15.6 \pm 5.6$ ). During the five years post baseline, the average time to complete the 8-foot up and go test was less than 7 seconds, but there were no significant ( $p > 0.05$ ) differences among years. The average upper body strength for SAIL participants increased for four years. There was a significant ( $p = 0.04$ ) difference on the number of repetitions completed in 30 seconds between year 3 and year 1 ( $19.8 \pm 5.2$  vs.  $17.8 \pm 4.9$ ). Finally, the average number of chair stands in 30 seconds increased for four years. There was a significantly higher number of repetitions in year 3 compared to year 1 ( $19.1 \pm 7.5$  vs.  $17.1 \pm 6.3$ ;  $p < 0.01$ ) and to year 2 ( $19.1 \pm 7.5$  vs.  $17.6 \pm 7.6$ ;  $p < 0.01$ ).

**CONCLUSIONS:** These results indicate that the SAIL program was successful at maintaining mobility and increasing upper and lower body strength of individuals over 5 years. These results suggest a potential decline in the risk of falling for SAIL participants.

**835** Board #69 May 29 3:30 PM - 5:00 PM  
**Effects Of Exercise Classes And Subsequent Independent Exercise Practice On Physical Fitness In Older Adults**

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(No relevant relationships reported)

**PURPOSE:** This study aimed to clarify the effects of instructor-led exercise classes and subsequent independent exercise practice on older adults' physical fitness levels. **METHODS:** The participants were 19 community-dwelling elderly adults (7 males, 12 females,  $69.4 \pm 3.5$  yrs) who took part in exercise classes under the leadership of an expert instructor, held once a week over 10 weeks. They subsequently performed independent exercise practice following the same schedule for 1 year. The exercise program emphasized aerobic exercises such as walking, muscle strength training for the trunk and limbs, and recreational activities. All the participants completed physical fitness assessments before and after the 10-week instructor-led exercise classes and at the 1-year follow-up. This assessment comprised 12 items designed to evaluate physical fitness levels, including hand-grip strength, sit-up, sitting trunk flexion, standing on one leg with the eyes open, 10-m walking time, 10-m obstacle walk, functional reach, the 30-s chair sit to stand test, the timed up and go test, the 5-second stepping test, whole body reaction time, and the 6-minute walk test. The participants

were instructed to wear the accelerometer on their waistline all day. **RESULTS:** The participation rate of exercise classes and exercise practice was  $90.0 \pm 11.0\%$  and  $76.5 \pm 14.6\%$ , respectively. Significant changes were observed in the 10-m walking time (pre:  $5.80 \pm 1.48$  sec and post:  $4.93 \pm 0.57$  sec,  $p < .05$ ), 10-m obstacle walk (pre:  $4.56 \pm 0.82$  sec and post:  $3.88 \pm 0.66$  sec,  $p < .05$ ), and timed up and go test (pre:  $4.83 \pm 0.59$  sec and post:  $4.33 \pm 0.53$  sec,  $p < .05$ ) performance after completion of the 10-week program. Furthermore, these changes were maintained at the 1-year follow-up. Although no significant change was observed in the 6-minute walk test after the 10-week exercise classes, a significant change was apparent at the follow-up (pre:  $629.9 \pm 51.8$  m and follow-up:  $677.1 \pm 54.7$  m,  $p < .05$ ). **CONCLUSIONS:** Our results clearly indicated that even low-frequency, continuous exercise can help improve and maintain physical fitness. However, probably because the independent exercise practice simply continued the activities of the 10-week exercise program, we observed no further effects by the 1-year follow-up.

**836** Board #70 May 29 3:30 PM - 5:00 PM  
**Acceptance And Feasibility Of Using A Seated Elliptical During Sedentary Behaviors In Older Adults**

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Older adults aged 60+ years are particularly vulnerable to the exposure and negative health consequences related to sedentary behavior (SB). There is limited evidence for the feasibility and effectiveness of SB interventions in older adults. **PURPOSE:** The purpose of this study is to explore the feasibility and acceptability of using a seated elliptical device (SED) to replace SB with a light-intensity physical activity (LPA) in the homes of older adults. **METHODS:** Twenty older adults (mean  $\pm$  SD,  $71.9 \pm 5.3$  years) participated in this feasibility study. Each participant was outfitted with hip-mounted activity monitor and SED in the home for seven days. Participants were randomly assigned to one of four pedaling duration groups (15, 30, 45, and 60 minutes/day) and instructed to accumulate SED pedaling at a self-selected light-intensity during typical SB activities for a minimum of three of the next seven days. A Fisher's exact test was used to test for group differences in pedaling goal adherence and a one-way ANOVA was used to test for linear trends in accumulated pedaling durations across groups. Cohen's  $d$  was performed to estimate effect sizes for displacing SB with SED-based LPA for each group. **RESULTS:** There was 100% adherence across all four pedaling duration groups with no significant difference in total pedaling days completed ( $p = .241$ ) and a significant linear group trend ( $p < .001$ ) for minutes pedaled per day. The 45 and 60 min group accumulated greater minutes per day of pedaling than the 15 and 30 min groups ( $p < .005$ ) with no significant differences between the 45 and 60 min groups or the 15 and 30 min groups. Across groups there was a 4.3% to 11.3% reduction in daily SB (Cohen's  $d$ : 0.72 to 1.57) and 8.3% to 23.6% increase in LPA (Cohen's  $d$ : 0.41 to 1.2) on pedaling days. Participants' perceptions of using the SED were positive. **CONCLUSIONS:** Older adults were successfully able to exceed 60 minutes of daily pedaling without altering or interrupting their typical daily behaviors. The long term impact of these daily changes in LPA on health and function in aging populations are to be determined.

**837** Board #71 May 29 3:30 PM - 5:00 PM  
**Cadence (steps/min) Thresholds For Relative Intensity Indicators In Older Adults**

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 (No relevant relationships reported)

In young adults, a cadence (steps/min) of 100 steps/min has been associated with absolutely-defined moderate intensity, measured in metabolic equivalents (METs; 1 MET = 3.5 mL/kg/min). However, less is known about how cadence is associated with relative intensity indicators in older adults.

**PURPOSE:** To investigate cadence thresholds associated with ACSM-defined indicators of moderate relative intensity (40-59% of heart rate reserve [%HRR], 64-76% of maximum heart rate [%HRmax] percentage, and a Borg scale rating of perceived exertion [RPE] of 12-13).

**METHODS:** Thirty-seven older adults (mean  $\pm$  SD; age =  $68.5 \pm 4.7$  years, BMI =  $26.3 \pm 3.9$  kg/m<sup>2</sup>) completed a progressive treadmill walking protocol that consisted of 5-minute bouts increasing by 0.5 mph from 0.5 to 6.0 mph. The protocol ended following the

bout where the participant naturally selected to jog or run, > 75% HRmax, or reported a Borg scale RPE > 13. Intensity indicators were analyzed using Receiver Operating Characteristic curves. Optimal cadence thresholds associated with moderate intensity were determined using Youden's index.

**RESULTS:** Four participants did not reach moderate intensity based on %HRR, and three did not reach moderate intensity based on %HRmax. %HRR and %HRmax were both associated with moderate intensity cadence thresholds of 111 steps/min. %HRR had a sensitivity of 76%, a specificity of 87%, and an area under the curve (AUC) of 0.76. %HRmax had a sensitivity of 75%, a specificity of 87% and an AUC of 0.75. Additionally, RPE was associated with a moderate intensity threshold of 104 steps/min, with 78% sensitivity, 80% specificity, and an AUC of 0.83.

**CONCLUSION:** Cadence thresholds associated with relative indicators of moderate intensity were consistently higher (4-11 steps/min) than the commonly reported heuristic value of 100 steps/min, although still within an obtainable cadence for ambulatory, healthy older adults. Relative indicators provide an opportunity to individualize cadence-based intensity prescription.

Supported by NIH/NIA Grant 5R01AG049024 – CADENCE-Adults study

**838** Board #72 May 29 3:30 PM - 5:00 PM  
**Less Is More: A Pilot Study Assessing The Benefit Of Exercise Frequency For Older Adults**

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 (No relevant relationships reported)

There are countless benefits of exercising for older adults including a maintenance of bone density, muscle mass, and the preservation of muscular strength and endurance. Although older adults benefit from exercising it may be more convenient, more accessible, and less of a burden to exercise less times per week. **PURPOSE:** The purpose of this pilot study is to quantify if there are any added benefits to exercising three days a week compared to two days a week. **METHODS:** Participants included community dwelling adults ( $N = 36$ ,  $M = 74.34 \pm 7.91$  years) who self-selected exercise frequency by joining a multi-component fitness class offered in their local community. Classes were held either two or three days per week depending on the location. The Functional Fitness Test and Short Physical Performance Battery were conducted two times 6 months apart at all locations. Results were analyzed using repeated measures ANOVA. **RESULTS:** A significant group-by-time interaction was observed for hand-grip strength,  $F(1, 18) = 7.92$ ,  $p = .01$ , with the two days per week group improving by 13% and the three days per week group decreasing by 1.9%. Interactions were not significant for chair stands test, arm curl test, 8 Foot Up-and-Go, or Gait speed,  $p > .05$ . There was a significant time effect for the chair stand test [ $F(1, 15) = 7.54$ ,  $p = .01$ ], gait speed [ $F(1, 19) = 7.91$ ,  $p = .01$ ], and hand-grip strength [ $F(1, 18) = 4.61$ ,  $p = .04$ ] with all tests indicating improvements from the first to second test. Univariate effect sizes indicate a trend toward greater improvements in the 2 d/wk group when compared to the 3 d/wk group with the exception of the arm curl which favors 3 d/wk. **CONCLUSION:** Although results are preliminary, this study indicates that handgrip strength was enhanced when participants were involved in a multi-component exercise program two days per week (13%). Chair stands test, arm curl test, 8 Foot Up-and-Go, and Gait speed increased regardless of the number of days per week of exercise. Notable limitations to the study are the number of males ( $N = 6$ ) compared to females ( $N = 30$ ) and participant's self-selection of exercise frequency. Also, we did not track outside influences such as physical activity levels, health status, and history of disease. Future studies should confirm these results using an experimental design in a larger, more diverse sample.

**839** Board #73 May 29 3:30 PM - 5:00 PM  
**The SIENA Study: Sisters Integrating Exercise and Neuro Activity**

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 (No relevant relationships reported)

**PURPOSE:** Alzheimer's disease (AD) dementia affects an estimated 4.7 million aging adults and is projected to significantly increase to 13.8 million by the year 2050. The prevalence of AD dementia is higher in women with more than two-thirds of all diagnosed cases exhibited in women. This condition is characterized by memory loss and cognitive decline. Pro-health behaviors including physical activity and meditation have been evidenced as neuroprotective behaviors among aging adults. Therefore, the purpose of this study was to explore health behaviors that may contribute to better cognitive functioning among aging women. **METHODS:** Catholic Sisters  $n = 39$ ;  $M_{age} = 78.9$ ,  $SD = 8.2$  completed three cognitive assessments; digit symbols task (DST), controlled oral word association (COWAT) and animal naming (AN) and four functional fitness tasks; sit to stand (STS), get up and go (GNG), arm curl (AC) and six minute walk task (WALK). Demographics and prayerful meditation were measured via self-report. Bivariate correlation analyses between variables and mediation analyses using SEM in stata were conducted to explore direct and indirect effects. **RESULTS:** The DST was associated with three functional fitness tasks; AC ( $r = .39$ ,  $p < .05$ ) GUG

( $r=-.49, p<.05$ ) and WALK ( $r=.44, p<.05$ ). AN was associated with 2 functional fitness tasks; AC ( $r=.44, p<.05$ ), GUG ( $r=.37, p<.02$ ) and COWAT was associated with WALK ( $r=.37, p<.03$ ). A mediation model was explored and explained 24% of the variance. There was a significant indirect effect of functional fitness on Age ( $B=-.211358, SE=.49, z=-4.3, p<.001$ ) and Age on Cognition ( $B=-1.32, SE=.41, z=-3.18, p<.001$ ). Functional fitness had a direct effect on meditative prayer ( $B=-.28, SE=1.11, z=-2.55, p>.01$ ) but not on cognition ( $B=-.784, p>.05$ ). **CONCLUSION:** Given the positive associations between functional fitness and cognition, yet the inverse association between fitness and prayer, future research should explore physically active prayer interventions and their influence on cognition.

**840** Board #74 May 29 3:30 PM - 5:00 PM  
**Daytime Steps Per Minute Correlate With Functional Fitness In Hispanic Elders In Puerto Rico**

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(No relevant relationships reported)

Walking cadence is a gait parameter associated with reduced risk of mortality, cardiovascular events, and falling among elder adults; but has not been reported among older Hispanics in Puerto Rico (PR). However, poor physical function, and low moderate to vigorous physical activity among older Puerto Rican adults in the USA and PR have been reported. **PURPOSE:** To evaluate the association between functional fitness and daytime walking cadence among Hispanic elders living in PR. **METHODS:** A group of 62 older adults ( $F=38, M=24$ ; age =  $76.4 \pm 8.4$  yr), participants in two HOPE centers in PR, completed a battery of senior fitness tests (and wore an accelerometer for 7-consecutive days. Spearman correlation and linear regression analyses were conducted to test associations between mean daytime walking cadence (steps/min) and functional fitness. **RESULTS:** Mean steps/day =  $3,410 \pm 1,910$ , and total daytime mean steps/min =  $4 \pm 2$ . Significant correlations were observed between walking cadence and cardiorespiratory fitness (6 min walk) ( $\rho = 0.41, P=0.001$ ), agility (foot up and go) ( $\rho = -0.39, P=0.003$ ), muscle endurance (sit-ups and biceps curl) ( $\rho = 0.27, 0.29; P=0.03, 0.02$ , respectively), and body composition (waist to height ratio) ( $\rho = -0.27, P=0.03$ ). **CONCLUSION:** Supporting previous studies, walking cadence significantly correlated with most functional fitness parameters in our group of older Hispanic adults in PR; thus, suggesting that those with higher mean steps/min (uncensored mean cadence) have higher cardiorespiratory fitness, agility, muscle endurance, and lower waist to height ratio; all critical health parameters for this population.

**841** Board #75 May 29 3:30 PM - 5:00 PM  
**Physical Activity, Sedentary Time, And Sleep Quality Among Hispanic Women With Rheumatoid Arthritis**

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Rheumatoid Arthritis (RA) is a chronic inflammatory disease commonly associated with physical inactivity and poor sleep quality (SQ). No previous studies have evaluated these associations among Hispanic women, and none have used objective assessment of physical activity (PA) and sedentary time (ST) in this population. **PURPOSE:** To evaluate associations between PA, ST, and SQ among Hispanic women with RA. **METHODS:** A group of 16 Hispanic women with RA (mean age =  $49.4 \pm 14.5$ yr, and BMI =  $26.91 \pm 5.3$  kg/m<sup>2</sup>) wore an ActiGraph GT3X+ accelerometer attached to an elastic waist band in the right hip area for 7 consecutive days to determine PA and ST. Participants also completed the Pittsburgh Sleep Quality Index (PSQI). Correlation analyses were used to evaluate associations between PA, ST, and SQ components. **RESULTS:** Mean of total moderate to vigorous PA (MVPA) was 178.6 min/week, and ST was 6.2 hr/day. Considering total MVPA, 50% of study participants were considered active, while 33% were considered sedentary. From the PSQI, 62.5% had poor sleep quality. A significant association was observed between ST and sleep efficiency ( $r = 0.61, P = 0.01$ ); thus, suggesting that ST negatively influence this aspect of sleep quality in our group of Hispanic women with RA. PA and ST did not appear to influence other sleep quality components. **CONCLUSION:** Different from other studies, physical inactivity and ST were not highly prevalent behaviors, but ST was an important determinant of sleep efficiency in our group of Hispanic women with RA. Regardless of PA classification, ST must be considered in any intervention aimed to improve sleep in this population.

**842** Board #76 May 29 3:30 PM - 5:00 PM  
**The Effect Of A Multicomponent Exercise Program On Sleep Quality In Institutionalized Elderly**

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Sleep disorders are one of the most prevalent changes in the elderly and this has been associated with a negative impact on health outcomes. Exercise to be a potential non-pharmacological treatment to improve sleep quality. However, the effects in older has been largely unexplored. **PURPOSE:** To evaluate the effects of exercise on sleep complaints in older adults residing in a nursing home. **METHODS:** A total of thirteen older adults ( $84.1 \pm 6.9$  years) were according to the inclusion criteria. Socio-demographic data was collected using a structured questionnaire. Anthropometric measures were obtained using standardized techniques. Sleep quality was collected by self-report through the face to face Oviedo sleep questionnaire. The EQ-D5 was used to assess the health related quality of life. The training program included a multicomponent exercise intervention (9 weeks; 2 times per week) focused on mobility, strength and balance. Student paired t-test was carried out to detect any significant differences between the pre-test and post-test in any variable. The difference between variables was calculated using the effect size (ES) through Cohen's d. The significance level was set at  $p < 0.05$ . **RESULTS:** The EQ-5D mean scores were similar for the four dimensions (pre-post intervention) including mobility, pain/discomfort, self-care and usual activities; however the dimension related with depression improved 31% at the end of the intervention. The t-student test and Cohen's d showed a medium non-significant effect on sleep satisfaction ( $p = 0.26$ ; ES: 0.32; insomnia ( $p = 0.37$ ; ES: 0.38) and hypersomnia ( $p = 0.09$ ; SE: 0.52). **CONCLUSIONS:** A supervised exercise program has a moderately beneficial effect on sleep quality in terms of insomnia, hypersomnia and depression in older people.

**843** Board #77 May 29 3:30 PM - 5:00 PM  
**Assessing The Health Needs of Older Adults Living in an Underserved Urban Community**

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(No relevant relationships reported)

Between 2012 and 2050, the population of older adults (>65 years old) is projected to nearly double and the preservation of their capacity to live independently remains a large public health concern. The American Gold Star Manor is a not for profit trust that owns and operates an older adult living community, subsidized by the Housing and Urban Development Division of the United States. Located in an urban subset of northern Long Beach, California, the manor is home to seniors with relations to the United States military and veterans. **PURPOSE:** The purpose of this study was to assess the health needs of a multi-ethnic older adult population in an underserved urban community. The data collected from this study will be used in a future study to inform the development and assessment of a monthly walking program for older adults living at Gold Star Manor. **METHODS:** An information session was held at American Gold Star Manor where an eleven-item survey was used to assess the current health needs of residents living at Gold Star Manor. In total, 29 residents (62+ years) attended the information session and completed the survey. The residents were given a set of topics and instructed to mark all topics they were interested in learning more about. Additionally, they were given space to fill in any topics that were not part of the provided selection. **RESULTS:** Of the 29 individuals surveyed, we found that 55% residents preferred English as their spoken language, 35% residents preferred Korean as their spoken language, and 10 residents preferred Spanish. Of the choices provided, 66% residents selected joint health, 62% selected social health, 48% selected cardiovascular health, 34% selected pedestrian safety, and 34% selected hydration and nutrition. In the open-ended section, residents recorded interest in learning about diabetes management, physical fitness, and cognitive health. **CONCLUSIONS:** Based on the needs assessment, the topics garnering the most interest among the American Gold Star Manor residents include joint health, social health, cardiovascular health, pedestrian safety, hydration, nutrition, diabetes management, physical fitness, and cognitive health.

**844** Board #78 May 29 3:30 PM - 5:00 PM  
**Handgrip Strength as a Screening Assessment for Functional Limitations**  
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There appears to be an undisputed strong relationship between isometric handgrip strength (HGS) and functional fitness test performance, ability to perform activities of daily living (ADLs), and mortality, but the extreme diversity in how HGS data are interpreted make it difficult to utilize the assessment in a meaningful way. **PURPOSE:** To simplify this interpretation by establishing a single and meaningful universal HGS cutoff that would inform the test administrator whether or not additional functional fitness testing was warranted. It was hypothesized that subjects scoring above the HGS cutoff would exhibit fewer perceived and actual functional limitations. **METHODS:** Male (n = 24; Age = 62.3 ± 14.3 years) and female (n = 59; Age = 64.7 ± 13.0 years) subjects self-reported their perceived ability to complete the variety of ADLs included in the Composite Physical Function Scale (maximum score of 24 indicating no perceived functional limitations). They additionally completed a battery of functional fitness assessments, which included HGS, 30-s Chair Stand, 8-ft Up-and-Go, 10 lb and 25 lb lift and carry, and 400 m Walk Test. A self-developed cell phone application was utilized to produce more outcomes, such as steady-state gait speed and cadence during the 400 m Walk Test. Independent samples *t*-tests were used to compare the perceived and actual functional fitness outcomes between subjects with grip strength < 30 kg and those with grip strength ≥ 30 kg. Additionally, positive predictive value (PPV), and negative predictive value (NPV) were calculated to investigate the accuracy of a 30 kg HGS cutoff to identify subjects with perceived or actual functional limitations. **RESULTS:** Subjects with a HGS ≥ 30 kg scored significantly higher on the CPF Scale, compared with subjects with a HGS < 30 kg (23.9 +/- vs. 22.4 +/- 3.3, respectively). Likewise, Subjects with a HGS ≥ 30 kg performed significantly better on every functional fitness test outcome, compared with subjects with a HGS < 30 kg. The NPV (true negative) was excellent (≥ 90%) for all outcomes, while the PPV (true positive) was poor (≤ 56%) for all outcomes. **CONCLUSIONS:** A HGS ≥ 30 kg appears to be an appropriate cutoff to accurately rule out current functional limitations in males and females 40 years of age and older.

**845** Board #79 May 29 3:30 PM - 5:00 PM  
**Relationship Between Functional Physical Condition And Age In Institutionalized Older Adults In Bogotá-Colombia**  
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 (No relevant relationships reported)

#### Purpose

The quantification of functional physical condition (CFF) in the elderly is an important indicator to define the state of health, the level of dependence and the quality of life in functional physical condition this population. The objective of this study was to establish the relationship between age and age in a group of elderly people residing in retirement home in the city of Bogotá.

#### Methodology

Cross-sectional descriptive observational study, which evaluated the functional physical condition (SFT) in 253 older adults (42.6% men and 57.3% women) institutionalized in the city of Bogotá. The CFF was evaluated through the senior fitness test, in the application the protocols proposed in the validation to Colombia were followed. The measure consisted of 6 physical tests: chair stand (repetitions), arm curl (repetitions), aerobic capacity in 2 minutes (repetitions), flexibility (cm); and 8 foot up and go (ms). A univariate descriptive analysis and a correlation analysis between age and physical condition variables were performed. An appreciative scale of the correlations was established as follows: weak for values > 0.40; moderate, between 0.41 and 0.60; strong, between 0.61 and 0.80, and very strong, between 0.81 and 1.0.

#### Results

In all CFF tests, significant differences were found for all age ranges in both men and women (p < 0.01). The following correlations were identified between the CFF variables and age: chair stand (r<sub>2</sub> = 0.850), arm curl (r<sub>2</sub> = 0.928), trunk flexion (r<sub>2</sub> = 0.928), back scratch (r<sub>2</sub> = 0.862), 2-minute step (r<sub>2</sub> = 0.914), 8 foot up and go (r<sub>2</sub> = 0.877) in men. In the case of women, very strong correlations were observed in the aerobic capacity (r<sub>2</sub> = 0.916), chair stand (r<sub>2</sub> = 0.764), arm curl (r<sub>2</sub> = 0.682), back scratch (r<sub>2</sub> = 0.678), 8 foot up and go (r<sub>2</sub> = 0.739) and moderate in trunk flexion (r<sub>2</sub> = 0.458).

#### Conclusion.

There is a linear relationship between age and performance in CFF tests.

**846** Board #80 May 29 3:30 PM - 5:00 PM  
**Objectively-determined Physical Activity And Its Association With Mobility Limitations In Older, Chronic Disease Patients**  
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 (No relevant relationships reported)

Mobility limitations are linked with increased risk of disability and mortality among older adults with chronic disease. Physical activity (PA) has consistently been associated with the preservation of mobility and improvements in physical function in aging populations. Although accelerometry is accepted as the gold standard of objective PA measurement, knowledge of objectively-determined PA in free living conditions and its association with mobility limitations among older adults with chronic disease remains limited. **PURPOSE:** To examine the association of objectively-determined PA in free-living conditions, assessed using the LIFECORDER EX (LC) accelerometer, with select mobility outcomes. **METHODS:** Associations between objectively-determined PA and mobility performance (400 MWalk and Stair Climb tests) and mobility-related self-efficacy (MRSE) were examined from the baseline assessments of 3 prior lifestyle intervention trials in 156 older prostate cancer and knee osteoarthritis patients. Moderate-Vigorous (MVPA) and light (LPA) were measured using LC accelerometry in free-living conditions across 7 consecutive days. **RESULTS:** Results of partial correlation analyses controlling for age revealed that total weekly MVPA was significantly correlated with 400 MWalk (r = -.36; p < .01), Stair Climb (r = -.29; p < .05), and MRSE (r = -.27; p < .01). LPA was also significantly correlated with 400 MWalk (r = -.49; p < .01), Stair Climb (r = -.40; p < .01), and MRSE (r = -.38; p < .01). **CONCLUSIONS:** The present findings demonstrate that objectively-determined PA measured using the LC accelerometer are associated with mobility performance and MRSE in older adults with chronic disease. The results also provide evidence further supporting the validity of accelerometry as a measure of mobility limitations among older prostate cancer and knee osteoarthritis patients. Given the established complexity of objective PA assessment in aging populations, the present findings have implications for PA interventions in the preservation of mobility among older adults with chronic disease.

**847** Board #81 May 29 3:30 PM - 5:00 PM  
**Cardiovascular Risk Among Non-sedentary Elderly: Circumferences Trend Analysis Over Three Decades**  
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 (No relevant relationships reported)

**Purpose:** To describe and analyze the trend of adiposity-related circumferences of non-sedentary women between 1998 and 2017 **Methods:** The present study is part of the Mixed Longitudinal Project of Physical Fitness and Aging of SCS, developed by CELAFISCS, since 1998, in Brazil - SP. Sample comprised only female subjects, 50 years-old and older, and who were involved in a PA program and participated in at least one evaluations between 1998 and 2017, totalizing a sample of 6367 individuals. The circumference analyzed were waist, hip and waist for hip ratio (WHR). To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years and over **Statistical analysis:** Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable (Y) and the years of evaluation as independent variable (X). For each variable, the model with the highest statistical significance (p) and the best accuracy measure (r<sup>2</sup>) was selected. Was considered significant model p < 0.05. **Results:** Waist circumference presented a negative trend in the three age groups analyzed. Hip circum (cm) presented a negative trend in the age groups of 60 to 69 and 70 years and over, while WHR showed a negative trend in the age groups of 50-59 and 70 years and over. In the age group of 50 to 59 years, the mean WHR was 0.88 cm, with a decrease of 0.01 cm every year. In the age group of 60 to 69 years, the mean waist circumference was 87.90 cm, and there was a decrease of 0.05 cm in each year; the mean hip circum was 98.82 cm, with a decrease of 0.02 cm every year. In the age group of 70 years and over, the mean waist circum was 88.62 cm, with a decrease of 0.07 cm every year; the mean WHR was 0.89 cm, with every year decrease of 0.01 cm. **Conclusion:** Over the three decades analyzed, elderly active women of all age groups showed a tendency to decrease CV risk, although it still remained at a high risk, suggesting a positive impact of a PA program on CV risk.

Table. Trend analysis of adiposity-related circumferences of non-sedentary elderly according to age group

	50 to 59 years			60 to 69 years			70 years and over		
	Model	r	p	Model	r	p	Model	r	p
Waist Circum. (cm)	y = 89.80 - 0.04 <sup>a</sup>	0.38	0.0060	y = 87.50 - 0.05 <sup>a</sup>	0.51	0.0000	y = 88.62 - 0.07 <sup>a</sup>	0.64	0.0001
Hip Circum. (cm)	y = 102.13 - 0.05 <sup>a</sup>	0.12	0.1531	y = 98.82 - 0.02 <sup>a</sup>	0.61	0.0001	y = 99.00 - 0.02 <sup>a</sup>	0.71	0.0000
WHR	y = 0.89 - 0.01 <sup>a</sup>	0.35	0.0052	y = 100.11 - 0.01 <sup>a</sup>	0.61	0.0001	y = 89.89 - 0.01 <sup>a</sup>	0.68	0.0001

a. first-order regression model; b. second-order regression model; c. third-order regression model.

**848 Board #82 May 29 3:30 PM - 5:00 PM**  
**Different Exercise Training On Reaction Time In Older Adults With Mild Cognitive Impairment**

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**PURPOSE:** To examine the effects of reaction ability after 12 weeks of two different types of exercise intervention in community-dwelling elderly with mild cognitive impairment.  
**METHODS:** 72 participants aged over 60 years old were classified as probable mild cognitive impairment (MCI) using the Saint Louis University Mental Status (SLUMS) examination. Participant were assigned to 3 groups (CG, n=22, 74.58±5.78 years; RTG, n=24, 72.00±7.15 years; MEG, n=26, 72.77±5.65 years). Exercise groups performed twice-weekly resistance training or multicomponent exercise training for 1.5 hours led by certified fitness instructors, and the control groups performed twice-weekly tablet personal computers course for 12 weeks. The primary outcome measure were the simple reaction time and simple movement time were measured by Vienna-test system (VTS), the total body reaction time was measured with both their feet on a measuring instrument (HELMAS NH-3000I).  
**RESULTS:** After the training period, of the 72 participants, 53 completed 12-week trial (18 in the MEG group, 18 in RT group, 17 in CG group). The total body reaction time for the MEG (-21.93%), and RTG (-9.04%) had decreased significantly than the CG (+1.13%) (p < .05), and the simple movement time for the MEG (-7.41%), and RTG (-0.81%) had decreased significantly than the CG (+27.58%) (p < .05).  
**CONCLUSIONS:** These findings indicate that participating in the multicomponent exercise and resistance exercise program on building community for health promotion can improve reaction time in elderly with cognitive impairment. These findings suggest that short time twice-weekly MET and RTG are promising and effective strategies in community-based health promotion activities with mild cognitive impairment.

**849 Board #83 May 29 3:30 PM - 5:00 PM**  
**Bone-targeted Exercise For Older Men With Osteopenia And Osteoporosis: LIFTMOR For Men Trial Preliminary Findings**

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**PURPOSE:** The LIFTMOR (Lifting Intervention For Training Muscle and Osteoporosis Rehabilitation) for Men trial was designed to compare the effects of 2 novel bone-targeted exercise programs on risk factors for falls and fracture in men with low bone mineral density (BMD). **METHODS:** LIFTMOR for Men is a 3-arm, 8-month, semi-randomised, intervention trial. Men ≥50 years of age with low BMD, screened for conditions and medications known to affect bone, were recruited. Eligible participants were randomised to 2/week, supervised high-intensity resistance and impact training (HiRIT) or bioDensity (bD) machine-based isometric exercise. Intervention responses are compared with those of a self-selected, non-randomised control (CON) sample of age-matched men following their habitual lifestyles. Outcomes at baseline and follow-up include: anthropometry; DXA-derived lumbar spine (LS) and femoral neck (FN) BMD; physical function (back extensor strength [BES], lower extremity strength [LES], timed-up-and-go [TUG], and 5-times sit-to-stand [STS]); and safety and compliance. Per-protocol analyses of preliminary outcomes were conducted using repeated measures ANCOVA, controlling for age, calcium consumption, prior physical activity, and initial values for BMD [adjusted mean change ± SE and adjusted p values are presented]. **RESULTS:** 93 men (67.1±7.5yr; 82.1±11.6kg; 175.2±6.7cm) with low BMD (FN T-score -1.6±0.6) were recruited, and designated CON (n=26) or randomly assigned to HiRIT (n=34) or bD (n=33). To date, 67 have completed the study and are included in these preliminary findings (21 CON; 24 HiRIT; 22 bD). Compliance is 75.6±17.9% for HiRIT and 81.1±12.1% for bD (NS). Between-group differences have appeared in several outcome measures but only the improvement in LS BMD (HiRIT 0.049±0.01g/cm<sup>2</sup> vs CON 0.013±0.01g/cm<sup>2</sup>; p=0.01) and STS (HiRIT 1.6±0.3s vs bD 0.8±0.3s; p=0.01) have reached significance. Within-group improvements have been observed for LS

and FN BMD in both HiRIT and bD, all functional outcomes for HiRIT (all p<0.05), and in LES, TUG, and STS for bD (all p<0.05). There have been no adverse events. **CONCLUSION:** Although preliminary, findings suggest that both novel bone-targeted exercise programs improved BMD and physical function in older men with osteopenia and osteoporosis. Data collection is ongoing.

**850 Board #84 May 29 3:30 PM - 5:00 PM**  
**Behavioral Responses on a Virtual Reality Induced Cognitive Task Between Young and Older Adults**

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 (No relevant relationships reported)

Controlling for and measuring explanatory variables can be difficult but virtual reality (VR) is emerging as a viable means for replicating authentic physical activity settings within the lab. **PURPOSE:** Using VR, we determined if young and older adults differ on behavioral responses of reaction time and accuracy during standing, walking and fast walking conditions that require dual-task completion. **METHODS:** Thirty-two young adults (Mean age= 21.03) and thirteen older adults (Mean age= 69.6) participated in this study and were instructed to stand or walk on a Motek instrumented treadmill integrated with a 180° VR projection screen. Participants performed three eight-minute physical activity conditions; standing, walking and fast walking. During the conditions, 60 red and green objects appeared at random on the VR screen to replicate a Go/No Go cognitive task. Using gloves that had kinematic-motion capture markers, participants were instructed to strike the green objects. A motion capture system connected to the treadmill recorded reaction time and accuracy on correct object strikes for all conditions. **RESULTS:** We used paired sample t-tests to verify that the physical activity conditions increase in intensity by comparing heart rate measurements between conditions. There was a significant increase in heart rate (bpm) between the standing and walking conditions (p<0.05) and between the walking and fast walking conditions (p<0.05) for both the young and older adults. T-tests determined that there were no significant differences in accuracy between the young and older adults during any of the three conditions (p>0.05). T-tests determined that young adults had a significantly quicker reaction time than older adults during all three conditions (p<0.05). **CONCLUSIONS:** Surprisingly, older adults performed just as accurately as young adults during dual-task cognitive conditions carried out in a VR environment. VR may be an appropriate intervention to enhance cognitive stimulation to attenuate cognitive decline.

**851 Board #85 May 29 3:30 PM - 5:00 PM**  
**Relationship Between Attention And Balance In Older Adults**

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 (No relevant relationships reported)

Several studies found that the reduction of capacity of concentration in older adults contributed to gait and mobility disturbances. The natural walking pattern was disrupted by diverting their attention to a secondary task, and the situation was even more serious among balance-impaired older adults who showed impairments when shifting their attention from task to task. However, there is limited information about the performance of attention and balance in old adults. **Purpose:** To investigate the relationship between attention and balance in community-dwelling older adults. **Method:** Thirty-three elderly (67.9±4.8 years) with no cognitive or neurological deficits (MMSE score: 28.41± 2.33) volunteered attending the test. The balance ability was measured by Y-balance which included three parameters, right front side, right rear inner stride and right rear outer stride. The single and dual tasks were used to measure the attention of the subjects. The single task was face emotion recognition including happy face and sad face. The dual task was face emotion recognition while walking with self-selected speed. Face recognition correct rate and face recognition correct reaction time in single and dual task were gathered. Person correlation coefficient (r) was used to determine the relationship between attention and balance. **Results:** Some low-to-moderate correlations were found between attention and balance, which were summarized in the table below:

Tasks			Balance		
			right front side	right rear inner stride	right rear outer stride
Sad face	Dual task	Correct rate	-0.12	-0.17	-0.08
		Correct reaction time	-0.32*	-0.33*	-0.32*
	Single task	Correct rate	-0.16	-0.12	-0.14
		Correct reaction time	-0.12	-0.20	-0.21
Happy face	Dual task	Correct rate	0.19	0.06	0.09
		Correct reaction time	-0.31*	-0.33*	-0.31*
	Single task	Correct rate	-0.08	-0.10	-0.18
		Correct reaction time	-0.16	-0.27*	-0.25

Note: \* $p < .05$ .

**Conclusions:** The attention does have low-to-moderate relationship with balance, which means that we may promote one through training another one.

**Key words:** attention; balance ability; elderly.

**852** Board #86 May 29 3:30 PM - 5:00 PM  
**The Effects of Modified Parkour Exercise on Arterial Health and Fitness Components in Elderly Individuals**  
 Moneeb A. Khokhar<sup>1</sup>, Alexei Wong<sup>1</sup>, Jennifer Tripken<sup>1</sup>, Ngoc-Huong Vinnedge<sup>1</sup>, Arturo Figueroa, FACSM<sup>2</sup>. <sup>1</sup>Marymount University, Arlington, VA. <sup>2</sup>Texas Tech University, Lubbock, TX.  
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Aging is associated with declines in vascular and muscular functions. It is crucial to reduce the negative effects of aging on vascular and muscular health by implementing appropriate lifestyle interventions, such as exercise training. Modified Parkour Exercise (MPK) has been found to increase agility and balance in elderly individuals. However, the possibility of MPK improving vascular and muscular functions in the elderly is currently unknown. **PURPOSE:** The purpose of this study was to examine the effects of a MPK regimen on blood pressure (BP), wave reflection (AIx), muscular strength and flexibility in elderly individuals. **METHODS:** Eighteen elderly individuals [age (69 ± 1 years); BP (126/78 mmHg) and body mass index (28.3 ± 1.6 kg/m<sup>2</sup>)] were randomized to either MPK (n=9) or no-exercise control group (n= 9) for 8 weeks. MPK consisted of modified dynamic and static bodyweight exercises 3 x week. Training volume was progressed by increasing the number of exercises (2 to 5), sets and repetitions for dynamic exercises (3 to 4 sets and 8 to 20 repetitions) and duration for static exercises (30 s to 60 s). Modified Parkour movements were progressed by increasing their complexity. Supine BP, AIx, and heart rate (HR), 30s chair stands (CHAST) and sit and reach (SITNR) scores were measured at baseline and after 8 weeks.

**RESULTS:** There were significant group-bytime interactions ( $P < 0.05$ ) for BP, AIx, CHAST and SITNR. There were significant decreases ( $P < 0.05$ ) insystolic BP (-4±1 mmHg), diastolic BP (-3±1 mmHg) and AIx (-4±1 %) as well as significant increases ( $P < 0.05$ ) in CHAST (2±1 stands) and SITNR (6±2 cm) following MPK compared with no changes after control. No significant changes were observed in HR for both groups.

**CONCLUSIONS:** MPK led to reductions in BP, wave reflection in elderly individuals. MPK may be an effective intervention in the prevention of hypertension and cardiovascular events as well as declines in muscular strength and flexibility in the elderly.

**853** Board #87 May 29 3:30 PM - 5:00 PM  
**Changes in Physical Function and Body Composition among Group Lifestyle Balance Program Participants with Arthritis**  
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 (No relevant relationships reported)

Weight loss through diet and physical activity (PA) is recommended for osteoarthritis (OA) management. The Group Lifestyle Balance Program (GLBP) is an evidence-based, behavior change program designed to promote weight loss in individuals with prediabetes or metabolic syndrome through PA and healthy eating. To date, the GLBP has not been evaluated on those with OA specifically.

**PURPOSE:** To examine the effects of the GLBP on measures of body composition and physical function (PF) in overweight and obese (BMI ≥ 27) individuals with OA (N=15).

**METHODS:** This study used a single-group, quasi-experimental design with repeated measures. All participants received the GLBP and outcome variables were obtained at baseline, 3, 6, and 12 months. Lean mass (LM), fat mass (FM), and body fat percentage (BF%) were obtained via bioelectric impedance. Total weight (WT), Body Mass Index (BMI), and waist circumference (WC) were also obtained. Measures of PF included the Short Physical Performance Battery (SPPB), grip strength (GS), 30-second chair stand test (CS30), and the Long Distance Corridor Walk (LDCW). The SPPB includes the time to complete 5 repeated chair stands (5CS), balance testing (side-by-side stand, semi-tandem stand, and tandem stand), and an 8-foot walk. The Friedman test was used to examine differences in SPPB scores and one-way repeated measures analysis of variance was used to examine mean differences in scores for all other outcomes.

**RESULTS:** Participants had a mean age of 70.20 ± 3.95 years and were primarily white (93%), female (80%) and college educated (67%). There was a significant effect of time for WT ( $F_{(1.448, 20.275)} = 6.591, p = .011$ ), BMI ( $F_{(1.529, 21.408)} = 6.474, p = .010$ ), and WC ( $F_{(2.898, 40.566)} = 4.826, p = .006$ ). Bonferroni post hoc analyses indicated WT ( $p = .001$ ), BMI ( $p = .002$ ), and WC ( $p = .022$ ) significantly improved from baseline to 3 months. There was also a significant effect of time for 5CS ( $F_{(3, 42)} = 3.190, p = .033$ ) and CS30 ( $F_{(3, 42)} = 6.956, p = .001$ ). Post hoc analyses indicated CS30 scores significantly improved from baseline to 3 months and from baseline to 12 months ( $p = .007$ ). There were no significant differences observed for any other outcome measure ( $p > 0.05$ ).

**CONCLUSION:** The GLBP may be effective at improving weight and physical function measures in people with OA, but more research is warranted.

**854** Board #88 May 29 3:30 PM - 5:00 PM  
**Role of Physical Exercise on Cognition & Falls Risk Factors in Alzheimer's Disease**  
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 (No relevant relationships reported)

**PURPOSE:** Falls are one of the leading cause of mortality and morbidity in older people and the risk of falling is exacerbated by impaired mental status due to dementia. However, whether persons with dementia benefit from fall prevention exercise training is unclear. This study aimed to evaluate the contribution of an exercise multicomponent training (MT) on cognition, balance, mobility and lower limbs muscle strength in the elderly with dementia as important risk factors for falling. **METHODS:** Sixty-four elders (78.5 ± 8.3 years) clinically diagnosed with dementia, were divided for convenience into two groups: Experimental Group (EG, n= 38) and Control Group (CG, n= 26). The EG participated in a 6-month supervised MT intervention (2 days/week, 60 min/session including aerobic, muscular resistance, flexibility, coordination and postural exercises). Cognitive function (MMSE), functional mobility (Time Up and Go -TUG -Test), balance and gait (POMA, Tinetti Index) and lower muscle strength (30-second Chair Stand) were assessed before and after 6 months of the experimental protocol. **RESULTS:** A two-way ANOVA, with repeated measures, revealed significant group and time interactions on cognitive function, TUG and Tinetti Index, presenting the EG a significantly better performance over the time compared to the CG. However, no statistically significant main effect was founded on the lower muscle strength. **CONCLUSIONS:** Our results suggest that a 6-month exercise multicomponent training can have a positive influence on the gait, balance, mobility and cognition, and therefore, seems to be an important strategy to reduce the risk of falling in dementia older adults. Support from IPDJ and FCT (CIAFEL -UID/DTP/00617/2013; "Body and Brain" -POCI-01-0145-FEDER-031808).

855 Board #89 May 29 3:30 PM - 5:00 PM

**Physical Activity Levels in a Structured Physical Exercise Community Program in Elderly**Renata A. Miyabara, Ovidiu Constantin Baltatu, Luciana Aparecida Campos Baltatu. *Universidade Anhembi Morumbi, São Paulo, Brazil.*

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(No relevant relationships reported)

**PURPOSE:** A decline in physical activity levels in older people is related with worsening of quality of life and a lower cardiorespiratory fitness level, which are associated with cardiovascular disease events and mortality from all causes. The aim of this study was to survey the level of self-reported physical activity in elderly people practicing different levels of physical activity program. An urban community of Sao Paulo was investigated. **METHODS:** This was a community-based cross-sectional study of a cohort of 50 individuals aged 60 or over, participating in a 6-month structured physical exercise community program and a control group of 50 sedentary elderly individuals age-matched. The structured physical exercise community program adheres to the Position Stand of the American College of Sports Medicine, as it included combined aerobic exercise, muscle strengthening exercises, and flexibility exercises. Physical activity levels were evaluated using the International Physical Activity Questionnaire (IPAQ).

**RESULTS:** The group participating in a physical exercise program had significantly higher levels of physical activity in the moderate activity ( $318.8 \pm 561.8$  vs.  $238.5 \pm 831.6$  MET-min/wk,  $p < 0.001$ ), vigorous ( $125.8 \pm 245.7$  vs.  $66.2 \pm 228.9$  MET-min/wk,  $p < 0.002$ ) and total activity ( $846.0 \pm 951.1$  vs.  $691.0 \pm 1239.1$  MET-min/wk,  $p < 0.05$ ). No differences between these groups were observed in walking activity ( $275.6 \pm 289.8$  vs.  $320.1 \pm 498.4$  MET-min/wk,  $p = 0.6$ ).

**CONCLUSIONS:** Our structured physical exercise community program proved effective in order to overcome the decline in physical activity levels in elderly population.

856 Board #90 May 29 3:30 PM - 5:00 PM

**Effects Of Resistance, Power, And Multicomponent Training With Elastic Resistance On Strength In Older Women**Nicole L. Rogers<sup>1</sup>, Pedro Gargallo<sup>2</sup>, Álvaro Jueas<sup>2</sup>, Eva Tamayo<sup>2</sup>, Sara Torkamaneh<sup>2</sup>, J.F. Guzmán<sup>2</sup>, J. Fernández-Garrido<sup>2</sup>, Guillermo Saez<sup>2</sup>, Michael E. Rogers, FACSM<sup>1</sup>, Juan C. Colado<sup>2</sup>. <sup>1</sup>Wichita State University, Wichita, KS. <sup>2</sup>University of Valencia, Valencia, Spain. (Sponsor: Michael E. Rogers, FACSM)

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The associations between strength losses in lower limbs and functional limitations are high for older adults. It is necessary to know the effects of modalities such as power training (PT) and multicomponent training (MT) on muscle strength compared to traditional resistance training (TRT) in this population. **PURPOSE:** To investigate the effects of 20-weeks of PT, MT, and TRT using variable resistance (elastic bands with loops) on isokinetic strength in older women (OW). **METHODS:** 136 sedentary OW (68.09  $\pm$  4.78 yr) were randomized into PT (n=34), MT (n=34), TRT (n=34), and control groups (CG) (n=34). All exercise groups trained twice weekly for 20 weeks. PT performed 6 exercises, 3-4 sets of 10-12 repetitions, at a 4 rate of perceived exertion (RPE) in the first repetition and no more than 6 in the last. MT performed balance, muscular endurance (2 exercises, 3-4 sets of 15 repetitions at 7-9 RPE), aerobic, flexibility, and coordination exercises. The TRT performed 6 exercises, 3-4 sets of 6 repetitions at 7-9 RPE. Maximum strength of knee extensors (KE) and hip abductors (HA) was measured at 60°/s and 180°/s in the dominant side with an isokinetic dynamometer. Trial (2) by group (4) repeated measures ANOVA was used to determine differences regarding time and groups. **RESULTS:** PT group showed a significant increase in HA (+89.61%) and KE (+22.75%) muscle strength at 180°/s with significant differences ( $p < 0.05$ ) between MT, TRT, and CG groups for HA, and between CG for KE. TRT group showed a significant improvement in HA (+76.74) and KE (+11.29) at 60°/s with significant differences between CG in both. MT showed a significant increase in HA at 60°/s (+13.5%) and 180°/s (+29.85%), and also in KE at 60°/s (+4.62%) with significant differences between CG in HA at 180°/s and KE at 60°/s. No significant changes were observed for the CG. **CONCLUSIONS:** PT is the most effective training modality for increasing muscle strength output at high velocity, while TRT is more effective for improving maximal strength at low velocity, for HA and KE. MT can be an effective alternative as it induces adaptation at high velocity on HA and at low velocity on KE. The use of elastic bands with loops (CLX bands) can facilitate the application of these types of programs.

857 Board #91 May 29 3:30 PM - 5:00 PM

**Multicomponent, Power, And Resistance Training With Elastic Resistance: Effects On Physical Function In Older Women**Michael E. Rogers, FACSM<sup>1</sup>, Pedro Gargallo<sup>2</sup>, Álvaro Jueas<sup>2</sup>, Eva Tamayo<sup>2</sup>, Sara Torkamaneh<sup>2</sup>, J.F. Guzmán<sup>2</sup>, J. Fernández-Garrido<sup>2</sup>, Guillermo Saez<sup>2</sup>, Nicole L. Rogers<sup>1</sup>, Juan C. Colado<sup>2</sup>.<sup>1</sup>Wichita State University, Wichita, KS. <sup>2</sup>University of Valencia, Valencia, Spain.

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For older adults, the maintenance of muscle power and balance is a key factor in everyday task performance. Understanding the effects of emerging training modalities such as power training (PT) and multicomponent training (MT) compared to traditional resistance training (TRT) is of benefit to this age group. **PURPOSE:** To investigate the effects of 20-weeks of PT, MT, and TRT using variable resistance (elastic bands with loops) on physical function in older women (OW). **METHODS:** 136 sedentary OW (68.09  $\pm$  4.78 yr) were randomized into PT (n=34), MT (n=34), TRT (n=34), and control groups (CG) (n=34). All exercise groups trained twice weekly for 20 weeks. PT performed 6 exercises, 3-4 sets of 10-12 repetitions, at a 4 rate of perceived exertion (RPE) in the first repetition and no more than 6 in the last. MT performed balance, muscular endurance (2 exercises, 3-4 sets of 15 repetitions at 7-9 RPE), aerobic, flexibility, and coordination exercises. The TRT performed 6 exercises, 3-4 sets of 6 repetitions at 7-9 RPE. Variables analyzed were static balance (Romberg), agility (Up & Go), gait speed (4m), muscle strength (30-s chair stand), and aerobic capacity (6-minute walk test). Trial (2) by group (4) repeated measures ANOVA was used to determine differences regarding time and groups. **RESULTS:** MT showed significant improvements ( $p < 0.05$ ; +56.8%) in static balance with significant differences between TRT and CG. PT showed significant improvements in all variables except static balance, with significant differences between MT and CG in muscle strength (PT: +29.20%; MT: +21.14%; CG: -2.69%), being the group with greatest improvements in 3 of 5 variables (agility: -14.26%; gait speed: -13.83%; muscle strength: +29.20%). PT, MT, and TRT showed significant improvements over time and between CG in agility, gait speed and aerobic capacity. No significant changes were observed for the CG. **CONCLUSIONS:** The three interventions are effective in improving physical function in OW, although the PT program induces greater adaptations in lower limb muscle strength, gait speed, and agility, while MT had a larger influence on balance. The use of elastic bands with loops (CLX bands) can facilitate the application of these types of programs.

858 Board #92 May 29 3:30 PM - 5:00 PM

**Compositional Associations Of Objectively Measured Activities With Declined Cognitive Function In Older Adults: NEIGE Study**Shiho Amagasa<sup>1</sup>, Shigeru Inoue<sup>1</sup>, Hiroshi Murayama<sup>2</sup>, Takeo Fujiwara<sup>3</sup>, Hiroyuki Kikuchi<sup>1</sup>, Noritoshi Fukushima<sup>1</sup>, Masaki Machida<sup>1</sup>, Sebastien Chastin<sup>4</sup>, Yugo Shobugawa<sup>2</sup>. <sup>1</sup>Tokyo Medical University, Tokyo, Japan. <sup>2</sup>The University of Tokyo, Tokyo, Japan. <sup>3</sup>Tokyo Medical and Dental University, Tokyo, Japan. <sup>4</sup>Glasgow Caledonian University, Glasgow, United Kingdom. <sup>5</sup>Niigata University, Niigata, Japan.

(No relevant relationships reported)

There is a growing literature that takes into account the co-dependence of time-use domains. Less is known about the combined effect of time spent in sedentary behavior (SB) and accumulating physical activity (PA) at different intensity and bout length. **PURPOSE:** To investigate a cross-sectional association of objectively-determined activities and cognitive function in community-dwelling older adults.

**METHODS:** A random sample of older adults (n=512, 47% male, aged 65-84 years) from NEIGE study in Tokamachi city, Niigata, Japan wore a tri-axial accelerometer (HJA-750C, Omron) for seven consecutive days and responded to a questionnaire in the fall of 2017. We assessed SB, light-intensity PA (LPA), short-bout (<10min) moderate-to-vigorous PA (MVPA), and long-bout ( $\geq 10$ min) MVPA. Cognitive function was assessed by interviewers using the Mini-Mental State Examination, regarding a score of  $\leq 26$  as declined cognitive function. Data were analyzed using the compositional regression approach using isometric log-ratio transformations of the time-use composition, adjusting for age, sex, residential area, living arrangement, working with income, educational attainment, BMI, perceived health, and number of disease.

**RESULTS:** One third of older adults had declined cognitive function. SB, LPA, short-bout MVPA, and long-bout MVPA accounted for 50.2%, 43.8%, 3.4% and 2.6% of accelerometer wear time, respectively. A significant beneficial association was observed between larger proportion of long-bout MVPA relative to other activities and cognitive function. SB, LPA, and short-bout MVPA were not associated.

**CONCLUSIONS:** Promoting long-bout MVPA may be important for cognitive health among older adults.



859 Board #93 May 29 3:30 PM - 5:00 PM

**Changes in Fitness and Fatness Levels in Qatari Schoolboys Over the Last Decade**

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(No relevant relationships reported)

**PURPOSE:** This study examined changes in anthropometric and cardiorespiratory fitness (CRF) characteristics of 26,325 Grade 6 (G6) schoolboys (11.0-12.99 y) living in the State of Qatar between 2003-2016. **METHODS:** Anthropometric measures included standing height (cm), body mass (kg) and body mass index (BMI, kg/m<sup>2</sup>). A multistage shuttle run test (MSRT, laps) was used to assess CRF. Comparisons between Qatari and non-Qatari boys were also conducted. **RESULTS:** The results showed a trend for decreasing CRF (less MSRT laps) and increasing fatness (higher BMI) across the study period, irrespective of nationality. Qatari students generally performed worse on the MSRT test and were fatter than their non-Qatari peers. Also, the Qatari students displayed bigger decreases in MSRT (10 vs 4 laps) and their body mass (2.5 vs 0.7 kg) and BMI (1.3 vs 0.6 kg/m<sup>2</sup>) increased more over the study period than their non-Qatari peers. Furthermore, the percentage of G6 schoolboys classified as overweight or obese increased over the study period for all nationalities, with Qatari boys showing a greater prevalence of overweight or obesity than their non-Qatari peers. For example, the percentage of Qatari boys classified as overweight or obese by Centers for Disease Control and Prevention (CDC) standards increased from an average of 40.1% between 2003-2006 to 49.3% between 2013-2016 while the average for non-Qatari boys increased from 32.6% to 39.9% for the same periods. **CONCLUSIONS:** These data support the need to establish a mechanism for the prevention and treatment of obesity and the development of physical activity strategies in the State of Qatar.

860 Board #94 May 29 3:30 PM - 5:00 PM

**Participation in Physical Activity is Associated with Sexual Activity in Older English Adults**

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**Purpose:** Physical activity (PA) is a potential modifiable correlate of the age-related decline in sexual function, but no studies have explicitly tested associations between PA and sexual activity. This study aimed to examine associations between PA, sedentary behaviour and sexual activity, problems and concerns in older adults. **Methods:** A Cross-sectional observational population study. Data were from the English Longitudinal Study of Ageing, a nationally representative sample of older men and women living in England. A total of 7,038 older men and women aged  $\geq 50$  years were included. PA and TV viewing time were self-reported. Sexual behaviour and concerns were assessed by validated self-completion questionnaire and analyses were weighted for non-response. Covariates included age, partnership status, socioeconomic status, limiting long-standing illness, smoking status, alcohol intake and depressive symptoms. Adjusted logistic regression were used to investigate associations between PA, sedentary behaviour and sexual activity, problems and concerns. **Results:** The odds of reporting any sexual activity were increased among individuals who participated in moderate (OR=1.64, 95%CI:1.24-2.15 in men, OR=1.21, 95%CI:0.97-1.52 in women) or vigorous (OR=2.06, 95%CI:1.50-2.84 in men, OR=1.42, 95%CI:1.09-1.85 in women) PA at least once a week. Erectile difficulties were less common among men who were active (OR=0.58, 95%CI:0.44-0.77 for vigorous PA). Results linking sedentary behaviour with sexual activity and function were less consistent, although women who watched  $\geq 6$  hours of TV/day had lower odds of thinking about sex frequently (OR=0.69, 95%CI:0.50-0.96) or, if they did not live with a partner, being sexually active (OR=0.40, 95%CI:0.22-0.72). **Conclusions:** Encouraging older adults to be more physically active could help to improve sexual relationships and, as a result, mental health and wellbeing.

861 Board #95 May 29 3:30 PM - 5:00 PM

**Lower Aerobic Reserve is Associated with Poorer Physical Function in Community Dwelling Older Adults**

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Reduced gait speed in older adults is a well-established predictor of disability and mortality. Recent evidence indicates that this decline in gait speed is accompanied by an increase in the energetic cost of walking and a decrease in peak energy expenditure. However, the association between this loss of aerobic reserve (AR) and functional performance has not been explored. **PURPOSE:** To examine the relationship between AR and physical function in older men and women. **METHODS:** AR was calculated as the percentage of the energetic cost of slow walking relative to peak walking energy expenditure in 20 participants of the Longitudinal Aging Study at Towson (65% women, age 70 $\pm$ 8 yrs). Slow walking energy expenditure was assessed as the average rate of oxygen consumption during the final 2 minutes of a 5 minute standardized treadmill walking test at 1.5 mph (0.67m/s) using indirect calorimetry. Peak walking energy expenditure was assessed as the average steady-state rate of oxygen consumption during 400 meters of fast-paced walking over a 20-meter course using a portable indirect calorimeter. Physical function (PF) was assessed using components of the expanded Short Physical Performance Battery (ExSPPB) test consisting of time to complete 5 repeated chair stands, standing balance, and two measures of gait speed over 6 meters (normal walk and narrow walk). The association between AR and functional performance was modeled using linear regression models, adjusted for age and body mass index. **RESULTS:** In fully adjusted models, PF was negatively associated with AR ( $\beta = -0.014$ ,  $p = 0.002$ ), indicating that PF score improved 0.014 for each one-percentage higher AR. In further analyses of the individual components of PF, time to complete 5 chair stands ( $\beta = -0.006$  chair stands per second,  $p = 0.02$ ) and normal gait speed ( $\beta = -0.009$  m/s,  $p < 0.005$ ) were found to be negatively associated with AR, but there was no association with standing balance. **CONCLUSION:** Greater aerobic reserve was associated with higher physical function, specifically chair stand time and normal gait speed. These results suggest that maintaining AR is critical to preserving lower extremity strength and speed with aging. Interventions to improve mobility in older adults should aim to both increase peak capacity and reduce energetic costs to optimize potential benefits.

862 Board #96 May 29 3:30 PM - 5:00 PM

**Detrimental Links Between Inflammation and Muscle Mass are Moderated by Physical Activity in Older Adults**

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While age-related elevations in systemic inflammation may contribute to the accelerated loss of skeletal muscle mass, previous findings have been based on a limited number of biomarkers. Moreover, whether links between inflammation and muscle mass are independent of protein intake and habitual physical activity (PA) remain unknown. **PURPOSE:** The aim of the study was to explore links between skeletal muscle mass and inflammatory biomarkers in older women with different metabolic risk status, while accounting for adherence to guidelines on protein intake and PA.

**METHODS:** Skeletal muscle mass index (SMI) was assessed in 112 women (67 $\pm$ 1.5 years) by bioelectrical impedance together with the equation of Janssen et al. (2002) to obtain muscle mass expressed in relation to body weight. Fasting blood samples were obtained following standardized protocols. Acute-phase proteins C-reactive protein (CRP) and fibrinogen were determined, together with the following inflammatory biomarkers: Adiponectin, Oncostatin-M (OSM), Leukemia inhibitory factor-receptor (LIF-R), Interleukin-6 (IL-6), IL-8, IL-12, and IL-18. Protein intake and PA were determined during 6 days by food record and accelerometry, respectively. Classification of metabolic risk status was based on the metabolic syndrome. Multivariate regression models were used to explore links between SMI and inflammatory biomarkers while adjusting for adherence to PA and protein intake guidelines and metabolic risk status.

**RESULTS:** Variations in SMI were inversely linked to levels of CRP ( $\beta$ -coefficient: -0.47;  $p < 0.05$ ) and OSM (-0.20  $p < 0.05$ ), where the OSM link was attenuated after further adjustment for PA. In contrast, positive links between SMI and adiponectin (0.19  $p < 0.05$ ) and LIF-R (0.24  $p < 0.05$ ) were observed, which both remained significant in fully adjusted models. Links to other biomarkers were non-significant. **CONCLUSIONS:** Several inflammatory markers are linked to skeletal muscle mass in older adults, where detrimental or beneficial actions are indicated depending on the

biomarker. While adherence to PA guidelines moderates some of these links, others seem unaffected by either PA and protein intake or metabolic risk status. Further research is needed to elucidate mechanisms underlying these observations.

### B-58 Free Communication/Poster - Physical Activity and Health I

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

#### 863 Board #97 May 29 2:00 PM - 3:30 PM The Relationship between Physical Activity and Physical Performance and Cognitive Abilities in the Chinese Elderly

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(No relevant relationships reported)

**PURPOSE:** Decreased physical and cognitive ability have become seriously problematic in aging. Studies seldom describe the relationship between physical activity (PA), physical performance and cognitive abilities, most of which by measuring only one or two specific abilities using questionnaires. The study was thus designed to examine the relationship between PA and physical performance and multiple cognitive abilities in the Chinese elderly.

**METHODS:** The design was a cross-sectional study. 148 people aged 65.15±7.79 were included from Guangxi Province in southern China. PA was measured by the Physical Activity Scale for the Elderly (PASE, Cronbach's  $\alpha=0.752$ ; Test-retest reliability=0.980). Physical performance included coordination and lower limb strength, functional walking ability and the balance ability. Cognitive abilities were measured by computer-based tests, including simple reaction time and executive function (stroop task and shifting task). The association between PA and the outcomes were examined using correlation matrix and linear regression.

**RESULTS:** 1) The average time spent on physical activity was 1.8h/d; 2) High levels of PA significantly associated with better gait speed ( $B=-0.67, p<0.05$ ), 30-s chair-stand test ( $B=0.72, p<0.05$ ) and reaction abilities ( $B=0.89, p<0.05$ ); 3) The gait speed significantly correlated with the accuracy of stroop task ( $r = 0.23, p = .018$ ) and shifting task ( $r = 0.21, p = 0.023$ ), grip strength significantly correlated with the accuracy and the reaction time of the stroop task ( $r = 0.19, p = 0.04$  &  $r = 0.19, p = 0.04$ ). However, other physical performance outcomes had no significant correlation with the cognitive abilities.

**CONCLUSIONS:** More physically active residents scored higher on physical performance outcomes. Positive associations were found between physical performance, executive function and reaction ability.

#### 864 Board #98 May 29 2:00 PM - 3:30 PM Cardiorespiratory Fitness and Body Mass Index with Gastroesophageal Reflux Disease in Older Adults

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**Purpose:** To examine the associations of cardiorespiratory fitness (CRF) and body mass index (BMI) with prevalence of Gastroesophageal Reflux Disease (GERD) in older adults.

**Methods:** This cross sectional study included 566 older adults (57% women; 72 years old) who were without heart attack, stroke, or cancer in the past 5 years. CRF was assessed via a 400-meter walk test and the minutes to complete the test were divided into sex-specific quartiles (fourths). Participants were categorized into normal weight (<25 kg/m<sup>2</sup>), overweight (25-29 kg/m<sup>2</sup>), and obese ( $\geq 30$  kg/m<sup>2</sup>) BMI groups. GERD cases were identified via self-report on a medical history questionnaire. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of GERD among CRF quartiles and BMI groups while adjusting for sex, age, smoking, heavy alcohol consumption, meeting walking guidelines based on  $\geq 7,500$  steps/day, and BMI (in CRF analyses) or CRF (in BMI analyses).

**Results:** Of the 566 adults, there were 123 (22%) GERD cases. Compared with the first quartile of CRF (least fit), the ORs (95% CIs) of having GERD were 0.70 (0.40-1.22), 0.65 (0.37-1.16), and 0.46 (0.25-0.87) among those in the second, third, and fourth (fittest) quartiles of CRF, respectively, after adjusting for all confounders except BMI. However, these associations were not significant after adjusting for BMI. Compared with the normal weight group, the ORs (95% CIs) of having GERD were 2.67 (1.51-4.72) and 4.32 (2.30-8.09) among the overweight and obese groups,

respectively, after adjusting for all confounders including CRF. In a joint analysis, compared with the unfit (first quartile of CRF) and obese, ORs (95% CIs) were 0.13 (0.03-0.48), 0.41 (0.17-0.96), 0.17 (0.08-0.36), 0.44 (0.23-0.83), and 0.53 (0.26-1.07) for the unfit-normal weight, unfit-overweight, fit-normal weight, fit-overweight, and fit-obese, respectively, after adjusting for all confounders.

**Conclusions:** Although both CRF and BMI appears to be associated with GERD in this sample of older adults, BMI was found to be more strongly associated with GERD independent of CRF. Among obese individuals, having high CRF may be associated with lower odds of GERD, but more research is warranted. Supported by unrestricted research grant by Biospace.

#### 865 Board #99 May 29 2:00 PM - 3:30 PM Longitudinal Stability of Exercise Behavior Across Exercise Domains

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**PURPOSE:** Many previous studies that have assessed the tracking of leisure time exercise behavior focused on various parts of the life span, and have treated exercise behavior as a uniform construct. This study provides novel insight by assessing the longitudinal tracking of exercise in six different domains: (1,2) team-based versus solitary activities, (3,4) competitive versus non-competitive, and (5,6) externally paced versus internally paced activities across the life-span (8-80 years).

**METHODS:** From the Netherlands Twin Register (NTR) all subjects with longitudinal exercise data were selected ( $N = 43,889$ ) and used to analyse the tracking of exercise behavior over time. With this dataset, we were able to examine tracking as a function of baseline age (8 to 80 years) and tracking duration (2 to 22-year follow-up), taking into account sex differences using generalized estimating equations.

**RESULTS:** Two-year tracking coefficients for total volume of exercise across age at baseline, ranging from .38 to .77 with a median of .57. Tracking coefficients tend to decrease as the distance to follow-up increases, down to a median of .38 for the 22-year tracking coefficients. The patterns of tracking were largely similar for solitary, competitive, non-competitive, externally and internally paced activities. With the exception of team-based activities, tracking was seen to increase as a function of baseline age.

**CONCLUSIONS:**

We conclude that exercise is moderate to highly stable across the lifespan, especially in late adulthood the tracking of exercise is high. This stability reinforces the existing evidence that exercise habits may be hard to change, but simultaneously suggests that successful intervention can lead to life-long habits.

#### 866 Board #100 May 29 2:00 PM - 3:30 PM Parasympathetic Nervous Regulation and Prevalence of Lifestyle-related Diseases In Japanese: Waseda's Health Study

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(No relevant relationships reported)

**PURPOSE:** Limited data are available on the relationship of parasympathetic nervous regulation with the prevalence of lifestyle-related diseases in Japanese men and women. We conducted a cross-sectional study to investigate the relationship between diving reflex (DR) and heart rate recovery after exercise (HRR) - markers of parasympathetic nervous regulation - with the prevalence of hypertension, diabetes, and dyslipidemia among Japanese men and women in WASEDA'S Health Study.

**METHODS:** WASEDA'S Health Study is a cohort study which was launched in 2014. We used data collected at baseline in this study. Participants were 193 Japanese men [median (IQR) age 57 (48-67) years] and 81 women [median (IQR) age 52 (44-58) years] who completed a medical examination, maximal exercise test, and diving reflex test. The participants were divided into tertiles based on DR indexes and HRR indexes. DR indexes were the peak value of the R-R interval during the test (R-Rmax), the relative difference between the baseline and peak response due to the test (R-Rchange), and the latency of DR (Latency). Also, HRR indexes were defined as the reduction in the heart rate from the rate at peak exercise to the rates 1, 2, and 3 minutes after the cessation of exercise (HRR1, HRR2, and HRR3). Odds ratios and 95% confidence

intervals for the prevalence of lifestyle-related diseases were obtained using logistic regression models while adjusting for sex, age, body mass index, physical activity, family history of lifestyle related diseases, cigarette smoking, and alcohol intake.

**RESULTS:** 119 participants had hypertension, 17 had diabetes, and 125 had dyslipidemia. Using the lowest DR indexes and HRR indexes as reference, we calculated odds ratios and 95% confidence intervals for the outcomes of interests. We found statistically significant dose-response relationships between R-Rmax and diabetes (P for trend = 0.016) as well as R-Rchange and diabetes (P for trend = 0.010). There was also a statistically significant dose-response relationship between Latency and dyslipidemia (P for trend = 0.013) and HRR3 and hypertension (P for trend = 0.047).

**CONCLUSIONS:** In cross-sectional analysis, the data suggest diving reflex may be related to the prevalence of lifestyle-related diseases, particularly diabetes.

**867** Board #101 May 29 2:00 PM - 3:30 PM  
**Impact Of Physical Activity Participation On Waist-to-hip Ratio[[unsupported Ansi Character - ]]]fa Propensity Score Analysis**

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**Impact of Physical Activity Participation on Waist-to-Hip Ratio: A Propensity Score Analysis**

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**PURPOSE:** To examine the impact of physical activity (PA) participation on college students' WHR using the propensity score analysis.

**METHOD:** A total of 1,144 college students (Male = 53.8%) from a major Chinese university were recruited for the study and their waist circumference (WC) and hip circumferences (HC) were measured, and WHR were computed. In addition, their daily time spent on the internet (ITT), their PA participation frequency per week (PAFW), time spent on PA each time (PATE) and time spent on PA per week (PATW) were collected through a survey. Using the propensity score analysis, in which sex, age, ITT, PATE, PAFW and PATW were used as the matching variables so that the impact of PA participation on WHR can be independently examined.

**RESULTS:** The descriptive statistics of key variables measures are summarized as below:

Variables	Mean	SD
Age (yr.)	20.570	3.424
WC (cm)	74.22	0 7.600
HC (cm)	92.200	5.297
WHR	.805	.066
ITT (hr.)	6.410	2.773
PAFW	3.780	2.312
PATE (hr.)	1.708	.794
PATW (hr.)	7.350	5.951

Using the ACSM 3-time per week recommendation as a criterion, 439 of 703 college students were extracted as the high frequent PA participation (HFPA) group and the rest as the low frequent PA participation (LFPA) group, and their group difference in WHR was computed and compared:

LFPA (M±SD) 0.834±0.048  
 HFPA (M±SD) 0.758±0.056

Mean Difference 0.081

Effect size 0.642

p-value <0.001

t-value 24.347

Coefficients 0.779

**Conclusion:** After using the propensity-score matching, the impact of the frequency of PA participation became very significant (ES = .64 and p<0.001), which indicates regular PA participation is the key for college students' weight control and management.

**868** Board #102 May 29 2:00 PM - 3:30 PM  
**Stronger Relationships Between Cardiometabolic Risk Factors and Physical Fitness than Objectively Measured Physical Activity**

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Previous studies have shown that physical fitness is more strongly associated with cardiometabolic health outcomes than self-reported physical activity (PA). However, objectively measured PA may offer more precision in defining PA than self-report methods. Therefore it is of interest to determine associations of objectively measured PA with cardiometabolic risk factors.

**PURPOSE:** To assess associations of objectively measured PA, as well as aerobic and muscular fitness, with cardiometabolic risk factors.

**METHODS:** 415 young healthy adult men (28±6 yrs.) participated in the study. PA was measured with a tri-axial accelerometer (Hookie Am 20, Traxmeet Ltd, Espoo, Finland) to assess light intensity (LIPA, 1.5-2.9 METs) and moderate-vigorous (MVPA, ≥3.0 METs) PA. Physical fitness was measured with 1-min push-ups and sit-ups (reps/min) and standing long jump tests. In addition, maximal isometric force of the leg and arm extensors was measured. All muscular fitness results were converted into a muscular fitness index (z-score). Cardiorespiratory fitness (VO<sub>2</sub>max) was determined using an indirect graded cycle ergometer test until exhaustion. In addition, blood pressure was measured and blood samples were drawn after an overnight fast. The analyzed cardiometabolic risk factors consisted of serum lipids (total cholesterol, LDL, HDL, triglycerides) and plasma glucose, insulin and HbA1C.

**RESULTS:** After adjustments for age and smoking, LIPA was associated with insulin (β=0.14, p<0.005), whereas MVPA was associated with HDL (β=0.13, p<0.05). Aerobic fitness was inversely associated with blood pressure and serum lipids (β=-0.15 - -0.42, p<0.005), excluding HDL, which was positively associated with aerobic fitness (β=0.32, p<0.001). Muscular fitness was inversely associated with diastolic blood pressure, serum lipids and insulin (β=-0.10 - -0.26, p<0.05), and positively with HDL (β=0.20 p<0.001).

**CONCLUSIONS:** MVPA was positively related only to HDL concentration, whereas physical fitness was related with numerous cardiometabolic risk factors. These findings emphasize the stronger relationship of physical fitness to cardiometabolic risk factors compared to physical activity. MVPA leading to higher fitness levels should be promoted in order to provide cardioprotective effects.

**869** Board #103 May 29 2:00 PM - 3:30 PM  
**Sedentary Behavior in Cardiac Patients**

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Sedentary Behavior (SB) is associated with increased risks for many adverse outcomes. Evidence is limited about 1) the amount of SB in cardiac patients and whether this changes after cardiac rehabilitation (CR), and 2) which cardiac patients present higher levels of SB. **PURPOSE** To examine 1) the amount of SB in cardiac patients and whether SB changes following completion of a supervised CR program, and 2) characteristics of cardiac patients with high levels (≥ 8 hrs per day) of SB. **METHODS** To investigate aim 1, cardiac patients (n=84) were included upon enrolment of a Dutch CR program with supervised exercise training sessions. SB was objectively assessed during 7 consecutive days using the ActivPal3 micro. Data were collected at baseline, directly after and 2-3 months after completion of the CR program. For aim 2, patients (n=600) who participated in CR were invited to complete an online questionnaire about general and disease-specific characteristics. Sedentary time was assessed using the Sedentary Behavior Questionnaire. **RESULTS** Aim 1. The mean sedentary time in cardiac patients (mean age 65 [SD 33] yrs, 79% male) was 10.2 (SD 1.7) and 10.4 (SD 1.8) hours per week- or weekend day, respectively. Sedentary time did not change after completion of the CR program (mean difference weekdays = 0.26 [95% CI -0.02; 0.54]; weekend day = 0.40 [95% CI -0.06; 0.88] hrs/day), or 2-4 months later (mean difference weekdays = 0.23 [95% CI -0.12; 0.58]; weekend day = 0.35 [95% CI -0.17; 0.88] hrs/day). Aim 2. Being employed (prevalence ratio

(PR) 1.46 [95% CI 1.26; 1.70]), being divorced or widow(er) (PR 1.75 [95% CI 1.21; 2.53]), being resuscitated (PR 1.31 [95% CI 1.09; 1.59]), a high level of cardiac anxiety (PR 1.38 [95% CI 1.19; 1.59]), and living in a rural environment (PR 0.80 [95% CI 0.66-0.97]) were independently associated with high levels ( $\geq 8$  hrs per day) of self-reported SB. **CONCLUSION** Cardiac patients present high levels of SB, and SB did not change after CR. Several patient characteristics (i.e. employment, marital status, resuscitation, cardiac anxiety and living environment) were significantly associated with sedentary time, which provides insight in who is the most at risk for SB associated adverse outcomes. Our data suggest that tailored initiatives are needed to target high levels of SB among cardiac patients.

**870** Board #104 May 29 2:00 PM - 3:30 PM  
**Measured Vs. Self-reported Height, Weight And BMI: Relationships With Anthropometry, Fitness, And Physical Activity**

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Researchers, policy makers, and clinicians commonly use height and weight to determine BMI and classify weight status. Self-report measures are utilized in a considerable portion of the scientific literature and national surveys, but often result in misreporting of height and weight, and consequentially underestimation of BMI and therefore potentially BMI category (weight status) misclassification. **PURPOSE:** To examine differences in self-reported and measured height, weight and BMI values, and whether discordance is associated with other anthropometric measures, fitness levels, and physical activity (PA) and sedentary behaviors (SB). **METHODS:** Data were collected from college students via: (1) a pre-consultation online questionnaire where participants self-reported sex, height, and weight; (2) an objective fitness assessment that assessed height, weight, body fat percentage, abdominal girth, predicted aerobic fitness, and muscular endurance; and, (3) a post-assessment electronic survey that assessed PA and SB. Parametric and non-parametric analyses was used to examine differences between groups. **RESULTS:** Self-report and measured height and weight data were collected from 1,061 participants, 224 of whom also provided PA and SB data. Women significantly under-reported weight ( $p = .003$ ,  $\eta^2 = .02$ ), and both sexes over-reported height ( $p < .001$ ,  $\eta^2 \geq .07$ ), resulting in a significant difference between BMIs calculated using self-reported and measured values ( $p < .001$ ,  $\eta^2 \geq .07$ ) and misclassification of BMI category of ~15% of both sexes. Minimal differences were found in anthropometric, fitness, or PA between those who over and underreported their height, but significant differences were found based on reporting differences for weight ( $p \leq .015$ ) and BMI ( $p \leq .015$ ). **CONCLUSIONS:** Students were found to have a tendency to underreport weight and overreport height, resulting in BMI category misclassification. Findings suggest that those who underreport weight tend to be in poorer health, as indicated by lower aerobic fitness in and higher abdominal girth and body fat percentage in particular. With respect to PA, overreporters tended to report lower PA levels than under and accurate reporters. Further research is required to establish the link between underreporting weight and overreporting PA.

**871** Board #105 May 29 2:00 PM - 3:30 PM  
**Muscle Strength and Bone Strength Assessed with Osteo-sono Assessment Index Among Recreationally Athletic Japanese Women**

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Low muscle strength is an independent risk factor for low bone strength, which is a well-established predictor of osteoporotic fracture. However, the association between muscle strength and bone strength remains unclear among recreationally athletic Asian women.

**PURPOSE:** To investigate the association between muscle strength and bone strength among recreationally athletic Japanese women. **METHODS:** This cross-sectional study was conducted in 7091 recreationally athletic Japanese women [mean (standard deviation), age 50.3 (15.2) years] who had undergone medical checkup and various exercise tests voluntarily from 1998 to 2016 at a preventive medical center. Participants completed a maximal voluntary knee extension test, quantitative ultrasound (QUS), calcaneal measurements, a medical examination, and questionnaires on lifestyle. Muscle strength, expressed as Nm per body weight in kilogram (Nm/kg), was measured at 60 degrees/s in the knee with an isokinetic dynamometer. The osteo-sono assessment index (OSI) evaluated right calcaneus heel bone strength using a QUS measurement. Multiple linear regression

analysis assessed independent association of muscle strength and OSI ( $\times 106$ ) after adjustment for age, systolic blood pressure, smoking, drinking, prevalence of diabetes, and body mass index.

**RESULTS:** Muscle strength had a positive association with OSI score after adjustment for potential confounding factors ( $\beta=0.17$ , 95% confidence interval; 0.15-0.19,  $p < 0.001$ ). Furthermore, age-stratified ( $\geq 50$  years and under) analyses showed similar patterns of association.

**CONCLUSIONS:** Our results suggest a dose-response association between muscle strength and bone strength after adjustment for potential confounding factors. We need to further investigate longitudinal relationship between muscle strength and bone strength in a cohort study.

**872** Board #106 May 29 2:00 PM - 3:30 PM  
**Cardiorespiratory Fitness and Prevalence of Lifestyle-related Diseases In Japanese Men And Women: WASEDA'S Health Study**

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Many epidemiological studies report that there is an inverse relationship between cardiorespiratory fitness and the prevalence of lifestyle-related diseases. However, limited data are available on this relationship among Japanese men and women.

**PURPOSE:** This cross-sectional study is to investigate the relationship between cardiorespiratory fitness and the prevalence of hypertension, diabetes, and dyslipidemia among Japanese men and women in WASEDA'S Health Study.

**METHODS:** WASEDA'S Health Study is a cohort study which was launched in 2014. We used part of the baseline data collected for this study. Participants were 631 Japanese men [median (IQR) age 56 (48-65) years] and 306 women [median (IQR) age 50 (45-57) years] who completed a medical examination, and maximal exercise test at baseline. The participants were then divided into quartiles based on cardiorespiratory fitness. The prevalences of lifestyle-related diseases were based on self-reports from questionnaires, blood pressure, and/or blood test at the medical examination. Odds ratios and 95% confidence intervals for the prevalences of lifestyle-related diseases were obtained using logistic regression models while adjusting for sex, age, body mass index, physical activity, family history of lifestyle-related diseases, cigarette smoking, and alcohol intake.

**RESULTS:** 366 participants had hypertension, 55 had diabetes, and 420 had dyslipidemia. Using the 1st quartile of cardiorespiratory fitness as reference, odds ratios and 95% confidence intervals for 2nd, 3rd, and 4th quartiles are shown in the table below.

**CONCLUSIONS:** These results suggest that there is an inverse relationship between cardiorespiratory fitness and the prevalence of hypertension and diabetes, but not dyslipidemia, among Japanese men and women. We intend to continue prospective follow-up of participants, to obtain more robust findings with longitudinal analyses.

	Cases	Q1 (lowest)	Q2	Q3	Q <sub>4</sub> (highest)	P for trend
Hypertension	366	1.00 (reference)	0.36 (0.22-0.60)	0.51 (0.30-0.85)	0.35 (0.19-0.62)	0.005
Diabetes	55	1.00 (reference)	0.93 (0.44-1.93)	0.39 (0.15-1.00)	0.46 (0.16-1.32)	0.049
Dyslipidemia	420	1.00 (reference)	0.98 (0.65-1.48)	1.06 (0.69-1.64)	0.92 (0.56-1.51)	0.850

**873** Board #107 May 29 2:00 PM - 3:30 PM  
**Association of Active Commuting with Sport Time and Outdoor Play Time in Chinese Schoolchildren**

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**PURPOSE:** Active commuting has been proved to be related to higher levels of physical activity in children in Western countries. Whether this relationship exists for specific forms of physical activity, e.g., sport participation and outdoor play, remains

unclear, especially among Chinese children. This study aimed to investigate the association of active commuting with sport time and outdoor play time in Chinese schoolchildren.

**METHODS:** A total of 441 children (49.7% boys, mean age =  $8.3 \pm 0.9$  years) in grades 1 to 3 from four primary schools in Beijing participated in this study. Information of children's walking trips, daily sport time, and daily outdoor play time was reported by parents using the modified Chinese version of the children's leisure activities study survey. Children were categorized as either active ( $\geq 6$  walking trips per week) or passive commuters ( $< 6$  walking trips per week) based on the parent-reported number of trips walking to and from school. Children reported their own sex, age, and exercise self-efficacy. Children's body weight and height were measured by researchers to calculate body mass index (BMI). Differences of daily sport time and outdoor play time between active vs. passive commuters were examined by the analysis of covariance (ANCOVA) adjusting for children's age, BMI, and exercise self-efficacy. ANCOVA were conducted separately for boys and girls.

**RESULTS:** 42.7% of boys and 40.3% of girls were classified as active commuters. In boys, no difference was found for daily sport time between active and passive commuters ( $62.0 \pm 46.7$  min/d vs.  $55.4 \pm 41.4$  min/d,  $P = 0.266$ ), whereas active commuters had more time of outdoor play than passive commuters ( $194.8 \pm 122.4$  min/d vs.  $153.7 \pm 122.3$  min/d,  $P = 0.041$ ). For girls, neither daily sport time ( $64.1 \pm 37.7$  min/d vs.  $54.1 \pm 43.9$  min/d,  $P = 0.110$ ) nor daily outdoor play time ( $146.3 \pm 129.6$  min/d vs.  $178.5 \pm 141.4$  min/d,  $P = 0.156$ ) differed between active and passive commuters.

**CONCLUSIONS:** Boys who actively commute to school have higher levels of outdoor play time. Promoting active commuting may increase levels of physical activity in Chinese schoolchildren.

**874 Board #108 May 29 2:00 PM - 3:30 PM**  
**A Comparison of Obesity and Other CVD Risk Factors between Boys and Girls in Kuwait**

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The prevalence of childhood obesity in Kuwait, among the highest globally including the US, is higher in boys than girls. Cardiovascular disease (CVD) risk is hence a concern, but data are limited comparing other CVD risk factors between boys and girls. **PURPOSE:** To compare the mean level and prevalence of CVD risk factors between 5th grade boys and girls in Kuwait. **METHODS:** A cross-sectional study of 367, 5th graders at  $10.4 \pm 0.4$  years of age, (53% girls), from 16 schools in 6 Kuwaiti cities. Outcome variables and at-risk cut points included: Body mass index (BMI) to classify overweight (OW) or obese (OB) [WHO 2007], total cholesterol (TC  $\geq 170$  mg/dL), low-density lipoprotein (LDL  $\geq 130$  mg/dL), high-density lipoprotein (HDL  $< 40$  mg/dL), TC:HDL-C ( $\geq 3.5$ ), triglycerides (TG  $\geq 100$  mg/dL), resting systolic (SBP), and diastolic blood pressure (DBP) ( $\geq 90$ th centile). Trained research assistants took measures with a portable anthropometer, scale, Cardiocheck Plus analyzer, and BP via auscultation with manual cuff. Physical activity (PA) and screen time (ST) were self-reported. Differences were examined with ANOVA or  $\chi^2$  (significance  $p \leq 0.05$ ). **RESULTS:** Mean and % at-risk for boys vs girls was: BMI Z score ( $1.32 \pm .11$  vs  $1.29 \pm .09$ ;  $p < 0.44$ ), OW (15.5% vs 27.1%,  $p < 0.007$ ), and OB (41.1% vs 37.8%,  $p < 0.487$ ). There were no significant differences in blood lipids except girls had higher TG ( $108.5 \pm 58.6$  vs  $91 \pm 42.7$  mg/dL,  $p < 0.009$ ). Girls vs boys had higher (non-significant) % at risk for TC (29% vs 23%;  $p < 0.28$ ), low HDL-C (21% vs 12%;  $p < 0.06$ ), TC:HDL-C (29.5% vs 22%;  $p < 0.16$ ), and TG (38% vs 30%;  $p < 0.19$ ); and lower % at risk for LDL-C (3.2% vs 4.5%;  $p < 0.60$ ). Girls also had significantly higher SBP ( $107.7 \pm 12$  vs  $102.4 \pm 11.5$  mmHg;  $p < 0.001$ ) and DBP ( $70.3 \pm 9.6$  vs  $64.8 \pm 8.7$  mmHg;  $p < 0.0001$ ), and % at-risk for BP (10% vs 6%;  $p < 0.16$ ), respectively. Boys mean PA (ds/wk  $\geq 60$  min;  $3.37 \pm 2.36$  vs  $2.47 \pm 2.24$ ;  $p < 0.001$ ) and ST (hrs/d;  $4.97 \pm 2.56$  vs  $4.50 \pm 2.77$ ;  $p < 0.119$ ) were higher than girls. Most girls and boys ( $> 80\%$ ) did not meet PA or ST ( $\leq 2$  hrs/d) recommendations. **CONCLUSION:** Contrary to previous data Kuwaiti boys did not have significantly higher obesity prevalence vs girls. Girls had significantly higher OW % at risk; and mean TG, SBP, DBP, and lower PA levels. Intervention studies on Kuwaiti children are warranted to reduce CVD risk factors including improving PA and ST behaviors.

**875 Board #109 May 29 2:00 PM - 3:30 PM**  
**Handgrip Strength and Congestive Heart Failure in Aging Adults: Getting a Grip on Heart Health**

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(No relevant relationships reported)

Handgrip strength is a powerful biomarker of aging that is linked to a variety of health conditions; however, it is not well understood how handgrip weakness factors into certain cardiovascular diseases such as congestive heart failure (CHF). **PURPOSE:** To determine the association between handgrip weakness on time to CHF for aging adults in the United States. **METHODS:** A discrete sample of 12,658 adults aged at least 50 years (age:  $68.0 \pm 10.2$  years at baseline) who participated in at least one wave of the 2006-2014 waves of the Health and Retirement Study were included. Interviews were conducted on participants biennially. Healthcare provider diagnosed CHF was self-reported at each wave. A spring-type hand-held dynamometer assessed maximal handgrip strength. Age- and race-specific maximal handgrip strength cut-points were used for determining weakness (Black men:  $< 40$ -kilograms, Black women:  $< 31$ -kilograms, White men:  $< 35$ -kilograms, White women:  $< 22$ -kilograms). A Cox proportional hazard regression model examined the association between handgrip weakness and time to CHF. Sex, race, age, body mass index, current smoking status, smoking history, self-rated health, diabetes status, and previously reported heart conditions aside from CHF were controlled for in the analyses. **RESULTS:** For those included, 4,141 (32.7%) were weak and 252 (2.0%) developed CHF during the mean follow-up of 5.6 $\pm$ 4.5 years. The covariate-adjusted Cox model revealed that those who were weak had a 35% higher hazard of CHF (hazard ratio: 1.35; 95% confidence interval: 1.02, 1.80), relative to those who were not-weak. **CONCLUSIONS:** Our findings suggest that handgrip weakness was associated with an increased risk of incident CHF for aging adults in the United States. Measures of handgrip strength should become more commonplace in clinical settings for assessing age-related weakness and risk for poor clinically-relevant health outcomes such as CHF. Similarly, interventions aiming to prevent or treat CHF in aging adults should incorporate measures of handgrip strength. Engaging in muscle strengthening activities and behaviors earlier in life may help to preserve strength and lower risk for CHF during aging.

**876 Board #110 May 29 2:00 PM - 3:30 PM**  
**Association Between Grip Strength and Diabetes Prevalence in 45- to 60-Year Old Chinese Men**

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Several studies showed that grip strength is related to cardiovascular risk factors, but few on the relationship between grip strength and prevalence of diabetes, especially for Chinese people.

**PURPOSE:** To explore the associations between grip strength and fasting blood glucose of diabetes and diabetes prevalence in 45- to 60-year old Chinese men. **METHODS:** All the subjected were recruited from three health management centers of hospitals in China, they finished the basic medical examination and grip strength test and  $VO_{2max}$  test. Diabetes was assessed by physical diagnosis or fasting blood glucose. Grip strength was tested in dominant hand; and  $VO_{2max}$  was measured by YMCA cycle test.

**RESULTS:** 1) There are 800 men recruited in this study, 82 of them are diabetes, the prevalence of diabetes is 10.25%. 2) The grip strength of diabetes patients is lower than that of other people [(35.50 $\pm$ 6.96) kg vs. (37.26 $\pm$ 7.40) kg,  $P < 0.05$ ], and also the  $VO_{2max}$  is lower than that of other people [(35.17 $\pm$ 7.86) mL/kg/min vs. (32.72 $\pm$ 6.06) mL/kg/min,  $P < 0.05$ ]. 3) In all men, the grip strength is negatively correlated with fasting blood glucose ( $r = -0.10$ ,  $P < 0.05$ ). In diabetes men, the grip strength is also negatively correlated with fasting blood glucose ( $r = -0.21$ ,  $P < 0.05$ ), after adjusted the age and BMI, the relationship is still significant ( $r = -0.233$ ,  $P < 0.05$ ). 4) If 5 kg increase in grip strength, the fasting blood glucose of diabetes men can decrease 1.165 mmol/L, and the prevalence of diabetes men will decrease 36.22%.

**CONCLUSIONS:** 1) The grip strength of diabetes men is related to fasting blood glucose; improving the grip strength can improve the blood glucose level of diabetes men and reduce the prevalence of diabetes. 2) Fasting blood glucose is negatively correlated with grip strength in men, which indicated that grip strength, a simple test index, could be as a predictor of diabetes in men.

Supported by China Health Promotion Foundation CHPF2014-FITEX

**877** Board #111 May 29 2:00 PM - 3:30 PM  
**Non-Exercise Estimated Cardiorespiratory Fitness Mediates the Relationship Between Comorbidities and Health-Related Quality of Life in Korean Older Adults**

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 (No relevant relationships reported)

**PURPOSE:** To investigate whether or not CRF mediates the relationship of comorbidities with health-related quality of life (HRQoL) in a representative sample of Korean older adults.

**METHODS:** Data from a total of 7,350 Korean older adults aged ≥60 years (58% women) who participated in the 2008-2011 Korean National Health and Nutritional Examination Survey were used in this analysis. HRQoL was assessed with the EuroQoL-5 dimensions (EQ-5D) index and EuroQoL visual analogue scale (EQ-VAS). Comorbidity was defined as physician-diagnosed chronic conditions. CRF was estimated with a non-exercise regression equation derived from sex, age, body mass index, and self-reported physical activity. The SPSS macro provided by Preacher and Hayes was used to test whether CRF mediated the relationship between comorbidity and HRQoL at statistical significance of  $p=0.05$ .

**RESULTS:** The total effect of the presence of comorbidities on HRQoL was significant (path c;  $\beta=-3.091$ ,  $p<0.001$ ). The presence of comorbidities was negatively related to eCRF in HRQoL model (path a:  $\beta=-0.403$ ,  $p<0.001$ ). As illustrated in Fig. 1, the effect of eCRF as a mediator on HRQoL was also significant (path b:  $\beta=1.574$ ,  $p<0.001$ ). The mediation analysis using the bootstrapping method (5,000 resamples) showed that eCRF mediated the relationship between the presence of comorbidities and HRQoL in Korean older adults (path a × b:  $\beta=-0.635$ , 95% CI=-0.746 ~ -0.524, Sobel test result  $Z=-11.029$ ,  $p<0.001$ ). In addition, a direct effect of the presence of comorbidities on HRQoL was also significant (path c':  $\beta=-2.456$ ,  $p<0.001$ ).

**CONCLUSIONS:** The current findings suggest that CRF mediates the relationship between comorbidities and HRQoL in Korean older adults. Supported by the National Research Foundation funded by the Korean Government (NRF-2018R1D1A1B07048153 and NRF-2016R1A6A3A11932432).

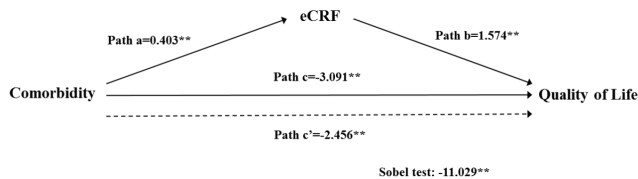


Fig. 1 The estimation of the direct and indirect effect of eCRF on health related quality of life

**878** Board #112 May 29 2:00 PM - 3:30 PM  
**Longitudinal Associations Between Handgrip Strength and Cardiovascular Biomarkers Among Rural Adults: A Project FRONTIER**

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The decrease in muscular strength is one of the key symptoms of sarcopenia in older adults. A growing body of literature shows inverse associations of maximal isometric handgrip strength, a simple and non-invasive measure of skeletal muscle strength, with risk for cardiovascular disease (CVD)-related morbidity and mortality. However, the evidence is equivocal and there is little research examining the relationship of the concurrent longitudinal change in handgrip strength and CVD biomarkers. **PURPOSE:** This study examined longitudinal relationships between maximal handgrip strength and CVD biomarkers in older adults living in rural areas. **METHODS:** Data for this study came from Project FRONTIER (N=138; 59±12y, average 2.8 follow-up years), an ongoing epidemiological study monitoring the health of adults in rural northwest Texas, USA. Handgrip strength normalized to body mass index and CVD biomarkers including triglycerides, fasting blood glucose, high-density lipoprotein cholesterol (HDL-C), waist circumference (WC), and blood pressure (BP) were obtained. The association between strength and CVD biomarkers was examined at baseline, with strength as a predictor of the annual change in biomarkers, and in a parallel fashion between the annual change in strength and CVD biomarkers. **RESULTS:** After adjusting for demographic information, results for the total sample showed strength to associate with WC ( $b=-13.6$ ,  $P<0.001$ ) and diastolic BP ( $b=6.1$ ,  $P=.025$ ) at baseline. Strength was not found to predict the annual change in any biomarker.

Rather, the annual change in strength was positively associated with the change in HDL-C ( $b=12.7$ ,  $P=.003$ ). Interestingly, when participants were stratified into low and higher CVD risk groups, low risk adults who did not lose strength had greater annual increases in HDL-C than low risk adults that lost strength (2.3 vs. -1.4 mg/dl/year,  $P<.001$ ). Adults with higher CVD risk who did not lose strength had greater annual decreases in triglycerides ( $P=.054$ ) and BP ( $P\leq 0.05$ ) than higher risk adults that lost strength. **CONCLUSIONS:** Collectively, the present findings suggest that maintenance of muscle strength with aging is related to positive changes in CVD risk factors.

**879** Board #113 May 29 2:00 PM - 3:30 PM  
**Reallocating Sedentary Time to Sleep or Physically Active Behaviors: Associations with BMI in College Students**

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**PURPOSE:** More than 160 million US adults aged 20 years and older are overweight or obese. College students represent a subpopulation at a higher risk for excess weight gain, which is often influenced by daily health behaviors, such as time spent in sleep, sedentary time (SED), and physical activity (PA). **METHODS:** This study applied a novel isotemporal substitution model approach to investigate how reallocating time spent in SED activities to sleep and PA influenced body mass index (BMI). College students ( $n=1,533$ , mean age:  $20.1\pm 1.5$  years, mean BMI:  $24.4\pm 4.7$  kg/m<sup>2</sup>) provided self-reported height, weight, and time spent in sleep, SED, and PA data anonymously through an online survey. Sleep was assessed via the Pittsburgh Sleep Quality Index. PA and SED were assessed via the International Physical Activity Questionnaire. **RESULTS:** Sleep ( $r=-0.070$ ) and moderate-to-vigorous intensity PA (MVPA) ( $r=-0.068$ ) were weakly but significantly associated with BMI (all  $P<.05$ ). SED ( $r=0.043$ ) and light-intensity PA (LPA) ( $r=-0.014$ ) were not associated with BMI (all  $P>.05$ ). In both the single and partition models, sleep ( $B=-0.223$  and  $B=-0.238$ , respectively) and MVPA ( $B=-0.333$  and  $B=-0.348$ , respectively) were inversely associated with BMI (all  $P<.05$ ). Among the total sample, reallocating 60-min of SED behavior with sleep ( $B=-0.277$ , 95% CI: -0.461, -0.093) or MVPA ( $B=-0.386$ , 95% CI: -0.635, -0.147) was associated with a small but significant decrease in BMI. In a subgroup analysis of overweight and obese participants ( $n=543$ , mean BMI:  $29.2\pm 4.3$  kg/m<sup>2</sup>), reallocating 60-min of SED behavior with sleep ( $B=-0.384$ , 95% CI: -0.667, -0.108) or MVPA ( $B=-0.796$ , 95% CI: -1.15, -0.436) was associated with a decrease in BMI, with the strongest association occurring when MVPA was substituted for SED. **CONCLUSION:** Reallocating 60-min of sedentary time with sleep or MVPA was associated with favorable effects on BMI among college students. Reductions in BMI were greater among overweight and obese individuals, especially when SED was replaced with MVPA.

**880** Board #114 May 29 2:00 PM - 3:30 PM  
**Co-existence Of Physical Activity And Sedentary Behavior Among Children And Adolescents In Shanghai, China**

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There is limited evidence for the prevalence of the co-existence of meeting physical activity (PA) and sedentary behavior (SED) guidelines, and their correlates among children and adolescents.

**PURPOSE:** To investigate the prevalence of PA and SED guidelines, and their co-existence, and to examine the associations between PA or SED, or both with gender and age among children and adolescents in Shanghai, China.

**METHODS:** Using a cross-sectional study design (conducted from September to December 2014), 50,090 children and adolescents (10-18 years old, 50.4% boys) were included in this study. A self-report questionnaire was used to measure participants' socio-demographic characteristics, PA, and SED. Descriptive statistics were used to describe sample characteristics, the prevalence of meeting PA and SED guidelines, and their co-existence. A Generalized Linear Model was conducted to explore the associations between the prevalence of PA and SED, and their co-existence with gender and age separately.

**RESULTS:** Of the children and adolescents studied, only 18.4% met the guidelines for PA, 25.5% met the guidelines for SED, and 5.7% met the guidelines for both. Boys

were more physically active (aOR = 1.43, 95% CI: 1.36-1.50), and girls were less sedentary (aOR = 1.29, 95%CI: 1.24-1.34). The prevalence of PA, SED, or both all declined as age increased ( $p < 0.001$ ). Stratified analysis by gender revealed greater declining trends of meeting the PA or SED guidelines, or both in girls with increasing age (all  $p < 0.005$ ).

**CONCLUSIONS:** Very few children and adolescents showed active lifestyles, and this was significantly related to age. Effective interventions aiming to promote PA and concurrently to limit SED among children and adolescents should be implemented as early as possible.

**881 Board #115 May 29 2:00 PM - 3:30 PM**  
**Association Of Cardiovascular Health Trajectories And**  
**Cardiorespiratory Fitness: The Cardia Study**

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 (No relevant relationships reported)

Ideal cardiovascular health (CVH) is a composite metric of seven health factors and behaviors. How cardiorespiratory fitness (CRF) is related to CVH is unclear. **Purpose:** To identify associations of CVH trajectories throughout adulthood with CRF in late-middle age. **Methods:** CVH components were measured in Black and White adults (N=2723, aged 18-30 yrs. at baseline) in the CARDIA Study at seven in-person examinations over 20 years. Graded treadmill tests at years 0 and 20 were used to measure CRF (minutes duration). CVH was determined by assigning each metric a score of 2 (ideal), 1 (intermediate), or 0 (poor) and summing the scores (range 0-14). Latent class modeling was used to identify subgroups of individuals with similar CVH trajectories from young adulthood to middle age. Multivariable logistic Poisson regression was used to assess the association between 20-year CVH trajectories and race- and sex-specific quartiles of CRF at year 20. **Results:** Five distinct CVH trajectories were identified: high (n=485), high-moderate (n=666), moderate (n=805), low-moderate (n=603), and low (n=164). Compared to the high trajectory group, odds ratios for low fitness (bottom quartile) at year 20 were 3.2 (95% CI: 1.9-5.2) for high-moderate, 6.6 (4.1-10.7) for moderate, 9.9 (6.1-16.4) for low-moderate, and 14.0 (8.2-24.0) for the low CVH trajectory groups after adjusting for race, sex, education, center, baseline CVH, and baseline CRF. **Conclusion:** Lower CVH trajectories throughout adulthood are associated with higher odds of low CRF in late-middle age.

**882 Board #116 May 29 2:00 PM - 3:30 PM**  
**A Prospective Cohort Study of Physical Fitness and**  
**Incident Glaucoma: The Niigata Wellness Study**

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 (No relevant relationships reported)

There is limited evidence exploring the association between cardiorespiratory fitness and the incidence of glaucoma. However, associations between other components of fitness and incident glaucoma are still unknown.

**PURPOSE:** To investigate the association between muscular and performance fitness and the incidence of glaucoma among Japanese workers in the Niigata Wellness Study. **METHODS:** Participants included 26,183 workers (18,129 men) [median (interquartile range) age 50 (44-56) years] free of glaucoma who underwent physical fitness tests in 2001. Muscular and performance fitness index was calculated using a summed z-score by sex and age from grip strength, vertical jump, single-leg balance with eyes closed, forward bending, and whole-body reaction time. The participants were divided into quartiles according to the muscular and performance fitness index and each physical fitness test. During 2002-2007, participants were followed for development of glaucoma, which was defined based on physician diagnosis. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) for the incidence of glaucoma

were estimated using Cox proportional hazards models after adjusting for age, sex, body mass index, cigarette smoking, alcohol intake, hypertension, dyslipidemia, and diabetes.

**RESULTS:** During the follow-up, 292 participants developed glaucoma. The HRs (95% CIs) for developing glaucoma across quartiles of muscular and performance fitness index (lowest to highest) were 1.00 (reference), 0.99 (0.74-1.34), 0.64 (0.46-0.89), and 0.64 (0.46-0.89) ( $P$  for trend = 0.001). For vertical jump, the HRs (95% CIs) of developing glaucoma across quartiles (lowest to highest) were 1.00 (reference), 0.73 (0.54-0.99), 0.76 (0.56-1.03), and 0.54 (0.38-0.77) ( $P$  for trend < 0.001). For whole-body reaction time, the HRs (95% CIs) across quartiles (slowest to fastest) were 1.00 (reference), 0.77 (0.57-1.04), 0.65 (0.47-0.89), and 0.51 (0.37-0.72) ( $P$  for trend < 0.001). There were no associations between the other physical fitness tests and the incidence of glaucoma.

**CONCLUSIONS:** Muscular and performance physical fitness may be associated with lower risk of incident glaucoma. The precise mechanisms, which may include beneficial changes to intraocular pressure and antioxidant effects, are unknown and should be explored.

**883 Board #117 May 29 2:00 PM - 3:30 PM**  
**Effects of Arterial Stiffness Between Objectively**  
**Measured Physical Activity and Domain-Specific**  
**Cognition in Older Adults**

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**PURPOSE:** To examine the effects of arterial stiffness (AS) on the associations between objectively measured physical activity (PA) and domain specific cognitive functioning in older adults. **METHODS:** This cross-sectional analysis included baseline data from 415 older adults enrolled in the Physical Activity and Aging Study (PAAS). Cognitive functioning was measured by working memory using Digit Span Test and selective attention and processing speed using computerized Stroop Test. PA over 7 days was measured with Omron accelerometer-based pedometers and time engaged in light-, moderate-, and vigorous-intensity PA with FitBit Charge 2 wristbands. AS was derived from carotid-femoral pulse wave velocity (cfPWV; AtCor Sphygmocor XCEL). High AS was defined as cfPWV  $\geq 10$  m/s, which is an established risk factor of cardiovascular diseases. Multivariable linear regression was used to model the associations between PA, AS, and each cognitive-domain score. **RESULTS:** Participants were a mean age of 72 ( $\pm 6$ ) years old and were well educated with 82% having a bachelor's degree or higher. Participants were also cognitively healthy (Mean Score of Mini-Mental State Examination 29.2 [ $\pm 1.29$ ] out of 30). Participants with high AS (20.96%, n=87) accumulated fewer total steps per day ( $p=0.01$ ), engaged in less light-intensity PA ( $p<0.01$ ), and had worse precision on the Stroop test ( $p < 0.01$ ) compared to those with low AS. There were no significant group differences for other cognitive test scores. Light-intensity PA was associated with better performance on the digit span forward among those with high AS ( $p=0.01$ ), but not those with low AS, after adjusting for age, sex, education, diabetes, hypertension, and current smoking status ( $p=0.01$ ) from linear regression. However, no significant results were found in other PA variables regardless of AS status. **CONCLUSIONS:** These results suggest a possible association of increased light-intensity PA with better working memory, particularly among older adults with high AS who are at higher risk of developing cardiovascular diseases.

Supported by unrestricted research grant by Biospace

**884 Board #118 May 29 2:00 PM - 3:30 PM**  
**Benefits of Behavior: Exercise Enhances Perception of**  
**Physical Function Independent of Improvement Among**  
**Diabetic Patients**

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In the U.S., approximately 1.5 million new cases of diabetes arise each year. Although these patients commonly report lower quality of life (QOL) than those without chronic illness, much of the literature remains focused on the physical benefits of weight loss and blood glucose management. To deliver individualized care, practitioners must also evaluate psychological health, including patient perceptions. **PURPOSE:** To determine factors that affect perception of physical function in diabetic patients. **METHODS:** 38 men and women with diabetes completed a 10-week, 20-session exercise program that included both aerobic and resistance training components. At baseline and follow-up, we measured body fat percent (BF%), body mass index (BMI), and performance on

six standard functional tests. Subjects also completed a self-report QOL questionnaire in which perception of physical function was assessed. Linear regressions tested the effect of functional performance (baseline capacity and 10-week change) on perception of function. **RESULTS:** Patients were 67.9±9.1 years of age, mean BMI was 31.5±6.1, and self-reported physical functioning ranged from 5.0 (very poor) to 100.0 (optimal); mean score was 54.7±26.8. At baseline, perception of physical functioning was not related to sex (p=0.751), age (p=0.405), BMI (p=0.610), or BF% (p=0.864). It was related to improved performances in six-minute walk (p<0.001), functional reach (p=0.046), timed up-and-go (p=0.080), chair stand (p=0.006), and sit-and-reach (p=0.024). At follow-up, perceptions of functioning improved by 13.8±24.5 points (25.7%; p=0.002) but there was no association with improvement in any anthropometric or functional tests: BMI (p=0.457), BF% (p=0.526), six-minute walk (p=0.131), functional reach (p=0.293), timed up-and-go (p=0.226), arm curl (p=0.966), chair stand (p=0.592), and sit-and-reach (p=0.970). **CONCLUSION:** 10 weeks of exercise improved perception of physical function by more than 25% in patients with diabetes. Improvement was unrelated to enhancement of any anthropometric or performance domain. Patients with diabetes seem to improve their perceptions via participation rather than progress. Thus, it may be important to incorporate the behavior of exercise into treatments, even if it fails to elicit physical improvement.

**885** Board #119 May 29 2:00 PM - 3:30 PM  
**Sedentary Behavior and Physical Inactivity among College Students Affect Core Strength, Flexibility, and Posture**

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 (No relevant relationships reported)

Sedentary behavior and physical inactivity have increased with advancements in technology. College students are high utilizers of computers and mobile devices, often for long periods with poor posture, putting them at risk for negative health consequences. **PURPOSE:** To evaluate the effects of sedentary behavior and physical activity participation on core strength, flexibility, and posture in college students. **METHODS:** College students (N=33; n=22 female, n=11 male) completed physical measures and questionnaires of sedentary behavior (SB) and physical activity (PA). Curl-up tests, sit and reach, and plumb line assessments indicated core strength, flexibility, and posture, respectively. Two-way ANOVAs were performed with participants categorized by their posture measures (rounded shoulders; RS, and forward head posture; FHP) on weekday and weekend SB, and PA per week. Associations were determined between SB, PA, core strength, flexibility, and body fat percentage by computing Pearson's correlation coefficients. **RESULTS:** There were no significant differences in SB and PA between postural groups. However, participants with RS and FHP spent an hour more per day being sedentary on average than those with RS alone (RS & FHP: SB weekday, M=3.74 hrs ± 0.79, SB weekend, M= 3.74 hrs ± 0.9; RS only: SB weekday, M= 2.62 hrs ± 0.36, SB weekend, M= 2.77 hrs ± 0.48). SB was associated with decreased flexibility (SB weekday: r=-0.47, p<0.01; SB weekend: r=-0.48, p<0.01), while physical inactivity was associated with higher body fat percentage (r=0.36, p=0.04) and decreased core strength (r=-0.51, p<0.01). Furthermore, college students who were sedentary during the week were also sedentary on the weekend (r=0.82, p<0.01). **CONCLUSIONS:** Sedentary behavior and physical inactivity were associated with negative changes in core strength, flexibility, posture, and body composition. Interventions targeting improvements in these behaviors among college students should include guidance on reducing screen time and limiting improper posture.

**886** Board #120 May 29 2:00 PM - 3:30 PM  
**Effects Of BMI And VO<sub>2peak</sub> On Cardiometabolic Health In Inactive, Overweight And Obese Adults**

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**PURPOSE:** Body mass index (BMI) and cardiorespiratory fitness (CRF; VO<sub>2peak</sub>) are significant predictors of cardiovascular health with high CRF being protective in the presence of high BMI. The current analysis aimed to determine relative contribution of overweight (OW) vs obese (OB) BMI while cross-stratifying with higher (HF) and lower (LF) CRF on blood lipids and glycemic markers. We hypothesized that an OW-HF group was more likely to have normal biomarkers compared to the OB-LF CRF group. **METHODS:** Insufficiently-active participants (N=89, male=22, female=67, BMI range=25-50) underwent the following assessments with the following cut-points for normal/abnormal: fasting glucose (GLU, ≤100 mg/dL), insulin (≤10 μU/mL), HOMA-IR (≤2.5), total-cholesterol (TC, ≤200 mg/dL), LDL-cholesterol (LDL-C, ≤130 mg/dL),

HDL-cholesterol (HDL-C, male ≥40 mg/dL, female ≥50 mg/dL), triglycerides (TG, ≤150 mg/dL). BMI was calculated from measured height and weight and VO<sub>2peak</sub> was estimated using a modified Balke protocol. BMI was stratified by overweight/obese cut-offs; high/low fitness was stratified at ≥6-MET from VO<sub>2peak</sub>. Groups were: OW-HF (n=28), OW-LF (n=36), OB-HF (n=5), OB-LF (n=20). Odds ratios (OR) for having normal biomarker concentrations were reported using multiple logistic regressions (α = 0.05).

**RESULTS:** Participants biomarker concentrations were (mean±SD): GLU: 92.0±8.8 mg/dL, insulin: 14.1±8.4 μU/mL, HOMA-IR: 3.3±2.2AU, TC: 173.5±29.5 mg/dL, LDL-C: 119.6±29.0 mg/dL, HDL-C: 48.9±13.6 mg/dL, and TG: 109.1±47.5 mg/dL. Measured height and weight confirmed BMI (33.4 ± 5.9 kg/m<sup>2</sup>). Estimated VO<sub>2peak</sub> was 23.5± 3.8 mL/kg/min. Compared to OB-LF, the OW-HF group was more likely to have normal HOMA-IR (OR 1.6; 95%CI = 1.04, 2.4; p = .03) and desirable HDL-C concentrations (OR 1.9; 95%CI = 1.2, 2.8; p < .01). No significant cross-stratified differences for HDL-C or HOMA-IR were observed. There were no significant differences for the other five biomarkers.

**CONCLUSIONS:** In this sample of insufficiently-active overweight and obese individuals, when cross-stratifying by CRF and BMI, a combination of OW and HF factors were related to normal HOMA-IR and HDL levels.

**887** Board #121 May 29 2:00 PM - 3:30 PM  
**Temporal Trends Of Physical Activity Among High School Students In The United States, 2011-2017**

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 (No relevant relationships reported)

**BACKGROUND:** Physical activity has long been considered an important component of a healthy lifestyle. The habit of physical activity as a childhood affects adults as well. Therefore, it is important to investigate the trend of physical activity among adolescents. **PURPOSE:** The purpose of this study was to evaluate temporal trends in physical activity among US high school students. Physical activity trends were evaluated by the whole group and the various subgroups, including different gender, race-ethnicity, and body mass index (BMI) levels. **METHODS:** Data from a total of 52,288 high school students who participated in the Youth Risk Behavior Survey (YRBS) from 2011 to 2017 were analyzed for this study. Physical activity was measured using a question of YRBS; during the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? BMI was categorized into four levels: (1) Obese (i.e., BMI ≥ 95th percentile by age and gender); (2) Overweight (i.e., 85th percentile ≤ BMI < 95th percentile by age and gender); (3) Normal weight (i.e., 5th ≤ percentile BMI < 85th percentile by age and gender); (4) Underweight (i.e., BMI < 5th percentile by age and gender). SAS (v 9.3) and Stata (v. 12) were used to examine the temporal trends of physical activity among US high school students. Tests for trend over the years were performed using linear and quadratic-specific orthogonal polynomial coefficients. **RESULTS:** For the overall sample, there were no linear and quadratic trends found in the weighted mean of number of days per week children engaged in at least 60 min/d of physical activity (linear: β = .05, p = .29; quadratic: β = .08, p = .28). Further, for nearly all subgroups, linear and quadratic trends were not observed. However, there was a linear trend observed by BMI; only students who are obese increased their physical activity from 2011 to 2017 (β = .15, p = .03). **CONCLUSIONS:** Despite the increased emphasis on physical activity over recent years, engagement in physical activity did not increase. Continuous monitoring of surveillance data is necessary to provide information on the allocation, development, implementation, and evaluation of community-based physical activity programs for adolescents.

**888** Board #122 May 29 2:00 PM - 3:30 PM  
**Temporal Associations of Nocturnal Sleep Duration with Physical Activity and Sedentary Time in Preschool Children**

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**PURPOSE:** To examine the associations between nocturnal sleep duration and physical activity (PA), sitting time (ST) and sit-to-stand transitions the following days among young children in Hong Kong. **METHODS:** 114 young children (71 boys) aged 3-6 years were recruited from 3 kindergartens. They were instructed to wear an activPAL™ for 24-hour over 7 consecutive days to determine PA, ST, sleep duration, and sit-to-stand transitions. For each participant, 7 pairs of sleep → PA/ST/transitions were generated, representing unique rows of sleep duration the preceding evening (e.g., Monday) and PA/ST/transitions the following day (e.g., Tuesday). To account for total waking hours, the



outcomes were presented in relative values (e.g., PA/waking hour). Linear mixed models were performed to determine the associations of nighttime sleep duration with PA, ST, and sit-to-stand transitions the following days, adjusting for age, sex, body weight status, parental educational attainment, and number of wear days. The repeated outcomes of sleep duration and activity patterns the following day nested within participants were treated as random effect.

**RESULTS:** Seventy children provided valid data of PA, ST, and sleep. On average, the children accumulated 2.37 hours of PA a day (SD 0.45) and slept for 9.72 hours per night (SD 0.97). Sleep duration in the preceding night was positively associated with daytime PA ( $b = 0.007$ ; 95% CI, 0.002 to 0.012;  $p = 0.011$ ) and sit-to-stand transitions ( $b = 0.573$ ; 95% CI, 0.336 to 0.810;  $p < 0.001$ ), while was negatively associated with ST ( $b = -0.016$ ; 95% CI,  $-0.028$  to  $-0.004$ ;  $p = 0.008$ ) the following day.

**CONCLUSIONS:** Longer nocturnal sleep duration was associated with more PA, frequent posture transitions, and less sitting time in the following day for preschool children. More work is needed to investigate how sleep parameters other than duration affect daytime activity behaviors.

This study was supported by Health and Medical Research Fund Research Fellowship Scheme from Food and Health Bureau, the Government of the Hong Kong Special Administrative Region of the PRC (#02160127).

889 Board #123 May 29 2:00 PM - 3:30 PM

### An Extended Twin-pedigree Study Of Voluntary Exercise Behavior In The Netherlands

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(No relevant relationships reported)

**PURPOSE:** In the current research we investigated the heritability of voluntary regular exercise behavior using extended pedigrees, this allowed us to estimate the contribution of shared household effects in the presence of non-additive genetic effects, in contrast to much of the earlier work based on twin data. In addition, rather than assessing the total volume of exercise behavior as a unitary construct we have separated this across three domains: time spent on (1) any voluntary exercise and sports, (2) solitary exercise and sports, or (3) team-based exercise and sports.

**METHODS:** For the participants in the Netherlands Twin Register (NTR) we constructed the extended pedigrees which specify all relations among nuclear and larger twin families in the register. A total of 253,015 subjects from 58,645 families were linked to each other, to the degree that we had information on the relations among participants. For 56,161 adolescent and adult NTR participants in 20,897 families data were available on harmonized scores for total weekly MET hours, and the six domains. We analyzed these data in the Mendel software package to estimate the contributions of additive and non-additive genetic factors.

**RESULTS:** The estimated broad-sense heritability of total weekly MET hours spent on (1) any voluntary exercise and sports was 41% (26% additive genetic effects (A), and 15% non-additive genetic effects (D)). A shared household effect explained 24% and unique environmental factors explained the remaining 35% of the variance. For weekly MET hours spent on team-based exercise non-additive (dominance) genetic factors (28%) were a larger contributor compared to additive genetic factors (19%), while in solitary exercise these results were reversed (12% and 22% respectively).

**CONCLUSIONS:** In concordance with previous literature, our results suggest that exercise is a heritable trait, however our varying results in the various domains of exercise suggest that, at least in behavioral genetics, splitting exercise over domains rather than treating it as a unitary construct may be preferable.

890 Board #124 May 29 2:00 PM - 3:30 PM

### Diurnal and Circannual Variation in Body Temperature: Implications for Heat Illness Protocols

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As warm-season temperatures continue to rise, the incidence of heat illness is likely to increase. Although preventive protocols currently consider environmental risk factors, there may be reason to emphasize

diurnal and seasonal influences. Data supporting seasonal fluctuation in body temperature are abundant in animals but limited in humans. **PURPOSE:** To examine circannual and diurnal patterns of body temperature in a patient population. **METHODS:** We analyzed 2,184 men and women admitted to a major hospital in Indiana over 3 years. Demographic, anthropometric, and cardiometabolic variables were collected along with season, month, and time of admission. The National Centers for Environmental Information's National Climate Report was used to generate month-by-month ambient temperature data; there were clearly defined cold (October through April) and warm (May through September) periods. All patients received oral temperatures. We used t-tests and ANOVAs to detect differences in

body temperature by time conditions; we used linear regression to test the effect of chronological variables on body temperature, holding all measured confounders constant. **RESULTS:** Mean body temperature was  $98.16 \pm 0.73^\circ\text{F}$ . The warmest period of the day was 6:00 to 10:00pm ( $98.27^\circ\text{F}$ ). The coldest period was 2:00 to 6:00am ( $98.05^\circ\text{F}$ ;  $p < 0.001$ ). ANOVA revealed differences in body temperature by month ( $F = 2.525$ ;  $p = 0.004$ ) and by season ( $F = 3.656$ ;  $p = 0.012$ ). The strongest comparison was the cold vs. warm period ( $T = -3.835$ ;  $p < 0.001$ ). Patients admitted during the cold period ( $N = 1,139$ ) had a temperature of  $98.10 \pm 0.81^\circ\text{F}$  while patients admitted during the warm period ( $N = 1,045$ ) had a temperature of  $98.22 \pm 0.63^\circ\text{F}$  ( $p < 0.001$ ). Lower temperatures were also found among patients  $\geq 65$  years ( $p < 0.001$ ) and those with a positive blood alcohol test ( $p = 0.004$ ). Holding all measured confounders constant, being admitted during the warmer months predicted an elevation in body temperature of  $0.13^\circ\text{F}$  ( $p < 0.001$ ). **CONCLUSION:** These findings support diurnal and circannual variations in humans. Coaches and athletic trainers may consider this when designing and monitoring practice conditions. Athletes will likely require closer observation along with updated prevention protocols when practicing outdoors to minimize the risk of a heat-related event.

891 Board #125 May 29 2:00 PM - 3:30 PM

### Compliance with Physical Activity Guidelines and Associations with Physical Literacy Among Future Physical Educators

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(No relevant relationships reported)

**Purpose:** To examine the relationship between pre-professional physical educators meeting the U.S. Physical Activity Guidelines and steps per week and physical literacy.

**Methods:** Twenty-five physical education teacher education (PETE) undergraduate majors (19 males, 6 females, aged 19-24 years) participated in assessments of Physical Literacy using the Canadian Assessment of Physical Literacy and wore GTX3+ accelerometers on their waist for a week. Freedman 1998 cut-points were used for determining moderate-to-vigorous physical activity (MVPA). Descriptive statistics were calculated for all variables. Correlations were calculated to examine the relationships between measured MVPA, measured steps, Physical Literacy, self-reported PA and sedentary time, and physical competence. **Results:** 16% were compliant with MVPA guidelines, 4% were compliant with both MVPA and 10,000 steps recommendations, 56% met MVPA but were considered low active steps, and 24% did not meet any recommendations. Participants' physical literacy considered below that of a proficient 12-year old. Significant relationships existed between self-reported PA and Physical Competence ( $r=0.40$ ,  $p \leq .05$ ), and MVPA and Physical Literacy ( $r=0.42$ ,  $p \leq .05$ ); however, no other relationships existed. **Conclusions:** These findings suggest that while PETE students may meet the minimum guidelines for physical activity, more work needs to be done to address their Physical Literacy.

892 Board #126 May 29 2:00 PM - 3:30 PM

### Association Between Walking and Sunburn: A Potential Trade-Off Between Cancer Prevention and Risk Factors

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(No relevant relationships reported)

The association between higher physical activity levels and increased sunburn prevalence is a health behavior trade-off between the health benefits of physical activity and potential increased risk of skin cancer. Walking is a common form of physical activity accessible to most people yet has an unknown association with sunburn. This is important because risk of melanoma doubles with five or more sunburns. **PURPOSE:** To examine whether sunburn prevalence varied by walking behavior.

**METHODS:** This study used the 2015 National Health Interview Survey of adults ( $N=26,632$ ), age  $\geq 18$  years. We defined four exclusive categories of weekly walking: 1) those who reported no walking or less than ten minutes total; 2) only transportation walking; 3) only leisure walking; and, 4) both categories of walking. It was necessary to disaggregate walking into categories, as there are different behaviors and contexts associated with leisure and transportation walking. We estimated the adjusted prevalence of sunburn (one or more in the past 12 months) by walking category and separately for walking duration; we stratified by gender and sun-sensitivity (any reported skin burn when not protected from the sun for one hour).

**RESULTS:** The adjusted sunburn prevalence was not different between walking categories for women, but it was for men. Specifically, prevalence was lower for men who reported not walking, 34.1% (95% CI: 32.2%-36.1%) compared to 38.8% (95% CI: 36.5%-41.2%) who walked for both purposes ( $P=0.003$ ). Among sun-sensitive individuals, the adjusted sunburn prevalence was not different by walking category for women ( $P=0.28$ ) or men ( $P=0.21$ ). Regardless of sun-sensitivity status, weekly minutes of transportation or leisure walking was not significantly associated with sunburn prevalence for women or men.

**CONCLUSIONS:** The results suggest that walking, unlike leisure-time physical activity, may not be generally associated with sunburn, except for the higher sunburn prevalence for men who walked for both leisure and transportation purposes. Research is needed into public health messages that encourage walking for physical activity and advise sun protection, with special attention to men.

893 Board #127 May 29 2:00 PM - 3:30 PM

**Relationship between Neighborhood Environment and Physical Activity in Freshmen from Tsinghua University in Beijing, China**

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Neighborhood walking environment is an environmental issue affecting human health-related behaviors in China and worldwide. Few studies so far have researched the relationship between neighborhood environment walkability and physical activity among freshmen in China.

**PURPOSE:** We examined the relationship between neighborhood environment walkability and physical activity. **METHODS:** Neighborhood environment was measured using the Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Physical activity data by the Global Physical Activity Questionnaire (GPAQ) were collected. The data were analyzed by Stata14.0. **RESULTS:** We conducted a cross-sectional questionnaire study on 3,411 freshmen from Tsinghua University in Beijing, China. Of the total sample size, 2,318 were male (67.96%), and 1,093 were female (32.04%). One of seven environmental attributes were significantly related to moderate and vigorous physical activity (MVPA) (MET-minutes/week) in neighborhood aesthetics (168.64 [44.12-293.16];  $p=0.008$ ). One of seven environmental attributes were significantly related to vigorous physical activity (VPA) (MET-minutes/week): neighborhood aesthetics (151.57 [45.08-258.07];  $p=0.005$ ). Two of seven environmental attributes were significantly related to moderate physical activity (MPA) (MET-minutes/week): walking facilities (75.56 [5.36-145.76];  $p=0.035$ ) and neighborhood aesthetics (68.07 [3.51-132.62];  $p=0.039$ ). One of seven environmental attributes were significantly related to sitting time (minutes/week) in walking facilities (-18.64 [-32.57 - -4.71];  $p<0.001$ ). **CONCLUSIONS:** A positive correlation between neighborhood environment walkability, especially neighborhood aesthetics and walking facilities, and physical activity was found.

894 Board #128 May 29 2:00 PM - 3:30 PM

**Factors Leading to Discrepancies in Accumulated Physical Activity During School Hours in Elementary School Students**

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(No relevant relationships reported)

Inconsistently implemented state physical activity (PA) mandates lack oversight and regulation. **PURPOSE:** This study quantifies sex and racial differences of in-school PA among fourth grade students. **METHODS:** Students ( $N=148$ ) from eight rural, low socioeconomic schools wore accelerometers during school for one week. Teachers recorded data related to PA setting and duration. **RESULTS:** Of the 148 students, only 12 met the 150 minutes of in-school moderate-to-vigorous physical activity (MVPA) per week, in accordance with the state's mandate. Students spent a significant percentage of the total school day sedentary (75.7±5.7%, mean±SD). Males spent significantly more of daily recess engaged in MVPA than females (24.9% and 18%, respectively). White students spent a higher percentage of recess in MVPA than Non-White students (29.2±13.1% and 21.1±13.1%, respectively). Schools with a certified physical education instructor ( $n=2$ ) participated in significantly more minutes of MVPA during recess (9.1±7.3) and physical education class (3.1±2.0) than other schools (5.2±2.7 and 2.5±1.8, respectively). **CONCLUSIONS:** Very few students achieved the state-mandated 30 minutes of MVPA per day during school hours; however, schools with certified physical educators achieved more MVPA throughout the school day. Recess PA contributed considerably to this discrepancy, highlighting the importance of encouraging active play and other types of PA during breaks in the school day.

895 Board #129 May 29 2:00 PM - 3:30 PM

**Title: Association of Sleep and Physical Activity with Cardiometabolic Risk in Older Women: A Compositional Analysis**

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**PURPOSE:** To investigate the effect of daily (24-hour) activity behaviors (sleep, sedentary, light and moderate physical activity [LPA and MVPA]) on cardiometabolic risk among older women, using a compositional data analysis approach.

**METHODS:** Participants from the Healthy Women Study 2010-11 follow-up visit ( $N=145$ , aged 73.3±1.7 years, white=91.5%) wore an ActiGraph GT1M accelerometer (hip) and an Actiwatch-2 (wrist) for 7 consecutive days, to objectively monitor physical activity and sleep. The estimated duration of sleep, sedentary, LPA, and MVPA, were averaged across valid wear days ( $\geq 4$  days of  $\geq 10$  hours). For each participant a composite cardiometabolic risk score was calculated by transforming metabolic syndrome (MetS) components including waist circumference, blood pressure, fasting triglyceride, fasting high-density lipoprotein (HDL), and fast blood glucose into z-scores and summing z-scores to create a continuous MetS z-score. A 24-hour time composition of activity behaviors was derived and isometric log-ratio multivariable linear regression was used to predict MetS z-score. Additional 24-hour compositions were created where a fixed duration of time was reallocated from one activity behavior to another (e.g., sedentary to LPA), while time spent in the remaining activities was unchanged. Reallocation was defined as 15 minutes for sleep, sedentary and LPA, behaviors; and 5 minutes for MVPA. **RESULTS:** Participants had a mean MetS z-score  $-0.01 \pm 3.22$ . Mean daily time (minutes) spent in activity behaviors was 403, 749, 282, and 7; for sleep, sedentary, LPA and MVPA, respectively. The 24-hour composition was a statistically significant correlate of MetS z-score ( $P < 0.001$ ). Reallocation of 5 minutes from MVPA to sleep, sedentary, and LPA, increased the predicted MetS z-score by 1.07, 1.07, and 1.06, respectively. The predicted MetS z-score was reduced by 0.88, 0.91, and 0.85 when 15 minutes of sleep, sedentary, or LPA time was replaced with MVPA. Reallocation 15 min of sedentary time to LPA reduced the predicted MetS z-score by 0.05. **CONCLUSIONS:** This cross-sectional study demonstrates the beneficial effect of MVPA on cardiometabolic risk among older women. The exchange of sedentary time for LPA may also reduce cardiometabolic risk in older women.

896 Board #130 May 29 2:00 PM - 3:30 PM

**Screen and Non-screen Sedentary Time in Older Adults Living in a Retirement Community**

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**PURPOSE:** This study aimed to describe the magnitude and composition of screen (SST) and non-screen sedentary time (NSST) in older adults living in a retirement community (RC); documenting gender, mobility aid, chronic disease and exercise participation in screen and non-screen sedentary time variation. **METHODS:** One hundred subjects (84.7 ± 6.3 years; 70% female) were recruited from a RC located in the Midwest area of United States. Sedentary behavior (SB) was measured using a questionnaire specifically developed for the older adult population. The questionnaire comprises of 10 questions related to time spent in different activities (eight related to NSST and two related to SST). Based on the questionnaire, three metrics were calculated and expressed as hours per day: a) NSST, given by the sum of time spent in the eight out of 10 possible activities; b) SST, given by the sum of time spent in two out of 10 activities and; c) total sedentary time (TST), given by the sum of the time spent in NSST and SST. **RESULTS:** The findings indicated that overall older adults living in a RC spend on average 10 hours per day in sedentary activities; being 6.5 in NSST and 3.5 hours in SST. Older males reported spending significant higher SST compared to their older female counterparts (4.5 vs. 3.1;  $P<.05$ ). Those not making use of a mobility aid reported significant higher TST (10.2 vs. 9.3) and NSST (6.8 vs. 5.6) compared to those using a mobility aid ( $P<.05$ ). Older adults presenting with  $\geq 3$  chronic diseases reported significant higher TST (10.6 vs. 9.5) and NSST (6.9 vs. 5.5) compared to those with less than 3 chronic diseases ( $P<.05$ ). No differences were observed for TST, NSST and SST between older adults engaged and not engaged in a regular exercise. The findings further indicated that activities such as TV watching and reading comprise nearly 45% of participants' TST and computer use accounted for about 12%. **CONCLUSION:** The findings indicated that older adults living in a RC spend a large number of hours in sedentary activities and that 65% of this time is

spend in NSST and 35% in SST. The findings further suggest that significant gender, mobility aid, and chronic disease variations exist in terms of TST, NSST and SST in this population. Supported by Dean's Research Grant COE-NIU (2017-2018)

**897 Board #131 May 29 2:00 PM - 3:30 PM**  
**Geographical Effects In Familial Clustering Of Physical Activity, Adiposity And Metabolic Syndrome**

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Metabolic syndrome (MetS) risk factors, adiposity and physical activity (PA) levels have a multifactorial aetiology, comprising genetic and non-genetic factors. Notwithstanding the consistent findings about their aetiology, biological and behavioural traits do not explain the total variation and the increase of metabolic disorders and physical inactivity over the past decade. Additionally, links may be identified between built and natural environments, namely PA environments, on adiposity, MetS and PA phenotypes, as well as how they may affect different behaviours, especially within families. **PURPOSE:** The purpose of this study was to estimate the magnitude of genetic and environmental factors on adiposity, MetS risk factors and PA levels, and to investigate the role of PA environments on these traits. **METHODS:** The sample comprised 259 nuclear families (781 individuals) from a rural city of Portugal. All PA facilities' locations and families' home addresses were geocoded and Euclidian distances were calculated. Percentage of total body fat was estimated by bioelectrical impedance. Systolic and diastolic blood pressure, waist circumference, fasting glucose, triglycerides and total cholesterol were measured. PA was estimated by the Baecke questionnaire. Quantitative genetic models were used and computations performed in SOLAR software.

**RESULTS:** Genetic and shared environmental factors explained 22% and 38% of PA and body fat total variance, respectively. MetS risk factors were moderate-to-highly heritable, ranging from 26% to 73%. Spatially structured data of PA environments had significant effects on MetS risk factors, adiposity and PA phenotypes ( $p < 0.05$ ), except for waist circumference, contributing to low adiposity levels ( $p < 0.05$ ), increases in PA ( $p < 0.05$ ), and being protective against the development of MetS risk factors ( $p < 0.05$ ). **CONCLUSIONS:** Taken together, these results have important implications for the design of intervention programs, which need to consider the familial context and PA environments to promote physically active lifestyles and their positive effects on health.

**898 Board #132 May 29 2:00 PM - 3:30 PM**  
**Objectively-Measured PA and Sedentary Behavior Across The Lifespan Of Individuals With and Without Metabolic Syndrome**

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**PURPOSE:** To investigate whether PA and sedentary behavior (SB) differ across the lifespan of individuals with and without metabolic syndrome (MetS). Few studies investigating lifestyle behaviors in this population have utilized objective measures of PA or included youth. **METHODS:** Participants from NHANES 2003-2006 (ages 6-85) were divided into 5 age categories: Childhood ( $\leq 12$  years) ( $N=6,672$ ), adolescence (13-19 years) ( $N=5,938$ ), early adulthood (20-40 years) ( $N=5,537$ ), middle adulthood (40-64 years) ( $N=5,176$ ), and late adulthood ( $\geq 65$ ) ( $N=3,730$ ). Classification of MetS was based upon waist circumference (men  $> 40''$ , women  $> 35''$ ), triglycerides ( $\geq 150$  mg/dl), HDL cholesterol (men  $< 40$  mg/dl, women  $< 50$  mg/dl), plasma glucose ( $\geq 110$  mg/dl or medicated), and blood pressure ( $\geq 130$  mmHg or medicated). Participants ( $N=27,053$ ) wore Actigraph AM-7164 accelerometers on the right hip for 7 days and were included in analyses if they wore the device for  $\geq 10$  hrs per day for 4 days. Independent samples t-tests were conducted between each group at each stage on counts per min (cpm), sedentary minutes, and minutes of light PA and MVPA. **RESULTS:** In this sample, MetS prevalence was 0% in children, 1% in adolescents, 4% in early adulthood, 13% in middle adulthood, and 17% in late adulthood. Pairwise comparisons of accelerometer values revealed no significant differences between groups in adolescence or early adulthood (all  $p > .05$ ). However, groups diverged sharply in middle adulthood, where adults with MetS evidenced lower cpm ( $M=316 \pm 150$  vs.  $M=249 \pm 127$ ), higher minutes of sedentary behavior ( $M=481 \pm 120$  vs.

$M=504 \pm 121$ ), and fewer minutes of light PA ( $M=259 \pm 70$  vs.  $M=241 \pm 71$ ) and MVPA ( $M=22 \pm 23$  vs.  $M=13 \pm 18$ ) (all  $p < .01$ ). Differences remained in late adulthood for cpm ( $t=3.473$ ,  $p=.001$ ) and minutes of light PA ( $t=3.004$ ,  $p=.003$ ) only. **CONCLUSION:** No differences were identified during the first 40 years of life, suggesting that MetS at these ages may be less behaviorally based. However, beginning in middle adulthood there was a divergence in accelerometer-measured behaviors, which coincided with a spike in prevalence in this age group. Middle adulthood is characterized by increasing responsibility through roles as caregivers and bread winners and may be an appropriate target for PA interventions to prevent chronic disease.

**899 Board #133 May 29 2:00 PM - 3:30 PM**  
**Vitamin D Status And Muscular Strength In Youth: NHANES 2011-2014**

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 (No relevant relationships reported)

Vitamin D is a critical component of musculoskeletal health in youth. While several studies have established the importance of vitamin D for bone development, research specific to muscular strength is lacking. **PURPOSE:** To investigate the association between serum 25-hydroxyvitamin D (25OHD) status and muscular strength in a nationally-representative sample of U.S. youth. **METHODS:** The analysis included 1,706 boys and 1,644 girls from the National Health and Nutrition Examination Survey 2011-2014 between 6-18.9 years. Status of 25OHD was defined as: severe/deficient  $\leq 37.5$  nmol/L, insufficient  $> 37.5$  to  $< 50$  nmol/L, and sufficient  $\geq 50$  nmol/L. Muscular strength was assessed via handgrip and expressed as age- and sex-specific percentiles of relative strength (kg strength/kg body mass). General linear models were used to quantify differences in strength percentile by 25OHD status. Logistic models were used to compare the odds of low strength ( $< 25^{\text{th}}$  percentile) between 25OHD groups. All analyses were stratified by sex while controlling for age, calcium intake, socio-economic status, race/ethnicity, physical activity, body mass index, and season of testing. **RESULTS:** Boys with sufficient 25OHD had a higher mean (SE) relative strength percentile than those in the insufficient or severe/deficient groups, 49.1 (1.8), 43.5 (2.2), and 40.7 (2.9), respectively ( $p < 0.05$ ). Relative strength percentile was also highest for girls with sufficient 25OHD compared to the insufficient or severe/deficient groups, 51.8 (1.9), 45.6 (2.4), and 41.1 (3.3), respectively ( $p < 0.05$ ). Further, boys in the insufficient group had a higher odds of low strength than 25OHD sufficient boys (odds ratio, OR = 1.8, 95%CI 1.1 to 3.0). Both girls in the insufficient and severe/deficient groups were more likely to have low strength compared to those with sufficient 25OHD, OR = 1.8 (1.1 to 2.8) and 3.3 (1.8 to 5.9), respectively. **CONCLUSIONS:** Youth with less than sufficient levels of 25OHD were consistently found to have lower relative handgrip strength and were more likely to have strength values below the 25<sup>th</sup> percentile. These findings underscore the importance of vitamin D for muscular strength in youth and future prospective studies to elucidate the mechanisms would be of benefit.

**900 Board #134 May 29 2:00 PM - 3:30 PM**  
**Is Seasonal Affective Disorder A Symptom Of A Larger Collection Of Sedentary And Obesity-related Disorders?**

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Seasonal affective disorder (SAD) is a subtype of major depressive disorder (MDD) that occurs during cold and overcast months. Physical activity (PA) is known to counteract depressive symptoms; however, the relationship between seasonal changes in PA and MDD is largely unexplored. Physical inactivity and consequent weight gain may contribute to a host of cardiometabolic and cerebral complications, with SAD being one diagnostic feature. **PURPOSE:** To evaluate seasonal differences in MDD among obese and non-obese patients in conjunction with cardiovascular, metabolic, and cerebral diagnoses. **METHODS:** We analyzed 2,306 consecutively-admitted patients at a Midwestern hospital over 3 years. Mean environmental temperature of the hospital's city during each of the 36 months was computed. Patients were assessed for obesity, MDD, diabetes, hypertension, peripheral vascular disease, congestive heart failure, cerebrovascular accidents, and dementia. Logistic regressions tested the effects of season and temperature on all diagnoses. **RESULTS:** Patients were 52.1  $\pm$  22.4 years old, 16.3% were obese, 1.1% had MDD, 14.3% had diabetes, 36.8% had hypertension, 0.7% had peripheral vascular disease, 4.4% had congestive heart failure, 3.6% had a cerebrovascular accident, and 4.6% had dementia. Between March 1 and June 30, MDD incidence was 532.8% higher than it was during all other months ( $p < 0.001$ ). These were not the coldest months (mean temperature was 5.9°F higher during this

period;  $p < 0.001$ ), but it was the period of greatest obesity (33.3% higher incidence;  $p = 0.003$ ). Likewise, colder temperature was a poor predictor of MDD ( $p = 0.465$ ), but predicted elevated rates of obesity ( $p < 0.001$ ), diabetes ( $p = 0.034$ ), hypertension ( $p < 0.001$ ), congestive heart failure ( $p = 0.013$ ), peripheral vascular disease ( $p = 0.058$ ), cerebrovascular accidents ( $p = 0.003$ ), and dementia ( $p = 0.001$ ). **CONCLUSION:** MDD diagnosis was highest at the end of the cold season, when obesity was at its peak; in turn, the likelihood of numerous obesity-related diagnoses was increased. This suggests a possibility that seasonal incidence of depression is not exclusively caused by diminished exposure to sunlight. Perhaps a colder environment limits engagement in PA; in turn, SAD is one component of a larger picture, which includes dysfunction of numerous systems.

**901** Board #135 May 29 2:00 PM - 3:30 PM  
**Muscular Strength and Whole-Body Bone Mineral Density in Older Adults With and Without Artificial Joints**

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**Purpose** Artificial joints (AJ) are prevalent in older adults, yet commonly ignored in bone related studies. We examined the effect of AJ on the association between muscular strength (MS) and whole-body bone mineral density (BMD) in older adults. **Methods** This cross-sectional study included 303 older adults (58% women)  $\geq 65$  years old from the Physical Activity and Aging Study (PAAS). MS (peak torque at 60°/sec) was assessed by leg extension (LE), leg flexion (LF), elbow extension (EE), and elbow flexion (EF) on the dominant limbs using isokinetic dynamometry (Biodex). Whole-body BMD (t-score) was assessed by dual-energy X-ray absorptiometry (DXA). Low BMD was defined as t-score  $< -1.0$ . AJ status was identified via medical history questionnaire. Linear and logistic regression were conducted in stratified samples of AJ status (yes/no) and sex including MS, age, hormone therapy (women only), smoking, cardiorespiratory fitness (400-meter walk test), physical activity, and body mass index (BMI). Odds ratios (ORs) of low BMD by sex-specific tertiles of MS were calculated in each stratum.

**Results** Forty-five (15%) older adults had AJ. T-scores were higher in individuals with AJ compared with individuals without AJ in both men (-0.6 vs. 1.9) and women (-1.4 vs. 0.6) (both  $p < 0.01$ ) since most materials in AJ (e.g., metals) are considered as bone tissues by DXA. LF, EE, and EF were positively associated with BMD in men without AJ (all  $p < 0.05$ ), but not in men with AJ after adjusting for the possible confounders including BMI. There were no associations between MS variables and BMD in women, regardless of AJ status (all  $p > 0.05$ ). Compared with the lowest (weakest) third of LF, ORs (95% confidence intervals) of low BMD for the middle and upper thirds of LF were 0.40 (0.15-1.08) and 0.27 (0.09-0.85) among men without AJ after adjusting for the possible confounders without BMI. We found similar results in LE. However, no associations were observed after further adjustment for BMI, possibly due to the confounding effects of BMI on both MS and BMD.

**Conclusion** Higher MS appears to be associated with higher BMD and lower odds of having low BMD in men without AJ, but not in men with AJ. These results indicate that AJ status should be considered in studies of muscular strength and bone health in older men.

Supported by unrestricted research grant by Biospace.

**902** Board #136 May 29 2:00 PM - 3:30 PM  
**Changes in Psychological State Measures After Green versus Suburban Walking Exercise: A Pilot Crossover Study**

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**PURPOSE:** Green exercise may have psychological benefits. This study compared changes in anxiety, mood, directed-attention abilities, and stress after walking in green (i.e., nature-based) and suburban environments.

**METHODS:** Twenty-three adults (4 male; 50±7 yr; BMI 31±8 kg/m<sup>2</sup>) participated in a crossover study comprised of once-weekly 50-min moderate-intensity walking sessions. Participants walked for three weeks in each of two treatment conditions: green and suburban, separated by a two-week washout period. In the first treatment period, 11 participants were assigned to green walking and 12 to suburban walking. Previously validated psychological questionnaires measured pre- and post-walk values for: 1) Anxiety: assessed by the State-Trait Anxiety Inventory; 2) Mood: evaluated via the Positive and Negative Affect Schedule; 3) Directed-attention: measured with the visual Backwards Digit-Span (BDS) Test; and 4) Stress: assessed by the Perceived

Stress Scale. Linear mixed models for repeated measures assessed pre- to post-walk changes between treatments. Baseline BDS scores were included as a covariate in the BDS outcome model to control for a learned effect.

**RESULTS:** Pre-walk outcomes were similar between walking conditions. Results indicated that anxiety decreased after green walking and increased after suburban walking (-1.75 vs. +1.13 units, respectively;  $p < 0.001$ ). For mood, positive affect improved after green walking and decreased after suburban walking (+2.16 vs. -0.32 units, respectively;  $p < 0.003$ ), and negative affect decreased marginally after green and suburban walking (-0.59 vs. -0.04 units, respectively;  $p = 0.06$ ). Directed-attention abilities did not improve after green and suburban walking (-0.09 vs. -0.08 units, respectively;  $p > 0.9$ ). Stress levels were slightly but not significantly reduced after green and suburban walking (-0.91 vs. -0.69 units, respectively;  $p > 0.5$ ). There were no sequence effects. Finally, no carryover effects were observed - suggesting adequate washout between treatments.

**CONCLUSIONS:** Green exercise was effective in reducing anxiety and improving mood in this sample but not in improving stress and directed-attention. Future research should identify the optimal dose of green exercise for maximum psychological health gain.

**903** Board #137 May 29 2:00 PM - 3:30 PM  
**Relationship Of Physical Activity And Quality Of Life During ART Treatment Among People Living With HIV**

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Physical functional impairments are seen among HIV-infected persons on effective antiretroviral therapy (ART). The impact of physical activity (PA) on health-related quality of life (HRQoL) during ART treatment is currently unknown. **Purpose:** To study the relationship between PA and physical and mental components of HRQoL in people living with HIV (PLWH) in China. **Methods:** This cross-sectional study is based on an HIV disclosure intervention study in Guangxi Zhuang Autonomous Region which initially enrolled 791 PLWH in 2013. The participants completed a total of six follow-up surveys at 6 month intervals. The International Physical Activity Questionnaire (IPAQ) was added only after the 4<sup>th</sup> follow-up in 2015 in which 718 PLWH participated. After excluding those with missing PA data (n=199), those with PA outlier (n=24), and those not under ART treatment (n=49), we included 446 participants (40.4% women, mean age 39.8 years) in the final analysis. Participants with a MET-minutes/week  $\geq 500$  were defined as active, and those  $< 500$  as inactive based on the current PA guidelines. The 12-item short-form health survey (SF-12) was used to measure HRQoL that is summarized by physical and mental component scores (PCS and MCS, respectively). Logistic regression was used to compare the odds of having a HRQoL component score above the norm between active and inactive participants. **Results:** The proportion of participants with a mean PCS and MCS 50 or above was 44% and 55%, respectively. More than 70% of participants met the current PA guidelines. Inactive individuals served as the referent group. After adjusting for age, gender, education, marital status, smoking, drinking, substance use, and body mass index, active participants had a 60% higher odds (odds ratio (OR), 1.60; 95% confidence interval (CI), 1.01-2.55) of MCS above the norm comparing with inactive participants. Additional adjusting for HIV duration did not change the association. However, no significant relationship was observed between physical activity and PCS. **Conclusion:** Physically active PLWH from China have greater QoL in mental health domain. PLWH commonly experience long-term psychological sequelae and impaired QoL. Findings from this study highlight the importance of examining the influence of PA on mental health in this high-risk population.

**904** Board #138 May 29 2:00 PM - 3:30 PM  
**Physical Activity, Sedentary Time, And BMI In 1<sup>st</sup>-4<sup>th</sup>Grade Hispanic Children In Puerto Rico**

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(No relevant relationships reported)

Low physical activity (PA) and high sedentary time (ST) are behaviors associated with poor health among children and adolescents, and are known to increase with age. Evidence of these associations among Hispanic children is sparse. **PURPOSE:** To compare PA and ST among 1<sup>st</sup> to 4<sup>th</sup> grade Hispanic children in Puerto Rico, and determine their association with BMI. **METHODS:** Children from 6 to 10 years of age attending 1<sup>st</sup> (n=44), 2<sup>nd</sup> (n=124), 3<sup>rd</sup> (n=90), and 4<sup>th</sup> (n=70) grade wore an ActiGraph® accelerometer for 7 consecutive days, and measures of height and weight were obtained to determine BMI. Generalized least squares fit model with random effects and post-hoc analyses were performed to detect differences and associations by school year and sex in PA (moderate to vigorous PA [MVPA]), ST, and BMI. **RESULTS:**

Minutes/day of MVPA averaged 287.4±54.5 in 1<sup>st</sup>, 277.4±55.4 in 2<sup>nd</sup>, 262.7±53.1 in 3<sup>rd</sup>, and 219.1±60.3 in 4<sup>th</sup> grade; with a significantly lower value in 4<sup>th</sup> grade, and girls being less active than boys (199.4±72.4 vs. 238.7±48.1 min/day,  $P<0.05$ ). Average hours/day of ST was 6.1±1.2 in 1<sup>st</sup>, 6.4±1.1 in 2<sup>nd</sup>, 6.6±1.2 in 3<sup>rd</sup>, and 7.3±1.5 in 4<sup>th</sup> grade; with higher values observed in 3<sup>rd</sup> and 4<sup>th</sup> grade ( $P<0.05$ ), and no differences by sex. BMI percentile for most children was in the normal weight range (girls= 62.5%, boys= 69.0%), and 33.4% were in a percentile representing overweight and obesity (girls= 37.5%, boys= 28.5%,  $P= 0.04$ ). No association was detected between BMI, PA, and ST. **CONCLUSION:** Although mean MVPA indicates compliance with current PA recommendation for children, lower values at 4<sup>th</sup> grade suggests a potential trend that must be addressed. No consensus yet exists regarding ST among children; however, the increase from 2<sup>nd</sup> to 3<sup>rd</sup> grade is another potential pattern to watch. Results also suggest that BMI classification might not affect PA and ST behavior in these young children. Supported by UPRRP/DEGI/FIPI.

**905** Board #139 May 29 2:00 PM - 3:30 PM  
**Modeling Longitudinal Changes in Physical Activity Levels: Oporto Growth Health and Performance Study**

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Adolescence is often viewed as a critical window for the development of healthy behaviors which can prevent the development of metabolic risk factors and related comorbidities. Although there is evidence of the independent associations of physical activity with subject and contextual factors, few studies examined the joint longitudinal links of these factors. **PURPOSE:** We aim to model longitudinal changes in youth total physical activity (TPA) as a function of their biological maturation (BM), weight status, socioeconomic status (SES), physical fitness (PF), sleep habits, fruits and vegetables consumption and built environment. **METHODS:** This is a mixed longitudinal study and the data comprised 7315 adolescents (3621 girls) divided into four age cohorts (10 to 12, 12 to 14, 14 to 16 and 16 to 18 years) measured annually for three consecutive years. TPA was estimated with the Baecke questionnaire; BM was indirectly assessed by the maturity offset; weight status was defined with cut-off points for age and sex defined by the International Obesity Task Force; SES was determined by the Portuguese schools' social support system; PF was assessed with the Fitnessgram test battery; sleep habits, fruits and vegetables consumption and built environment information were obtained by questionnaire. Random effects mixed-models were used and computations done in SuperMix v.1. **RESULTS:** Girls' TPA at baseline (10 years) was 7.27 points (possible range: from 3 to 15), being boys systematically more active ( $\beta=0.85$ ,  $p<0.001$ ); with increasing age, TPA decreases, independently of sex ( $\beta=-0.07\pm0.03$ ,  $p=0.022$ ); and the fittest teenagers were those more active ( $\beta=0.29\pm0.039$ ,  $p<0.01$ ); favorable neighborhood environments to healthy lifestyles were positively linked to TPA over the age (built facilities:  $\beta=0.06\pm0.02$ ,  $p<0.01$ ; sociocultural:  $\beta=0.09\pm0.02$ ,  $p<0.01$ ; and economic/political:  $\beta=0.07\pm0.02$ ,  $p<0.01$ ); although marginally, BM was positively associated with TPA changes ( $\beta=0.07\pm0.04$ ,  $p=0.064$ ). The others predictors did not show any significant association with TPA trajectories either sex. **CONCLUSIONS:** These results showed the decline of TPA during adolescence, emphasize the relevant role of PF, as well as favorable neighborhood environments to provide increments in TPA among adolescents.

**906** Board #140 May 29 2:00 PM - 3:30 PM  
**Additive And Interactive Effects Of Mvpa And Sitting Time On Metabolic Syndrome Risk Indicators**

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**Purpose:** This study was purposed to estimate the associations between MVPA and sitting time and metabolic syndrome risk in Korean adults. **Methods:** A total of 8997 non-institutionalized Korean adults (age=19-65) participated in the 2014-2015 KNHANES. Daily physical activity and sitting time during a typical week was measured using GPAQ. Metabolic syndrome risk factors were examined at the mobile examination center. The associations between MVPA + sitting time and metabolic syndrome risk indicators were analyzed using logistic and ordinary logistic regression. **Results:** Sitting time was associated with elevated risk for central obesity (OR=1.04,  $p<0.001$ ), hypertriglyceridemia (OR=1.04,  $p=0.001$ ), low HDL-cholesterol (OR=1.02,  $p=0.05$ ), hypertension (OR=1.04,  $p<0.001$ ). MVPA was significantly associated with

Impaired glucose tolerance (OR=.96,  $p=.004$ ), hypertension (OR=1.02,  $p<0.035$ ). Also, MVPA significantly moderated the association between sitting time and hypertriglyceridemia (OR=.997,  $p=.053$ ) and hypertension (OR=.996,  $p=.011$ ). According to the ordinary logistic model, sitting time was significantly associated with increased chance for having more number of metabolic syndrome risk indicators in the abnormal range (OR=1.04,  $p<0.001$ ). Even though MVPA did not have significant direct effects, it significantly moderated the sitting time-metabolic syndrome association in the same model (OR=.997,  $p=.009$ ). **Discussion:** While sitting time and MVPA are respectively a risk and protective factor for metabolic syndrome, negative effects of sitting time may be attenuated by participating in more MVPA or vice versa. Therefore, lifestyle interventions for the metabolic syndrome prevention should include both increasing MVPA and reducing sedentary behavior strategies. Corresponding: Miyoung Lee, mylee@kookmin.ac.kr

**907** Board #141 May 29 2:00 PM - 3:30 PM  
**Associations of Cardiorespiratory Fitness and Muscular Strength with Arterial Stiffness in Older Adults**

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 (No relevant relationships reported)

**Purpose:** To evaluate the associations of cardiorespiratory fitness (CRF) and muscular strength (MS) with arterial stiffness (AS) in older adults. **Methods:** This cross-sectional study included 390 older adults aged  $\geq 65$  years (mean age 72). Participants were free of diabetes and cardiovascular disease events that occurred within the past 2 years. CRF was assessed by time (minutes) to complete a 400-m walk test and MS by grip strength (Jamar Plus+ 12-064). Carotid-femoral pulse wave velocity (PWV) was used to assess AS (AtCor, Sphygmocor Xcel). High AS was defined as a PWV of 10 m/s or greater, as it has been established as a threshold for increased cardiovascular risk. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (95% CIs) of having high AS across sex-specific tertiles of CRF and MS. Further, CRF and MS were dichotomized into either weak or unfit (lower one-third), or strong or fit (upper two-thirds) in a joint analysis of CRF and MS with high AS. All logistic regression models included age, mean arterial pressure, body mass index, physical activity, smoking, heavy alcohol consumption ( $>14$  drinks per week for male,  $>7$  for female), and MS or CRF for each other. **Results:** Sixty-three (16 %) adults were identified as having high AS. Compared to the lowest CRF tertile (lowest 33%), ORs (95% CIs) of having high AS were 0.36 (0.16-0.81) and 0.51 (0.21-1.22), for middle and upper CRF, respectively, after adjusting for the possible confounders including MS. Compared to the lowest MS tertile (lowest 33%), ORs (95% CIs) of having high AS were 0.68 (0.33-1.39) and 0.31 (0.13-0.74), for middle and upper MS, respectively, after adjusting for the possible confounders including CRF. In the joint analysis, compared to the unfit and weak group, ORs (95% CIs) for high AS were 0.47 (0.16-0.81) for unfit and strong, 0.37 (0.13-1.04) for fit and weak, and 0.25 (0.12-0.60) for fit and strong. **Conclusion:** Higher levels of both CRF and MS were independently associated with reduced odds of having high AS in older adults. Future prospective studies could evaluate longitudinal associations of CRF and MS and attenuation of age-related AS, which is an emerging risk factor for cardiovascular diseases. Supported by unrestricted research grant by Biospace.

**908** Board #142 May 29 2:00 PM - 3:30 PM  
**Effects Of Physical Activity For Relative Risk Of Falls And Fall-related Fractures In The Elderly**

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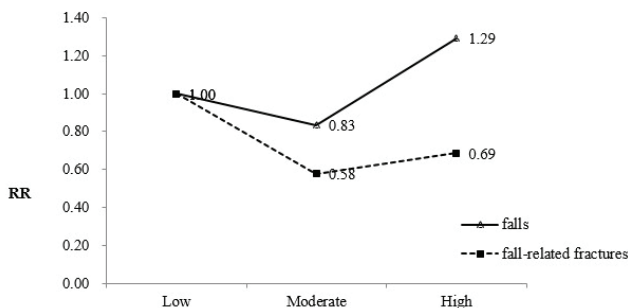
Fracture is a common source of morbidity and mortality in the elderly, approximately 10% of falls resulting in fractures. **Purpose:** To examine whether physical activity could reduce the risk of falls and fall-related fractures, which based on the epidemiological survey of older Chinese people. **Methods:** Referring to the questionnaire by the Disease Control and Prevention Center of Jurong. The Han nationality elderly over 60 years old (including 60) was involved. 6117 questionnaires were collected and 161 invalid questionnaires were deleted. The MET value was referred to the IPAQ. According to Physical Activity Index, the physical activity level (PAL) was divided into "Low", "Moderate" and "High". Comparisons between different groups were performed through Two-way ANOVA. **Results:** The significant difference was shown in height, weight, BMI and bone density between males and females ( $P<0.01$ ). The height had significant differences between different PAL. Bone density increased significantly with the increase of PAL. (Table1)

**Table 1.** Characteristics of subjects in baseline

Characteristics	sex	PAL			P
		Low 3,617	Moderate 911	High 1,428	
Height(cm)	M	163.58(6.32)	164.52(6.44)	163.47(6.26)	0.003
	F	152.71(5.78)	153.32(5.46)	153.36(5.31)	
Weight(kg)	M	64.92(10.70)	66.64(10.83)	64.31(10.39)	0.032
	F	58.83(10.01)	59.35(8.98)	59.14(9.27)	
BMI	M	24.24(3.76)	24.60(3.73)	24.03(3.45)	0.238
	F	25.18(3.76)	25.22(3.41)	25.13(3.61)	
Bone density(T value)	M	-0.57(0.81)	-0.48(0.75)	-0.40(0.76)	0.000
	F	-1.28(0.79)	-1.15(0.74)	-1.02(0.76)	

The RR of falls of “Moderate” decreased significantly compared with “Low” (RR=0.83, 95%CI=0.59-1.16). The RR of fall-related fractures of “Moderate” and “High” decreased significantly compared with “Low” (RR=0.58 and 0.69, 95%CI=0.26-1.28 and 0.37-1.27). (Figure 1)

**Conclusions:** Physical activity could increase the bone density; and the moderate PAL could decrease the RR of falls and fall-related fractures of the elderly. Though the high PAL could increase the RR of falls which might be explained by the increasing of outdoor activities, it could reduce the incidence of fall-related fractures.



**Figure 1.** Relationship between PAL and falls and falls and the fall-related fractures (The calculation of relative risk: based on the “Low” PAL group)

and 21 were classified as either Stage 1 hypertension (n=13, 9 M, 4 F; SBP: 129±6, DBP: 81±13 mmHg) or Stage 2 hypertension (n=8: 7 M, 1 F; SBP: 144±3, DBP: 83±13 mmHg). **CONCLUSIONS:** Under the recently-revised hypertension guidelines, the prevalence of elevated BP and Stage 1 and 2 hypertension was much higher than expected in this apparently healthy, physically-active college-aged group. It is a matter of debate if this group should be considered an important target for lifestyle modifications beyond physical activity, or if the new guidelines are applicable in this particular group.

**910** Board #144 May 29 2:00 PM - 3:30 PM

**A Modifiable Factors-based Model for Detecting Physically Inactive Individuals Using the Eurobarometer Survey**

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(No relevant relationships reported)

Reviews of physical inactivity (PIA) have not consistently identified systematic determinants influencing such behavior. Associations in subjective rather than objective measures may be important to consider when designing effective policy targeting PIA. **PURPOSE:** To analyze predictive variables that could influence PIA and how these factors may inform PIA-reducing policy. **METHODS:** Data from the 2014 Special Eurobarometer 412 (n = 27,919) were analyzed, including 40 separate variables and the International Physical Activity Questionnaire (IPAQ) for determining physical activity (PA) in MET-min per week. Variables included alternatives to car, places, reasons, and barriers to engaging in PA, memberships to clubs, and categorical responses regarding the extent of agreement with statements about the area, provision of activities, and local governance. A logistic regression model with a likelihood ratio statistic and a backward stepwise method was used to identify what variables contributed to PIA, which was defined as a “low” level based on IPAQ score. PIA was used as the dependent variable (0 = PA and 1 = PIA). Beta values (β) and standard errors (SE) are reported and Nagelkerke R<sup>2</sup> is indicated. A priori alpha level was set at 0.05. **RESULTS:** The model for detecting PIA (χ<sup>2</sup> = 2,023; p < 0.001; R<sup>2</sup> of Nagelkerke = 0.153) was able to identify 10.7% of the inactive and 96.9% of the active people (74.5% of the total sample). The variables contributing to the detection of PIA were (p ≤ 0.01): having a disability or an illness (β = 0.521, SE = 0.052), not having friends to do sport with (β = 0.314, SE = 0.089), lacking motivation or interest (β = 0.407, SE = 0.04), and being afraid of the risk of an injury (β = 0.190, SE = 0.073). Additionally, totally agreeing, tend to agree, and tend to disagree regarding the extent of local providers offering enough opportunities to be more active also contributed to the model (β = 0.302-433, SE = 1.353-1.542). **CONCLUSIONS:** Overall, the model was effective for detecting PA but not PIA. However, in the proportion where PIA was detected, key subjective factors influencing PIA began to emerge. Greater insight into these subjective mediators will be helpful in drafting effective policy around active living, and therefore better correlates should be included in future public health surveillance efforts.

**909** Board #143 May 29 2:00 PM - 3:30 PM

**High Prevalence of Hypertension in Apparently Healthy Physically-Active College-Aged Adults Under the New Hypertension Guidelines**

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Hypertension is an important risk factor for cardiovascular disease. Under the previous hypertension guidelines, 29% of adults in the US aged 18-60+ were hypertensive, with the highest prevalence (63%) in the 60+ age group. Prevalence in the 18-39 age group was the lowest at 7.5%. The newly revised American College of Cardiology/ American Heart Association Hypertension Guidelines lowered the threshold for hypertension. Many more individuals are expected to be diagnosed with either elevated blood pressure (EBP, 120-129/<80 mmHg) or hypertension (Stage 1, 130-139/80-89 mmHg; Stage 2, ≥140/90 mmHg) than before. Prevalence of hypertension in the lower end of the young adult group, ages 18-25, is not well characterized, and how the new guidelines apply to this age group has not yet been studied. **PURPOSE:** We aimed to determine the prevalence of hypertension (EBP, Stage 1, and Stage 2) in active college-aged adults. We hypothesized that hypertension would be <30% in this population. **METHODS:** Resting blood pressure (BP) was measured with a sphygmomanometer according to AHA guidelines in 100 participants (21±2 y, 53 females (F), 47 males (M)) after sitting for 10-15 min. Participants avoided caffeine and exercise for 4 h prior to measurement. All were physically active (athletes or recreationally active exercisers), and none were taking medications or supplements that directly affect resting BP. **RESULTS:** Of 100 participants, 54 (17 M, 37 F) had normal (<120/<80 mmHg) blood pressure. 25 (13 M, 12 F) had EBP (SBP: 123±4, DBP: 76±10 mmHg),

**911** Board #145 May 29 2:00 PM - 3:30 PM

**Examining the Influence of Waist Circumference in Cardiovascular Disease Mortality Risk Prediction Modeling**

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Despite the robust statistical association between waist circumference (WC) and cardiometabolic risk factors (hypertension, dyslipidemia), and outcomes (type 2 diabetes, cardiovascular disease (CVD)) there is little evidence exploring the addition of WC to risk factors commonly employed in CVD risk prediction models. **PURPOSE:** To assess the influence of adding WC to a CVD mortality risk model. **METHODS:** Data were obtained from the Aerobics Center Longitudinal Study. A total of 34,377 males (mean age 44.9 years; standard deviation (SD), 9.9 years) who completed a baseline medical examination between 1978 and 2002 were included. WC was measured at the level of the umbilicus and expressed as a continuous variable. CVD mortality was the main outcome. Deaths among participants were identified from the National Center for Health Statistic’s National Death Index. Follow-up time of less than 1 year (baseline to December 31, 2003 or CVD mortality) were excluded.

**RESULTS:** A total of 645 CVD deaths occurred over a mean follow-up period of 13.6 years (SD 7.4 years), for a total of 467,213 person-years of follow-up. Mean WC of the cohort was 94 cm (SD 11 cm). In a Cox proportional hazards model, including age, total cholesterol, HDL cholesterol, systolic blood pressure, current smoking status, and diabetes, WC was independently associated with CVD mortality ( $p < 0.0001$ ). The Harrell's C-index without WC in the model was 0.834, and 0.837 upon addition of WC to the model. **CONCLUSION:** In this large population sample of men, WC was significantly associated with cardiovascular disease mortality independent of cardiometabolic risk factors. However, the addition of WC to these variables did not meaningfully improve our cardiovascular disease mortality risk prediction model.

912 Board #146 May 29 2:00 PM - 3:30 PM

### The Prevalence of Depression Among Diabetic Patients is Associated with Hemoglobin

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(No relevant relationships reported)

More than 400 million adults have diabetes. Complications associated with diabetes poorly impact quality of life, including interactions between cardiovascular risk and depression. A diagnosis of diabetes associates with a three-fold increase in depression. The consequences of low Hb values on increased depression among healthy populations are well defined; however, isolating the relationship within a diabetic population requires further investigation. **PURPOSE:** To explore the effect of diabetes on hemoglobin levels (Hb) and depression in a diabetic population. **METHODS:** 2,206 hospital patients, age 15-98 years old were sampled; 14.6% had a diagnosis of diabetes. Independent-samples t-tests characterized the differences between diabetics ( $n=1,884$ ) and non-diabetics ( $n=322$ ). One-way ANOVA examined group differences between categorical Hb values, Chi-Square determined the relationship between diabetes and hemoglobin category, linear regression determined Hb levels among diabetics, and logistic regression analyses predicted depression outcomes based on Hb levels. **RESULTS:** Patients with diabetes were older ( $p<0.001$ ) and had lower hemoglobin ( $p<0.001$ ) and oximetry levels ( $p<0.001$ ). Non-diabetic patients had lower international normalized ratio ( $p<0.001$ ), systolic blood pressure ( $p<0.001$ ), mean arterial pressure ( $p=0.015$ ), and pulse pressure ( $p<0.001$ ). Hb categories differed in age, oximetry, international normalized ratio, pulse, diastolic blood pressure, mean arterial pressure, and pulse pressure ( $p<0.001$ ); groups differed for systolic blood pressure ( $p=0.013$ ). Additionally, chi-squared analysis demonstrated lower hemoglobin levels associated with increased diagnosis of diabetes ( $p<0.001$ ). Linear regression, controlling for age, predicted a decrease in Hb among diabetic patients ( $\beta=-0.460$ ;  $p<0.001$ ). Lastly, logistic regression determined with each additional g/dL of Hb, the odds of experiencing depression decreased by 31% ( $p<0.001$ ). **CONCLUSIONS:** Diabetes diminishes cardiovascular health, particularly Hb levels, and this predicts depression within this population. Physical activity should be a first-line intervention to improve quality of life in patients suffering from diabetes.

913 Board #147 May 29 2:00 PM - 3:30 PM

### Changes In Physiological Factors And Performances In Female Track-and-field Athletes Transitioning To Senior

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Performance decline in female track-and-field (T&F) athletes transitioning to senior has been indicated but there has not been any solutions of that yet. **PURPOSE:** To examine changes of physiological factors in female T&F athletes transitioning to senior and analyze their relationship to performances. **METHOD:** Of 142 top-level female T&F athletes recruited, we analyzed the data of 38 subjects who were sprinters and jumpers aged 17-18 in the season of 2016. We measured body composition with whole body mode dual-energy X-ray absorptiometry device in post-season of 2016 (Po-16) and 2017 (Po-17). Athletes' performances were assessed by International Amateur Athletics Federation scoring system. Comparisons were made by a one-way analysis of covariance. **RESULTS:** Compared to performances in Po-16, 14 athletes (Group A) were able to maintain or improve in Po-17, while the other 24 (Group B) were not able to and the scores were significantly different between the two groups ( $991.36\pm 46.50$  vs  $947.46\pm 64.24$  score,  $p<0.05$ ). In Po-16, there were no significant

differences in their body composition between the two groups. In Po-17, however, fat mass (FM) and FM% increased in Group B in all body parts, while they did not in Group A in any, and were significantly different between the two groups (Upper extremities (UE): FM  $833.07\pm 182.34$  vs  $1030.93\pm 260.77$ g,  $p<0.05$ , FM%  $15.90\pm 3.28$  vs  $18.44\pm 3.55$ %,  $p<0.05$ ; Trunk: FM  $2587.11\pm 699.19$  vs  $3493.36\pm 856.99$ g,  $p<0.01$ , FM%  $11.18\pm 2.60$  vs  $13.99\pm 2.46$ %,  $p<0.01$ ; Lower Extremities (LE): FM  $3175.16\pm 649.74$  vs  $4228.59\pm 830.73$ g,  $p<0.01$ , FM%  $16.84\pm 3.02$  vs  $20.54\pm 2.67$ %,  $p<0.01$ ; Total: FM  $7467.39\pm 1440.28$  vs  $9638.89\pm 1821.62$ g,  $p<0.01$ , FM%  $14.44\pm 2.36$  vs  $17.29\pm 2.22$ %,  $p<0.01$ , in Po-17, Group A vs Group B). In addition, lean mass (LM)% was significantly higher in Group A compared to Group B in Po-17 (UE:  $79.22\pm 3.12$  vs  $76.65\pm 3.43$ %,  $p<0.05$ ; Trunk:  $86.20\pm 2.59$  vs  $83.42\pm 2.36$ %,  $p<0.01$ ; LE:  $78.68\pm 3.09$  vs  $75.17\pm 2.54$ %,  $p<0.01$ ; Total:  $81.25\pm 2.30$  vs  $78.51\pm 2.08$ %,  $p<0.01$ ) in all body parts although there had been no significant difference in Po-16. **CONCLUSION:** While majority of female T&F athletes face performance decline when transitioning to senior, those who maintain or improve high performance levels were shown to have kept their FM and FM% low and LM% high. Supported by Japan Sports Agency, Support for female athletes.

914 Board #148 May 29 2:00 PM - 3:30 PM

### Arterial Compliance is Improved Following a Community-led 12-week Indigenous Wholistic Health and Wellness Program

Erin M. Shellington<sup>1</sup>, Shannon S.D. Bredin<sup>1</sup>, Kai L. Kaufman<sup>1</sup>, Henry Lai<sup>1</sup>, Jan Hare<sup>1</sup>, Moss Norman<sup>1</sup>, Paul Oh<sup>2</sup>, Ryan Rhodes<sup>3</sup>, Darren E.R. Warburton<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>University Health Network, Toronto, ON, Canada. <sup>3</sup>University of Victoria, Victoria, BC, Canada.

(No relevant relationships reported)

**PURPOSE:** Indigenous peoples are at a higher risk for many chronic diseases compared to the general population. Colonization and forced assimilation have led to marked changes in traditional roles and healthy lifestyle behaviors. The purpose of this study was to examine vascular health (arterial compliance) prior to and following an Indigenous led, and community-based 12-week lifestyle program representing Indigenous views of wholistic health and wellness.

**METHODS:** Indigenous adults were recruited to participate in a healthy lifestyle program through a community walk on National Indigenous Peoples Day (21/06/2018) in an Indigenous community. The program was a once weekly education session on healthy lifestyle behaviours (e.g., traditional diet), including sharing circles and a physical activity component (e.g., walk). Arterial compliance was assessed using applanation tonometry (HDI/PulseWave CR-2000) at pre- and post-intervention. **RESULTS:** A total of 11 participants (1 male; Age =  $47.3\pm 10.7$  yr, Height =  $161.1\pm 6.4$  cm, and Weight =  $82.3\pm 18.3$  kg) completed arterial compliance assessments. Large artery elasticity index was significantly improved over the program duration,  $t=-2.3$ ,  $p=0.04$  (pre:  $10.4\pm 1.9$ ; post:  $12.0\pm 2.4$  mL/mmHg x 10). There were no significant changes in resting systolic or diastolic blood pressure, pulse pressure, pulse rate, estimated cardiac output, cardiac index, systemic or total vascular resistance or small artery elasticity index following the program.

**CONCLUSIONS:** Arterial compliance, an important predictor of vascular health, is improved in Indigenous adults living in rural British Columbia following a 12-week program based on Indigenous worldviews. This data demonstrates health-related benefit of culturally appropriate programs. This project was funded by the Canadian Institutes of Health Research.

### B-59 Free Communication/Poster - Physical Activity and Cancer

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

915 Board #149 May 29 3:30 PM - 5:00 PM

### Effects of Combined Training on the Body Composition In Breast Cancer Survivors: A 1-y Follow-up

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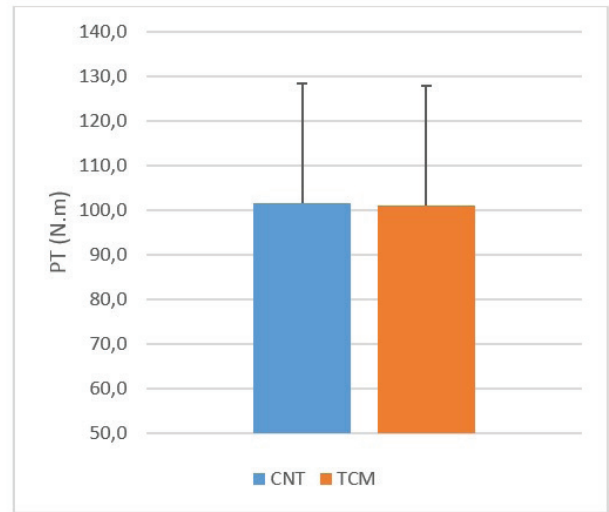
**Purpose:** Exercise program can improve the side effects of cancer treatment, such as, decreased total fat mass and trunk fat mass, however, it is not known whether these positive outcomes acquired are maintained long-term after program interruption. Thus,

the objective of this study was to verify if the effects of combined training on the body composition persisted over 1 year follow-up after training interruption in older breast cancer survivors undergoing aromatase inhibitor therapy.

**Methods:** Thirty-six breast cancer survivors (50+ years of age) that participated in a clinical trial during 9 months [Exercise group (EG): n= 18 and Control group (CG): n=18] were assessed for the 1 year follow-up. Body composition (total fat mass, percentage of fat mass, trunk fat and lean body mass) and bone mineral density were evaluated by DXA. The exercise group performed about 40 min of resistance training plus 30 min of aerobic training, three times per week during 9 months. Two-way repeated measure of ANOVA was used to compare groups and a Bonferroni's post hoc test was conducted when a significant interaction was observed.

**Results:** There were a significant group × time interaction for total fat mass (Pre= 30.7±7.7 vs Post=28.6±7.8 vs Follow-up= 30.3±8.1 kg,  $F= 4.864$ ,  $p=0.012$ ) and percentage of fat mass (Pre= 45.4±5.1 vs Post=43.2±5.8 vs Follow-up= 45.7±5.4 %,  $F= 6.808$ ,  $p= 0.002$ ). The Bonferroni's Post hoc test showed a decreasing for fat mass only in the EG after 9 months of training but there was a regain over 1 year follow-up. There were no statistically significant interaction for lean mass, trunk fat and bone mineral density ( $p>0.05$ ).

**Conclusions:** This study demonstrated the potential benefits of combined training (resistance plus aerobic) to decreased total and percentage of fat mass in breast cancer survivors undergoing aromatase inhibitor therapy, however, after training interruption there was a regain of body fat. Therefore, our results emphasize that is important to maintain an exercise training program over a prolonged period for this population.



**916 Board #150 May 29 3:30 PM - 5:00 PM**  
**Effects Of Chemotherapy On Muscle Performance In Women With Breast Cancer**

Vitor Alves Marques<sup>1</sup>, Rafael Ribeiro Alves<sup>1</sup>, Thaynã Coelho Guimarães<sup>1</sup>, Weder Alves Silva<sup>1</sup>, Claudio Barbosa de Lira<sup>1</sup>, Mario Hebling Campos<sup>1</sup>, João Ferreira Júnior<sup>2</sup>, Paulo Viana Gentil<sup>1</sup>, Carlos Alexandre Vieira<sup>1</sup>. <sup>1</sup>University Federal of Goiás, Goiânia, Brazil. <sup>2</sup>Federal Institute of Minas Gerais -, Rio das Pombas, Brazil.  
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 (No relevant relationships reported)

**PURPOSE:** To compare muscle performance on breast cancer women (BCW) during the treatment chemotherapy with apparently healthy women (CNT).  
**METHODS:** 19 BCW (52.2 ± 13,11yrs, 1.60 ± 0.07m, 66,8 ± 12.33kg, 27,6 ± 3,8kg/m<sup>2</sup>) undergoing chemotherapy (between the third and fourth cycle of chemotherapy: AC+T - Doxorubicin + Cyclophosphamide - Paclitaxel) and 18 CNT (55.8 ± 8.37yrs, 1.60 ± 0.06m, 69,0 ± 11.49kg, 28,3 ± 3,1kg/m<sup>2</sup>) without breast cancer, performed 2 sets of 4 unilateral isokinetic knee extension repetitions at 60°/s (Biodex system III, Inc., Shirley, NY, USA). The rest interval between sets was 2 minutes. All subjects were not involved in exercise programs that included resistance exercise. The normality of the data was performed by the Shapiro-Wilk test and the Student *t* test to compare the groups. Statistical significance was set at  $p<0.05$  for all comparisons.  
**RESULTS:** No significant differences were found in the peak torque values between groups ( $p = 0.95$ ). The peak torque was 101.1 ± 26.79 N.m for the BCW group and 101.7 ± 26.98 N.m for the CNT group. Separating the volunteers according to the level of physical activity, no differences were found between the groups for the PT values.  
**CONCLUSIONS:** Women with breast cancer undergoing chemotherapy treatment, between the third and fourth cycle of chemotherapy, did not present differences in measures of muscle performance when compared to apparently healthy women.

**917 Board #151 May 29 3:30 PM - 5:00 PM**  
**Impact Of Prehabilitation In Oncology Via Exercise - Breast Cancer: The Improve-B Study**

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 (No relevant relationships reported)

The manifold benefits of exercise during and after breast cancer therapy are well investigated and lead international agencies to recommend exercise for breast cancer patients and survivors (Schmitz, 2010). However, there is still a knowledge gap regarding the efficacy of prehabilitative exercise for patients undergoing breast cancer surgery. **PURPOSE:** Investigate the effects of exercise before surgery (prehabilitation), on the health perception and functional capability of women after surgery. **METHODS:** 33 sedentary breast cancer patients scheduled for breast cancer surgery were randomized to either a partly supervised (SE), a home based (HE) resistance exercise groups or a usual care group (UC), each consisting of 11 patients. The patients were assessed before the intervention, immediately before surgery, before and after adjuvant treatment. The data were analyzed via linear Mixed-Effect-Models, questionnaire scales were standardized to the pooled pretest standard deviation. The reported results are the incremental effects in the intervention groups compared to the UC at the post-surgical follow up. **RESULTS:** The interim results showed superior functional fitness for both exercise groups, with an incremental increase in the 6min walk distance of 123.5 meter (95%-CI= 41.8 - 206.1) in the HE and 113.0 meter (95%-CI= 27.3 - 198.7) in the SE. The gain of grip strength in the dominant hand surpassed the gain in the UC by 7.0kg (95%-CI= 3.6 - 10.4) in the HE and 5.4kg (95%-CI= 3.4 - 7.3) in the SE. In the non-dominant hand the strength gains were lower with 3.2kg (95%-CI= -0.15 - 6.6) in the HE and 3.1kg (95%-CI= -0.5 - 6.7) in the SE. Both exercise groups showed superior improvements in quality of life compared to the UC. With large effects of  $\beta= 1.34$  (95%-CI= 0.18 - 2.50) in the HE and  $\beta= 2.60$  (95%-CI= 1.31 - 3.89) in the SE in role function, and  $\beta= 0.49$  (95%-CI= -0.29 - 1.27) in the HE and  $\beta= 1.54$  (95%-CI= 0.66 - 2.42) in the SE, in physical function measures. **CONCLUSION:** These results support the implementation of a brief prehabilitative exercise intervention and display the multidimensional effects of exercise on functional, as well as psychological health parameters.

WEDNESDAY, MAY 29, 2019



918 Board #152 May 29 3:30 PM - 5:00 PM  
**Preliminary Findings from an eHealth Intervention to Increase Physical Activity Among Young Adult Cancer Survivors.**

Leah Meuter<sup>1</sup>, Ashlen Kuntz<sup>1</sup>, Cami Christopher<sup>1</sup>, Suzanne Phelan<sup>1</sup>, Siobhan Phillips<sup>2</sup>, Sarah Keadle<sup>1</sup>. <sup>1</sup>California Polytechnic State University, San Luis Obispo, CA. <sup>2</sup>Northwestern Medical School, Chicago, IL. (Sponsor: Dr. Todd Hagobian, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** This pilot study aims to determine the feasibility and acceptability of a remotely-delivered eHealth intervention that links physical activity and charity-based incentives to motivate young adult cancer survivors to initiate and maintain physical activity (PA). **METHODS:** Inactive cancer survivors (diagnosed between age 18-39y) were recruited through hospital support groups and online forums across the western United States. Screening and informed consent were done online; activity was measured via activPAL for 7-days at baseline and again at 12-weeks. Participants were randomized into either a PA only or Physical Activity+Charity Incentive group. Participants in the PA only group received a Fitbit One, personalized step goals, and weekly behavioral change content via email. PA+Incentive participants received the PA intervention plus donations to a cancer charity of their choice if daily step goals were attained. The primary aim was to evaluate feasibility and acceptability and the primary outcome was 12-week between-group changes in steps per day as measured by the activPAL. **RESULTS:** Seventy-six participants were screened; of those, 54 (71%) were eligible and provided informed consent and 51 (94%) completed the baseline assessments and were randomized. Those randomized were 88% female, 54% with prior breast cancer, 56.9% Non-Hispanic White; and had a mean age of 36.8 years. Of those eligible to date to complete the 12-wk measure (N=47), retention was high for the PA only (22/25) and PA+Charity (23/26) groups. The majority of participants reported they were "satisfied or very satisfied" with the overall intervention experience. There was some evidence that the PA+Incentive group was more satisfied with the overall experience as a study subject compared to the PA only group (45% vs 30% reporting "very satisfied"). This also holds true for the level of contact with staff (27% vs 15%) and content of emails (23% vs 10%). Some participants (23%) wanted more contact with study staff or other participants. **CONCLUSIONS:** These preliminary findings show that a mail-based intervention among young adult cancer survivors is feasible and acceptable to participants. The next step will be to evaluate if there was a significant change in daily steps as a result of the intervention. Support by Frost Fund and Cal Poly RSCA.

919 Board #153 May 29 3:30 PM - 5:00 PM  
**Higher Perceived Breast Cancer Risk is Associated with Less Aerobic Physical Activity in Women**

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**PURPOSE:** To examine the association between perceived breast cancer risk and aerobic physical activity among women. **METHODS:** We used cross-sectional data on women aged  $\geq 18$  years who participated in the 2015 National Health Interview Survey (n=17,967). Participants were asked to self-report whether they perceived themselves at less than average risk (ref), average risk, or higher than average risk for breast cancer. Aerobic physical activity was measured based on self-reported minutes of moderate-to-vigorous aerobic physical activity engaged in per week, then categorized into none (ref), some activity, and meeting the aerobic activity recommendation. Multinomial logistic regression models were fit, accounting for the complex survey design, to estimate associations between perceived risk of breast cancer with aerobic physical activity. Models were adjusted for age, education, race/ethnicity, and insurance. **RESULTS:** In adjusted models, compared with women who perceived themselves at low risk for breast cancer, those perceiving themselves at higher than average risk had 14% lower odds to meet the aerobic activity guideline, relative to no activity (Odds Ratio [OR]: 0.86; 95% Confidence Interval [CI]: 0.76-0.97). Similarly, compared with women who perceived themselves at low risk for breast cancer, those perceiving themselves at average risk for breast cancer had 23% lower odds to meet the aerobic activity guideline (OR 0.77, 95% CI 0.65-0.91). **CONCLUSIONS:** Among women, higher perceived breast cancer risk was associated with a lower likelihood of engaging in aerobic physical activity. Since greater physical activity can reduce the risk of breast cancer, future studies should also use longitudinal designs to determine if increasing physical activity decreases perceived breast cancer risk. Results suggest a possible role for health promotion interventions linking perceived breast cancer risk with physical activity. Supported by NIH P20CA221697-02, P20CA221696-02, and P20CA221697-01S1.

920 Board #154 May 29 3:30 PM - 5:00 PM  
**Effects Of Resistance Training On Muscle Strength Of Breast Cancer Survivors**

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**PURPOSE:** Examine the effects of highly supervised resistance training (RT) with low weekly frequency on muscle performance in women breast cancer survivors (BCS). **METHODS:** Seven BCS (55.85  $\pm$  3.62 years old, 68.48  $\pm$  11.21 kg) undergoing hormonal therapy (HT) (tamoxifen® or anastrozole), with no RT experience participated in the study. The BCS performed a full body RT protocol once a week for 8 weeks, followed by a resting period of 4 weeks and another 8 weeks of RT, totaling twenty weeks of the training protocol. The RT volume consisted of 3 sets of 8 to 12 repetitions until concentric volitional failure, performed on free weight and machines at 2 seconds of eccentric movement and 1 second of concentric movement, with 2 min of rest between sets on the following exercises: leg press (LP), stiff-legged deadlift, bench press (BP), supine lat pull down or seated cable row, and sit-up. Each BCS was individually supervised by trained physical education teachers. Muscle strength (MS) was assessed by the 10RM-test for the BP and LP. The assessments occurred pre-training (pre), post-training initial 8 weeks of training (post8), after 4 weeks of rest on week 12 (post12), and post-training second 8 weeks of training on week 20 (post20). Descriptive analyses are presented as mean and standard deviation. A repeated measurement ANOVA with the Bonferroni post hoc tests was used to examine differences between MS changes. **RESULTS:** MS was improved on the BP from pre to post8 (16.57  $\pm$  2.22 kg, 21.71  $\pm$  2.13 kg, p < 0.01), pre to post12 (16.57  $\pm$  2.22 kg, 20.14  $\pm$  1.67 kg, p = 0.01), and from pre to post20 (23.71  $\pm$  2.13 kg, p < 0.0001) and on the LP from pre to post8 (79.28  $\pm$  27.45 kg, 116.42  $\pm$  33.87 kg, p < 0.01), pre to post12 (79.28  $\pm$  27.45 kg, 108.57  $\pm$  34.24 kg, p = 0.04), and from pre to post20 (79.28  $\pm$  27.45 kg, 135.00  $\pm$  37.19 kg, p < 0.01). In addition, there was no significant difference during the rest period for upper and lower body strength (p=0.25 and p=0.99, respectively). **CONCLUSION:** It appears that weekly session of RT with individual supervision promotes gains in MS in women BCS undergoing HT. Furthermore, even with a rest period of 4 weeks from RT, MS in these women was maintained. Therefore, future studies examining the effects of RT on MS in women BCS should explore one day a week of RT protocols to confirm or refute the results of this promising new approach.

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**Effect of Exercise Therapy During Treatment for Gynecological Cancer: A Systematic Review and Meta-Analysis**

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Side effects of gynecological cancer treatments (GCT), such as cancer related fatigue, physical pain, lower limb lymphedema, induced menopause and sexual dysfunction, negatively affect the patients' Quality of Life (QoL). **PURPOSE:** To evaluate the effect of exercise therapy in randomized controlled trials (RCTs) on QoL in women during GCT. Secondary outcomes were the effects on body composition (BC), training modality, safety and physical activity (PA) behavior. **METHODS:** A systematic search in PubMed, Cochrane, EMBASE and SPORTDiscus was carried out to identify exercise training RCTs during GCT. Primary endpoint was the change in QoL from baseline (PRE) to after (POST) exercise intervention. Exclusion criteria was investigations with participants' mean age <18years, not written in English and not published in peer-review journals. Meta-analysis of Standardized Mean Differences (SMD) and 95% Confidence Interval (95%CI) were performed. **RESULTS:** Seven RCTs were selected, including a total of 112 and 105 participants in the exercise therapy and the control group, respectively. Four studies underwent unsupervised, home-based (HB) exercise; one study received instructions for unsupervised HB training (walking and strength exercises); one study received a comprehensive care program (group education and self-help group support, relaxation and HB aerobic and strength exercises); one study underwent pelvic floor rehabilitation training supervised by a physiotherapist and instructions for HB exercise. After the exercise therapy an increase in PA has been reported for all included studies (SMD=0.56, 95%CI: 0.38, 0.74). Exercise therapy did not show any significant differences in waist circumference (PRE:65.5 $\pm$ 33.1cm; POST:64.9 $\pm$ 33.6cm; SMD=-0.10, 95%CI: -0.78, 0.59), body mass (PRE: 105.6 $\pm$ 7.4kg; POST:102 $\pm$ 7.8kg; SMD=-0.09, 95%CI: -0.67, 0.50) or BMI (PRE:29.5 $\pm$ 8.3kg/m<sup>2</sup>; POST:30 $\pm$ 8.2 kg/m<sup>2</sup>; SMD=0.01, 95%CI: -0.67, 0.70),

compared to the control groups. No adverse events were reported during the exercise intervention. **CONCLUSION:** Exercise therapy during GCT showed improvements in PA and QoL. However, exercise therapy seems safe during GCT. Further research is needed to evaluate effect of supervised exercise interventions on cardiorespiratory fitness, type, frequency and training intensity.

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**Factors Affecting the Change in Quality of Life in Participants of a Cancer Exercise Program**

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**Purpose:** Anti-cancer treatment causes numerous cancer related symptoms (CRS) which may influence quality of life (QOL). The purpose of this analysis was to determine the relationship between having CRS and the magnitude of the change in QOL in cancer patients participating three to four months in various exercise classes at a comprehensive cancer center.

**Methods:** Data of 779 patients who participated between 2012 and 2017 in exercise classes at the National Center for Tumor Diseases (NCT) Heidelberg, Germany, were examined. Baseline characteristics assessed were anthropometric data, cancer diagnosis, peak power output (PPO) and, maximum peak oxygen uptake ( $VO_{2peak}$ ) in a cycle ergometer test as well as CRS by a self-developed anamnesis questionnaire. QOL was assessed at the start of the exercise program (t0) and after three to four months (t1) using the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-30, subscale global health status/QOL). CRS included fatigue, lymphedema, peripheral neuropathy, weight loss, pain, restricted mobility, and negative emotions (distress, anxiety, and depression). A multiple regression analysis was performed to determine the relationship between CRS and the change of QOL ( $\Delta$ QOL) from t0 to t1.

**Results:** Participants' (71% female, 29% male, n=779) mean age was 56±12 years (16-88 years, n=772), and body-mass-index was 25±5 kg/m<sup>2</sup> (15-57 kg/m<sup>2</sup>, n=755). Most frequent diagnoses were breast cancer (44%), colorectal cancer (7%), and gynaecologic tumor diseases (6%) (n=779). PPO averaged 1.7±0.6 W/kg (0.3-3.5 W/kg, n=273) and  $VO_{2peak}$  averaged 25±5 ml/min/kg (6-47 ml/min/kg, n=273).  $\Delta$ QOL was 1.75±16.02 (-50.0-50.0, n=105). Multiple regression analysis revealed that CRS explained 16% of the variance in  $\Delta$ QOL ( $R^2=.158$ ,  $F(7,97)=2.606$ ,  $p<.05$ ) ( $p=.272$ ,  $n=105$ ). Restricted mobility ( $\beta=.233$ ,  $p<.05$ ) and weight loss ( $\beta=.216$ ,  $p<.05$ ) significantly affected  $\Delta$ QOL.

**Conclusion:** Overall, QOL increased through exercise participation. Results indicated that participants who reported to have restricted mobility and weight loss at baseline tended to benefit more from exercise in terms of QOL. The results of this study can be used to understand how to modify the daily exercise sessions and focus on specific CRS to further improve QOL in cancer patients.

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**Home Exercise Program with Weekly Phone Calls Impacts Quality of Life in Cancer Survivors**

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Studies have proven exercise as an effective intervention for cancer survivors to improve quality of life (QOL). Less research has focused on the impact in a home setting, specifically for those in early phases of recovery. Limited evidence exists on techniques that can improve compliance to carry out home exercise programs (HEP).

**PURPOSE:** To determine the impact of weekly phone calls on QOL and adherence to an individualized HEP while simultaneously identifying motivators and barriers to completion. **METHODS:** This study was a case control of a heterogeneous sample of 16 participants with various cancer types in active treatment or less than 90 days since treatment. At physical therapy (PT) initial evaluation and following an 8 week program, participants completed the European Organization of Research and Treatment of Cancer QoL Questionnaire-Cancer 30 (EORTC). Participants were allocated based on blocked randomization and provided with an individualized HEP including strength and aerobic exercise. They were instructed to perform at a frequency consistent with the American College of Sports Medicine (ACSM) guidelines and maintain activity logs. The intervention group received weekly phone calls by a student PT. The control group did not receive communication. Wilcoxon signed-rank, Mann-

Whitney U, and thematic analysis were used to analyze data. **RESULTS:** There was no difference between groups for HEP completion and 20% of participants across groups achieved ACSM guidelines. No difference was found between groups for the EORTC QoL ( $p=.199$ ). The intervention group demonstrated significant improvements in the EORTC QoL ( $p=.046$ ) and physical function ( $p=0.017$ ). Motivators found in the treatment group included phone calls, decreased fatigue, feeling better with exercise, self-motivation, caregiver support and confidence. Barriers included fatigue, medical complications, weather, lack of time, pain, social engagements, nausea and psychological well-being. Only one barrier was determined and seen in the control group; pain/injury. **CONCLUSIONS:** Although phone calls did not impact compliance in this small study, they may be an effective strategy to help cancer survivors identify weekly motivators and barriers to completing a HEP and create adequate support to improve QOL.

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**Personal Training vs. Group-based Exercise Prescription Compliance in Breast Cancer Survivors**

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**PURPOSE:** Exercise interventions can improve fitness and quality of life among breast cancer survivors. The magnitude of these effects may be dependent on compliance to the intended exercise prescription (ExRx), but few studies in cancer survivors have reported this information. This study examined breast cancer survivors' ExRx compliance during a personal training (PT) or group-based exercise (GBE) intervention.

**METHODS:** Women (N=26) with stage I-II breast cancer who had completed chemotherapy and/or radiation treatment within the previous year were randomly assigned to PT or GBE for 8 weeks. All participants received supervised exercise twice per week for 60 minutes a session. Participants were compliant to aerobic ExRx if they completed 20-30 minutes at 50-80% of heart rate reserve. Participants were compliant to upper and lower body resistance ExRx if they completed 2-3 sets of 8 repetitions within 50-80% of 1RM for chest and leg press. Compliance to aerobic, upper, and lower resistance ExRx was coded dichotomously (yes/no) for each session, then summed and divided by the number of sessions attended to calculate percent compliance. Independent t-tests examined differences in ExRx compliance between PT and GBE. Results are reported as mean±SD.

**RESULTS:** Participants were aged 52±8.5 years, and 13.4±5.1 months post diagnosis. Of the N=24 who completed the intervention, exercise session attendance was 15.8±0.5 (99%) in PT, and 13.4±1.0 (82%) in GBE out of 16 possible sessions ( $p=.000$ ). Compliance for aerobic ExRx was 77.2±0.17% in PT, and 70.1±0.17% in GBE ( $p=.41$ ). Compliance for upper body resistance ExRx was 76.0±0.37% in PT and 82.4±0.20% in GBE ( $p=.597$ ). Compliance for lower body resistance exercise was 80.2±0.23% in PT and 87.9±0.21% in GBE ( $p=.40$ ).

**CONCLUSION:** Exercise session attendance was higher in PT. Overall ExRx compliance was >70% for aerobic, >80% for resistance, and similar in PT and GBE. With growing support for establishing exercise programs for cancer survivors, it is important to determine sustainable and scalable delivery modalities. GBE may be more resource conscientious than PT, and this study suggests GBE can achieve comparable ExRx compliance to PT. Future exercise intervention studies in breast cancer survivors should examine how ExRx compliance affects health and/or fitness outcomes.

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**Higher Perceived Colorectal Cancer Risk is Associated with Greater Aerobic Physical Activity in Adults**

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**PURPOSE:** To examine the association between perceived colorectal cancer risk and aerobic physical activity among US adults.

**METHODS:** We used cross-sectional 2015 National Health Interview Survey (NHIS) data on participants 18 years of age and older (n=16,711). Perceived colorectal cancer risk was assessed based on measures to which participants responded whether they considered themselves at less than average risk, average risk, or higher than average risk. Aerobic physical activity was measured based on self-reported minutes of moderate-to-vigorous aerobic activity per week, which were categorized into none (0 min/week), some aerobic physical activity (>0 min/week of activity but less than recommendation), and meeting the aerobic activity guideline (≥150 min of moderate-vigorous physical activity or ≥75 min of vigorous physical activity or 150 min of moderate physical activity/week). Multinomial logistic regression models that accounted for NHIS' complex survey design were used to estimate associations

between perceived risk of colorectal cancer (ref= less than average risk) with activity (ref= none). All models were adjusted for age, sex, education, race/ethnicity, and insurance.

**RESULTS:** After adjusting for covariates, compared with individuals who perceived themselves at less than average risk, those who perceived themselves at higher than average risk for colorectal cancer had 22% higher odds of engaging in some activity and 60% higher odds of meeting the aerobic activity guideline (Odds Ratio [OR]: 1.22, 95% Confidence Interval [CI]: 1.01-1.48; OR 1.60, 95% CI 1.37-1.86, respectively). In addition, those who perceived themselves at average risk for colorectal cancer had 25% higher odds of meeting the guideline (OR 1.25, 95% CI 1.07-1.47).

**CONCLUSIONS:** These findings suggest that perceived colorectal cancer risk may contribute to aerobic activity levels among adults. Although causal relations could not be established from these data, aerobic activity is known to aid in colorectal cancer prevention; therefore, adults who are aerobically active may be accurately perceiving their risk relative to those who are inactive. Future studies should use longitudinal designs to examine mechanisms that underlie this link.

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### The Effect of Familiarization on the Reliability of Isokinetic Assessment in Breast Cancer Survivors

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Muscle function plays an important role in quality of life of breast cancer survivors (BCS). Hence, several interventions have been proposed to improve muscle function during and after treatment. Thus, the assessment of muscular strength is essential for understanding the performance capacity of a BCS. Isokinetic dynamometer has been considered a gold standard method for assessing muscle strength in different populations. However, many internal and external factors in the isokinetic testing procedures can have an undesirable effect on the test results on BCS. **PURPOSE:** To assess the number of familiarization sessions required to test knee extensors strength and to state isokinetic dynamometer test-retest reliability to assess muscle function in BCS.

**METHODS:** Eleven breast cancer survivors (48.00 ± 6.25 years, 71.91 ± 11.55kg, 1.61 ± 0.06m) performed three isokinetic knee extension tests, separated by, at least, 72 hours. The isokinetic tests were composed by one warm-up set of 10 submaximal knee extensions at 120°/s, followed by two sets of four maximal knee extensions at 60°/s. All volunteers rested two minutes between sets. Muscle strength was determined as the greatest peak torque (PT) of each session. PT achieved in each session were compared with one-way ANOVA and Bonferroni adjustment. Typical error and intraclass correlation coefficients (ICC3.1) between non-different measures were calculated to determine test-retest reliability. **RESULTS:** Peak torque on the second session (119.18 ± 30.83 N.m) was significantly greater than first session (105.66 ± 30.21 N.m, p = 0.002). However, there was no difference between second and third sessions (121.30 ± 30.21 N.m, p = 0.885). Typical error and ICC<sub>3.1</sub> between second and third sessions were 3.08 and 0.97, respectively (95% ICC confidence interval: 0.92 to 0.99).

**CONCLUSIONS:** Isokinetic dynamometer is a reliable device to assess muscle function on BCS. However, to assess knee extensors strength on the isokinetic dynamometer, BCS require one familiarization session.

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### Effects of a Smartphone Based Exercise Intervention on Quality of Life in Breast Cancer Survivors

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A physically inactive lifestyle in breast cancer survivors elevates risk for recurrence, morbidity, and co-occurring chronic diseases. Exercise interventions, particularly those that combine both aerobic and resistance exercise, can help mitigate these risks and serve as an important pathway for promoting health and quality of life in breast cancer survivors. However, barriers to exercise may prevent adherence to recommended levels of activity. Smartphone based exercise programs may promote improvements in quality of life via a method that is both scalable and widely feasible for breast cancer survivors. **PURPOSE:** To determine the effects of a 6-week smartphone based aerobic and resistance exercise intervention on quality of life in breast cancer survivors.

**METHODS:** 34 women (age = 57.5 y.o) 6.7 years since diagnosis (YSD) were recruited through Army of Women, a national non-profit breast cancer organization,

to complete a 6-week intervention remotely. They were provided with a Fitbit and a mobile application that provided prompts to complete aerobic and resistance exercise. Additionally, written and video instructions were provided for each resistance exercise workout on the app. Surveys on depression and quality of life (Center for Epidemiologic Studies Depression, Short Form Health Survey, and Functional Assessment of Cancer Therapy - Breast Cancer) were completed pre and post the 6-week intervention. **RESULTS:** Regression analyses examined effects of aerobic and resistance exercise completed during the intervention on quality of life, controlling for YSD, race, stage, and BMI. Only resistance exercise was significantly associated with improvements in depression ( $\beta = 0.431$ ,  $t=2.79$ ,  $p = 0.01$ ), social functioning as measured by the SF-36 ( $\beta = -0.378$ ,  $t=-2.25$ ,  $p = 0.03$ ) and social well-being as measured by the FACT-B ( $\beta = -0.361$ ,  $t=-1.95$ ,  $p = 0.06$ ). **CONCLUSIONS:** These findings demonstrate the unique effects of a brief resistance exercise program delivered via a mobile application in improving quality of life in breast cancer survivors. Mobile application based exercise interventions offer significant scalability and improved feasibility for breast cancer survivors who may have limited access to a supervised exercise program.

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### The Long-term Effects Of A Physical Activity Behaviour Change Intervention On Cancer Survivors' Levels Of Depression, Fatigue And Mental Well-being

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**PURPOSE:** Exercise is known to increase cancer survivors' cardiorespiratory fitness and strength, assist in the management of treatment related side effects and reduce the risk of cancer recurrence and mortality. The aim of this study was to determine the long-term effects of the MedEx IMPACT (IMprove Physical Activity after Cancer Treatment) trial, a patient centred, evidenced-based and theoretically informed physical activity behaviour change intervention, on cancer survivors' long-term levels of depression, fatigue and mental well-being (MWB).

**METHODS:** Adults with an established diagnosis of cancer, who had completed their adjunctive therapy, were referred to a community-based exercise rehabilitation programme (CBERP) for survivors of cancer known as 'MedEx Move On'. Participants in the control group (CG) and intervention group (IG) attended two 60-min supervised exercise classes each week for 12 weeks. In addition, participants in the IG also received: i) a home-based exercise programme, ii) 4 PA information sessions and iii) a 1:1 exercise consultation. At baseline, programme completion (week 12) and 3-month follow-up, depression, fatigue and MWB were measured using the Patient Health Questionnaire (PHQ-8), Functional Assessment of Chronic Illness Therapy-Fatigue Scale (FACIT-Fatigue) and the short Warwick-Edinburgh mental well-being scale (SWEMWBS), respectively.

**RESULTS:** One-hundred and ninety-one survivors of cancer were recruited (CG, n=87; IG, n=104; mean age 56 ± 10 yrs, 73% female). Cancer diagnoses were breast (60%), colorectal (16%), prostate (13%) and other (11%). On average, participants attended 66% of the supervised exercise classes (CG=67±22%; IG=65±27%). 97 participants (51%) completed the trial. Depression, fatigue and MWB significantly improved in both groups from baseline to week 12, and 3 month follow-up (p<.001). There were no statistically significant differences between the CG and IG.

**CONCLUSIONS:** Participation in a 12-week CBERP has a positive long-term effect on cancer survivors' levels of depression, fatigue and MWB. The inclusion of additional behaviour change strategies to the supervised exercise classes did not augment the benefits achieved.

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### Cancer Survivorship Fitness Program: College and Community Connect

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Evidence confirms that exercise has positive effects on physical functioning (PF) and quality of life (QOL) in cancer survivors after treatment. Long term medical complications may impact exercise ability and precautions need to be taken to ensure safety. Exercise scientists (ES) and physical therapists (PT) are ideal providers suited to prescribe exercise in this population. An educational clinic where ES and PT students work together may be a beneficial environment to provide fitness support to cancer survivors.

**PURPOSE:** To examine the effects of an interdisciplinary 8-week supervised exercise program in post-treatment cancer survivors on a college campus, hypothesizing that participants would improve in QOL and PF.

**METHODS:** Nine participants with various types of cancer, stages II-III, within 3 years of treatment were included in this pilot-study. QOL was measured using the Short Form-36 (SF-36). PF was measured using grip strength, 30 second sit to stand (30s STS), single limb stance, 6 minute walk test (6MWT), and sit and reach flexibility test. Measurements were taken at baseline and at the end of the 8 week program. Participants worked with ES and PT students at the campus fitness facility on an individualized program created by the pair with faculty oversight. Participants were encouraged to meet American College of Sports Medicine guidelines for cardiorespiratory endurance, muscular fitness, and flexibility. Results were analyzed using descriptive statistics.

**RESULTS:** Seven participants completed the study. The greatest gains in PF were demonstrated in the 6MWT, flexibility, 30s STS, and grip strength. Overall, 86% of participants improved in the majority of PF tests. QOL improved in 71% of participants for physical function but only in 43% of participants for general health subscales.

**CONCLUSIONS:** This is the first known study design to combine an interdisciplinary approach (ES and PT) to exercise care for cancer survivors in an academic setting. This supportive and collaborative environment allowed for an individualized program and participant monitoring from both disciplines. Furthermore, it permitted learning opportunities for students and fitness opportunities for cancer survivors to enhance the continuum of care.

**930 Board #164 May 29 3:30 PM - 5:00 PM**  
**Body Composition, Strength, and Physical Function Following Two Training Interventions for Breast Cancer Survivors**

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Cancer treatments including surgery, chemotherapy, radiation, and hormone suppressant therapy have greatly improved the survival of breast cancer patients. Although these treatments have been successful in reducing breast cancer mortality, they are accompanied by long-term side effects that include accelerated losses in muscle mass and gains in fat mass. These changes lead to losses in strength and physical function. While resistance training programs have been shown to attenuate these negative changes in body composition, strength, and physical function, there is a lack of research examining the effects of resistance training combined with high impact training or a low impact yoga program to maintain or improve these measures. **PURPOSE:** To examine the effects of functional impact training (FIT) and yin yoga (YY) on body composition, strength, and physical function in breast cancer survivors (BCS). **METHODS:** Forty-four BCS (60.3 ± 8.3 yrs) were assigned to a 24-week FIT (resistance+high impact exercises) or YY intervention (stretching+relaxation) 2x/wk. Pre- and post-body composition measurements were assessed via dual energy X-ray absorptiometry. Upper body strength was measured by a one-repetition maximum chest press test. Lower body strength was assessed by Biodex isokinetic knee extension and flexion at 60, 120 and 180°/s. The Continuous Scale-Physical Functional Performance (CS-PFP) test assessed physical function. Data were analyzed using a repeated measures analysis of variance. Significance was accepted at p≤0.05. **RESULTS:** Body composition did not change. FIT improved upper body strength (73 ± 18 to 83 ± 22 kg) compared to YY (60 ± 15 to 59 ± 16 kg). Main time effects occurred for lower body strength with a mean extension and flexion improvement of 13% and 16%, respectively. A main time effect occurred for CS-PFP (68.53 ± 12.87 to 73.66 ± 12.62 U). **CONCLUSION:** Our findings suggest that FIT and YY are beneficial for strength and physical function in BCS. FIT may be a high impact alternative to traditional weight training for BCS while YY may be a viable option for BCS who require a program of lower intensity. Supported by: ACSM Doctoral Student Grant; NSCA Graduate Student Research Grant.

**931 Board #165 May 29 3:30 PM - 5:00 PM**  
**Cross-sectional Correlates of Physical Activity and Sedentary Time among Young Adult Cancer Survivors**

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Cancer survivors are less active than the general population. Previous research has examined predictors of physical activity among cancer survivors; however, few studies have focused on adolescent and young adult (AYA) survivors.

**Purpose:** To examine cross-sectional relationships between demographic, psychosocial, disease-related characteristics, and measures of physical activity (steps, MVPA, and sedentary time) among AYA cancer survivors.

**Methods:** Eligible participants were diagnosed with cancer between 18-39y, >6 months post-treatment, and engaged in <60 min/wk of exercise. Participants wore an activPAL monitor for 7-days to obtain estimates of physical activity and sedentary time. Participants self-reported their health history (e.g., cancer type and treatment), demographics, psychosocial correlates (e.g., self-efficacy), and symptoms (e.g., fatigue). We used Pearson correlations to assess bivariate relationships. For variables with significant correlations, we used linear regression models to assess the relationship between activity variables, demographics, and psychosocial factors.

**Results:** Fifty-four participants were eligible and provided informed consent; of those, 51 completed the baseline assessments and 48 had valid baseline data. Fatigue was significantly correlated with steps per day (R = -0.39), minutes of MVPA (R = -0.38), and percent of time sedentary (R = 0.40). There were no other significant correlations between psychosocial variables and steps, MVPA, or sedentary time. After adjusting for age and gender, breast cancer survivors had significantly higher steps per day than other cancer types (1,651 steps), more minutes of MVPA (13.7 min/day) and less sedentary time (-8.4%, p<0.05). The relationship between higher levels of fatigue, less physical activity, and more sedentary time remained significant after adjusting for age, gender, and cancer type (p<0.05).

**Conclusions:** Preliminary results indicate a significant relationship between higher levels of fatigue, more sitting time, and less daily physical activity. Future research is needed to determine if increasing physical activity will reduce fatigue in AYA cancer survivors. Supported by Frost Fund and Cal Poly RSCA Grant.

**932 Board #166 May 29 3:30 PM - 5:00 PM**  
**Social Representations About Physical Activity In A Group Of Women With Breast Cancer In Bogota**

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Abstract. The social representations are systems with an own logic and language with the function to establish an order both in the material and social world, which give explanations and generate codes to name and signify a lot of the experiences that accompany them. In the case of Physical Activity (PA) representation in patients with cancer, his meaning can be of vital importance for the illness coping. This investigation pretended identify the social representations of the physical activity (understanding P.A. as a mediator of all activity that generate pleasure, integration and identity to a group), in a group of women that live with breast cancer in Bogotá city. From a hermeneutic historical paradigm, a qualitative approach and a narrative design, we inquired 11 women that live with breast cancer about their representations of physical activity, using ATLAS TI as tool. A content analysis was developed, in which 65 codes and 18 emerging categories associated with the concepts of information, attitude and representational field were identified. According to this analysis physical activity is represented as a way to be more conscientious about their health and a mechanism that generates well being, favoring the quality of life. Likewise, it was recognized that physical activity is seen as an aspect that favors family relationships and a tool for strengthening networks generating attitudinal changes, a feeling of overcoming and the desire to help other people who live with the disease. The body and human movement in this disease is a mediator of the daily activities of women that gives a new meaning to cancer and the beliefs about the disease by making possible new alternatives of intervention in addition to the medical ones for management and treatment.

**933** Board #167 May 29 3:30 PM - 5:00 PM  
**Assessment of Physical Activity Levels and Quality of Life in Women Suffering from Breast Cancer**

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A wealth of evidence suggests exercise as a complementary therapy for breast cancer (BC), by reducing the expression of oncogenes and atrophy genes, inducing antioxidant defense pathways and helping combat chronic inflammation. However, exercise appears not to be adequately incorporated in the therapeutic strategy of cancer. **PURPOSE:** This study assessed the physical activity (PA) levels and quality of life (QoL) of women under different BC treatment strategies and compared them with those of age-matched healthy females.

**METHODS:** 141 women were recruited, 76 women with BC under chemotherapy or radiotherapy (age: 53.3 yrs, height: 1.61m, mass: 71.3kg, BMI: 26.7 kg/m<sup>2</sup>) and 65 healthy women who served as control group (age: 49.6 yrs, height: 1.65m, mass: 69.0kg, BMI: 25.3 kg/m<sup>2</sup>). Levels of PA were self-estimated with the International Physical Activity Questionnaire (IPAQ) and QoL with the SF-36 Health Survey questionnaire.

**RESULTS:** All BC women refrained from high-intensity PA, while 49.30% of the control group participated in high-intensity PA. However, 50.55% of women under radiotherapy, 44.43% under chemotherapy and 35.70% of women subjected to both therapies participated in moderate-intensity PA. They selected brisk walking as the preferred form of PA by 87.33%, 90% and 83.50%, respectively. In the control group, 59.70% of the individuals participated in moderate-intensity PA and 98.40% of them used to walk. Moreover, BC patients accumulated 8-10.3 h per day of sedentary lifestyle in contrast with the control group that spent 2 h per day sitting. When BC patients estimated their QoL, 15.30% of them assessed it as excellent, 60% as very good, 23.07% as average and 1.50% as poor. Similarly, 10.30%, 55.17%, 29.30% and 3.40% of the control group evaluated their QoL as excellent, very good, average and poor, respectively. **CONCLUSIONS:** Our findings revealed that BC patients didn't engage in high-intensity PA, however they estimated their QoL as very good. PA levels of moderate-intensity were similar in the two groups, indicating that BC patients were willing to exercise but refrained from doing more intense activities, possibly because of their cancer-related fatigue. Moreover, patients subjected to both therapies exhibited lower rates of PA, potentially due to the overall burden of the therapeutic intervention.

**934** Board #168 May 29 3:30 PM - 5:00 PM  
**Effects of a Lifestyle Intervention on Self-Efficacy Outcomes in Prostate Cancer Patients Undergoing Androgen Deprivation**

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Self-efficacy (SE) beliefs in one's ability to successfully satisfy the demands of planning and engaging in health behaviors are integral to successful exercise and dietary (EX+D) behavior change. Emerging evidence suggests lifestyle EX+D interventions result in improvements in a variety of clinically relevant outcomes in prostate cancer (PCa) patients undergoing androgen deprivation therapy (ADT). However, studies delineating the effects of EX+D interventions upon changes in key SE outcomes remain limited. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D) intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX+D intervention on select SCT outcomes at the end of the intensive phase of the intervention. **METHODS:** A total of 32 PCa patients (*M* age = 65 years) on ADT were randomly assigned to the EX+D (*n* = 16) or SC (*n* = 16) interventions. Measures of select SE outcomes were obtained at baseline and 2 and 3-month follow-up assessments. **RESULTS:** Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant treatment main effects for (*p* < 0.05) for multiple SE outcomes. Post hoc analysis revealed that the EX+D intervention resulted in superior improvements in exercise (*d* = .62), coping (*d* = .68), and scheduling (*d* = .68) SE relative to the SC intervention at 3 months. Partial correlation analyses also revealed that scheduling and coping SE were significantly correlated with mobility performance (*p* < 0.01) and exercise participation

(*p* < 0.01) at 3 months. **CONCLUSIONS:** Findings from the IDEA-P trial suggest that the EX+D intervention, implementing a GMCB approach, resulted in superior changes in select SE outcomes relative to SC approach. Additionally, greater SE was related to superior mobility performance and exercise participation across the trial. These results underscore the utility of a GMCB-based EX+D intervention for promoting meaningful improvement in key SE outcomes among PCa patients undergoing ADT.

**935** Board #169 May 29 3:30 PM - 5:00 PM  
**Relationship Between Perceived Fatigue & Muscular Performance Fatigability in Cancer Survivors**

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**BACKGROUND:** Cancer related fatigue (CRF) is the most prevalent treatment-related side-effect in cancer survivors (CS). Few studies have verified the relationship between CRF to biochemical, psychological and behavioral factors. However, to date, the relationship between perceived fatigue (PF) and muscular performance fatigability (MPF) has not been evaluated in CS.

**PURPOSE:** To evaluate the relationship between PF and muscular performance fatigability in CS, after treatment.

**METHODS:** Nineteen CS participated on this preliminary/exploratory study. To evaluate MPF, the CS performed an unilateral isokinetic right knee extension, consisting of one set of 30 repetitions either at 90°.s-1 or 120°.s-1. MPF was defined as the decline in force during the 30 reps and was expressed as a percentage of the decline on knee torque. CS performed a warm-up consisting of one set of 10 reps at 120°.s-1 prior to testing. The PF was evaluated by the Multidimensional Fatigue Inventory (MFI-20), that comprises five subscales: general fatigue, physical fatigue, mental fatigue, reduced activity, and reduced motivation, with scores on each subscale ranging from 4 to 20, with higher scores indicating greater fatigue. The relationship between PF and MPF was analyzed using Pearson correlations. A significance level of *p* < 0.05 was used for all analyses.

**RESULTS:** Nineteen hematological CS, 32.9±2.0 years weight 72 ±11.57 kg, height 1.71±0.08 m participated in the study. CS reported an average general fatigue score of 12.3±3.3, physical fatigue of 10.9±3.8, mental fatigue of 11.4±3.8, reduced activity of 11.0±2.9 and reduced motivation of 8.1±2.8. MPF score was 56.9±8.9. There were significant moderate positive correlations between muscular performance fatigability and physical fatigue (*r*=0.45, *p*<0.04) and mental fatigue (*r*=0.57, *p*<0.01).

**CONCLUSIONS:** A significant correlation between MPF and the MFI physical fatigue and mental fatigue domains were observed. The results of this preliminary investigation warrants the need for further research necessary for a better understanding of mechanisms associated with physical and mental influences on muscular performance. The understanding of potential mechanisms are paramount for the development of exercise training interventions aimed to maximize muscle performance in CS.

**936** Board #170 May 29 3:30 PM - 5:00 PM  
**Effects Of Exercise Dose And Type During Breast Cancer Chemotherapy On Longer-term Body Composition Outcomes**

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**PURPOSE:** To examine the effects of different doses and types of exercise during breast cancer chemotherapy on body composition outcomes and the associations between self-reported physical activity and body composition outcomes at 1-year follow-up.

**METHODS:** The Combined Aerobic and Resistance Exercise (CARE) Trial randomized a total of 301 breast cancer patients during chemotherapy either to standard-dose (20-30 min/session) aerobic exercise (STAN; *n*=96), higher-dose (50-60 min/session) aerobic exercise (HIGH; *n*=101), or aerobic and resistance-combined (50-60 min/session) exercise (COMB; *n*=104). Each exercise program consisted of three sessions/week in supervised settings for one year. Body composition including lean body mass, whole body fat, and percent body fat was measured using dual x-ray absorptiometry. Physical activity levels were assessed by self-reported questionnaire

and categorized into meeting physical activity guidelines (aerobic only; strength only; combined; and neither). Assessment was conducted at baseline, post-intervention, and 12-month follow-up.

**RESULTS:** Of 301 patients, 284 (94.4%) and 263 (87.4%) completed body composition and self-reported physical activity assessment at 12-month follow-up, respectively. There were no significant effects of the randomized interventions on body weight, lean body mass, body fat mass, and percent body fat at 12-month follow-up; and no significant changes within each group. Meeting the combined physical activity guideline at 1-year follow-up was significantly associated with higher lean body mass compared to meeting neither guideline (+0.9 kg;  $p = 0.017$ ). Moreover, meeting the aerobic guideline only was significantly associated with a lower body fat percent compared to meeting the combined guideline (-1.3%;  $p = 0.049$ ) and with a higher lean body mass compared to meeting neither guideline (+0.8 kg;  $p = 0.037$ ).

**CONCLUSIONS:** Combined or higher dose aerobic exercise during breast cancer chemotherapy was not superior to a standard dose of aerobic exercise for body composition outcomes at 1-year follow-up. Meeting the combined or aerobic guidelines during follow-up, however, was associated with higher lean body mass and lower percent body fat, respectively which can have implications for breast cancer outcomes.

**937 Board #171 May 29 3:30 PM - 5:00 PM**  
**A Modified Participatory Action Research Process To Enhance Utilization Of a Co-located Exercise Oncology Clinic**

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Exercise offers great potential as an adjunct therapy to reverse treatment-related side-effects and increase quality and quantity of life in people with cancer. Regardless, most patients do not exercise during treatment and it is often overlooked by clinicians as an important component of cancer care. Innovative implementation strategies are needed to overcome these barriers. A 5+ year partnership between the Exercise Medicine Research Institute at Edith Cowan University (ECU) and GenesisCare has demonstrated that co-locating an exercise clinic within a cancer treatment facility is a feasible solution, yet referrals and program uptake have been suboptimal.

**PURPOSE:** To investigate the barriers and facilitators to program referral and uptake and provide recommendations to optimize program utilization.

**METHODS:** A variation of participatory action research methodology was employed to understand the factors impacting exercise program referral and uptake, and to design solutions to improve both. A stakeholder advisory group (SAG) was convened to guide the process. Key stakeholders were identified as SAG members and a comprehensive mixed methods approach was used to gain feedback from all program users. Utilization and financial data were collected via clinic records.

**RESULTS:** This 6-month process successfully engaged key partner organizations and individuals, and led to the development of an implementation-ready program model. Multiple barriers and facilitators within and across the domains of the social-ecological model were revealed and accounted for in the model's development. Logistics (e.g., finances, hours of operation, referral pathways), programming options, and issues around clear communication within the system were targeted as major areas for improvement. Leadership's commitment to change and strong belief in the value and potential of the program were key to success.

**CONCLUSION:** The successful operation of a co-located exercise and cancer treatment facility requires leadership buy-in supported by a robust implementation plan that considers all domains of the social-ecological model. Stakeholders should be engaged throughout the process, using their input to create a clear vision that can be effectively communicated to all program users.

**938 Board #172 May 29 3:30 PM - 5:00 PM**  
**Feasibility And Adherence For Exercise During All Chemotherapy: EnACT**

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Several national and international agencies recommend exercise following a cancer diagnosis. Current research suggests that exercise is safe and effective during adjuvant therapy and has been shown to improve fatigue, pain, physical function, symptom management, quality of life, depression and anxiety. Despite the evidence in favor

of exercising during chemotherapy, the acceptability and feasibility of an exercise intervention among cancer patients receiving chemotherapy remains unknown.

**PURPOSE:** To determine if an individualized exercise intervention is accepted by cancer patients receiving chemotherapy and is feasible for them to complete.

**METHODS:** One hundred sixty-eight patients diagnosed with cancer actively receiving chemotherapy were recruited for an out-patient exercise intervention. Participants were prescribed an individualized home-based exercise program that included resistance, aerobic, flexibility and balance exercises. Exercise equipment included resistance bands, and adjustable dumbbells. Participants were in the study either the length of their chemotherapy regimen or for six months, whichever came first. An exercise physiologist followed-up with participants during their regularly scheduled infusions to document the progress of their exercises and make any necessary adjustments to the exercise prescription. **RESULTS:** Seventy four participants (47F, 27M; 58.2 ± 11.9 years) completed the entirety of the exercise intervention. Feasibility was defined as completing one third of prescribed exercises and adherence was defined as the number of completed exercise sessions divided by the number of prescribed sessions. Overall 86.5% of participants reached the feasibility threshold. Patients with non-metastatic cancer had higher feasibility at 89.4% compared to patients with metastatic cancer at 81.5%. The adherence rate for aerobic, balance and flexibility training was 75%, while the resistance training adherence rate was 60%. Adherence rates were higher in the metastatic group, 76%, compared to the non-metastatic group, 70%. **CONCLUSION:** An exercise intervention for cancer patients receiving chemotherapy is feasible and the adherence rates are comparable to and even higher than those seen in previous exercise studies done with cancer patients.

**939 Board #173 May 29 3:30 PM - 5:00 PM**  
**Moving Medicine: Development Of An Exercise Oncology Tool For Clinical Practice**

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The Moving Medicine Cancer resource translates exercise oncology evidence into a tool for everyday practice in healthcare. It was created by the Faculty of Sport and Exercise Medicine in partnership with Public Health England and Sport England.

**PURPOSE**

Evidence that Physical Activity (PA) can mitigate cancer-related fatigue, deconditioning and late effects, positively impacting physical function, quality of life and survivorship continues to grow. However most people living with cancer do not attain recommended PA levels and under 10% of HCPs provide PA advice. The Moving Medicine digital resource is designed to overcome barriers and integrate PA into every healthcare contact.

**METHOD**

Created in a knowledge-into-action framework, Moving Medicine Cancer is one of 9 themes promoting PA in non-communicable disease. Development comprised two phases:

1. Knowledge creation

A literature search yielding 34000 papers found 500 relevant for inclusion.

Evidence was graded and divided into pre, during and post treatment. An expert multidisciplinary panel was recruited for consultation. An iterative process refined and prioritized evidence into clinical context.

2. Action cycle

Delphi study and COM-B framework analysis drove action cycle creation. This enabled end-user driven design.

**RESULTS**

The online tool is a time-based framework with practical information reflecting clinical priorities and accessible embedded evidence. It presents infographics with a conversational guide to support patient-focused consultation using behavioural change techniques. Moving Medicine was developed in collaboration with over 25 medical organisations and charities. Its launch in October 2018 by the UK Health Secretary received positive feedback. Formal evaluation will follow the initial delivery phase.

**CONCLUSION**

This novel resource harnesses current knowledge to facilitate quality conversations about PA across cancer care. As exercise oncology evolves, the Cancer Moving Medicine tool has capacity to develop precision PA prescription for the growing population of people living with and after cancer. Its developers welcome future collaboration with the international Exercise Oncology community to optimise health and wellbeing for patients. Moving Medicine is open access and free to use at [www.movingmedicine.ac.uk](http://www.movingmedicine.ac.uk).

940 Board #174 May 29 3:30 PM - 5:00 PM

**Exercise During Chemotherapy And Its Effects On Symptom Management: Enact: Exercise In All Chemotherapy**

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Nearly half of all cancer patients undergo chemotherapy. Many patients experience chemotherapy-related side effects, including decreased quality of life. The American College of Sports Medicine recommends exercise following a cancer diagnosis and current research suggests that exercise is safe during chemotherapy and can be used as a complementary strategy to manage symptoms. **PURPOSE:** To examine whether an individualized exercise program delivered during chemotherapy can improve chemotherapy-related symptoms. **METHODS:** One hundred sixty-eight patients diagnosed with cancer actively receiving chemotherapy were recruited for a home-based exercise intervention. Participants were prescribed an individualized exercise program focusing on resistance, aerobic, flexibility, and balance training. Participants were in the study for the length of their chemotherapy regimen or up to six months, whichever came first. At baseline and completion of the study participants were asked to complete the following questionnaires: Brief Pain Index (BPI), European Organization for Research and Treatment of Cancer- Quality of Life (EORTC QLQ-C30), Patient-Reported Outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE), and Fatigue Symptom Inventory (FSI). **RESULTS:** An interim analysis included seventy-four participants (47F, 27M; 58.2 ± 11.9 years). A Paired-Sample T-test analysis showed a significant increase in social functioning (MD=8.18, SD=27.38, p=.03) and a significant decrease in fatigue inference in regards to relations with others (MD= -0.38, SD=2.80, p=.01). Additionally, severity of headaches (MD= -0.31, SD= .60, p=.05) and frequency of nausea (MD=-0.47, SD=1.54, p=.02) significantly decreased with exercise. Severity of neuropathy significantly increased (MD=0.47, SD=1.24, p= .005), however, it did not significantly interfere with activities of daily living. Severity of pain and overall fatigue did not significantly change with exercise. **CONCLUSION:** These preliminary findings show that an individualized exercise program can improve some chemotherapy related symptoms and may help manage others.

941 Board #175 May 29 3:30 PM - 5:00 PM

**The Effects of Different Intensity Exercise on Lactate Metabolism of DEN-induced Hepatocellular Carcinoma.**

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**PURPOSE:** Lactate is not only a waste product of glycolysis, but also an important signaling molecule regulating tumorigenesis. Lactate also is produced during exercise, but exercise can enhance body function to eliminate lactate. Whether exercise suppress tumorigenesis by regulating lactate metabolism? So the primary purpose of our investigation to compare the anti-tumor effect between different intensity exercise from the perspective of lactate metabolism.

**METHODS:** From 8 to 26 weeks of age, mice with DEN treatment run on the treadmill at different intensity. NC: injection saline only. DEN: injection DEN only. HIT: treatment DEN, running on the treadmill at 1.5km/h, alternating run 2 minutes and rest 2 minutes for 40 minutes once a day, 5 days a week. ET: treatment DEN, running on the treadmill at 0.8 km/h for 40 minutes once a day, 5 days a week. ELISA, RT-PCR and WB were used to evaluate relative serum, relative mRNA and protein expression. **RESULTS:** We found that tumor incidence was similar between DEN and HIT (66.7% vs. 62.5%); however, it was significantly smaller in ET compared to DEN and HIT (20% vs. 66.7%, 20% vs. 62.5%). The lactate in serum was significantly higher in HIT compared to DEN (25.817±2.696 vs. 18.668±1.086mmol/l, p<0.05.). The pyruvate in serum was also significantly higher in HIT compared to DEN (17.136±1.354 vs 13.545±0.545mmol/l, p<0.05). The lactate in mitochondria was significantly lower in ET compared to NC (0.453±0.047 vs. 0.703±0.066mmol/l, p<0.01), but there was no significant change in cytoplasm lactate dehydrogenase between each groups. Most importantly, we found that endurance exercise significantly increased the mRNA levels of COX1 in ET in liver, compared to NC, DEN and HIT (2.629±0.5 vs. 1.0±0.107, p<0.001, 2.629±0.5 vs. 0.884±0.154, p<0.01, 2.629±0.5 vs. 1.172±0.288, p<0.05). The mRNA levels of CYTb in ET in liver was significantly higher than NC and DEN (1.964±0.452 vs. 1.0±0.122, p<0.05, 1.964±0.452 vs. 0.829±0.140, p<0.05). The mRNA levels of NDI in ET in liver was also significantly higher than NC and DEN (1.894±0.433 vs. 1.0±0.176, p<0.05, 1.894±0.433 vs. 0.654±0.069, p<0.01).

**CONCLUSIONS:** Long-term endurance exercise decreased the hepatic tumor incidence and improved the mitochondrial function. But high-intensity interval exercise increased the lactate production.

942 Board #176 May 29 3:30 PM - 5:00 PM

**Exercise during Chemotherapy Improves Physical Function: Findings from EnACT: Exercise in All Chemotherapy**

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Current research shows that exercise during chemotherapy is safe, feasible, and effective at improving physical function and managing symptom severity and interference in a number of different cancer types. Despite the positive findings of exercise during chemotherapy, referral for exercise during treatment has not yet become standard of care. Additionally, there is a lack of information on the effectiveness of an institute-wide exercise program for patients receiving chemotherapy. **Purpose:** To evaluate changes in objectively-measured physical function in patients receiving chemotherapy after receiving a personalized exercise prescription. **Methods:** One hundred sixty eight subjects (65M, 103F; 59.32 ± 11.83 years) actively receiving chemotherapy enrolled in an out-patient exercise intervention. Participants were given home-based exercises that included resistance, aerobic, flexibility, and balance exercises. Exercise equipment included resistance bands and adjustable dumbbells. Physical function (PF), was measured using the 30-second chair stand (30CST), Timed-Up-and-Go (TUG), Hand-Grip Strength (HGS), and the 4-Stage Balance test (BAL). Data collection was performed prior to beginning the exercise program and following completion of their chemotherapy regimen (non-metastatic patients) or 6 months after starting EnACT (metastatic patients). **Results:** Eighty two subjects completed physical function testing. A Paired-Samples T-test analysis showed a significant increase in the 30CST (MD= .74, SE= .34, p= .03) and a significant decrease in TUG (MD= -0.42, SE= .19, p= .03). There were no significant changes in HGS for either right or left hand. While the BAL also showed no significant changes after the exercise intervention, the Instep balance test showed a trend towards significant increases in performance time (MD= 0.31, SE= .17, p= .06). **Conclusion:** These preliminary results indicate that integrating a personalized exercise prescription into standard of care is efficacious in improving physical function despite the rigorous burden of receiving chemotherapy. Improving the physical function of patients during chemotherapy may prevent future treatment-related decrements in functional capacity and the need for rehabilitative measures.

943 Board #177 May 29 3:30 PM - 5:00 PM

**Communicating Exercise Oncology Research in the Digital Age: Presenting the Exercise Oncology Twitter Conference**

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Scientists and healthcare professionals are utilizing social media to amplify their scientific impact, acquire and share information, and communicate research to a broader audience. As such, researchers are looking for ways to engage this medium to promote scientific findings while also providing networking opportunities, particularly when costs associated with conference travel are high. **Purpose:** To examine the use of a Twitter Conference as a means to effectively communicate advances in the field of exercise oncology. **Methods:** The Exercise Oncology Twitter Conference (ExOncTC) occurred in October, 2018. Each presentation consisted of six tweets over 15 minutes, each using the official conference hashtag (#ExOncTC). Attendees were able to interact during a presentation via the conference hashtag. Website registration data was used to descriptively characterize presenters and registered participants while Twitter Analytics (twitter.com) and Union Metrics (unionmetrics.com) were used to aggregate data to determine engagement and reach. **Results:** The ExOncTC featured 68 presenters from 13 countries and 48 unique institutions. Presenters varied in academic background, ranging from undergraduate students (1.5%) to terminal degree holders (46%), and profession (inc. professors/researchers (42.5%) and M.D.s (6%)). Participants, including researchers, physicians, students, patients, and cancer organizations, could officially register via the website (n=231), follow the @ExOncTC Twitter handle (n=805), or search the conference hashtag (#ExOncTC). During the conference, #ExOncTC was tweeted 1,501 times by 483 unique users for 4,943 total engagements (number of times a user interacts with a tweet). Collectively, these tweets reached 453,900 unique users and 145,000 impressions (number of times users saw a tweet) with potential impressions equaling 1.8 million (total number of

views possible). **Conclusions:** Total reach of the ExOneTC demonstrates the potential effectiveness of utilizing a Twitter conference as a platform to communicate the field of exercise oncology. When considering the low financial and environmental costs, as well as the opportunity to increase scientific communication across populations, Twitter conferencing should be explored as a tool for scientific dissemination.

944 Board #178 May 29 3:30 PM - 5:00 PM

### Effects of Taichi-Qigong Exercise On QoL of Nasopharyngeal Carcinoma Survivors

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The incidence of nasopharyngeal carcinoma (NPC) in endemic areas is high. The long-term chemotherapy and radiotherapy cause bodily dysfunction and low quality of life (QoL) in NPC survivors. Complementary therapy especially mind-body exercise such as Taichi-Qigong becomes an option for NPC survivors to improve the QoL.

**Purpose:** To examine the effects of 10 weeks Taichi-Qigong training and health education lectures on QoL of NPC survivors. **Methods:** Thirty eligible participants were recruited and randomly assigned into either intervention or control group. 14 of NPC survivors (n=7 for intervention group; n=7 for control group) completed pre-post assessment of QoL satisfactory. The intervention group practiced the active, low-intensity 18-form internal Taichi-Qigong exercise for at least 3 times a week for 10 weeks plus three health education seminars during the 10-weeks intervention period. The control group engaged in the health education seminars only over the 10-weeks period. QoL was assessed by Functional assessment of cancer therapy - General (FACT-G) which included four subscales: physical well-being (PWB), social well-being (SWB), emotional well-being (EWB) and functional well-being (FWB). **Results:** Significant differences were found on subscales of EWB (p=0.011), and the effects of Taichi-Qigong on SWB is marginally significant (p=0.056). **Conclusion:** The results of this study provide preliminary data to support that Taichi-Qigong exercise, as a complementary therapy, may contribute to positive effects for NPC survivors in terms of improved QoL outcomes.

945 Board #179 May 29 3:30 PM - 5:00 PM

### Objectively Assessed Physical Activity And Sedentary Behavior In Patients With Advanced Renal Cell Carcinoma

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Reported Relationships: P. Zimmer: Consulting Fee; IPSEN Pharma GmbH. Industry contracted research; IPSEN Pharma GmbH.

**PURPOSE:** Increased levels of physical activity are associated with decreased cancer risk and mortality in many cancer types. Moreover, physical activity is known to reduce several side effects of cancer and its treatment thereby improving patients' quality of life. So far, most studies have focused on frequently observed types of cancer, such as breast-, prostate-, lung- and colorectal carcinoma. Recent data from epidemiological studies also reported such relationships for renal cell carcinoma (RCC). Observational studies have included heterogeneous populations in view of stage of disease and type of treatment. Further, collected data on physical activity have based on self-reported assessments, representing a major limitation of these trials.

**METHODS:** Against this backdrop we have initialized the multicenter observational CABOCARE trial in Germany and Austria. Patients with advanced RCC (n=105) are recruited after treatment decision for cabozantinib has been made. Cabozantinib is an inhibitor of receptor tyrosine kinases c-MET, VEGFR and AXL, which has proven to prolong progression free survival (PFS) compared to standard care with sunitinib. Patient characteristics, state of disease, occurrence of adverse events, quality of life (FACT NFKSI-19), self-reported physical activity (newly developed visual analogue scales) as well as objective physical activity, sedentary behaviour and sleep data (Actigraph® GT9X Link device) are recorded at baseline, and each-three months thereafter. **RESULTS/ CONCLUSIONS:** Thereby, CABOCARE (NCT03647878) will be the first observational trial collecting objective physical activity and sleep data and their associations with PFS, adverse events and quality of life in patients with advanced RCC in a longitudinal fashion. The trial has opened in September 2018. Here we would like to present data of the first patients.

946 Board #180 May 29 3:30 PM - 5:00 PM

### Effect of High Intensity Interval Training on Cardiorespiratory Fitness in Breast Cancer Patients Undergoing Anthracycline Chemotherapy

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**PURPOSE:** Anthracycline is a cardio-toxic chemotherapy regimen to treat breast cancer, however, breast cancer patients experience significantly impaired cardiorespiratory fitness (CRF) during and after anthracycline chemotherapy. Exercise, particularly, high-intensity interval training (HIIT), appears to be more effective than continuous steady-state exercise training for increasing CRF in patients with heart failure. It remains unclear whether HIIT improves CRF in breast cancer patients undergoing anthracycline chemotherapy. We sought to determine the effects of HIIT on CRF, measured by  $\dot{V}O_{2max}$ , in breast cancer patients undergoing anthracycline chemotherapy.

**METHODS:** Thirty breast cancer patients were randomized to either the HIIT (n=15) or delayed (DEL; n=15) groups. CRF was assessed at baseline and post-intervention using a maximal cycling protocol to obtain  $\dot{V}O_{2max}$ . Peak power output (PPO) was obtained at the last stage of testing to prescribe intensity of HIIT. The HIIT group participated in an 8-week HIIT intervention 3 times per week on a cycle ergometer. Each HIIT session included 7 alternating bouts of 90% PPO followed by 10% PPO. The DEL group was offered the same HIIT intervention after the 8 week study period. Paired t-test and repeated measures ANOVA were performed to assess changes in CRF. **RESULTS:** At baseline, the HIIT and DEL groups did not differ by age (46.9±9.8 yr), BMI (31.0±7.5 kg/m<sup>2</sup>), and  $\dot{V}O_{2max}$  (18.8±5.9 ml/kg/min). At post-intervention,  $\dot{V}O_{2max}$  significantly decreased (19.4±3.9 to 16.2±3.1; -16.5±7.9%) in the DEL group (P<.01).  $\dot{V}O_{2max}$  did not change post-intervention in the HIIT group (18.2±7.6 to 18.3±7.7 ml/kg/min; 0.5±6.2%; P>.05). There was no group (HIIT vs DEL) x time interaction (Pre vs Post) following the 8-week intervention (P>.05). **CONCLUSIONS:** An 8-week HIIT intervention did not significantly improve CRF in breast cancer patients undergoing anthracycline chemotherapy, however HIIT may be an option to maintain CRF during anthracycline chemotherapy.

### B-60 Free Communication/Poster - Cancer

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

947 Board #181 May 29 3:30 PM - 5:00 PM

### Physiological Fitness Efficiency of Breast Cancer Survivors Improves Despite Maintenance of Aerobic Capacity: Preliminary Analysis

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**PURPOSE:** To evaluate the ranges of physiological fitness responses of breast cancer survivors (BCS) following a 16-week community-based exercise intervention. **METHODS:** Cardiopulmonary exercise testing was used to evaluate aerobic capacity ( $\dot{V}O_{2peak}$ ), time to exhaustion (TTE), Borg rating of perceived exertion (RPE), max power, and peak lactate. Brachial cuff tonometry was used to evaluate augmentation index (AIx@75) and subendocardial viability ratio (SEVR). Assessments were completed pre-post 16-weeks of progressive aerobic and strength training exercise at a community-based center. Specific attention was directed at evaluating the range of changes per outcome. Descriptive statistics were used to characterize the sample, paired t-tests to assess pre-post changes in study outcomes. **RESULTS:** Twenty BCS (mean±SD; 58±9.6yrs, 166±8cm, 75±15kg) participated and were evaluated. Mean changes (min, max; p-value) revealed AIx@75= -3.4(-27, 18.5; p=0.17), SEVR=7(-11, 36; p<0.05),  $\dot{V}O_{2peak}$ =0.5(-6.2, 6.8; p=0.5)mL/kg/min, TTE=60(-6, 132; p<0.001) sec, RPE=0(-5, 4; p=0.9), peak power=15(-1, 34; p<0.001)Watts, lactate=1.1(-1.1, 4.7; p<0.01)mmol. **CONCLUSION:** All 20 patients produced the same or significantly more work at post testing despite no change in aerobic capacity, demonstrating greater physiological efficiency. The heterogeneity of responses observed support the notion that tailored training programs are likely necessary to maximally benefit individual patients. Means to significantly improve or prevent declines in  $\dot{V}O_{2peak}$  like those observed in some patients within our study, are critical as  $\dot{V}O_{2peak}$  relates to



comorbidity and mortality. However, community-based exercise programs can be a powerful tool for improving other physiological outcomes related to cardiovascular health and physical fitness. Supported by funding from Breast Cancer Research Foundation of New York.

**948** Board #182 May 29 3:30 PM - 5:00 PM  
**Acute Effect of Aerobic Exercise on Arterial Stiffness in Breast Cancer Survivors: Preliminary Results**

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(No relevant relationships reported)

Breast cancer survivors (BCS) who underwent chemotherapy treatment have increased risk of cardiovascular disease (CVD). Chemotherapy contributes to increased arterial stiffness. Acute aerobic exercise has been demonstrated to be effective in improving arterial stiffness in healthy individuals, however, it is unknown if BCS have a similar response to aerobic exercise. **PURPOSE:** To determine if arterial stiffness is different between BCS and healthy controls following acute aerobic exercise. **METHODS:** Seven BCS (48 ± 4 yrs; 26.0 ± 2.8 kg/m<sup>2</sup>) and seven female controls (43 ± 9 yrs; 22.7 ± 3.5 kg/m<sup>2</sup>) completed a 30-min bout of aerobic cycling exercise at 65% of their maximal aerobic capacity. Central arterial stiffness was evaluated by pulse wave velocity (PWV) via applanation tonometry at baseline, 5 and 30-min post exercise. Hemodynamic variables [cardiac output (Q), heart rate (HR), and mean arterial blood pressure (MAP)] were acquired with an automated ambulatory blood pressure monitor. Carotid arterial stiffness was determined using ultrasonography [β-stiffness index, pressure-strain elasticity modulus (Ep) and arterial compliance (AC)]. **RESULTS:** See Table. Both groups had similar increases in AC at 30-min compared to 5 min post-exercise ( $p < 0.05$ ). HR increased in both groups post exercise ( $p < 0.05$ ); however, BCS had an overall higher HR compared to the control group ( $p < 0.05$ ). There were no differences in PWV, β-stiffness, Ep and AC responses following exercise between the groups. **CONCLUSIONS:** These results suggest that BCS have similar arterial stiffness responses compared to a healthy control group. Interestingly, PWV decreased (approached significance), while AC decreased following exercise, showing a possible differential response between the aorta and carotid artery, suggesting more investigation in this area.

	Group	Baseline	5-min	30-min
PWV (m/s)	BCS	7.0 ± 1.5	6.6 ± 0.7	6.6 ± 0.9
	Control	6.8 ± 1.6	6.4 ± 1.1	6.4 ± 1.0
β-stiffness index	BCS	5.9 ± 3.0	7.3 ± 3.4	7.1 ± 4.0
	Control	5.1 ± 1.1	5.7 ± 1.7	5.2 ± 1.1
Ep (kPa)	BCS	74 ± 33	87 ± 32	79 ± 39
	Control	62 ± 14	72 ± 25	63 ± 18
AC (mm <sup>2</sup> /kPa)*	BCS	1.06 ± 0.31	0.76 ± 0.24	0.93 ± 0.34
	Control	1.16 ± 0.34	0.93 ± 0.21	1.12 ± 0.17
Q (L/min)	BCS	4.5 ± 0.6	4.6 ± 0.6	4.5 ± 0.6
	Control	4.7 ± 0.8	4.9 ± 0.5	4.9 ± 1.0
HR (bpm)*#	BCS	70 ± 7	107 ± 6	86 ± 7
	Control	63 ± 10	92 ± 17	73 ± 10
MAP(mmHg)	BCS	97 ± 5	94 ± 9	93 ± 7
	Control	95 ± 9	98 ± 7	95 ± 8

Mean ± SD, \*Time Effect, #Group Effect,  $p < 0.05$

**949** Board #183 May 29 3:30 PM - 5:00 PM  
**Do Taxane Based Chemotherapies Impair Improvements in VO<sub>2</sub> in Female Cancer Survivors**

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(No relevant relationships reported)

**Purpose:** To determine if female cancer patients who underwent taxane-based chemotherapies benefited from exercise as compared to those who received non-taxane based treatments. **Methods:** Retrospectively, 101 females (57.88 ± 11.59), with female cancers (Breast (79), Ovarian (10), Endometrial (4), Uterine (2), and Cervical (1)) enrolled in a cancer rehabilitation program underwent a variety of fitness assessments, but only measures of VO<sub>2</sub> are reported here. Each subject was provided an individualized mixed home (2 days) and facility based (1 day) 12 week exercise intervention. **Results:** A strong positive correlation between VO<sub>21</sub>-VO<sub>22</sub>

( $r = 0.802, p = 0.000$ ), a low to moderate negative correlation between VO<sub>21</sub>+age ( $r = -0.365, p = 0.000$ ), a low negative correlation between VO<sub>22</sub>+age ( $r = -0.215, p = 0.036$ ) were found. A significant change from VO<sub>21</sub> to VO<sub>22</sub> ( $t = -5.372, p = 0.000$ ) was determined. While there were no differences between Taxane and Non-Taxane measures of VO<sub>2</sub>, there was a trend in percent change in VO<sub>2</sub> ( $F = 3.306, p = 0.073$ ). There were also no differences in any measure of VO<sub>2</sub> between taxane and non-taxane treatments by cancer type. Regression analysis indicated only age ( $t = 2.775, p = 0.007$ ) predicted percent change in VO<sub>2</sub> values and VO<sub>2</sub> 1 values ( $t = -3.606, p = 0.001$ ), while age and cancer type predicted VO<sub>22</sub> values ( $t = -2.117, p = 0.037$ ;  $t = -2.217, p = 0.029$  respectively). **Conclusion:** The data does not support the hypothesis that taxane based chemotherapies result in lower VO<sub>2</sub> values, as both age and cancer type had greater overall effects on VO<sub>2</sub>. Additionally, significant improvements in VO<sub>2</sub> after the 12-week exercise intervention, regardless of treatment type, age, or cancer type supports the effectiveness of exercise-based cancer rehabilitation program to improve VO<sub>2</sub> in a female cancer population.

**950** Board #184 May 29 3:30 PM - 5:00 PM  
**Taxane Based Chemotherapies Impact on Balance and VO<sub>2</sub> in Female Cancer Survivors.**

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**Purpose:** The purpose of this study was to determine if taxane based chemotherapies have an impact on VO<sub>2</sub> and or balance versus non-taxane based chemotherapies in female cancer survivors. **Methods:** Twenty-six females (Avg. 58.11 years 29-72), enrolled in a cancer rehabilitation program underwent a treadmill assessment of VO<sub>2</sub> and four measures of balance (TUG, 4stage, sittostand, 6MWT). **Results:** No differences were found in measures of balance or VO<sub>2</sub> between those who received taxane based chemotherapies vs. non-taxane based chemotherapies ( $p > 0.05$ ). Significant increases in HR ( $t = 10.71, p = 0.000$ ) and Dyspnea ( $t = 5.96, p = 0.000$ ) occurred with significant correlations between pre-exercise ( $r = 0.605, p = 0.001$ ) and post-exercise ( $r = 0.729, p = 0.001$ ) Dyspnea and RPE. Trends in associations between TUG and 6MWT ( $p = 0.073$ ), 4stage and VO<sub>2</sub> ( $p = 0.057$ ), 6MWT and 4stage ( $p = 0.08$ ) were also observed. Significant positive correlation between 6MWT and VO<sub>2</sub> ( $r = 0.487, p = 0.012$ ) and a negative correlation between %change in Dyspnea and VO<sub>2</sub> ( $r = -0.474, p = 0.014$ ) were found. A negative correlation between pre-exercise HR and 6MWT speed ( $r = -0.441, p = 0.027$ ) and strong positive correlation between 6MWT distance and 6MWT Speed ( $r = 0.968, p = 0.000$ ). 6MWT distance moderately predicted VO<sub>2</sub> ( $r = 0.487, F = 7.461, p = 0.012$ ). **Conclusion:** The data does not support the hypothesis that taxane based chemotherapies affect VO<sub>2</sub> values, or measures of balance. However, trends suggest a larger population might detect an association among the balance measures and VO<sub>2</sub> and therefore perhaps detect a difference. Expected changes and associations between RPE and Dyspnea were found, with lower scores likely associated with higher fitness as evidenced by negative correlation between %change in Dyspnea, 6MWT speed and pre-exercise HR and 6MWT speed and distance.

**951** Board #185 May 29 3:30 PM - 5:00 PM  
**The Effect Of Doxorubicin On Myocardial Extracellular Matrix Degradation**

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Doxorubicin (DOX) is an effective anthracycline chemotherapy agent associated with several adverse side effects including cardiotoxicity. Although the mechanism responsible for the cardiotoxic effects of DOX has yet to be fully elucidated, the leading theory is that the generation of reactive oxygen species (ROS) damages cardiomyocytes and leads to cell death. ROS play a role in the expression and activation of matrix metalloproteinases (MMPs), a family of enzymes involved in extracellular matrix (ECM) degradation. Normally, MMP activity is regulated by tissue inhibitors of metalloproteinases (TIMPs). We hypothesized that DOX treatment would lead to overexpression of MMPs or underexpression of TIMPs, which would compromise the integrity of the myocardial ECM and disrupt cardiac function.

**PURPOSE:** To investigate the effects of DOX on MMP-2, MMP-9, and TIMP-2 expression in rat cardiac tissue. **METHODS:** At 20 weeks of age, Sprague Dawley rats received a bolus injection of DOX (12 mg/kg; n=6) or saline (0.9%; n=8) as a control. Five days post-injection, cardiac tissue was collected from each animal, homogenized, and standardized for protein content. Samples were analyzed for expression of MMP-2, MMP-9, and TIMP-2 using western blotting with enhanced chemiluminescence. All results were normalized to GAPDH. Data were analyzed using a Student's T-Test ( $\alpha = 0.05$ ). **RESULTS:** Results showed significantly lower expression of MMP-9 in

cardiac tissue from animals treated with DOX relative to the control ( $p = 0.0068$ ). There was no significant difference in expression of MMP-2 ( $p = 0.8757$ ) or TIMP-2 ( $p = 0.2266$ ) between groups. **CONCLUSIONS:** These findings suggest that treatment with DOX significantly reduced the expression of MMP-9, contradicting our hypothesis. A potential explanation for these findings is that there is an intermediate factor affecting MMP-9 expression. Future studies should profile all components of MMP/TIMP signaling during DOX treatment.

## B-61 Free Communication/Poster - Acute Exercise

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

### 952 Board #186 May 29 2:00 PM - 3:30 PM Evaluating Physiological Stress Response in Junior LevelTrack and Field Athletes

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Exercise and competition function as stress factors and may result in dysregulation in the neuroendocrine and cardiovascular systems. **PURPOSE:** The intent of the study was to evaluate neuroendocrine and cardiovascular response using salivary cortisol and heart rate/ blood pressure respectively in junior track and field athletes across a season. **METHOD:** Fifty-One Jamaican junior level track and field athletes (26 females, 25 males) participated in the study. Data was collected throughout the athletic season over two main periods: (1) a preparation period and (2) a competition period which was further subdivided into two stages: development game stage and major game stage. Athletes delivered a saliva sample prior to bedtime (8 pm - 10 pm) during each phase of the season. Resting blood pressure and heart rate were monitored throughout the season. Data collected during the preparation and competition periods were compared using Friedman's test and Wilcoxon signed-rank test. **RESULTS:** There were significant changes in salivary cortisol across the season  $p < 0.05$ . The concentration of cortisol increased during the development game stage (42%), then further increased in the major game stage (53%). With regard to cardiovascular response, there were significant differences in heart rate across the season  $p < 0.05$ . However, there was no significant change in blood pressure across the season in the athletes. **CONCLUSION:** Overall, there was an increase in cortisol across the season. This could possibly be due to the accumulation of stress factors over the competitive season which might be due to improper training regimens. Resting heart rate and blood pressure may not be good indicators of stress in athletes.

### 953 Board #187 May 29 2:00 PM - 3:30 PM The Acute Cardiovascular And Respiratory Responses To Isotonic Versus Isometric Whole Body Resistance Exercises

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**PURPOSE:** Aerobic exercise is recommended for blood pressure control rather than resistance exercise. However, resistance exercise is gaining prominence, particularly isometric exercise. The purpose was to compare the cardiorespiratory responses to whole body isotonic (IT) and isometric (IM) resistance exercises.

**METHODS:** 8 normotensive males ( $21 \pm 2$  years) completed one familiarisation session, then an IM and IT session in a counter-balanced order, each separated by at least 72 hours. 10-repetition maximum (10-RM) for each exercise was determined in the familiarisation session. IM were held in the mid-range for 40 seconds and IT were performed for 10 repetitions with 2 seconds concentric and 2 seconds eccentric. Single sets of dumbbell lunge, barbell bench press, barbell squat, bent-over barbell row, and dumbbell shoulder press were performed, with 150 seconds rest between exercises. Oxygen uptake ( $\text{VO}_2$ ) was collected continuously. Blood pressure (BP) and heart rate (HR) were recorded post-exercise. Rate-pressure product (RPP) was calculated from HR and BP. Energy expenditure (EE) was calculated from  $\text{VO}_2$ . Repeated measures analyses were applied to the data.

**RESULTS:** Mean EE was significantly greater during IT ( $6.14 \pm 0.65$  kcal) than IM ( $4.52 \pm 0.73$ ;  $p=0.024$ ), with EE greater during IT compared to IM for lunge ( $6.86 \pm 1.55$  v  $4.98 \pm 0.92$  kcal;  $p=0.033$ ), squat ( $8.32 \pm 1.80$  v  $4.54 \pm 1.14$  kcal;  $p=0.002$ ), and row ( $6.66 \pm 0.82$  v  $5.36 \pm 0.77$  kcal;  $p=0.001$ ). Mean systolic BP ( $137 \pm 12$  v  $134 \pm 11$  mmHg;  $p=0.609$ ) and diastolic BP ( $73 \pm 13$  v  $73 \pm 4$  mmHg;  $p=0.923$ ) were not significantly different between IT and IM for the five exercises. Mean RPP was not

significantly different between IT ( $18086 \pm 2764$ ) and IM ( $16879 \pm 2386$ ;  $p=0.300$ ), but was significantly greater during squat in IM ( $18668 \pm 2217$ ) and IT ( $20080 \pm 4017$ ) compared to bench press in IM ( $15023 \pm 2324$ ;  $p=0.025$ ) and IT ( $15858 \pm 2379$ ;  $p=0.003$ ). Systolic BP was not significantly reduced 60 minutes following IT ( $-8 \pm 9$  mmHg;  $p=0.053$ ) and IM ( $-10 \pm 15$  mmHg;  $p=1.05$ ) or diastolic BP ( $-0 \pm 9$  mmHg;  $p=1.000$ ) following IT, however diastolic BP significantly reduced following IM ( $-10 \pm 11$  mmHg;  $p=0.028$ ).

**CONCLUSIONS:** An IT resistance exercise session induced significantly greater energy expenditure while an IM resistance exercise session induced significantly greater post-exercise diastolic hypotension.

954 Board #188 May 29 2:00 PM - 3:30 PM

### Effects of Acute Moderate Exercise on Nitric Oxide and Endothelial Microparticles in Patients with Hypertension

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(No relevant relationships reported)

**PURPOSE:** Nitric oxide (NO) is a strong vasodilator released by endothelial cells, and endothelial microparticles (EMP) are membranous vesicles released into the circulation from activated or apoptotic endothelial cells, both of whose level can reflect the endothelial function. But few research explored the effect of exercise on nitric oxide and endothelial microparticles. The purpose of the study was to evaluate the effects of acute moderate exercise with different duration on NO and EMP in young male patients with grade 1 hypertension.

**METHODS:** Seventeen young male patients with grade 1 essential hypertension (SBP between 140-159 and/or DBP between 90-99 mmHg) who did not take antihypertensive drugs were recruited in this study. They randomly performed twice exercises on a bicycle ergometer at a moderate intensity of 40%-50% of their HR reserve; one was 20 min (E20 group), the other one was 40 min (E40 group); there was one week break between two exercises. The level of NO (nitrate/nitrite reduction) and EMP (flow cytometry) in plasma were detected before and immediately after exercise.  $\text{CD31}^+/\text{CD42}^-$  events were defined as EMP and were expressed as events per ml plasma.

**RESULTS:** Mean age of patients was  $34.8 \pm 3.5$  yrs, and BMI was  $27.6 \pm 2.7$  kg/m<sup>2</sup>. The plasma NO level of E20 and E40 increased significantly after exercise ( $65.75 \pm 23.97$  umol/L vs.  $71.37 \pm 25.18$  umol/L and  $64.08 \pm 23.13$  umol/L vs.  $77.94 \pm 23.73$  umol/L,  $P < 0.01$  for both). There was no difference in plasma NO level between the two groups before and after exercise, but the increase of NO level in E40 was greater than that in E20 ( $24.47\%$  vs.  $9.24\%$ ,  $P < 0.01$ ). The plasma EMP level of E20 and E40 decreased significantly after exercise ( $1968.38 \pm 399.40$  vs.  $1814.99 \pm 388.25$  and  $1891.43 \pm 334.15$  vs.  $1604.61 \pm 351.61$ ,  $P < 0.01$  for both). There were no difference in plasma EMP level between the two groups before and after exercise, but the decrease of EMP level in E40 was greater than that in E20 ( $15.66\%$  vs.  $8.00\%$ ,  $P < 0.01$ ).

**CONCLUSION:** Both 20-min and 40-min acute moderate exercise can improve endothelial function by increasing nitric oxide and decreasing endothelial microparticles level in patients with hypertension, and the effect of 40-min is better than that of 20-min. Supported by Research on Prevention and Control of Major Chronic Non-communicable Diseases (2016YFC1300202).

955 Board #189 May 29 2:00 PM - 3:30 PM

### Changes in Oxygen Uptake, Blood Acidosis, and Muscle Oxygenation During Maximal Interval Exercise

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**PURPOSE:** We investigated whether changes in oxygen uptake ( $\text{VO}_2$ ), blood acidosis, or peripheral muscle oxygenation became limiting factors when interval exercise increases above the maximal intensity. **METHODS:** A group of nine active but not specifically trained male volunteer subjects participated in our study (age:  $23 \pm 3$  yrs., body mass:  $72 \pm 7$  kg, height:  $177 \pm 5$  cm and  $\text{VO}_{2\text{max}} = 57 \pm 5$  ml.kg<sup>-1</sup>.min<sup>-1</sup>). The exercise was conducted on an electronically braked cycle ergometer and consisted of two tests. The first test (T1) consisted of initial warmup, followed by  $10 \times 1$  min maximal intensity and 1 min recovery intervals to determine if all subjects were able to complete the required 10 intervals. Several days later, subjects conducted a second test (T2) that was identical to the T1 with the exception that the workload was increased by 40 W above the workload conducted in T1. During tests, we determined individual maximal intensities,  $\text{VO}_2$  and the resulting  $\text{VO}_{2\text{max}}$ . The respiratory gas exchange

measures, blood acid-base, muscle oxygenation and heart rate (HR) were determined. Exercise values and recovery intervals from 3rd to final repetition were compared between T1 and T2 intensity using two-way repeated measures ANOVA. **RESULTS:** Subjects reached 9±1 intervals during T1 (350±40 W) compared to 5±2 during T2 (390±40 W) due to fatigue.  $\dot{V}O_2$  increased from 3.33±0.34 in T1 to 3.83±0.53 l·min<sup>-1</sup> in T2 ( $p=0.006$ ). Pulmonary ventilation ( $\dot{V}_E$ ) increased from 77±31 in T1 to 117±27 l·min<sup>-1</sup> in T2 ( $p=0.04$ ). HR increased from 171±12 beats per minute (bpm) in T1 to 178±9 bpm in T2 ( $p=0.03$ ). Although, blood lactate concentration (LA) increased and blood pH values decreased considerably during T2, they were similar to values at exhaustion in T1 test. None of the muscle oxygenation variables: oxyhemoglobin (HbO<sub>2</sub>), deoxyhemoglobin (HHb) and total hemoglobin (Hb<sub>tot</sub>) changed significantly. **CONCLUSION:** The results of our study revealed that changes in blood acidosis and muscle oxygenation during tests were the limiting factors and not the  $\dot{V}O_2$  uptake.

**956 Board #190 May 29 2:00 PM - 3:30 PM**  
**Sodium Induced Volume Loading and the Exercise Pressor Reflex**

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The average American consumes far more sodium than is recommended. Consuming high amounts of sodium may augment blood pressure (BP) responses to physical stress like exercise. Exaggerated BP responses to exercise are thought to be an early symptom of some cardiovascular diseases like hypertension. **PURPOSE:** This analysis contains two studies. The purpose of study one was to determine at what time point both blood plasma and serum sodium would be consistently elevated following sodium and water consumption. The purpose of study two was to examine if elevated plasma and serum sodium result in an elevated BP response to handgrip (HG) exercise and the cold pressor test (CPT). **METHODS:** Study 1: Eight participants drank 423mL of normal saline (sodium 154mmol/L) and had repeat blood draws every 30min for 3hr. Study 2: Sixteen different participants underwent two randomized data collection visits; an experimental (EXP) visit 90min following normal saline consumption and a control (CON) without saline consumption. At each visit beat-by-beat BP and heart rate were recorded during a 5min rest period followed by 2min of isometric HG at 30% maximal voluntary contraction. Two minutes of post exercise ischemia (PEI) were performed immediately following HG. After a ≥10min rest, participants underwent a 2min CPT. **RESULTS:** Study 1: Both plasma volume (+6.8 ± 1.3 %Δ) and serum sodium (+3.5 ± 1.3 %Δ) were elevated ( $p<0.05$ ) at or before the 90min time point and remained elevated throughout the 3hr follow-up period. Study 2: There were no significant differences in mean arterial pressure (MAP) during HG (EXP: 17.4 ± 2.1 mmHg; CON: 19.1 ± 1.5 mmHg), PEI (EXP: 16.9 ± 2.9 mmHg; CON: 16.9 ± 1.9 mmHg), or the CPT (EXP: 20.3 ± 2.7 mmHg; CON: 20.9 ± 2.9 mmHg) between conditions ( $P>0.05$ ). MAP recovery from the CPT was significantly slower in the saline condition (1min recovery: EXP; 15.7 ± 2.0 mmHg, CON; 12.3 ± 2.2 mmHg,  $P<0.05$ ). **CONCLUSIONS:** The current data found no significant differences in cardiovascular responses during handgrip or the cold pressor test between conditions. However, a modest delay in the recovery of blood pressure was found following the cold pressor test during sodium and volume loading. This suggests acute salt and water consumption increases cardiovascular strain following an intense physical stressor.

**957 Board #191 May 29 2:00 PM - 3:30 PM**  
**Recovery Pattern of Cardiac Autonomic Control Following Aerobic Exercise with Different Volumes in Hypertensive Men**

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 (No relevant relationships reported)

The recovery pattern of cardiac autonomic control to acute aerobic exercise (AE) is a robust index of individual ability to recruit vagal tone and may provide further evidence of the risks and benefits of a typical AE bout to promote health. However, the extent to which postexercise autonomic control, as assessed by heart rate variability (HRV), depends on exercise volume remains unclear in hypertensive individuals. **PURPOSE:** The present study investigated the effect of cycling bouts with different volumes on HRV markers in hypertensive men. **METHODS:** Ten unmedicated men [age: 39±7 yr; body mass index: 29.3±1.0 kg/m<sup>2</sup>; maximal oxygen uptake ( $\dot{V}O_{2max}$ ): 26.7±0.8 mL·kg<sup>-1</sup>·min<sup>-1</sup>; 24-h ambulatory systolic/diastolic BP (SBP/DBP): 139±8/86±7 mmHg] visited the laboratory four times to undertake the following procedures: a) assessment of resting and maximal  $\dot{V}O_2$ ; b) perform a non-exercise control session (CTL) and two AE expending 150 (AE150) and 300 kcal (AE300) at 50%  $\dot{V}O_{2reserve}$  in a randomized, counter-balanced order. The root mean square of successive R-R differences calculated for consecutive 30-s windows (rMSSD 30s) was calculated to assess the vagal reactivation during the first 5 min of recovery in a supine

position via cardiachometer (RS800cx, Polar TM, Finland). Prolonged HRV analysis [i.e. low-frequency band (LF), high-frequency band (HF), and sympatho-vagal balance (LF:HF ratio)] was performed during the subsequent 21-h under ambulatory conditions using a three-channel Holter (CardioLight, Cardios Ltda, Brazil). Marginal models were used to compare HRV changes between trials. **RESULTS:** Significant differences for rMSSD 30s were only detected between CTL vs. AE150 [Δ - 38.8 ms ( $P<0.001$ )] and CTL vs. AE300 [Δ - 40.0 ( $P<0.001$ )]. Within the subsequent 21-h of recovery, no significant differences were observed among CTL, AE150 and AE300 for LF, HF and LF:HF ratio.

**CONCLUSIONS:** These findings suggest that exercise volume is not a major determinant of exercise prescription when considering the recovery pattern of cardiac autonomic control in hypertensive men, at least when AE is performed at moderate-intensity.

**958 Board #192 May 29 2:00 PM - 3:30 PM**  
**Pulse Wave Reflection Responses After Aerobic Exercise with Different Volumes in Normotensive and Hypertensive Men**

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Although aerobic exercise (AE) has been established as effective for lowering blood pressure (BP), little is known about the alterations in aortic BP after exercise. **PURPOSE:** To investigate the acute pulse wave reflection responses after moderate AE with different volumes in normotensive (NT) and hypertensive (HT) men. **METHODS:** We included 14 normotensives [age: 40.7±2.8 yr; body mass index (BMI): 25.7±0.9 kg/m<sup>2</sup>; maximal oxygen uptake ( $\dot{V}O_{2max}$ ): 31.3±1.8 mL·kg<sup>-1</sup>·min<sup>-1</sup>; 24-h ambulatory systolic/diastolic BP (SBP/DBP): 120.6±1.6 / 73.9±1.2 mmHg] and 10 hypertensive men [age: 39.2±2.3 yr; BMI: 29.3±1.0 kg/m<sup>2</sup>;  $\dot{V}O_{2max}$ : 26.7±0.8 mL·kg<sup>-1</sup>·min<sup>-1</sup>; 24-h ambulatory SBP/DBP: 139.3±2.6 / 86.4±2.1 mmHg]. Participants undertook a maximal cardiopulmonary exercise test, a non-exercise control session (CTL), and two cycling bouts at 50% $\dot{V}O_2$  reserve (150 vs. 300 kcal) in a randomized order. Aortic systolic blood pressure (SBPa), aortic pulse pressure (PPa), augmentation pressure, and augmentation index were determined using applanation tonometry 10 min before, and 30- and 70-min after CTL and the two exercise bouts (SphygmoCor v7). **RESULTS:** In NT, AE50%-150kcal decreased SBPa in comparison with CTL, until 30 min of recovery [CTL: &#91 7.5±3.3 mmHg; AE50%-150cal: &#91 -0.5±2.8 mmHg ( $p<0.05$ )]. However, in HT men, only AE50%-300kcal attenuated the SBPa increase observed in the CTL (CTL: &#91 9.2±0.9 mmHg ( $p<0.001$ ); AE50%-300cal, &#91 4.9±2.3 mmHg ( $p=0.07$ )). In addition, NT men showed a decrease in PPa after all AE bouts, without differences between conditions. In the HT group, both AE bouts attenuated the PPa increase observed in CTL (CTL: &#91 4.3±0.1 mmHg ( $p<0.05$ ); AE50%-150cal, &#91 1.6±1.4 mmHg ( $p=0.41$ ); AE50%-300cal, &#91 2.6±3.9 mmHg ( $p=0.18$ )). Lastly, only AE50%-150kcal was able to reduce pulse wave reflection until 30 min of recovery in NT men. **CONCLUSION:** In NT, lower AE volume was able to reduce pulse wave reflection and central BP until 30 min of recovery. However, only the greater AE volume attenuated the increase in central aortic BP and PPa, with no difference in pulse wave reflection after any experimental protocol in the HT group.

**959 Board #193 May 29 2:00 PM - 3:30 PM**  
**Peak Physiological Responses In Cycling And A New Underwater Swimming Test In Highly Trained Artistic Swimmers**

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 (No relevant relationships reported)

**PURPOSE:** The purpose of this study was to compare peak oxygen uptake ( $\dot{V}O_{2peak}$ ) measured in an underwater swim test (UWST) and during a maximal aerobic capacity test on a cycle ergometer (Velotron Pro, Seattle, WA, USA). **METHODS:** Highly trained artistic swimmers (n=14, 14.9 ± 1.9 yrs) completed a synchronised swimming specific test (275m UWST) in a 25m pool an incremental exercise test to volitional fatigue (15 W every 30 sec to exhaustion) on a cycle ergometer to determine  $\dot{V}O_{2peak}$ . The UWST and maximal aerobic capacity testing occurred on consecutive days. The 275m UWST comprised 50m freestyle followed by 25m underwater breast stroke three times, with an additional 50m freestyle. During the UWST participants wore water-resistant HR monitors (Polar OH1) and had expired gases collected (Cosmed K4 b<sup>2</sup>) in the 20 sec immediately upon completion of the UWST to determine  $\dot{V}O_{2peak}$ . During the cycle test, HR (Polar Electro, Kempele,

Finland) and expired gases were collected using a MOXUS metabolic cart (AEI Technologies, Pittsburgh, PA, USA). Peak physical work capacity (PWC) (W) was measured as the highest completed 30 sec stage of the test.

**RESULTS:**  $VO_{2peak}$  achieved after the UWST ( $44.3 \pm 8.0$  mL/kg/min) and cycle ergometer ( $42.3 \pm 7.2$  mL/kg/min) did not differ significantly from each other ( $t=-0.59$ ,  $df=13$ ,  $p=0.563$ ,  $d=0.21$ ).  $HR_{peak}$  was significantly lower during the UWST ( $162.5 \pm 18.4$  bpm) ( $t=7.812$ ,  $df=12$ ,  $p<0.00$ ,  $d=2.10$ ) when compared to the cycle test ( $194.6 \pm 11.6$  bpm). The UWST time and PWC during the bike test were not significantly correlated to each other ( $r=-0.25$ ,  $p=0.393$ ). There was no significant correlation between the  $VO_{2peak}$  achieved during the UWST and the duration of the UWST ( $r=-0.39$ ,  $p=0.17$ ).  $HR_{peak}$  during the UWST was significantly correlated with the  $VO_{2peak}$  ( $r=0.62$ ,  $p=0.03$ ,  $CI_{95}$  [38.93, 46.44]) and  $HR_{peak}$  achieved on the cycle ergometer ( $r=0.59$ ,  $p=0.04$ ,  $CI_{95}$  [188.79, 200.92]).

**CONCLUSIONS:** The similarities in  $VO_2$  data during the UWST and  $VO_{2peak}$  protocol suggest the UWST is a valid method of determining  $VO_{2peak}$  in highly trained artistic swimmers. A goal when selecting a  $VO_2$  protocol is to mimic the demands of the sport. In this population, the UWST is likely better than the cycle ergometer, as the modality of swimming with breath holding more closely matches the demands of an artistic swim routine.

**960 Board #194 May 29 2:00 PM - 3:30 PM**  
**Sex Differences in Autonomic Function Following Aerobic Exercise**

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Heart rate variability (HRV), blood pressure variability (BPV) and baroreceptor sensitivity (BRS) provides insight into cardiovascular regulation in different physiological settings. Pre-menopausal females have been shown to exhibit a cardioprotective autonomic profile compared to males following maximal exercise, but it is unknown if there are sex differences in autonomic recovery following submaximal aerobic exercise.

**PURPOSE:** To determine the effects of sex on autonomic function at rest and following an acute bout of submaximal aerobic exercise.

**METHODS:** Forty-three (males  $n=22$ , age =  $22 \pm 1$  yrs, BMI =  $25.9 \pm 0.7$  kg/m<sup>2</sup>; females  $n=21$ , age =  $22 \pm 1$  yrs, BMI =  $23.7 \pm 0.5$  kg/m<sup>2</sup>) healthy, normotensive participants completed a 45-min moderate intensity aerobic exercise session. Beat-to-beat BP was recorded using finger plethysmography for 5 min prior to exercise (REST), at 30 min (P30), 60 min (P60) and 90 min (P90) following exercise. Frequency domain measurements of HRV and BRV were calculated. The low frequency power of BPV (BPV\_LF) was used as an estimation of sympathetic vasomotor tone and the ratio of low- (LF) and high-frequency (HF) bands in HRV (LF/HF) has been used to quantify the degree of sympathovagal balance. BRS was estimated by the alpha coefficient method (Alpha\_LF). Repeated measures analysis of variance (ANOVA) (2 x 4; sex x time-point) was performed.

**RESULTS:** Data were presented in Table 1 as mean  $\pm$  standard error.

**CONCLUSION:** Forty-five min of submaximal aerobic exercise results in sustained disturbance of cardiovascular homeostasis as manifested by elevated sympathovagal balance and increased cardiovagal baroreceptor sensitivity 90 min after exercise. In addition, young, healthy women exhibited lower sympathetic tone at rest and during recovery from aerobic exercise compared to age-matched males.

Table 1. Autonomic function variables at rest and 30,60, and 90 mins following aerobic exercise								
	Male (n=22)				Female(n=21)			
	REST	P30	P60	P90	REST	P30	P60	P90
HRV_LF/HF <sup>#</sup>	4.87 $\pm$ 0.16	5.10 $\pm$ 0.18	5.10 $\pm$ 0.18	4.93 $\pm$ 0.12	4.44 $\pm$ 0.17	4.28 $\pm$ 0.19	4.55 $\pm$ 0.19	4.65 $\pm$ 0.18
HRV_HF (ms <sup>2</sup> )	6.92 $\pm$ 0.23	6.55 $\pm$ 0.29	6.97 $\pm$ 0.27	7.00 $\pm$ 0.23	7.07 $\pm$ 0.23	6.94 $\pm$ 0.20	6.95 $\pm$ 0.27	7.34 $\pm$ 0.24
HRV_LF (mmHg <sup>2</sup> ) <sup>#</sup>	7.19 $\pm$ 0.21	7.05 $\pm$ 0.22	7.47 $\pm$ 0.19	7.63 $\pm$ 0.23	6.90 $\pm$ 0.21	6.62 $\pm$ 0.23	6.89 $\pm$ 0.10	7.38 $\pm$ 0.23
BPV_LF (mmHg <sup>2</sup> ) <sup>\$*</sup>	1.91 $\pm$ 0.17	2.14 $\pm$ 0.18	1.99 $\pm$ 0.17	1.98 $\pm$ 0.19	1.48 $\pm$ 0.17	1.54 $\pm$ 0.19	1.31 $\pm$ 0.18	1.42 $\pm$ 0.19
BPV_HF (mmHg <sup>2</sup> )	0.15 $\pm$ 0.14	0.10 $\pm$ 0.16	0.19 $\pm$ 0.18	0.41 $\pm$ 0.19	0.42 $\pm$ 0.15	0.40 $\pm$ 0.16	0.16 $\pm$ 0.18	0.43 $\pm$ 0.19
Alpha_LF (ms/mmHg) <sup>#</sup>	2.75 $\pm$ 0.13	2.57 $\pm$ 0.11	2.80 $\pm$ 0.10	3.01 $\pm$ 0.11	2.63 $\pm$ 0.15	2.59 $\pm$ 0.13	2.78 $\pm$ 0.12	2.80 $\pm$ 0.12

\* P<0.05 Significant sex differences at rest for T-test; \$ P<0.05 Significant main effect of sex for 2-way ANOVA; # P< 0.05 Significant main effect of time for 2-way ANOVA

**961 Board #195 May 29 2:00 PM - 3:30 PM**  
**Augmentation of Oxygen Uptake Response through Inhalation of Molecular Hydrogen during an Incremental Exercise Test**

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 (No relevant relationships reported)

It has recently been shown that molecular hydrogen (H2) ameliorates oxidative stress-induced tissue damage by scavenging reactive oxygen species and modifies mitochondrial function. However, studies on the effects of H2 during exercise in healthy humans are limited. **PURPOSE:** To investigate the effects of H2 gas inhalation on oxygen uptake (VO2) response during an incremental exercise test performed on a cycle ergometer. **METHODS:** This study was designed as a single-blind, randomized, controlled trial. Eight men and a woman (height,  $169.4 \pm 8.0$  cm; age,  $22.4 \pm 5.54$  years; weight,  $64.9 \pm 9.8$  kg [means  $\pm$  SD]) volunteered to perform an incremental cycling exercise test while inhaling two kinds of gases: 1% H2 gas (H2 trial) and air (control trial). The workload was gradually increased by 20 W every 1 min until volitional fatigue. Respiratory parameters were measured during the test using a metabolic gas analyzer. The peak VO2 (VO2peak) was defined as a 20-s averaged peak value of VO2 during exercise. Blood samples were collected from the subjects' fingertips before, during, and immediately after exercise to evaluate the systemic redox status by measuring biological antioxidant potential (BAP) and diacron-reactive oxygen metabolites (d-ROMs). **RESULTS:** The result of repeated-measure two-way analysis of variance showed no significant trial-by-work rate interaction in carbon dioxide production ( $P = 0.64$ ), respiratory exchange ratio ( $P = 1.00$ ), minute ventilation ( $P = 0.81$ ), and heart rate ( $P = 1.00$ ) responses to the exercise. However, the H2 trial showed a significantly augmented VO2 response to exercise compared with that observed in the control trial ( $P < 0.05$ ). Furthermore, the H2 trial showed a significantly increased VO2peak compared to the control trial ( $3705.4 \pm 285.9$  vs.  $3398.7 \pm 249.9$  mL/min, means  $\pm$  SE,  $P < 0.01$ , paired t-test). BAP/d-ROM responses, indicative of systemic redox status, tended to increase in the H2 trial compared to the response in the control trial ( $P = 0.05$ ), suggesting that the H2 trial reduced oxidative stress or increased antioxidative activity. **CONCLUSIONS:** H2 gas inhalation significantly increased the VO2 response and VO2peak during incremental exercise, suggesting that H2 gas might affect mitochondrial function during exercise.

**962** Board #196 May 29 2:00 PM - 3:30 PM  
**Heavy Rope Exercise on Cardiovascular Hemodynamics and Arterial Stiffness in Resistance-Trained Individuals**  
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 (No relevant relationships reported)

Heavy rope exercise is utilized as a means to increase power, muscle hypertrophy and maximal strength. However, the effects of heavy rope exercise on cardiovascular hemodynamics and arterial stiffness is not known. **PURPOSE:** To evaluate the effects of an acute bout of heavy rope exercise on cardiovascular hemodynamics and arterial stiffness. **METHODS:** Fifteen resistance-trained individuals volunteered to participate. Cardiovascular hemodynamics and arterial stiffness were collected at rest, 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes after an acute bout of heavy rope exercise. Cardiovascular hemodynamics were determined through the use of photoplethysmography, and included heart rate (HR), mean arterial pressure (MAP), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR). Arterial stiffness was measured via carotid-femoral pulse wave velocity (cfPWV). The acute heavy rope exercise consisted of six, 15-second exercise bouts, using a double wave pattern, separated by 30-second passive recovery intervals; the pace of the exercise was set at 180bpm. One-way repeated measures analysis of variance were used to evaluate the main effect of time (rest, Rec1, Rec2, and Rec3) on all variables. Paired t-tests, with a Bonferroni correction, were used for post-hoc comparisons. **RESULTS:** There were no significant main effects of time for MAP or SV. There were significant ( $p=0.0001$ ) main effects of time for HR (rest:  $64\pm 11$ bpm; Rec1:  $86\pm 10$ bpm; Rec2:  $78\pm 10$ bpm; Rec3:  $72\pm 9$ bpm), CO (rest:  $6.8\pm 0.7$ L/min; Rec1:  $8.3\pm 1.1$ L/min; Rec2:  $7.9\pm 0.9$ L/min; Rec3:  $7.5\pm 0.9$ L/min) and TPR (rest:  $12\pm 1.2$ mmHg/mL/min; Rec1:  $9.8\pm 1.1$ mmHg/mL/min; Rec2:  $10.6\pm 1.1$ mmHg/mL/min; Rec3:  $11.3\pm 1.1$ mmHg/mL/min). HR, and CO were elevated at all times post-exercise, and were higher at Rec1 compared to Rec2, and Rec3, and were lower at Rec3 compared to Rec1 and Rec2. TPR was reduced at Rec1, Rec2 and Rec3 compared to rest. There was also a significant main effect of time ( $p=0.003$ ) for cfPWV (rest:  $5.6\pm 0.8$ m/s; Rec1:  $5.9\pm 0.7$ m/s; Rec2:  $5.7\pm 0.8$ m/s; Rec3:  $5.5\pm 0.7$ m/s) such that it was attenuated at Rec3 compared to Rec1 and Rec2. **CONCLUSIONS:** These data demonstrate that acute heavy rope exercise increases cardiovascular workload for at least 60 minutes, as demonstrated by the augmentation of HR and CO for up to one-hour post-exercise.

**963** Board #197 May 29 2:00 PM - 3:30 PM  
**Hemodynamic and Pressor Responses to Combination of Yoga and Blood Flow Restriction**  
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Blood flow restriction (BFR) training has been increasingly incorporated into a more common activity of daily exercise (e.g., yoga). However, BFR may increase blood pressure and myocardial oxygen demand by augmenting vascular resistance. Yoga is characterized by systemic isometric exercises and accompanied by marked pressor responses. This raises the concern of exaggerated cardiovascular responses when yoga is performed with BFR. **Purpose:** To determine the impact of a combination of yoga and BFR on cardiovascular responses. **Methods:** Twenty young healthy participants ( $M=10$ ,  $F=10$ ) performed 20 yoga poses with and without BFR bands placed on both legs. Beat by beat blood pressure and heart rate were measured using finger plethysmography during the yoga exercise. Blood lactate concentration, flow-mediated dilation (endothelium-dependent vasodilation), and cardioankle vascular index (arterial stiffness) were measured before and after the yoga exercise. **Results:** At baseline, there were no significant differences in any of the variables between the BFR and non-BFR conditions. Systolic and diastolic blood pressure and heart rate increased significantly in response to the various yoga poses ( $p<0.01$ ). However, there were no significant differences between the BFR and non-BFR conditions. In general, hemodynamic responses were more pronounced during more difficult yoga postures (e.g., Crescent Lunge, Half Moon, Chair Pose, and Downward Facing Dog). Rate-pressure products increased significantly during yoga exercises with no differences between the two conditions. Rating of perceived exertion (RPE) was not different between the conditions. Blood lactate concentration was significantly greater after performing yoga with BFR bands ( $p=0.007$ ). Cardioankle vascular index decreased similarly after yoga exercise in both conditions while flow-mediated dilation remained unchanged. **Conclusion:** The use of blood flow restriction bands in combination with systemic isometric exercise like yoga did not result in marked hemodynamic and pressor responses.

**964** Board #198 May 29 2:00 PM - 3:30 PM  
**Cardiac Autonomic and Blood Pressure Responses to an Acute Session of Battling Ropes Exercise**  
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Increased blood pressure (BP) and autonomic dysfunction are independent risk factors for cardiovascular disease. Heart rate variability (HRV) is used as a measure of cardiac autonomic function in many research settings, including the evaluation of the autonomic control during and after physical activity. A prolonged sympathetic predominance and a slow parasympathetic reactivation contribute to a delayed BP and heart rate (HR) recovery after exercise which is thought to be associated with increased risk of acute cardiac events. Therefore, understanding the impact of various exercise modalities on the post-exercise autonomic modulation of HR and BP would allow for appropriate exercise prescription in susceptible populations. Battling ropes exercise (BRE) has become an extremely popular training modality for improving both anaerobic and aerobic fitness. However, the HRV and BP responses induced by an acute BRE bout are currently unknown. **PURPOSE:** To evaluate the effects of an acute session of BRE on HRV and BP responses in healthy young males. **METHODS:** 8 young healthy males [age ( $23\pm 1$  years)] completed a BRE or a no-exercise control trial in a randomized order. During the BRE trial, participants completed ten-30s sets of battling ropes waves followed by 1 min of rest. Low-frequency power (LF), high-frequency power (HF), the LF to HF ratio (LF/HF), HR, and BP were collected in the supine position at baseline, 3, 10 and 30 min after each trial. LF and HF were normalized to total power resulting in nLF, nHF and nLF/nHF. **RESULTS:** There were significant group-by-time interactions ( $P < 0.05$ ) for nLF (sympathetic activity), nHF (vagal tone), nLF/nHF (sympathovagal balance), HR, systolic and diastolic BP. There were significant increases ( $P<0.05$ ) in nLF, nLF/nHF, and HR as well as significant decreases ( $P < 0.01$ ) in nHF, systolic ( $\sim 6$ mmHg) and diastolic ( $\sim 4$ mmHg) BP for 30 min after BRE compared to no changes after control. **CONCLUSIONS:** Our findings indicate that BRE increases sympathovagal balance 30 min post-exercise which is concurrent with a sustained hypotensive effect in young healthy males. Further research is warranted to evaluate the potential clinical application of BRE in populations that might benefit from post-exercise hypotension.

**965** Board #199 May 29 2:00 PM - 3:30 PM  
**Renal Vascular Responsiveness to Sympathetic Activation is Not Affected by Prior High Intensity Anaerobic Exercise**  
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 (No relevant relationships reported)

**Purpose:** Orthostatic hypotension is common following high intensity anaerobic exercise. The renal vasculature contributes to blood pressure regulation during orthostasis. Renal blood flow decreases during anaerobic exercise and remains depressed for up to 60 min following exercise cessation. The responsiveness of the renal vasculature to sympathetic stimulation, such as during orthostasis, following anaerobic exercise is unknown. We hypothesize that prior high intensity exercise attenuates increases in renal vascular resistance (RVR) during sympathetic activation. **Methods:** Ten healthy adults ( $23\pm 3$  y) completed two 2 min cold pressor tests (CPT). The CPT stimulates the sympathetic nervous system. A CPT was completed before and after a Wingate Anaerobic Test that consisted of 30 s of maximal effort cycling exercise at a resistance equal to 7.5% body mass. In both instances, the CPT was administered following 10 min supine rest. Heart rate (ECG), mean arterial pressure (Penaz method, MAP), and renal blood velocity (RBV) were measured pre-CPT, at 1 min and 2 min of the CPT, and 1 min post-CPT. RBV was measured via the coronal approach at the distal segment of the right renal artery with Doppler ultrasound. RVR was calculated as MAP/RBV. Data are presented as mean  $\pm$  SD. **Results:** Pre-CPT, heart rate was elevated after exercise ( $61\pm 5$  vs.  $87\pm 13$  bpm,  $P<0.01$ ) and RBV was lower ( $34\pm 7$  vs.  $32\pm 7$  cm/s,  $P=0.02$ ). However, MAP ( $85\pm 13$  vs.  $82\pm 13$  mmHg,  $P=0.50$ ) and RVR ( $2.4\pm 0.5$  vs.  $2.6\pm 0.7$  mmHg/cm/s,  $P=0.08$ ) were not different between before and after exercise. Before exercise, heart rate (at 2 min CPT:  $66\pm 9$  bpm,  $P=0.02$ ) and MAP (at 2 min CPT:  $108\pm 21$  mmHg,  $P=0.05$ ) increased during the CPT, returning to pre- levels 1 min post-CPT ( $P=0.22$ ). Before exercise, RBV decreased during the CPT (at 2 min:  $29\pm 7$  cm/s,  $P=0.03$ ), returning to pre- levels 1 min post-CPT ( $P=0.61$ ). RVR increased during the CPT (at 2 min:  $4.0\pm 0.7$  mmHg/cm/s,  $P<0.01$ ), returning to pre- levels 1 min post-CPT ( $P=0.28$ ). Changes in heart rate, MAP, RBV, and RVR during the CPT did differ between before and after exercise (interaction: all  $P\geq 0.74$ ). **Conclusion:** Increases in RVR invoked by sympathetic activation are not affected by prior high intensity anaerobic exercise. Therefore, the renal vasculature does not likely contribute to post- anaerobic exercise orthostatic hypotension.

966 Board #200 May 29 2:00 PM - 3:30 PM  
**Autonomic Nervous System and its Relevance in the Regulation of Heart Rate Recovery Post Exercise**  
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The recording of heart rate variability (HRV) is a strategy for the rapid and non-invasive evaluation of the Autonomic Nervous System (ANS) activity. Previous studies have shown a rapid activation of the parasympathetic nervous system at the end of a physical effort and the association of this with the likelihood of developing cardiovascular disease. **PURPOSE:** Establish the relationship between recovery heart rate (RHR) after exercise and HRV at rest in apparently healthy men and women. **METHODS:** Quantitative, cross-sectional, exploratory research conducted in 50 subjects (25 men and 25 women) of  $19 \pm 2.34$  years. Subjects were monitored by continuous electrocardiographic reading all throughout the different activities. The HRV was evaluated at rest for 5 minutes, using time, frequency and non-linear analyzes, cardiac vagal index (CVI) was calculated using  $\text{Log}_{10}(\text{SD1} * \text{SD2})$ . Subsequently, a physical test of 6 minutes on the bike was performed between 50 and 60% of the maximum reserve heart rate. In the end, the RHR was evaluated every 10 seconds during the first minute. Subsequently, the relationship between HRV and RHR was analyzed using the Pearson correlation coefficient (r). **RESULTS:** In all population, mean HR at rest and RHR had an inverse effect, finding the following correlations: 10s ( $r = -0.35$   $p = 0.01$ ), 20s ( $r = -0.37$   $p = 0.007$ ), 40s ( $r = -0.40$   $p = 0.004$ ) and 60s ( $r = -0.53$   $p = 0.000$ ). Additionally, in women exist a direct correlation between RHR and CVI been more significant in the following correlations: 40s ( $r = 0.41$   $p = 0.044$ ), 50s ( $r = 0.52$   $p = 0.008$ ) and 60s ( $r = 0.59$   $p = 0.002$ ); however, in men this correlation was not significant. **CONCLUSIONS:** When performing stress tests in apparently healthy people, the decrease of the HR after exercise could be used to evaluate the activity of the ANS, specifically the activation of parasympathetic system demonstrated by the significant correlations between RHR and HR at rest, as well as the correlation between RHR and CVI. Therefore, the activity in the first minute after ceasing the exercise shows that the evaluation of the parasympathetic nervous system could be implemented in the early diagnosis and prognosis of chronic diseases including cardiovascular diseases.

967 Board #201 May 29 2:00 PM - 3:30 PM  
**Effects of Electronic and Conventional Cigarette Smoking on Post-exercise Autonomic Recovery**  
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Since nicotine-bearing cigarette smoking can induce acute cardiac autonomic imbalance, it may cause to persist sympathetic excitatory, and delay vagal reactivation during post-exercise recovery. However, the effects of post-exercise cigarette smoking on cardiac autonomic nervous system is still uncertain; especially the difference between *e*-cigarettes and conventional cigarette smoking on cardiac autonomic recovery after exercise is unknown. **PURPOSE:** this study was aimed at investigating the influence of cigarette smoking on heart rate variability, and the difference between *e*-cigarettes and conventional cigarette smoking on autonomic balance after aerobic exercise. **METHODS:** Apparently healthy male smokers ( $n=40$ ,  $23.03 \pm 3.30$  yrs) were participated in a randomized crossover study where three experimental sessions (non-smoking condition, NS; *e*-cigarette smoking, ES; conventional cigarette smoking, CS) were applied after 30 min single bout treadmill running at 60%  $\text{HR}_{\text{max}}$ . Either *e*-cigarette or conventional cigarette smoking was performed for 5 min immediately after exercise. Heart rate variability (HRV) was monitored before, during, and after exercise. **RESULTS:** As results of HRV analysis, parasympathetic activity indices ( $r\text{MSSD}$ ,  $p\text{NN50}$ ,  $\text{HF}$  and  $\text{SD1}$ ) were significantly decreased in both CS and ES compared to NS ( $p < .001$ , respectively). In particular, those parasympathetic indices at CS were significantly decreased at CS while smoking and post-exercise recovery ( $p < .001$ , respectively) whilst there was no significances at ES. In contrast, sympathetic activity index ( $\text{LF}/\text{HF}$  ratio) was significantly increased at both CS and ES compared to NS ( $p < .001$ ). Especially CS had significantly greater  $\text{LF}/\text{HF}$  ratio than ES while smoking and post-exercise recovery ( $p < .001$ ). **CONCLUSIONS:** This study had found that both *e*-cigarette and conventional cigarette smoking induce delayed parasympathetic reactivation and sympathetic withdrawal after aerobic exercise. In particular, conventional cigarette smoking had more sympathetic excitatory persisting responses than *e*-cigarette after aerobic exercise.

968 Board #202 May 29 2:00 PM - 3:30 PM  
**Hypotensive Effects of High Intensity Resistance Training to Muscle Failure in Hypertensive Postmenopausal Women**  
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 (No relevant relationships reported)

**PURPOSE:** Moderate-intensity Resistance Training (RT) has been recommended for blood pressure (BP) control by the main guidelines. However hypotensive effects of high intensity RT using higher loads to muscle failure in hypertensive patients is little know. Therefore, the aim of the study was to verify the behavior of BP after the session of high intensity resistance training in hypertensive women. **METHODS:** A randomized crossover design clinical trial was conducted with 10 controlled hypertensive women with age equal to:  $58.9 \pm 6.8$ , body mass index equal to:  $27.1 \pm 3.8$ . The participants performed two experimental protocols: a control session and RT session with 6 repetition maximum (RM) to muscle failure. The order of execution of the sessions was performed randomly by lot. The sessions of 6RM was performed with three exercises (lat pulldown, barbell bench press and  $45^\circ$  leg press) in three sets to momentary concentric failure. During the control session the participants followed of rest in the laboratory. Systolic blood pressure (SBP), diastolic blood pressure (DBP) were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated measures ANOVA were used. **RESULTS:** The SPB decrease in 1 h ( $124.3 \pm 10.8$ ) and 24 h ( $126.2 \pm 13.6$ ) after the 6RM session to muscle failure when compared to pre ( $135.7 \pm 14.1$ ), ( $p < 0.05$ ). SBP was higher for 6RM ( $144.7 \pm 16.4$ ) than control ( $134.2 \pm 18.1$ ) immediately after session ( $p < 0.05$ ). There were no differences for DBP among protocols ( $p \geq 0.05$ ). **CONCLUSIONS:** The RT using higher loads to muscle failure promote SPB hypotension 1 h and 24 h after the session. No DPB changes were observed after the RT protocols. The high intensity resistance training can decrease the SPB acutely and help in control of blood pressure in hypertensive women.

969 Board #203 May 29 2:00 PM - 3:30 PM  
**Circulating Inflammatory And Oxidative Stress Responses To Steady-state Moderate-intensity And High-intensity Interval Exercise In Mid-spectrum Chronic Kidney Disease**  
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 (No relevant relationships reported)

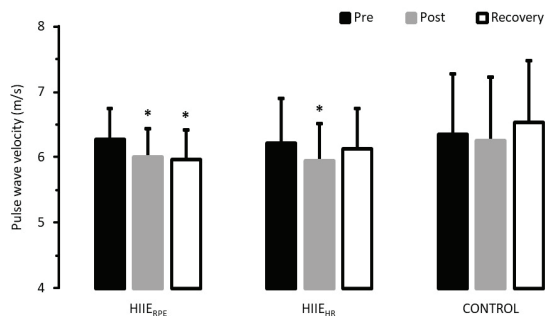
Inflammation and oxidative stress can be potent modulators of vascular function. These factors may transiently respond to moderate-intensity steady state exercise (SSE) in a manner that improves post-exercise vascular function in healthy adults. Whether exercise imparts similar effects in adults with Stage 3 or 4 chronic kidney disease (CKD) remains understudied. Moreover, a comparison of SSE and high-intensity interval exercise (HIIE) may add to clinically-relevant findings for improving vascular function in mid-spectrum CKD. **PURPOSE:** To determine the influence of SSE and a comparable amount of HIIE on post-exercise inflammation and oxidative stress in patients diagnosed with secondary Stage 3 or 4 CKD. **METHODS:** Twenty participants ( $n = 6$  men;  $n = 14$  women; age  $62.0 \pm 9.9$  yr; weight  $80.9 \pm 16.2$  kg; body fat  $37.3 \pm 8.5\%$  of weight;  $\text{VO}_2\text{max}$   $19.4 \pm 4.7$  ml/kg/min) completed 30 min of SSE at 65%  $\text{VO}_2\text{reserve}$  or HIIE by treadmill walking (90% and 20% of  $\text{VO}_2\text{reserve}$  in 3:2 min ratio) in a randomized crossover design. Both exercise conditions averaged  $\sim 65\%$   $\text{VO}_2\text{reserve}$ . Blood samples were obtained by the same technician under standardized conditions just before, 1hr and 24hrs after exercise. Total antioxidant capacity (TAC), paraoxonase1 (PON1), asymmetric dimethylarginine (ADMA), <sup>3</sup>nitrotyrosine (<sup>3</sup>NT) and interleukin-6 (IL6) responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVAs. **RESULTS:** Relative to pre-exercise measures: TAC increased by 4.3% 24hr after exercise ( $p = 0.012$ ). PON1 was maintained 1hr and elevated by 6.1% 24hr after SSE, but not HIIE ( $p = 0.035$ ). When corrected for plasma volume shifts, ADMA increased 30 ng/ml at 1hr but was 58 ng/ml lower 24hrs after exercise ( $p = 0.0006$ ). <sup>3</sup>NT and IL6 remained stable in the hours after exercise ( $p > 0.05$ ). **CONCLUSION:** Modest inflammatory and oxidative stress marker responses to either SSE and HIIE may contribute to improved vascular function in mid-spectrum CKD.

970 Board #204 May 29 2:00 PM - 3:30 PM

**Arterial Stiffness Response to High Intensity Interval Training in Young Healthy Individuals**

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**PURPOSE:** To assess arterial stiffness response to high-intensity interval training (HIIE) controlled by rating of perceived exertion (RPE) and heart rate (HR) in young healthy individuals. **METHODS:** Twelve young (21 ± 2 yrs) sedentary or insufficiently active individuals were randomly assigned to perform HIIE prescribed and self-regulates by 6 to 20 RPE (HIIE<sub>RPE</sub>, 25 min), HIIE prescribed and regulated by HR response to cardiopulmonary exercise testing (HIIE<sub>HR</sub>, 25 min) and non exercise control (CON) session (25 min of seated resting). Arterial stiffness (carotid-femoral pulse wave velocity - PWV) were measured before (pre), immediately after (post) and 30 min after (recovery) each intervention with participants quietly in supine position. Two-way ANOVA with repeated measures (intervention vs. time) was used to indicate inter- and intra-interventions differences and the Bonferroni *post hoc* analysis was used to identify significant differences were indicated by two-way ANOVA. **RESULTS:** PWV was lower ( $P < 0.05$ ) at post- than pre-intervention during both HIIE<sub>RPE</sub> (0.28 ± 0.17 m/s) and HIIE<sub>HR</sub> (0.27 ± 0.11 m/s). However, PWV remained lower at recovery only during HIIE<sub>RPE</sub> (0.30 ± 0.10 m/s,  $P < 0.05$ ), returning to pre-intervention levels during HIIE<sub>HR</sub>. PWV did not change significantly during CON. **CONCLUSION:** These results suggests that HIIE promotes positive acute effects in arterial stiffness in young healthy individuals. Both exercise intervention reduced PWV at post-intervention, but only HIIE<sub>RPE</sub> maintained the reduction at recovery, demonstrating that 6 to 20 RPE scale is an accessible, simple and useful tool for prescribing and self-regulating HIIE and promote cardiovascular benefits in young individuals.



**Figure.** Pulse wave velocity during interventions. Data are expressed as mean ± SD. HIIE<sub>RPE</sub>: high-intensity interval exercise prescribed and self-regulated by RPE; HIIE<sub>HR</sub>: high-intensity interval exercise prescribed and regulated by heart rate response to cardiopulmonary exercise testing. Asterisk denotes significant difference from pre at same group (\*:  $P < 0.05$ ).

971 Board #205 May 29 2:00 PM - 3:30 PM

**The Effect of Sodium Supplementation on Postexercise Hypotension Following Acute Submaximal Aerobic Exercise**

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**PURPOSE:** Acute submaximal aerobic exercise confers cardiovascular benefits including a prolonged reduction in blood pressure (BP) termed postexercise hypotension (PEH). PEH is thought to contribute to the chronic BP-lowering effects of aerobic training. Chronic sodium (Na<sup>+</sup>) supplementation expands plasma volume (PV) and may attenuate PEH. Therefore, this study tested the hypothesis that Na<sup>+</sup> supplementation attenuates PEH following acute aerobic exercise. **METHODS:** Healthy young adults (n=11, age 26 ± 4 years; body mass index 23.5 ± 2.4 kg/m<sup>2</sup>) consumed a recommended Na<sup>+</sup> diet (2,300 mg Na<sup>+</sup>/d) for 10 days on two occasions;

participants also consumed pills containing a total of either 4,000 mg Na<sup>+</sup> or a placebo in random order. Participants collected their urine for the final 24 hours of each intervention for quantification of urinary Na<sup>+</sup> excretion. On day 10 of each intervention, participants completed 50 minutes of dynamic cycling exercise at 60% VO<sub>2peak</sub>. Brachial BP was recorded via automated oscillometry before and every 10 minutes after exercise for one hour. The change in PV was estimated using hemoglobin and hematocrit following each intervention. BP responses following exercise were compared using a two-way repeated measures ANOVA. Urinary and blood measures and the nadir in BP after exercise were compared using paired t-tests. **RESULTS:** The mean VO<sub>2peak</sub> of participants was 41.6 ± 8.8 ml/min/kg and mean power at 60% VO<sub>2peak</sub> was 127 ± 40 W. Urinary Na<sup>+</sup> excretion was increased following Na<sup>+</sup> supplementation (277 ± 50 vs. 153 ± 73 mmol/24 hours,  $p < 0.001$ ). Na<sup>+</sup> supplementation expanded PV approximately 10.2 ± 8.9%. Despite significantly greater Na<sup>+</sup> excretion, serum [Na<sup>+</sup>] (141.0 ± 1.8 vs. 141.7 ± 3.0 mEq/L,  $p = 0.34$ ) and plasma osmolality (294 ± 4 vs. 295 ± 6 mOsm/kg H<sub>2</sub>O,  $p = 0.22$ ) were not different following Na<sup>+</sup> supplementation compared to placebo. PEH was observed following both conditions (nadir systolic BP: -4.7 ± 3.8 vs. -4.6 ± 2.9 mmHg,  $p = 0.91$  and mean BP: -6.1 ± 4.3 vs. -5.0 ± 3.4 mmHg,  $p = 0.38$ ). However, when comparing Na<sup>+</sup> supplementation to placebo, there was not a significant diet effect regarding reductions in systolic BP ( $p = 0.93$ ) or mean BP ( $p = 0.41$ ) following exercise. **CONCLUSIONS:** These preliminary data suggest that Na<sup>+</sup> supplementation does not attenuate PEH following acute aerobic exercise despite increased PV.

972 Board #206 May 29 2:00 PM - 3:30 PM

**Blood Chemistry Changes During an Ultra-marathon Competition**

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**PURPOSE:** The purpose for this study is to assess venous electrolyte changes in ultra-marathon athletes. There are few studies on ultra-endurance activities reporting blood parameter changes and their potential effects, and those that are published have conflicting results. We speculate that plasma fluid shifts and the metabolic demands occurring during an ultramarathon will result in significant changes in metabolites, electrolytes, hemoglobin and hematocrit levels that could be of risk to the runner's health. **METHODS:** Consent was obtained from each participant the day before the Saint Sebastian 100, November 2017. The event was conducted over a repeated ten-mile loop in the Saint Sebastian Preserve, Florida. The environmental conditions were moderately warm and humid. Races consisted of 50 kilometers, 50 miles and 100-mile distances. Blood samples were collected from the antecubital vein with 1 cc insulin syringes. Blood was analyzed with an i-STAT Handheld blood analyzer with the CHEM8+ cartridge (© Abbot Point of Care, Princeton, NJ). Paired sample t-tests were used to compare pre and post-race values (mean ± SD),  $p \leq 0.05$ , number of participants n=12. **RESULTS:** Significant changes pre to post race were found in the following: Potassium (3.97 ± 0.19, 4.27 ± 0.48 (mmol/L),  $t(11) = -2.31$ ;  $p = 0.04$ ); BUN (16.75 ± 8.18, 25.25 ± 7.28 (mg/dl),  $t(11) = -4.89$ ;  $p < 0.001$ ); Creatinine (0.85 ± 0.13, 1.48 ± 0.68 (mg/dl),  $t(11) = -3.31$ ;  $p = 0.007$ ); Hematocrit (44.75 ± 3.41, 47.25 ± 3.67 (%),  $t(11) = -4.38$ ;  $p = 0.001$ ); Hemoglobin (15.217 ± 1.15, 16.07 ± 1.24 (g/dl),  $t(11) = -4.35$ ;  $p = 0.001$ ); Sodium and glucose did not show significant changes pre to post race. Significant changes were not noted between different race distances. **CONCLUSION:** The results from this study show dehydration, muscle catabolism, and increased stress upon kidney function in the ultra-marathon athletes. These results demonstrate that electrolytes are altered post ultramarathon. The severity of these alteration is not known as various studies show opposing results. More research is needed to determine the extent of these changes and why some studies show changes when others do not. These changes could be of clinical significance to the runner's health or possibly through training they have adapted to these stressful alterations.

973 Board #207 May 29 2:00 PM - 3:30 PM

**Electrocardiogram T-Wave Morphology and Amplitude Differences during an Ultramarathon Competition**

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**PURPOSE:** The goal of this research is to study the effect of ultramarathon competition on T-wave morphology and amplitude changes. T-wave changes can be an indication of a vast number of conditions with many being of critical nature. This makes understanding what changes ultrarunners are undergoing critical for monitoring and understanding physiological changes associated with ultramarathons. **METHODS:** In this study, volunteer subjects Male n=25, Female n=20 signed an informed consent, then completed their ultramarathon distance. 12 lead EKGs were measured pre and post-race. EKGs were recorded and analyzed with ECG

Synchronous V1.3.1 and statistics were performed in SPSS V21. Paired sample t-tests were used to compare pre and post-race T-wave amplitude values (Pre/Post mean  $\pm$  SD,  $p < 0.05$ ). **RESULTS:** A total of 405 T-waves were analyzed. There was no change in t-wave morphology pre versus post-race for 83.95% ( $n=340$ ), while 16.05% ( $n=65$ ) changed morphology (upright, inverted, flat, camel hump and biphasic). Major changes observed were inverted to upright ( $n=24$ ), upright to inverted ( $n=9$ ), biphasic to upright ( $n=9$ ) and camel hump to upright ( $n=6$ ), other changes only occurred in 1 or 2 leads. Significant changes in T-wave amplitude (mv) pre- to post-race were found in the following leads: (Pre/Post mean  $\pm$  SD,  $p < 0.05$ ): **lead I** ( $0.168 \pm 0.114$ ,  $0.254 \pm 0.105$ ,  $t(44) = -4.845$ ;  $p < 0.001$ ); **lead II** ( $0.305 \pm 0.124$ ,  $0.398 \pm 0.137$ ,  $t(44) = -4.081$ ;  $p < 0.001$ ); **lead aVR** ( $-0.24 \pm 0.11$ ,  $-0.29 \pm 0.15$ ,  $t(44) = 0.04$ ); **lead aVF** ( $0.231 \pm 0.0805$ ,  $0.284 \pm 0.117$ ,  $t(44) = -3.666$ ;  $p < 0.001$ ); **lead V1** ( $0.00333 \pm 0.136$ ,  $0.0973 \pm 0.161$ ,  $t(44) = -5.144$ ;  $p < 0.001$ ); **lead V2** ( $0.358 \pm 0.233$ ,  $0.528 \pm 0.346$ ,  $t(44) = -5.462$ ;  $p < 0.001$ ); **lead V3** ( $0.440 \pm 0.215$ ,  $0.590 \pm 0.290$ ,  $t(44) = -5.951$ ;  $p < 0.001$ ); **lead V4** ( $0.480 \pm 0.190$ ,  $0.589 \pm 0.254$ ,  $t(44) = -3.899$ ;  $p < 0.001$ ); **lead V5** ( $0.168 \pm 0.114$ ,  $0.254 \pm 0.105$ ,  $t(44) = -4.035$ ;  $p < 0.001$ ), and **lead V6** ( $0.329 \pm 0.103$ ,  $0.398 \pm 0.148$ ,  $t(44) = -3.348$ ;  $p < 0.001$ ); leads III and aVL showed no change in amplitude. **CONCLUSION:** From this study, the results show evidence that long-distance running can alter T-wave morphology and amplitude pre- to post-race. Possible causes of these changes include hyperkalemia, cardiac strain, long QT syndrome, Tachycardia Induced cardiomyopathy all in response to the ultramarathon.

**974** Board #208 May 29 2:00 PM - 3:30 PM  
**Metabolic and Hemodynamic Efficiency of Identical Workloads Performed with Stable Supine vs Upright Cycle Ergometry**

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Although differences among postural positions during cycle ergometry generally display a metabolic response favoring the upright posture, the use of identical workloads regardless of pedal frequency are scarce. Using an electromagnetically braked ergometer with a constant load that accommodates a range of pedal frequency of 155 rpm, provided an identical workload despite positional changes and/or variation in pedal frequency. In addition, a lack of subject stability during supine exercise may contribute to an increased energy cost. **Purpose:** To determine the metabolic efficiency between supine (S) versus upright (U) cycling at identical workloads with stable supine subject positioning. **Methods:** 15 healthy college students (age  $20.9 \pm 1.3$  yr, ht.  $172.3 \pm 8.5$  cm, body mass  $76.9 \pm 12.6$  kg,  $8 \frac{1}{2}$ ) volunteered to participate in two randomly assigned GXT trials preceded by 5 minutes of rest, followed by a progressive increase of 25 watts per 3 min stage, starting at 50 w. Open circuit spirometry measured metabolism and hemodynamics were assessed by cardiac impedance. The seat was located 12° posterior of vertical above the center crank (CC) for the U trial and the subject was supine with the CC elevated 33 cm above the platform for the S trial. **Results:**  $\dot{V}O_2$  (L/min) were  $1.12 \pm 0.17$  vs  $1.06 \pm 0.14$ ,  $1.35 \pm 0.18$  vs  $1.28 \pm 0.13$ ,  $1.55 \pm 0.17$  vs  $1.52 \pm 0.12$ , and  $1.76 \pm 0.17$  vs  $1.78 \pm 0.15$ , and cardiac output [Q](L/min) were  $13.6 \pm 2.8$  vs  $12.0 \pm 3.5$ ,  $15.1 \pm 3.1$  vs  $14.1 \pm 3.5$ ,  $16.4 \pm 3.1$  vs  $16.6 \pm 2.0$ , and  $18.3 \pm 3.0$  vs  $19.1 \pm 2.4$ , for 50, 75, 100, and 125 watt workloads, for U vs S trials, respectively. NSD was found between  $\dot{V}O_2$  or Q at all workloads, except  $\dot{V}O_2$  at 75 w. **Conclusion:** Often extraneous subject supine mobility may impact cycling energy cost, however the subjects used a supine cycling platform, thus shoulder support prevented posterior body migration. At low to moderate intensity cycle exercise, with subjects in a stable position, the hemodynamic and metabolic response to supine vs upright cycling is virtually indistinguishable.

**975** Board #209 May 29 2:00 PM - 3:30 PM  
**Acute Effects of a Vinyasa Flow Yoga DVD on Lipid Profile and Fasting Glucose**

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Short- and long-term interventional trials have demonstrated the efficacy of various styles of hatha yoga in improving both lipid profile and fasting glucose concentrations; however, the acute effects of yoga on these measures are unknown. Vinyasa flow yoga is a style of hatha yoga characterized by continuous movement, smooth transitioning between postures, and a synchronization of breath and posture transitions. **PURPOSE:** The purpose of this study was to evaluate the acute effects of a Vinyasa yoga session on lipid profile and fasting glucose concentrations in yoga practitioners with a minimum of 3 months of yoga practice experience. **METHODS:** Nine yoga practitioners (20 - 75) completed one 60-minute Vinyasa yoga DVD. Whole blood samples were obtained (after 8 hrs of fasting) and analyzed for

total- and HDL-cholesterol, triglyceride, and glucose concentrations via reflectance photometry. Briefly, 35 $\mu$ L blood samples were applied to test cassette sampling wells and color changes of the reagent pads were converted to concentration values. LDL-cholesterol was calculated using the Friedewald equation.

**RESULTS:** After completion of the Vinyasa flow yoga session, a significant decrease in LDL-cholesterol ( $p < 0.01$ ) was observed. Total cholesterol tended to decrease ( $p = 0.128$ ) after the intervention, although not statistically significant. No changes occurred in fasting glucose ( $p = 0.769$ ), HDL-cholesterol ( $p = 0.431$ ), or triglyceride concentrations ( $p = 0.328$ ).

**CONCLUSIONS:** These results illustrate that a 1-hour session of Vinyasa flow yoga can improve LDL-cholesterol concentrations. These acute changes in lipid measures could lend support for the potential efficacy of yoga, an alternative exercise mode, in inducing positive changes in lipid profile and producing favorable changes in cardiovascular disease risk profile. This study was funded in part by Pure Action, Inc. Austin, TX, USA.

**976** Board #210 May 29 2:00 PM - 3:30 PM  
**Acute Handgrip Exercise Alters the Inter-arm Systolic Blood Pressure Difference in Young Males and Females**

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A large inter-arm difference (IAD) in systolic blood pressure (BP) is linked to an increased likelihood of cardiovascular and peripheral vascular disease, hypertension, and premature mortality. An acute bout of aerobic exercise can alter IAD both during the activity and into post-exercise recovery. Isometric handgrip exercise (IHE) results in acute alterations in BP that differ from aerobic exercise. Further, sex differences in IHE-mediated BP exist, and cardiovagal modulation is a plausible mechanism. No prior investigations have examined IAD during IHE in males and females. **PURPOSE:** To characterize IAD and heart rate variability (HRV) to IHE in men and women. **METHODS:** On visit one, participants completed three maximal voluntary isometric contractions (MVIC) per arm using a handgrip dynamometer. During visit two, after a five-minute rest, resting HRV was assessed while each participant breathed at a rate of 12 breaths/minute. HRV analysis software was used to determine relative low- and high-frequency power for each participant. Subsequently, a series of three resting bilateral BP measures were collected and averaged (REST) utilizing an automatic oscillatory BP device. Following REST, participants maintained the handgrip dynamometer at 20% MVIC for two minutes (arm randomly assigned), at which time bilateral BP and HRV were again measured (IHE). An independent-samples t-test and repeated measures ANOVA were used to compare and track variables of interest. **RESULTS:** IHE resulted in increased IAD in both males and females. Males demonstrated higher IAD at REST ( $7 \pm 6$  vs  $3 \pm 3$  mmHg) and during IHE ( $12 \pm 9$  vs  $5 \pm 4$  mmHg) than their female counterparts ( $P < 0.05$ ), with males also expressing a lower high-frequency HRV at rest ( $P < 0.05$ ). **CONCLUSIONS:** Isometric handgrip exercise altered IAD from rest to exercise, with males displaying increased IAD during both conditions. The attenuated exercise pressor response observed in female participants may be due, in part, to a higher observed baseline of cardiovagal modulation. Future studies should address potential responses following repeated bouts of IHE, which may have important implications in those with IAD.

**977** Board #211 May 29 2:00 PM - 3:30 PM  
**The Acute Effects of Vinyasa Flow Yoga on Arterial Stiffness**

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 (No relevant relationships reported)

Arterial stiffness (AS) is a marker of subclinical atherosclerotic disease associated with reductions in the buffering capacity of the central, elastic arteries. Previous research has demonstrated reductions in AS with a relatively short-duration, 8-week Bikram (hot) yoga practice. However, the acute effects of yoga on this measure have not been investigated. Vinyasa flow yoga is a style of hatha yoga which involves a higher intensity sequence of postures compared to other yoga styles along with continuous movement. As yoga could potentially be as effective as aerobic exercise in treating co-morbidities associated with CVD, it is pertinent to clarify whether an acute bout of Vinyasa flow yoga could lead to meaningful changes in indices of AS.

**PURPOSE:** The aim of this study was to investigate the acute impact of one bout of Vinyasa flow yoga on indices of AS in healthy adults. **METHODS:** 11 apparently healthy adults ages 20-75 yrs with at least 3 months of yoga experience completed a one-hour Vinyasa flow yoga DVD. Seated blood pressure measures were obtained pre- and post-intervention. Augmentation index (AIx) and carotid-femoral pulse wave velocity (cfPWV) were measured before and after the yoga



session via Sphygmocor applanation tonometry. AIX recordings included crude AIX, AIX at a heart rate of 75 beats per minute (AIX@75), and peripheral AIX (P2/P1). Mood affect was assessed via PANAS 20-item survey.

**RESULTS:** After completion of the yoga DVD, significant reductions in AIX and peripheral AIX ( $P < 0.05$  for both) were observed. Although not statistically significant, AIX@75 tended to decline ( $p = 0.068$ ) while cPPWV ( $P = 0.459$ ) was unaltered. No significant changes in positive or negative affect were observed although negative affect tended to decline ( $P = 0.126$ ).

**CONCLUSIONS:** These results highlight the efficacy of a single bout of hatha yoga in improving central and peripheral arterial stiffness measures and provide insight into the potential effects of yoga in mediating CVD risk.

**978** Board #212 May 29 2:00 PM - 3:30 PM  
**Walking With Leg Blood Flow Restriction: Wide-rigid Cuffs Vs. Narrow-elastic Bands**

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*Reported Relationships: S. Stray-Gundersen: Other (please describe); Received BFR bands from company as a gift for research.*

Blood flow restriction (BFR) training has become a popular form of exercise. The concept is that light exercise with BFR would elicit similar adaptations achieved with intense exercise. Walking exercise in combination with pressurized wide-rigid (WR) cuffs has been shown to elicit higher cardiac workload and a vascular dysfunction due presumably to reperfusion injury to the endothelium. In contrast, narrow-elastic (NE) BFR bands, similar to the original Kaatsu bands, may elicit different hemodynamic effects, as the limb is able to increase in diameter with increased blood flow accompanying exercise. **Purpose:** To compare two distinct forms of BFR bands during light-intensity exercise on cardiovascular responses. **Methods:** Six young healthy participants ( $M = 4$ ,  $F = 2$ ) performed 5 bouts of 2-minute walking intervals at 3.2 kph with a 1-minute rest and deflation period between bouts with either WR or NE bands placed on both upper thighs. Cuff pressure was increased to 160 mmHg in WR cuffs and 300 mmHg in NE bands. Beat-by-beat blood pressure and heart rate were measured continuously using finger plethysmography. Blood lactate concentration, rating of perceived exertion (RPE), flow-mediated dilation (index of endothelium-dependent vasodilation), and cardio-ankle vascular index (measure of arterial stiffness) were assessed before and after the walking exercise. **Results:** At baseline, there were no significant differences in any of the variables between the WR and NE conditions. Heart rate increased similarly in both conditions. Increases in systolic and diastolic blood pressure were greater ( $p < 0.01$ ) in the WR than the NE condition ( $160 \pm 13 / 92 \pm 11$  mmHg vs.  $127 \pm 9 / 71 \pm 16$  mmHg, respectively). Double product, a function of heart rate and systolic blood pressure, increased to a greater extent in the WR than in the NE condition. Increases in RPE and blood lactate concentration from baseline were greater in the WR compared with the NE condition ( $p < 0.05$ ). **Conclusion:** Use of wide-rigid BFR cuffs resulted in a marked increase in pressor responses compared with narrow-elastic BFR bands, suggesting that narrow-elastic bands may present a safer alternative for at-risk populations to perform BFR exercise.

**979** Board #213 May 29 2:00 PM - 3:30 PM  
**The Hemodynamic and Metabolic Response to Maximal Supine vs Upright Cycle Ergometry**

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*(No relevant relationships reported)*

Performance comparisons between supine (S) and upright (U) cycling have been reported to range from similar responses to as much as 150% greater for U conditions. In part, differences in performance have been attributed to a greater muscle perfusion pressure in the upright position resulting from an enhanced hydrostatic pressure in the lower extremities. **Purpose:** The purpose was to determine the hemodynamic and metabolic response to a maximal workload performed in a supine and an upright cycling position. **Methods:** 15 healthy college students (age  $20.9 \pm 1.3$  yr, ht.  $172.3 \pm 8.5$  cm, body mass  $76.9 \pm 12.6$  kg,  $8 \text{♂}$ ) volunteered to participate in two randomly assigned GXT trials preceded by 5 minutes of rest, and followed by a progressive increase of 25 watts per 3 min stage, starting at 50 w to volitional exhaustion. Open circuit spirometry measured metabolism and hemodynamics were assessed by cardiac impedance. The seat was located  $12^\circ$  posterior of vertical above the center crank (CC) for the U trial and each subject was supine with the CC elevated 33 cm above the platform for the S trial. **Results:** The following variables were measured during the final minute of exercise: workload  $216 \pm 41$  vs  $175 \pm 39$  watts\*,  $\text{VO}_2$   $2.68 \pm 0.52$  vs  $2.32 \pm 0.60$ , (L/min)\*,  $\text{Ve}$   $95.2 \pm 17.8$  vs  $75.9 \pm 19.0$  (L/min)\*, RER  $1.15 \pm .04$  vs  $1.12 \pm .05$ ,  $\text{Ve}/\text{VO}_2$   $42.9 \pm 5.8$  vs  $36.7 \pm 6.1$ \*, RPE  $9.9 \pm 0.3$  vs  $9.9 \pm 0.6$ , HR  $193 \pm 6.6$  vs  $177 \pm 11$  b/min\*, cardiac output (Q)  $23.6 \pm 7.2$  vs  $22.4 \pm 2.7$  (L/min), and SV  $121 \pm 33$  vs  $126 \pm 10$  (mL/beat), for U vs S, respectively (\* $p < .05$ ). Workload,  $\text{Ve}$ ,  $\text{VO}_2$ , and HR were 23, 27, 15, 11, and 9% higher for U vs S trials, respectively ( $P < .05$ ).

**Conclusion:** Attainment of a greater workload in the U trial (+23%), may, in part, be attributed to enhanced peripheral perfusion, familiarity with the U testing, and greater sympathetic drive. Despite a theoretical advantage for venous return in the S position, Q and SV did not differ between positions. Energy requirements of  $12.4$  vs  $13.3$  mL $\text{O}_2$ /watt for U vs S, respectively, confirms S to be less efficient than U.

**980** Board #214 May 29 2:00 PM - 3:30 PM  
**Menstrual Phase Differences In The Physiological Resolution Of Periodic Breath-holding During Heavy Intensity Fartlek Exercise**

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*(No relevant relationships reported)*

**PURPOSE:** Fluctuations in ovarian hormones have been shown to affect the physiological responses to heavy-intensity exercise. These responses may be exacerbated during backstroke swimming during the underwater push-off phase where swimmers are required to perform breath holds (~5 s) while kicking to the surface. The purpose of this study was to compare the singular and combined effects of repeated cycles of 5 s breath holds (BH) and hi-power output (HPO), every 30 s, during heavy-intensity (HVY) exercise during follicular (FOL) and luteal (LUT) phases.

**METHODS:** Eight eumenorrheic women ( $22 \pm 1$  yr,  $\text{VO}_{2\text{max}}$   $2.36 \pm 0.4$  L $\text{min}^{-1}$ ) performed four 6-min exercise bouts on a cycle ergometer at a power output of 50 % of the difference between ventilatory threshold and  $\text{VO}_{2\text{max}}$  ( $\alpha 50\%$ ) in the FOL and LUT. A continuous HVY (CONT) with free breathing, and 3 intermittent conditions including, repeated cycles of 25 s free breathing and 5 s BH (BH), repeated cycles of 25s at  $\alpha 50\%$  and 5s at peak aerobic power (HPO) and combining the BH and HPO (BH-HPO) perturbations were performed. Gas exchange and vastus lateralis deoxygenation (HHb) were recorded during all trials.

**RESULTS:** Mean Ventilation ( $V_E$ ) and total [hemoglobin] were higher in all conditions during LUT vs FOL (LUT  $78.0 \pm 10.7$ ; FOL  $75.1 \pm 10.7$  L $\text{min}^{-1}$  and FOL:  $2.0 \pm 2.2$   $\mu\text{Mol}$ ; LUT:  $2.9 \pm 1.9$   $\mu\text{Mol}$  respectively  $p < 0.05$ ). Carbon dioxide production ( $\text{VCO}_2$ ) was higher during LUT BH-HPO (LUT:  $2.41 \pm 0.18$  L $\text{min}^{-1}$ ; FOL:  $2.19 \pm 0.24$  L $\text{min}^{-1}$   $p < 0.05$ ). Whereas % $\alpha\text{HHb}$  was greater during the 5s BH vs the 25s free-breathing period in both LUT (25s:  $87 \pm 9\%$ ; 5s:  $89 \pm 8\%$   $p < 0.05$ ) and FOL (25s:  $86 \pm 15\%$ ; 5s:  $89 \pm 13\%$   $p < 0.05$ ) phases. Further, % $\alpha\text{HHb}/\alpha\text{VO}_2$  was greater during BH (6%) and HPO-BH (7%) during the 5s BH vs the 25s free-breathing in both phases (FOL:  $46.0 \pm 18\%$ ; LUT:  $45 \pm 14\%$  and FOL:  $44 \pm 18\%$ ; LUT:  $44 \pm 15\%$  respectively  $p < 0.05$ ).

**CONCLUSION:**

Low  $\text{PO}_2$  in the area of investigation (i.e. vastus lateralis) during heavy intensity exercise has been shown to increase  $\text{CO}_2$  transport by increasing the affinity of  $\text{CO}_2$  to Hb (Haldane effect). Moreover, the increased pulmonary diffusion capacity during the LUT phase suggested elsewhere would facilitate the observed increase in  $\text{VCO}_2$  and  $V_E$  during the BH-HPO protocol of the present study. Finally, females show increased local muscle deoxygenation in both BH conditions during both the FOL and LUT phases.

**981** Board #215 May 29 2:00 PM - 3:30 PM  
**Integrative Physiological Responses To A 25-day Ultra-endurance Exercise Challenge**

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**Purpose.** This case-report characterised the respiratory, cardiovascular, and nutritional/gastrointestinal (GI) responses of a trained individual to a novel ultra-endurance exercise challenge. **Methods.** A male athlete (age 45 yr, mass 80.7 kg, stature 1.71 m,  $\text{VO}_{2\text{max}}$  54.8 mL $\text{kg}^{-1}\text{min}^{-1}$ ) summited 100 mountains on foot (all elevations >600 m) in 25 consecutive days, and cycled between five base-camps throughout the UK. Laboratory measures of pulmonary function (spirometry, whole-body plethysmography, single-breath rebreath), respiratory muscle strength (maximum static mouth-pressures), and cardiovascular structure and function (echocardiography, electrocardiography, large vessel ultrasound, flow-mediated dilatation) were assessed at baseline and at 48 h post-challenge. Dietary intake (4-d food diary), self-reported GI symptoms, and plasma endotoxin concentrations were assessed at baseline, pre/post mid-point (day 13), pre/post penultimate point (day 24), and at 48 h post-challenge. **Results.** The participant completed the challenge with a total exercise time of 142 h ( $5.3 \pm 2.8$  h $\text{d}^{-1}$ ), distance of 1141 km ( $42.3 \pm 43.9$  km $\text{d}^{-1}$ ), ascent of 33804 m ( $1252 \pm 807$  m $\text{d}^{-1}$ ), and energy expenditure of 80460 kcal ( $2980 \pm 1451$  kcal $\text{d}^{-1}$ ). Relative to

baseline, there were post-challenge decreases in pulmonary volumes and capacities (6 - 32%), expiratory flows (9 - 28%), maximum expiratory mouth-pressure (19%), and maximum voluntary ventilation (29%). Heart rate variability had deteriorated, manifesting in a 48% decrease in the root mean square of successive differences (RMSSD) and a 70% increase in the low-frequency/high-frequency ratio (LF/HF). There were no notable changes in any other index of cardiovascular structure or function. Pre- to post-challenge endotoxin concentrations were elevated by 60%, with a maximum increase of 130% after a given stage, congruent with an increased frequency and severity of GI symptoms. **Conclusions.** This is the first study of the integrative physiological responses to an ultra-endurance exercise challenge. The findings extend our understanding of the limits of physiological function and may inform medical best-practice for personnel supporting ultra-endurance events.

**982** Board #216 May 29 2:00 PM - 3:30 PM  
**Genetic, Physiologic, and Behavioral Predictors Of Cardiorespiratory Fitness In Specialized Military Men**  
 Dianna Christine Laver<sup>1</sup>, Lisa M. Hernández<sup>1</sup>, Matthew R. Schoenherr<sup>1</sup>, Jeremiah Stump<sup>2</sup>, Marcus K. Taylor, FACSM<sup>3</sup>.  
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 (No relevant relationships reported)

Cardiorespiratory fitness (CRF) is a crucial performance requirement of specialized military occupations. Age and physical activity (PA) are established predictors of CRF, but it is not clear how these predictors combine with each other and/or with genetic predisposition. **PURPOSE:** To derive inclusive explanatory models of CRF in U.S. Navy Explosive Ordnance Disposal (EOD) operators, synthesizing conventional (e.g., age, body composition, and PA) and novel influences (e.g., genetic variance), was performed. **METHODS:** Forty male, active duty EOD operators completed a graded exercise test to assess maximal oxygen consumption and ventilatory threshold (VT) using the Bruce protocol. Aerobic performance was further quantified via time of test termination and time at which VT was achieved. Body composition was determined via dual-energy x-ray absorptiometry, and PA was assessed by self-report. Genetic variants underlying human stress systems (5HTTLPR, BclII, -2C/G, and COMT) were assayed. **RESULTS:** In univariate regression models, age, body composition, PA, and 5HTTLPR consistently predicted CRF and/or aerobic performance ( $R^2$  range .07-.55). Multivariate regression models routinely outperformed the univariate models, explaining 36%-62% of variance. **CONCLUSIONS:** This study signifies a shift toward inclusive explanatory models of CRF and aerobic performance, accounting for combined roles of genetic, physiologic, and behavioral influences. These findings have implications for assessment, selection, and training of specialized military members, and may also impact mission success and survivability.

**983** Board #217 May 29 2:00 PM - 3:30 PM  
**Influence of Menstrual Cycle Phase on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress**  
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 (No relevant relationships reported)

Cardiovascular drift (CV drift) is related to reduced maximal oxygen uptake ( $\dot{V}O_{2max}$ ) during heat stress. Whether this relationship is modified by elevated core temperature during the luteal phase (LP) of the menstrual cycle remains unknown. **PURPOSE:** To test the hypothesis that the magnitude of CV drift and accompanying decrement in  $\dot{V}O_{2max}$  is greater during the LP of the menstrual cycle vs. the follicular phase (FP). **METHODS:** Seven women (mean±SD; age=24±5 y) completed a graded exercise test in ~22 °C to determine  $\dot{V}O_{2max}$ , followed by one 15-min and one 45-min trial at 60%  $\dot{V}O_{2max}$  in 35 °C—each immediately followed by measurement of  $\dot{V}O_{2max}$ —in the FP and LP. CV drift was measured between 15 and 45 min during the 45-min trials. The purpose of the separate 15- and 45-min trials was to measure CV drift and  $\dot{V}O_{2max}$  over the same time interval. **RESULTS:** Rectal temperature ( $T_{re}$ ) at rest and during exercise was higher in the LP ( $p<0.05$ ). Heart rate increased 9% between 15 and 45 min in both phases ( $p=0.71$ ), while stroke volume decreased more in the LP (-18%) compared to the FP (-11%;  $p<0.001$ ).  $\dot{V}O_{2max}$  decreased significantly over time ( $p=0.002$ ), but menstrual cycle phases were not different (16% and 13% for LP and FP, respectively,  $p=0.28$ ). **CONCLUSION:** Greater thermal strain in the LP compared to the FP did not modulate the relationship between CV drift and  $\dot{V}O_{2max}$  during exercise in the heat.

**984** Board #218 May 29 2:00 PM - 3:30 PM  
**Should  $\dot{V}O_2$  Be Normalized By Fat-free Mass In Recreationally Active Adolescent Males And Females?**  
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**PURPOSE:** This research aims to observe sex difference in oxygen consumption ( $\dot{V}O_2$ ) expressed in absolute terms and relative to body weight and to fat-free mass in adolescent children while exercising at submaximal and maximal intensity. **METHODS:** Body composition (Bod Pod, COSMED) and cardiorespiratory fitness (K5, COSMED) were assessed on twenty-two recreationally active, healthy adolescents (age 16-17 years; 9 males, fat mas% 16.8 ± 8.0; 13 females, fat mas% 27.4 ± 5.4). A 15 watts/min incremental test to exhaustion was performed on a cycle ergometer to measure  $\dot{V}O_2$  at the aerobic threshold (AerT) and at peak exercise ( $\dot{V}O_{2peak}$ ) using breath-by-breath gas analysis. Values were expressed in both absolute terms and normalized by body mass and fat-free mass. The AerT was identified using the V-slope technique and as the lowest respiratory equivalent for oxygen. **RESULTS:** The  $\dot{V}O_2$  at the AerT was higher in males than females when expressed in absolute terms (1184 ± 222 vs 942 ± 202 ml/min,  $p = 0.015$ ) and normalized by body weight (16.9 ± 2.2 vs 16.4 ± 3.1 ml/kg/min) but the trend was inverted when  $\dot{V}O_2$  was normalized by FFM (20.43 ± 2.92 vs 21.57 ± 2.86 ml/kg/min). The same trend was observed at peak exercise. Males reported higher  $\dot{V}O_{2peak}$  than females when expressed in absolute terms (1792 ± 250 ml/min vs 2344 ± 554 ml/min,  $p < 0.01$ ) and normalized by body weight (33.5 ± 6.1 vs 30.6 ± 5.5 ml/kg/min) but lower when normalized by FFM (40.1 ± 5.7 vs 41.4 ± 8.0 ml/kg/min). Male adolescents exerted higher power than females both at the AerT (63 ± 13 vs 57 ± 20 watts) and peak effort (198 ± 40 vs 160 ± 20 watts,  $P < 0.01$ ). **CONCLUSIONS:** This study provides reflection on whether  $\dot{V}O_2$  should be normalized by total mass or FFM in adolescent males and females.

**985** Board #219 May 29 2:00 PM - 3:30 PM  
**Cardiovascular Drift and Maximal Oxygen Uptake in Men Versus Women During Heat Stress**  
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It has been well demonstrated that biophysical factors, such as rate of metabolic heat production ( $\dot{H}_{prod}$ ) and body size, are of primary importance in explaining variability of thermoregulatory responses during exercise in a compensable environment. It is unknown whether these same factors influence cardiovascular (CV) drift and a concomitant reduction in maximal oxygen uptake ( $\dot{V}O_{2max}$ ) during prolonged exercise in the heat. **PURPOSE:** To test the hypothesis that men experience a greater increase in heart rate (HR) and decrease in stroke volume (SV) accompanied by a greater reduction in  $\dot{V}O_{2max}$  during prolonged exercise in a hot environment compared to women at the same relative metabolic intensity. **METHODS:** Seven men [(mean±SD); mass=76.2±8.8 kg,  $\dot{V}O_{2max}$ =54.7±5.5 mL/kg/min] and 7 women (mass=58.9±9.4 kg,  $\dot{V}O_{2max}$ =42.0±9.2 mL/kg/min) performed a graded exercise test in ~22 °C to determine  $\dot{V}O_{2max}$ . Then on separate, counterbalanced occasions participants cycled at 60%  $\dot{V}O_{2max}$  for either 15 or 45 min in 35 °C, immediately followed by graded exercise to elicit  $\dot{V}O_{2max}$ . CV drift was measured between 15 and 45 min during the 45-min trials. The separate 15- and 45-min trials were necessary to measure  $\dot{V}O_{2max}$  during the same time interval that CV drift occurred. Women were tested during the follicular phase of the menstrual cycle. **RESULTS:** Because of differences in aerobic fitness and body size,  $\dot{H}_{prod}$  was higher ( $p<0.05$ ) for men (666 W, 8.8 W/kg) than women (402 W, 7.1 W/kg), but the increase in rectal temperature from 15 to 45 min was not different (men=1.0±0.4 °C; women=0.7±0.2 °C;  $p=0.25$ ). Likewise, CV drift was not different between groups (men: 14% increase in HR and 12% decrease in SV; women: 9% increase in HR and 11% decrease in SV; all  $p>0.05$ ).  $\dot{V}O_{2max}$  decreased between 15 and 45 min, but men (-13%) and women (-13%) were not different ( $p=0.95$ ). **CONCLUSION:** Despite exercising at a higher  $\dot{H}_{prod}$ , larger, more aerobically fit men did not experience greater CV drift and concomitant reductions in  $\dot{V}O_{2max}$  during heat stress compared to smaller, less fit women.

986 Board #220 May 29 2:00 PM - 3:30 PM

**Sedentary Behaviors Modulates Metabolic and Inflammatory Biomarkers in Healthy Males**

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**PURPOSE:** Sedentary behavior (SB) has emerged rapidly as a serious health problem globally. The purpose of this study was to assess the association between the increased time spent in SBs and metabolic and inflammatory biomarkers in healthy males.

**METHODS:** Thirty-five healthy male adults participated in this cross-sectional study (age, 21.8 ± 2.8 yr; body height, 171.9 ± 6.4 cm; body weight, 61.7 ± 5.6 kg; % body fat, 15.6 ± 4.3%; body mass index (BMI) 20.9 ± 1.5 kg/m<sup>2</sup>; waist circumference 75.5 ± 5.2 cm; heart rate (HR) 69.4 ± 7.8 bpm; systolic blood pressure (SBP) 108.7 ± 9.4 mmHg; diastolic blood pressure (DBP) 69.7 ± 8.3 mmHg). Subjects were required to wear the activPAL™ to continuously monitor their 24-hour activities for 7 days without any removal. Based on their SB, subjects were divided into high SB group (HSB, N=18) and low SB group (LSB, N=17). Blood samples were collected in the morning after overnight fast and no exercise was performed over the past 24 hours. Serum inflammatory biomarkers, including tumor necrosis factor alpha (TNFα), interferon-γ (IFNγ), interleukin 1β (IL-1β), monocyte chemoattractant protein 1 (MCP1) were measured by Flow Cytometry, while total cholesterol (TC), triglycerides (TRG), high-density lipoprotein (HDL), low-density lipoprotein (LDL) were analysed by xMark™ Microplate Absorbance Spectrophotometer at 500.0nm. Blood glucose (GLU) was measured by Alere Cholestech LDX® Analyzer. Independent-Samples T test and bivariate correlate were applied to analyze the differences between two groups and correlations among various biomarkers using SPSS version 23. **RESULTS:** Sedentary time of subjects in HSB group was higher than LSB group (19.9 ± 0.9 vs 17.3 ± 1.2 hr, p<0.01). No difference was found between two groups in MVPA and anthropometric results. An inverse relationship was observed between IFN-γ and sedentary time (r = -0.342, p<0.05). TNF-α was negatively associated with TC (r = -0.343, p<0.05), whereas IL-1β was negatively associated with TRG (r = -0.395, p<0.05). In addition, TRG and GLU were higher in the HSB group (p<0.05), while HDL was lower in the LSB group (p<0.01). **CONCLUSIONS:** The results suggest that a close relationship exists between sedentary time and inflammatory and metabolic biomarkers.

987 Board #221 May 29 2:00 PM - 3:30 PM

**Prevalence Of Fluctuated Heart Rate Recovery In Healthy Adults Undergoing Repeated Exercise Stress Tests**

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**Background:** Heart rate (HR) at 1 minute during the recovery from an exercise stress test (EST) of less than 18 beats per minute (b/min) is regarded as “pathologic” and is associated with poor prognosis. We previously showed the inconsistency of HR recovery (HRR) in patients referred for diagnostic EST.

**Purpose:** To investigate the prevalence of HRR in healthy individuals undergoing routine ESTs. In addition, we examined the autonomic function of HR variability measures prospectively in “Normal”, “Pathological” and inconsistency / “Fluctuated” HRR subjects undergoing EST.

**Methods:** We collected ESTs data from healthy subjects (n=66) undergoing annual checkups at the Institute for Medical Screening, Sheba Medical Center. We also examined the autonomic function prospectively in individuals (n=29) undergoing EST. Autonomic function was calculated using power spectral analysis. Independent T-Test and analysis of variance with repeated measures (ANOVA) were performed and a p-value ≤ 0.05 was considered significant.

**Results:** 40% of individuals demonstrated “fluctuated” HRR, 57% demonstrated “normal” HRR (> 18 b/min), and 3% demonstrated “pathological” HRR (≤ 18 b/min) during 17 years (average of 5.39 ± 1.65 tests). HRV indices showed no significant differences between the 3 groups either at rest, peak exercise or during the recovery period.

**Conclusion:** Our results demonstrate that HRR is not a constant value, and fluctuate between “normal” to “pathologic” among individuals undergoing routine and repeated ESTs. No differences were found in autonomic function indices. These data may question the clinical significance of HRR post exercise.

**B-62 Free Communication/Poster - Oxygen Uptake Kinetics**

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

988 Board #222 May 29 2:00 PM - 3:30 PM

**Ventilatory Variability is Not Associated with Differences in VO<sub>2peak</sub> Between Gas Sampling Intervals**

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Scientific literature suggests that oxygen consumption (VO<sub>2</sub>) variability during cardiopulmonary exercise tests results mainly from ventilation (VE) irregularities. Gas sampling intervals (GSI) reduce irregularities to unveil the underlying metabolic rate, however, large GSIs may obscure the true maximal rate. Despite the many used GSIs, few studies have investigated the simultaneous effect of altering GSI on ventilation and VO<sub>2peak</sub>. **PURPOSE:** The purpose of this study was to determine the degree to which GSIs alter VE variability and the correlation with simultaneous changes in VO<sub>2peak</sub>. **METHODS:** Recreational to well-trained subjects (12 male, 2 female, 23.9 ± 7.9 years) completed a Bruce treadmill test. Eight GSIs from previous literature were chosen. VE data was taken from the last minute of the last full stage completed by the participant. VE variability was reported as standard deviation (VESD) and normalized standard deviation (VENSD, SD divided by number of values used to determine SD). VO<sub>2peak</sub> for each GSI was defined as the single highest VO<sub>2</sub> value. One-way, repeated measures ANOVAs were used to determine GSI differences in VE variability and VO<sub>2peak</sub>. Pearson's correlations were used to determine the strength of relationship between VESD and VENSD with VO<sub>2peak</sub> for each subject, then averaged for the group. **RESULTS:** ANOVAs showed significant differences for VESD (max: 15-sec block, 5.5 L\*min<sup>-1</sup>; min: 15-breath block, 3.1 L\*min<sup>-1</sup>) between (p < 0.001, η<sup>2</sup> = 0.841) and within subjects (p < 0.005, η<sup>2</sup> = 0.337). ANOVAs showed significant differences for VENSD (max: 30-sec block, 2.3 L\*min<sup>-1</sup>; min: 15-breath moving, 0.1 L\*min<sup>-1</sup>) between (p < 0.001, η<sup>2</sup> = 0.827) and within subjects (p < 0.001, η<sup>2</sup> = 0.644). VO<sub>2peak</sub> was significantly different between GSIs (max 7-breath median 62.7 ± 10.6 ml\*kg<sup>-1</sup>\*min<sup>-1</sup>, min 30-sec block 58.7 ± 11.7 ml\*kg<sup>-1</sup>\*min<sup>-1</sup>, p < 0.001, η<sup>2</sup> = 0.577). The average individual Pearson's correlations for VO<sub>2peak</sub> vs VESD and VENSD were 0.083 and -0.484, respectively, with only one individual reaching significance in VESD (p < .05) and three reaching significance in VENSD (p < .05). **CONCLUSIONS:** VE variability appears to be subject dependent. Within-subject VE variability did not correlate well with VO<sub>2peak</sub>. VE variability does not appear to play a role in the change in VO<sub>2peak</sub> that occurs with a change in GSI.

989 Board #223 May 29 2:00 PM - 3:30 PM

**Chronic Adaptations On The Oxygen Uptake Kinetics In Trained Older Adults With Coronary Artery Disease**

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(No relevant relationships reported)

Previous studies have reported that slower VO<sub>2</sub> kinetics typically observed in healthy older individuals can be prevented by long-term endurance training interventions. However, the chronic adaptations on the VO<sub>2</sub> kinetics and muscle deoxygenation ([HHb]) kinetics response in trained older adults with coronary artery disease (CAD) remains unknown.

**PURPOSE:** to compare VO<sub>2</sub> and [HHb] kinetics response in moderate exercise in older adults with CAD and a control group (CG) of healthy active age- and gender-matched individuals. Both groups did at least 6 months the following exercise training (ET) prescription, 3 d.wk<sup>-1</sup> x 60-min: 30 min at 60-70% heart rate reserve + 2 x 8-12 repetitions in 6 major muscle groups.

**METHODS:** thirty-two male participants (age: 63.5 ± 8.3 years; n= 17 CAD and n=15 CG) completed the following assessments: 1) incremental symptom-limited cycling cardiopulmonary exercise test; 2) square-wave transitions from rest to moderate-intensity exercise. Pulmonary VO<sub>2</sub> was collected breath-by-breath and [HHb] data of the vastus lateralis was determined by near-infrared spectroscopy. The parameters of the VO<sub>2</sub> and [HHb] kinetics were determined using a monoexponential model. Differences between groups was assessed with the independent-samples t-test. **RESULTS:** Peak oxygen consumption and peak work load were lower in CAD compared to CG (CAD: 23.2 ± 6.2, CG: 30.4 ± 7.5 ml/kg/min, p<0.05; and CAD: 158 ± 47, CG: 193 ± 50 W, p<0.05). For the square-wave transition, VO<sub>2</sub> amplitude was significantly lower in CAD patients than CG group (10.1 ± 2.9 vs 13.1 ± 3.8 ml/kg/min, p<0.05). In contrast, VO<sub>2</sub> baseline, time constant of the primary phase, gain and mean response time were not significant (p>0.05). The effective deoxy-[Hb+Mb] was not statistically different between groups (p>0.05). **CONCLUSIONS:** Long term ET in CAD participants had lower measured VO<sub>2,peak</sub> and work load compared to age- and gender matched. However, both pulmonary and muscular oxygen kinetics were not slower in older adults with CAD compared to their training-matched counterparts. These findings support the importance on the referral of elderly patients to community-based cardiac rehabilitation ET program to maintain their submaximal pulmonary and muscle [HHb] kinetics to continue their ability to perform daily activities.

**990 Board #224 May 29 2:00 PM - 3:30 PM**  
**Dynamic Adjustment Of Beat-by-beat Cardiac Output And Vo<sub>2</sub> Kinetics During Moderate Intensity Exercise Transitions**

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 (No relevant relationships reported)

The kinetic adjustment of oxygen utilization (VO<sub>2</sub>) to exercise transitions of higher metabolic demands is proposed to be affected by central and peripheral alterations within the O<sub>2</sub> transport system and/or intracellular mechanisms of control. Although limitations in O<sub>2</sub> availability within the microcirculation but not at the conduit artery level have been proposed, knowledge is limited in relation to the contribution of the dynamic adjustment of cardiac output (Q) to the VO<sub>2</sub> kinetics response, and how training status might modify this response. **PURPOSE:** This study aimed to compare the adjustment of muscle VO<sub>2</sub> (i.e., Phase II VO<sub>2</sub>) to that of central O<sub>2</sub> delivery as examined by the adjustment of Q during step transitions to moderate intensity exercise. **METHODS:** Sixteen young healthy male participants (35 ± 6 yrs) performed 3 step transitions from 20W to moderate-intensity cycling on a cycle ergometer to determine the breath-by-breath VO<sub>2</sub> and the beat-by-beat Q responses. Participants were separated into two groups: trained (n= 9, VO<sub>2,max</sub> 4.54 ± 0.40 L/min) and untrained (n= 7, VO<sub>2,max</sub> 3.49 ± 0.68 L/min). Phase II VO<sub>2</sub> and Q were modeled with a monoexponential model. Paired and unpaired t-tests and Pearson product moment correlations were used to compare the time constants of VO<sub>2</sub> (τVO<sub>2</sub>) and Q (τQ). Statistical significance was set at P<0.05. **RESULTS:** Mean τVO<sub>2</sub> was faster in the trained (13.9 ± 2.7s) compared to untrained (24.4 ± 6.4 s). τQ was slower than τVO<sub>2</sub> in the trained (18.5 ± 6.0 s) but not untrained (20.2 ± 9.2 s). No difference was found between τQ between groups. Overall mean data showed no difference between τVO<sub>2</sub> (18.5 ± 7.1 s) and τQ (19.3 ± 7.3 s). No significant correlations were found between τVO<sub>2</sub> and τQ in trained (r=0.34), untrained (r=0.47), or when considering the two conditions together (r=0.37). **CONCLUSION:** This study demonstrated the dynamic adjustment of Q to exercise transition within the moderate intensity domain does not differ amongst trained and untrained individuals, even in the presence of training induced speeding of the VO<sub>2</sub> kinetics. These data support the notion that mechanisms other than central delivery of O<sub>2</sub>, such as improved blood flow redistribution within the active tissues and/or intracellular components are responsible for controlling the rate of adjustment of VO<sub>2</sub>.

**991 Board #225 May 29 2:00 PM - 3:30 PM**  
**Case Study of Physiological Measurements during Yoga Asana Practice**

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 (No relevant relationships reported)

**PURPOSE:** To conduct a preliminary case study to evaluate real time physiological changes and responses to mediation, Hatha yoga, inversion (experimental) and standing postures (control) and to determine the feasibility, reliability and validity of oxygen consumption and rate pressure product measured by a wearable metabolic device.

**METHODS:** A 500-hour registered yoga teacher (RYT) volunteered for this study and informed consent was obtained from the subject. A wearable metabolic device, calibrated to according to manufacturer's specifications, was worn for the duration

of each session. We conducted three sessions for this study. Blood pressure (BP), Heart Rate (HR), Oxygen Consumption (VO<sub>2</sub>) and Respiratory Quotient (RQ) were monitored. Each session began with a two minute meditation in a cross leg pose, followed by a warm up consisting of Sun Salutations and ended with a cool down. In addition, the first session included Mountain Pose then Chair Pose held for two minutes each. For the third session, supported shoulder stand and headstand were performed in place of the standing postures, each for two minutes. Heart Rate and VO<sub>2</sub> were recorded every minute. We obtained BP during the last 30 seconds of each posture.

**RESULTS:** Over the trials, mean VO<sub>2</sub> was 3.1 ± 0.08 ml·kg<sup>-1</sup>·min<sup>-1</sup> for the meditative pose, while the inverted pose yielded a mean VO<sub>2</sub> of 19.5 ± 1.5 ml·kg<sup>-1</sup>·min<sup>-1</sup>. A t-test between meditation and inversion for VO<sub>2</sub> and HR was significant (p<0.05).

**CONCLUSIONS:** These results will be put into the broader aspects of yoga and physiological measurements discussed above with further trials and additional subjects. This will assist in the implementation of yoga and other meditative movement technologies to be implemented into exergame software applications that can be hosted on personal computers and smartphones.

Trial	Meditation			Inversions		
	VO <sub>2</sub>	HR	RQ	VO <sub>2</sub>	HR	RQ
1	2.3	60	0.72	20.2	106	0.87
2	3.1	47	0.72	17.8	87	0.68
3	3.9	63	0.77	20.5	91	0.68
Mean	3.1	56.7	0.74	19.5	94.7	0.74
SD	0.80	8.5	0.03	1.48	10.0	0.11

**992 Board #226 May 29 3:30 PM - 5:00 PM**

**Limb Stiffness Is Lower In Those Who Rupture Contralateral Non-ACLR Knee Post Primary ACL Surgery**

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**Purpose**

The aim of this study was to identify biomechanical differences during jump and CoD testing 9 months after ACL reconstruction (ACLR) between those that went on to injure their non-ACLR limb and those that did not at 2 year follow up.

**Methods**

Nine months after ACLR, 105 males athletes who were returning to pre-injury sport participation (55 going on to suffer contralateral ACL injury/60 matched subjects with no second injury at 2 years post op) were prospectively assessed using isokinetic strength testing and 3D biomechanical analysis of double leg drop jump (DLDJ), single leg drop jump (SLDJ) and planned and unplanned 90° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the non-ACLR side and in limb symmetry index between groups were analysed with statistical parametric mapping (SPM, OD unpaired t-test). Biomechanical differences in the jump and CoD tests on the non-ACLR side and in symmetry between groups was analysed with SPM (1d, unpaired t-test). Effect size was calculated using Cohen's D for all analyses.

**Results**

There was no difference in IKDC score between groups. There was a small effect size difference in quadriceps strength on the non-ACLR side in the group that went on to injure that limb (ES 0.39) with no difference in LSI or across the hamstring strength and jump height tests. There was no difference in measures of biomechanical symmetry between groups for any of the tests and no difference on the non-ACLR side for the CoD tests. There were large effect size differences on the non-ACLR side in the SLDJ and DLDJ for COM stiffness (ES 0.78 & 0.82), ground contact time (ES 0.73 & 0.85), lowering of COM to ankle and knee (ES 0.7 to 0.81), vertical ground reaction force (ES 0.63 to 0.78) representing less stiffness on the non-ACLR side in the group that went on to injure non-ACLR limb after return to sport.

**Conclusion**

This study demonstrated clear biomechanical differences on the non-ACLR side in those that went on to injure the ACL in the limb despite little difference in strength and jump measures and measures of symmetry. These results suggest plyometric exercises to improve limb stiffness may be important to reduced injury risk to the non-ACLR limb after primary ACLR.

**993** Board #227 May 29 3:30 PM - 5:00 PM  
**Gait Asymmetry Can Predict Functional Performance Post ACL Reconstruction: A Pilot Study**  
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 (No relevant relationships reported)

Wearable inertial sensors are practical and inexpensive technology that can be used to detect gait asymmetries following anterior cruciate ligament reconstruction (ACLR). Specifically, individuals after ACLR walk with asymmetries in shank angular velocity (SAV) during landing, which may be indicative of abnormal knee joint loading. However, it is unknown whether these asymmetries in SAV detected at early stage of rehabilitation can predict functional performance at 6 months after ACLR. **PURPOSE:** To investigate whether SAV asymmetries during walking at 4 months after surgery can predict return-to-activity criteria at 6 months in individuals with ACLR. **METHODS:** Fourteen individuals (8 females; age= 27.79±7.9 y) with primary unilateral ACLR participated in the study. Participants were instructed to walk at a self-selected speed along a 12-meter straight walkway at 4 months after surgery. SAV peak was calculated bilaterally during landing as the first negative peak value after heel strike in the sagittal plane. The average SAV peak was calculated for each limb. At 6 months after surgery, participants completed return-to-activity criteria testing (isometric quadriceps index, single-legged hop tests, Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS), and Global Rating Score (GRS)). Inter-limb symmetry (ACLR limb/uninjured limb\*100) was calculated for SAV peak and functional measures. Linear regression models were used to determine whether SAV peak at 4 months would predict functional performance at 6 months following surgery. **RESULTS:** Asymmetry in SAV at 4 months was a significant predictor for asymmetries in the isometric quadriceps strength ( $r^2=0.39$ ,  $p=.02$ ), single hop for distance ( $r^2=0.36$ ,  $p=.02$ ), triple hop for distance ( $r^2=0.34$ ,  $p=.03$ ), and triple-cross-over hop for distance ( $r^2=0.51$ ,  $p=.001$ ), but not for the 6-meter timed hop ( $r^2=0.17$ ,  $p=.14$ ) at 6 months. Greater SAV asymmetry was a significant predictor for worse scores on the KOS-ADLS ( $r^2=0.49$ ,  $p=.006$ ) and GRS ( $r^2=0.46$ ,  $p=.008$ ). **CONCLUSIONS:** This pilot study showed that gait asymmetry detected by inertial sensors at early stage of rehabilitation can predict functional performance at 6 months after ACLR. Implementing these sensors in clinical practice may help clinicians to monitor gait on a regular basis during rehabilitation.

**994** Board #228 May 29 3:30 PM - 5:00 PM  
**Hip, Knee, And Ankle Contributions During Sloped Walking In Individuals With Aclr**  
 Katie Corona, Hillary H. Holmes, Randall Fawcett, Jaimie A. Roper. *Auburn University, Auburn, AL.* (Sponsor: Mark Tillman, FACSM)  
*Reported Relationships: K. Corona: Other (please describe); This was sponsored by an undergraduate research fellowship from Auburn University.*

**PURPOSE:** To compare joint moment contributions at the knee, ankle, and hip during flat, incline, and decline walking between limbs in individuals with ACL reconstructed (ACLR). **METHODS:** We analyzed 8 participants with ACLR. Each participant walked flat, uphill, and downhill at 0, 10, and -10 degrees with pre-determined speeds (1.3 m/s, 1.0 m/s, 1.0 m/s). Kinematic and kinetic data were collected during the final 30 seconds of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contributions at the hip, knee, and ankle were determined by dividing the peak sagittal joint moments by the sum of all three peak moments during stance. A 2x3 (limb x condition) ANOVA was implemented to evaluate interlimb differences across conditions, with post-hoc bonferroni adjustments. **RESULTS:** No significant main effect of limb or limb x condition interaction was found. Hip contributions were 13% greater during incline walking (28% contribution) compared to decline (15% contribution). During decline walking (57% contribution) knee contributions were 42% greater compared to incline (15% contribution) and 41% greater compared to flat walking (16% contribution). During flat walking (54% contributions) ankle contributions were 27% greater compared to decline (27% contributions) and 30% greater during incline walking (57% contributions) compared to decline. **CONCLUSIONS:** These results suggest that individuals with ACLR are capable of maintaining lower extremity joint symmetry with respect to walking at an incline and decline. Future studies will investigate differences in lower extremity joint contributions between individuals with ACLR and a healthy, age-matched control group.

**995** Board #229 May 29 3:30 PM - 5:00 PM  
**Post-Trial Feedback Alters Single and Dual Task Landing Performance in Healthy and ACL Reconstructed Athletes**  
 Thomas W. Kernozek, FACSM<sup>1</sup>, Brett McCutchin<sup>1</sup>, Maria Lee<sup>1</sup>, Jackie Cleerman<sup>1</sup>, Jessica Onsager<sup>1</sup>, Jeremie Schiedermaier<sup>1</sup>, Becky Heinert<sup>2</sup>, Drew Rutherford<sup>1</sup>. <sup>1</sup>*University of Wisconsin-La Crosse, La Crosse, WI.* <sup>2</sup>*Gundersen Health System, La Crosse, WI.*  
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 (No relevant relationships reported)

ACLR reconstructed (ACLR) individuals have unequal lower extremity loading during bilateral landing. Post-trial feedback may be used to alter landing mechanics in both healthy and ACLR populations. **PURPOSE:** Determine how post-trial feedback of vertical ground reaction force (vGRF), loading asymmetry (LA), and frontal-plane video (FPV) of control and ACLR groups can be used to alter these variables during single- and dual-task landing performances using a low-cost custom portable system in female athletes. **METHODS:** 24 female athletes were placed in a control (n=12) or ACLR (n=12) group. Single-task (ST) or dual-task (DT with/without jumping for a ball) drop landing trials were performed from a 50 cm height in blocks of 3 ST and 6 DT (pre-tests), 6 ST and 6 DT with post-trial visual feedback, and 3 ST and 6 DT post-tests. Peak vGRF, LA, and frontal plane knee-to-ankle ratio between task (ST or DT) and over time (pre-test, feedback, post-test) were compared using a three-way repeated measures ANOVA. **RESULTS:** Peak vGRF decreased (4.43±0.81 vs. 3.64±0.44 vs. 3.44±0.48 BW,  $p<0.001$ ) and improved knee-to-ankle ratio (0.94±0.13 vs. 1.01±0.12 vs. 1.05±0.12,  $p<0.001$ ) occurred over time (pre-test, feedback, post-test). ACLR group LA was larger compared to controls (0.16±0.08 vs. 0.09±0.08,  $p=0.043$ ). **CONCLUSION:** Peak vGRF and knee-to-ankle ratio improved over time for both groups. The ACLR group had higher LA compared to controls. Post-trial feedback may produce immediate changes in peak vGRF and knee-to-ankle ratio, however more post-trial feedback in LA may be necessary to produce changes in asymmetry in ACLR populations.

**996** Board #230 May 29 3:30 PM - 5:00 PM  
**Spatiotemporal Variables During Self-selected And Fastest-comfortable Walking Speeds In Individuals Following Acl Reconstruction**  
 Jennifer L. Hunnicutt<sup>1</sup>, Michelle M. McLeod<sup>2</sup>, Harris S. Slone<sup>3</sup>, Chris M. Gregory, FACSM<sup>3</sup>. <sup>1</sup>*Emory University, Atlanta, GA.* <sup>2</sup>*College of Charleston, Charleston, SC.* <sup>3</sup>*Medical University of South Carolina, Charleston, SC.* (Sponsor: Dr. Chris Gregory, FACSM)  
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**PURPOSE:** As a first step in translating the wealth of biomechanical gait studies following ACL reconstruction (ACLR), we conducted a study evaluating gait using more clinically applicable tool, the GAITRite portable walking system. Although this system has been used in a number of other populations (i.e., older adults, stroke), it has rarely been used in individuals following ACLR. The purpose was to describe spatiotemporal variables in individuals following ACL reconstruction. We hypothesized that individuals following ACLR would demonstrate between limb differences in spatiotemporal variables. **METHODS:** Participants walked over a portable walking system (GAITRite, CIR Systems, Inc., Franklin, NJ, USA) for three trials at their self-selected walking speed and three trials at their fastest-comfortable speed. They were not permitted to use any assistive devices during trials. Gait speed and spatiotemporal variables were collected and analyzed. Between limb differences in step length and percentage of gait cycle spent in single limb support were analyzed using paired samples t-tests. **RESULTS:** Data from 30 active individuals (23 years; 19 males; 9 mo. post-ACLR; IKDC score=80.5) are presented. Self-selected and fastest comfortable walking speeds were 1.22 and 1.89 m/s. Step length was significantly different between limbs at both self-selected (surgical limb=69.9±8.1; non-surgical limb=70.9±8.5;  $p=0.029$ ) and fastest-comfortable walking speeds (surgical limb=86.7±10.0; non-surgical limb=88.4±10.0;  $p<0.001$ ). There were no significant differences between limbs for percent of gait cycle spent in single limb support during self-selected walking (37.0±1.3 vs 37.3±1.5;  $p=0.065$ ), however, there were significant differences during fastest-comfortable walking speed (40.1±1.6 vs 40.6±1.5;  $p=0.003$ ). **CONCLUSIONS:** Although small, the observed shorter steps may be indicative of off-loading of the surgical limb. Further work is underway to include investigation of earlier time points following ACLR and relationship of spatiotemporal parameters to kinetic data.

997 Board #231 May 29 3:30 PM - 5:00 PM

**Dexterity of the Lower Limb Coordination In ACL Injured Athletes**

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**PURPOSE:** Regaining the “dexterity” in lower limb control is important for successful return to sports after ACL injury. The purpose of this pilot study is to evaluate the dexterity of the ACL-injured limb from the viewpoint of the complexity, smoothness, and accuracy of the inter-joint coordination. **METHODS:** Three male volunteers who had histories of ACL rupture participated in this study (One had already reconstructed, and the other had not reconstructed yet at the test day). The motor task was the lower limb target pursuing with the custom-made smart leg press device. As a target, the vertical bar, which sinusoidally up and down with the 0.5 Hz frequency, was presented on the PC screen. The volunteers were asked to control the vertical position of the mouse cursor with the leg press device and follow the target as precise as possible. The ankle, knee, and hip joint angles in the sagittal plane were calculated from 3D motion capture data. To quantify the complexity, the approximated entropies (ApEn) of those joint angles and cursor movement were calculated. The smoothness of the movement was evaluated with the root mean squared jerk (RMSJ), and the accuracy was quantified with the root mean squared error between target and cursor (RMSE). Those three performance variables were presented as the involved/uninvolved ratio. **RESULTS:** The ACL-reconstructed limb showed high complexity, less smooth, and moderately accurate pattern as compared to uninvolved limb. The non-reconstructed limb showed low complexity, less smooth, and not accurate patterns (Fig. 1). **CONCLUSIONS:** The complex and less smooth, but the accurate pattern in the reconstructed limb may suggest that the ACL reconstruction contributed on regaining fine inter-joint coordination which creates precise end-effector control based on the various combination of joint angles. The ACL reconstruction may help not only rebuilding the ligamentous structure but also regaining a dexterity of the movement.

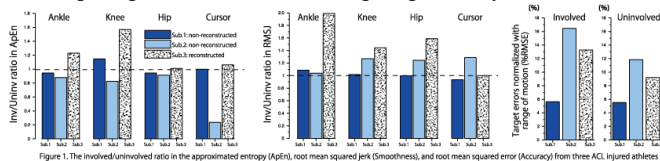


Figure 1. The involved/uninvolved ratio in the approximated entropy (ApEn), root mean squared jerk (Smoothness), and root mean squared error (Accuracy) from three ACL injured athletes

998 Board #232 May 29 3:30 PM - 5:00 PM

**Altered Somatosensory Cortex Activation in ACLR Patients during Single-Legged Balance Task**

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Recent studies have suggested that an anterior cruciate ligament reconstruction (ACLR) causes neuroplastic changes in the brain associated with muscle coordination. However, it remains unclear how an ACLR patients’ brain responds during postural control, which is a good clinical indicator for muscle coordination, when compared to healthy controls. **PURPOSE:** To examine differences in brain activity during a single-legged postural control testing between ACLR patients and healthy controls. **METHODS:** In this preliminary data, four healthy controls (CONT; 21.8±2.2yrs, 84.8±28.3kg, 180.3±5.08cm) and four ACLR patients (ACLR; 28.5±10.7yrs, 83.9±23.3kg, 179.1±10.5cm) volunteered. Frontal theta (Fz, 4-8Hz) and Parietal alpha-2 (Pz, 10-12Hz) electrocortical activations ( $\mu V^2/Hz$ ) were quantified using a mobile electroencephalograph (EEG) during one-legged postural stability testing. Independent t-tests were used to determine electrocortical activation differences between groups. **RESULTS:** The ACLR had a lower Alpha-2 power at Pz compared to the CONT (32.71±3.33,  $V^2/Hz$  vs. 38.76±3.24,  $V^2/Hz$ ,  $p=0.041$ ) during the single-legged postural control. No difference in frontal theta power (Fz) existed between the groups (38.46±1.02,  $V^2/Hz$  vs. 41.63±4.34,  $V^2/Hz$ ,  $p=0.205$ ). **CONCLUSIONS:** Our findings reveal less parietal Alpha-2 power in the ACLR patients compared to the healthy controls, while no different frontal theta power between groups during the postural control. As less Alpha-2 power represents less inhibition of sensory and attention to or movement in space, our findings suggest that ACLR patients may have increased cortical activation in the somatosensory cortex to compensate for altered proprioception following a surgical repair, when compared to healthy controls. During critical decision making, such as high intensity athletics,

this heightened somatosensory cortex activation could disrupt the rapid response mechanisms, and it may explain why some ACLR patients suffer poor muscle coordination and are at higher incidence of re-tear.

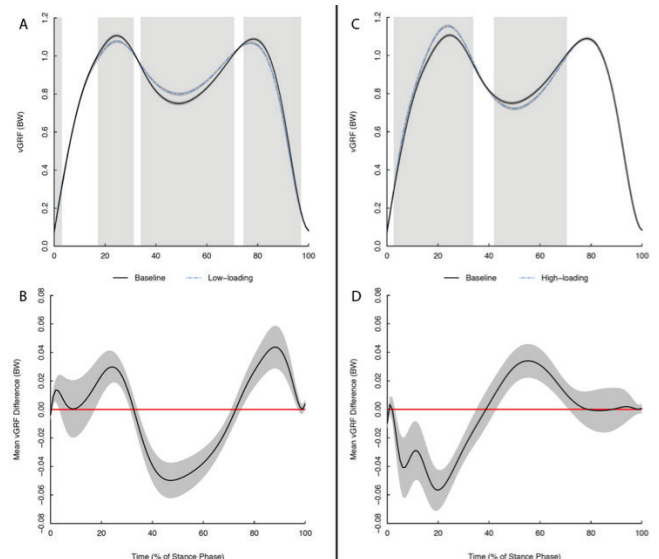
999 Board #233 May 29 3:30 PM - 5:00 PM

**Manipulating Initial Peak vGRF During Walking Affects Loading Throughout Stance in Individuals with ACL Reconstruction**

Alyssa Evans<sup>1</sup>, Brittney A. Luc-Harkey<sup>2</sup>, Hope C. Davis<sup>1</sup>, J. Troy Blackburn<sup>1</sup>, Matthew K. Seeley<sup>3</sup>, Jason R. Franz<sup>1</sup>, Brian Pietrosimone, FACSM<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Brigham and Women’s Hospital, Boston, MA. <sup>3</sup>Brigham Young University, Provo, UT. (Sponsor: Brian Pietrosimone, FACSM)  
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Gait alterations may be associated with osteoarthritis development following anterior cruciate ligament reconstruction (ACLR). Novel gait retraining paradigms are being developed to optimize peak vertical limb loading in the first half of stance; yet the effect of changing this single discrete variable on loading characteristics across the entire stance phase remain unknown.

**PURPOSE:** Determine the effect of increasing and decreasing the first peak of the vertical ground reaction force (vGRF) by 5% during walking using real-time biofeedback (RTBF) of vGRF throughout stance. **METHODS:** 30 ACLR participants (21 females, 20.4±2.9 yrs, 172.7±10.8 cm, 73.2±16.1 kg, 47.8±4.2 months post-ACLR) completed one 20-minute control condition and two experimental conditions (high- and low-loading). For high- and low-load conditions, participants walked for 20 minutes on a force-measuring treadmill with RTBF displayed on a screen cuing a 5% increase (high) or decrease (low) in the first peak of the vGRF relative to vGRF collected in the control condition. vGRFs were collected at 1000 Hz throughout the 19<sup>th</sup> minute. Two functional analyses of variance were conducted to evaluate vGRF magnitude throughout stance. **RESULTS:** Figures 1A and 1C depict mean vGRF, normalized to body weight (BW), throughout the stance phase. Figures 1B and 1D depict pairwise comparison functions (solid black lines) and associated 95% confidence intervals (gray bands), indicating mean differences between the two conditions. Significant between-condition differences existed in the high-loading condition between 42 and 74% of stance, and in the low-loading condition (between 38 and 70%, and 76 and 97% of stance). **CONCLUSION:** RTBF, used to cue changes in the first vGRF peak, results in loading alterations throughout stance. Specifically, high loading results in lesser vGRF at midstance but a similar propulsive peak. Conversely, low loading increases vGRF during midstance and decreases vGRF during toe-off.



**B-63 Free Communication/Poster - Anterior Cruciate Ligament Injury**

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

**1000 Board #234 May 29 3:30 PM - 5:00 PM  
Lower Extremity Kinematic Differences Between ACLR Limb and Non-Surgical Limb During a Cutting Task**

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Injury to the anterior cruciate ligament (ACL) is considered one of the most devastating injuries to the lower extremity. The gold standard treatment for ACL injury is surgical ACL reconstruction (ACLR) followed by 6-12 months of rehabilitation. Kinematic lower limb asymmetries in individuals post-ACLR have been identified during a variety of tasks such as walking, hopping and landing. However, there is limited understanding of whether limb kinematic asymmetries exist during a multi-directional high-risk task such as cutting. **PURPOSE:** To assess kinematic asymmetry between ACLR and non-surgical limbs during a cutting task. **METHODS:** Twelve participants (7 females, 5 males) who had undergone an ACLR and returned to full activity participated in this study. Twenty-one lower extremity markers and six marker clusters were placed on participants who ran down a 7-meter runway, planted their foot, and performed a 45° angle cutting task. Cutting tasks were performed to the right and the left of the runway. For left cutting tasks, the right limb was the planting limb and vice versa. Five successful trials were collected for each limb using an 8-camera 3D motion capture system. Joint kinematics were calculated and variables of interest included peak hip and knee flexion, ankle dorsiflexion, and combined sagittal-plane joint excursion. Differences in kinematics between limbs were calculated using paired *t*-tests with the alpha level set to 0.05. **RESULTS:** Peak hip flexion was greater in the non-surgical limb (non-surgical: 45.11 ± 14.97°, ACLR: 41.68 ± 16.62°, *p* = 0.029), and a trend for greater peak knee flexion was found in the non-surgical limb (non-surgical: 51.9 ± 8.04°, 49.44 ± 8.88°, *p* = 0.068). Combined sagittal-plane joint excursion was greater in the non-surgical limb during the cutting task (non-surgical: 146.28 ± 15.90°, ACLR: 133.66 ± 16.02°, *p* < 0.01). **CONCLUSION:** Subjects post-ACLR exhibited greater utilization of their non-surgical limb in the sagittal plane during a cutting task. This movement pattern suggests an avoidance behavior of their ACLR limb and suggests that further rehabilitation is necessary in these individuals post-ACLR in an effort to reduce their risk of re-injury.

**1001 Board #235 May 29 3:30 PM - 5:00 PM  
Altered Brain Morphology In Women With History Of ACL Rupture: A Structural MRI Study**

Felix Proessel, Anne Z. Beethe, Adam J. Sterczala, Courtenay Dunn-Lewis, Christopher Connaboy, Bradley C. Nindl, FACSM, Shawn D. Flanagan. *University of Pittsburgh, Pittsburgh, PA.*  
(No relevant relationships reported)

Anterior cruciate ligament ruptures (ACLR) are among the most common musculoskeletal injuries in young women. Despite the presence of supraspinal alterations after ACLR, the global and localized morphological underpinnings have yet to be elucidated.

**PURPOSE:** This study aimed to determine whether brain morphology differs in individuals with a history of ACLR compared to healthy controls with no history of injury.

**METHODS:** Twenty (10 ACLR, 10 controls) age- and physical activity-matched women (age: 20.9±2.9yr, weight: 65.9±8.8kg, height: 165.2±6.2cm) underwent 3T T1-weighted structural brain magnetic resonance imaging. Mean cortical thickness, grey matter and white matter volume were measured globally and within 70 and 95 anatomically defined regions of interest (ROIs), respectively. A two-way analysis of variance was used to determine differences in global and regional brain structure between ACLR and controls, while correcting for multiple comparisons by controlling the false discovery rate.

**RESULTS:** Mean duration since the completion of rehabilitation after ACLR was 3.1±1.1yr. Five injured the left leg and all but two participants were right foot dominant. Cortical thickness was significantly greater for controls in the left precentral gyrus (3.62±0.22 vs. 3.19±0.39mm, respectively *P*=0.019) and left paracentral lobule (3.70±0.23 vs. 3.27±0.26mm respectively; *P*=0.025). No differences in gray or white matter volume were seen for any of the ROIs between groups.

**CONCLUSION:** Three years after ACLR rupture, young women demonstrated persistent alterations in cortical thickness relative to individuals without a history of injury. Together with evidence of other supraspinal and neuromuscular deficits,

this suggests cortical involvement in the ACLR pathological process. Thus, neurophysiological assessments should be considered in addition to traditional musculoskeletal measurements.

Supported by a doctoral grant from the National Strength and Conditioning Association (SDF)

**1002 Board #236 May 29 3:30 PM - 5:00 PM  
Persistent Reductions in Strength of Sensorimotor Circuits Governing Injured Leg After ACL Rupture**

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Traumatic peripheral injury, like ACL rupture, may alter neurobiological structure and function, with regional reductions in sensorimotor circuit excitability and altered activity patterns in the prefrontal cortex. **PURPOSE:** To examine the long-term neurobiological consequences of ACL rupture on cortical silent periods (CSPs) in the motor cortical (M1) representations of the vastus lateralis (VL). **METHODS:** Nine women with a history of unilateral ACL rupture, repair and rehabilitation (3.3 ± 1.2 years prior) participated in the study. Maximal voluntary isometric contraction force (MVIC) was obtained for each leg during a bilateral, closed kinetic chain movement. Active stimulus response curves were produced at 15% MVIC. Biphasic single pulse transcranial magnetic stimulation (TMS) was delivered to the left or right VL hotspot at 40, 50, 60, 70, 80, and 90% stimulator output (SO). Five pulses were delivered during each 25s contraction, with 30s rest between contractions. SO order and leg were randomized. Contralateral CSPs were measured from TMS stimulus onset to the visual resumption of muscle contractile activity. Responses to each leg-specific SO were averaged for each subject and analyzed via two-way repeated measures ANOVA with Fisher's LSD pairwise comparisons. **RESULTS:** Because CSPs were consistently produced above 70% SO, quantitative analysis was limited to 70, 80, and 90% SO. Significant main effects were observed for SO (*p*=0.001) and Leg (*p*=0.026). CSP duration increased in parallel with SO intensity (80% vs. 70% Δ=32.1ms, *p*=0.002; 90% vs. 70% Δ=54.5ms, *p*=0.002; 90% vs. 80% Δ=22.4ms, *p*=0.015). CSPs were generally longer in the injured leg (Δ=21.6ms, *p*=0.026). At 70 and 80% SO, CSPs were longer in the injured leg (70% SO: 25.8ms Δ, *p*=0.017; 80% SO: 18.3ms Δ, *p*=0.026; 90% SO: 20.6ms Δ, *p*=0.099). A trend of increased CSP duration at 90% SO may reflect ceiling effects in the silent period of the injured leg. **CONCLUSIONS:** Injured-leg M1 representation stimulation increased CSP durations compared to the uninjured leg. These deficits persisted years after rehabilitation, and were reproducibly detected during bilateral closed kinetic chain movements at 15% MVIC and SOs above 70%. Our observations indicate long-term reductions in the strength of the sensorimotor circuits governing the injured leg.

**1003 Board #237 May 29 3:30 PM - 5:00 PM  
Characterization Of Gender Differences In Kinematics And Surface Emg In ACLR**

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**PURPOSE:** The mechanism and specific characteristics of differences between sexes are not clear. Using three-dimensional motion capturing system in kinematics and surface electromyography (sEMG) to discuss the changes of hip and knee flexion angle and neuromuscular signals in ACLR.

**METHODS:** Eight MX-F20 motion-capture cameras were connected with a VICON Vgas CMOS sensor. 10 subjects (5 males and 5 females) were selected after ACLR within 1 year. Making sure model of lower limbs can be caught by cameras. Placing electrodes on subjects' lower limbs of gluteal muscle, vastus medialis, lateral femoral, rectus femoris, and biceps femoris respectively. The electrodes are connected with the NORAXON wireless sEMG signal collector to collect the surface myoelectric signal of 10 muscles during action process. Subjects to stand in a standing position by their feet, on a skip box with the height of 30cm, and landing in the feet. At the same time, collecting landing moments in the course of the operation, gathering flexion angles of hip joint and knee joint, and changing of the 10 muscular sEMG signal. Rate of contributing in these muscles of this motion and hip and knee flexion angles were analyzed. Using a separate T-test comparative analysis of gender was performed by SPSS19.0.

**RESULTS:** There is a significant difference in hip flexion angle of affected side (unaffected side: Mean = 17.01, SD = 9.28; affected side: Mean = 17.33, SD = 13.53; *t* = 0.467, *p* = 0.034), and knee flexion angle is not significantly different. (unaffected: Mean = 29.0, SD = 15.51; affected: Mean = 27.54, SD = 16.33; *t* = -0.298, *p* = 0.404). There is a significant difference in knee flexion angle of gender (male: Mean

= 376.56, SD = 156.86; female: Mean = 17.52, SD = 9.87; p = 0.049), and there is no significant gender difference in hip flexion angle in affected side. Among the Averaged mean amplitude of all periods, the gluteal muscle play an important role in this action.

**CONCLUSIONS:**

Changing about range of motion and stability of hip joint with affected side is greater than unaffected. The knee flexion angle is affected by gender in the presence of foot-landing-landing process, and knee flexion angle of female knees is smaller than that in males, but in muscle stimulation rate, women are more dependent on thigh muscle strength rather than gluteal muscle.

**1004** Board #238 May 29 3:30 PM - 5:00 PM

**Associations Between Knee Kinematics During Gait And Quadriceps Corticomotor Excitability Following Anterior Cruciate Ligament Reconstruction**

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 (No relevant relationships reported)

Impaired quadriceps function is associated with a more extended knee throughout the stance phase of gait in individuals with anterior cruciate ligament reconstruction (ACLR). This stiffened knee strategy may alter tibiofemoral loading and hasten joint breakdown and osteoarthritis development. Altered quadriceps corticomotor excitability may influence knee kinematic during gait; yet it is unknown if quadriceps corticomotor excitability associates with gait kinematics.

**PURPOSE:** To determine associations between quadriceps corticomotor excitability and sagittal plane knee kinematics during walking for ACLR individuals. **METHODS:** Thirty-three individuals with unilateral ACLR participated in this cross-sectional study (72% female, 22.2 ± 3.5years; 72.5 ± 17.2kg; 1.7 ± 0.1m; 49.9 ± 40.4 months post-ACLR). Quadriceps corticomotor excitability was assessed as active motor threshold (AMT) from the vastus medialis of the ACLR limb using transcranial magnetic stimulation. Three dimensional biomechanics were collected during over ground walking at a self-selected speed and extracted from the first 50% of stance. We evaluated sagittal plane knee kinematics for the current study including (knee flexion angle at heel strike [HS]; peak knee flexion angle; knee flexion excursion [peak angle - HS angle]). Partial Pearson product-moment correlations were used to assess associations between kinematic variables and corticomotor variables in the ACLR limb controlling for gait speed ( $\alpha = 0.05$ ).

**RESULTS:** AMT was not associated with sagittal plane knee kinematics in the ACLR limb during walking (angle at HS  $r = -0.13$   $P = 0.47$ ; peak knee flexion angle  $r = -0.22$   $P = 0.22$ ; knee flexion excursion  $r = -0.19$   $P = 0.29$ ).

**CONCLUSIONS:** No associations were found between quadriceps corticomotor excitability and sagittal plane knee kinematics during gait in individuals with ACLR. Central pattern generators, and not cortical excitability, may more strongly influence gait kinematics. Further work is necessary to determine the influence of altered corticomotor excitability on other gait outcomes including kinetics and lower limb muscle activity patterns.

**1005** Board #239 May 29 3:30 PM - 5:00 PM

**Hyaluronate Injections after Anterior Cruciate Ligament Reconstruction Does Not Improve Running Mechanics**

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Mitigating inflammation early after anterior cruciate ligament reconstruction (ACLR) may help strength and biomechanical outcomes further in rehabilitation. **PURPOSE:** The purpose of this study was to determine if hyaluronate injections (HI) administered early after surgery improves strength and running mechanics six months after ACLR. **METHODS:** Nineteen individuals (Table 1) who suffered an ACL tear during sport participation were enrolled in a randomized double-blind controlled trial to test a post-operative intraarticular HI compared to a placebo one week after surgery (one patient screen failed, and one withdrew after surgery). Six months post-surgery individuals completed isokinetic quadriceps strength (IKQS) at 60°/second and a biomechanical analysis of overground running using 3D motion capture and force plates. Visual 3D was used to calculate bilateral lower extremity biomechanics including knee excursion (KEX) from initial contact to peak knee flexion, and peak vertical ground reaction forces (VGRF). Inverse dynamics were used to calculate internal peak knee abduction

moments (KAM), and peak knee extension moments (KEM). A repeated measures analysis of variance was used to determine differences between groups (injection vs control) and limb (involved and uninvolved). An alpha value of 0.05 was used.

**RESULTS:** There were no significant differences between the injection group and the control group in peak IKQS or running mechanics, and there was no significant group x limb interaction. In both the injection group and the control group, the involved limb exhibited significantly lower IKQS and KEM, less KEX, and lower peak VGRF (Table 1) compared to the uninvolved limb. **CONCLUSION:** The individuals who received the HI post-surgery did not present with improved strength or running mechanics six months post ACLR compared to control subjects. Future research should investigate further benefits of neuromuscular and physiological factors from a HI.

Table 1	Control Mean ± SD		Hyaluronan Injection Mean±SD		Between Group Involved limb p-value	
Sex	Female = 4, Male = 4		Female = 6, Male = 3			
Age (yrs)	18.88± 3.78		18.40± 2.17			
Mass (kg)	87.41± 17.36		81.45± 24.41			
Height (m)	1.78± 0.09		1.74± 0.13			
	Un-involved	Involved	Within Group p-value	Un-involved	Involved	Within Group p-value
Peak IKQS (Nm/kg)	217.20± 48.14	128.31± 35.33	<0.001	221.54± 61.28	143.05± 60.74	<0.001
KAM (Nm/kg)	-0.82± 0.52	-0.89± 0.48	0.725	-0.92± 0.67	-0.93± 0.46	0.725
KEM (Nm/kg)	4.08± 0.83	1.93± 0.75	<0.001	3.80± 0.36	2.48± 0.39	<0.001
KEX (°)	27.89± 6.28	18.36± 3.73	0.007	26.74± 0.82	21.93± 1.52	0.039
Peak VGRF (xBW)	3.32± 0.65	2.99± 0.57	0.001	3.13± 0.36	2.95± 0.35	0.007

**1006** Board #240 May 29 3:30 PM - 5:00 PM

**Somatosensory Function and Gait Biomechanics In Individuals With Anterior Cruciate Ligament Reconstruction**

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 (No relevant relationships reported)

Somatosensory function of the knee is reportedly altered following anterior cruciate ligament reconstruction (ACLR), potentially influencing the risk of osteoarthritis (OA). Poorer somatosensory function is associated with aberrant gait biomechanics in individuals diagnosed with knee OA, but this relationship has not been evaluated following ACLR. **PURPOSE:** To compare somatosensory function between limbs in individuals with ACLR and evaluate associations between somatosensory function of the ACLR limb and gait biomechanics. **METHODS:** Sixty-eight individuals with unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 15 mo) volunteered. Somatosensory function was assessed bilaterally as the ability to replicate a specified knee flexion angle during a joint position sense task (i.e. joint position sense error - JPSE). Gait outcomes were assessed during the first 50% of stance including vertical ground reaction force (vGRF), instantaneous loading rate, internal extension moment, and internal valgus moment. **RESULTS:** There was no difference in JPSE between the ACLR limb and the contralateral limb (2.9 ± 1.2° vs 2.8 ± 1.7°, p = 0.71). Additionally, there was no correlation between the ACLR limb JPSE and vGRF (r = -0.095, p = 0.44), instantaneous loading rate (r = -0.121, p = 0.33), internal extension moment (r = -0.018, p = 0.88), or internal valgus moment (r = -0.073, p = 0.55). **CONCLUSIONS:** JPSE did not differ between the ACLR and contralateral limbs, and JPSE in the ACLR limb was not associated with gait biomechanics. The mean time since ACLR in our sample was approximately 2 years, thus somatosensory adaptations may have occurred bilaterally at time of testing. Moreover, neuromuscular function of the contralateral limb is also influenced by ACLR, potentially confounding a comparison of JPSE between limbs that may have both undergone changes post-



operatively. These findings suggest the need to compare somatosensory function to a healthy cohort. Furthermore, the small magnitude and limited variability of JPSE likely minimized its ability to predict gait outcomes. Future research is necessary to determine whether somatosensory deficits emerge at later time points post-ACLR compared to a healthy cohort and if they influence knee OA risk.

**1007** Board #241 May 29 3:30 PM - 5:00 PM  
**The Relationship Between Body Composition and Quadriceps Function Following Anterior Cruciate Ligament Reconstruction**

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 (No relevant relationships reported)

Anterior cruciate ligament reconstruction (ACLR) and obesity are primary risk factors for posttraumatic knee osteoarthritis (PTOA). ACLR leads to quadriceps dysfunction, and greater fat mass may exacerbate this dysfunction as adipose tissue negatively influences strength and muscle activation. Deficiencies in quadriceps function may result in reduced capacity to attenuate energy at the knee, potentially contributing to aberrant joint loading that contributes to PTOA.

**Purpose:** To determine the relationship between body composition and quadriceps function in individuals with ACLR.

**Methods:** Thirty-five (20 F, 15 M; 71±12 kg; 23.7±2.8 BMI; 48±35 months since ACLR) individuals at least 6 months removed from unilateral ACLR volunteered for the study. Total body fat percentage (BF%), limb fat mass (LFM), and limb lean mass (LLM) were obtained bilaterally using dual x-ray absorptiometry (DXA). LLM and LFM were normalized to total body mass. Quadriceps function was assessed bilaterally from maximal voluntary isometric contractions (MVIC) and a single limb hop (SLH) task. Peak torque (PT) was averaged from 2 MVIC trials and normalized to body mass. Maximum hop distance was averaged from 3 hop trials. Associations between measures of body composition and quadriceps function were analyzed via Pearson Product Moment correlations.

**Results:** In the ACLR limb, PT was associated with BF% ( $r=-0.620$ ,  $p<0.001$ ), LFM ( $r=-0.525$ ,  $p<0.001$ ), and LLM ( $r=0.552$ ,  $p<0.001$ ). Hop distance in the ACLR limb was also associated with BF% ( $r=-0.656$ ,  $p<0.001$ ), LFM ( $r=-0.698$ ,  $p<0.001$ ), and LLM ( $r=0.441$ ,  $p=0.008$ ). PT and SLH distances for the contralateral limb were also significantly related to BF%, LFM, and LLM. Body mass index (BMI) was not significantly related to PT or SLH distance in either limb.

**Conclusion:** BF%, LLM, and LFM are related to measures of quadriceps function following ACLR. The negative associations between functional outcomes (PT and SLH distance) and measure of adipose composition (BF% and FT) indicate that greater fat tissue may contribute to exacerbated quadriceps dysfunction after ACLR. Continued research is needed to evaluate body compositional changes following ACLR and how it influences other factors related to the development of PTOA.

**1008** Board #242 May 29 3:30 PM - 5:00 PM  
**Landing Biomechanics Following Patellar And Hamstring Tendon Anterior Cruciate Ligament Reconstruction**

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Individuals with an ACL reconstruction (ACLR) have different landing adaptations depending if they received patellar (PG) or hamstring tendon (HG) graft reconstruction. No study has evaluated landing biomechanics following these procedures in soccer players.

**Purpose:** To compare landing biomechanics between soccer players following PG or HG ACLR during planned and unplanned landing tasks.

**Methods:** Six soccer players with a PG ACLR (age, 25.83 ± 4.44 years; height, 1.73 ± 0.04 m; weight, 70.91 ± 8.00 kg, BMI, 23.64 ± 3.29 kg/m<sup>2</sup>, time since surgery, 4 ± 3.38 years) and 6 soccer players with a HG ACLR (age, 26.83 ± 3.25 years; height, 1.69 ± 0.08 m; weight, 67 ± 6.16 kg, BMI, 23.40 ± 2.08 kg/m<sup>2</sup> time since surgery, 5 ± 2.89 years) participated in the study. Planned landing (PL) included jumping forward and landing on two force plates, whereas unplanned landing (UL) included jumping forward to head a soccer ball and landing on the force plates. Participants performed 4 trials of each landing task. Outcome measures included peak flexion angles and extension moments of the hip, knee, and ankle joints, and electromyography of gluteus maximus, quadriceps, hamstrings, and gastrocnemius muscles. A 2×2 ANOVA (group × landing) was performed for each measure.

**Results:** There were no significant group × landing interactions for any of the outcomes. Significant main effects of landing were found. The UL showed smaller hip flexion ( $F_{1,10} = 48.77$ ,  $p < 0.001$ ), smaller knee flexion ( $F_{1,10} = 28.02$ ,  $p < 0.001$ ), and

lower ankle plantarflexion moments ( $F_{1,10} = 26.48$ ,  $p < 0.001$ ). Significant main effects for group for quadriceps muscle and hip extension moments were found showing that the PG group landed with reduced quadriceps activity ( $F_{1,10} = 11.72$ ,  $p = 0.007$ ), and greater hip extension moments ( $F_{1,10} = 14.69$ ,  $p = 0.003$ ).

**CONCLUSION:** The UL showed greater injury predisposing factors compared with the PL. Although the PG group showed nearly similar landing biomechanics to the HG group during both maneuvers, they (PG) demonstrated a protective landing pattern by reducing quadriceps activity and increasing the demand on the hip extensors. These findings reinforce the clinical emphasis on improving the use of hip and knee joints during landing to reduce the risk of consequent injuries in soccer players following PG ACLR.

**1009** Board #243 May 29 3:30 PM - 5:00 PM  
**Improvements in Somatosensory Function with Vibration do not Influence Gait Biomechanics in Individuals with Anterior Cruciate Ligament Reconstruction**

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Anterior cruciate ligament reconstruction (ACLR) incurs somatosensory deficits that potentially alter gait biomechanics and contribute to knee osteoarthritis (OA) risk. Individuals diagnosed with knee OA also display somatosensory deficits, and improving somatosensory function in this population improves gait biomechanics linked to OA progression. Vibratory stimuli potentially improve somatosensory function and may be an effective approach for reducing knee OA risk following ACLR. **Purpose:** To evaluate the effects of vibration on somatosensory function and determine if improving somatosensory function influences gait biomechanics in individuals with ACLR. **Methods:** Gait biomechanics and somatosensory function were assessed in 68 individuals with unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 15 mo) prior to and following one session of a whole body vibration (WBV), local muscle vibration (LMV), or control (CON) intervention. Gait outcomes included the peak vertical ground reaction force (vGRF) and its instantaneous loading rate, peak internal knee extension and valgus moments, and knee flexion displacement during the first 50% of stance. Somatosensory function was assessed as the ability to reproduce a specified knee angle (active joint position sense error - JPSE) by calculating the difference between the target and reproduced angles. **Results:** WBV (3.0 ± 0.3° vs. 2.0 ± 0.2°,  $p = 0.010$ ) and LMV (3.1 ± 0.3° vs. 2.2 ± 0.2°,  $p = 0.045$ ) decreased JPSE, but no effect was noted with CON (2.8 ± 0.3° vs. 2.8 ± 0.2°,  $p = 0.927$ ). However, the change in JPSE was not correlated with changes in knee flexion displacement ( $r = -0.169$ ,  $p = 0.175$ ), vGRF ( $r = -0.047$ ,  $p = 0.706$ ), loading rate ( $r = -0.058$ ,  $p = 0.643$ ), or internal knee extension ( $r = -0.194$ ,  $p = 0.120$ ) or valgus ( $r = -0.034$ ,  $p = 0.789$ ) moments. **Conclusions:** Vibration improved somatosensory function, but this enhancement did not influence gait biomechanics. A ceiling effect potentially limited the influence on gait biomechanics as evidenced by the small magnitude and limited variability of JPSE. Additionally, a single exposure to vibration may be insufficient to permit somatosensory enhancement that manifests as improvements in gait biomechanics. Future work is necessary to evaluate the relevance of somatosensory deficits to knee OA risk following ACLR.

**1010** Board #244 May 29 3:30 PM - 5:00 PM  
**Walking Biomechanics Six and Twelve Months Following Anterior Cruciate Ligament Reconstruction Compared to Healthy Controls**

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Vertical ground reaction force (vGRF) during walking is associated with cartilage metabolism, cartilage composition, and patient symptoms in individuals with anterior cruciate ligament reconstruction (ACLR). However, it is unclear how vGRF changes throughout stance between 6- and 12-months following ACLR compared to an uninjured control group.

**Purpose:** Compare vGRF between the uninjured and involved limbs 6- and 12-months following ACLR, as well as to a healthy control limb. **Methods:** vGRF normalized to body weight (BW) was collected at 6- and 12-months following surgery in individuals with ACLR and at one time point in healthy controls. 2 × 2 functional analyses of variance were used to evaluate the effects of limb (involved and uninjured) and time (6- and 12-months) on time-normalized vGRF waveforms in

individuals with ACLR. Pairwise comparison functions were used to compare time-normalized vGRF waveforms in controls and the involved and uninvolved limbs at 6- and 12-months.

**RESULTS:** Thirty individuals with ACLR (50% female, 21.6±3.4 years, body mass index (BMI)=24.2±3.2 kg/m<sup>2</sup>) and 48 controls (67% female, 20.3±1.6 years, BMI=23.1±3.3 kg/m<sup>2</sup>) completed the current study. At 12-months, both the involved and uninvolved limbs demonstrated lesser vGRF (-3% BW) during the first peak (13-28% of stance) and greater vGRF (+2% BW) during mid-stance (46-66% of stance) compared to 6-months. Over time, the involved limb demonstrated lesser vGRF (-2 to -4% BW) at the first (13-28% of stance) and second (77-87% of stance) peaks compared to the uninvolved limb. Healthy controls demonstrated greater vGRF at the first (6-months: +8% BW, 1-32% of stance; 12-months: +10% BW, 1-33% of stance) and second peaks (6-months: +5% BW, 69-91% of stance; 12-months: +4% BW, 72-92% of stance) and lesser vGRF in mid-stance (6-months: -2% BW, 39-54% of stance; 12-months: -3% BW, 38-64% of stance) compared to the involved limb at both 6- and 12-months. **CONCLUSIONS:** Individuals may achieve more symmetrical loading over time by lowering vGRF of the uninvolved limb between 6- and 12-months following ACLR. Future gait retraining programs may seek to achieve optimal loading in both the involved and uninvolved limbs, as well as symmetrical loading between limbs in individuals with an ACLR.

## B-64 Free Communication/Poster - Jumping and Landing

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

### 1011 Board #245 May 29 3:30 PM - 5:00 PM Effects of Arch Type of the Propulsion Mechanics of Jumping and Hopping Tasks

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The structural alignment of the medial longitudinal arch has an influential role in generating the locomotive mechanisms in bipedalism. Evidence suggests healthy arch types exhibit foot function advantageous in forward propulsion. Further, studies indicate that any compositional alterations may result in accessory motion and dysfunction of the foot. However, recent anecdotal assumptions propose that such compromised foot architecture may develop biomechanical characteristics beneficial for propulsive patterns in the medial and lateral directions. The purpose of this study was to examine the influence normal arch (NA) and low (LA) arch types have on propulsive mechanics during directional-specific locomotive tasks. **METHODS:** Twenty-two male collegiate athletes, eleven NA and LA, participated in the study. The Arch Height Index Measurement System was utilized to obtain foot anthropometric measurement for arch height classification. Participants performed three complete trials of lateral hopping (one-leg ski jumping; LJ), unilateral forward hopping (FH), and unilateral stationary hopping (SH), at a self-selected speed. Normalized peak mediolateral ground reaction forces (mGRFs) were collected during the propulsion phase of each task. **RESULTS:** A 2 (arch type) x 3 (jumping/hopping tasks) mixed-factorial ANOVA were performed to determine the effects of arch height on the propulsion phase of each condition. A significant main effect across conditions was observed ( $F(1.258, 25.154) = 11.526, p < 0.001, \eta^2 = 0.366$ ). Follow-up pairwise comparisons indicated that LJ yielded significantly greater lateral force, when compared to FH ( $p = 0.011$ ) and SH ( $p = 0.001$ ). Additionally, a significant difference was observed between arch height ( $F(1, 20) = 4.502, p = 0.047, \eta^2 = 0.184$ ), indicating LA produced larger lateral forces when compared to the NA individuals. However, there was no significant interaction between arch height and the conditions ( $F(1.258, 25.154) = 1.756, p = 0.198$ ). **CONCLUSION:** While the differences amongst conditions were expected, the results revealed that LA displayed larger mGRFs when compared to NA. These findings of this study may suggest that the altered foot positioning of the LA, specifically the everted posture, may act as a beneficial source for directionally specific tasks.

### 1012 Board #246 May 29 3:30 PM - 5:00 PM

#### Effect of Sex on Linear and Nonlinear Kinematic Variability during a Stop Jump

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Women are 4 to 6 times more likely to sustain a non-contact ACL injury compared to men. Sex differences in lower extremity landing mechanics are believed to be associated with this increased risk. However, no previous studies have examined sex-specific differences in the variability of lower extremity mechanics during a landing. Variability may provide unique information regarding movement control which pertains to injury risk. **Purpose:** To compare variability in hip and knee kinematics during a stop jump between men and women. **Methods:** 22 male and 20 female healthy uninjured individuals completed seven bilateral stop jumps while lower extremity kinematics and kinetics were collected. Hip and knee joint 3D kinematics were calculated from initial contact to toe off of the first landing and time normalized using Visual 3D. Linear variability was quantified as the standard deviation of peak knee flexion and peak knee ab/adduction across the seven trials, then as the average standard deviation during ground contact. Joint couples were created between knee flexion and knee abduction, hip flexion and knee abduction, hip rotation and knee abduction, knee flexion and knee flexion velocity, and knee abduction and knee abduction velocity, all isolated to the landing phase. Vector coding variability and divergence of nearest neighboring trajectories was quantified for each couple and divergence was quantified for knee flexion and knee abduction angle time series. All variability outcome measures were compared between sex for the dominant limb only using independent t-tests. **Results:** There were no sex-based differences when looking at any linear variability measures. Women had increased vector coding variability for the knee abduction/knee abduction velocity coupling ( $F: 36^{\circ} \pm 12^{\circ}, M: 29^{\circ} \pm 7^{\circ}, p = 0.025$ ). Women had increased trajectory divergence of knee abduction angles ( $F: 1.3^{\circ}/s \pm 4^{\circ}/s, M: 1.0^{\circ}/s \pm 3^{\circ}/s, p = 0.009$ ) and of the knee abduction/knee abduction velocity coupling ( $F: 1.4^{\circ}/s \pm 4^{\circ}/s, M: 1.1^{\circ}/s \pm 3^{\circ}/s, p = 0.013$ ). No other sex-specific differences were observed. **Conclusion:** Women have increased knee kinematic variability during landing then men, particularly when looking at knee abduction. Linear methods of quantifying variability may be insensitive for identifying sex differences in landing variability.

### 1013 Board #247 May 29 3:30 PM - 5:00 PM

#### The Effect Of Video And Verbal Biofeedback In Landing Mechanics Parameters During Drop Vertical Jump.

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(No relevant relationships reported)

The video and verbal feedback, could offer a quick, simple and effective alternative to training programs for altering high-risk movement patterns during landing tasks such drop vertical jump. **PURPOSE:** To investigate the effect of verbal and video biofeedback on height, power, flight time and contact time during drop vertical jump. **METHODS:** Twenty-two recreationally trained women (22 ± 4 yrs; 72; 72 ± 3.9 kg; 172 ± 2.9) performed the drop vertical jump (DVJ) using a 40 cm box on three different protocols: control set (CS) – three DVJ were performed without any feedback; video feedback (VF) – the participant watched the video of the CS and were instructed to improve the stability or power in the next trials; verbal feedback (VBF) – the researcher provide instructions regarding landing, lower limb alignment and knee stabilization after CS. Three-minute rest were adopted between trials. A randomized order was adopted between protocols. The DVJ was assessed using a OPTOGAIT System. The jump height, relative power, flight time and contact time were measured during DVJ. **RESULTS:** Regarding the DVJ height (CS = 18.6 ± 7.5cm; VF = 20 ± 6.3cm; VBF = 20.1 ± 5.3cm), no main effects for protocols was noted ( $F_{2,26} = 1.647; p = 0.212$ ). Similar results were observed for relative power (CS = 14.9 ± 4.1 w/kg; VF = 15.2 ± 3.2 w/kg; VBF = 15.1 ± 2.7 w/kg;  $F_{2,26} = 0.195; p = 0.824$ ) and flight time (CS = 0.37 ± 0.08 sec; VF = 0.39 ± 0.06 sec; VBF = 0.39 ± 0.05 sec;  $F_{2,26} = 2.776; p = 0.081$ ). However, a significant main effect for protocols was noted for contact time (CS = 0.64 ± 0.11 sec; VF = 0.69 ± 0.08 sec; VBF = 0.72 ± 0.09 sec;  $F_{2,26} = 3.996; p = 0.031$ ). Longer contact time was observed under VF ( $p = 0.033$ ) and VBF ( $p = 0.031$ ) than CS. **CONCLUSION:** Therefore, the increase in contact time noted under VF and VBF protocols would lead to a decrease in the rate of loading experienced by the hip, knee and ankle joints during the initial landing of DVJ, therefore decreasing injury risk.

Table 1 – Drop vertical jump parameters between biofeedback protocols.  
\* Significant difference for control set ( $p < 0.05$ ).

	Control Set	Video	Verbal
Height (cm)	18.6 (7.5)	20 (6.3)	20.1 (5.3)
Power (Watts/kg)	14.9 (4.1)	15.2 (3.2)	15.1 (2.7)
Flight time (sec)	0.37 (0.08)	0.39 (0.06)	0.39 (0.05)
Contact Time (sec)	0.64 (0.11)	0.69 (0.08)*	0.72 (0.09)*

**1014** Board #248 May 29 3:30 PM - 5:00 PM  
**Association Of The Autonomous Nervous System And The Neuromuscular Performance In The Vertical Jump**

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The interactions between neuromuscular and metabolic processes can produce muscular contraction; Thus, the sympathetic nervous system takes special relevance because of its contribution in the autonomic control, which participates in the energetic supply of the muscular fibers and in the neuromuscular performance. This performance can be evaluated by using the vertical jump test, and its relationship with autonomic regulation is determined by the analysis of heart rate variability (HRV).

**PURPOSE:** The aim of this study is to describe correlations between HRV and jump performance variables in young female professional soccer players.

**METHODS:** Thirteen professional female soccer players (Aged: 20.7 +/- 2.6 years; Weight: 60.9 +/- 4.4 Kg) were analyzed, we evaluated HRV to determine autonomic regulation, we also evaluated neuromuscular performance during countermovement (CMJ) and squat jump (SJ) using tri-axial force platform. A statistical analyses was calculated to determine associations between variables of autonomic regulation and jump performance.

**RESULTS:** Positive associations were found between CMJ contraction time and maximal heart rate (HR) during standing position ( $p=0.01$ ,  $r_2=0.4$ ), SJ peak concentric velocity and LF/HF index in immediate postural change ( $P=0$ , 0453,  $r_2=0$ , 2739). Additionally, negative correlations were observed in CMJ concentric force and Stress Index ( $p=0.001$ ,  $r_2=0.42$ ), sympathetic index ( $p=0.001$ ,  $r_2=0.41$ ), average HR ( $P=0.002$   $r_2=0.58$ ) and minimum HR in supine position ( $p=0.005$ ,  $r_2=0.52$ ) and SJ peak concentric velocity and LF/HF index in orthostatic postural change ( $P=0$ , 0453,  $r_2=0$ , 2739).

**CONCLUSIONS:** There is an inverse correlation between concentric contraction force and sympathetic modulation. Likewise, a positive association was found between some parameters related to neuromuscular power and variables of sympathetic activity, evidencing the existence of an influence of sympathetic system in explosive sports. According to this correlation, we suggest the use of HRV parameters that reflect sympathetic activity in the monitoring of training loads.

**1015** Board #249 May 29 3:30 PM - 5:00 PM  
**Screening for Injury Risk in Gymnasts: Examining the Sport Specificity of the Drop Vertical Jump**

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Gymnastics has one of the highest rates of lower extremity (LE) ligamentous injury even among contact sports. Excessive frontal plane motion of the LE during landing from a DVJ is linked to injury at the hip, knee and ankle. In addition, sagittal plane motion plays a key role in absorption of forces upon landing. Frontal and sagittal plane motion of the LE during DVJ tasks are often used to screen injury risk in field sport athletes. However, no gymnastics-specific screening tool exists.

**PURPOSE:** To evaluate the differences in landing biomechanics during the DVJ and a sport specific landing during the roundoff back handspring (ROBHS) among gymnasts.  
**METHODS:**

15 gymnasts (mean age: 17.0 ± 3.1 y, height: 1.58 ± 0.81 m, mass: 55.6 ± 9.3 kg) underwent 3D motion capture during ROBHS and DVJ tasks using a 20-camera motion capture system (240 Hz, Vicon™). A 15-segment model was created for joint calculations in Visual 3D™. Ankle, knee, and hip angles were analyzed at initial contact (IC) and peak knee flexion (PKF) of one trial of the ROBHS and DVJ. Paired samples T-test assessed differences in joint kinematics between the two skills ( $\alpha=0.05$ ). **RESULTS:** At IC, sagittal plane ankle (DVJ -19.33 ± 6.61°, ROBHS 5.04 ± 7.9°,  $p < .001$ ), hip (DVJ 23.43 ± 12.17°, ROBHS 62.91 ± 12.36°,  $p < .001$ ), and frontal plane hip angles (DVJ 4.30 ± 3.74°, ROBHS -2.48 ± 3.23°,  $p < .001$ ) are significantly different between skills. At PKF, sagittal plane knee motion is significantly different between skills (DVJ 75.70 ± 14.43°, ROBHS 93.02 ± 7.61°,  $p < .001$ ). Hip motion between IC and PKF in two planes (sagittal: DVJ 35.08 ± 17.96°, ROBHS -25 ± 5.24°,  $p < .001$  and transverse: DVJ -5.16 ± 5.90°, ROBHS .40 ± 4.60°,  $p = .001$ ) are significantly different between skills. **CONCLUSIONS:** The difference in hip frontal plane results at IC and PKF between skills could be due to the difference in stance width. Additionally, the DVJ jump task encourages an upright posture at IC, rather than the flexed trunk position at IC of the ROBHS. Furthermore, the sagittal plane results at IC suggest that force absorption across joints differs during the two skills. Our results show that the DVJ may not be a sport specific screening tool for gymnastics. Therefore, further investigation is needed with comparison to other tumbling passes to clarify its usefulness in gymnastics.

**1016** Board #250 May 29 3:30 PM - 5:00 PM  
**The Influence Of Concussion History On Landing Biomechanics In Adolescent Athletes: A Pilot Investigation.**

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Sport-related concussion (SRC) is now classified as a major public health concern affecting millions of athletes each year. Recent evidence suggests that previously concussed athletes are at greater risk for lower extremity (LE) injury beyond the resolution of traditional SRC assessment batteries. The current literature has yet to elucidate the biomechanical movement patterns of sport-specific activities that may provide rationale for LE injury risk following SRC.

**PURPOSE:** To examine landing biomechanics in adolescent athletes who report a SRC history.

**METHODS:** Three athletes with a SRC history (age: 11.3 ± 3.5 yrs; previous SRCs: 1.3 ± 0.6) and two athletes without a SRC history (age: 13.0 ± 4.2 yrs) completed drop-landings from 30 cm and 60 cm. Three dimensional kinematic data were measured via a 10-camera motion analysis system at 100 Hz, while kinetic data were collected at 1000 Hz with two adjacent force platforms. The preferred limb to initiate the drop-landing was used for data analysis in comparing landing mechanics between groups. Five landing trials were collected to ensure landing performance stability. The independent variables were group (concussion, control) and landing height (30, 60 cm), while the dependent variables included maximum vertical ground reaction force (vGRF), loading rate, and knee joint kinematic parameters during the landing tasks. **RESULTS:** Athletes with a previous SRC demonstrated a 7.9% increase (4.22 BWs vs 3.89 BWs) in maximum vGRF and 14.7% increase in loading rate (109.2 BWs / sec vs 93.2 BWs / sec) from the 60 cm height compared to control athletes. Additionally, previously concussed athletes demonstrated an 8.8 degrees (-4.9° vs 3.9°) and 11.2 degrees (-8.1° vs 3.1°) increase in knee abduction angle from the 30 cm and 60 cm heights compared to control athletes. Knee sagittal plane range of motion was decreased by 56.2% (52.0° vs 81.2°) from the 30 cm height and 30.3% (62.3° vs 81.1°) from the 60 cm height in athletes with a previous SRC. **CONCLUSIONS:** Preliminary analysis highlights that previously concussed adolescent athletes demonstrate landing mechanics that may increase LE injury risk. Specifically, athletes with a SRC history demonstrate sagittal and frontal plane knee motion during landings that are associated with greater risk of an anterior cruciate ligament injury.

**1017** Board #251 May 29 3:30 PM - 5:00 PM  
**Post-Trial Feedback May Alter Single and Dual Task Landing Performance in Female Collegiate Athletes**

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injuries are common during athletic landing activities especially in females. The use of performance-based feedback may be used to alter landing mechanics. **PURPOSE:** Provide vertical ground reaction force (vGRF), loading asymmetry (LA), and qualitative frontal-plane video (FPV) as post-trial feedback of each landing task using a low-cost custom portable system to evaluate

and train female collegiate athletes during single- and dual-task landing performances. **METHODS:** 65 female collegiate athletes participated. Trials were either single-task (ST) drop landings or dual-task (DT with/without jumping for a suspended ball). These were performed from a 50 cm drop height in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-trial visual feedback (peak vGRF in bodyweight (BW), LA, and FPV), and 3 ST and 6 DT post-tests. Peak vGRF and frontal plane knee-to-ankle ratio between landing task (ST or DT) and over time (pre-test, feedback, post-test) were compared using a two-way repeated measures ANOVA. **RESULTS:** There was a decrease in the peak vGRF ( $4.29 \pm 0.93$  vs.  $3.55 \pm 0.57$  vs.  $3.44 \pm 0.66$  BW,  $p < 0.001$ ) as well as an improvement in knee-to-ankle ratio ( $0.97 \pm 0.15$  vs.  $1.01 \pm 0.12$  vs.  $1.04 \pm 0.13$ ,  $p < 0.001$ ) over the time course of the blocked trials. A main effect showed ST to have lower peak vGRF than DT ( $3.71 \pm 0.82$  vs.  $3.81 \pm 0.83$  BW,  $p = 0.002$ ), with the greatest difference in the post-test ( $3.35 \pm 0.57$  vs.  $3.53 \pm 0.73$  BW,  $p = 0.001$ ). **CONCLUSION:** Peak vGRF was different between ST and DT landing but improved with immediate post-trial feedback. Knee-to-ankle ratio was not different between ST and DT landing but improved with post-trial feedback. Post-trial feedback appears to produce immediate short term changes in landing performance in female collegiate athletes within a single training session.

**1018** Board #252 May 29 3:30 PM - 5:00 PM  
**Cognition Matters: Brain Function May Explain Deficiencies In Unanticipated Single-leg Landing Quality**

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It has been speculated that cognitive performance may play a role in injury risk during sports-related movements such as jump landings. However, there is a paucity of research concerning this hypothesis. **PURPOSE:** The present study aimed to elucidate the potential association between brain function and biomechanical stability as well as decision-making success in an unanticipated jump-landing task. **METHODS:** Twenty healthy male participants ( $27 \pm 4$  years) performed 70 counter-movement jumps with single-leg landings ( $n = 35$  anticipated/ unanticipated each) on a pressure plate. In the anticipated condition, the required landing leg was indicated already before take-off. For the unanticipated jumps, this information was presented only during the flight phase. Biomechanical landing quality was estimated from vertical peak ground reaction force (pGRF), time to stabilization (TTS), center of pressure path way (COP), and standing errors (i.e. falls, touching the ground with the free leg). Decision-making accuracy was assessed as the amount of landing errors (wrong/both feet). Differences between conditions as well as their associations with several measures of cognitive function were analyzed controlling for relevant covariates. **RESULTS:** Unanticipated landings resulted in higher COP values ( $588$  vs.  $516$  mm,  $p < .001$ ,  $d = .65$ ) and more standing errors ( $n = 2.1$  vs.  $0.3$ ,  $p < .001$ ;  $d = 1.1$ ) than anticipated trials. While the biomechanical deficit was not related to cognitive function ( $p > .05$ ), there was an unexpected correlation between the increase in standing errors and higher cognitive flexibility ( $r = -.481$ ,  $p = .037$ ) as well as better working memory capacity ( $r = .502$ ,  $p = .028$ ). An opposite pattern was found for the landing errors occurring in the unanticipated condition: poor decision-making was associated with deficits in cognitive flexibility ( $r = .609$ ;  $p < .001$ ) and working memory ( $r = -.500$ ;  $p < .05$ ). **CONCLUSIONS:** Cognitive function may be an important but understudied moderator of unanticipated jump landing safety. Further research should be dedicated to the development of specific training methods aiming to improve movement-related decision-making under time constraints.

**1019** Board #253 May 29 3:30 PM - 5:00 PM  
**Risk Factors Associated With Medial Tibial Stress Syndrome In Military Cadets During Basic Training**

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Medial Tibial Stress Syndrome (MTSS) is one of the most frequent pathologies in military personnel. As the muscles of the lower extremity contribute to the attenuation of impact forces in activities such as running and jumping, neuromuscular performance deficiencies and asymmetries may be associated with an increased risk for musculoskeletal injuries. **PURPOSE:** To determine the kinetic risk factors associated with MTSS through the bilateral countermovement jump (CMJ) in army cadets. **METHODS:** Ethical approval was granted by the General José María Córdova Military School of Cadets where the study was conducted. This observational study

was executed in a cohort of 123 cadets (followed for 24 weeks) who entered to the military school in 2017. Anthropometric, demographic data and MTSS history were recorded. Jump height (cm), peak landing force (N\*kg), peak landing force asymmetry (%), concentric mean force (N\*kg), concentric mean force asymmetry (%), eccentric deceleration rate of force development (EDRFD [N/s\*Kg]) and EDRFD asymmetry (%) were evaluated through the bilateral CMJ on a pair of uniaxial force platforms. After the follow-up, the cadets with MTSS were determined through the clinical history. **RESULTS:** The incidence of MTSS was 13% ( $n = 16$ ). In the bivariate analysis, height, EDRFD asymmetry, sex (female;  $RR = 2.84$ ; 95%  $CI = 1.16-6.94$ ), provenance (rural;  $RR = 2.65$ ; 95%  $CI = 1.04-6.72$ ), and MTSS history (yes;  $RR = 5.71$ ; 95%  $CI = 2.23-14.62$ ), were significantly associated with MTSS ( $p \leq 0.05$ ). In the logistic regression, EDRFD asymmetry ( $OR = 1.03$ ; 95%  $CI = 1.00-1.07$ ), sex ( $OR = 4.91$ ; 95%  $CI = 1.38-13.37$ ), and provenance ( $OR = 4.82$ ; 95%  $CI = 1.04-6.72$ ), were significantly associated with MTSS ( $p \leq 0.05$ ). MTSS history was significant for  $p \leq 0.1$  ( $OR = 8.95$ ; 95%  $CI = 0.68-118.73$ ). The predictive model was significantly associated with MTSS ( $p \leq 0.01$ ), had a sensitivity of 31.3% and a specificity of 99.1% (overall prognosis of 90.2%). **CONCLUSIONS:** While we identified important non-modifiable risk factors for MTSS in cadets during basic training, we also found that higher CMJ EDRFD asymmetry was a significant risk factor. This suggests that the bilateral CMJ may be a useful tool for pre-entry screening in and that high EDRFD asymmetry could be a potential target of pre-basic training risk reduction conditioning.

**B-65** Free Communication/Poster - Firefighter Physiology

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

**1020** Board #254 May 29 2:00 PM - 3:30 PM  
**A Comparison Of On- And Off-Duty Physical Activity In Career Firefighters**

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Physical inactivity coupled with increasing obesity levels in firefighters plays a critical role in accumulating cardiovascular events. **PURPOSE:** To examine differences in career firefighters' objectively measured physical activity (PA) levels while on- and off-duty. **METHODS:** Twenty-nine career firefighters (age:  $34.45 \pm 7.15$  yr; BMI:  $28.97 \pm 2.52$  kg · m<sup>-2</sup>) participated in a non-experimental, within-subjects study. Firefighters wore an accelerometer during waking hours of their nine-day tour, which included three, 24-hour on-duty days and six, off-duty days. Accelerometers assessed PA intensity using Freedson (1998) cut-points and step count. Height and weight were also measured to calculate BMI. Dependent t-tests, independent t-tests, and Pearson product-moment correlations were used to analyze the data in SPSS (v24). **RESULTS:** Firefighters (overweight=20; obese=9; normal weight=0) met the ACSM PA guidelines more often while on-duty ( $n = 17$ ) compared to when they were off-duty ( $n = 9$ ). While on-duty, firefighters attained an average of  $35.51 \pm 19.22$  minutes of moderate-to-vigorous physical activity (MVPA) compared to  $27.82 \pm 18.91$  minutes ( $p = 0.055$ ,  $d = 0.40$ ) when off-duty. Firefighters engaged in significantly more light PA during on-duty days ( $351.11 \pm 59.90$  minutes) compared to off-duty days ( $315.83 \pm 86.90$  minutes) ( $p = 0.026$ ;  $d = 0.47$ ). There were significant correlations between on- and off-duty days for sedentary behavior ( $r = -0.53$ ,  $p < 0.001$ ), moderate PA ( $r = 0.37$ ,  $p < 0.05$ ), and MVPA ( $r = 0.41$ ,  $p < 0.05$ ). **CONCLUSION:** As a group, firefighters in this study did not meet ACSM PA guidelines, especially when off-duty, which may place them at greater risk for a cardiac event. Firefighters must rely on their cardiovascular health to perform the physiologically demanding tasks that their job requires. In the future, researchers need to collaborate with fire departments across the country to assess and develop ways to enhance PA levels in firefighters with the goal of improving their overall health and well-being, which ultimately may decrease the risk of cardiac events.

**1021** Board #255 May 29 2:00 PM - 3:30 PM  
**Comparing Physical Fitness in Career vs. Voluntary Firefighters**

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**PURPOSE:** Some firefighting departments are composed of professional firefighters (career firefighters) while some smaller towns cannot fully fund a professional firefighting department and rely on their citizens to volunteer their time and put their lives at risk to perform fire suppression and other related firefighting tasks when those events arise. The purpose of this study was to assess the potential similarities and differences in health and physical fitness profile between career firefighters and volunteer firefighters.

**METHODS:** The research protocol consisted of a health and physical fitness assessment testing the 5 components of health-related fitness (body composition, cardiovascular fitness, muscular strength, muscular endurance, and flexibility) using previously published and accepted protocols. The participant population consisted of career firefighters (CFF) who were all members of the Bowling Green Fire Department in Bowling Green, KY and voluntary firefighters (VFF) were all members of the Warren County Fire Department (Warren County, KY). The total sample size consisted of 139 firefighters comprised of 120 CFF and 19 VF.

**RESULTS:** An independent *t*-test showed evidence of CFF having a significantly higher value/score for the following variables: height ( $p = 0.034$ ),  $\dot{V}O_2$  max ( $p = 0.006$ ), push-ups completed ( $p = 0.023$ ), and plank time ( $p < 0.0005$ ). VFF had a significantly higher value for the following variables: fat mass ( $p = 0.002$ ), body fat percentage ( $p < 0.0005$ ), and absolute grip strength ( $p = 0.029$ ). There were not shown to be any significant differences between groups for the following variables: age ( $p = 0.299$ ), body mass ( $p = 0.161$ ), fat-free mass ( $p = 0.292$ ), body mass index ( $p = 0.056$ ), flexibility ( $p = 0.097$ ), or relative grip strength ( $p = 0.934$ ).

**CONCLUSIONS:** In regards to the physical fitness testing of the current sample, the VFF had a significantly worse health and fitness profile across a number of variables compared to the CFF. Despite the financial and commitment status of volunteer firefighting departments, they perform an equally dangerous and important job as firefighters of professional/career firefighting departments and more attention should be directed at developing the fitness and performance of these firefighters as well.

**1022** Board #256 May 29 2:00 PM - 3:30 PM  
**Handgrip Strength Levels in Male and Female Brazilian Military Firefighters**

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Low handgrip muscular strength (HMS) is associated with increased morbi-mortality. HMS has been shown to predict some firefighters' job-related task performance. However, little is known about firefighters HMS descriptive values and there is no specific fitness categories for grip strength for firefighters. **PURPOSE:** To describe HMS in Brazilian military firefighters in association with gender and job experience. **METHODS:** We evaluated 290 firefighters (70% men) with mean age of 28.9±6.4 yrs. HMS was measured using a calibrated handgrip dynamometer (SaehanCorp, Korea). Volunteers performed to maximally maximal contractions with each hand, holding the dynamometer in line with the forearm in the upright position (ACSM 10<sup>th</sup> ed guideline). Final score was the sum of the highest values on each hand and categorized by ACSM guideline. Fair or poor HMS were classified as suboptimal, all other categories (excellent, very good and good) were classified as good strength. Data are presented as median (min-max) values due to nonparametric distribution (Kolmogorov-Smirnov test). Chi-square (of Fisher) test was used to compare

classification. Job experience was classified as rookie (those who have just finished training academy) and as veteran. Mann-Whitney test was used for comparisons. **RESULTS:** Absolute HMS was higher in men as compared to women: 100 (61-156) vs 64 (45-97) kg/f ( $p=0.05$ ). However, the proportion of volunteers in each category was similar among genders ( $p=0.26$ ). Proportions of HMS categories are shown on Table 1. **CONCLUSION:** This cross-sectional study showed that about 25% of volunteers showed suboptimal HMS and that male veterans had higher strength than rookies. Data support the recommendation for upper limbs strength training among firefighters, mainly among those joining the corporation.

Sex	Strength Classification	Rookie	Veteran	p value*
Male	Good	101 (63.1%)	35 (83.3%)	0.01
	Suboptimal	59 (36.9%)	7 (16.7%)	
Female	Good	58 (73.4%)	7 (77.8%)	1.00
	Suboptimal	21 (26.6%)	2 (22.2%)	

\*: Chi-square or Fisher test

**1023** Board #257 May 29 2:00 PM - 3:30 PM  
**Total Energy Intake and Self-selected Macronutrient Distribution During Wildland Fire Suppression**

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Wildland firefighters (WLFF) are required to work long hours in extreme environments resulting in high daily rates of total energy expenditure (TEE) (Ruby, 2002; Cuddy, 2015). Increasing the number of eating episodes throughout the workshift and/or providing rations that better promote convenient nutrient delivery (Cuddy, 2007; Montain, 2008) has been shown to augment self-selected work output on the fireline. Regular consumption of supplemental carbohydrate (CHO) has also demonstrated enhanced work output, particularly during the shifts' latter hours (Cuddy, 2007). However, it remains unclear how current feeding strategies of WLFF compare to more frequent nutrient delivery. **PURPOSE:** The aim of the current study was to determine the self-selected field total energy intake (TEI), composition and patterns of WLFF feeding during wildland fire suppression shifts. **METHODS:** 86 WLFF (16 female, 70 male; 27.5±6.4 yrs) were deployed to 12 different wildland fire assignments across six regions of the US during the 2018 fire season. Pre- and post-shift food inventories were collected at WLFF basecamp and provided item-specific nutrient content (calories [kcal], CHO, fat, protein). Workshift nutrient consumption (TEI, feeding frequency [total number of and interval between feeding episodes], feeding episodic composition) was monitored in real-time by field researchers on the fireline via observational data capture in mobile tablets. **RESULTS:** Workshift length averaged 14.0±1.2 hr, with a TEI of 1523±639 kcal (51±10, 37±9, 14±5 % for CHO, fat, and protein, respectively). The total number of eating episodes was 4.3±1.7 with an average interval of 117±76 min. Eating episodes averaged 346±311 kcal and included 44±38 g CHO. Using similar intake metrics, TEI was 893±353 and 1356±560 kcal for breakfast and dinner, respectively. **CONCLUSION:** The present workshift TEI approximates 34% of the TEE compared to our prior doubly labeled water studies (Ruby, 2002; Cuddy 2015). These data also demonstrate that WLFF consumption patterns using current rations may not deliver adequate nutrients for the occupational demands of WLFF. Future work should elucidate the impact of workshift provisions on overall patterns of self-selected work output.

Supported by National Technology & Development Program, USDA Forest Service

**1024** Board #258 May 29 2:00 PM - 3:30 PM  
**Longitudinal Changes in Single-Leg Dynamic Balance Asymmetries Among Firefighter Recruits: An Observational Cohort Study**

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Previous research has demonstrated a link between asymmetries in single-leg dynamic balance ability and musculoskeletal injury (MSKI) risk. Specifically, previous research has indicated that a right vs. left asymmetry of ≥ 4 cm on the anterior reach direction of the star excursion balance test (SEBT<sub>ANT</sub>) is associated with a greater risk of MSKI.

Previous research also suggests that the overall dynamic balance ability of firefighter recruits increases as they progress through their firefighter recruit training academy, but then decreases during the transition into active-duty service. However, longitudinal changes in single-leg dynamic balance asymmetries during and after firefighter recruit training academies have yet to be examined. **PURPOSE:** To describe longitudinal changes in single-leg dynamic balance asymmetries among firefighter recruits. **METHODS:** 27 male firefighter recruits (mean  $\pm$  SD, age = 29.9  $\pm$  4.1 yrs; height = 179.8  $\pm$  4.6 cm; body mass = 87.2  $\pm$  9.7 kg) enrolled in the same training academy volunteered to participate in the current study. The SEBT<sub>ANT</sub> was conducted bilaterally at the beginning (W1) and end (W14) of their firefighter training academy, as well as at the end of the probationary period of their active-duty service (W38). All SEBT<sub>ANT</sub> data were recorded in cm and right vs. left SEBT<sub>ANT</sub> asymmetries were defined as: < 4 cm and  $\geq$  4 cm. A Cochran's Q Test was utilized to examine for changes in the frequency of SEBT<sub>ANT</sub> right vs. left asymmetries across time. An alpha of 0.05 determined statistical significance. **RESULTS:** Although the number of firefighter recruits who demonstrated a right vs. left SEBT<sub>ANT</sub> asymmetry of  $\geq$  4 cm increased from W1 to W14 (7/27 to 9/27), and from W14 to W38 (9/27 to 11/27), there was not a significant ( $Q = 1.333$ ,  $df = 2$ ,  $P = 0.513$ ) change in asymmetry frequency over time (25.9% vs. 33.3% vs. 40.7%). **CONCLUSION:** Despite previous research suggesting that there are significant changes in dynamic balance ability among firefighter recruits as they progress through their firefighter recruit training academy and begin active-duty service, similar significant changes in single-leg dynamic balance asymmetries were not identified. Future research should prospectively examine which factors of dynamic balance ability are most predictive in MSKI risk among this cohort population.

**1025** Board #259 May 29 2:00 PM - 3:30 PM  
**Contributors to Perceived Occupational Fatigue in Career Firefighters**  
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*(No relevant relationships reported)*

Firefighters are susceptible to work-related fatigue due to long and strenuous shiftwork. Work-related fatigue can be linked to the majority of the fatal and non-fatal injuries in the fire service. **PURPOSE:** The purpose of this study was to examine the influence of isometric strength, body mass index, and age on perceived work-related fatigue in career firefighters. **METHODS:** Thirty-two firefighters [29 males, 3 females; age: 33.7 $\pm$ 9.2 years (20-50); stature: 177.2 $\pm$ 7.6 cm (153.0-190.5); mass: 94.5 $\pm$ 20.8 kg (64.0-152.0)] volunteered for this investigation. Participants completed an occupational fatigue questionnaire that measured three dimensions of work-related fatigue: acute fatigue (AF), chronic fatigue (CF), and inter-shift recovery (IR). Participants performed 3-4 leg extension isometric maximal voluntary contractions (MVCs) on a custom-built calibrated load-cell dynamometer with a two minute recovery period in between each contraction. Maximal strength, or isometric peak force, was calculated as the highest 100ms value during the MVC plateau. Local firefighters work three 24-hr shifts on-off over one rotation followed by four days of rest. Maximal strength testing was completed pre-rotation and post-rotation (five days apart). Percent change in maximal strength [% $\Delta$ PF = (Post-Pre)/Pre  $\times$  100] was calculated. Stepwise regression analyses were conducted for each dimension of fatigue. Predictor variables were  $\Delta$ PF, body mass index, and age. An alpha level was set *a priori* at 0.05 for all analyses. **RESULTS:** The stepwise analyses suggest that age alone significantly contributed to AF ( $R^2=0.274$ ,  $P=0.001$ ) and CF ( $R^2=0.280$ ,  $P=0.001$ ). Age and  $\Delta$ PF combined significantly contributed to IR ( $R^2=0.269$ ,  $P=0.004$ ). BMI failed to significantly contribute to any of the stepwise regression models. **CONCLUSION:** These findings suggest that older firefighters experience greater levels of perceived acute and chronic work-related fatigue. Furthermore, older firefighters with greater maximal strength losses experience poorer perceived IR. While age is non-modifiable, interventions aiming to mitigate strength loss across shiftwork may be helpful at enhancing IR. Supported by the National Institute of Occupational Safety and Health (T42OH008673)

**1026** Board #260 May 29 2:00 PM - 3:30 PM  
**Sedentary Behavior and Daily Steps Count In Brazilian Wildland Military Firefighters - Brasília Firefighters Study**  
 Daniel R F Saint-Martin, Leonardo Segedi, Edgard M K Von Koenig Soares, Rosenkranz Maciel Nogueira, Guilherme Eckhardt Molina, Luiz Guilherme Grossi Porto. *University of Brasília and GEAFS, Brasilia, Brazil.*  
*(No relevant relationships reported)*

Wildland firefighters' (WF) routine involves long displacements and intense physical demands, interspersed with sedentary behavior (SB). Little is known about SB and daily steps pattern of WF during routine work. **PURPOSE:** We analyzed the SB and total daily steps of Brazilian WF during a 24-hour shift-work. **METHODS:** We evaluated 22 WF, aged 35.9 $\pm$ 6.4 yrs, BMI of 25.3 $\pm$ 2.9 kg/m<sup>2</sup>, during the dry season.

Volunteers wore an accelerometer (ActiGraph-GT3X+) during a 24h shift work and reported main duties performed on a log. SB was evaluated by the vector magnitude using <200 counts/min as cut-off point. We compared SB and daily steps according to 3 periods of the day: morning (08:00-11:59 plus 06:00-07:59 of the following day); afternoon (12:00-17:59) and evening (18:00-23:59). Night period (00:00 to 05:59) was excluded due to insufficient data. We compared SB and daily steps during the day and between those who participated or not in at least one episode of wildland fire suppression (Mann-Whitney text). Friedman text with a Wilcoxon post-hoc test ( $p$ -value  $\leq$  0,02) were used to compare the 3 moments. Data are shown as median (min-max). **RESULTS:** WF spent 73 (15-142) min in the morning, 131 (17-192) min in the afternoon and 109 (13-193) min in the evening on SB. They accumulated 3,508 (1,322-12,237) steps in the morning, 4,105 (963-18,450) in the afternoon and 5,499 (571-13,883) in the evening. Those who participated or not in at least one episode of wildland fire suppression showed similar SB and daily steps ( $p>0,05$ ). SB pattern throughout the day are show on Figure 1. **CONCLUSION:** WF achieved similar daily steps in the 3 periods of the day. Time spent in SB was higher in the evening as compared to the morning. Our results suggest that WF remain little time in SB as compared to other professions and achieved a high daily steps count (>10,000) during a 24-h routine work.

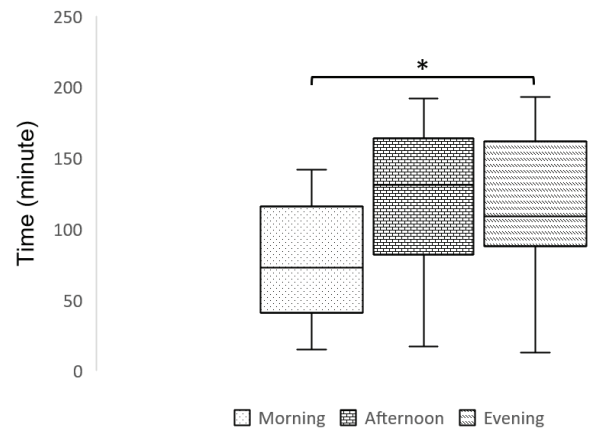


Figure 1. Sedentary behavior by different moment on day among on-duty firefighters Friedman text ( $p = 0.03$ ); \*Wilcoxon text ( $p = 0.01$ )

1027 Board #261 May 29 2:00 PM - 3:30 PM

**Firefighters' Quality of Life is Positively Associated With Cardiorespiratory Fitness Both on Men and Women**

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Firefighting is a hazardous profession. Occupational hazard may negatively impact quality of life (QoL). Firefighters' job-related activities result in vigorous physical effort that requires considerable cardiorespiratory fitness (CRF). The National Fire Protection Association (NFPA) recommends a CRF  $\geq$  42 ml·kg<sup>-1</sup>·min<sup>-1</sup> (12METs) for safety purposes. **PURPOSE:** We evaluated QoL of male and female firefighters in association with CRF. **METHODS:** We evaluated 104 female (35.0±6.2 yrs, BMI: 23.2±2.5 kg/m<sup>2</sup>) and 686 male (37.9±6.8 yrs, BMI: 26.3±3.0 kg/m<sup>2</sup>) Brazilian firefighters. CRF was estimated by the 12-min Cooper test and QoL was evaluated by the World Health Organization QoL questionnaire in four domains: physical (PHYD), psychological (PSYD), social relationship (SRD) and environment (ENV D). QoL was compared within each gender among those who met or did not meet the minimum CRF recommendation for firefighters. Among men we used the NFPA CRF cut-off point (12 METs) and for women we used its corresponding value from the Cooper test gender-specific classification (9.5 METs). Comparison were made by Mann-Whitney test; GLM was applied for age-adjustment and Spearman test for correlations. **RESULTS:** Absolute CRF among men was higher than among women: 12.2±1.7 vs 10.1±1.7 METs ( $p<0.001$ ), but the proportion of volunteers who met the recommended CRF was similar between genders. QoL was similar between genders in all domains ( $p\geq 0.21$ ). QoL comparisons by gender are shown on Table 1. QoL showed low significant correlation with CRF among women ( $0.2 < r_s < 0.26$ ) and men ( $0.16 < r_s < 0.28$ ) ( $p<0.04$ ). **CONCLUSION:** Among both men and women firefighters, better QoL was significantly associated with higher CRF. Firefighters with CRF above the minimum recommended gender-specific threshold showed higher values of QoL. Our results support the recommendation for regular physical training among firefighters both for safety and QoL reasons.

	Women	Women	Men	Men
	<9.5 METs	$\geq$ 9.5 METs	<12 METs	$\geq$ 12 METs
	n = 34 (32.7%)	n = 70 (67.3%)	n = 289 (42.1%)	n = 397 (57.9%)
PHYD	67.9 (28.6–96.4)	78.6 (50.0–100)*	71.4 (17.9–100)	78.6 (21.4–100)*
PSYD	70.8 (29.2–100)	75.0 (50.0–95.0)*	70.8 (20.8–100)	75.0 (16.7–100)*
RSD	64.0 (37.5–87.5)	75.0 (33.3–100)	75.0 (25.0–100)	75.0 (16.7–100)*
ENV D	68.8 (53.1–90.6)	75.0 (16.7–100)*	62.5 (25.0–100)	68.8 (15.6–100)*

\* $p<0.05$ -Mann-Whitney test, age adjusted by GLM

1028 Board #262 May 29 2:00 PM - 3:30 PM

**Comparing the Subjective and Objective Responses to Submaximal and Maximal Tasks in Firefighter Recruits**

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(No relevant relationships reported)

Previous literature has established that numeric ratings of perceived exertion (RPE<sub>NUM</sub>) are associated with heart rate (HR) during a task. Recently, the use of a 100mm visual analog scale (RPE<sub>VAS</sub>) has been used as an alternative to RPE<sub>NUM</sub>. Prior FF research has not concurrently examined RPE<sub>NUM</sub>, RPE<sub>VAS</sub>, and HR during tests of varying intensity. If RPE<sub>NUM</sub> and RPE<sub>VAS</sub> are not different from an objective measure such as HR during tasks of varying intensity, then RPE may represent a low cost method to determine the level of exertion following a FF task. **PURPOSE:** To determine the influence of test (submaximal and maximal) on RPE<sub>NUM</sub>, RPE<sub>VAS</sub>, and HR. **METHODS:** Seventeen FF recruit volunteers (20.63 ± 0.5yrs, 178.0 ± 8.2cm, 84.89 ± 14.82kg) from an urban fire department completed a submaximal Step-Test (SUB) and maximal Tower Climb Test (MAX). RPE<sub>NUM</sub> and RPE<sub>VAS</sub> were collected following each test and expressed as a percent of maximal possible response. HR was the average HR from each test and expressed as a percent of estimated maximum. A 2x3 repeated measures ANOVA was performed to determine the effect of test (SUB, MAX) on response (RPE<sub>NUM</sub>, RPE<sub>VAS</sub>, HR). An alpha of  $p<0.05$  determined statistical significance with an adjusted alpha of  $p<0.017$  for follow-up tests. **RESULTS:** The 2x3 ANOVA indicated a significant interaction between test type and response ( $F(1.463,64)=41.626, p<0.001$ ). Follow-up paired *t*-tests revealed that for each response, SUB was significantly ( $p<0.001$ ) lower than MAX. There were non-significant differences between RPE type for the SUB (RPE<sub>NUM</sub> [28.2 ± 6.3%] vs. RPE<sub>VAS</sub> [26.9 ± 11.1%];  $p=0.489$ ) and MAX (RPE<sub>NUM</sub> [76.8 ± 17.6%] vs. RPE<sub>VAS</sub> [76.7 ± 15.2%];  $p=0.949$ ) tests. For the SUB test, HR (69.9 ± 5.3%), was significantly ( $p<0.001$ ) higher than both RPE types, whereas for the MAX test HR (86.0 ± 4.7%) was not different from RPE<sub>NUM</sub> ( $p=0.059$ ) or RPE<sub>VAS</sub> ( $p=0.036$ ). **CONCLUSIONS:** The absence of a difference between RPE and HR during MAX suggests that RPE may be a suitable alternative to heart rate monitors to monitor intensity in FF recruits during maximal tasks. The significant differences between RPE<sub>NUM</sub> and RPE<sub>VAS</sub> and HR during SUB suggests that FF recruits may underestimate the intensity of a SUB task. Practitioners should use caution when relying solely on subjective feedback from SUB tasks as RPE may underestimate actual intensity.

1029 Board #263 May 29 2:00 PM - 3:30 PM

**Effect Of Uncompensable Heat From The Wlff Helmet**

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(No relevant relationships reported)

Despite upwards of 40-50% of heat lost through the head during exercise, little regard has been given to the role of the wildland firefighter (WLFF) helmet in uncompensable heat stress. **PURPOSE:** To investigate factors of heat stress with and without a standard issue WLFF helmet. **METHODS:** Eleven male subjects (age = 25.2±4.9 yrs) were recruited with a  $\dot{V}O_{2max} >40$  ml·kg<sup>-1</sup>·min<sup>-1</sup> and  $\leq 65$  ml·kg<sup>-1</sup>·min<sup>-1</sup> ( $\dot{V}O_{2max} = 54.2\pm 5.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>). Subjects were required to finish a 90-minute exercise protocol in a heat chamber (35°C and 30% RH), with a standard WLFF para-aramid shirt and pants, cotton t-shirt, and either with or without a WLFF helmet. A randomized crossover design was implemented, with a minimum two week washout period. Skin blood flow to the head and neck (SBFh; SBFn), head heat (HH), T<sub>sk</sub>, skin temperature on chest and neck (T<sub>skc</sub>; T<sub>skn</sub>), HR, PSI, RPE, perceived head heat (PHH) and sweat rate were recorded during trials. A 2x3 ANOVA was used to analyze SBF, and 2x4 ANOVA was used to analyze HH, CT, ST, HR, PSI, RPE, and PHH. One-way ANOVA was used to analyze sweat rate. **RESULTS:** Nine of the 11 subjects were able to finish the 90 minute exercise trial. The HH, SBFh, and PHH (36.41±0.76°C w/helmet v. 35.22±0.98°C w/out helmet; 211.9±86.8 AU w/helmet v. 185.5±73.3 w/out helmet; 10.1±3.2 AU w/helmet v. 8.5±2.6 w/out helmet; respectively) were all significant ( $p<0.05$ ) with a main effect between trials. HR, PSI, T<sub>sk</sub>, and T<sub>skc</sub> demonstrated main effects of time ( $p<0.05$ ), but were not different between trials. Sweat rate was not significant among trials (2.09±0.44 L·h<sup>-1</sup> w/helmet vs. 1.85±0.44 L·h<sup>-1</sup> w/out helmet). **CONCLUSION:** These data (HH, SBFh, and PHH) suggest that the current WLFF helmet causes heat accumulation and resultant redirection of blood flow to the head. While some physiological factors (T<sub>skc</sub>, HR, T<sub>skn</sub>, PSI, and sweat rate) did not reach significance between trials; trends existed for PSI ( $p=0.09$ ) and RPE ( $p=0.09$ ). The design of the WLFF helmet lacks ventilation, which from these data, may result in metabolic alterations, and perceived discomfort.  
Funded by the USFS (14-CR-11138200-009)

**1030** Board #264 May 29 2:00 PM - 3:30 PM  
**Th Effects Exercise Within Personal Protective Equipment Microclimate On Mental Processing On Different Age Populations**

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*(No relevant relationships reported)*

**PURPOSE:** The purpose of this study was to determine the effects of exercise within personal protective equipment microclimate leading to rapid head acquisition on mental processing and decision making in different age populations. **METHODS:** The study was factorial in design and included 15 male participants with an age range from 19-54 who were divided into 2 groups: 30 years old and above group (+30) (n=8), and 29 years old and below group (-29) (n=7). Each group performed a Go/No-Go test while wearing a Muse headband to obtain P300 ERPs, prior to and post exercise in firefighting turnout gear (PPE) and t-shirts and shorts while wearing a backpack matched in mass to the gear worn in PPE (CON). Subjects completed a graded exercise test until core temperature had rose 39.5 °C, or voluntary max had been achieved. The muse data was collected/analyzed by Peer-Analytics and later tested within Excel by a 2 tailed T-test between: 30+ and -29, and CON and PPE conditions. **RESULTS:** There was no significant differences between the 30+ and -29 P300 ERPs or within each groups CON/PPE conditions. However, both groups made significantly more errors ( $p < 0.05$ ) post-PPE than pre-PPE (+30:  $\mu_{\text{post}} = 18.375$ ,  $\mu_{\text{pre}} = 5.625$  -29:  $\mu_{\text{post}} = 25.143$ ,  $\mu_{\text{pre}} = 10.714$ ) while only the 30+ showed significant difference between post CON/PPE trails ( $\mu_{\text{PPE}} = 18.375$ ,  $\mu_{\text{CON}} = 12.5$ ). There was no difference between -23 and +30 when comparing post-PPE errors. **CONCLUSION:** Exercising within a personal protective equipment microclimate will negatively affect executive function of decision making regardless of age.

**B-66** Free Communication/Poster - Military Physiology

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

**1031** Board #265 May 29 2:00 PM - 3:30 PM  
**Commercial Footwear with Lateral Torsional Stiffness that May Reduce Injury Risk in Army Basic Trainees**

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*(No relevant relationships reported)*

Musculoskeletal injuries place a burden on the U.S. Military with estimates that 25% of men and 50% of women experience an injury in Army Basic Training. In 2016, 18% of Cadet basic trainees at the U.S. Military Academy (USMA) sustained a lower-extremity (LE) injury. In that sample, Cadets wearing shoes with mild to moderate lateral torsional stiffness (1.30 - 2.29 Newton [N] meters[m]) were 49% less likely to incur any type of LE injury and 52% less likely to incur an overuse LE injury than Cadets wearing shoes with minimal (<.0130 Nm) or extreme (>.0230 Nm) lateral torsional stiffness. **PURPOSE:** To identify athletic footwear, commercially available at West Point, NY, with mild to moderate lateral torsional stiffness characteristics. **METHODS:** Twenty (10 shoes men's size 10, 10 shoes women's size 8) new shoes of varying brands were included in this analysis. The Shoe Stiffness in Torsion Measurements device and methods of data collection described by Zifchock, were used to quantify lateral torsional stiffness. Each shoe was measured twice by a single rater and averaged for the overall analysis. Rater reliability analyses suggest the SySTM device is useful for repeatable measurements of lateral torsional stiffness. **RESULTS:** Six out of 20 shoes (2 men's, 4 women's) demonstrated mild to moderate lateral torsional stiffness to include; Men's New Balance Minimus MT10GG, and Nike Flex 2017 RN; Women's Sketchers Go Run 3, Asics Gel-Fit Sana 3, Nike Free TR 7 Selfie, and Nike Flex Trainer 7. Fourteen out of 20 shoes (8 men's, 6 women's) did not demonstrate mild to moderate lateral torsional stiffness. Of those 14 shoes, 13 demonstrated extreme lateral torsional stiffness; Men's Nike Lunar Fingertap TR, Nike Retaliation TR, Nike Air Zoom Pegasus 34, Asics FuseX Rush, Asics Gel-Contend 4, Brooks Adrenaline GTS 18, and New Balance Trufuse 860v7; Women's Under Armour Micro G Assort 7; Asics RoadHawk FF, Asics GT 1000-6, Brooks Ghost 10, Adidas Cosmic 2, and New Balance W940GP3. One demonstrated minimal lateral torsional stiffness; Women's Asics Metrolyte Gem. **CONCLUSION:** We identified 6 shoes commercially available at West Point, NY, with mild to moderate lateral torsional stiffness. These shoe recommendations can inform Cadet basic trainees on footwear that may be protective of LE injury during USMA Army Basic Combat Training.

**1032** Board #266 May 29 2:00 PM - 3:30 PM  
**Changes in Body Composition during U.S. Army Basic Combat Training**

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*(No relevant relationships reported)*

The last major investigations of body composition in Basic Combat Training (BCT) were in 1989 and 1993, before training was integrated for men and women. The data demonstrated that, with BCT, most individuals gained lean mass and the fatter individuals lost the greatest amount of fat mass. Current Army accession standards are derived from the changes observed during BCT for this earlier generation of recruits. **PURPOSE:** To assess changes in body composition in current-day Army recruits. **METHODS:** Trainees (n=109 women, W, and 254 men, M), aged 17-38, body mass index 24.0±2.7 kg·m<sup>-2</sup> (W, mean±SD) and 25.0±3.5 kg·m<sup>-2</sup> (M), were assessed for body composition (DXA, Prodigy, GE Lunar) in the first week of BCT and during the final week (wk 8). Repeated measures ANOVA were used to assess changes in body mass (BM), body fat (%BF), and lean mass (LM). **RESULTS:** Average BM at entry was 62.9±8.5 kg (W), 77.7±12.2 kg (M), with changes by wk 8 of 0.3±3.1 kg (W) (p=0.29) and 1.2±4.5 kg (M) (p<0.01). Women started with 31.8%±5.3% BF and lost 3.8%±2.2%; men began with 22.4%±6.2% BF and lost 3.3%±2.9% (p<0.01 for both). Women began BCT with 41.5±5.7 kg LM and gained 2.5±1.7 kg; men began with 58.2±7.0 kg LM and gained 1.7±2.1 kg (p<0.01 for both). **CONCLUSIONS:** Compared to a national sample (NHANES), Army recruits are leaner than the US population, especially female recruits. During BCT, further gain in LM and loss of fat, especially in women, were masked in small or nonsignificant changes in BM. These pilot data provide up-to-date descriptions of the entry body composition of Army recruits and the magnitude of change that occurs with BCT; further analyses of the larger cohort including musculoskeletal injury, fitness testing, and long term service outcomes will help validate and redefine Army entry standards. *The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army.*

**1033** Board #267 May 29 2:00 PM - 3:30 PM  
**Relationship Of Sex And Physical Activity On Vertical Jump Power Changes In U.s. Army Trainees**

Peter N. Frykman, Kathryn M. Taylor, Barry A. Spiering, Marilyn A. Sharp, Brittany R. Hotaling, Julie M. Hughes, Stephen A. Foulis. *USARIEM, Natick, MA.*  
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*(No relevant relationships reported)*

One goal of Basic Combat Training (BCT) is to improve the general fitness of recruits to successfully meet the demands of military activities. Previous studies have focused on the aerobic fitness responses to BCT. In contrast few investigations have examined the changes in whole body power production following BCT and if these changes may be modified by various pre-BCT factors. More specifically, do all recruits show similar training responses in terms of muscular power production as measured by vertical jump (VJ) testing? **PURPOSE:** To determine the relationship of sex and physical activity history on changes in VJ power output following BCT. **METHODS:** Four hundred fourteen recruits (298 men; 116 women; (mean ± SD) age: 21 ± 3 y; height: 172 ± 9 cm; body mass: 73.0 ± 13.4 kg) performed maximal VJ testing before and after 8 weeks of U.S. Army BCT. Body mass and VJ height were used to estimate VJ peak power using the Harman equation. Recruits filled out a survey on their prior physical activity during the 2 months prior to entering BCT. Logistic regression was used to calculate odds ratios showing whether sex or physical activity prior to BCT is predictive of changes in a recruit's VJ power output. **RESULTS:** Females were 2.1 times more likely to show an increase in VJ power than males (p=0.01). Recruits that performed running training 3-4 times per week were 1.8 times more likely to improve their VJ power than recruits that only ran 0-2 times per week (p=0.01). Recruits that had an average running mile time from 7:00-7:59 (min:sec) were 1.6 times more likely to generate more VJ power than those running at a sub 7:00 mile time (p=0.03). **CONCLUSION:** Recruits showed differential changes in VJ performance following BCT, depending on sex, prior running training experience, and average 1-mile running time. **DISCLAIMER:** The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government. Supported by the U.S. Army Medical Research and Materiel Command.



**1034** Board #268 May 29 2:00 PM - 3:30 PM  
**Effects of U.S. Army Basic Combat Training on Vertical Jump Ability in Men and Women**

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(No relevant relationships reported)

U.S. Army basic combat training (BCT) is designed to improve the general fitness of recruits. However, little scientific data exists to describe the effects of BCT on muscular power capabilities. Existing data indicates BCT has little or even a net negative effect on vertical jump (VJ) performance. This finding is concerning given the positive relationship between muscular power capabilities and military occupational task performance. **PURPOSE:** To describe the effects of BCT on VJ performance in men and women. **METHODS:** Four hundred fourteen recruits (298 men; 116 women; mean  $\pm$  SD age: 21  $\pm$  3 y; height: 172  $\pm$  9 cm; mass: 73.0  $\pm$  13.4 kg) performed maximal VJ testing before and after 10 weeks of BCT. Body mass and VJ height were used to estimate VJ peak power using the Harman equation. Comparisons were made using a sex by time repeated-measures ANOVA and Fisher LSD post hoc tests. **RESULTS:** A significant ( $p < 0.05$ ) sex by time interaction existed for body mass, VJ height, and VJ peak power (Table 1). Men decreased body mass and VJ ability, while women maintained body mass and slightly improved VJ ability.

Table 1. Effects of basic combat training (BCT) on body mass, vertical jump (VJ) height, and VJ peak power in men and women

		Pre-BCT	Post-BCT
Body Mass (kg) <sup>†</sup>	Men	77.3 $\pm$ 12.7	75.9 $\pm$ 9.9*
	Women	62.2 $\pm$ 8.0	62.7 $\pm$ 7.2
VJ Height (cm) <sup>†</sup>	Men	51 $\pm$ 9	50 $\pm$ 9*
	Women	35 $\pm$ 7	36 $\pm$ 6*
VJ Peak Power (W) <sup>†</sup>	Men	7761 $\pm$ 652	7643 $\pm$ 618*
	Women	6221 $\pm$ 491	6299 $\pm$ 472*

Values = mean  $\pm$  SD; <sup>†</sup> = significant sex by time interaction; \* = significantly different than corresponding pre-BCT value.

**CONCLUSIONS:** Men and women demonstrated differential responses to BCT; however, the changes were extremely small, indicating that BCT is not an effective stimulus to improve VJ performance.

Supported by the U.S. Army Medical Research and Materiel Command.

Disclaimer: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or as reflecting the views of the Army, the Department of Defense, or the U.S. Government.

**1035** Board #269 May 29 2:00 PM - 3:30 PM  
**Comparison Of Body Composition Components in Civilian and Air Force Men and Women**

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(No relevant relationships reported)

The military continues to evaluate body composition as a consideration for service. However, limited data are available comparing active duty (AD) and civilian (CIV) individuals. **PURPOSE:** To evaluate body composition of fat mass (FM), fat-free mass (FFM) and percent body fat (%fat) in AD and CIV men and women. **METHODS:** AD men (n = 213, 32.1  $\pm$  7.5 yrs, 177.6  $\pm$  6.9 cm, 87.6  $\pm$  12.7 kg) and women (n = 115, 32.2  $\pm$  9.3 yrs, 163.1  $\pm$  8.0 cm, 70.4  $\pm$  11.3 kg) and CIV men (n = 64, 46.1  $\pm$  7.5 yrs, 177.7  $\pm$  7.6 cm, 89.6  $\pm$  15.0 kg) and women (n = 46, 40.0  $\pm$  9.6 yrs, 163.4  $\pm$  6.4 cm, 75.9  $\pm$  15.9 kg) were stratified by exercise level as sedentary (SED), low active (LACT), active (ACT), and Very active (VACT) based on standard parameters. Each participant volunteered to be measured by whole body plethysmography. **RESULTS:** A sex  $\times$  duty  $\times$  activity (2  $\times$  2  $\times$  4) MANOVA produced nonsignificant interaction effects ( $p > 0.32$ ) for %fat, FM, and FFM. Men were significantly lower in %fat (23.5  $\pm$  8.3%) and higher in FFM (66.6  $\pm$  8.3 kg) than women (33.6  $\pm$  8.5% and 47.3  $\pm$  6.0 kg, respectively), with no significant difference in FM (21.6  $\pm$  10.2 vs 25.1  $\pm$  10.2 kg). AD was significantly lower in %fat (26.5  $\pm$  9.3%) and FM (21.8  $\pm$  9.3 kg) and higher in FFM (59.7  $\pm$  11.9 kg) than CIV (31.2  $\pm$  10.4%, 26.0  $\pm$  11.5 kg, and 55.6  $\pm$  12.0 kg, respectively). More active individuals had significantly lower %fat (24.1  $\pm$  9.0%) and FM (19.8  $\pm$  8.9 kg) with no significant difference in FFM (61.2  $\pm$  12.1 kg) than sedentary individuals (33.0  $\pm$  8.2%, 27.7  $\pm$  9.9 kg, and 54.9  $\pm$  10.9 kg, respectively). Age was significantly correlated with %fat ( $r = 0.20$ ) and FM ( $r = 0.18$ ) but accounted

for no more than 4% of the common variable between them. Age was also negatively correlated with activity level in AD ( $r = -0.23$ ,  $p < 0.001$ ) but not in CIV ( $r = -0.03$ ,  $p = 0.78$ ). A greater portion of AD were ACT (51%) or VACT (16%) compared to CIV (30% and 11%, respectively). When sex was partitioned out, body mass index (BMI) had a slightly stronger correlation with %fat and FM in CIV ( $r = 0.78$  and 0.91, respectively) than in AD ( $r = 0.70$  and 0.82, respectively). **CONCLUSION:** Air Force AD personnel have better body composition profiles than CIV personnel but both appear to gain FM and %fat over time based on cross-section analysis. Further research should investigate the ability of other indices to longitudinally track body composition changes in military personnel.

**1036** Board #270 May 29 2:00 PM - 3:30 PM  
**Backpack Hip Strap Use on Oxygen Consumption, Blood Pressure and Muscle Oxygen Saturation While Walking**

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(No relevant relationships reported)

Previous work has shown that energy expenditure increases while carrying a loaded backpack. However, few investigations have focused on the impact of utilizing a hip strap. **PURPOSE:** To determine if using a backpack hip strap (HS) has any physiological effects while walking. **METHODS:** Thirteen subjects (23  $\pm$  4.8 yrs; 5 females, 8 males) walked for 30 mins on a treadmill with a backpack containing 30% of the subject's bodyweight at a 3% grade and speed eliciting 40-50% of their heart rate reserve. Two trials were performed: without a HS (UnST) and with HS (ST). Heart rate (HR), oxygen consumption ( $\dot{V}O_2$ ), systolic blood pressure (SBP), and oxygen saturation of the quadriceps ( $Q\text{ SmO}_2$ ) and calf ( $C\text{ SmO}_2$ ) were measured throughout each trial. Five minute averages were calculated for HR,  $\dot{V}O_2$ ,  $Q\text{ SmO}_2$  and  $C\text{ SmO}_2$  at baseline (BL), mins 0-5, 6-10, 11-15, 16-20, 21-25, and 26-30. SBP was analyzed as a change score from baseline. A repeated measures ANOVA was used to evaluate the differences between trials at each time point. **RESULTS:** HR at mins 0-5 (UnST: 121  $\pm$  4 bpm; ST: 120  $\pm$  3 bpm) was elevated ( $p < 0.001$ ) compared to BL (UnST: 81  $\pm$  4 bpm; ST: 80  $\pm$  4 bpm) and remained elevated from BL for the remainder of the trial. All other HR measures were similar with no difference between trials ( $p = 0.912$ ).  $\dot{V}O_2$  at mins 0-5 (UnST: 1.6  $\pm$  0.1 L/min; ST: 1.5  $\pm$  0.1 L/min) was elevated ( $p < 0.001$ ) compared to BL (UnST: 0.38  $\pm$  0.02 L/min; ST: 0.38  $\pm$  0.03 L/min), but was similar to all other time points with no difference between trials ( $p = 0.317$ ). The change in SBP at mins 0-5 (UnST: 26  $\pm$  8 mmHg; ST: 31  $\pm$  6 mmHg) was similar to all other time points ( $p = 0.115$ ) and did not differ between trials ( $p = 0.224$ ).  $Q\text{ SmO}_2$  at mins 11-15 (UnST: 87  $\pm$  3 %; ST: 84  $\pm$  4 %) was higher compared to BL (UnST: 78  $\pm$  3 %; ST: 79  $\pm$  4 %;  $p = 0.040$ ) and remained elevated for the remainder of the trial with no difference between trials ( $p = 0.515$ ).  $C\text{ SmO}_2$  at mins 0-5 (UnST: 55  $\pm$  6 %; ST: 47  $\pm$  7 %;  $p < 0.001$ ) was lower compared to BL (UnST: 72  $\pm$  4 %; ST: 74  $\pm$  4 %;  $p < 0.001$ ) and remained lower until mins 11-15 (UnST: 69  $\pm$  6 %; ST: 66  $\pm$  6 %;  $p = 0.776$ ). No further changes occurred throughout the rest of the trial ( $p < 0.040$ ).  $C\text{ SmO}_2$  did not differ at any time between the trials ( $p = 0.263$ ). **CONCLUSIONS:** This preliminary data suggests a backpack HS has little physiological effect during 30 minutes of walking with a load of 30% the wearers body weight.

**1037** Board #271 May 29 2:00 PM - 3:30 PM  
**Sex Differences In Energy Balance During Arduous Military Training**

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(No relevant relationships reported)

A negative energy balance has implications for the health and performance of military personnel, with women possibly more susceptible to metabolic perturbations associated with reduced energy availability than men. Women are increasingly employed in more physically arduous military roles, and therefore, there is a requirement to better understand the energy status of women operating in environments of high energy expenditures. **PURPOSE:** To investigate the sex differences in energy balance during 44 weeks (three terms of 14 weeks) of arduous military training. **METHODS:** Twenty Officer Cadets (men: n = 8; mean  $\pm$  SD, age 26  $\pm$  3 y, height 1.84  $\pm$  0.07 m, body mass 85.0  $\pm$  7.7 kg; women: n = 12; age 25  $\pm$  3 y, height 1.70  $\pm$  0.04 m, body mass 65.3  $\pm$  5.6 kg) participated. Dietary intake was measured during each term by researcher-lead weighed food during scheduled mealtimes, and food diaries and wrapper collection during non-scheduled mealtimes, over three 10 d periods (one per term). Total energy

expenditure (TEE) was measured over each 10 d sampling period using doubly labelled water. Body composition was measured by DXA at the start of training and at the end of each term. **RESULTS:** Average daily energy intake ( $3160 \pm 568$  vs  $2609 \pm 568$  kcal·d<sup>-1</sup>) and TEE ( $4552 \pm 534$  vs  $3365 \pm 416$  kcal·d<sup>-1</sup>) were higher for men than women, respectively (both  $P \leq 0.005$ ). Both sexes demonstrated negative average daily energy balance, with a greater deficit in men compared to women ( $-1333 \pm 965$  vs  $-756 \pm 826$  kcal·d<sup>-1</sup>, respectively,  $P = 0.016$ ). There was no difference in average daily carbohydrate ( $4.3 \pm 1.1$  vs  $4.7 \pm 1.5$  g·kg·d<sup>-1</sup>), protein ( $1.7 \pm 0.4$  vs  $1.6 \pm 0.4$  g·kg·d<sup>-1</sup>) or fat intake ( $1.5 \pm 0.4$  vs  $1.7 \pm 0.5$  g·kg·d<sup>-1</sup>) between men and women, respectively ( $P \geq 0.167$ ). Lean and fat mass did not differ in either sex over time (all  $P \geq 0.336$ ). **CONCLUSION:** The observed greater energy deficit in men is predominantly due to the higher TEE, and should be considered when designing feeding strategies. Despite the acute demonstration of negative energy balance in both men and women, there were no differences in lean or fat mass in either sex at our measured timepoints. This finding may reflect an underestimation of energy intake, or the limited frequency of DXA measurements. Future work should explore how dietary intake may be optimised to achieve energy balance in arduous military training environments.

**1038** Board #272 May 29 2:00 PM - 3:30 PM  
**Physical Fitness Decrements In The Postpartum Us Army Servicewoman**

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(No relevant relationships reported)

United States military service members are required to maintain a requisite level of physical fitness. Women in the US Army are exempt from fitness standards for the first 6 months postpartum. While many women successfully meet the minimum standards 6 months postpartum, the time course necessary to re-attain pre-pregnancy fitness levels is unknown. **Purpose:** To determine the time course necessary to re-attain pre-pregnancy physical fitness, as determined via the Army Physical Fitness Test (APFT), in a cohort of postpartum US Army women. **Methods:** 236 primigravid active duty Army women who delivered at Tripler Army Medical Center between 1 Jan 2011 and 31 March 2017 were eligible for inclusion. APFT data (push-up and sit-up repetitions, 2 mile run time) were obtained from the Digital Training Management System; the last test prior to and all available tests postpartum were used for analysis. Data were analyzed with repeated measures ANOVA and Fisher's exact test. **Results:** The number of postpartum APFTs available for analysis ranged from 1 to 6 per individual. Follow-up time ranged from 4.5 to 72 months postpartum. During the last pre-pregnancy APFT push-up, sit-up and 2 mile run scores were  $39.2 \pm 11.6$  reps,  $68.2 \pm 11.5$  reps and  $17.1 \pm 1.8$  min, respectively. 6 months post-partum, push-up and sit-up scores were lower and run time was significantly longer ( $34.1 \pm 11.1$ ,  $61.5 \pm 12.5$  and  $18.0 \pm 1.8$ , respectively;  $p < 0.01$  for all). While scores gradually progressed towards pre-pregnancy levels, pre-pregnancy fitness was not re-attained during the study period. By 30 months postpartum push-up reps, sit-up reps and run times were  $36.7 \pm 12.4$ ,  $66.6 \pm 12.8$  and  $17.7 \pm 1.7$ , respectively,  $p < 0.01$  vs pre-pregnancy for all. The failure rate for the APFT was 3.8% pre-pregnancy, 14.2% at the first postpartum APFT and ranged from 7.7-9.9% for all time points thereafter. **Conclusions:** These data indicate that the postpartum US Army servicewoman fails to return to pre-pregnancy fitness levels, when followed for up to 72 months. While a majority of the women meet minimum fitness standards, ~8-10% did not. The causal factors underlying these results are unknown. However, as ~25% of women had higher scores at the first postpartum APFT vs pre-pregnancy, it is possible to re-attain pre-pregnancy fitness levels.

**1039** Board #273 May 29 2:00 PM - 3:30 PM  
**Equation to Estimate Total Energy Expenditure in Military Populations Using a Wrist-Worn Physical Activity Monitor**

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**PURPOSE:** The gold-standard method for measuring free-living Total Energy Expenditure (TEE) is the Doubly Labelled Water (DLW) technique, but it is expensive and can only quantify TEE over 7-10 days. Wrist-worn physical activity monitors (PAM) are cheaper and can be used to estimate TEE over any time periods. Equations have been developed to estimate TEE from wrist-worn PAM in civilian but not in

military populations, where TEE and activity type differ markedly. The aim of this study was to develop an equation to estimate TEE from a wrist-worn PAM in a military population.

**METHODS:** Twenty-six (14 male, 12 female) Officer Cadets (OC, mean  $\pm$  SD: age  $23 \pm 2$  years, height  $1.73 \pm 0.09$  m, body mass  $77.2 \pm 9.4$  kg) wore a PAM (GENEActiv, Cambridge, UK) continuously on the dominant wrist over three 10-day blocks of military training on base and field exercises. Immediately prior to each 10-day block, OCs consumed a bolus of DLW and provided daily urine samples, which were analysed by mass spectrometry to determine TEE<sub>DLW</sub>. The PAM recorded continuously at 50 Hz throughout each 10-day block and the manufacturer's software was used to estimate TEE for each OC using an equation developed in a civilian population (TEE<sub>CIV</sub>). Each OC in each 10-day block was treated as a separate 'observation' (n=53). A random sample of 30 observations were entered into a linear regression to produce a model to estimate TEE for military populations (TEE<sub>MIL</sub>). The TEE<sub>MIL</sub> equation was applied to the remaining 23 observations to quantify the mean bias  $\pm$  95% Limits of Agreement (LoA) between TEE<sub>DLW</sub> and TEE<sub>CIV</sub> or TEE<sub>MIL</sub>. **RESULTS:** The TEE<sub>MIL</sub> equation [TEE<sub>MIL</sub> =  $563.116 + (0.886 \times \text{TEE}_{\text{CIV}})$ ] exhibited a strong correlation ( $r=0.826$ ) and a Standard Error of the Estimate of 475 kcal·day<sup>-1</sup>. Applying the equation reduced mean bias  $\pm$  95% LoA against TEE<sub>DLW</sub> from  $-194 \pm 1055$  kcal·day<sup>-1</sup> for TEE<sub>CIV</sub> to  $0.79 \pm 996$  kcal·day<sup>-1</sup> for TEE<sub>MIL</sub>. **CONCLUSIONS:** The TEEMIL equation developed in this study improves the estimation of TEEDLW from a PAM in military populations compared to an existing TEECIV equation. Future research should explore data processing techniques to identify different physical activity types from wrist-worn PAM in military settings to further improve TEE estimation and validate these equations in different military cohorts.

**1040** Board #274 May 29 2:00 PM - 3:30 PM  
**Differences Between Responders and Non-responders for Endurance Performance During Combined Training in Military Operation**

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Military operations lasting several months may cause negative changes in aerobic fitness of deployed soldiers. Despite the well-known benefits of physical training on soldier readiness, intervention studies focusing on endurance performance during military operations are lacking.

**PURPOSE:** To investigate inter-individual variation in training adaptations of endurance performance during deployment.

**METHODS:** 91 male soldiers (30 $\pm$ 8 yr) volunteered for the baseline tests including assessments of body composition, physical performance (3000-m run, max. isometric leg and arm extension, 1-min push-ups and sit-ups, and standing long jump), as well as a military simulation test (MST). Training was monitored using diaries. After the 19-week follow-up, the available data was divided into two groups based on the change in endurance performance: Responders (n=25) decreased their 3000-m run time while non-responders (n=24) maintained or increased their 3000-m run time.

**RESULTS:** The responders initially had higher fat mass ( $12.8 \pm 3.6$  vs.  $9.6 \pm 5.7$  kg,  $p < 0.001$ ), lower muscle mass ( $38.0 \pm 3.9$  vs.  $40.3 \pm 4.1$  kg,  $p = 0.046$ ), poorer standing long jump ( $227 \pm 16$  vs.  $242 \pm 27$  cm,  $p = 0.016$ ) and MST performance ( $156 \pm 23$  vs.  $143 \pm 24$  s,  $p = 0.028$ ) compared to non-responders. Both groups performed a similar volume of endurance training during the follow-up ( $1.7 \pm 0.8$  vs.  $1.9 \pm 2.8$  times/week,  $p = 0.22$ ). During the operation, the responders maintained their training frequency at the level of pre-deployment ( $\Delta 0.1 \pm 1.1$  vs.  $-1.2 \pm 1.9$  times/week,  $p = 0.012$ ). In addition, they performed lower body strength training with lower average volume load ( $14354 \pm 6076$  vs.  $19489 \pm 6202$  kg/week,  $p = 0.010$ ). However, their fat mass decreased ( $-7.6 \pm 11.7$  vs.  $14.2 \pm 20.4$  %,  $p < 0.001$ ) and MST time improved ( $-13.6 \pm 6.8$  vs.  $-7.5 \pm 6.5$  %,  $p = 0.006$ ) more when compared to the non-responders.

**CONCLUSIONS:** Soldiers who initially demonstrated lower physical fitness and higher fat mass improved their physical performance more than their non-responder counterparts. Positive training responses in non-responders might have been achieved using higher volume and / or intensity of endurance training. In addition, it is obvious that more individualized strength and endurance training should be emphasized during prolonged military operations.

- 1041** Board #275 May 29 2:00 PM - 3:30 PM  
**The Effect of Body Mass on Physical Performance in Naval Special Warfare Operators**  
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 (No relevant relationships reported)

**The Effect of Body Mass on Physical Performance in Naval Special Warfare Operators**

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 US Naval Special Operations Forces have performed some of the US Military's most rigorous missions. The Human Performance Program (HPP) developed a physical performance testing battery to assess and monitor physical performance. Testing bias relative to body mass has been noted in past literature, including military physical fitness tests. **PURPOSE:** This retrospective study looked to determine if there is body mass bias in the HPP performance assessment and if an optimum body mass for each performance test could be determined. **METHODS:** Data from 333 subjects (age: 28.4 ± 5.0 yr; height: 178.4 ± 6.2 cm; mass: 86.0 ± 9.2 kg) were analyzed to compare body mass to performance on the eight performance tests: standing long jump, Pro-Agility test, weighted pull-up, body weight bench press, 1-RM deadlift, 274-m shuttle run, 4.83-km run, and 800-m swim. Linear regression analysis was used to analyze the relationship of body mass to performance; a 2<sup>nd</sup> degree polynomial was utilized to determine best-fit curves for each of the physical performance tests; ANOVA was utilized to examine differences in performance between body mass quartiles. **RESULTS:** Significantly better performance for lighter subjects was found in the Pro-Agility test, weighted pull-up, body weight bench press, 274-m shuttle run, and 4.83-km run. Heavier subjects performed better in the 1-RM deadlift. Second-degree polynomial regression revealed optimum body mass for the Pro-Agility test, 274-m shuttle run, and 4.83-km run to be somewhat heavier than the lowest body mass. **CONCLUSION:** These findings could help professionals better assess and train operators of varying body size.

The views and opinions expressed are the authors' and do not reflect those of Naval Special Warfare Command, the US Navy or the Department of Defense.

- 1042** Board #276 May 29 2:00 PM - 3:30 PM  
**Minimalist Style Military Boot Improves Running Economy Under Load In Trained Males**  
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**PURPOSE:** Minimalist style boots (MIN) may improve running economy for soldiers under load versus the traditional boot type (TRD). However, running economy (RE) under load with MIN has not been examined. **METHODS:** In this study, male participants (n = 14) completed a VO<sub>2</sub> peak test (46.6 ± 7.3 ml/kg/min) under load (16 kg) while wearing their normal athletic shoes. Treadmill speed for RE tests was determined by the slowest pace in which participants completed a full stage with a running gait pattern during the VO<sub>2</sub> peak test. Load was applied using a ~7.5 kg weighted compression garment to simulate body armor and a ruck sack of ~8.5 kg. During the second trial participants completed two, 5-min running treadmill exercise bouts with the same load arrangement while wearing MIN (~500 g) and TRD (~800 g). RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5 with confirmation of steady state (difference in VO<sub>2</sub> < 0.1 L/min between minutes). There was a 10-min rest period between running bouts (counter-balanced crossover design). **RESULTS:** Paired sample t-tests indicated a significant difference (p = 0.003) in RE between MIN (2.95 ± 0.28 L/min) and TRD (3.04 ± 0.30). Thirteen participants had lower RE during MIN producing a small-moderate effect size (Cohen's d = 0.32). RER also increased (p < .001) during TRD (0.99 ± 0.07) versus MIN (0.94 ± 0.06). Overall, leg, and breathing RPE (p < 0.05) were all improved during MIN. **CONCLUSIONS:** When moving at minimal running speed under load, MIN provides notable improvement in RE.

- 1043** Board #277 May 29 2:00 PM - 3:30 PM  
**Effects Of Core Stability Exercise On Subjective Rating Of Low Back Pain In ROTC Cadets**  
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 (No relevant relationships reported)

**PURPOSE:** While previous research has investigated lower extremity injuries and low back pain in Soldiers during basic training, little research has investigated load carriage and low back pain in Reserve Officer Training Corps (ROTC) program participants. Thus the purpose of this study was to investigate the effects of a core stability program on subjective rating of low back pain and overall physical function during load carriage exercise.

**METHODS:** Subjects (age: 19.75 +/- 1.55 years) included cadets enrolled in the ROTC program at the University of Massachusetts (Amherst) (n=10) who were randomly assigned into a core stability or a non-core stability group. All subjects completed a 1.5 hour ruck march with 35lb load at volitional pace once per week over a 3-week period. At baseline and upon completion of the 3-week intervention period, subjects completed a 3-mile timed ruck march. Immediately prior to each 1.5 hour ruck march session, the core stability group performed a series of core stability exercises. Subjective low back pain score (Visual Analog Scale) was obtained immediately after completion of each ruck march session.

**RESULTS:** The core stability group showed a significantly lower average low back pain score (mean score = 1.90) over the course of the intervention period compared to the control group (mean score = 3.00). No significant difference (p = 0.49) was found between pre- and post-intervention 3-mile ruck march completion times between groups.

**CONCLUSIONS:** The core stability program resulted in significant decreases in subjective rating of low back pain associated with load carriage in ROTC participants. Study results suggest that implementing a core stability program in military personnel during basic training or tactical operations involving load carriage may thus provide benefit in preventing low back pain.

- 1044** Board #278 May 29 2:00 PM - 3:30 PM  
**Factors Impacting Soldier-Athletic Performance of U.S. Service Academy Cadets**  
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 (No relevant relationships reported)

Early identification of factors impacting soldier-athletic performance can assist in designing training programs & selection of key personnel. **PURPOSE:** Investigate factors via selected physical assessment tests {(PAT's); Soldier Performance Index (SPI); Cadet Combine (CC)} which identify overall soldier-athletic performance of U.S. Service Academy cadets (USSAC's). **METHODS:** 66 fit subjects (42 men; 24 women) participated in a 19-hour lecture/lab course over a 2-month period which included 2 embedded PAT's examining combat readiness components of strength, endurance, mobility, power/speed. Specific data analysis & criterion determination was used on the 0-368+ point SPI & 0-137.5 point CC. **RESULTS:** Multiple regression analysis indicated push-ups (PU) & 400 meter run; adjusted R<sup>2</sup> = 0.83 for CC, while PU, 500 meter row & reps to failure of 220-lb trap bar dead lift (TBDL); adjusted R<sup>2</sup> = 0.84 for SPI. Correlation between the two PAT's; r = 0.91, adjusted R<sup>2</sup> = 0.83. Criterion cut points (70% of USSAC's best scores; or top 10 performers) for both SPI & CC revealed a stable metric in identifying higher end physical performance cadets. Descriptive data:

Group (n) (±SD)	HT in	BM Lbs	45lb GSq Rep	65lb BP Reps	5- Sec Pull-ups Reps	2MR Secs	300 MF/BSB Secs	155lb BP Reps	APFT Pts	SPI Pts	CC Pts	TBDL/BM Ratio
ALL (66)	68 (3.8)	163 (26.5)	63.7 (27)	51.6 (34.3)	7.4 (4.4)	862.2 (103)	66.9 (7.7)	5.6 (7.1)	276.8 (31.6)	180.2 (57.8)	92.9 (24.2)	1.75 (31)
70% Best >240 SPI (10)	71.3 (3.1)	186.9 (19.8)	82.8 (23)	104.8 (37.9)	11.3 (1.6)	811 (64.6)	62.3 (3.6)	17.6 (6.4)	294.8 (39.8)	261.5 (15.2)	116.9 (5.5)	1.99 (30)
Group (n)	HT/BM in/lb	5-10-5 Secs	SLJ cm	MB Pat cm	5- Sec Pull-ups Reps	Beep levels	500 M Row Secs	220lb TBDL Reps	APFT Pts	SPI Pts	CC Pts	TBDL/BM Ratio
ALL (66)	Same	5.1 (4.1)	217 (36)	621.4 (118)	7.4 (4.4)	8.4 (1.6)	110 (13.4)	9.1 (10.2)	276.8 (31.6)	180.2 (57.8)	92.9 (24.2)	1.75 (31)
70% Best >87 CC (41)	70.6/175 2.6/21	4.89 (27)	232 (24)	691 (90.5)	10.1 (2.3)	9.3 (1.3)	102.4 (7.2)	14.2 (9.9)	279.9 (31.2)	216.5 (33.4)	109.7 (8.9)	1.84 (32)
>240 SPI (10)	Same	4.83 (20)	251 (21)	771 (92)	11.3 (1.6)	9.3 (1.5)	97.2 (9.7)	20.8 (9.7)	294.8 (39.8)	261.5 (15.2)	116.9 (5.5)	1.99 (30)
>116 CC (10)	70.8/174.4	4.81 (16)	246 (22)	747 (55.5)	11.6 (1.4)	9.9 (8.5)	97.0 (3.9)	19.4 (8.7)	302.9 (31.5)	253.4 (22.9)	119.2 (2.96)	2.08 (36)

**DISCUSSION:** Our data indicate that both SPI & CC provide a stable metric in PAT's & the top tier (n=10) are able to provide robust physical ability in the strength, endurance, mobility, power/speed realm. Lower body strength as indicated via reps of 220-lb TBDL & 1-RM TBDL/BM ratio suggests a simple test which is predictive of higher SPI & CC scores respectively. While soldier-athletic performance is key, our robust PAT's were not influenced via BM when separated via gender. **CONCLUSIONS:** For soldier-athletes desiring success on the five combat readiness components, reps of 220-lb TBDL, 400 meter run, 500 meter row, PU and either the SPI or CC are simple, reliable field tests which can assist classify and select personnel for more arduous military applications. An enhanced physical profile should be the goal of any soldier-athlete.

**1045 Board #279 May 29 2:00 PM - 3:30 PM**  
**Sleep Patterns During Arduous Military Training in Men and Women**

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 (No relevant relationships reported)

Sleep is a critically important component of health, but is often restricted in a military environment as a stressor in training and in preparation for operations. Following the recent opening of combat roles to women serving in the UK military, quantifying sleep parameters during arduous training, and understanding how men and women respond to disturbed sleep, is necessary for management of health and performance. Sex differences in sleep quantity and efficiency may manifest in responses to training-related stressors, and it is therefore important to quantify these sleep parameters in a basic military setting. **Purpose:** To quantify sleep duration and efficiency in male and female Officer Cadets over 7 days of arduous basic military training. **Methods:** Twenty-six Officer Cadets (mean ± SD; 9 men; age: 25.3 ± 3.2 y, height: 1.83 ± 0.07 m, weight: 84.7 ± 7.2 kg; and 17 women; age: 24.8 ± 2.5 y, height: 1.71 ± 0.04 m, weight: 66.5 ± 5.9 kg) wore wrist-based tri-axial accelerometers (GeneActiv, UK) continuously for 7 days, during the first term of British Army Officer Training at the Royal Military Academy, Sandhurst, UK. Data were processed using commercially-available software (GeneActiv, UK) to derive: time in bed (min); time asleep (min) and sleep efficiency (%). **Results:** Officer Cadets spent an average of 412 ± 140 min (6h 52 min) in bed, and 329 ± 80 min (5h 29 min) asleep, giving a mean sleep efficiency of 83% ± 14%, over 7 days. Compared with men, women spent longer in bed (433 ± 149 (7h 13 min) vs 370 ± 108 min (6h 10 min), respectively, P≤0.01) and longer asleep (341 ± 83 (5h 41 min) vs 304 ± 67 min (5h 4 min), respectively, P≤0.01). There was no difference in sleep efficiency between the sexes (84 ± 13% vs 82 ± 14%, respectively, P=0.30). **Conclusion:** Officer Cadets slept less than the 7-9 hours per night recommended by The National Sleep Foundation. This may have implications for musculoskeletal and immune health during arduous training. Women slept more than men, however it is unclear whether this is due to physiological or behavioural differences between the sexes. The implications of inadequate sleep, and the mechanisms for the reported sex difference, warrant further examination to optimise performance and reduce injury risk in arduous military basic training.

**1046 Board #280 May 29 2:00 PM - 3:30 PM**  
**Sympathetic Nervous System Response During Close Quarters Combat in Elite Military Men**

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 (No relevant relationships reported)

Combat is physiologically stressful and associated with alterations and declines in several performance domains vital to the success of ground combat element (GCE) operations. Acutely, the body responds to stress via the "fight-or-flight" system, which alters activity of the autonomic nervous system (ANS) and can be monitored via heart rate variability (HRV). Currently, it is not well understood if ANS plays a role in the shooting performance of GCE operators. **PURPOSE:** To determine if HRV is correlated to shooting performance. **METHODS:** Active duty, elite GCE operators (n = 40) were recruited to participate in a 21-day close quarters combat (CQC) training program. Measures of HRV, marksmanship, and tactical/safety violations (errors) were recorded prior to (anticipation), during (execution), and immediately after (recovery) a similar shooting task on Day 1 and Day 21 of training. **RESULTS:** Heart rate was significantly less at every time point on Day 21 when compared to Day 1 (anticipation: -8.9%, execution: -11.5%, recovery: -8.6%; p < .05). The mean normalized low frequency power (LFnu)—a measure of sympathetic drive—was not different between days (p > .05), but it was significantly lower during the execution phase in comparison to the anticipation (-11.2%) and recovery phases (-12.0%, p < .05). The mean normalized high frequency power (HFnu)—a measure of parasympathetic modulation—was 14.9% higher in Day 21 compared to Day 1 (p < .05). In addition, the HFnu was 17.7% lower in the recovery compared to the execution phase (p < .05). The mean ratio of LF to HF (LF/HF) power was not different between days (p > .05), but it was significantly higher during recovery (35.4%) when compared to the execution phase (p < .05). Pearson product-moment correlation analysis revealed there was also a positive correlation between the LF/HF power ratio during the anticipation phase and the number of errors committed during execution on Day 1 (r = .635, p < .05). **CONCLUSION:** There is a positive correlation between sympathetic drive, during the anticipation phase of CQC training, and error rate at the onset of CQC training. These data suggest that those with a lower sympathetic tone perform better than those with a higher sympathetic tone.

**1047 Board #281 May 29 2:00 PM - 3:30 PM**  
**Leveraging Machine Learning Techniques to Reveal Relationships between Neuromuscular Traits in Previously Concussed Warfighters**

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Concussions are common in military personnel and may result in an increased risk of musculoskeletal injury. The underlying mechanisms for this increase risk are unknown and warrant additional research. One plausible explanation may be that neuromotor deficiencies may enhance injury risk following concussion through altered muscular activation or contraction timing. **Purpose:** To compare military personnel with at least one concussion during the past 1 month to 2 years (CONCUSSED) to military branch-, age- and Special Forces group- matched controls (CONTROL) on physiological, musculoskeletal and biomechanical performance. **Methods:** A total of 48 (24 CONCUSSED, 24 CONTROL) male Air Force Special Operators and Naval Special Warfare Operators aged 19 to 34 years participated in the study. Participants provided self-reported demographics and injury history and the following assessments: 1) physiological- body composition, anaerobic power and capacity, aerobic capacity and lactate threshold; 2) musculoskeletal- isokinetic strength testing of the lower extremity, including time to peak torque for each muscle group, and balance using the Neurocom system; and 3) biomechanical- single-leg jump and landing task, including landing kinematics of the hip, knee and ankle. A C5.0 decision tree algorithm and one-way ANOVA were used to compare the two groups on the physiological, musculoskeletal, and biomechanical outcomes. **Results:** No differences were demonstrated using one-way ANOVA. The C5.0 algorithm revealed CONCUSSED demonstrated quicker time to peak knee flexion angle during the single-leg landing task (<=0.170 secs; CONCUSSED: n=22 vs. CONTROL: n=14), longer time to peak torque in knee extension isokinetic strength testing (>500 msec; CONCUSSED: n=18 vs. CONTROL: n=4) and larger knee flexion angle at initial contact (>7.7°; CONCUSSED: n=18 vs. CONTROL: n=2). **Conclusion:** The findings supported the hypothesis that CONCUSSED military personnel would demonstrate altered neuromuscular control in landing strategies and muscular activation. Future research should assess prospectively potential neuromuscular changes following concussion and determine if these changes increase the risk of subsequent musculoskeletal injuries and concussion.

**B-67 Free Communication/Poster - Translational/ Occupational Physiology**

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
Room: CC-Hall WA2

**1048 Board #282 May 29 2:00 PM - 3:30 PM Effects Of Exercise And Sanqi Ginseng Interventions On Mtss Of Swat Trainees**

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(No relevant relationships reported)

**PURPOSE:** To investigate the therapy effects of exercise and Sanqi Ginseng, a Chinese herbs, and their combination on medial tibial stress syndrome (MTSS) of the special weapons and tactics (SWAT) trainees.

**METHODS:** 162 SWAT trainees with MTSS were divided randomly into 3 groups: exercise (E), Sanqi ginseng tablets group (S), and their combination (ES). Participants in E-group maintained the original training, including jumping and all of other training movements, for four months while S-group used oral Sanqi ginseng tablets, (1.2 g for each time, 3 times per day to control the pain at a mid-level for 4 months) without training, and finally, ES-group took both exercise and Sanqi tablets at the same time. The MTSS healing rates measured (numerical ratings scale (NRS) = 0 was seemed as healing) were compared 4 months later. The tibia bone mineral density and average lumbar T score, left and right leg muscle mass, subjective pain NRS were tested also before and after the intervention.

**RESULTS:** The healing rates of E, S and ES groups were 63.0, 88.9, 96.3%, respectively; the average NRS in ES (mean =1.04 & SD =0.3) group after the intervention was lower than E (mean =3.5 & SD =0.46,  $p < 0.05$ ,  $\eta_p^2 = 0.899$ ) and S (mean =1.4 & SD = 0.51,  $p < 0.05$ ,  $\eta_p^2 = 0.023$ ), and the lower limb muscle mass was significantly higher than that in the other two groups ( $p < 0.05$ , for SE vs E,  $\eta_p^2 = 0.595$ ; for SE vs S,  $\eta_p^2 = 0.266$ ).

**CONCLUSIONS:** A combination of exercise and Sanqi ginseng could effectively reduce the NRS during training process, resulting in a better healing effect of MTSS.

**1049 Board #283 May 29 2:00 PM - 3:30 PM Cardiovascular Risk Factors of Working Primary School Teachers**

Martina Uvacek, Mate Petrekanits, Lilla Török, Judit Boda-Ujlaky. University of Physical Education, Budapest, Hungary. (Sponsor: Pat Vehrs, FACSM)  
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(No relevant relationships reported)

In Hungary about 77000 people work as teachers in primary school. Generally, stressful work negatively affects health and can increase risk of noncommunicable diseases. Previous research revealed that teachers have better physical health status compared to the general population (Seibt 2011). Health status is often assessed using questionnaires, and as a result, there is a lack of research using objective measures of health in primary school teachers. **PURPOSE:** To collect data about health status, body composition, blood pressure and arterial stiffness in primary school teachers and compare some results to the EHIS study results reported in 2014. The participants involved were over 35 years of age and had more than ten years' experience as school teachers.

**METHODS:** 24 subjects (mean age: 46.8±7.4y.) were recruited from different primary schools using the snowball research method (Kaltun2001). Data collected included body mass index (BMI) and body composition (BF%), information from a health behaviour questionnaire (eating habits, physical activity, smoking) (WHO 2010) and resting arterial stiffness measured via TensioMed arteriography (Illyés 2005). Descriptive statistical analysis and Chi square tests were used with SPSS Statistics program version 22.

**RESULTS:** The mean BMI was 26.9±5.5 and BF% was 26.9±6.5 in teachers, 50% were overweight or obese. According to the questionnaire 62% of the teachers ate breakfast regularly and only 20% were physically active ≥ 2.5h/week, 20% smoked, 22% had elevated blood pressure and 20% had elevated pulse wave velocity or augmentation index (Willum-Hansen et al. 2006). Compared to data from the European Health Interview Survey (EHIS) ([www.ksh.hu/docs/hun/xftp/statukor/elef14.pdf](http://www.ksh.hu/docs/hun/xftp/statukor/elef14.pdf)) teachers in this study were the same active (4.1%vs.4.5%) and were the same overweight and obese (50%vs.54%) as Hungarians in the general population. The prevalence of smoking among teachers was significantly ( $p < 0.05$ ) less (20%) than the general population (29%).

**CONCLUSIONS:** Half of the investigated middle-aged teachers already had some health problems. The health-related concepts and mental health programs for teachers are essential to prevent chronic diseases and psychosomatic disorders.

**1050 Board #284 May 29 2:00 PM - 3:30 PM****Effects of Environmental Condition and Body Fat Percentage on Substrate Utilization during and following Exercise**

Brittany N. Followay<sup>1</sup>, Jeremiah A. Vaughan<sup>2</sup>, Elliott Arroyo<sup>3</sup>, Brandon M. Gibson<sup>3</sup>, Joseph A. Laudato<sup>3</sup>, Ellen L. Glickman, FACSM<sup>3</sup>, Adam R. Jajtner<sup>3</sup>. <sup>1</sup>Ripon College, Ripon, WI. <sup>2</sup>Bemidji State University, Bemidji, MN. <sup>3</sup>Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

(No relevant relationships reported)

**PURPOSE:** To examine the effects of environmental condition and body fat percentage on substrate utilization during and following exercise.

**METHODS:** Recreationally active men consisting of 4 low-fat (LF; 10.9% ± 2.5; 23.8 ± 3.1yrs; 182.6 ± 7.1cm; 80.7 ± 4.5kg; 4.03 ± 0.34L·min<sup>-1</sup>) and 4 high-fat (HF; 15.9% ± 2.2; 23.3 ± 1.9yrs; 180.9 ± 4.3cm; 79.6 ± 5.9kg; 3.63 ± 0.13L·min<sup>-1</sup>) completed six experimental trials: a VO<sub>2</sub>max test and 5 cycling trials in 5°C/20%RH (LT), 22°C/45% RH (MTMH), 22°C/70% RH (MTHH), 35°C/45% RH (HTMH), and 35°C/20% RH (HTLH) in a counterbalanced fashion. During cycling trials, participants completed 60-min of cycling at 60% VO<sub>2</sub>max, a 15-min rest period, cycling at 90% VO<sub>2</sub>max until exhaustion (TTE), and a 60-min recovery (REC). AUCi for absolute carbohydrate (CHO) utilization was calculated during cycling at 60% VO<sub>2</sub>max, TTE, and REC for each condition. Data were analyzed using a mixed-design ANOVA.

**RESULTS:** A condition x BF interaction was observed during cycling at 60% VO<sub>2</sub>max ( $F = 2.907$ ;  $p = 0.048$ ). Specifically, CHO utilization was greater during LT (496.9 ± 83.43kcal;  $p = 0.015$ ) compared to MTHH (416.12 ± 73.91kcal) in LF individuals, with no significant differences between conditions in HF individuals ( $p > 0.05$ ). During the TTE, no condition x BF interaction was observed ( $F = 0.410$ ;  $p = 0.799$ ) however; a main effect of condition was observed ( $F = 3.412$ ;  $p = 0.028$ ). Specifically, CHO utilization was greater during MTMH (73.53 ± 11.96kcal;  $p = 0.020$ ) and MTHH (75.66 ± 16.69kcal;  $p = 0.019$ ) compared to HTMH (29.87 ± 5.55kcal). During REC a condition x BF interaction was observed ( $F = 5.982$ ;  $p = 0.004$ ). Post-hoc analysis indicated a main effect of condition in LF individuals ( $F = 12.371$ ;  $p = 0.016$ ). Specifically, absolute CHO utilization was significantly higher in LT (96.259 ± 4.929kcal) compared to HTLH (5.783 ± 1.583kcal). No main effect of condition was observed in the HF individuals ( $F = 1.402$ ;  $p = 0.292$ ).

**CONCLUSIONS:** Data suggests that individuals with a lower BF% may utilize greater absolute CHO during exposure to cold environments compared to those with higher BF%, during both moderate intensity exercise and resting conditions. Additionally, exposure to moderate compared to hot temperatures may result in prolonged TTE, likely due to a longer TTE.

Study partially funded by the Kent State University Research Council.

**1051 Board #285 May 29 2:00 PM - 3:30 PM****An Examination of Physiological Responses in EMT Students During Occupational and Heat Stress**

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(No relevant relationships reported)

**PURPOSE:** The purpose of the present study is to observe the impact of a hyperthermic environment on physiological responses in EMT students performing a simulated occupational task. **METHODS:** Ten EMT students completed a simulated occupational task in two conditions; thermoneutral environment, or hyperthermic condition (100°F, 60-70% RH). The following primary dependent variables were analyzed; heart rate (HR), mean arterial pressure (MAP), rating of perceived exertion (RPE), oxygen consumption (VO<sub>2</sub>), thermal sensation (TS), mood (TMD), core temperature (T<sub>c</sub>), and mean skin temperature (MST). Following 30 minutes of acclimation participants completed an aerobic bout of exercise followed immediately by an anaerobic bout of exercise. The aerobic exercise consisted of a 10-minute treadmill walk at 70%-80% of their previously determined maximal heart rate. The anaerobic exercise consisted of lifting a 50 lb. sandbag to a metronome over the course of 5 minutes. This process was repeated once, resulting in a total exercise time of 30 minutes. **RESULTS:** A main effect of condition was found for T<sub>c</sub> ( $p = 0.033$ ), further explained by elevated T<sub>c</sub> post-exercise in the hyperthermic condition (38.08±0.38°C) compared to the thermoneutral condition (37.71±0.33°C) ( $p = 0.002$ ). A significant time by condition interaction was seen for TS ( $p = 0.043$ ), further explained by elevated TS scores at every time point with the exception of post-exercise. During exercise, average TS score was 8.35±0.87 in the hyperthermic condition, compared to 6.85±0.78 in the thermoneutral condition ( $p < 0.05$ ). MST also elicited a significant time by condition interaction ( $p = 0.033$ ). MST was elevated at all time points in the hyperthermic condition when compared to the thermoneutral condition. Average MST during exercise was 36.75±0.70°C in the hyperthermic condition, compared to 33.44±0.73°C

in the thermoneutral condition ( $p < 0.001$ ). No difference was observed for TMD between conditions ( $p = 0.354$ ), although a worsening mood following acclimation ( $19.96 \pm 42.00$ ) compared to baseline ( $-77.08 \pm 74.41$ ) was observed. **CONCLUSION:** Future research should emphasize a focus on maintaining a lower core and skin temperature while focusing on enhanced mood under occupational and heat stress in order to improve physiological and motor performance.

**1052** Board #286 May 29 2:00 PM - 3:30 PM  
**Effects Of Nsaid Use On Biomarkers Of Kidney Stress Following A Marathon**

Whitley C. Atkins<sup>1</sup>, Aaron R. Caldwell<sup>1</sup>, Cory L. Butts<sup>2</sup>, Lisa Jansen<sup>1</sup>, Melani R. Kelly<sup>3</sup>, Margaret Gibson<sup>4</sup>, Dawn M. Emerson<sup>3</sup>, Brendon P. McDermott, FACSM<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Weber State University, Ogden, UT. <sup>3</sup>University of Kansas, Lawrence, KS. <sup>4</sup>Truman Medical Center, Kansas City, MO.

(No relevant relationships reported)

The use of nonsteroidal anti-inflammatory drugs (NSAID) is common practice by participants in marathons and other endurance events. Previous research suggests that renal stress is apparent immediately following marathon completion. However, the potential exacerbating effect of NSAID use during a marathon is not well-understood. **PURPOSE:** Investigate the effect of NSAID use on biomarkers of renal stress following a marathon. **METHODS:** Twenty-two volunteer participants (14 males, 8 females;  $38 \pm 10.2$  y,  $70.7 \pm 10.1$  kg,  $171.0 \pm 7.7$  cm) at the Kansas City Marathon were recruited and assigned to either a control ( $n = 15$ ) or NSAID ( $n = 7$ ) group based on planned or habitual use. Pre-race NSAID ingestion was self-reported as  $9.15 \pm 4.62$  mg/kg of ibuprofen ( $n=4$ ) or  $3.75 \pm 1.73$  mg/kg naproxen sodium ( $n=3$ ). Urine samples were collected pre-marathon, post-marathon, and 24-h post-marathon. Samples were stored at  $-80^\circ\text{C}$  and later analyzed for urinary neutrophil gelatinase lipocalin (uNGAL) and urinary cystatin C (uCyC). A robust two-way mixed ANOVA with trimmed means was utilized to account for potential outliers. When significant interaction or main effects were observed, pairwise comparisons were calculated using robust bootstrapped effect sizes with 95% confidence intervals. **RESULTS:** Immediately post-marathon, there was a significant increase in uNGAL (Cohen's  $d_r = 0.47$  95% C.I. [0.23, 0.85]) but there was no longer a significant elevation by 24-h post-marathon (Cohen's  $d_r = 0.16$  95% C.I. [-0.61, 3.36]). There were no significant effects detected for Cystatin C. Further, NSAID ingestion did not affect uCyC or uNGAL values. **CONCLUSION:** Renal stress biomarkers suggest potential kidney tubular injury immediately post-marathon, but potential renal stress was negated by 24-h of recovery. Moderate NSAID ingestion before the marathon did not affect kidney stress biomarkers.

**1053** Board #287 May 29 2:00 PM - 3:30 PM  
**A Novel Assessment of Law Enforcement Officer Response to a Dynamic Shooting Protocol**

JohnEric W. Smith<sup>1</sup>, Brandon D. Shepherd<sup>1</sup>, Teena M. Garrison<sup>1</sup>, Benjamin M. Krings<sup>2</sup>, Matthew J. McAllister<sup>3</sup>. <sup>1</sup>Mississippi State University, Mississippi State, MS. <sup>2</sup>University of Wisconsin-Platteville, Platteville, WI. <sup>3</sup>Texas State University, San Marcos, TX.

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(No relevant relationships reported)

Police officers' responses to violent situations are frequently scrutinized. **PURPOSE:** This study was created to establish a Target Assessment, Action, and Accuracy Protocol (TAAAP), assessing law enforcement personnel's decision making and firearm proficiency in a dynamic environment. We hypothesized the TAAAP would result in a greater performance differentiation than a traditional shooting test. **METHODS:** Healthy, non-colorblind, law enforcement officers ( $n=7$ ) participated in four trials; traditional fatigued, TAAAP fatigued, traditional fresh, and TAAAP fresh. The traditional protocol required officers to fire eight shots in 15 s at a target 3 m away, then fire four rounds in 6 s at a target 6.1 m away. Following a magazine change, the protocol was repeated. The TAAAP consisted of multiple targets, both hostile and friendly, at varying distances across five separate shooting bays. Fatigued protocols required participants to run until volitional fatigue and shoot, whereas subjects had no physical exertion prior to beginning the fresh trials. Shooting accuracy and response time were collected and analyzed. **RESULTS:** The traditional shooting test demonstrated an accuracy rate of  $88 \pm 9\%$  while the TAAAP demonstrated an accuracy rate of  $49 \pm 17\%$ . The findings of the current study demonstrated TAAAP is a more challenging assessment tool as compared to traditional shooting tasks. **CONCLUSIONS:** While the traditional task demonstrated a potential ceiling effect, the TAAAP may provide a better example of shooting accuracy in naturalistic settings when compared to the results from officer involved shootings at less than 6.1 m.

**1054** Board #288 May 29 2:00 PM - 3:30 PM  
**Correlation Between  $\dot{V}O_{2\max}$  and Anaerobic Power in Law Enforcement SWAT Team Members**

Shea B. Caddel, Matthew C. Jackson, Nicole C. Dabbs, Jason Ng. California State University, San Bernardino, San Bernardino, CA.

(No relevant relationships reported)

**PURPOSE:** The purpose of this investigation was to examine the relationship between maximal oxygen uptake ( $\dot{V}O_{2\max}$ ) and anaerobic power in Special Weapons and Tactics (SWAT) team members of law enforcement. **METHODS:** Fourteen healthy men and one healthy woman (age:  $33 \pm 6$  y, height:  $179.6 \pm 6.7$  cm, body mass:  $89.6 \pm 10.4$  kg) performed a graded exercise test to measure  $\dot{V}O_{2\max}$  and a Wingate Anaerobic Test to measure anaerobic power on two separate occasions.  $\dot{V}O_{2\max}$  was determined with a graded exercise test on a motorized treadmill using the Costill-Fox protocol. Anaerobic power was determined using the Wingate Anaerobic Test where participants cycled against a resistance of 9% of body mass ( $8 \pm 1$  kg) on a Wingate cycle ergometer. Pearson's  $r$  correlations were conducted to analyze the relationship between absolute  $\dot{V}O_{2\max}$  and absolute power as well as relative  $\dot{V}O_{2\max}$  and relative power. **RESULTS:** Absolute  $\dot{V}O_{2\max}$  was significantly positively correlated to absolute peak power ( $r = 0.60$ ;  $p = 0.02$ ) and absolute average power ( $r = 0.75$ ;  $p < 0.01$ ). Moreover, relative  $\dot{V}O_{2\max}$  was significantly positively correlated to relative peak power ( $r = 0.56$ ;  $p = 0.03$ ) and relative average power ( $r = 0.64$ ;  $p = 0.01$ ). **CONCLUSIONS:** There are moderate-to-strong positive correlations between  $\dot{V}O_{2\max}$  and anaerobic power. It is possible that adaptations that occur with high intensity anaerobic exertions might be related to changes in aerobic metabolism. Future research might consider examining the effectiveness of anaerobic power training on aerobic fitness among the tactical athlete populations.

**1055** Board #289 May 29 2:00 PM - 3:30 PM  
**Influence Of Working Hours On Pregnancy Outcomes: A Systematic Review And Meta-analysis**

Margie H. Davenport, Robin Featherstone, Ben Vandermeer, Meghan Sebastianski, Chenxi Cai. University of Alberta, Edmonton, AB, Canada.

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(No relevant relationships reported)

Approximately 90% of women remain employed during pregnancy. Long working hours have been hypothesized to be associated with an increased risk of adverse pregnancy outcomes including miscarriage and preterm delivery. **PURPOSE:** The purpose of this review was to evaluate the effect of long working hours ( $>40$  hour work week) on maternal and fetal health outcomes. **METHODS:** Five electronic databases and two grey literature sources were searched up to March 12, 2018 and the results underwent duplicate independent screening. Studies of all designs were included (except case studies), and contained information on the Population [women who engaged in paid work during pregnancy], Exposure [ $>40$  h work week], Comparator [working  $\leq 40$  h/week], and Outcomes [preterm birth, low birthweight (birthweight  $< 2,500$ g), small for gestational age, miscarriage, gestational hypertension, pre-eclampsia and intrauterine growth restriction]. Pooled odds ratio (OR) and 95% confidence interval (CI) were calculated using a random-effect, inverse variance method. Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to assess the quality of evidence. **RESULTS:** A total of 41 observational studies ( $N=126,632$ ) were included. "Low" to "Very low" quality evidence from observational studies revealed that compared with normal working hours (working  $\leq 40$  h/week), long working hours were associated with an increased odds of having a preterm delivery (OR: 1.16, 95% CI: 1.04, 1.3,  $I^2=53\%$ ), a small-for-gestational age baby (OR: 1.13, 95% CI: 1.00, 1.27,  $I^2=47\%$ ) and miscarriage (OR: 1.36, 95% CI: 1.17, 1.59,  $I^2=47\%$ ). When meta-analysis was restricted only to adjusted ORs, long working hours were associated with an increase in risk of preterm delivery (OR: 1.18, 95% CI: 1.01, 1.37,  $I^2=60\%$ ) and miscarriage (OR: 1.39, 95% CI: 1.09, 1.78,  $I^2=54\%$ ). We found no significant association between long work hours and low birth weight, pre-eclampsia, gestational hypertension or intrauterine growth restriction. **CONCLUSIONS:** Engaging in a work week over 40 hours is associated with an increased risk of adverse pregnancy outcomes. Supported by an Occupational Health and Safety Futures Research Grant, Alberta SPOR SUPPORT Unit KT Platform and Heart & Stroke Foundation of Canada National New Investigator Award (MD).

1056 Board #290 May 29 2:00 PM - 3:30 PM

**Influence Of Shift Work On Pregnancy Outcomes: A Systematic Review And Meta-analysis**Chenxi Cai, Robin Featherstone, Meghan Sebastianski, Margie H. Davenport. *University of Alberta, Edmonton, AB, Canada.*  
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Shift work including rotating shift and night shift has been suggested to be associated with risk of adverse pregnancy outcomes due to disrupted circadian rhythms and neuroendocrine adaptations which may affect fetal growth and timing of parturition. **PURPOSE:** To evaluate the association between shift work and pregnancy outcomes. **METHODS:** Five electronic databases and two grey literature sources were searched up to March 12, 2018 and the results underwent duplicate independent screening. Studies of all designs were included (except case studies), and contained information on the Population [women who engaged in paid work during pregnancy], Exposure [rotating shift work (working a pattern of days and nights) or fixed night shift (typical working day between 22:00 to 08:00)], Comparator [fixed day shift (typical working day between 8:00-18:00)], and Outcomes [preterm birth, low birthweight, small for gestational age, miscarriage, gestational hypertension and pre-eclampsia]. Pooled odds ratio (OR) and 95% confidence interval (CI) were calculated using a random-effect, inverse variance method. Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to assess the quality of evidence. **RESULTS:** A total of 41 observational studies (N=145,671) were included. "Low" to "Very low" quality evidence from observational studies revealed that compared with fixed day shift, rotating shift was associated with an increased odds of preterm delivery (OR: 1.16, 95% CI: 1.03, 1.3, I<sup>2</sup>=34%) and having a small-for-gestational age baby (OR: 1.23, 95% CI: 1.08, 1.39, I<sup>2</sup>=11%). Fixed night shift was associated with an increase odds of preterm delivery (OR: 1.25, 95% CI: 1.05, 1.48, I<sup>2</sup>=36%), miscarriage (OR: 1.31, 95% CI: 1.09, 1.57, I<sup>2</sup>=34%) and gestational hypertension (OR: 1.22, 95% CI: 1.01, 1.48, I<sup>2</sup>=0%). When meta-analysis was restricted only to adjusted ORs, fixed night shift was associated with an increase in risk of miscarriage (OR: 1.34, 95% CI: 1.10, 1.63, I<sup>2</sup>=38%). Rotating shift or fixed night shift were not significantly associated with low birth weight or pre-eclampsia. **CONCLUSIONS:** Pregnant women who work with rotating shift or fixed night shift have an increased risk of adverse pregnancy outcomes.

Supported by Alberta OHS Futures Research Grant and the Alberta SPOR SUPPORT Unit.

1057 Board #291 May 29 2:00 PM - 3:30 PM

**Effects of Powered Air-Purifying Respirators on Tear Osmolarity after Exercise**Edward J. Sinkule, FACSM<sup>1</sup>, Jeffrey B. Powell<sup>1</sup>, Amanda L. Strauch<sup>1</sup>, Tyler D. Quinn<sup>2</sup>. <sup>1</sup>Centers for Disease Control and Prevention/NIOSH, Pittsburgh, PA. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA.

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*(No relevant relationships reported)*

Powered air-purifying respirators (PAPRs) are used frequently in healthcare because they provide superior respiratory protection and improved comfort when compared to N95 filtering facepiece respirators. However, dry eyes from airflow on the face with PAPRs have been reported by users. Tear osmolarity is among several factors for diagnosing dry eye syndrome. **PURPOSE:** This study compared tear osmolarity measurements among participants performing the same energy expenditures while wearing two different NIOSH-approved PAPRs. **METHODS:** After protocol approval by the NIOSH IRB, men (n=12) and women (n=12) provided written informed consent. Participants wore randomly-assigned PAPRs at the same absolute energy expenditures. The treadmill exercise trials included four minutes each of standing rest, VO<sub>2</sub>=1.0 L/min, VO<sub>2</sub>=2.0 L/min, and VO<sub>2</sub>=3.0 L/min or maximum (all STPD); separated by 20 minutes of sitting rest and rehydration. All PAPRs were equipped with HEPA filters. Tear osmolarity (mOsm/L) was measured with an instrument which uses a 50 nanoliter tear sample. The largest measurement from both eyes was used for the results. The BASELINE tear osmolarity measurements were the average of osmolarity measurements obtained when participants arrived and the pre-exercise period before donning the PAPR. The tear osmolarity measurements from both PAPRs (PAPR1 and PAPR2) were measured immediately after each exercise trial. **RESULTS:** Tear osmolarity between the men and women across all trial periods were not statistically different (BASELINE p=0.17; PAPR1 p=0.53, PAPR2 p=0.11). Mean (±SD) tear osmolarity for BASELINE, PAPR1, and PAPR2 from men were 315±19, 304±12, and 314±23, respectively. Mean (±SD) tear osmolarity for BASELINE, PAPR1, and PAPR 2 from women were 307±9, 307±11, and 300±14, respectively. Tear osmolarity of each PAPR was not statistically different from BASELINE for men (PAPR1 p=0.07; PAPR2 p=0.81) and women (PAPR1 p=0.90; PAPR2 p=0.18). **CONCLUSION:** After wearing PAPRs for more than 20 minutes, tear osmolarity for each PAPR was not different than baseline. Areas of future research include the evaluation of tear osmolarity with longer

periods of PAPR use and the comparison of tear osmolarity with blood osmolarity for research when instantaneous, non-invasive osmolarity measurements would be beneficial.

1058 Board #292 May 29 2:00 PM - 3:30 PM

**Validity and Reproducibility of Commercial Cycling Power Meters in Hot and Cold Environmental Temperatures**Camille Larson. *University of Nebraska at Omaha, Omaha, NE.*  
(Sponsor: Dustin Slivka, FACSM)*(No relevant relationships reported)*

**PURPOSE:** Power meters provide objective monitoring of exercise intensity, unaffected by day-to-day physiological variations. The validity and reliability of most power meters have been assessed in laboratory settings with controlled, stable environmental conditions. Since a factor of importance for athletes exercising in a wide range of different environmental temperatures is the accurate recording of the training values regardless of environmental fluctuations. The purpose of this study was to examine potential differences in power output of the CompuTrainer, PowerTap, Stages, and Vector power meters in hot and cold compared to a room temperature environment. **METHODS:** Recreationally trained participants (7 males, 3 females, n = 10, age: 24 ± 1 years, height: 176 ± 6.1 cm, weight: 75.4 ± 10 kg, VO<sub>2peak</sub>: 56.6 ± 8.3 ml · kg<sup>-1</sup> · min<sup>-1</sup>) completed three incremental VO<sub>2peak</sub> cycling trials in hot (33°C), cold (7°C), and room temperature (RT, 20°C) conditions. The power meters were placed on a standard road bicycle and power output was logged and recorded. **RESULTS:** The CompuTrainer's power output was higher in the RT trial compared to the cold (p = 0.006) and hot (p = 0.047), but not between the hot and cold trial (p = 0.734). The PowerTap's power output was not different in RT and cold (p = 0.875), but was lower in the hot compared to RT (p < 0.001) and compared to cold (p < 0.001). The Stages' power output was not different between RT and cold (p = 0.234), but was lower in the hot compared to RT (p < 0.001) and cold (p < 0.001). The Vector's power output was not different between RT and cold (p = 0.067) but was lower in the hot compared to RT (p < 0.001) and cold (p < 0.001). **CONCLUSION:** Environmental temperature may affect the reproducibility of power meters, thus revealing the significance of recognizing potential differences between temperatures when choosing a power meter.

1059 Board #293 May 29 2:00 PM - 3:30 PM

**Effect of Recreational Soccer Play in the Air of Fine Particulate Matter on Pulmonary Function and Blood Pressure in Collegiate Men**Min Gi Jung, Jaemyung Kim, Yunbin Lee, Somi Yun, Eunjin Hwang, Dahye Lim, Dae Taek Lee. *Kookmin University, Seoul, Korea, Republic of.*

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*(No relevant relationships reported)*

**PURPOSE:** Although exercise in polluted air was not recommended, no concrete information regarding health effects of air pollution has been established in real situations. This study aimed to examine the effects of polluted air on pulmonary responses and blood pressure following vigorous outdoor exercises. **METHODS:** A total of 9 healthy young men (21.5±1.5 yrs, 172.2±5.2 cm, 68.4±9.9 kg), who formed an intramural collegiate team and regularly played recreational soccer, participated in two of four-week experiments. Each was conducted in the fall (October, FS) and the Spring (April, SS). Before (Wk0) and after (Wk4) the experiments, their maximal oxygen uptake (VO<sub>2max</sub>), forced vital capacity (FVC), forced expiratory volume in first second (FEV<sub>1</sub>), FEV<sub>1</sub>/FVC, and systolic and diastolic blood pressure (SBP, DBP) were measured. During each of the experimental period, they played on the average of six sessions while recording their heart rate. In each session, they were trained for 54±1 min (at an intensity of 60.4±2.5 and 57.8±4.8% of VO<sub>2max</sub> in FS and SS, respectively) followed by 55±4 min of friendly game (at 84.8±3.0 and 82.6±1.1% of VO<sub>2max</sub> in FS and SS, respectively). After each play session, FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, SBP, and DBP were measured. Air quality was measured by light-scattering method. PM<sub>10</sub> and PM<sub>2.5</sub> in FS was 44.0±34.1 and 24.1±23.7 µg/m<sup>3</sup>, while those in SS was 92.0±23.7 and 49.3±25.7 µg/m<sup>3</sup>, respectively. **RESULTS:** When the change of measured variables between Wk0 and Wk4 was compared, no differences were found. Repeated measures of FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, SBP, and DBP during sessions of FS did not revealed any significances, but FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC and SBP in SS were significantly increased (p<0.05). When the lowest and the highest particulate concentrations were compared in each season (20 vs. 107 of PM<sub>10</sub> and 8 vs. 69 µg/m<sup>3</sup> of PM<sub>2.5</sub> in FS; 28 vs. 159 of PM<sub>10</sub> and 17 vs. 90 µg/m<sup>3</sup> of PM<sub>2.5</sub> in SS), no differences were noticed during FS. But FVC and FEV<sub>1</sub> were increased higher after play sessions in highly polluted air than clean air. **CONCLUSIONS:** In general, the concentration of fine particulate matter in the air did not affect pulmonary and blood pressure responses for the healthy recreational exercisers. But the higher concentration of particulate matter in the air may influence on pulmonary responses after vigorous outdoor activities.

- 1060** Board #294 May 29 2:00 PM - 3:30 PM  
**Blood Pressure Responses to Air Pollution in Chinese Children: Effect Modification by Obesity**  
 Zhaohuan Gui<sup>1</sup>, Mao Wang<sup>1</sup>, Li Cai<sup>1</sup>, Jun Ma<sup>2</sup>, Yinghua Ma<sup>2</sup>, Jin Jing<sup>1</sup>, Yajun Chen<sup>1</sup>. <sup>1</sup>*School of Public Health, Sun Yat-sen University, Guangzhou, China.* <sup>2</sup>*School of Public Health, Peking University, Guangzhou, China.*  
 (No relevant relationships reported)

**PURPOSE:** To assess effect modification by obesity on the association between pollutants and blood pressure (BP) in Chinese children.

**METHODS:** We investigated 26,039 Chinese children, aged 6-18 years old, from 50 elementary schools and 44 middle schools from seven provinces in China in 2014. The weight, height, waist circumferences, and BP were measured. Total seven and half months concentrations of particulates with an aerodynamic diameter < 2.5 and ≤10 μm (PM<sub>2.5</sub> and PM<sub>10</sub>), ozone (O<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxides (NO<sub>2</sub>), and carbon monoxide (CO) were assessed based on the measurement from national monitoring stations and the personal short-term inhalation rate. Two-level regression analysis was used to examine the effects, controlling for sex, age, early life factors, physical activity, screen time, socioeconomic status, passive smoking exposure, and family history of hypertension.

**RESULTS:** The results showed that associations existed between elevated BP and pollutants. The increase in systolic BP ranged from 0.21 mmHg per 62.2 mg/m<sup>3</sup> increase for CO (95%CI: 0.03-0.40 mmHg) to 1.49 mmHg per 1320.4 μg/m<sup>3</sup> increase for PM<sub>10</sub> (95%CI: 1.21-1.86 mmHg). The increases in mean diastolic BP ranged from 0.42 mmHg per 368.6 μg/m<sup>3</sup> increase for NO<sub>2</sub> (95%CI: 0.22-0.62 mmHg) to 0.82 mmHg per 1320.4 μg/m<sup>3</sup> increase for PM<sub>10</sub> (95%CI: 0.54-1.10 mmHg). Compared to children with normal weight or non-abdominal obesity, underweight, overweight, obese, or abnormally obese children exhibited consistently stronger effects.

**CONCLUSIONS:** Study findings indicate that high levels of PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, and CO are associated with increased BP among Chinese children. Underweight, overweight, obesity, and abdominal obesity may increase the risk.

- 1061** Board #295 May 29 2:00 PM - 3:30 PM  
**Effect of Two Equipment Load Bearing Strategies on Low Back Discomfort in On-duty Police Officers**  
 Jeffrey M. Janot, Chantal Bougie, Anna Kohler, Sierra Freid, Jessica Nagel, Maddy Downing, Lindsey Opelt, Marquell Johnson, Nick Beltz, Andrew Floren, Saori Braun. *University of Wisconsin-Eau Claire, EAU CLAIRE, WI.*  
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 (No relevant relationships reported)

Jeffrey Janot, Chantal Bougie, Anna Kohler, Sierra Freid, Jessica Nagel, Maddy Downing, Lindsey Opelt, Marquell Johnson, Nick Beltz, Andrew Floren, Saori Braun  
**ABSTRACT**

Effect of two equipment load bearing strategies on low back discomfort in on-duty police officers

**KEY WORDS:** back pain, load bearing vest, occupational health

**PURPOSE:** Low back pain is a common condition affecting active-duty police officers. Carrying equipment at the waist using a standard duty belt has been linked to discomfort while on duty. The purpose of this study was to determine if a load bearing vest worn on the trunk is more effective at decreasing low back discomfort compared to the standard duty belt. **METHODS:** 15 police officers (13 m, 2 f), aged 25-45 y/o, were recruited for this study. Screening criteria were active duty for 1 year and a rating of "minimal disability" on the Oswestry LBP Disability scale. Officers were randomized into either a duty belt or load bearing vest group pre-study. A crossover design was used for the 6-mo study requiring each officer to wear the duty belt or vest each for a 3-mo period. Each work shift the officers rated their level of low back discomfort using a visual-analog scale (VAS) numbered 0-10 (0 = no pain; 10 = worst pain imaginable). Other physical measures included in the analysis were body composition, spine mobility, and core and aerobic endurance. **RESULTS:** There were significant ( $p < .05$ ) differences between vest and belt conditions for each month (1: 2.97±0.73 belt vs 0.95±1.24 vest; 2: 4.08±1.03 belt vs 0.55±1.12 vest; 3: 4.17±1.21 belt vs 0.24±0.41 vest; 4: 4.97±2.43 belt vs 2.03±1.63 vest; 5: 3.33±1.18 belt vs 1.29±1.05 vest; 6: 4.90±2.57 belt vs 1.03±1.10 vest). Pearson's  $r$  values indicated weak ( $r = -.26$  to  $.39$ ) and nonsignificant ( $p > .05$ ) correlations between belt VAS scores and physical measures and some moderate ( $r = -.51$  to  $.46$ ) but nonsignificant ( $p > .05$ ) correlations between vest VAS scores and physical measures. **CONCLUSIONS:** Results demonstrated that a load bearing vest produced lower VAS scores compared to the duty belt. There were no significant relationships between physical measures and VAS scores indicating that the load bearing devices were most responsible for eliciting the VAS results reported. Thus, to decrease discomfort, we recommended that officers use a load bearing vest system while on duty.

- B-68** Free Communication/Poster - Medical Issues  
 Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

- 1062** Board #296 May 29 3:30 PM - 5:00 PM  
**No Association between Serum Vitamin D and Physical Fitness in Trained Youth Soccer Athletes**  
 Shane D. Scholten<sup>1</sup>, Derek D. Ferley<sup>2</sup>, Matthew D. Vukovich, FACSM<sup>3</sup>, Brooke S. Bleeker<sup>1</sup>, Hunter A. Haman<sup>1</sup>, McKayla J. Horstman<sup>1</sup>, Alaina K. Klapperich<sup>1</sup>, Tara L. Sandgren<sup>1</sup>, Clark P. Vargo<sup>1</sup>. <sup>1</sup>*Augustana University, Sioux Falls, SD.* <sup>2</sup>*Avera Sports Institute, Sioux Falls, SD.* <sup>3</sup>*South Dakota State University, Brookings, SD.* (Sponsor: Dr. Matthew Vukovich, FACSM)  
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Vitamin D is known to affect bone health and muscle function. Insufficient vitamin D (25(OH)D) status may negatively affect adolescent physical performance levels.

**Purpose:** To examine the cross-sectional association between 25(OH)D status and several markers of physical performance in youth club soccer athletes.

**Methods:** 42 adolescent, male and female club soccer players age 14-18 were recruited during the winter season. 25(OH)D status, measured in January, was assessed from a capillary blood sample analyzed using liquid chromatography-tandem mass spectrometry. Physical performance was evaluated using a variety of agility, muscular strength, and cardiorespiratory fitness tests. Participants were classified as 25(OH)D Deficient (< 50 nmol/L), Insufficient (50-75 nmol/L), or Sufficient (> 75 nmol/L) and a relationship between physical performance and 25(OH)D classification was determined using a one-way ANOVA.

**Results:** Mean 25(OH)D status was 67.0 ± 16.7 nmol/L. 19% (8/42) of the participants were vitamin D deficient, 55% (23/42) were vitamin D insufficient, and 26% (11/42) were vitamin D sufficient. There were no associations found between 25(OH)D status and the variety of agility, muscular strength, and cardiorespiratory fitness tests ( $p > 0.05$ ).

**Conclusions:** This investigation demonstrates there are no associations between 25(OH)D status and physical performance in adolescent soccer players. Our participants were competitive adolescent athletes with none being severely deficient which may mask associations in this population group.

- 1063** Board #297 May 29 3:30 PM - 5:00 PM  
**Acute and Chronic Changes of Hematological Variables in College Football Athletes with Sickle Cell Trait**  
 Haoyan Wang<sup>1</sup>, Nathan P. Lemoine, Jr.<sup>1</sup>, Matt Martone<sup>1</sup>, Brian A. Irving, FACSM<sup>1</sup>, Guillaume Spielmann<sup>1</sup>, Jack Marucci<sup>1</sup>, Shelly Mullenix<sup>1</sup>, Derek D. Calvert<sup>1</sup>, Timothy S. Church<sup>2</sup>, Jennifer Rood<sup>2</sup>, Brian Harrell<sup>3</sup>, Neil M. Johansen<sup>1</sup>. <sup>1</sup>*Louisiana State University, Baton Rouge, LA.* <sup>2</sup>*Pennington Biomedical, Baton Rouge, LA.* <sup>3</sup>*Baton Rouge General Sports Medicine, Baton Rouge, LA.*  
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 (No relevant relationships reported)

**PURPOSE:** To determine the acute and chronic changes of hematological in NCAA Division I football players with sickle cell trait (SCT) and healthy control (CON) before and after a single practice (acute) and pre-and post-training camp in pre-season (chronic). **METHODS:** Eight athletes (n=4 SCT; n=4 CON) had blood drawn pre-and post-training camp in pre-season. Six of them (n=3 SCT; n=3 CON) had blood drawn before and after a single pre-season scrimmage. Hemoglobin electrophoresis (Hb-A, Hb-A2, Hb-S and Hb-F), complete blood count, and chemistry panel 26 were analyzed using 2-way RM ANOVA. **RESULTS:** Baseline total hemoglobin content was similar between SCT and CON (mean±SD; 14.1±0.6 g/dL vs. 14.5±0.6 g/dL;  $P=0.41$ ). However, Hb-A was lower (58.4±3.8% vs. 86.6±17.5%;  $P=0.02$ ) and Hb-S was higher in SCT than CON (36.8±3.6% vs. 0.2±0.4;  $P<0.0001$ ), and results were consistent at all time points. After a single practice, uric acid was significantly higher in SCT compared to CON (7.5±0.8mg/dL vs. 6.4±0.4mg/dL;  $P_{all}=0.04$ ). However, blood urea nitrogen (BUN) was lower in SCT (16.1±3.5mg/dL) than CON (23.4±1.6mg/dL;  $P_{all}=0.006$ ). The chronic changes between pre-and-post camp showed that SCT had lower in BUN (16.1±3.9mg/dL vs. 20.5±3.3 mg/dL;  $P_{all}=0.015$ ) and total bilirubin (0.73±0.14mg/dL vs. 1.13±0.27mg/dL;  $P_{all}=0.027$ ) compared to CON. In complete blood count profile, white blood count, neutrophils, lymphocytes, and monocytes significantly decreased in both groups ( $P_{all}<0.05$ ). **CONCLUSION:** Both acute and chronic changes showed SCT had lower BUN than CON suggesting exercise might have different effects on kidney function between two groups. Subclinical changes in resting immune cell counts between pre- and post-training camp suggest that athletes' immune function may be dampened by repeated bouts of exhaustive exercise.



1064 Board #298 May 29 3:30 PM - 5:00 PM

**Blood Flow Response and Changes in Fluid Distributions after Percussive Massage Therapy**

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*(No relevant relationships reported)*

**PURPOSE:** Percussive massage therapy is a widely used modality for sports rehabilitation and recovery after intense exercise. Recent advancements in handheld vibration technology have further increased its popularity. While athletes, trainers, and therapists collectively tout its practical benefits for sports performance, the underlying mechanisms are largely unknown. To provide such insight, we assessed blood flow response and changes in fluid distributions after applying percussive massage therapy to the quadriceps muscles of each leg.

**METHODS:** Forty-one participants (23 female, 25.1 ± 3.0 years of age) with a range of body fat percentage (23.8 ± 7.9%) were tested. Percussive massage therapy was applied for 2 minutes by a study investigator. Two devices were used simultaneously, TheraGun G2PRO and HyperIce Hypervolt, with similar speed setting (40 percussions per second) and randomly assigned to one of each participants' legs. A thermal camera (FLIR C2) was used as a proxy for blood flow. All images were taken with participants seated and an ice-water slurry between their abducted legs as a control for temperature. Fluid distributions, including extracellular water (ECW) and the ratio of ECW to total water (ECW/TW), were assessed through bioelectrical impedance analysis (Biospace Inbody 770).

**RESULTS:** Immediately after the treatment, there was no difference in surface temperature compared to baseline in either thigh. However, the temperature in both thighs was greater than baseline in the 3rd to 8th minutes (~3°F, P<0.006), indicating a delayed blood flow response. Temperatures returned to baseline by the 12th minute post-massage. Differences between devices were observed. The percent change from baseline was significantly greater in the G2PRO thigh than the Hypervolt thigh at minutes 5 (3.7% vs 3.2%), 6 (3.7% vs 3.2%), 7 (3.6% vs 3.1%), and 12 (1.9% vs 1.4%, respectively) post-massage (all P<0.006). For ECW and ECW/TW, a significant decrease was observed only in the G2PRO leg between 2 and 9 minutes post-massage (P<0.0167). However, there was no difference between legs.

**CONCLUSIONS:** Overall, the G2PRO and Hypervolt induce a delayed blood flow response; however, the G2PRO has a larger, longer-lasting effect. In addition, the G2PRO appears to influence fluid distributions, while the Hypervolt does not.

1065 Board #299 May 29 3:30 PM - 5:00 PM

**Low Energy Availability May Cause REE Suppression and Bone Loss in Japanese Male Athletes**

Motoko Taguchi<sup>1</sup>, Kuniko Moto<sup>1</sup>, Sihyung Lee<sup>1</sup>, Suguru Torii<sup>1</sup>, Nobuko Hongu, FACSM<sup>2</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>University of Arizona, Tucson, AZ. (Sponsor: Nobuko Hongu, FACSM)

*(No relevant relationships reported)*

**PURPOSE:** Recently, it has been reported that low energy availability (EA) affects physical conditions (i.e. impairments of metabolic rate, bone health, immune functions, protein synthesis etc.) in male athletes as well as female. However, few EA data of male athletes have been reported. The aim of this study was to estimate EA of Japanese male athletes, and to examine the relationship between their EA and resting energy expenditure (REE), and the status of bone health.

**METHODS:** Five male collegiate long-distance runners (age: 19.6±0.8 yrs., average running time: 133±20 min/day) during a training season participated in this study. Total energy intake (TEI) was assessed using 7-day dietary records with food pictures that were taken by the athletes. Further, they were interviewed on their food picture by a sports dietitian. Exercise energy expenditure (EEE) was determined by HR-VO<sub>2</sub> method. EA was calculated by subtraction of EEE from TEI and normalized by fat free mass (FFM). REE was measured in the morning fasting by indirect calorimetry using Douglas bag technique, and blood sampling were conducted to assess Triiodothyronine, sex hormones and bone resorption marker (serum NTx). Body composition was measured by DXA (Hologic Horizon A). REE was predicted using organ-tissue mass derived from DXA, and REE suppression was estimated by the ratio of measured REE to predicted REE.

**RESULTS:** Mean EA of the subjects was 16.4±3.3 kcal/kg FFM/day, which was below the cut off value (30kcal/kg FFM/day). Measured REE was also below the average of Japanese athletes presented in our previous study. Based on the mean ratio of measured REE to predicted REE (0.91), energy metabolism of these athletes seemed to be suppressed. In addition, the value of NTx showed a high value exceeding the reference range, subjects were considered to be in a state where bone resorption was promoted.

**CONCLUSIONS:** These data suggested that low EA could impair energy metabolism and bone health in Japanese male collegiate long-distance runners.

1066 Board #300 May 29 3:30 PM - 5:00 PM

**Nocturnal Hypoglycemia Incidents Following Moderate and Vigorous Physical Activity in Athletes With Type 1 Diabetes**

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*(No relevant relationships reported)*

**PURPOSE:** For adolescent athletes with type 1 diabetes mellitus (T1DM), proper glucose management during and after prolonged activity could prove difficult because of the body's response throughout the process of gluconeogenesis. Understanding their body's glucose response to physical activity could aid in effectively addressing nocturnal hypoglycemia. Therefore, the purpose of this investigation was to examine the acute temporal associations between blood glucose and measures of moderate and vigorous intensity physical activity via an accelerometer in a sample of athletes with T1DM. **METHODS:** 10 adolescent athletes with diagnosed T1DM between the ages of 13 - 17 and who were involved in competitive sports in the previous 12 months were recruited for this study. All participants wore an accelerometer and continuous glucose monitor (CGM) consecutively for a minimum of 2-weeks with a total of 168 patient-days of collected data. Nocturnal hypoglycemia was defined as a blood glucose reading <70 mg/dl during sleeping hours that lasted ≥ 10 minutes as indicated by the CGM.

**RESULTS:** Incidents of nocturnal hypoglycemia occurred 29% of the nights measured with an average duration of 52.33 ± 41.04 minutes. A multiple linear regression showed vigorous intensity to be a significant predictor of nocturnal hypoglycemia after controlling for all variables (β=0.169, p=0.02) with an average time of 26 minutes of vigorous intensity. **CONCLUSIONS:** Engaging in vigorous intensity physical activity increased the risk of prolonged nocturnal hypoglycemia in adolescent athletes with T1DM. Incorporating accelerometers into patient care could prove beneficial when making further recommendations for athletes by improving glucose management. Funded by Children's Hospital Foundation, Christensen Family, Norton Children's Hospital, and University of Louisville.

1067 Board #301 May 29 3:30 PM - 5:00 PM

**The Implications of New Blood Pressure Guidelines on Hypertension Prevalence in Former NFL Players**

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*(No relevant relationships reported)*

**Purpose:** Examine potential implications of the new 2017 ACC/AHA hypertension (HTN) guidelines on the prevalence of HTN in a population of former professional football players.

**Methods:** Blood pressure (BP), height, weight, and waist circumference were collected from former professional football players (n = 1240) between April 2015 and August 2018 during cardiovascular screening events held throughout the U.S. Demographic information was collected, including age, race, career playing position, and previous HTN diagnosis. HTN status was assessed via 2010 JNC (2010) and 2017 ACC/AHA (2017) guidelines. Means were analyzed using one-way ANOVA, Pearson's correlation, and Chi square, where appropriate.

**Results:** The overall prevalence of hypertensive BP observed in this cohort was 38.5% (2010) and 70.5% (2017; p < 0.0001). While all subjects previously identified as having stage 1 HTN by 2010 guidelines were re-categorized as stage 2 under new 2017 guidelines, 72.8% of subjects previously identified as prehypertensive were re-categorized as having stage 1 HTN. There was an overall increase (p < 0.0001) in HTN prevalence by 2017 versus 2010 criteria in all groups when data were stratified by age, race, and playing position. There was an 83.4% increase in the prevalence of previously undiagnosed HTN under the new 2017 guidelines (48.6%) versus 2010 guidelines (26.5%; p < 0.0001). Correlation of body mass index and waist circumference with HTN revealed a significant association (p < 0.0001) of body mass index and HTN under both 2010 guidelines (r = 0.2036) and 2017 guidelines (r = 0.1547). Conversely, the association between waist circumference and HTN under 2010 guidelines (r = 0.1825; p < 0.0001) was better than that of 2017 guidelines (r = 0.0422; p = 0.1379), but only the correlation with HTN under 2010 guidelines was found to be significant.

**Conclusions:** Changes to the guidelines for the categorization of BP are expected to substantially increase HTN diagnosis in this population of former professional football players, as previously undiagnosed HTN under the new 2017 guidelines almost doubled in the current study. Given the significant increase in former players found to have stage 2 HTN, it is also likely that the number of men in this population prescribed antihypertensive medications will increase substantially.

1068 Board #302 May 29 3:30 PM - 5:00 PM

**Comparison between Dual X-ray Absorptiometry and Magnetic Resonance Imaging for Visceral Fat Assessment in Athletes**

Hiroko Murata<sup>1</sup>, Tomoyoshi Yagi<sup>1</sup>, Eri Takai<sup>1</sup>, Suguru Torii<sup>1</sup>, Taishi Midorikawa<sup>2</sup>, Nobuko Hongu, FACSM<sup>3</sup>, Motoko Taguchi<sup>1</sup>. <sup>1</sup>Waseda University, Tokyo, Japan. <sup>2</sup>Obirin University, Tokyo, Japan. <sup>3</sup>Arizona University, Tuscon, AZ. (Sponsor: Nobuko Kay Hongu, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Visceral fat is related to cardiometabolic risk in athletes as well as non-athletes. Magnetic resonance imaging (MRI) estimates visceral adipose tissue (VAT) from a direct differentiation of VAT from subcutaneous adipose tissue. Recently, some validation studies of VAT assessment using dual X-ray absorptiometry (DXA) have been reported. This study aimed to compare DXA measurements of VAT with the gold standard MRI in athletes with wide ranges of body size.

**METHODS:** This study included 77 male collegiate athletes (age, 20 ± 2 yr; height, 175.1 ± 7.4 cm; body weight, 79.6 ± 17.4 kg; body mass index, 25.9 ± 5.3 kg/m<sup>2</sup>) from different sports (e.g. sumo, judo, lifters, wrestlers, basketball, volleyball, swimming, etc.) Paired measurement of VAT was performed using MRI (Signa 1.5T; General Electric Co., Ltd., WI, USA) and DXA (Horizon A configured with software APEX 5.6, Hologic Inc.). MRI-VAT volume was calculated by integrating six 65-mm single MRI slices corresponding to the level of DXA-VAT volume measurement. Data were compared using Wilcoxon signed rank test and a Bland-Altman plot was used to assess systematic error. Data were shown mean ± SD for parametric data and median (Inter quartile range) for nonparametric data.

**RESULTS:** The VAT volumes of DXA (248 (212 - 298) cm<sup>3</sup>) and MRI (211 (180 - 269) cm<sup>3</sup>) differed significantly (p<0.01). Regression analysis showed a linear relationship between DXA and MRI VAT volumes (r=0.89). The fit line for the relationship between MRI and DXA VAT volume was calculated as follows: DXA-VAT volume = 0.87×MRI-VAT volume + 68 (cm<sup>3</sup>). Bland-Altman analysis showed DXA-VAT volume overestimated by 37 ± 50 cm<sup>3</sup> compared with MRI-VAT volume, with no systematic error (p=0.75).

**CONCLUSIONS:** DXA-VAT volume was overestimated compared to MRI-VAT volume among male collegiate athletes with wide ranges of body size. The overestimation of DXA-VAT volume needs further investigation.

1069 Board #303 May 29 3:30 PM - 5:00 PM

**Rapid Diagnostic Testing as a Tool for Guiding Treatment of Infectious Disease in Elite Athletes**

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(No relevant relationships reported)

**PURPOSE:**

To describe the most common etiologies of upper respiratory tract infections (URI) in elite athletes presenting to an ambulatory sports medicine clinic as diagnosed with polymerase chain reaction rapid diagnostic testing (PCR).

**METHODS:**

Retrospective analysis of medical records from 42 patient-athletes who presented to a sports medicine clinic for evaluation of URI. Clinic care pathways identify a criterion for the implementing PCR testing of patient's presenting with symptoms and objective signs of an URI. Descriptive statistics were used to describe the etiology of URI in this cohort.

**RESULTS:**

42 URI cases met clinical criteria for PCR testing. 22 of these cases yielded positive identification of at least one pathogen. 21 of the 22 positive cases represented viral agents (95%). Influenza was the responsible agent in 50% of positive cases. *Chlamydia pneumoniae* was the sole bacterial pathogen identified. There were 3 cases of co-infection composed of multiple viral pathogens.

**CONCLUSION:**

Viral pathogens are the most common cause of URI in the elite athlete population. The identification of viral URI with PCR testing in athlete populations provides for the opportunity to implement evidence-based management. The significant number of negative PCR findings in patients with upper respiratory symptoms suggests there are additional unidentified etiologies for respiratory symptoms in athletes. The impact of PCR on the treatment strategies and outcomes of URI requires further investigation.

1070 Board #304 May 29 3:30 PM - 5:00 PM

**Effects of Two Cooling Strategies on Performance and Perceptual Measures Among Athletes with an SCI**

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(No relevant relationships reported)

Individuals with spinal cord injury (SCI) have thermoregulatory inhibition, increasing the risk for heat related complication during exercise. Studies have examined cooling methods within this population, however many strategies are impractical.

**PURPOSE:** To compare the effects of ad libitum use of two practical cooling methods: ice slurry (IS) and artificial sweat (SB), on performance and perceptual measures in recreationally trained athletes with SCI.

**METHODS:** Recreational wheelchair basketball (WB) and rugby (WR) athletes with SCI (n=5; age 32.8±12.0 y; playing 3.2±1.9 y; BMI 25.0±8.1 kg/m<sup>2</sup>; peak oxygen consumption [VO<sub>2peak</sub>]) 19.6±3.5 ml/kg/min) completed three lab visits; a familiarization, and two cooling trials in a climate controlled chamber (30.1±0.2°C, 51.7±2.0% relative humidity). Following familiarization, participants were assigned to IS or SB with an isocaloric, isovolumetric control beverage (CON). Participants completed an arm ergometry game simulation consisting of four quarters (four minutes of active recovery (A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub>) and a 15-s sprint (S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub>, S<sub>4</sub>)). The assigned ad lib cooling method was available during programmed rest after each sprint. IS and CON were split into two 3.4g/kg boluses provided 10-min prior to exercise and during passive rest. Peak power output (W), perceived exertion (RPE), and thermal sensation (TS) were collected every four and five min.

**RESULTS:** W (mean±SD) was greater during sprints with SB than IS, respectively (S<sub>1</sub>: 93.6±57.8W, 85.9±53.5W; S<sub>2</sub>: 97.1±53.2W, 86.5±40.8W; S<sub>3</sub>: 99.1±57.0W, 90.9±48.9W; S<sub>4</sub>: 96.5±51.2W, 90.6±47.7W). TS (mean±SD) was similar across all exercise for both SB and IS, respectively: S1: 5.2±1.1, 5.4±0.5; S2: 6.0±1.0, 6.2±0.8; S3: 6.4±0.9, 6.4±0.6; S4: 6.8±1.1, 6.8±0.5; A1: 5.0±0.7, 5.4±0.5; A2: 5.4±1.1, 6.0±1.0; A3: 6.2±0.8, 6.6±0.9; A4: 6.6±0.9, 6.6±0.6. RPE (mean±SD) was similar for SB and IS, respectively, with SB trending higher at the end of exercise: S1: 12.4±1.6, 12.4±2.0; S2: 14.2±1.6, 13.8±1.6; S3: 15.6±0.9, 13.8±1.3; S4: 15.4±1.5, 14.6±1.1; A1: 10.2±1.8, 11.0±2.5; A2: 11.8±0.8, 12.4±1.8; A3: 13.4±2.5, 12.8±1.3; A4: 14.0±1.4, 13.2±1.5. **CONCLUSIONS:** Implementation of SB yielded a greater power output and RPE than IS, but similar TS outcomes. Athletes may use either cooling method based on comfort and availability.

1071 Board #305 May 29 3:30 PM - 5:00 PM

**Hydration Status and Drinking Behavior of Adolescent Athletes**

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(No relevant relationships reported)

Professional young athletes should adopt an appropriate nutritional behavior including fluid consumption and hydration program. Previous studies showed high prevalence of inappropriate pre-training hydration status and poor drinking habits among athletes.

**Purpose:** To estimate pre and post-training hydration status and to assess water consumption patterns of young elite athletes during a training session at the Academy for Sport Excellence at Wingate Institute.

**Methods:** Seventy seven academy athletes (38 females, ages 13-21) training in basketball, waterpolo, volleyball, handball, rugby, triathlon and swimming were included. Body weight, urine specific gravity (USG) and volume of fluid intake before and after afternoon training session were measured.

**Results:** The average USG prior training was 1.021±0.007 (no difference between different sports), indicating dehydration status equal to the loss of 3%-5% body weight (according to Casa DJ et al, 2000). A further decrease of an average of 1.5±0.7% Body weight was measured during practice, which sums up to a deficit of approximately 4.5-6.5% in body weight by the end of practice. Athletes lost an average of 0.4 (± 0.57) kilograms and consumed 0.7 (± 0.44) liters of water during training, both with a significant difference between teams at different sport professions (P<0.001, P=0.001 respectively). Volleyball players lost less weight than other athlete during training (difference was significant when compared to swimmers and basketball players (difference between groups=0.7 and 0.8 kilograms; P=0.018, P=0.002 respectively). Swimmers, waterpolo players and triathletes drank less compared to other athletes and most significantly less than handball players (difference between groups=0.9, 0.9 and 1.1 liters; P=0.007, P<0.001 and P=0.003 respectively).

**Conclusions:** Young athletes in our center do not consume sufficient amount of fluids. Both pre-training hydration status and water consumption during training were not

adequate, and varied between different sport disciplines. Water-sports athletes drank less than other athletes. Education and intervention should be conducted to improve athletes drinking behavior and hydration status.

- 1072** Board #306 May 29 2:00 PM - 3:30 PM  
**Medical Encounters, Cardiac Arrests and Deaths During a 109km Mass-Participation Cycling Event Involving 102251 Starters**  
 Jannelene Killops<sup>1</sup>, Martin Schweltnus, FACSM<sup>2</sup>, Dina Janse Van Rensburg, FACSM<sup>3</sup>, Sonja Swaneveldt<sup>4</sup>, Esme Jordaan<sup>4</sup>.  
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<sup>2</sup>*SEMMLI, University of Pretoria, Pretoria, South Africa.* <sup>3</sup>*Sports Medicine, University of Pretoria, Pretoria, South Africa.* <sup>4</sup>*South African Medical Research Council, Cape Town, South Africa.*  
 (Sponsor: Martin Schweltnus, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** Limited data are available on medical encounters, including serious life-threatening encounters and deaths during cycling events. The purpose was to determine the incidence and nature of medical encounters during a community-based mass participation cycling event.

**METHODS:** This retrospective, descriptive study was conducted during the Cape Town Cycle Tour (109km) in South Africa over 3 years, and involved 102251 race starters. Medical encounters were recorded on race day each year and are reported as an incidence rate (IR per 1000 starters; 95% CI). Overall illness-related (by organ system) or injury-related (by anatomical region) encounters, and severity (moderate, serious life-threatening, sudden cardiac arrest / death) were recorded.

**RESULTS:** In 3 years, 539 medical encounters were recorded (IR 5.27 (4.84-5.74), with a significantly higher injury- (3.23; 2.90-3.60) compared to illness-related (2.10; 1.84-2.40) ( $p < 0.0001$ ) incidence. Incidence of serious life-threatening medical encounters was 0.49 (95%CI; 0.37-0.65) and 2 cardiac arrests and 1 death occurred (1/51126 and 1/102251 respectively). Injury incidence was highest in upper limb (1.85; 1.60-2.13), lower limb (0.96; 0.79-1.0) and head/ neck (0.77; 0.62-0.96) while illnesses incidence was highest for fluid/electrolyte abnormalities (0.59; 0.46-0.76) and the cardiovascular system (0.48; 0.36-0.63).

**CONCLUSIONS:** In a 109km community-based mass participation cycling event, 1 in 190 cyclists starting the race required medical assistance or evaluation by the medical team on race day. Injury-related (1 in 310 cyclists) encounters were higher than illness-related medical encounters (1 in 476) among race starters. Serious life-threatening medical encounters occurred in 1 in 2045 race starters. Risk factors associated with medical encounters need to be determined to enable implementation of safer cycling strategies.

- 1073** Board #307 May 29 3:30 PM - 5:00 PM  
**Impact of Silver Ion Laundry Treatment on Athletic Gear and Environmental Pathogens and Athlete Health**  
 Priya Balachandran<sup>1</sup>, John J. Openshaw<sup>2</sup>. <sup>1</sup>*Applied Silver, Inc., Hayward, CA.* <sup>2</sup>*Stanford University, Palo Alto, CA.*  
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Community-acquired infections caused by *Staphylococcus* and MRSA can spread easily through sharing towels, gear and contaminated surfaces. The resulting skin infections can lead to athlete disqualifications, cancellations of competitions and potential impact on team performance. In this study, we evaluate a residual antimicrobial textile treatment as an environmental hygiene and infection control strategy through improved textile cleanliness and reduced athlete risk for infection. **PURPOSE:** To determine the impact of silver-based residual antimicrobial textile treatment on *Staphylococcus* and MRSA levels on athletic gear, environmental surfaces, athlete infection rates and number of missed play days. **METHODS:** The study, conducted at a professional sports facility over a six-month period, included pre-season and regular season use. Residual antimicrobial silver ion laundry additive was injected onto textiles during the final rinse stage of the facility's standard laundry process. Bioburden data for *Staphylococcus* and MRSA was collected approximately every 4 weeks using contact plates. Athletes' shirts, shorts, jerseys, girdles and towels, and locker room surfaces including carpets, upholstery and other hard surfaces were sampled. Infection rates and number of days missed pre- and post-laundry treatment are also being recorded. Samples collected before initiating the silver ion textile treatment served as the control data set. **RESULTS:** Prior to silver-ion treatment implementation, significant levels of *Staphylococcus* were measured on athlete textiles (average 75 CFU/100 sq. cm.) and on environmental surfaces (average 16 CFU/100 sq. cm.). Silver ion treatment of the textiles resulted in dramatic decreases in *Staphylococcus* by 77% on textiles and by 37.5% on environmental surfaces. Similar trends were also observed with MRSA. The overall bioburden levels continue to trend downward during the period of treatment. **CONCLUSIONS:** The current results demonstrate that a normal laundry process augmented with an active antimicrobial

treatment provide athletic gear and a locker room environment that are and stay cleaner. Final data related to cleanliness, infection rates and player days will be tallied at the close of 2018.

- 1074** Board #308 May 29 3:30 PM - 5:00 PM  
**Effects of Mistletoe Extract Supplementation on Inflammation Markers after Strenuous Exercise in Rowers**  
 Soo-Min Ha<sup>1</sup>, Jung-Sook Kim<sup>1</sup>, Bo-Sung Kim<sup>1</sup>, Jeong-Ah Lee<sup>2</sup>, Yoon-Jung Choi<sup>1</sup>, Do-Yeon Kim<sup>1</sup>. <sup>1</sup>*Pusan National University, Busan, Korea, Republic of.* <sup>2</sup>*Kyungseong University, Busan, Korea, Republic of.*  
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Excessive long-term training and extensive exertion during exercise can inflammatory cytokine expression. Various measures have been explored to minimize this, and dietary supplements having anti-inflammatory and antioxidant functions can help athletes recover from repetitive intensive exercises, thereby preventing reduced vitality.

**Purpose:** This study aimed to identify the effect of mistletoe extract consumption on inflammatory markers of university male rowing athletes for 8 weeks during the winter training period. **Methods:** This study included 20 male rowing athletes divided into the Korean Mistletoe extract supplement group (KME,  $n = 10$ ) and the control group (CON,  $n = 10$ ). The KME group took 110 mL of mistletoe extract every morning and evening after meals (total of 220 mL) for eight weeks. Before and after taking mistletoe for eight weeks, 2,000 m rowing performance capabilities were measured, and KME group took 110 mL of mistletoe extract after recovery from the rowing exercise. Blood samples were collected during the rest, immediately after exercise, and after 30 min of recovery. Among inflammatory markers, IL-6 and TNF- $\alpha$  were analyzed. **Results:** Both groups showed a significantly reduced 2,000-m rowing time (KME;  $p < 0.001$ , CON;  $p < 0.01$ ), and the total number of strokes were significantly fewer in the KME group than in the CON group ( $p < 0.05$ ). After supplementation the levels of IL-6 and TNF- $\alpha$  were lower in the KME group than in the CON group in all periods of the rest ( $p < 0.001$ ), immediately after exercise (IL-6;  $p < 0.01$ , TNF- $\alpha$ ;  $p < 0.001$ ), and after 30 min of recovery ( $p < 0.01$ ). **Conclusion:** Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.

- 1075** Board #309 May 29 3:30 PM - 5:00 PM  
**A Retrospective Analysis Of VPBs In Trained Bicuspid Aortic Valve Athletes.**  
 Matteo Donadei<sup>1</sup>, Lorenzo Casatori<sup>1</sup>, Giorgio Galanti<sup>2</sup>, Pietro Amedeo Modesti<sup>3</sup>, Laura Stefani<sup>2</sup>. <sup>1</sup>*Sports Medicine, Florence, Italy.* <sup>2</sup>*Sports Medicine-FIMS (Italian Federation of Sport Medicine), Florence, Italy.* <sup>3</sup>*Sports Medicine Center-University of Florence, Florence, Italy.*  
 (No relevant relationships reported)

**Purpose:** Bicuspid aortic valve (BAV) represents a common congenital cardiac disease (1-2%) normally compatible with sports activity. In case of competitive sports, the eligibility can be otherwise limited by the presence of symptoms, aortic valve dysfunction or arrhythmias. The investigation aims to verify, in a large cohort of BAV athletes, the prevalence of ventricular arrhythmic events (VPBs) found at the maximal exercise test (ET) at the first sports medicine clinical evaluation. **Methods:** A sample of 356 BAV athletes, regularly followed at Sports Medicine Center of the University of Florence, since 10 years, was retrospectively evaluated for arrhythmic events found at the first check-up. The athletes (321 M and 35 F) were in the range of 8-50 years old (medium  $24.00 \pm 14.14$ ) and practiced sports at high cardiovascular impact (predominantly soccer, basketball and track and field). Inclusion criteria were to undergo a 2D echocardiography and ET conducted at 85% of their maximal effort. VPBs were reported if they were  $\geq 3$  at rest and/or during the test. Exclusion criteria were age  $> 50$  years and the presence of any other cardiac or systemic structural disease. They were matched with a control group of 400 athletes (age  $19.70 \pm 9.7$ ) without BAV and similarly trained. **Results:** Only 25 (7.02%) showed VPBs at the ET. The total amount was 403 single VPBs and 4 monomorphic couples; a polymorphic pattern was present in only 3 athletes and only 5 had induced-exercise VPBs at peak. None of them showed acute events or had major arrhythmias. The difference of the VPBs prevalence in BAV athletes versus control (VPBs in 6.25%) was not significant ( $p > 0.05$ ). **Conclusions:** Prevalence of VPBs is low in BAV athletes and it seems to be not different from athletes without BAV. In case of sports eligibility, BAV should not be considered as a cause of risk of major arrhythmic events. More data in this field could optimize the cost/effective ratio for the eventual ECG holter indications.

**1076** Board #310 May 29 3:30 PM - 5:00 PM  
**Knowledge, Attitude, and Behavior Related to Exertional Heat Illnesses in Japanese College Athletes**  
 Yuki Murata<sup>1</sup>, Kazuaki Kato<sup>1</sup>, Yuri Hosokawa<sup>2</sup>, Samantha E. Scarneo<sup>3</sup>, Ryo Uchida<sup>1</sup>. <sup>1</sup>Nagoya University, Nagoya, Japan. <sup>2</sup>Ritsumeikan University, Kusatsu, Japan. <sup>3</sup>Korey Stringer Institute at University of Connecticut, Storrs, CT.  
 (No relevant relationships reported)

Previous studies reported sport was number one cause of heat illness for young people visiting the emergency department in Japan. However, information of athletes' perception for exertional heat illnesses (EHI) is limited.

**Purpose:** To examine the current level of knowledge, attitude, and behavior of EHI in Japanese college athletes.

**Methods:** We distributed a questionnaire to 1386 students among 5 universities in Japan, and 556 athletes responded, resulting in a response rate of 57%. Knowledge was measured with 18 true/false questions, attitude was measured with 1 scenario toward playing through symptoms of EHI on 4-point Likert scale, behavior was measured with 3 questions on 4-categories modified based on the Transtheoretical Stages of Change (unaware, undecided to implement, decided to implement, implemented) about EHI. Descriptive statistics and Chi-Squared tests of association were conducted.

**Results:** Only 4 subjects correctly answered all of the knowledge questions. More than half of the subjects answered incorrectly to questions about the relationship between survival rate and duration of hyperthermia (60%, n=326), the best cooling method for EHI (91%, n=493), and heat acclimatization (56%, n=302). Thirty percent of subjects (n=160) reported they would play through symptoms of EHI. Thirty nine percent (n=205) of subjects were unaware that physical activities should be canceled if temperature exceeds 35°C, while 39% (n=206) undecided to implement, 11% (n=59) decided to implement, and 11% (n=58) had already implemented the recommendation. Twenty percent (n=104) of subjects were unaware ice should be prepared for workouts in the heat, while 13% (n=67) undecided to implement, 15% (n=80) decided to implement, and 52% (n=278) had already implemented the recommendation. Subjects who were undecided to implement the recommendation to cancel workouts when temperature exceeds 35°C were associated with continuing exercise despite having EHI symptoms ( $X^2=27.64$  (df=3),  $p<.01$ ).

**Conclusion:** Most of the respondents had not implemented the recommendation to cancel physical activities in extreme heat condition and the behavior was associated with an attitude toward the need to stop exercise when having EHI symptoms. The overall findings of this study show the need for improved education for Japanese athletes.

**1077** Board #311 May 29 3:30 PM - 5:00 PM  
**Comparison of Various Body Condition Measurements to Air Displacement Plethysmography in Female Collegiate Athletes**  
 Ryan Z. Lawless, Emily L. Langford, Michelle L. Eisenman, Ronald L. Snarr, Greg A. Ryan. *Georgia Southern University, Statesboro, GA.*  
 (No relevant relationships reported)

Body composition is an important consideration for athletes and coaches. Air displacement plethysmography (ADP) is often preferred in this population due to relative ease of administration and accuracy of measurement. However, other methods may provide a quicker or more cost-effective way of determining body fat percentage (BF%) in athletes. **Purpose:** To compare BF% from various body fat estimators to the criterion of ADP in female Division-I collegiate athletes. **Methods:** Forty-eight female athletes (age:  $18.0 \pm 0.7$  years, height:  $146.3 \pm 56.9$  cm, weight:  $55.9 \pm 23.8$  kg) underwent a body composition test battery consisting of: 1) hand-to-foot bioelectrical impedance spectroscopy (HF-BIS); 2) hand-to-foot bioelectrical impedance analysis (HF-BIA); 3) foot-to-foot BIA (FF-BIA); and 4) 3-site Jackson-Pollack skinfold (SF). All SF testing was performed by the same test administrator, and BF% was estimated using the Brozek body density formula. Mean comparisons were assessed using a one-way ANOVA against the criterion of ADP and all correlations were run using Pearson's product moment correlations. **Results:** Significant, positive relationships were found between all variables when compared to ADP (HF-BIS:  $r = 0.68$ ,  $p < .01$ ; HF-BIA:  $r = 0.79$ ,  $p < .01$ ; FF-BIA:  $r = 0.76$ ,  $p < .01$ ; and SF  $r = 0.84$ ,  $p < .01$ ). When compared to the criterion of ADP ( $22.2 \pm 7.1\%$ ), only the HF-BIA ( $26.1 \pm 5.4\%$ ) was found to significantly overestimate BF% ( $p = 0.03$ ). No significance was noted with HF-BIS ( $25.5 \pm 5.6\%$ ,  $p = 0.38$ ), FF-BIA ( $22.1 \pm 5.7\%$ ,  $p = 0.16$ ), or SF ( $24.6 \pm 6.1\%$ ,  $p = 0.21$ ). **Conclusion:** The results of this study suggest that a moderate-to-strong relationship exists between BF% estimated via ADP and other laboratory and field-based methods. Given the strength of its relationship to ADP, it appears 3-site SF analysis may provide a cheap, time-saving estimate of BF% in Division-I female athletes.

**1078** Board #312 May 29 3:30 PM - 5:00 PM  
**The Association Between Sleep Quality On Quality Of Life Among Healthy High School Athletes**  
 Morgan N. Potter, David R. Howell, Katherine S. Dahab, Emily A. Sweeney, Jay C. Albright, Aaron J. Provance. *Children's Hospital Colorado, Aurora, CO.*  
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 (No relevant relationships reported)

**Purpose:** The objective of our study was to investigate the association between self-reported sleep quality (SQ) and quality of life (QOL) measures in healthy high school athletes.

**Methods:** We assessed the SQ and QOL of high school athletes (age range = 13-18 years) during their pre-participation physical examination (PPE). Participants completed the Pittsburgh Sleep Quality Index (PSQI), and the PROMIS Pediatric Profile 37 QOL questionnaire. Standard PPE forms which included demographics, sports participation, and injury history were also completed by the participants. Based upon the self-reported sleep habits assessed during the PSQI, we grouped participants into poor (PSQI score  $\geq 5$ ) or good (PSQI score  $< 5$ ) SQ. We compared QOL between groups using independent sample t-tests and Fisher's exact tests. A series of multivariable linear regression models were then constructed to evaluate the independent association between PSQI and QOL ratings after adjusting for age and sex.

**Results:** A total of 99 participants completed both the PSQI and PROMIS 37 questionnaires; 33 were classified as having poor SQ [mean PSQI:  $6.8 \pm 2.0$ ; mean age:  $15.1 \pm 1.0$ ; 56% female] and 66 were classified as having good SQ [mean PSQI:  $2.2 \pm 1.3$ ; mean age:  $15.2 \pm 1$ ; 59% female]. There were no significant demographic differences (age, sex, level of play, hours per week in sports, injury history) between the groups. While the two groups reported similar bed times, the poor SQ group reported taking significantly longer to fall asleep than the good SQ group (mean =  $25.7 \pm 18.6$  vs.  $11.2 \pm 5.5$  minutes;  $p < .001$ ), and woke up one hour earlier than the good SQ group (mean =  $6:10$  AM vs.  $6:28$  AM;  $p < .001$ ). Multivariable regression analysis indicated that worse SQ was significantly associated with higher pain interference ( $\beta = 0.42$ ; 95% CI =  $0.14-0.70$ ;  $p = 0.004$ ), anxiety ( $\beta = 0.48$ ; 95% CI =  $0.16-0.80$ ;  $p = 0.004$ ), depressive symptoms ( $\beta = 0.49$ ; 95% CI =  $0.19-0.80$ ;  $p = 0.002$ ), and fatigue ( $\beta = 0.60$ ; 95% CI =  $0.14-0.70$ ;  $p = 0.004$ ) ratings.

**Conclusion:** Poor self-reported SQ among healthy adolescent athletes is associated with more anxiety and depressive symptoms, fatigue, and pain interference ratings. When treating youth athletes, clinicians should consider assessing sleep hygiene and patterns in order to provide guidance on issues pertaining to reduced QOL.

**1079** Board #313 May 29 3:30 PM - 5:00 PM  
**Examination of Athletic Identity and Quality of Life Related to Sport Participation**  
 Heather E. Key, Toni M. Torres-McGehee, Samantha R. Weber, Rachel Sharpe, Eva Monsma, Mike McCall. *University of South Carolina, Columbia, SC.*  
 (No relevant relationships reported)

Athletes often develop athletic identities over time, which helps an athlete's performance and self-esteem during sport participation but can have negative repercussions once an athlete retires. Preparation for this loss is important in preventing negative mental health consequences and decreases in the quality of life.

**Purpose:** To examine overall quality of life and athletic identity (e.g., immediately after retirement and "now" in retirement) and determine differences across gender, sport type (team vs. individual), and number of years of participating in sport and number of years retired (e.g., 0-5, 6-10, 10-15 year, etc.). **Methods:** Retired athletes (n=125; ages:  $29.1 \pm 11.1$  years; males: n=51; females: n=74) were recruited via convenience sample to participate in an online survey. Each participant completed at minimum of 4 years of high school sports, or  $\geq 2$  years of collegiate athletics, or  $\geq 2$  years of professional sports. The survey included demographic questions, the Athletic Identity Measurement Scale (AIMS) to measure athletic identity (immediately following sport and "now") and the Quality of Life Index (QLI). Basic descriptive, independent samples t-tests and ANOVAs were used. **Results:** A significant difference between gender and AIMS "now" in retirement was found (males:  $31.2 \pm 10.1$ ; females:  $26.4 \pm 7.5$ ;  $P = .003$ ); but no differences were found between gender and QLI total, QLI subscales and AIMS "now" in retirement. No significant differences were found between team vs. individual sport and total QLI and both AIMS. A significant difference was revealed between number of years participating in sport and AIMS immediately following retirement ( $P = 0.02$ ) and QLI-family subscale ( $P = 0.014$ ). There was a significant difference between number of years retired and the QLI-family subscale ( $P = .014$ ); with Tukey post hoc revealing significant differences between years 0-5 and 21-25 ( $6.08 \pm 4.5$  vs.  $12.8 \pm 2.2$ ;  $P = .018$ ). **Conclusion:** Those who played sports longer, had the strongest athletic identities upon retirement. Men are more

likely to maintain a strong athletic identity, even after retirement. Men and women are equally likely to exhibit a decrease in quality of life, in regards to family 25 years post retirement.

**1080** Board #314 May 29 3:30 PM - 5:00 PM  
**Effect of Low Ph Magnesium-sulfate Foam on Night Leg Cramps: A Double-blind Randomized Trial**

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A large portion of the adult population suffers from night leg cramps (NLC); but there are few safe and effective treatment options. Magnesium oxide supplementation has been found ineffective; however, low pH topical foam with magnesium sulfate has not been examined. **Purpose:** Examine the effectiveness of a topical low pH foam with and without magnesium sulfate on NLC spasm frequency, severity/pain and the effects on activities of daily life. **Methods:** A double-blind randomized trial of 36 (females = 27, males = 9) adult participants (age: 52.0 ± 11.9 yrs.; weight: 94.8 ± 24.3 kg; height: 167.9 ± 9.0 cm; body fat%: 39.8%±12.3%) who experienced a minimum of 3-NLCs per week were recruited from local medical facilities in southeast region. Participants were randomized into 2 groups (Control [C] or Intervention [INT]) and completed a 14 consecutive day home-based treatment (Theraworx Relief®). Participants were given 5 bottles of foam (C or INT) to rub on their lower limbs twice a day and in the event of a cramp for the 14 days and completed surveys to assess frequency of NLC, pain levels, restless leg syndrome quality of life questionnaire (RLSQL) and the multi-dimensional fatigue inventory to assess social and daily function, sleep quality, and emotional well-being which were turned in at the end of each week. **Results:** The INT group had significant improvements in post-intervention: total social function ( $P=0.02$ ), total daily function ( $P=0.003$ ), total emotional well-being ( $P=0.03$ ), and total RLSQL ( $P=0.01$ ). Regression models also demonstrated significant improvement within the INT group in emotional well-being (-13.3;  $P=.03$ ), total number of NLCs (-1.9;  $P=.02$ ), and severity x frequency (-12.8;  $P=.02$ ). The C group had significant improvements in daily (-11.5;  $P=.03$ ) and social function (-10.9;  $P=.04$ ). **Conclusion:** Theraworx Relief® with magnesium significantly improved quality of life as measured by domains on the total RLSQL. Although there was no difference in frequency and severity of NLCs between groups, we did see a significant reduction in NLCs within the intervention group. Few evidence-based treatments options are available for NLCs. Given the high prevalence of this condition and potential impact on health and well-being this treatment has the potential to improve health outcomes in patients who suffer with NLCs.

**1081** Board #315 May 29 3:30 PM - 5:00 PM  
**Difference Between USI Humeroulnar Medial Joint Space Measurements Using Gravity-induced Vs. 3kg External Load Valgus Forces**

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 (No relevant relationships reported)

**PURPOSE:** Injuries of the ulnar collateral ligament (UCL) are a common pathology in overhead athletes. Ultrasound imaging is becoming a more common diagnostic tool to diagnose UCL pathology. Ultrasound imaging protocols have been described using external mechanical valgus forces to evaluate medial joint space (MJS) opening as an indicator of joint instability and UCL insufficiency. However, this external mechanical force is often poorly tolerated by athletes with acute injuries. A gravity induced valgus force is often better tolerated, however this method may potentially result in lesser joint space opening. The purpose of this pilot study was to examine differences in joint space opening measurements between these two methods of applying valgus force while performing ultrasound imaging. **METHODS:** Nine asymptomatic NCAA Division I collegiate baseball pitchers (age 20.1 ± 1.3 yrs) participated in this study. Ultrasound images were obtained of the MJS on the participant's throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with elbow position at 30 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the MJS. Ultrasound imaging measurements to evaluate MJS opening were performed from the apex of the trochlea to the apex of the ulna. A 3-kg valgus force, as measured by a hand-held dynamometer, was applied 20 cm distal to the medial epicondyle, and the imaging measurement was repeated. A paired t-test was performed to evaluate differences in joint space measurements between the two test protocols. **RESULTS:** There was no significant difference between the MJS

measurements (mean difference .005cm,  $t = -.743$ ,  $p = .479$ ) using the gravity-induced valgus method (mean opening .441cm, SD .074cm) and the 3kg external force method (mean opening .446cm, SD .071cm).

**CONCLUSIONS:** The results of this pilot study indicate that a gravity induced valgus force during ultrasound imaging of the UCL and MJS may yield similar joint opening compared to a mechanically induced 3kg external force. As external valgus force is often poorly tolerated in the presence of acute injury, gravity induced force may provide for an alternate method of evaluating medial joint space opening. Further research is recommended using larger sample size and symptomatic populations.

**B-69** Free Communication/Poster - Diabetes

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM  
 Room: CC-Hall WA2

**1082** Board #316 May 29 3:30 PM - 5:00 PM  
**Comparison of Two Diabetic Education Programs Designed to Tread Adult-Onset Diabetes Mellitus**

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 (No relevant relationships reported)

**INTRODUCTION:** Diabetes mellitus or adult onset diabetes or type 2 diabetes, is the most common form of diabetes. Millions of Americans are diagnosed with type 2 diabetes every year, and many more are unaware they are at high risk.

**PURPOSE:** The purpose of this study was to compare the diabetic education programs of two certified diabetic dietitians, one with a focus on diet and the other with a focus on exercise, over 6 months, to determine which program was more successful in the treatment of type 2 diabetes.

**METHODS:** Forty participants were randomly selected and separated into two groups. The subject pool was limited to those using oral diabetic medications. All participants had an initial evaluation of body mass index (BMI), hemoglobin A1c, fasting blood sugar, waist circumference, and weight. These measurements were repeated again after three and six months of treatment for analysis. The exercise group and the diet group each included 10 males and 10 females. The exercise (E) group met with their trainer five times per week and the diet (D) group received information about choosing foods to limit impact on blood glucose. A 2 x 3 repeated measures ANOVA was used to determine the effects of an exercise vs diet program.

**RESULTS:** All participants completed their respective programs. The exercise group (10 males, 10 females) were 62.4 ± 8.6 yrs and the diet group (10 males, 10 females) was of 65.1 ± 9.8 yrs. The exercise group (31.9 ± 4.5) had a significant decrease ( $p < 0.05$ ) in BMI at 6 months when compared to the diet group (29.5 ± 4.32). Measurements of A1c (E=6.94±0.7%; D=7.77±1.1%), fasting blood glucose (E=132.2±13.4 mg/dl; D=132.2±16.0 mg/dl), waist circumference (E=40.4±4.5 in; D=45.2±6.5 in), and weight (E=207.9±43.1 lbs; D=222±43.8 lbs) decreased in both groups over the six month study, however, the changes were accelerated in the exercise group resulting in significantly lower values.

**CONCLUSION:** After six months of either an intensive exercise regimen or diet regimen, there were significant decreases seen for all variables. However, the results for the exercise group were associated with accelerated decreases as compared to the diet group by a significant margin. Individualized exercise programs appear to be the most effective at controlling type 2 diabetes with the potential for decreasing the risk of other comorbidities.

**1083** Board #317 May 29 3:30 PM - 5:00 PM  
**Post-Meal Walking Improves Postprandial Glycaemia in Women with Gestational Diabetes Mellitus**

Hannah Christie, Robin Pezzutto, Julie Kinsey, Monique Francois. University of Wollongong, Wollongong, Australia.  
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 (No relevant relationships reported)

**PURPOSE:** To investigate the effects of post-meal walking (PMW) on glycaemic control in women with Gestational Diabetes Mellitus (GDM).

**METHODS:** Eighty women with physician-diagnosed GDM will be randomised to i) Control standard-care alone (CON), or ii) PMW in addition to standard-care, from weeks 28 to 36 of gestation. Participants in the PMW group were advised to perform 10 min of PMW after main meals, whilst the CON group were advised to perform 30 min of daily physical activity. Blood glucose was assessed using continuous Glucose Monitoring (iPro CGM) and physical activity, sedentary time and adherence was assessed using ActivPal accelerometers for 7-days at weeks 28 and 35 of gestation. Fasting glucose was measured from capillary glucometer measures each morning.

**RESULTS:** Preliminary data from nine women with GDM are presented (PMW n=5 and CON n=4). Postprandial, fasting glucose and physical activity did not

differ between the CON and PMW groups during the first 7-day monitoring period. Compared to baseline, the PMW improved the 3-h average glucose after breakfast (-0.35 mmol.L<sup>-1</sup>, p = 0.03) and lunch (-0.34 mmol.L<sup>-1</sup>, p = 0.01), enough to remain in target ranges for blood glucose (5.0 - 7.4 mmol.L<sup>-1</sup>). No difference was seen after dinner in the PMW group (-0.11 mmol.L<sup>-1</sup>, p = 0.22), due to reduced adherence (40%) to PMW after dinner. **CONCLUSIONS:** Preliminary data supports the notion that PMW can improve blood glucose levels after breakfast and lunch in women with GDM when adhered to, however the impact of dinner requires further research. PMW may be an effective adjunct to standard-care for the management of GDM in pregnancy.

**1084** Board #318 May 29 3:30 PM - 5:00 PM

**Accuracy Of A Handheld Blood Glucose Monitor During Exercise And An Oral Glucose Tolerance Test**

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(No relevant relationships reported)

**PURPOSE:** The purpose of the present study was to examine the validity and reliability of a handheld blood glucose monitor during an oral glucose tolerance test (OGTT) and 60-minute bout of exercise.

**METHODS:** A total of 30 subjects (mean age ± SD = 22.3 ± 1.9 yrs; body mass = 77.6 ± 14.2 kg; height = 171.3 ± 9.6 cm; physical activity = 6.2 ± 4.3 hr·wk<sup>-1</sup>) volunteered to participate in a single visit to the laboratory for an OGTT (n=15) or 60-minute treadmill exercise test (n=15). For the OGTT, the subjects were required to visit the laboratory in the morning following an 8-hour overnight fast and ingest a 75-gram load of glucose. For the treadmill test, the subjects were required to walk at 5.6 km·hr<sup>-1</sup> for 60 minutes. Blood glucose concentrations were measured from the fingertip at six different time points during the OGTT (0, 10, 20, 30, 60, and 90 min) and treadmill test (0, 5, 10, 15, 30, and 60 min). Each blood sample was analyzed four times at each time point, two by the reference method and two by the handheld monitor.

**RESULTS:** Our findings indicated that the blood glucose values provided by the handheld monitor were significantly (P < 0.05) greater than the reference method at all time points of the OGTT and treadmill test. In addition, the handheld device exhibited an overall mean absolute relative deviation (±SD) of 9.0 (±7.0) and did not meet the 95% accuracy requirements of ISO 15197:2013 (only 87.2% of all values met the criteria). The Bland-Altman plot for constant error (reference method - handheld monitor) versus the reference method indicated an average negative bias (CE = -8.2 mg·dL<sup>-1</sup>) that increased (r = -0.23) at higher blood glucose values. Intra-device reliability analyses for the handheld monitor on two consecutive measurements taken at the same time points demonstrated the intra-class correlation (ICC) was R = 0.99 and coefficient of variation (CV) = 3.0%, with no mean differences between measurements.

**CONCLUSIONS:** The present findings indicated that the handheld monitor provided highly reliable, yet inaccurately high blood glucose values compared to the reference method during the dynamic conditions associated with an OGTT and exercise.

**1085** Board #319 May 29 3:30 PM - 5:00 PM

**Effects of IT-based Interactive Exercise Education Program on Exercise Duration in Gestational Diabetes Mellitus Patients**

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(No relevant relationships reported)

**Purpose :** Adoption of Information Technology (IT) to promote and manage health behaviors in clinical settings is an emerging modality. This study investigates the effects of IT-based interactive exercise education program on exercise duration in Gestational Diabetes Mellitus (GDM) patients.

**Methods :** For 3 months long study, 49 pregnant women (33.6±3.3 yrs, 161±5 cm, 60.6±13.8 kg, and 23.4±5.1 kg/m<sup>2</sup>, before pregnancy), who were diagnosed GDM at 24-28 weeks of gestation (100 g oral glucose tolerance test; 89±10, 186±26, 179±20, and 148±23 mg/dL, at 0, 60, 120, and 180 min, respectively), agreed to participate. Only those who met study criteria were included in the study. Prior to the study, they were educated how to use and record their on-line life log including exercise duration, intensity and types. They were recommended to participate in exercise program; aerobic activities for 20-30 min/d, a minimum of 150 min/week, at perceived exertion (RPE) of 11-13, and/or 40-60% of heart rate reserve, and strength training 2-3 d/week, 10-15 rep/set, and 2-3 sets. Based on the on-line communication frequencies, they were grouped as less frequent (LF, n=27, as <1 times/week) and highly frequent (HF, n=22, as ≥1 times/week). Statistical software SAS version 9.4 were used and statistical significance was set at p < 0.05.

**Results :** A total of 5,947 life log from 49 participants were acquired. Approximately 88.5% of participants preferred walking as an aerobic exercise mode, and they walked at RPE of 11-13. The communication frequency was 4.5±4.3 times for LF and 24.3±19.4 times for HF (p<0.001). The daily exercise duration was 25.1±28.6 and 51.9±41.9 min/day (p<0.05), and weekly exercise duration was 164±177 and 356±271 min/week in LF and HF, respectively (p<0.05).

**Conclusion :** They met exercise recommendations in terms of exercise duration, intensity, and type. The frequent interactive communications between GDM patients and exercise professionals thru on-line using IT-based exercise behavior data may be effective for the GDM patients to exercise longer.

**B-70 Free Communication/Poster - Exercise Testing I**

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

**1086** Board #320 May 29 3:30 PM - 5:00 PM

**Exercise Stress Echocardiography and Myocardial Perfusion Testing in Pediatric Patients with Coronary Artery Anomalies**

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(No relevant relationships reported)

**Introduction:** Exercise stress echocardiography (echo) detects ischemic wall motion abnormalities. Exercise stress nuclear imaging (Mibi) detects perfusion abnormalities. We present results of Cardiopulmonary Exercise testing (CPET) with simultaneous echo and Mibi in pediatric patients with coronary artery anomalies, including those with other congenital heart disease. **Purpose:** To determine the yield of CPET electrocardiography with two simultaneous imaging techniques (echo and Mibi) in the detection of exercise-induced myocardial ischemia. **Methods:** Retrospective review of CPET with echo and Mibi results in patients with coronary abnormalities (CAA). CAA group was age, gender, and size matched to normals (Control) undergoing CPET only. CPET performed with a ramped cycle protocol with echo and Mibi images obtained at rest and peak exercise. Oxygen consumption (VO<sub>2</sub>), carbon dioxide production (VCO<sub>2</sub>) and respiratory minute volume (VE) were measured throughout exercise. Respiratory exchange ratio (RER), oxygen uptake efficiency slope (OUES), VE/VO<sub>2</sub> and VE/VCO<sub>2</sub> equivalents and VE/VCO<sub>2</sub> slope were calculated at anaerobic threshold (AT) and peak exercise. **Results:** No significant difference in Peak RER. Significant difference was seen in VE/VCO<sub>2</sub> slope and OUES at AT and VE/VO<sub>2</sub>, VE/VCO<sub>2</sub> equivalents and VE/CO<sub>2</sub> slope at peak exercise. At peak, CAA group had 1 patient with significant ST segment depression, another had significant wall motion abnormalities and a third had a perfusion defect. No significant ST depression in the control group.

CPET Results	AT		Peak		OUES	RER
	OUES	VE/VO <sub>2</sub>	VE/VCO <sub>2</sub>	VE/VCO <sub>2</sub> Slope		
<b>Normal (n=9)</b>	20 ± 6	2672 ± 1164	32 ± 5	28 ± 5	25 ± 5	2501 ± 1110
<b>CAA (n=9)</b>	*27 ± 7	*1617 ± 580	**41 ± 8	**34 ± 5	**32 ± 5	1891 ± 681
Inter-group comparisons were made using an unpaired student t-test. *P<0.05, **P<0.01						

**Conclusion:** Both groups had similar exercise intensity. There were significant differences in VE/VO<sub>2</sub>, VE/VCO<sub>2</sub> equivalents and VE/VCO<sub>2</sub> slope at peak exercise suggesting aerobic and ventilatory inefficiency in CAA patients. There was a significant frequency of ischemic response to exercise uncovered equally by each testing modalities. Combined use of Mibi and echo improves diagnostic yield in CAA patients with ischemia.

WEDNESDAY, MAY 29, 2019

**1087** Board #321 May 29 3:30 PM - 5:00 PM  
**Cardiopulmonary Exercise Testing in Pediatric Idiopathic Bronchiectasis**  
 Ronen Bar-Yoseph<sup>1</sup>, Michal Gur<sup>1</sup>, Merav Zucker-Toledano<sup>1</sup>, Gur Mainzer<sup>2</sup>, Vered Nir<sup>1</sup>, Lea Bentur<sup>1</sup>. <sup>1</sup>Ruth Children's Hospital, Rambam Health Care Campus, Haifa, Israel. <sup>2</sup>The Baruch Padeh Medical Center, Poriya, Israel, Poriya, Israel.  
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 (No relevant relationships reported)

**Abstract:**

**Introduction:** Pediatric bronchiectasis etiologies consist mainly of cystic fibrosis (CF), primary ciliary dyskinesia (PCD) and idiopathic. Cardiopulmonary exercise testing (CPET) is gaining importance in clinical medicine and provides clinical insight into overall fitness, exercise limitations, disease prognosis, and therapeutic interventions. While there is growing data on exercise capacity using CPET in pediatric CF and PCD patients, studies on idiopathic bronchiectasis (IB) are scarce. **Purpose:** To compare exercise capacity using CPET in IB vs CF and PCD in pediatric population. **Methods:** Cross-sectional retrospective/prospective controlled study assessing CPET using cycle ergometer. Exercise parameters were compared. **Results:** Forty-two patients with bronchiectasis and 50 controls were evaluated; 12 IB (age 13.4 ± 3.4 y/o, FEV<sub>1</sub>%predicted 84.3 ± 15.3), 9 PCD (11.7 ± 3.6 y/o, FEV<sub>1</sub>%predicted 72.8 ± 23.5) and 21 CF (12.2 ± 3.2 y/o, FEV<sub>1</sub>%predicted 80.7 ± 11.5). Peak oxygen uptake (peak  $\dot{V}O_2$ ) was preserved in IB and CF groups vs. control (2104.0 ± 712.4; 1695.6 ± 537.3; 1937.8.0 ± 718.2 mL/min respectively) while PCD patients had decreased values (1315.0 ± 330.7) vs. IB and control (p < 0.005). Breathing limitation was found in all study groups vs. control; low breathing reserve (25% in IB; 52% CF; 33% PCD; 4% control, p < 0.02) and increased  $\dot{V}E/\dot{V}CO_2$  (IB 29.1 ± 2.6; CF 32.1 ± 4.0; PCD 32.0 ± 4.4; control 27.2 ± 2.1, p < 0.015). Moreover, IB patients had lower  $\dot{V}E/\dot{V}CO_2$  compared to CF patients (p < 0.03). **Conclusions:** CPET parameters may differ between IB and other bronchiectasis etiologies. IB pediatric patients demonstrated preserved exercise capacity and lower  $\dot{V}E/\dot{V}CO_2$  compared to PCD and CF respectively. Larger longitudinal studies are needed to better study exercise capacity in different etiologies pediatric bronchiectasis.

**1088** Board #322 May 29 3:30 PM - 5:00 PM  
**Estimation of Ventilatory Thresholds in Physically Active Subjects During an Incremental Treadmill Test**  
 Romeu C. Silva, Jr, Robson Spolao, Domingos R. Pandelo, Jr, Alexandre Correia Rocha. FEFIS / CAP, Santos, Brazil.  
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 (No relevant relationships reported)

**Purpose:** The aim of the present study is to develop equations to estimate ventilatory thresholds (VT) 1 and 2 in physically active subjects. Such equations can be very useful for training prescription, since most physical education professionals and athletes do not have access to ergospirometric tests.

**Methods:** Fifteen physically active men, age 32.53 ± 11.83 years, with VO<sub>2</sub>peak of 54.17 ± 11.74 ml / kg / min participated in the study. All volunteers underwent a progressive ergospirometric treadmill test, which was maintained at a one percent slope (to simulate the friction of a run on the street) and speed was increased by 1 km/h each stage (2 minutes). This incremental procedure was adopted until the subject reached fatigue. A gas analyzer and a heart rate monitor were used to measure VO<sub>2</sub>peak. The gas analyzer has been calibrated as per manufacturer's specifications. Based on the results, a linear regression was used to estimate the speed in km/h of VT 1 and 2 as a function of the maximum speed (MS) reached, in km/h of the final heart rate (FHR), in beats per minute.

**Summary of Results:** The ventilatory threshold 1 was given by equation 1:

$$VT1 \text{ (km/h)} = 0.160 + 0.745 \text{ (MS)} - 0.004 \text{ (FHR)}$$

In the regression a R<sup>2</sup> of 0.86 (and an R of 0.94) was found, which can be considered a model with a good fit, as a function of the explained variance.

The ventilatory threshold 2 was given by equation 2:

$$VT2 \text{ (km/h)} = -1.043 + 1.054 \text{ (MS)} - 0.007 \text{ (FHR)}$$

In the regression, a R<sup>2</sup> of 0.94 (and an R of 0.97) was found, which can be considered a model with an excellent fit, as a function of the explained variance.

**Conclusion:** According to the results obtained, the proposed equations can be a very useful alternative for estimating ventilatory thresholds 1 and 2, constituting an important instrument, mainly for professionals who do not have access to laboratory measures, according to their applicability and assistance in planning and application of physical activity.

**1089** Board #323 May 29 3:30 PM - 5:00 PM  
**Methodological Considerations for Calculating Ventilatory Efficiency from a Maximal Exercise Test in Apparently Healthy Adults**  
 James E. Peterman, Adam Grim, Leonard A. Kaminsky, FACSM, Mitchell H. Whaley, Bradley S. Fleenor, Matthew P. Harber, FACSM. Ball State University, Muncie, IN. (Sponsor: Matthew P Harber, FACSM)  
 (No relevant relationships reported)

The slope of the relationship between ventilation rate ( $V_E$ ) and rate of carbon dioxide production ( $VCO_2$ ) known as ventilatory efficiency ( $V_E/VCO_2$  slope), is associated with mortality in clinical populations and may have prognostic utility in apparently healthy adults. Despite its prognostic potential, there is currently no standardized method for calculating the  $V_E/VCO_2$  slope in apparently healthy adults. **PURPOSE:** To compare how different methods of data averaging influence the calculation of the  $V_E/VCO_2$  slope from a maximal cardiopulmonary exercise test (CPX). **METHODS:** Two hundred seventy-two apparently healthy adults (49% female, age 44 ± 20 y, body mass index 27.1 ± 5.6 kg/m<sup>2</sup>, VO<sub>2max</sub> 33.3 ± 12.5 ml/kg/min) performed a maximal CPX to determine cardiorespiratory fitness. For each test, the  $V_E/VCO_2$  slope was determined by commercially available metabolic software (ParvoMedics TrueOne 2400) calculating CPX data using time averages of 60, 30, 20, 15, and 10s, and also by averaging every 4 breaths. Pearson correlations and one-way analysis of variance with Dunnett's multiple comparison tests were used to examine differences between averaging methods. The criterion method was the 20s average. **RESULTS:** The different data averaging methods were all significantly correlated to the criterion (all P < 0.001; r = 0.99). However, in comparison to the criterion mean (29.6 ± 4.6), all other methods were significantly different (60s: 29.2 ± 4.6; 15s: 29.7 ± 4.7; 10s: 29.7 ± 4.7; 4-breath: 30.4 ± 4.9; all P < 0.001), with the exception of 30s averaging (29.5 ± 4.6; P = 0.22). The greatest difference from the criterion occurred with the 4-breath averaging method (mean difference -0.9; CI: -1.0, -0.8). **CONCLUSIONS:** The calculation of ventilatory efficiency is impacted by varying methods of data averaging. However, the differences between data averaging methods is small and future research is needed to determine if these differences influence the prognostic utility of ventilatory efficiency in this population.

**1090** Board #324 May 29 3:30 PM - 5:00 PM  
**Comparison of Peak Cardiopulmonary Exercise Parameters in Recumbent Bicycle Versus Treadmill Exercise Testing**  
 Julie C. Fernie, Sonali S. Patel, Roni M. Jacobsen, Christopher M. Rausch. Children's Hospital Colorado, Aurora, CO.  
 (No relevant relationships reported)

The recumbent bicycle (RB) is a novel exercise testing modality that has a patient exercise in a semi-supine position, allowing for increased echocardiographic imaging during exercise compared to a treadmill (TM) test. Previous studies have shown higher peak heart rate (HR) and higher VO<sub>2</sub>peak measured on the TM versus an upright bicycle ergometer (UBE). More recent studies between RB and UBE demonstrate lower peak HR on a RB but no significant difference in VO<sub>2</sub>peak on RB versus UBE. There are no studies that directly compare exercise parameters on the TM to those on a RB. **PURPOSE:** To determine if RB testing yields comparable maximal cardiopulmonary exercise results to the TM. **METHODS:** Patients with a history of non-progressive Kawasaki disease who performed a maximal Bruce TM test and RB test within two years per standard of care were evaluated. All tests were performed on the same metabolic system (MedGraphics). Group differences were evaluated with t-testing. **RESULTS:** Nine children completed maximal tests on both the TM and RB. There were no significant differences in age (TM 13.2 years ± 3.9, RB 14.7 ± 3.7, p = 0.4324), height (TM 154.2 cm ± 18.56, RB 161.6 ± 12.88, p = 0.3454) weight (50.3 kg ± 18.38, RB 55.2 ± 13.70, p = 0.5332) or BMI (TM 20.31 ± 4.22, RB 20.89 ± 3.47, p = 0.7550) between groups. There was no significant difference in peak HR (TM 194 ± 5.5, RB 186 ± 13.5, p = 0.1343) or VO<sub>2</sub>peak (mL/kg/min; TM 47.68 ± 13.15, RB 45.21 ± 13.53, p = 0.7001) between modalities. There was no significant difference in anaerobic threshold (AT; TM 32.24 ± 13.11, RB 27.88 ± 10.26, p = 0.4602) or percentage of VO<sub>2</sub>peak at which AT occurred (TM 67% ± 15, RB 62% ± 10, p = 0.4618). Peak respiratory exchange ratio (RER) was significantly higher on the RB (TM 1.02 ± 0.07, RB 1.11 ± 0.0175, p = 0.0175) and VE/VCO<sub>2</sub> was significantly higher on the TM (TM 27.63 ± 1.73, RB 22.18 ± 3.62, p = 0.0009). **CONCLUSION:** Exercise testing by RB yields comparable peak exercise parameters (HR, VO<sub>2</sub>peak, AT, and AT percent of VO<sub>2</sub>peak) compared to the TM despite a different body position. The significant difference seen in peak RER and VE/VCO<sub>2</sub> between modalities may be due to different positional body mechanics or small sample size.

**1091** Board #325 May 29 3:30 PM - 5:00 PM  
**Twelve-lead Ecg And Echocardiography Evaluation In Division Ii College Athletes**

Ludmila M. Cosio-Lima, Emily Grammer, Cameron Addie, Marisa Straughn, Lauren Adlof, Jeffrey Simpson, Youngil Lee, Amy Crawley. *University of West Florida, Pensacola, FL.*  
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(No relevant relationships reported)

**Twelve-lead ECG and Echocardiography Evaluation in Division II College Athletes**

Ludmila Cosio-Lima, Emily Grammer, Cameron Addie, Marisa Straughn, Lauren Adlof, Jeffrey Simpson, Youngil Lee, Amy Crawley  
 University of West Florida, Pensacola, FL 32514  
 The presence of cardiac abnormalities due to ventricular mass and volume has been documented in elite and Division I College athletes. Due to limited resources, cardiovascular screening among Division II College athletes is scarce or non-existent. **PURPOSE:** To examine ventricular remodeling through electrocardiographic (ECG) characteristics and focused echocardiography (FECH) in Division II college athletes. **METHODS:** Thirty six athletes (males = 18; females = 18) of different ethnicities (Caucasian = 60%, African American = 40%) from basketball (48%), soccer (27%), volleyball (9%) and football (16%) completed cardiovascular screening with a resting 12-lead ECG and focused echocardiography analysis. ECG abnormalities were compared with race, gender, and sports using a mixed model ANOVA. **RESULTS:** Although sports teams were not predictors for an abnormal ECG, 20% of the athletes presented with abnormal ECGs. The highest independent predictor of abnormal ECGs was found in African American males, when compared to Caucasians (65% vs. 32%;  $p = 0.035$ ). African American male athletes had, on average, higher left ventricular mass indexes ( $72 \pm 8$  vs  $66 \pm 8$  g/m<sup>2</sup>;  $p = 0.008$ ), higher mass/volume ratio ( $1.01 \pm 0.11$  vs  $0.98 \pm 0.07$  g/ml;  $p = 0.002$ ), and higher QRS vector magnitudes ( $2.9 \pm 0.5$  vs  $2.4 \pm 0.4$  mV;  $p = 0.002$ ) than Caucasian male athletes. In addition African American athletes demonstrated a significantly greater prevalence of left ventricular hypertrophy compared to Caucasians male athletes (68% vs. 32%;  $p = 0.04$ ) and all female athletes (72% vs. 21%;  $p = 0.001$ ). **CONCLUSIONS:** African American male athletes at the Division II level present with increased concentric ventricular remodeling and ventricular voltage in comparison to Caucasian athletes of both genders. This highlights the need for a greater emphasis to be placed on cardiovascular screenings, specifically for African American males in Division II athletics, as a diagnostic tool to detect early warning signs of cardiovascular irregularities.

**1092** Board #326 May 29 3:30 PM - 5:00 PM  
**Hemodynamic Responses to an Exercise Stress Test in Parkinson's Disease Patients without Orthostatic Hypotension**

Kirk B. Roberson<sup>1</sup>, Joseph Signorile<sup>2</sup>, Carlos Singer<sup>3</sup>, Kevin Jacobs, FACSM<sup>2</sup>, Moataz Eltoukhy<sup>2</sup>, Nicolette Ruta<sup>2</sup>, Nicole Mazzei<sup>2</sup>, Andrew Buskard<sup>2</sup>. <sup>1</sup>Stetson University, DeLand, FL. <sup>2</sup>University of Miami, Coral Gables, FL. <sup>3</sup>University of Miami, Miami, FL. (Sponsor: Dr. Kevin Jacobs, FACSM)  
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The presence of postganglionic sympathetic denervation is well established in Parkinson's disease (PD). Denervation at cardiac and peripheral blood vessel sites may lead to abnormal cardiovascular and hemodynamic responses to exercise. **PURPOSE:** The aim of the present investigation was to examine how heart rate (HR) and hemodynamics are affected by an exercise test in PD patients without orthostatic hypotension. **METHODS:** Fourteen individuals with PD and sixteen age-matched healthy controls performed an exercise test on a cycle ergometer. HR, blood pressure, and other hemodynamic variables were measured in a fasted state during supine rest, active standing, exercise, and supine recovery. **RESULTS:** Peak HR and percent of age-predicted maximum HR (HRmax) achieved were significantly blunted in PD (MD=9,  $p < .05$ ; MD=5,  $p < .01$ ). HRmax remained significantly elevated in PD at minutes five (MD=7,  $p = .03$ ) and ten (MD=6, SE=2,  $p < .05$ ) of recovery, compared to controls. Systolic, diastolic, and mean arterial pressures were significantly lower at multiple time-points during active standing in PD compared to controls, but not a peak exercise. Systemic vascular resistance (SVRi) decreased significantly at the onset of exercise in PD compared to control (Stage 1: MD=-335.9,  $p = .03$ ), and remained significantly lower during exercise (Stage 2: MD=-338.6,  $p = .01$ ) and the first minute of supine recovery (MD=-328.6,  $p = .02$ ). End diastolic volume (EDVi) was significantly lower in PD during supine rest (MD=-10.2,  $p = .04$ ) and at minutes one (MD=-9.7,  $p = .01$ ) and five (MD=-7.1,  $p = .04$ ) of recovery. **CONCLUSIONS:** Our results indicate for the first time that normal hemodynamics are disrupted during orthostatic stress and exercise in PD. Despite significant differences in EDVi at rest and during recovery, and SVRi during exercise, cardiac index was not affected. Our finding of significantly blunted HRmax and HR recovery in PD patients has substantial implications for exercise prescription and recovery guidelines.

**1093** Board #327 May 29 3:30 PM - 5:00 PM  
**Influences Of Race And Body Composition On Vo2 Peak: Findings From The Activity Counseling Trial**

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 (No relevant relationships reported)

Previous studies suggested blacks have lower estimated cardiorespiratory fitness (CRF) levels compared to whites, reflecting a higher burden of obesity among blacks. Lesser known are the joint effects of race and measures of obesity on directly measured CRF. **PURPOSE:** To characterize the impact of obesity [body mass index (BMI) and body fat percent (% fat)] on directly measured CRF in blacks and whites. **METHODS:** We included 874 Activity Counseling Trial participants (24.8% self-reported blacks) who completed maximal oxygen uptake (VO<sub>2</sub> peak) treadmill exercise test, BMI, and percent body fat, determined by skinfold measurement, at baseline. Linear regression models were constructed with VO<sub>2</sub> peak as the outcome and adjusted for age, sex, race, socioeconomic status, BMI, % body fat, and cardiovascular risk factors. **RESULTS:** VO<sub>2</sub> peak indexed to body mass was substantially lower in blacks (20.40 vs 26.70 ml/kg/min,  $p < .0001$ ), reflecting higher indices of obesity in blacks (BMI: 32.73 vs 28.32,  $p < .0001$ ; % body fat 36.58 vs 31.44,  $p < .0001$ ). Similar findings were observed comparing absolute VO<sub>2</sub> peak (1919.18 vs. 2229.72 ml/min,  $p < .0001$ ). In multivariable adjusted models, black race was strongly associated with both lower absolute and indexed VO<sub>2</sub> peak [Std. Beta (blacks vs. whites = -0.12 & -0.14 respectively  $p < 0.0001$  for both)]. There was a significant interaction between race and both BMI ( $p < .0001$ ) and % body fat ( $p < .0001$ ) on indexed VO<sub>2</sub> peak. In race-stratified analyses, we observed a modestly weaker association between BMI and VO<sub>2</sub> peak in blacks (see Table). Similar findings were observed for % body fat. **CONCLUSIONS:** Directly measured VO<sub>2</sub> peak is lower in blacks reflecting a higher burden of obesity. Nevertheless, the impact of obesity on VO<sub>2</sub> peak is modestly greater among whites, suggesting excessive adipose tissue has a slightly more negative impact on VO<sub>2</sub> peak among whites.

Table: Association between measures of BMI, % body fat and indexed VO<sub>2</sub> peak in blacks and whites.

	Blacks	Whites	Intercept p-value
	Std. Beta	Std. Beta	
BMI	-0.32	-0.40	<.0001
% Body fat	-0.37	-0.50	<.0001

**1094** Board #328 May 29 3:30 PM - 5:00 PM  
**Influence of an Exercise Program on Cardiopulmonary Exercise Testing Derived Variables**

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 (No relevant relationships reported)

Cardiopulmonary exercise testing (CPX) has emerged as a useful tool in assessing disease severity and prognosis in clinical populations. Yet, little is known about the trainability of specific variables, aside from cardiorespiratory fitness (CRF), particularly in apparently healthy individuals. **PURPOSE:** The purpose of this study was to evaluate the changes in oxygen consumption at ventilatory threshold (VO<sub>2</sub> at VT), oxygen uptake efficiency slope (OUES), ventilatory power (VP; systolic blood pressure/VE/VCO<sub>2</sub> slope) and circulatory power (CP; peak SBP x VO<sub>2max</sub>) which is a surrogate for cardiac power in apparently healthy adults following an exercise program. **METHODS:** Participants (n=79, 34 males/45 females, age 51.3±1.5 years, body mass index 29.0±0.7 kg/m<sup>2</sup>) performed a maximal VO<sub>2max</sub> test before and after ~6 months of exercise training to determine VO<sub>2</sub> at VT, OUES, CP, and VP. Statistical analysis used were matched paired t-tests. **RESULTS:** VO<sub>2</sub> at VT (ml/kg/min) increased in the total sample (Pre: 19.8±0.4 vs. Post: 20.7±0.4,  $p = 0.001$ ), males (Pre: 20.7±0.7 vs. Post: 22.3±0.8,  $p = 0.0024$ ), and females (Pre: 16.9±0.6 vs. Post: 18.5±0.8,  $p = 0.0003$ ). CP (ml/kg/min-mmHg) increased in the total sample (Pre: 5428.9±136.0 vs. Post: 5655.6±123.4,  $p = 0.001$ ), males (Pre: 5790.1±294.7 vs. Post: 6254.0±243.3,  $p = 0.0142$ ), and females (Pre: 4130.0±175.5 vs. Post: 4808.6±197.5,  $p = 0.001$ ). OUES increased in males only (Pre: 2.3±0.1 vs. Post: 2.5±0.1,  $p = 0.0013$ ). VP (mmHg) did not increase in any group. **CONCLUSION:** VO<sub>2</sub> at VT and CP can be altered with exercise training, independent of sex, while the adaptability of OUES appears to be sex-specific. Additionally, VP is not influenced by exercise training. Future research should explore the sex-specific response of CPX-variables to exercise training.



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**Dichotomy In The Mechanism Of Ramp-incremental Exercise Intolerance In Chronic Heart Failure**

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Chronic heart failure (CHF) is a complex multifaceted disease that has wide ranging detrimental effects on each step in the delivery and utilization of O<sub>2</sub>, irrespective of CHF etiology. Aerobic capacity (VO<sub>2peak</sub>) is reduced and exercise tolerance is limited by fatigue and/or dyspnea. Exercise intolerance is the strongest predictor of mortality in CHF. Whether fatigue or symptoms is the primary mechanism of exercise intolerance in CHF is unknown.

**PURPOSE:** To use an innovative ramp-incremental cardiopulmonary exercise test (RI-CPET) to investigate whether fatigue or symptoms predominate as the mechanism of exercise limitation in CHF.

**METHODS:** Sixteen CHF patients (left ventricular ejection fraction (LVEF) = 28 ± 8 %) completed RI-CPET to intolerance that ended with measurement of maximal voluntary isokinetic power (MVIP) at VO<sub>2peak</sub>. MVIP was measured during 4-5 s of maximal effort. At VO<sub>2peak</sub> comparison of MVIP with peak RI-work rate (RI-WR<sub>peak</sub>) identified fatigue (inability to increase MVIP above RI-WR<sub>peak</sub>) or symptoms (MVIP > RI-WR<sub>peak</sub>) as the primary mechanism of exercise intolerance. Breath-by-breath VO<sub>2</sub> was measured throughout.

**RESULTS:** At VO<sub>2peak</sub> (n = 16; VO<sub>2peak</sub> = 17.2 ± 5.2 ml·kg<sup>-1</sup>·min<sup>-1</sup>), MVIP was greater than RI-WR<sub>peak</sub> (213 ± 132 vs. 109 ± 44 W; p = 0.002). However, two patterns of response emerged: (1) MVIP not different to RI-WR<sub>peak</sub> (n = 6; 144 ± 66 vs. 115 ± 47 W; p = 0.547); (2) MVIP > RI-WR<sub>peak</sub> (n = 10; 256 ± 145 vs. 105 ± 44 W; p = 0.002). There was no difference in VO<sub>2peak</sub> (19.1 ± 4.9 vs. 16.1 ± 5.3 ml·kg<sup>-1</sup>·min<sup>-1</sup>; p = 0.268) or LVEF (28 ± 8 vs. 29 ± 7 %; p = 0.827) between these two sub-groups.

**CONCLUSION:** These data suggest that a maximum voluntary isokinetic measurement, at the end of a standard RI-CPET, may identify CHF patients in whom exercise intolerance is limited by the capacity of the neuromuscular system to generate power (the 'fatigue' group: MVIP ≤ RI-WR<sub>peak</sub>) compared with those in whom exercise was limited with a substantial reserve in the power producing capacity of the neuromuscular system (the 'symptoms' group: MVIP > RI-WR<sub>peak</sub>). This dichotomy in mechanism of RI-CPET exercise limitation was independent of VO<sub>2peak</sub> or LVEF. This variability in the mechanism of exercise limitation, objectively identified using an innovative RI-CPET, may have implications for targeting treatment to optimize outcomes in CHF.

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**6-minute Walk Work (6-mww) Better Correlates With Vo<sub>2</sub>Peak Than 6-minute Walk Distance (6-mwd)**

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**PURPOSE:** Results from the 6-Minute Walk Test (6-MWT) are often used clinically as a surrogate measure of physiologic function (aerobic capacity) despite the fact that distance alone is not a determinant of work performed and hence not a measure of energy expenditure (Chung et al. *Respir Med.* 2001; 95: 618). Therefore, we hypothesized that expressing the distance covered during a 6-MWT relative to body weight (6-minute walk work, 6-MWW) would be more closely associated with VO<sub>2peak</sub> than 6-MWT distance (6-MWD) alone

**METHODS:** 187 adult survivors of a variety of cancer types (115 females) underwent the validated University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI) maximal exercise test, exercising to volitional fatigue. VO<sub>2peak</sub> was estimated using ACSM walking equations. One week later subjects completed the 6-MWT as described by the American Thoracic Society (*Am J Respir Crit Care Med.* 2002;166:111). 6-MWW (m·kg) was calculated (6-MWD (m) X body weight (kg)). Means and standard deviations were generated for the variables of interest. Correlational analysis was performed to explore the relationship between 6-minute walk outcomes and estimated VO<sub>2peak</sub>.

**RESULTS:** Subjects weighed 81.2 ± 23.7 kg, were 61.5 ± 13 years old, and covered 485 ± 107 m during the 6-MWT. 6-MWW averaged 38816 ± 12190 kg·m and cost 1.89 ± 0.68 L of O<sub>2</sub>/min of activity. The correlation coefficient (r) between estimated VO<sub>2peak</sub> and 6-MWD and 6-MWW were 0.479 and 0.758 respectively. Correlation

coefficients between gender and 6-MWD and 6-MWW were similar and moderate in males (0.517 and 0.537 respectively) and disparate in females (0.482 and 0.871 respectively).

**CONCLUSIONS:** The strong correlation between VO<sub>2peak</sub> and 6-MWW suggests that this derived outcome measure provides a more clinically useful biomarker of physiologic status in a population of cancer survivors than 6-MWD. Because 6-MWD is a well-recognized biomarker of physical functional status, clinicians might report both 6-MWD and 6-MWW to create a more complete assessment of their patients with a history of cancer. The strength of these associations supports developing a predictive equation for VO<sub>2peak</sub> based on 6-MWW. However, the gender disparity in r values supports the direct assessment of aerobic capacity rather than relying on a surrogate measure such as the 6-MWW.

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**Cancer Exercise Rehabilitation Training - A Case Study**

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Cancer exercise therapy has been shown to increase physical function, reduce fatigue and build self-confidence. There is a gap in the research pertaining to the implementation of a cancer therapy program in a setting that would be effective and easily replicated. **PURPOSE:** The purpose of this study was to show the effectiveness of the implementation of cancer exercise therapy with a breast cancer survivor in a local fitness facility. **METHODS:** The Rocky Mountain Cancer Rehabilitation Institute (RMCRI) (Colorado, USA) has developed a protocol for the assessment and implementation of a cancer exercise rehabilitation program. RMCRI's protocol utilizes a "phase" system to guide the exercise prescription for each participant very similar to cardiac rehabilitation treatment plans. The guidelines were implemented by the exercise physiologist who conducted this research. Additionally, the researcher also sat for and passed the ACSM's Certified Cancer Exercise Trainer certification exam prior to conducting the training. The exercise session consisted of 60 minutes of resistance and flexibility exercises specifically prescribed for the patient. The patient's heart rate and oxygen saturation were monitored during each session. The study was for 16 weeks three times per week. **RESULTS:** A pre and post fitness assessment was administered to the patient. The largest improvements were found in balance, muscular strength, core stability, and cardiorespiratory fitness. Balance improved by 75%, core stability improved by 100%, and cardiorespiratory endurance (VO<sub>2peak</sub>) improved by 16.7%. There were also large percent increases in 1RM for leg extension (70%), leg press (68%), shoulder press (64%), and chest press (29%). QOL index measures also increased 33% during the intervention. **CONCLUSIONS:** The results of this case study suggest that successful implementation of an exercise therapy program can be effective in a health and fitness center. With the growing number of cancer survivors there will be an increased need for the development of cancer exercise training that is easy to implement in a local fitness facility. This study shows the relative ease of implementation in a community based fitness facility.