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Location of Urban Green Spaces with Emphasis on Effective Quality Factors Using Fuzzy AHP Method

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Abstract: Literature indicates that comparative ratios provide ambiguous and inaccurate judgments in many cases. Quality forecasts have been relatively more successful when compared to quantitative estimates. The uncertainty in preferential judgment leads to uncertainty in classification of other options and difficulty in stabilization of preferences. The objective of this article was to study and evaluate the effective quality factors in Location of the urban green spaces and their prioritization by using Fuzzy AHP method. This study offers a formulated strategy based on different views and expert opinions. The analysis for factor prioritization is to be performed in many ways to include different views and opinions. The analysis potentially presents the undefined relations in the applications of integrated and formulated strategies in different time spans. This analysis may provide a conclusive approach in location of decision making process to urban landscape designers. It provides an increased capability for identifying the factors and priorities that lead to the selection of a suitable site among many options.
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Keywords: Designing City View, Quality Factors, Fuzzy AHP Method, Factor Analysis, Factor Prioritization.

Introduction

Traditionally, green space location would be decided based on common approaches without regard to quality requirements. Any empty space would get a green space label. This space would be added to per capita green space merely based on its area without considering any of the important quality factors.

The extended application of mathematical and computer modeling together with quantitative analysis has come to the aid of decision making processes. They have been helpful in scientific and improved design processes. Now, proper location of urban green spaces has become an important aspect of urban landscape design.

Uncertainty in the proper location always occurs when considering the diversity, changeability, and complexity of environmental factors that influence urban green spaces. The complexity attributed to environmental protection issues has rendered location based on a single criterion, i.e. per capita green space, ineffective. Decision making based on multiple criteria is now increasing in popularity.

The basic factors used in location of decision making process for landscape architectural design should be clearly converted from common principles into mathematical concepts. The rules and principles of the method should be defined as the first step. Then, the effective factors shall be assessed using the evaluation method. This method is an effective substitute for the classical methods. Fuzzy AHP is an advanced analytical method vis-à-vis the classical AHP method. AHP method is a simple approach. However, it may lead to uncertainty in decision making when considering both qualitative and quantitative factors. The underling uncertainty may produce poor judgment and, consequently, inappropriate decisions.

Researchers have studied fuzzy AHP which is an extension of Saaty theorem. They have argued that fuzzy AHP produces sufficient explanation for various decision making processes when compared with the classical AHP method.

Weck et al. applied fuzzy AHP to study the production cycle alternatives. Cebi and Kahraman used fuzzy AHP to determine multi criteria for the selection of real estate for transportation companies. Kuo et al. devised a decision support system for selecting convenience store location through integration of fuzzy AHP and artificial neural network. Cheng offered a new algorithm for evaluating the naval tactical missile systems by fuzzy AHP based on the grade value of membership function.

Complicated systems show human experience and judgment in the form of ambiguous linguistic patterns. A better presentation of linguistic could be in the form quantitative data series. These data sets can be corrected by using the analytical methods of fuzzy set theorem. Classical AHP methods are commonly used in relatively palpable (non-fuzzy) decision making processes. These methods involve various degrees of biased judgment.

Classical AHP methods do not take into account the uncertainties related to the mental judgments of AHP that affect the selection and prioritization of criteria for a successful decision making. Classical AHP is still unable in reflect

human thinking styles. Fuzzy AHP was proposed to avoid risks during implementation. It is a fuzzy format for solving fuzzy hierarchy problems.

Fuzzy AHP Analysis

AHP is a structured approach for organization and analysis of complicated decision making scheme. Thomas L. Saaty proposed this technique in 1970 based on mathematics and psychology principles. The original method has been studied and modified many times. AHP approach has special application in decision making. This method is used around the world for decision making in various fields including government, business, industry, health, and education.

AHP helps decision makers to identify the right decision. The right decision is the one which is the most appropriate for a given objective according to the understanding of the decision maker(s) of the problem under consideration. AHP provides a logical and comprehensive framework for a decision making process. This framework provides for quantification and definition of elements that are critical in making decisions which could contribute to achieving the overall objectives. An AHP user breaks down the problem into a hierarchy of simpler problems that could individually be analyzed. Elements of the hierarchy should explain every aspect (tangible and intangible) of decision making process. They could further measure, estimate, and define - totally or partially - any factor that is useful in the decision making process.

Fuzzy AHP is an approach for classifying decision making options in order to select the best option when decision maker has multi criteria. This approach answers this question: "which option?" Decision maker uses fuzzy AHP to select options that fit the best with the decision criteria. The selection process involves the classification of decision making options using a quantitative scoring scheme. Every decision option is classified against decision criteria.

Many applications have been proposed using fuzzy AHP. This study uses Extent Analysis method proposed by Chang on the chosen problem. Extent analysis method of fuzzy AHP depends on the feasibility degree of every criterion. Triangular fuzzy numbers are assigned to linguistic variables based on responses received on questionnaire forms. These numbers establish a given level in the hierarchy of pairwise comparison matrix. The result of every matrix level and a new set (l, m, u) is calculated. Values for l_i / l_i, m_i / m_i, u_i / u_i, $(i=1,2,. . . , n)$ are calculated to find a triangular fuzzy number for each criteria in the same way the last M_i

(l_i, m_i, u_i) set for M_i criteria is used in the process. Membership function is constructed for each criterion in the next step and their commonalities are identified through pairwise comparison.

A common point is found for each comparison in fuzzy logic. The membership number for each point is mapped to its weight. The degree of membership can be defined as the feasibility of that amount. The minimum degree of feasibility that is attributed to a given criterion is measured in conditions that feasibility is highest relative to others. This feasibility is also considered as weight of the criterion before normalization. The weight of every criterion obtained through this process is normalized and named as the degree of importance or the final weight for hierarchy.

In applying the extend analysis of Chang to hierarchical processes, every criterion is selected and is subjected to extend analysis, which is identified as g_i. Therefore, m limit analysis for each criterion can be calculated from the following formula:

The objective of this formula is to obtain a value for g_j where the set $(i=1; 2; 3.... n)$ and all of M_{gj}^{j} $(j=1; 2.... . m)$ are triangular fuzzy numbers (TFNs). The analysis steps of Chang are discussed below.

Step 1: Fuzzy Number

The fuzzy number of combined limit of S_i is defined in formula 1 after considering the hierarchical criterion.

$$S_i = \sum_{j=1}^{m} M_{gi}^{j} \otimes [\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j}]^{-1} \tag{1}$$

Formula 2 is obtained next.

$$\sum_{j=1}^{m} M_{gi}^{j} \tag{2}$$

Limit analysis of m for a given matrix is given in formula 3 after fuzzification process.

$$\sum_{j=1}^{m} M_{gi}^{j} = (\sum_{j=1}^{m} lj \; ; \sum_{j=1}^{m} m_j \; ; \sum_{j=1}^{m} uj \;) \tag{3}$$

A new set of (l, m, u) is calculated to be used in formula 4.

$$[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j}]^{-1} \tag{4}$$

In this set l is the lowest limit, m is the highest possible number, and u is the highest limit. Formula 5 is obtained after fuzzification of M_{gj}^{j} $(j=1; 2; 3.... . m)$.

$$\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} = (\sum_{j=1}^{m} lj \; ; \sum_{j=1}^{m} m_j \; ; \sum_{j=1}^{m} uj \;) \qquad (5)$$

Reverse vector analysis of formula 5 produces formula 6 as explained below.

$$[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} \;]^{-1} = \{ \frac{1}{\sum_{j=1}^{m} uj} ; \frac{1}{\sum_{j=1}^{m} m_j} ; \frac{1}{\sum_{j=1}^{m} lj} ;] \qquad (6)$$

Step 2: Feasibility Degree of $M_2 = (l_2 \; ; m_2 \; ; u_2 \;) \geq M_1 = (l_1 \; ; m_1 \; ; u_1 \;)$ is defined as formula 7: **x** and **y** represent the numbers on axis of the function for each criterion.

These terms are treated equally in formula 8.

In this formula, **d** is the highest common point

$$V(M_2 \geq M_1) = \begin{cases} 1 & if \; m_2 \geq m_1 \\ \\ \dfrac{l_1 - u_2}{(l_1 - u_2) + (u_1 - l_2)} & otherwise \end{cases} \qquad (8)$$

between μ_{M1} and μ_{M2}. We need values for **V (M2 $\geq$ M1)** and **V (M1 $\geq$ M2)** in order to compare **M1** and **M2**.

Step 3: Convex Fuzzy Number
The feasibility degree of a convex fuzzy number greater than the convex fuzzy number **k** is obtained from **M$_i$ (i = 1, 2, 3, 4, 5, ... , k)** which is defined by the least number for **V (M $\geq$ M$_i$), i = 1, 2, 3, 4, 5, ... , k**.
We assume **k $\neq$ i for k = 1, 2, 3, 4, 5, ... , n** in order to calculate the weighted vector in formula 9.
d (Ai) = min V (Si$\geq$Sk)   (9)
In this equation **A$_i$ (i=1, 2, 3…. n)**
Step 4: Normalization
Normalized weighted vectors in formula 10 are:
W = (d^T(A1), d^T (A2), d^T d^T (A3), d^T (A4), d^T (A5), d^T (A6), ..., dd^T (An) $)^T$ (10)
W are non-fuzzy numbers.

Effective Quality Factors in Location of Urban Green Space

Effective quality factors were identified by reviewing the available journal articles relevant to the evaluation of urban green spaces and by interviewing the experts in the field. Nine criteria

(7)

were identified as effective quality factors: Sustainability, Aesthetics, Safety, Connectivity and Accessibility, Legibility, Desirability, Dependency, Adaptability, Biodiversity.

A questionnaire was prepared to determine the degree of significance for each factor. The respondents were asking to select the related linguistic variables to be used in the evaluation of the questions. Triangular fuzzy numbers proposed by Chang are adapted for quantifying the evaluation based on the provided scale. The results are, then, expanded (Table 1).

Table 1 - Fuzzy Numbers (Chang)

Number	Qualification
(7/2,4,9/2)	Very Strong
(5/2,3,7/2)	Strong
(1,1,1)	Equal
(3/2,2,5/2)	Weak
(2/3,1,3/2)	Very Weak

This study used fuzzy analysis in location of decision making based on the selected criteria. Thirty questionnaires were distributed to expert individuals in order to devise a suitable model for location of urban green spaces. Pairwise comparisons were carried out on proposed sites by considering every criterion with special emphasis on quality factors. The comparisons were based on fuzzy indexes provided in table 1.

The followings are two samples of the questions on the questionnaire.

Question 1: How significant is factor 1 relative to factor 2?

Question 2: What is the priority of site 1 vis-à-vis site 2 over factor 1?

Questions were organized in a table before distribution to the experts. These questions are identical for both classical AHP and fuzzy AHP. The significance weights are calculated by using the method proposed for each approach.

For example, contiguity and accessibility are reported as weak when comparing site 1 with site. The number reported in the table for this comparison is (2/3, 1, 3/2). It means that the accessibility of site 2 is more suitable than site 1. The suitability is presented by triangular fuzzy numbers. Similarly, answers obtained from thirty questionnaires were evaluated using fuzzy AHP formulas.

Respondents had one week to fill out the questionnaires. This time was given to provide enough time to experts to visit the site and evaluate their location of criteria. The results of analysis are presented in the next table.

Criteria were identified and compared for best fit according to fuzzy AHP method. The criteria were calculated by using the relevant process and classified based on the given hierarchy.

The following calculations were performed to obtain significance numbers for the first level.
Step1:

$$\left(\sum_{j=1}^{m} lj \; ; \sum_{j=1}^{m} m_j \; ; \sum_{j=1}^{m} uj \; ; \right) = (79.36, 98.75, 123.05)$$

$$\left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (0.01, 0.01, 0.013)$$

$$S1 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (10.17, 13, 15.5) \otimes (0.0.01, 0.0.01, 0.013) = (0.083, 0.132, 0.195)$$

$$S2 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (14, 17, 20.5) \otimes (0.0.01, 0.0.01, 0.013) = (0.114, 0.172, 0.258)$$

$$S3 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (14.07, 17.5, 21.17) \otimes (0.0.01, 0.0.01, 0.013) = (0.114, 0.175, 0.267)$$

$$S4 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (7.34, 9.58, 12.69) \otimes (0.0.01, 0.0.01, 0.013) = (0.60, 0.97, 0.160)$$

$$S5 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (8.19, 9.83, 12.07) \otimes (0.0.01, 0.0.01, 0.013) = (0.67, 0.100, 0.152)$$

$$S6 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (7.40, 9.17, 11.97) \otimes (0.0.01, 0.0.01, 0.013) = (0.60, 0.93, 0.151)$$

$$S7 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (5.64, 7.17, 9.47) \otimes (0.0.01, 0.0.01, 0.013) = (0.46, 0.73, 0.119)$$

$$S8 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (6.80, 8.17, 9.97) \otimes (0.0.01, 0.0.01, 0.013) = (0.55, 0.83, 0.126)$$

$$S9 = M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \quad \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = (5.75, 7.33, 9.73) \otimes (0.0.01, 0.0.01, 0.013) = (0.47, 0.74, 0.123)$$

Step2: Using these vectors,
V(S1>S2) = 0.67 ; V(S1>S3) = .064; V(S1>S4)= 1; V(S1>S5)= 1; V(S1>S6)= 1; V(S1>S7)= 1; V(S1>S8)= 1; V(S1>S9)= 1
…………
V(S9>S1)= 0.41;V(S9>S2) = 0.08 ;V(S9>S3) = .007;V(S9>S4)= 0.73;V(S9>S5)= 0.69;V(S9>S6)= 0.77; V(S9>S7)= 1; V(S9>S8)= 0.89;

Step3: Thus the weight vector from step2 is found as:
W^t = (0.64, 0.97, 1, 0.36, 0.33, 0.30, 0.05, 0.11, 0.07)

Step4: With normalize, W_{Goal} = (0.167, 0.253, 0.262, 0.095, 0.086,.079, 0.012,.028,0.020)
With similar calculate for each of items related with 9 factors. (Table2)

Table 2- Matrix of criteria based on EA method - AHP Fuzzy

Criteria	Aesthetics	Safety	Sustainability	Connectivity and accessibility	Legibility	Dependency	Desirability	Biodiversity	Adaptability
Aesthetics	1.00 1.00 1.00	0.67 1.00 1.50	1.50 2.00 2.50	0.67 1.00 1.50	0.67 1.00 1.50	1.50 2.00 1.50	2.50 3.00 3.50	1.00 1.00 1.00	0.67 1.00 1.50
Safety	0.67 1.00 1.50	1.00 1.00 1.00	0.67 1.00 1.50	3.50 4.00 4.50	2.50 3.00 3.50	0.67 1.00 1.50	1.50 2.00 2.50	2.50 3.00 3.50	1.00 1.00 1.00
Sustainability	0.40 0.50 0.67	0.67 1.00 1.50	1.00 1.00 1.00	2.50 3.00 3.50	1.50 2.00 2.50	2.50 3.00 3.50	2.50 3.00 3.50	1.50 2.00 2.50	1.50 2.00 2.50
Connectivity and accessibility	0.67 1.00 1.50	0.22 0.25 0.29	0.29 0.33 0.40	1.00 1.00 1.00	0.67 1.00 1.50	0.67 1.00 1.50	0.67 1.00 1.50	2.50 3.00 3.50	0.67 1.00 1.50
Legibility	0.67 1.00 1.50	0.29 0.33 0.40	0.40 0.50 0.67	0.67 1.00 1.50	1.00 1.00 1.00	2.50 3.00 3.50	1.00 1.00 1.00	1.00 1.00 1.00	0.67 1.00 1.50
Dependency	0.67 0.50 0.67	0.67 1.00 1.50	0.29 0.33 0.40	0.67 1.00 1.50	0.29 0.33 0.40	1.00 1.00 1.00	0.67 1.00 1.50	0.67 1.00 1.50	2.50 3.00 3.50
Desirability	0.29 0.33 0.40	0.40 0.50 0.67	0.29 0.33 0.40	0.67 1.00 1.50	1.00 1.00 1.00	0.67 1.00 1.50	1.00 1.00 1.00	0.67 1.00 1.50	0.67 1.00 1.50
Biodiversity	1.00 1.00 1.00	0.29 0.33 0.40	0.40 0.50 0.67	0.29 0.33 0.40	1.00 1.00 1.00	0.67 1.00 1.50	0.67 1.00 1.50	1.00 1.00 1.00	1.50 2.00 2.50
Adaptability	0.67 1.00 1.50	1.00 1.00 1.00	0.40 0.50 0.67	0.67 1.00 1.50	0.67 1.00 1.50	0.29 0.33 0.40	0.67 1.00 1.50	0.40 0.50 0.67	1.00 1.00 1.00
weight	0.167	0.253	0.262	0.095	0.086	0.079	0.012	0.028	0.02

Table 3 provides a sample calculation for fuzzy evaluation matrix.

Table 3 - Importance coefficient of criteria and alternatives- AHP fuzzy

Criteria / Alternatives	Aesthetics	Safety	Sustainability	Connectivity and accessibility	Legibility	Dependency	Desirability	Biodiversity	Adaptability	Result
Weight	0.167	0.253	0.262	0.095	0.086	0.079	0.012	0.028	0.020	
Site1	0.217	0.144	0.195	0.290	0.228	0.264	0.220	0.201	0.285	0.205
Site2	0.297	0.220	0.226	0.173	0.301	0.242	0.245	0.324	0.257	0.243
Site3	0.277	0.255	0.211	0.196	0.203	0.283	0.289	0.124	0.101	0.233
Site4	0.142	0.196	0.168	0.115	0.102	0.105	0.083	0.262	0.303	0.159
Site5	0.017	0.087	0.184	0.212	0.093	0.082	0.128	0.033	0.044	0.111
Site6	0.050	0.099	0.016	0.014	0.073	0.025	0.035	0.056	0.009	0.049

Conclusions

1. The current policy in urban design is to give equal weight to quality factors compared to the quantitative factors that traditionally have been used to evaluate types of green spaces to meet various needs of target users.

2. Site selection based on proper quality criteria is a part of the location of requirements for urban green space.

3. Consideration of quality criteria makes it easier to achieve location of objectives for urban

green spaces that are more congruent with environmental protection requirements.

4. Location of urban green spaces are a fuzzy decision making problem that involves judgment about many quality factors. This study presented a multi criteria decision making method established based on fuzzy mathematical analysis method. This method improves the certainty of decision making.

5. An evaluation model can be made by using a systematic analytical method intended to evaluate the relation between factors, layers, and sub factors that are effective in location of urban green spaces.

6. Meeting the study objectives in location of urban green spaces based on expert opinions and careful planning required many details. Using different method before offering a suitable design may be beneficial in obtaining useful results and improving productivity.

References

1. Anderson, P. 1999. Complexity Theory and Organization Science Organization Science.
2. Ann Arbor. and Ulrich's Kaplan, (2004) Humanscape : Environments for People,
3. Bishop.D. and Rohrmann.B. (2003)Subjective responses to simulated and real environments: a comparison, Landscape and urban planning Journal, Vol 65, Amsterdam : Elsevier Press.
4. Booth, N. K. 1983: Basic Elements of Landscape Architectural Design, New York: Elsevier Science Publishing Co., Inc.
5. Bouyssou, D. et al. (2000) Evaluation and Decision Models: A Critical Perspective, Boston: Kluwer Academic Publishers.
6. Cebi, S. and Kahraman, C. (2010) Fuzzy multi criteria group decision making for real estate investments, Proceedings of The Institution of Mechanical Engineers Part I-journal of Systems and Control Engineering.
7. Chang, D. Y. (1996) Fuzzy Analytic Hierarchy Process: Extend Analysis Method, Fuzzy sets and systems Journal.
8. Cheng C.H., Yang K. L., Hwang C.L., (1999) Evaluating attack helicopters by AHP based on linguistic variable weight, European Journal of Operational Research.
9. Conway.H. (2004) Parks need people need parks: the skills shortage in parks, New York : Cambridge University Press.
10. Larson.C. D. and H. Forman.E.H. (2007) Application of the Analytic Hierarchy Process to Select Project Scope for Videologging and Pavement Condition Data Collection, 86th Annual Meeting Compendium, Transportation Research Record Journal.
11. Leung, L. C. and Chao, D. (2000) On Consistency and Ranking of Alternatives in Fuzzy AHP, European Journal of Operational Research.
12. Marsh, W. M. (2005) Landscape Planning: Environmental applications, New York: John Wiley & Sons.
13. Marsh. W. (2005) Landscape Planning Environmental applications, Hoboken, NJ : Wiley Press.
14. Saaty.T.L. and Peniwati.K. (2008) Group Decision Making: Drawing out and Reconciling Differences, Pittsburgh, PA: RWS Press.
15. Wang, H. F. (2004) Multi Criteria Decision Analysis: From Certainty to Uncertainty, Taiwan: Ting Long Book.

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Identifying Prognostic Factors for Toxic Epidermal Necrolysis

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Abstract: Toxic epidermal necrolysis (TEN) is a rare, but life-threatening drug allergy that results in death in approximately 25-50 % of patients. There is still controversy over whether the performance of a severity-of-illness score specified TEN (SCORTEN) accurately predicts mortality or if treatment interventions such as corticosteroid or intravenous immunoglobulin (IVIg) could alter mortality. Our purpose was to identify prognostic factors and to assess SCORTEN. Charts of 26 patients aged 54.1 years, admitted to the hospitals (2004–2012) with toxic epidermal necrolysis were reviewed. SCORTEN was associated with a higher mortality rate and the areas under the receiver-operating characteristic curves were 94.5%. The presence of comorbidity, and/or gout, diabetes, higher SCORTEN, statistically significantly increased risk of death. The corticosteroids therapies had the trend to increase the mortality for TEN. IVIg and surgical debride did not significantly alter mortality.
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Keywords: Toxic epidermal necrolysis (TEN), Seven independent prognostic factors of toxic epidermal necrolysis (SCORTEN), mortality, complications.

1. Introduction

Toxic Epidermal Necrolysis (TEN) is a drug-related skin conditions with epidermal detachment of the skin and mucosal erosions (Figure 1) caused by sudden apoptosis of keratinocytes [1-3]. TEN with a mortality rate of 25-50% [4]. A severity-of-illness score specified for TEN, SCORTEN, was developed in 2000 [5]. The investigations of SCORTEN conducted in Asian with TEN were still sparse and whether the IVIg or corticosteroids have the therapeutic effectiveness is still in question [6,7]. The goal of this study is to identify the prognostic factors, to investigate the therapeutic efficacy of corticosteroids and IVIg, and to evaluate the performance of SCORTEN in two medical centers in Taiwanese patients with TEN.

2. Methods

Patients and data collection

Medical charts of all consecutive patients admitted to the burn unit at Taichung Veterans General Hospital and intensive care unit at Chung Shan Medical University Hospital, Taiwan from January 2004 to January 2012 were retrospectively reviewed. Patients were eligible if the discharge diagnosis was toxic epidermal necrolysis. The diagnosis was confirmed by clinical manifestations, or skin biopsy showing full thickness necrosis of the epidermis and a negative direct immunofluorescence test.

Figure 1: Clinical pictures of toxic epidermal necrolysis

Table 1 Demographic variables for patients in this study (n=26)

Demographic criteria	No. (%)
Female	9 (34.6)
Male	17 (65.4)
Survive	15 (57.7)
Dead	11 (42.3)
Age*	54.1 (24.6)
Body surface area involved (%)*	57.7 (15.8)
SCORTEN*	3.1 (1.3)
Days in hospital*	19.2 (13.6)
Comorbidity	15 (57.7)
Corticosteroids	4 (15.4)
IVIg	1 (3.8)
Surgical debride	13 (50)
Supportive	21 (80.8)

*mean (standard deviation)

Table 2. Patient detail characteristics in this study

No.	Age (yrs)	Sex	Cause	Onset (day)	Hospital Stay(day)	Treatment	SCORTEN	Mortality
1	84	F	Allopurinol	1	7	Supportive	5	yes
2	73	M	Sulpyrine	0	15	Supportive	3	yes
3	66	M	Acetylsalicylic acid	1	9	Supportive	5	yes
4	55	M	Piperacillin	1	2	Supportive	4	yes
5	62	M	Chinese herbal medicine	0	7	Corticosteroid	5	yes
6	83	M	Allopurinol	0	5	Supportive	5	yes
7	44	M	Sulfonamide	1	15	Corticosteroid	3	yes
8	62	F	Thalidomide	0	29	Supportive	5	yes
9	67	F	Cephalexin	0	45	Corticosteroid	4	yes
10	75	M	Carbamazepine	1	9	Supportive	4	yes
11	82	M	Mefenamic acid	1	9	Supportive	4	yes
12	75	F	Allopurinol	0	17	Supportive	3	no
13	81	M	Ketorolac tromethamine	0	10	Corticosteroid	3	no
14	20	M	Ketorolac tromethamine	0	13	IVIg*	1	no
15	89	M	Mefenamic acid	0	14	Supportive	2	no
16	34	F	Ibuprofen	0	35	Supportive	3	no
17	23	F	Chinese herbal medicine	0	20	Supportive	2	no
18	31	F	Ibuprofen	0	27	Supportive	3	no
19	10	M	Ibuprofen	0	30	Supportive	2	no
20	49	M	Carbamazepine	0	10	Supportive	2	no
21	69	M	Ketoprofen	0	42	Supportive	4	no
22	16	F	Naproxen	0	19	Supportive	1	no
23	38	F	Carbamzepine	0	15	Supportive	1	no
24	62	M	Penicillin	0	58	Supportive	2	no
25	11	M	Chinese herbal medicine	1	21	Supportive	3	no
26	46	M	Phenytoin	16	3	Supportive	0	no

*IVIg: Intravenous immunoglobulin

Statistical analysis

Data were analyzed using SAS 9.1.3 (SAS Institute, Cary, NC, USA) and SPSS 13.0 (SPSS Inc., Chicago, IL, USA) software. Patients who died during hospitalization were compared with those who did not by using Fisher's exact probability test for nominal variables, and unpaired two-tailed t test for continuous variables. Differences were considered significant at $p < 0.05$. The expected mortality rate predicted by the SCORTEN was calculated using the formula: P (death) = $e^{logit}/1 + e^{logit}$ where logit = $-4.448 + 1.237$(SCORTEN) [5]. The standardized mortality ratio (standardized mortality ratio = Σ observed deaths/Σ expected deaths) was used to determine whether there was a significant difference between observed and expected mortality on the first day of admission. Predictive accuracy of the logistic regression models was assessed by receiver-operating characteristic (ROC) curves and the area under the curve (AUC). Kaplan-Meier curves were constructed to evaluate the actuarial risk of death relative to treatment regimen. The log-rank test was used to compare treatment regimens relative to survival.

3. Results and Discussions

A total of 26 patients (9 female, 17 male) with mean age 54.1 years old were enrolled (Table 1). Four (15.4%) received corticosteroids, 13 (50%) received surgical debride, and 1 (3.8%) received treatment with IVIg. As in Table 2, 11 patients (42.3%) died of TEN, which is comparable to the average TEN mortality rate published in the literature [8-11]. Seven independent prognostic factors of toxic epidermal necrolysis was calculated (SCORTEN) (Table 3) [5,7].

Table 3. SCORTEN*

| Prognostic factor	1	0
Age (yr)	$\geqq 40$	< 40
Heart rate (/min)	$\geqq 120$	< 120
Detached body surface (%)	> 10	$\leqq 10$
Serum glucose (mg/dL)	> 252	$\leqq 252$
Serum urea nitrogen (mg/dL)	> 27	$\leqq 27$
Serum bicarbonate (mmol/L)	< 20	$\geqq 20$
Malignancy	Yes	No

*Seven independent prognostic factors of toxic epidermal necrolysis (SCORTEN)

One patient had SCORTEN of 0, three patients had SCORTEN of 1, five patients had SCORTEN of 2, seven patients had SCORTEN of 3, five patients had SCORTEN of 4, and five patients with a SCORTEN of 5 (Table 4). In order to analyze how accurately SCORTEN predicted mortality in our study, we compared the probability of death for each patient to a logistic model of the patient's actual death status. The probability of death for each patient was calculated using the same logistic regression equation created by Bastuji-Garin *et al.* [4,5].

Table 4 SCORTEN on admission

	No. of patients	Predicted mortality ¥		Actual mortality	
		%	No. of deaths	%	No. of deaths
SCORTEN					
0	1	1.2	0.01	0	0
1	3	3.9	0.12	0	0
2	5	12.2	0.61	0	0
3	7	32.4	2.27	28.6	2
4	5	62.2	3.11	80.0	4
5	5	85.0	4.25	100.0	5
6	0	95.1	0	0	0
7	0	98.5	0	0	0
Total	26		10.37		11

¥ Values predicted by the SCORTEN with the formula P (death)=$e^{logit}/1+e^{logit}$ where logit=-4.448+1.237(SCORTEN).
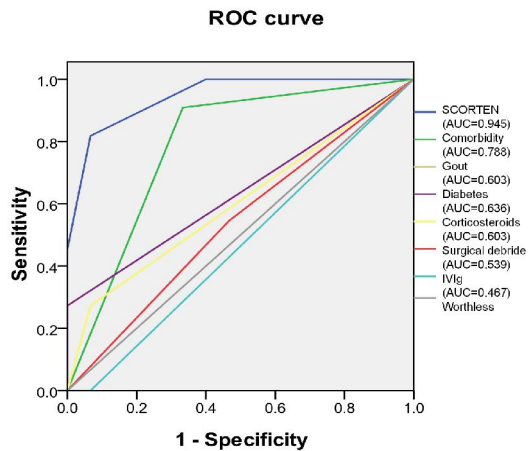
ROC curve

Figure 2: ROC curve for SCORTEN, comorbidity, diabetes, gout, corticosteroids, surgical debride, and IVIg.

Figure 2 shows an ROC curve. An AUC of 1 indicates a perfect test, or perfect accuracy (100%), whereas an AUC of 0.5 means that the test is no better than a random guess (50%-50%). In this study, the AUC for the variable SCORTEN on admission was 0.945, showing excellent correspondence

between observed and predicted mortality. The AUC was 0.788 (comorbidity), 0.636 (diabetes mellitus), 0.603 (gout), 0.603 (corticosteroids), 0.539 (surgical debride), and 0.467 (intravenous immunoglobulin). Although the corticosteroids therapies that were reported to reduce morbidity and improve outcome of TEN patients [12,13], we found that corticosteroids had the trend to deteriorate the mortality of patients with TEN (p=0.17) (Figure 3).
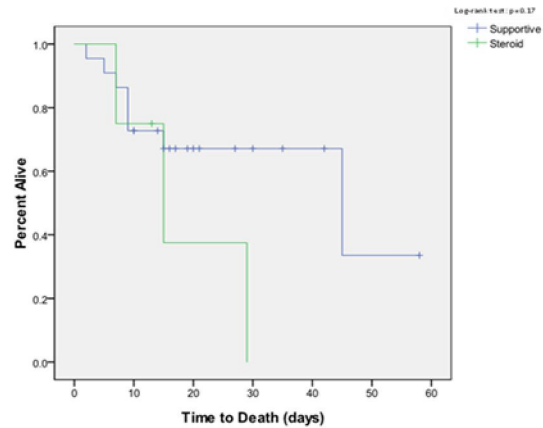
Figure 3: Kaplan-Meier survival curves by corticosteroids treatment

4. Conclusion

In conclusion, mortality in our retrospective case-control study was similar to what has been described in the literature. SCORTEN was confirmed as an accurate predictor of mortality in our study. New information from this analysis shows worse mortality if patients had the presence of additional comorbidities including diabetes and gout; the addition of these comorbidities to SCORTEN also improved its predictive ability. The corticosteroids therapies might increase the mortality for TEN. Surgical debride and IVIg did not significantly alter mortality.

Conflict of interest
The authors state no conflict of interest.

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References

[1] Yang CY, Dao RL, Lee TJ, Lu CW, Yang CH, Hung SI, et al. (2011) Severe cutaneous adverse reactions to antiepileptic drugs in Asians. Neurology 77: 2025-2033.

[2] Pereira FA, Mudgil AV, Rosmarin DM (2007) Toxic epidermal necrolysis. J Am Acad Dermatol 56: 181–200.

[3] Yu-Ling Ho, Yun-Ting Chang, Yu-Tseng Chu, Shiao-Chi Wu (2010) Performance of the SCORTEN in Taiwanese patients with Stevens-Johnson syndrome and toxic epidermal necrolysis. Dermatol Sinica 28: 15-20.

[4] Firoz BF, Henning JS, Zarzabal LA, Pollock BH (2012) Toxic epidermal necrolysis: five years of treatment experience from a burn unit. J Am Acad Dermatol 67: 630-635.

[5] Bastuji-Garin S, Fouchard N, Bertocchi M, Roujeau JC, Revuz J, Wolkenstein P (2000) SCORTEN: a severity-of-illness score for toxic epidermal necrolysis. J Invest Dermatol 115:149–153.

[6] Huang YC, Li YC, Chen TJ (2012) The efficacy of intravenous immunoglobulin for the treatment of toxic epidermal necrolysis: a systematic review and meta-analysis. Br J Dermatol 167: 424-432.

[7] Tan SK, Tay YK (2012) Profile and pattern of Stevens-Johnson syndrome and toxic epidermal necrolysis in a general hospital in Singapore: treatment outcomes. Acta Derm Venereol 92: 62-66.

[8] Guégan S, Bastuji-Garin S, Poszepczynska-Guigné E, Roujeau JC, Revuz J (2006) Performance of the SCORTEN during the first five days of hospitalization to predict the prognosis of epidermal necrolysis. J Invest Dermatol 126: 272-276.

[9] Chung WH, Hung SI, Hong HS, Hsih MS, Yang LC, Ho HC, et al. (2004) Medical genetics: a marker for Stevens-Johnson syndrome. Nature 428: 486.

[10] Chen P, Lin JJ, Lu CS, Ong CT, Hsieh PF, Yang CC, et al. (2011) Carbamazepine-induced toxic effects and HLA-B*1502 screening in Taiwan. N Engl J Med 364: 1126-1233.

[11] Huang CH, Ho JC, Cheng YW, Wu WM (2009) Epidemiological Study of Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis: Retrospective Analysis of Southern Taiwanese Population During 2002 to 2007. Dermatol Sinica 27: 15-26.

[12] Yamane Y, Aihara M, Tatewaki S, Matsukura S, Kanbara T, Yamakawa Y, et al. (2009) Analysis of treatments and deceased cases of severe adverse drug reactions – analysis of 46 cases of Stevens-Johnson syndrome and toxic epidermal necrolysis. Aerugi 58: 537–547.

[13] Kardaun SH, Jonkman MF. (2007) Dexamethasone pulse therapy for Stevens-Johnson syndrome/toxic epidermal necrolysis. Acta Derm Venereol 87: 144–148.

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Antimicrobial Effect and Immunomodulation of Atorvastatin

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Abstract: Objectives: Epidemiological studies of statins have suggested a link between statin therapy and a decreased risk of bacterial infection. It has been proposed that the mechanism underlying this protective effect of statins relates to their known immunomodulatory and anti-inflammatory effects. The aim of this study is to explore the antibacterial effect of atorvastatin, and its immunomodulation effect on tumor necrosis factor alpha, TNF α, and C reactive protein, CRP. **Method:** 20 serum samples were collected from patients who were under therapy with Atorvastatin for more than three months and 10 serum samples from control group who do not administer any statins. The serum samples were analyzed for TNF α quantitatively using ELISA kit and CRP semi quantitatively by agglutination kit. The antibacterial effect was tested against five clinical isolates for each of *E. coli, S. aureus,Proteus sp., and Bacillus sp.* **Results:** the concentration of TNF α and CRP were significantly decreased than the control group. Atorvastatin showed significant antibacterial effect against the tested bacterial isolates compared to that of the control except for *Proteus sp.* in addition to its effect on lipids profile. **Conclusion:** Atorvastatin shows antibacterial effect & reduces serum concentrations of TNF α & CRP, but still future studies are recommended to elucidate mechanism (s) by which atorvastatin is inducing its antibacterial effects.

Key words: Atorvastatin, TNF α, antibacterial

1. Introduction

Statins are a class of lipid lowering drugs that inhibit 3- hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase leading to decreased cholesterol and isoprenoid synthesis. Several recent studies have shown a link between statin use and a decreased risk of sepsis and inflammation. Statins possess a number of pleiotropic effects that are thought to have a beneficial effect on the cascade of detrimental events that characterize the sepsis syndrome (Kouroumichakis *et al.*, 2011). Statins have also been shown to decrease production of proinflammatory cytokines such as tumor necrosis factor α (TNF-α), interleukin- 1 (IL-1), and IL-6 present during sepsis (Zhang *et al.*, 2005). TNF α is a central mediator that stimulates leukocytes and vascular endothelial cells to release other cytokines to express cell- surface molecules that enhance neutrophil- endothelial adhesion at sites of infection, and to increase prostaglandin and leukotriene production (Anas *et al.,* 2010), so it was chosen to be determined in this study. There are some data that suggest that statins interfere with the recognition of microbial products by immune cells thus depressing the inflammatory cascade (Weitz-Schmidt *et al*., 2001). Another mechanism was suggested by Jerwood & Cohen (2008) that it would be due to direct antimicrobial effect.

Nine cohort studies addressed the effect of statins on various types of infection: bacteremia (n = 3), pneumonia (n = 3), sepsis (n = 2), and bacterial infection (n = 1).(Tleyjeh *et al.,* 2009). The aim of this study was to assess the direct antibacterial effect of Atorvastatin and immunomodulation on TNF-α and CRP in addition to its effect on lipids profile.

2. Materials & Methods:

Antibacterial effect:

It was done according to the method described by Jerwood and Cohen (2008). Briefly twenty bacterial isolates, (*Bacillus sp.*, methicillin resistant *Staphylococcus aureus, E. coli* and *Proteus mirabilis*) were recovered from frozen or ambient saves by spreading on blood agar plates and inspected for contamination after overnight incubation. The test organisms from these plates were made up to a turbidity equivalent to that of a 0.5 McFarland standard then diluted 1:100 in Mueller–Hinton broth. These inocula were prepared immediately prior to each experiment. Testing was by a method based on the classical microtitre broth dilution recommended by the CLSI (formerly the NCCLS). Atorvastatin was obtained from the manufacturer as pure drug and dissolved in methanol to give an initial concentration of 1 g/L. The first test well therefore contains a concentration of 500 mg/L after the addition of isolate broth. There were eight further wells tested, each with half the concentration of the previous and the concentration in the final well tested was 7.8 mg/L. The trays were read after 18–24 hrs of incubation at

37˚C in air. Positive growth and negative sterility controls, and a methanol control were included on each microtitre tray. The MIC of the statin was taken to be that at which there was no visible growth.

Tests applied on serum:

Twenty patients who were under atorvastatin treatment for more than three months were chosen as the test group and ten normal people were chosen as the control group. Briefly ten milliliters of venous blood was collected from both groups and the following tests were applied:

Effect on TNF- α:

TNF-α was measured quantitatively by Orgenium Laboratories human TNF-α ELISA kit according to the manufacturer's instructions. Briefly,prepare all reagents, samples and standards. Add 50 ul standards (starting from 500 pg/ml), test samples and sample diluents as a blank into the appropriate wells of the strips. Incubate one hour at room temperature then wash 5 times. Add 50 ul ready for use biotin antibody promptly to each well, incubate 30 minutes at room temperature then wash 5 times. Add 50 ul ready to use HRP- streptavidin solution,incubate for 30 minutes at room temperature then wash 5 times. Add 50 ul TMB substrate solutions to each well, incubate 20 minutes at room temperature.

Finally add 25 ul stop solution to each well, read at 450 nm against 630 nm immediately. Calculation of the result is done by construction of a standard curve which is generated by plotting optical density for each of the standard concentrations versus the corresponding TNF α concentration. The concentration read from the standard curve must be multiplied by the dilution factor.

Effect on CRP:

CRP was measured semi quantitatively by CRP- latex slide agglutination, (SPINREACT, S.A.U Ctra. Santa Coloma, Spain), according to the manufacturer's instructions. Briefly make serial dilutions of the sample in 9 g/l saline solution of the sample and one drop of each positive and negative control into separate circles on the slide test. Add one drop (50 ul) next to the sample to be tested. Mix the drops with different stirrers for each sample to be tested. Place the slide on mechanical rotator at 80-100 r.p.m. for two minutes. Examine microscopically the presence of or absence of visible agglutination immediately after removing the slide from the rotator. The presence of agglutination indicates a CRP concentration equal or greater than 6mg/l. the titre is defined as the highest dilution showing a positi e

result. The approximate CRP concentration in the patient serum is calculated as 6 X CRP titre = mg/l.

Determination of lipids profile:
   a) Measurement of Triacylglycerols (TAG):
   b) The TAG levels were determined according to the method of *Siedel et al. (1983)* using diagnostic kit provided by Spectrum Diagnostics (Egypt).
   c) Measurement of Total Cholesterol (TC): The TC levels were determined according to the method of *Richmond, (1973)* using diagnostic kit provided by Spectrum Diagnostics (Egypt).
   d) Measurement of High Density Lipoprotein-Cholesterol (HDL-C) The HDL-C levels were determined by Spectrum Diagnostics kits according to the method of *Burstein et al. (1970).*
   e) Measurement of Low Density Lipoprotein-Cholesterol (LDL-C) Serum LDL-C levels were determined according to the method of *Richmond (1973)* using diagnostic kit provided by Biosystem (Egypt).

Statistical analysis was done by SPSS 17.0 programme. to determine if there was significant difference between the test group and the control group.

3. Results:

Antibacterial effect There is significant difference between MIC of atorvastatin and that of methanol (Control) as shown in tables (1& 2). On the contrary, Atorvastatin has no effect on *Proteus sp.* as the mean MIC of atorvastatin was the same as methanol.

Effect on TNF α:

Atorvastatin significantly reduced the concentration of TNF- α in serum of patients treated with it compared to the control group. Results are shown in table (3).

Effect on CRP:

CRP concentration in serum of patients treated with Atorvastatin was significantly reduced than the control group. Results are shown in table *(3).*

Effect on Lipids Profile:

Atorvastatin significantly affected the concentration of cholesterol, HDL & LDL, while it has no significant effect on triglyceride (Tables 4 & 5).

4. Discussion:

Statins have a proven role in cardiovascular patients primarily via their cholesterol-lowering

ability but also possess antiinflammatory and immunomodulatory pleiotropic effects that have been postulated to be beneficial in patients with sepsis and/or infection.

This study was done to assess that the antibacterial effect of Atorvastatin is due to immunomodulatory effect, especially on TNF- α, or due to its direct antibacterial effect. HMG-CoA reductase, the target of statins, is essential in prokaryotes but it is required for the biosynthesis of isoprenes, not sterols as in eukaryotes. Furthermore,the bacterial HMG-CoA reductase is of a different structural class with an affinity for statins that is _10 000 times weaker than the enzyme found in eukaryotes (Friesen & Rodwell, 2004) Thus, it is highly unlikely that the antimicrobial effect we have seen can be attributed to a known mechanism of action of statins.

In another work, statins decreased lipopoly saccharide toxicity by reduction of NF- Kappa B activation and subsequent release of TNF by modulating 3- hydroxyl – 3- methylglutaryl coenzyme A reductase activity (Fraunberger *et al*.,2009). This work is in agreement with this study as TNF is significantly decreased in the test group than in the control group (Table 3). A meta-analysis regarding the use of statins for the prevention and treatment of infections has indicated that the use of statins might be beneficial ((Tleyjeh *et al.,* 2009). Several mechanisms could explain this protective effect. Statins are known to have immunomodulatory properties (Kwak *et al*., 2000). In contrast some studies stated that the antimicrobial effect of statins is due to direct effect; Lovastatin reduces the intracellular growth of *Salmonella typhimurium* (Catron *et al*., 2004); and reduces HIV-1 viral load (del Real *et al.*, 2004). Fluvastatin significantly reduces cytomegalovirus DNA concentration and production of viral particles (Potena *et al.*, 2004). Similarly, a number of studies have found that statins exhibit direct antifungal activity (Gyetvai *et al.*, 2006).

Atorvastatin has an unexpected antimicrobial effect *in vitro* but requires concentrations that are far higher than are probably achieved *in vivo* with traditional indications for statins. Therefore, statins probably do not exert a significant antimicrobial effect in patients. However, since multiple dose statins are known for their favorable effect on the course of bacterial infections (Thomsen *et al.,* 2006), it is possible that statins undergoes accumulation at target human tissues upon multiple dosing, or there could be a formation of relevant breakdown products *in vivo*. Other possible mechanisms could be related to the pleiotropic properties of statins. For example,multiple statins including atorvastatin and simvastatin, were shown to be cytotoxic, to suppress cells growth, and to promote apoptosis (Muck *et al.*, 2004; Yamazaki *et al.,* 2006; Tapia-Perez *et al.,*2011). It is possible that the currently reported antibacterial activity of statins is related to such effects.

Results of the current work showed that Atorvastatin has antibacterial effect against *Bacillus sp. , Staph. aureus and E. coli*, but it showed no activity against *Proteus sp.*

Also Atorvastatin decreased serum concentration of TNF α and CRP in patients treated with it in addition to its effect on lipids. In conclusion future studies are recommended to elucidate mechanism (s) by which atorvastatin is inducing its antibacterial effects.

References:
1. Anass AA, Wiersinga WJ, de Vos AF, & Van der Poll T. 2010: Recent insights into the pathogenesis of bacterial sepsis. *Neth J Med; 68:147- 52*
2. Burstein, M.; Scholnick, H.R. and Morfin, R. 1970: Rapid method for the isolation of lipoproteins from human serum by precipitation with polyanions. *Journal of Lipid Research; 11: 583-595.*
3. Catron, D. M. Yvonne Lange, Jayme Borensztajn, Matthew D. Sylvester, Bradley D. Jones, and Kasturi Haldar *2*004. *Salmonella enterica* serovar Typhimurium requires nonsterol precursors of the cholesterol biosynthetic pathway for intracellular proliferation. *Infect. Immun.*, 72:1036-1042.
4. del Real, G. Sonia Jiménez-Baranda, Emilia Mira, Rosa Ana Lacalle, Pilar Lucas, Concepción Gómez-Moutón, Marta Alegret, Jose María Peña, Manuel Rodríguez-Zapata, Melchor Alvarez-Mon, Carlos Martínez-A.,and Santos Mañes *2*004. Statins inhibit HIV-1 infection by down-regulating Rho activity. *J. Exp. Med.* 200:541-547.
5. Fraunberger P,Grone E, Grone HJ, Walli AK. 2009: Simvastatin reduces endotoxin – induced nuclear factor Kappa B activation and mortality in guinea pigs despite lowering circulating low-density lipoprotein cholesterol. Shock; 32:159-63.
6. Friesen JA & Rodwell VW., 2004: The 3-hydroxy-3-methylglutaryl coenzyme-A (HMG-CoA) reductases. Genome Biol; 5: 248.2–248.7.
7. Gyetvai, A. Emri, T., Takács, K., Dergez, T., Fekete, A., Pesti, M., Pócsi, I. & Lenkey, B. *2*006. Lovastatin possesses a fungistatic effect

against *Candida albicans,* but does not trigger apoptosis in this opportunistic human pathogen. *FEMS Yeast Res.* , 6 :1140-1148.

8. Jerwood S.and J.Cohen. 2008: Unexpected antimicrobial effect of statins. Journal of Antimicrobial Chemotherapy; 61: 362–364

9. Kwak, B., Mulhaupt, F., Myit, S. & Mach, F. 2000: Statins as a newly recognized type of immunomodulator. *Nat. Med.* 6: 1399-1402.

10. Lervang HH., 2006: Statin use and mortality within 180 days after bacteremia: a population based cohort study. *Crit Care Med*, 34:1080–1086.

11. Muck AO, Seeger H, Wallwiener D., 2004: Classspecific pro-apoptotic effect of statins on human vascular endothelial cells. *Z Kardiol*, 93:398–402.

12. Potena, L. Giada Frascaroli, Francesco Grigioni, Tiziana Lazzarotto, Gaia Magnani, Luciana Tomasi, Fabio Coccolo, Liliana Gabrielli, Carlo Magelli, Maria P Landini, Angelo Branzi *2*004: Hydroxymethyl-glutaryl coenzyme a reductase inhibition limits cytomegalovirus infection in human endothelial cells. *Circulation,* 109: 532-536.

13. Richmond, W., 1973: Preparation and properties of a cholesterol oxidase from Nocardia sp. and its application to the enzymatic assay of total cholesterol in serum. *Clinical Chemistry; 19:1350-1356.*

14. Siedel, J.; Hagele, E.O.; Ziegenhorn, J. and Wahlefeld, A.W., 1983: Reagent for the enzymatic determination of serum total cholesterol with improved lipolytic efficiency. *Clinical Chemistry; 29(6): 1075-1080.*

15. Tapia-Perez JH, Kirches E, Mawrin C, Firsching R, Schneider T., 2011: Cytotoxic effect of different statins and thiazolidinediones on malignant glioma cells. *Cancer Chemother Pharmacol*, 67:1193–1201.

16. Thomsen RW, Hundborg HH, Johnsen SP, Pedersen L, Sorensen HT, Schonheyder HC, Tleyjeh IM, Kashour T, Hakim FA. 2009: Statins for the prevention and treatment of infections: a systematic review and meta-analysis. *Arch Intern Med; 169:1658-67.*

17. Weitz-Schmidt G, Welzenbach K, Brinkmann V, *et al.,* 2001: Statins selectively inhibits leukocyte function antigen-1 by binding to a novel regulatory integrin site. *Nat Med; 7:687-92.*

18. Yamazaki H, Suzuki M, Aoki T, Morikawa S, Maejima T, Sato F, Sawanobori K, Kitahara M, Kodama T, Saito Y., 2006: Influence of 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors on ubiquinone levels in rat skeletal muscle and heart: relationship to cytotoxicity and inhibitory activity for cholesterol synthesis in human skeletal muscle cells. *J Atheroscler Thromb*, 13:295–307.

19. Zhang J, Cheng X, Liao YH, *et al.,* 2005. Simvastatin regulates myocardial cytokine expression and improves ventricular remodeling in rats after acute myocardial infarction. *Cardiovasc Drugs Ther; 19: 13-21.*

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Protective antioxidant effect of garlic against cypermethrin induced lung toxicity in adult male mice: Biochemical and Histopathological studies

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Abstract In the present study, the protective effect of garlic against cypermethrin -induced lung toxicity was studied. Adult male mice (N=20) with average weight 18- 20 g were used in the study. Animals were divided into four groups of 5 each: group I control received corn oil; group II received cypermethrin (2.8 mg/kg BW) in corn oil. Group III received garlic (500 mg/kg BW); group IV received both cypermethrin and garlic. All treatments were given by oral gavage for 14 days. The results showed that cypermethrin increased thiobarbituric acid-reactive substances (TBARS) and decreased activities of the antioxidant enzymes (GST: glutathione S – transferase; -SH group; SOD: superoxide dismutase). Lung injury was confirmed by histopathological changes. Animals treated with garlic and cypermethrin together showed that lung TBARS returned to the control level which indicating a protective effect of garlic. Also, garlic was able to increase the reduced activities of the antioxidant enzymes induced by cypermethrin. In addition, garlic protected the lung from histological changes induced by cypermethrin. In conclusion, garlic was found to provide protective effect against and cypermethrin induced damage in mice alveoli and bronchioles with the attenuation of the oxidative stress and the preservation in antioxidant enzymes. It could be advised as an as Therefore this effective dietary supplements in developing countries where pesticide pollution is high.

1. Introduction

The potency of garlic (G) (*Allium sativum*) has been acknowledged for 5000 years. In ancient times, the Babylonians, Egyptians, Phoenicians, Vikings, Chinese, Greeks, Romans and Hindus used garlic frequently as a remedy for many diseases (Block, 1985). Garlic, one of the best-researched herbal remedies, holds a unique position in history, traditionally employed to treat infection, colds, diabetes, heart disease, and it has been evaluated for lowering blood pressure, cholesterol, and glucose concentration, as well as for the prevention of arteriosclerosis and cancer, garlic consumption inversely correlates with the risk of oral, stomach, esophageal, colon, and prostate cancers (Tsai *et al.,* 2012). In the recent time, there has been growing interest in exploiting the biological activities of different ayurvedic medicinal herbs, due to their natural origin, cost effectiveness and lesser side effects (Naik *et al.,* 2003; Sharma *et al.,* 2010). Studies carried out on garlic constituents have reported the presence of two main classes of antioxidant components, namely flavonoids and sulfur-containing compounds (diallyl sulfide, trisulfide and allyl-cysteine) (Kodera *et al.,* 2002; Bozin *et al.,* 2008). In addition to sulfur-containing compound, garlic is also rich in trace elements and zinc, manganese, copper, selenium, and iodine are 556.1, 446.9, 143.3, 5.5 and 2.5 µg/ 100 g fresh garlic

respectively (Gorinstein *et al.,* 2005). Over 70 fatty acids have been determined, with linoleic (46 -53%), palmitic (20 - 23%), oleic (4 -13%), and alinolenic (3- 7 %) acids being most abundant, accounting for 80% of the total lipids (Tsiaganis *et al.,* 2006).The protein content of raw garlic ranges from 2.6% to 3.0%, depending on the variety of garlic. The average content of free amino acids is 2.13%. Concentrations of dietary fiber and total tocopherols in raw garlic are 2310 and 103.1 mg/100 g fresh weight, respectively. Ascorbic and total polyphenols levels are 73.6 and 1.9 mg in 100 g dry weight (Gorinstein *et al.,* 2008).

Garlic extract boosts some immune functions and selectively kills cancer cells by apoptosis (Ban *et al.,* 2007;.Shukla and Kalra, 2007) Also garlic prevents many types of cancer by disabling free radicals (Ide and Lau, 1997; Das and Saha, 2009). Free radicals are defined as species having one or more unpaired electrons which make them unstable and highly reactive. Among the most common oxygen free radicals are the superoxide anion ($O_2^{\cdot-}$), the hydroxyl radical ($^{\cdot}OH$) and peroxyl radicals (ROO·). Other kinds of ROS are not free radicals, the most important one being hydrogen peroxide (H_2O_2). The sources of the $O_2^{\cdot-}$ are dioxygen-reducing enzymes such as NADPH oxidases, xanthine oxidase, monoamine oxidase, prostaglandin synthases (Peyrot and Ducrocq, 2008). To neutralize free radicals and counteract the detrimental effect of ROS, cells

express a wide array of endogenous antioxidant enzymes. These include "direct antioxidants," such as superoxide dismutases (SODs), catalase, and glutathione peroxidase, as well as "indirect" antioxidant enzymes, such as glutathione S-transferases (GSTs), metallothioneins, and NADPH:quinine oxidoreductase (Cho *et al.,* 2006 ; Wesselkamper *et al.,* 2006). Proper regulation of these antioxidant enzymes is essential for mammals to maintain balances between oxidants and antioxidants (Gong *et al.,* 2009).

The lung is an organ susceptible to oxidative stresses that are derived from oxygen or inflammatory responses (Chow *et al.,* 2003; Nakamura *et al.,* 2005). The imbalance of oxidants and antioxidants plays an important role in the development of various pulmonary diseases, such as acute respiratory distress syndrome and chronic obstructive pulmonary disease (Christofidou-Solomidou and Muzykantov, 2006; Rahman, 2008; Gong *et al.,* 2009).

The widespread use of pesticides in public health protection and agricultural programs has caused severe environmental pollution and health hazards, particularly in developing countries, including cases of severe acute and chronic human and animal poisoning as well as damage to other non-targeted organisms (Assayed *et al.,* 2010 a). Cypermethrin is a type II pyrethroid compound classified as a toxicity class III chemical (Borges *et al.,* 2007). Cypermethrin is one of the most common contaminants in the ecosystem. Recently, there are many studies concerning the role of cypermethrin exposure on the induction of oxidative stress (Jin *et al.,* 2011; Hussiena *et al.,* 2011). The toxic effects of oxygen free radicals and reactive oxygen compounds can lead to a wide variety of health hazards, including aging, cancer, atherosclerosis, viral infections, stroke, myocardial infarction and arthritis (Ames *et al.,* 1993). During pyrethroid metabolism, reactive oxygen species (ROS) are generated and result in oxidative stress in intoxicated animals (Kale *et al.,* 1999). Toxicants may produce oxidative stress by direct biotransformation to electrophilic or free radical intermediates, inducing or altering enzymatic system within the cell such as cytochrome P-450 within the peroxisomes and mitochondria, generating free radicals and depleting or inhibiting normal enzymatic and nonenzymatic antioxidant systems which scavenge the free radicals and protect the cell or overburden the repair mechanisms within the cell (Datta *et al.,* 1992 ; Retter, 1993 ; Stephen *et al.,* 1997 ; Salah *et al.,* 2009). Cells have enzymatic and non-enzymatic scavenger systems against these free radicals. Nevertheless, if free radical production and scavenger systems somehow become unbalanced, cells are exposed to oxidative damage resulting in cell

injury (Parinandi *et al.,* 1990; Griesmacher *et al.,* 1995).

This study aimed to evaluate (1) the influence of cypermethrin on antioxidant enzymes and hist pathological changes in lung tissue in male mice, (2) the protective role of garlic in alleviating the deteriorating effect of cypermethrin on lung function and structure.

2. Material and methods
2.1. Cypermethrin

Cypermethrin was obtained from one of the stores that sell pesticides in Jeddah, one of the import of the Saudi Company delta Chemical Industries. It is used in controlling insects, ticks, beetles, butterflies and larvae and is also used in crops, cotton, grain, ornamentals, potatoes and other vegetables, and appreciates the active ingredient pesticide by 10%.

2.2. Garlic

Garlic extraction was performed according to the earlier described methods (Batirel *et al.,* 1996; Saner *et al.,* 2003). Briefly, garlic bulbs (30 g) were crushed in distilled water (60 ml) and squeezed through a double cheese cloth and aliquots were stored at -20 ◦C till further use. Each ml of the extracted aliquot was equivalent to about 500 mg of garlic (Flora *et al.,* 2009).

2.3. Experimental design

In this study 20 adult males of albino mice (MF1) were used. Animals were purchased from the King Fahd Center for Medical Research, King Abdulaziz University in Jeddah. They were nearly of equal average weights (31 ± 2 g). The animals were acclimatized for 7 days prior to their use in experiments and housed in stainless steel cages in an air-conditioned room maintained at 25 ± 2 ◦C and 12 h with alternate day and night cycles. Mice were then divided into four groups of five mice each and were treated as below for the period of 2 weeks:

Group I: control (treatment corn oil, drinking water).

Group II: Cypermethrin (CYP) the animals were orally gavaged 2.8 mg / kg of cypermethrin dissolved in corn oil for the duration of the experiment by oral tube feeding (Coombs *et al.,* 1976).

Group III: Aqueous extract of garlic, 500 mg/kg, orally, once daily (Flora *et al.,* 2009).

Group IV: CYP (as in group II) + garlic extract, 500 mg/kg, orally, once daily.

The aqueous extract of garlic was administered 1h prior to the cypermethrin dose. The doses of the garlic were selected based on previously reported work (El- Demerdash *et al.,* 2005; Eidi *et al.,*

2006). After the administration of the last dose, the animals were provided 24 h rest then the following were carried out:

a- Blood collection and biochemical studies:

Under ether anesthesia, blood was collected for serum separation and kept at -20 C till used. Animals were then sacrificed, the thorax was opened and lungs were removed, parts were washed with cold saline buffer. Washed tissues were immediately stored at - 80 ° C. To obtain the enzymatic extract, tissues were homogenized in ice-cold 50 mM sodium phosphate buffer (pH 7.0) containing 0.1 m Methylene diaminetetraacetic acid (EDTA) to yield 10% (W/V) homogenate. The homogenates were then centrifuged at 1000 rpm for 10 min at 4° C. The concentration of measured as thiobarbituric acid reactive substances (TBARS) in the tissues of mice was assayed by the method of Ohkawa *et al.* (1979). Superoxide dismutase (SOD) activity was determined by the epinephrine method (Misra and Fridovich, 1972). Glutathione S- transferase (GST) activity toward 1-chloro-2,4- dinitrobenzene as a substrate was determined according to Habig *et al.* (1974). Sulphydryl groups (SH groups) were measured in tissue homogenates after reaction with 5,50-dithiobis-(2-nitrobenzoic acid) using the method of (Ellman, 1959).

b. Histopathological studies:
1. Light microscopic studies

For light microscopic examinations, the lung tissues were dissected, and the tissue samples were fixed in 10% formalin, processed in a series of graded ethanol solutions, and embedded in paraffin. Paraffin sections were cut with a microtome to a 5 μm thickness and stained with hematoxylin and eosin for light microscopic examination. The sections were viewed and photographed on a light microscope (Olympus BX51, Tokyo, Japan) with an attached

camera (Olympus C-5050, Olympus Optical Co. Ltd., Japan).

2. Transmission electron microscopy studies

For electron microscopic examinations, primary fixation of small pieces from right lobes was done in 3% glutaraldehyde in sodium phosphate buffer (200 m M, pH 7.2) for 3 h at 4 ∘C. lung tissues were washed with the same buffer and postfixed in 1% osmium tetroxide (Agar Sci. Ltd.) in sodium phosphate buffer, pH 7.2, for 1 h at 4 ∘C. Tissue samples were washed with the same buffer for 3 hrs at 4 ∘C and then embedded in Araldite (Agar Sci. Ltd.). Thin sections were cut with a Leica EM UC6 (Leica Co., Austria) ultramicrotome. Samples were stained with 2% uranyl acetate and lead citrate. The sectionswere viewed and photographed on a Jeol 100 CXII transmission electron microscope (TEM) (Jeol Ltd., Japan) at 80 kV.

2.5. Statistical analysis

The program used was Statistical Packagee For Social Science (SPSS 15). Student s t-test was used to study the difference in concentration thiobarbituric acid-reactive substances TBARS and antioxidant enzymes in lung. One – way random statistical analysis was used and the results were written as Stander Erro ± Mean.

3. Results
3.1. Effects of cypermethrin and garlic treatment on lung TBARS and antioxidant enzymes.

The results summarized in (Table 1) indicated that treatment with cypermethrin alone significantly increased ($P < 0.05$) the level of TBARS and decreased GST, SH group and SOD comparing to control group. While the treatment of cypermethrin with garlic significantly ($P < 0.05$) decreased the levels of TBARS, increased the levels of the activities of the enzymes GST, SH and SOD in lung, compared to cypermethrin group alone.

Table 1: Means of TBARS, GST, SH and SOD levels in lung of male mice treated with cypermethrin (CYP), garlic (GAR) and cypermethrin (CYP) + garlic (GAR).

Experimental groups / Parameter	Control	CYP	GAR	CYP+ GAR
TBARS	13.50 ± 0.07^{b}	24.70 ± 0.20^{a}	13.14 ± 0.05^{c}	15.50 ± 0.10^{b}
GST	0.642 ± 0.007^{a}	0.604 ± 0.002^{c}	0.642 ± 0.007^{a}	0.632 ± 0.010^{b}
-SH group	1.33 ± 0.007^{a}	0.009 ± 1.07^{c}	1.33 ± 0.006^{a}	1.28 ± 0.004^{b}
SOD	12.50 ± 0.07^{a}	8.81 ± 0.07^{c}	12.51 ± 0.06^{a}	11.70 ± 0.18^{b}

Values were expressed as means ± SE; n = 5 for each treatment group. Mean values within a row not sharing a common superscript letters (a, b, c, d) were significantly different, $p < 0.05$; TBARS: thiobarbituric acid reactive substances (nmol/g tissue); GST: glutathione S-transferase (μmol/h/mg protein); -SH group (mmol/g);SOD: superoxide dismutase (U/mg protein).

3.2. Histopathology.
3.2.1. Light microscopic study.

Fig. (1) Shows the normal structure of control mice lung parenchyma including bronchioles, alveolar spaces and related blood vessels. Alveolar spaces and bronchioles are lined by normal epithelium reported in literatures (Fig. I). In cypermtherin group there was the bleeding and inflammatory cells within alveolar spaces and inside the cavity of bronchioles (Fig II). In cypermtherin + garlic group the alveolar spaces and bronchioles are normal except of few bronchioles that still showed congestion of their accompanied blood vessels (Fig IV). The garlic group did not perform pathological changes in the structure of alveolar disuse (Fig III).

3.2.2. Transmission electron microscopy.

Fig. (2) Fine structure alveolar spacesshowed that they is lined by pneumocytes type 2 and pneumocytes type 1. capillary- alveolar barrier was observed to be of normal thickness. Capillaries were identified by presence of red blood corpuscles Fig (I). Cypermtherin group exhibited a decrease in alveolar spaces with inflammatory cell infiltrate. Capillary congestion was also observed there was an increase in the number of pneumocytes type 2 and increased thickness alveolar septa between alveolar spaces (Fig II). No pathological changes in the structure of alveolar spaces in garlic group (Fig III). Cypermtherin + garlic group showed marked decrease in alveolar spaces inflammatory infiltrate, which which are lined by nearly normal pneumocytes type 2 which showed have microvilli and mitochondria, pneumocytes type 1 were also of normal appearance septal capillaries showed no signs of congestion observed in cypermtherin group (Fig IV).
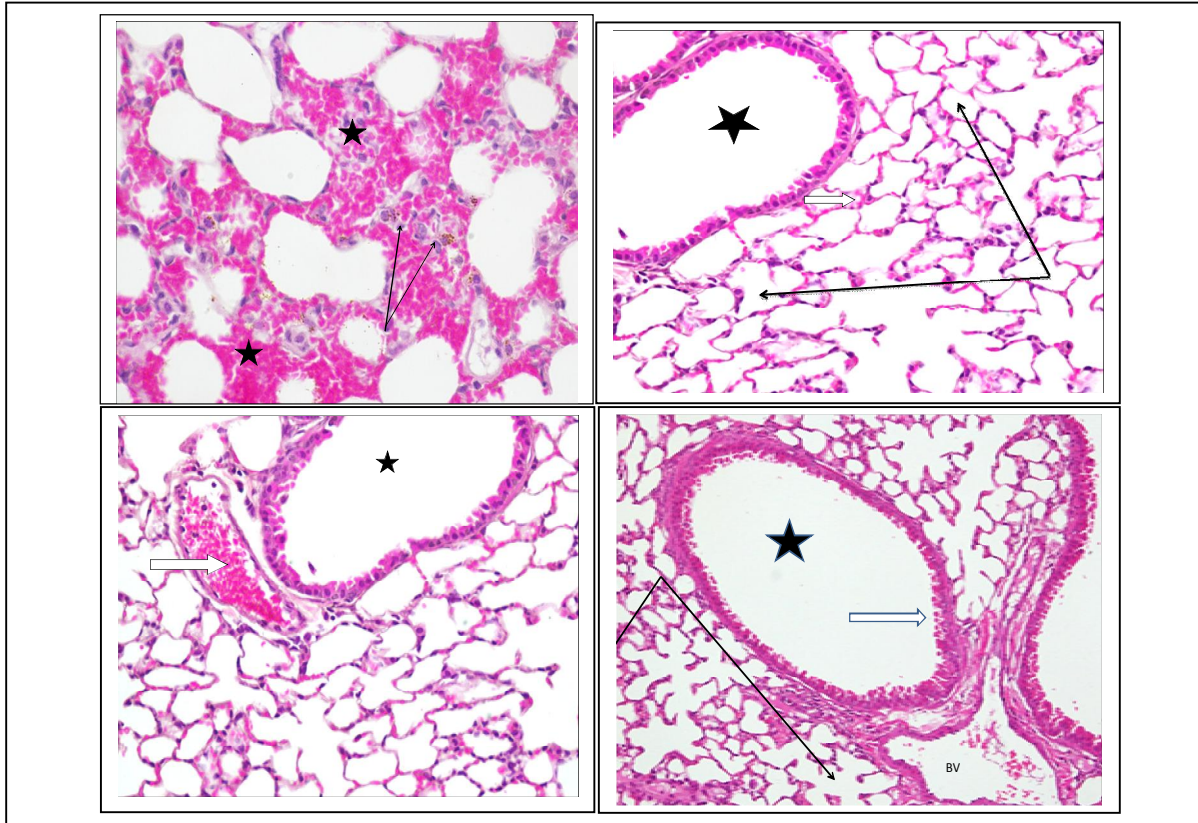
Fig. 1. Photomicrograph of mice lung stained with H&E. (I) Lung section of control group showing normal bronchioles (stars *) with normal epithelium (White arrow), alveolar spaces (thin black arrows), blood vessels (BV). (II) Cypermethrin group showed marked decrease in alveolar spaces. Most showed bleeding and inflammatory cell infiltrate (stars *). (III) The garlic group: note the normal structure of alveolar spaces (thin black arrows), bronchiole cavity free of any secretion (star *) and has normal epithelial lining (white arrows). (IV) Cypermtherin + garlic group: notice that alveolar spaces and are similar to control group of bronchiolar blood vessels (white arrow) were observed. (I) X 400, (II) X 400, (III) X400, (IV) X400.
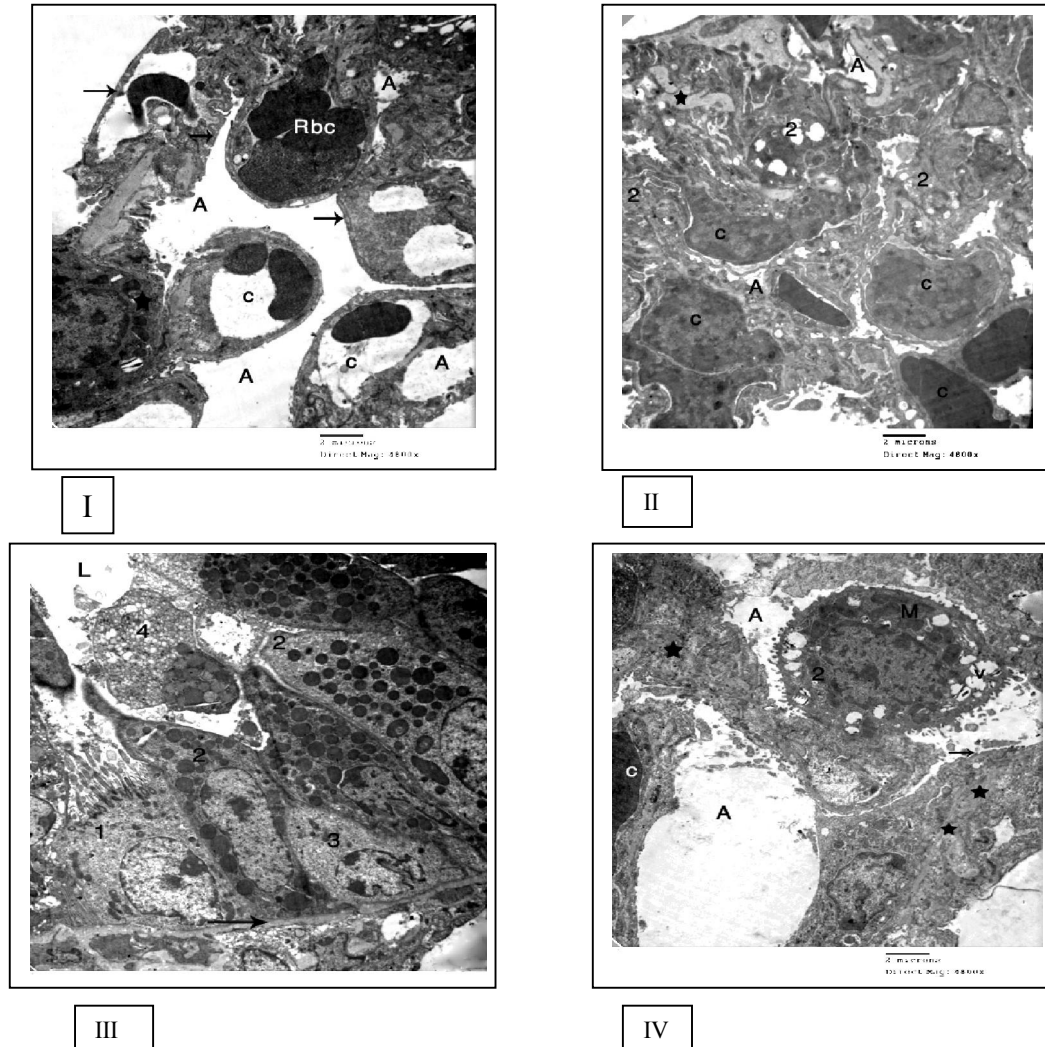
Fig. 2 Electron micrograph of lung in mice. (I) control group: showing the structure of alveolar spaces cells (A) pneumocytes type 2 (*) and pneumocytes type 1 (arrow) and also showing the capillary-alveolar membrane barrier (2) capillary contains red blood corpuscles (rbc). (II) Cypermtherin group showing a decrease in the alveolar space cavity (A) and an increase in the number of pneumocytes type 2 (2) and increased thickness of septal tissue between alveolar spaces (*). (III) No pathological changes in the structure of alveolar tissue in garlic group. (IV) Cypermtherin + garlic group showed an improvement in the inflammatory infiltrate of alveolar spaces, which contain pneumocytes type 2 (2) with microvilli (V) and mitochondria (M), it also shows the pneumocytes type 1 (arrow), alveolar space cavities (A) and shows the basement membrane of sepal capillaries (*). (I) X 4800, (II) X 4800, (III) X 3800, (IV) X4800.

4. Discussion

Epidemiological and experimental evidences of reported in past literature suggested that the use of synthetic chemicals is a major environmental carcinogenic enhancers via generation of free radicals such as reactive oxygen species (ROS) inducing oxidative stress and cellular injury (El-Wakf et al., 2009; Shaarawy et al., 2009; Hassan et al., 2010). Free radicals are known to play an important role in the toxicity induced by pesticides and environmental chemicals. Changes in the status of the antioxidant, oxygen free radicals, the scavenging enzyme system, and lipid peroxidation (Etemadi-Aleagha et al., 2002; Muthuviveganandavel et al., 2011) induced plays an important role in the pathogenesis of various pulmonary diseases. Much work has been done to investigate the protective role of antioxidant enzymes, including GST, glutathione peroxidase, metallothionein, SOD, and catalase, in the lung (Gong et al., 2009). Cypermethrin has also been shown to induce oxidative stress and generation of reactive oxygen species (ROS) in experimental systems

(Hussiena *et al.,* 2011). Gabbianelli *et al.* (2004) suggested that superoxide anion and hydrogen peroxide are the main source of cypermethrin-induced free radical production. Therefore, examining the change in activity of antioxidant enzymes such as SOD, CAT, and GPX is considered as an effective method of denoting oxidative stress. More recently, these enzymes have been used to detect biological toxicity and/or to monitor the impact of chemical pollutants (Xu *et al.,* 1997).

In the current study the cypermtherin group has significantly increased (P <0.05) the concentration of TBARS and antioxidant enzymes GST and SH and SOD in the lung compared with the control group (Table 1). These findings are in agreement with the study of (Abdollahi *et al.,* 2004), who noted that high levels of TBARS in plasma and various tissues is an evidence of a significant increase in the oxidation of cell membranes by free radicals that result in the emergence of oxidative stress. These findings are in agreement with the study of Cochrane (1991), who suggested that when antioxidants in the body is unable to dominate the free radicals production, oxidative stress occurs with subsequent cellular damage. Also, cypermethrin was reported to cause biochemical and haematological changes in rabbit. (Zatta *et al.,* 1998). The lung sections of the cypermethrin group under the light microscope showed pathological changes in thein the form of alveolar exudate and congestion and increased bronchiolar secretion. While under the electron microscopy the cypermtherin group showed a decrease in alveolar cavities as a result of capillary congestion, an increase in the number of pneumocyte type 2 and increased thickness of the basement membrane barriers between alveolar spaces and capillaries were observed. These findings are in agreement with the study of (Ulaiwi, 2011), who fed 24 rabbits cypermtherin for 21 days,and his results showed histopathological alteration such as engorgement of pulmonary capillary and congestion of pulmonary alveoli, thickening and congestion of the alveolar septa and swollen and tortuous of smaller veins, similar findings were reported by Nagarjuna and Jacob (2009) after mice exposure to sublethal doses (41 mg/kg bw) of cypermethrin as single dose, double dose and multiple dose. Cypermethrin administered at repeated oral doses of 5 and 20 mg/kg/day for 30 days produced thickening of alveolar septa in lungs (Grewal *et al.,* 2010). Sayim *et al.* (2005) and Hussiena *et al.* (2011) reported that Cypermethrin caused different histopathological changes in rat organs including ischemia and pyknosis of the cytoplasm of the neurons in the brain tissue A Study done by Al-Azizz (2012) demonstrated also lung toxicity in pigeonsupon

exposure to different doses of cypermethrin. The pathological changes found by the author in the lungs with low, intermediate and high dose are emphysema and congestion, and some with foamy alveolar macrophages.

Biochemical assays done in the present study showed that administration of garlic with cypermethrin result in improvement of antioxidants enzymes levels with reduced TBARS levels. This could be attributed to the role of garlic as an antioxidant that preventing the accumulation of toxins within the cell and promote the production of energy. These findings are in agreement with study of (El-Banna *et al.,* 2009) who found that feeding garlic with chlorpyrifos (CPF) the most widely used organophosphate insecticides has led to a decrease in concentration of TBARS and an increase in the levels of antioxidant enzymes in the liver. However, the administration of garlic can modulate the oxidative stress and improve the antioxidant system through the direct cytoprotective effect of garlic oil constituents; diallyldisulphide (DADS, 60%), allyl propyl disulphide (6%), allicin (0.3–0.5%) and diallyltrisulphide (DATS) (Anwar and Meki, 2003; Sener *et al.,* 2003; Pari *et al.,* 2007; Hassan *et al.,* 2010). The results suggested by (Mirunalini *et al.,* 2004) that garlic oil may exert its chemopreventive effects by modulating lipid peroxidation and enhancing antioxidant status in the liver and blood during buccal pouch carcinogenesis induced by 7,12-dimethylbenz [a] anthracene (DMBA) in male Syrian hamsters. Another study done by Zare *et al.* (2008), who investigated the effect of 1, 2, and 3 times intraperitoneal injections of aged garlic extract on an established allergic airway inflammation in murine model (BALB/c mice). Their results indicated that three-time intra peritoneal injections of the aged garlic extract caused a significant decrease in the hallmark criteria of allergic airway inflammation levels.

Histopathological studies of the present study confirmed the protective role of garlic and the improvement of biochemical parameters. Animals fed garlic with cypermtherin showed return the alveolar tissue and bronchioles to their normal form except of few bronchioles that showed congestion of accompanied blood vessels. These findings are in agreement with the study of Assayed *et al.* (2010b), who suggested that garlic and ascorbic acid dampen the reproductive toxicity and/or teratogenicity of cypermethrin toxicity in rats. With the study of (Nwokocha *et al.,* 2012), garlic can be used in the reduction of some metal accumulation in the liver. (Ziu *et al.,* 1994) reported that mice injected with ascites tumor cells that were pretreated with an

extract of garlic developed strong immunity against the same type of tumor cells.

5. Conclusion

The present study concluded that, cypermethrin caused significant increase in the concentration TBARS and decreased antioxidant enzymes and this coincide with pathological changes seen in lung parenchyma under either by light or electron microscope. Moreover, using garlic in combination with cypermethrin minimized its toxic effects on most of the tested parameters and this may be attributed to the vital role of garlic as antioxidant that could be beneficial in alleviating cypermethrin toxicity. Consequently, exposure to cypermethrin should be reduced and attention must be paid to take care when dealing with cypermethrin sources.

References

Abdollahi M, Mostafalou S, Pournourmohammadi S and Shadnia S (2004). Oxidative stress and cholinesterase inhibition in saliva and plasma of rats following subchronic exposure to malathion. Comparative Biochemistry and Physiology Part C:Toxicology & Pharmacology, 137(1); 29-34.

Al-Azizz Suzan A(2012). The Pathological Effect of Cypermethrin on Domestic Pigeons (Culumba livia gaddi) at Basrah City/Southern Iraq. International Journal of Poultry Science,11 (4); 302-310.

Ames V.N, Shigenaga M. K and Hagan T.M (1993). Oxidants, antioxidants and the degenerative diseases of aging. Proceedings of the National Academy of Sciences of the United States of America, 90; 7915–7925.

Anwar M.M and Meki, A.R (2003). Oxidative stress in streptozotocin-induced diabetic rats: effects of garlic oil and melatonin. Comp. Biochem. Physiol. Mol. Integr. Physiol. 135; 539–547.

Assayed M.E, Khalaf A.A and Salem H.A (2010a). Protective effects of garlic extract and vitamin C against *in vivo* cypermethrin-induced cytogenetic damage in rat bone-marrow, Mutat. Res, 702 ; 1–7.

Assayed M.E, Khalaf A.A and Salem H.A (2010b). Protective effects of garlic extract and vitamin C against *in vivo* cypermethrin-induced teratogenic effects in rat offspring. Food and Chemical Toxicology, 48 ; 3153–3158.

Ban J.O, Yuk D.Y, Woo K.S, Kim T.M, Lee U.S and Jeong H.S, *et al.* (2007). Inhibition of cell growth and induction of apoptosis via inactivation of NF-kappaB by a sulfur compound isolated from garlic in human colon cancer cells. J Pharmacol Sci,104;374 - 383.

Batirel H.F, Aktan S, Aykat C, Yegen B.C, Coskun T (1996). The effect of aqueous garlic extract on the levels of arachidonic acid metabolites (leucotrienes C4 and prostaglandins E2) in rat forebrain after ischemia-repurfusion injury, Prostagland Leucotri. Ess. Fatty Acids, 54; 289–292.

Block, E (1985). The chemistry of garlic and onions. Scientific American, 252; 114-119.

Borges Adriana, Scotti Luciana V, Siqueira Daniele R, Zanini Rebeca, Amaral Fernanda do, Jurinitz Daiane F and Wassermann Guillermo F (2007). Changes in hematological and serum biochemical values in jundia´ Rhamdia quelen due to sub-lethal toxicity of cypermethrin. Chemosphere, 69 ; 920–926.

Bozin B, Dukic N.M, Samojlik I, Goran A and Igic, R (2008). Phenolics as antioxidants in garlic (*Allium sativum* L., Alliaceae). Food Chem, 111; 925–929.

Cho H. Y, Reddy S. P and Kleeberger, S. R. (2006) Antioxid. Redox Signal, 8; 76–87.

Chow C. W, Herrera Abreu M. T, Suzuki T and Downey G. P (2003). Oxidative stress and acute lung injury. Am. J. Respir. Cell Mol. Biol. 29, 427–431.

Christofidou-Solomidou M and Muzykantov V. R. (2006). Antioxidant strategies in respiratory medicine.Treat Respir. Med. 5, 47–78.

Cochrane C.G (1991). Cellular injury by oxidants. Am. J. Med., 91: 23S-30S.

Coombs A, Carter B, Hend R, Butterworth S and Buckwell A (1976). Toxicity studies on the insecticide WL 43467: Summary of results of preliminary experiments. Unpublished report No. TLGR.0104.76 from Shell Toxicology Laboratory (Tunstall). Submitted to the WHO by Cyanamid, Wayne, NJ, USA.

Das Iia, Ph.D.a, and Saha Tapas, Ph.D.b (2009). Effect of garlic on lipid peroxidation and antioxidation enzymes in DMBA-induced skin carcinoma. Nutrition,25 ; 459–471.

Datta C, Gupta J and Sarkar A (1992). Effects of organophosphorus insecticide phosphomidon on antioxidant defense components of human erythrocyte and plasma. Indian. J. Exp. Biol, 30; 65-67.

Eidi A, Eidi M and Esmaeili E (2006).Antidiabetic effect of garlic (Allium sativum L) in normal and streptozotocin-induced diabetic rats. Phytomedicine, 13 ;624–629.

El-Banna Sabah G, Attia Ahmed M, Hafez Afaf M, El-Kazaz Sara M (2009). Effect of garlic consumption on blood lipid and oxidant/antioxidant parameters in rat males exposed to chlorpyrifos. Slovak J. Anim. Sci., 42 (3);111 – 117.

El-Demerdash F.M, Yousef M.I and Abou El-Naga N.I (2005). Biochemical study on the hypoglycemic effects of onion and garlic in alloxan-induced diabetic rats, Food Chem. Toxicol, 43 ;57–63.

Ellman, G.L. (1959). Tissue sulfhydryl groups. Archives of Biochemistry and Biophysics, 82: 70-77.

El-Wakf A.M, Hassan H.A, El-said F.G and El-Said A (2009). The association between nitrite contamination of drinking water and changes in methemoglobin level other hematological parameters in young and adult male rats. J. Egypt. Soc. Toxicol, 49; 91–96.

Etemadi-Aleagha A, Akhgari M, Abdollahi M (2002). A brief review on oxidative stress and cardiac diseases. Mid. East Pharmac, 10;8-9.

Flora S.J.S, Mehta Ashish and Gupta Richa (2009). Prevention of arsenic-induced hepatic apoptosis by concomitant administration of garlic extracts in mice. Chemico-Biological Interactions, 177;227–233.

Gabbianelli R,. Nasuti C, Falcioni G and Cantalamessa F (2004). Lyphocyte DNA damage in rats exposed to pyrethroids effect of supplementation with vitamins E and C, Toxicology,203 ; 17–26.

Gong Haibiao, He Jinhan, Lee Jung Hoon, Mallick Edward, Gao Xiang, Li Song, Homanics Gregg E and Xie Wen (2009). Activation of the Liver X Receptor Prevents Lipopolysaccharide-induced Lung Injury. The Journal of Biological Chemistry, 284, (44): 30113–30121.

Gorinstein S, Drzewiecki J, Leontowicz H, Leontowicz M, Najman K, Jastrzebski Z, *et al.* (2005). Comparison of the bioactive compounds and antioxidant potentials of fresh and cooked Polish, Ukrainian, and Israeli garlic. J Agric Food Chem, 53; 2726-2732.

Gorinstein S, Leontowicz H, Leontowicz M, Namiesnik J, Najman K, Drzewiecki J, *et al.* (2008). Comparison of the main bioactive compounds and antioxidant activities in garlic and white and red onions after treatment protocols. J Agric Food Chem,56;4418- 4426.

Grewal K. K, Ranjit Kaur G. S, Brar R. S and Sandhu H. S (2010). Toxic Impacts of Cypermethrin on Behavior and Histology of Certain Tissues of Albino Rats. Toxicol Int. Jul-Dec, 17(2); 94–98.

Griesmacher A, Kindhauser M, Andert E.S (1995). Enhanced serum levels of thiobarbituric acid reactive substances in diabetes mellitus. Am. J. Med. 98, 469–475.

Habig W.H, Pabst M.J and Jabkoby W.B (1974). Glutathione-S-transferase. J Biol Chem, 249; 7130-7139.

Hassan H. A, Hafez H. S and Zeghebar F. E (2010). Garlic oil as a modulating agent for oxidative stress and neurotoxicity induced by sodium nitrite in male albino rats. Food and Chemical Toxicology,48 ; 1980–1985.

Hussiena H. M, Abdoub H. M and Yousef M.I (2011). Cypermethrin induced damage in genomic DNA and histopathological changes in brain and haematotoxicity in rats: The protective effect of sesame oil. Brain Research Bulletin.

Ide N and Lau B.H (1997). Garlic compounds protect vascular endothelial cells from oxidized low density lipoprotein-induced injury. J Pharm Pharmacol,49; 908 - 911.

Jin Y, Zheng S, Pu Y, Shu L, Sun L, Liu W and Fu Z(2011). Cypermethrin has the potential to induce hepatic oxidative stress, DNA damage and apoptosis in adult zebrafish (Danio rerio), Chemosphere, 82 ; 398–404.

Kale M, Rathore N, John S and Bhatnagar D (1999). Lipid peroxidative damage on pyrethroid exposure and alterations in antioxidant status in rat erythrocyte: a possible involvement of reactive oxygen species. Toxicol Lett,105;197–205.

Kodera Y, Suzuki A, Imada O, Kasuga S, Sumioka I, Kazenawa A, Taru N, Fujikawa M, Nagae S, Masamoto K, Maeshige K and Ono K (2002). Physical, chemical, and biological properties of S-allylcysteine, an amino acid derived from garlic. J. Agric. Food Chem, 50; 622–632.

Mirunalini S, Kumaraguruparan R, Subapriya R and Nagini S (2004). Garlic Oil Enhances Hepatic and Blood Antioxidants During Hamster Buccal Pouch Carcinogenesis. Pharmaceutical Biology, 42, (3): 240–245.

Misra H.P and Fridovich I (1972). The role of superoxide anion in the autooxidation of epinephrine and simple assay for superoxide dismutase. J Biol Chem, 247; 3170-3175.

Muthuviveganandavel V, Muthuraman P, Muthu S and Srikumar K (2011). Individual and combined biochemical and histological effect of Cypermethrin and Carbendazim in male albino rats. Journal of Applied Pharmaceutical Science, 01 (09); 121-129.

Nagarjuna A and Jacob Doss P (2009). Acute oral toxicity and histopathological studies of cypermethrin in rats. Indian J. Anim. Res, 43 (4) ; 235-240.

Naik G.H, Priyadarsini K.I, Satav, J.G, Banavalikar, M.M, Sohani, D.P, Biyani, M.K and Mohan, H (2003). Comparative antioxidant activity of individual herbal components used in ayurvedic medicine. Phytochemistry, 63; 97–104.

Nakamura T, Nakamura H, Hoshino T, Ueda S, Wada H and Yodoi J (2005). Antioxid. Redox Signal, 7; 60–71.

Nwokocha Chukwuemeka R, Owu Daniel U, Nwokocha Magdalene I, Ufearo Chibueze S,Iwuala Moses O.E (2012). Comparative study on the efficacy of Allium sativum (garlic) in reducing some heavy metal accumulation in liver of wistar rats. Food and Chemical Toxicology, 50 ; 222–226.

Ohkawa H, Okishi N and Yogi K (1979). Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. Anal Biochem, 95; 351-358.

Pari L, Murugavel P, Sitasawad S.L and Kumar, K.S (2007). Cytoprotective and antioxidant role of diallyltetrasulfide on cadmium induced renal injury: an in vivo and in vitro study. Life Sci. 7; 50–658.

Parinandi, N.L, Thompson E.D.W, Schmid H.O.H (1990). Diabetes heart and kidney exhibit increased resistance to lipid peroxidation. Biochem. Biophys. Acta 1047, 63–69.

Peyrot F. and Ducrocq C (2008). Potential role of tryptophan derivatives in stress responses characterized by the generation of reactive oxygen and nitrogen species. J Pineal Res. 45, 3; 235-246.

Rahman I. (2008). Antioxidant therapeutic advances in COPD. Ther. Adv. Respir. Dis. 2, 351–374.

Retter R.J (1993). Interactions of the pineal hormone melatonin with oxygen-centred free radicals: A brief review. Brazilian J. Med. Biol. Res., 26: 1141-1155.

Salah S.H, Abdou H.S and Abdel Rahim E.A (2009). Modulatory Effect of Vitamins A, C and E mixtures Against Tefluthrin Pesticide Genotoxicity in Rats. Research Journal of Agriculture and Biological Sciences, 5(6): 1070-1078.

Saner G, Satiroglu H, Sehirili A.O, Kacmaz A (2003).Protective effect of aqueous garlic extract against oxidative organ damage in a rat model of thermal injury, Life Sci, 73 ; 81–91.

Sayim F. N, Yavasoglu U.K and Uyanikgil Y(2005). Neurotoxic effects of cypermethrin in Wister rats: a haematological, biochemical and histopathological study, J. Health Sci.,51 ; 300–307.

Shaarawy S.M, Tohamy A.A, Elgendy S.M, Abd-Elmageed Z.Y, Bahnasy A, Mohamed M.S, Kandil E, Matrougui K (2009). Protective effects of garlic and silymarin on NDEA-induced rats hepatotoxicity. Int. J. Biol. Sci, 5; 549–557.

Sharma Veena, Sharma Arti and Kansal Leena (2010). The effect of oral administration of Allium sativum extracts on lead nitrate induced toxicity in male mice. Food and Chemical Toxicology, 48; 928–936.

Shukla Y and Kalra N (2007). Cancer chemoprevention with garlic and its constituents. Cancer Lett,247;167– 181.

Stephen B, Kyle L and Yong X (1997). Role of oxidative stress in the mechanism of dieldrin's hepatotoxicity. Ann. Clin. Lab. Sci., 27: 196-208.

Tsai Chia-Wen, Chen Haw-Wen, Sheen Le-Yen and Lii Chong-Kuei (2012). Garlic: Health benefits and actions. Bio Medicine, 2 ;17-29.

Tsiaganis M.C, Laskari K, Melissari E (2006). Fatty acid composition of Allium species lipids. J Food Compost Anal,19;620-627.

Ulaiwi H. Kh (2011). Hemato-biochemical and histopathological alterations induced by acute cypermethrin toxicity in rabbits. AL-Qadisiya Journal of Vet. Med. Sci. 10,1;84-94.

Wesselkamper S. C, McDowell S. A, Medvedovic M, Dalton T. P., Deshmukh H. S, Sartor M. A, Case L. M, Henning L. N, Borchers M. T., Tomlinson, C. R, Prows D. R and Leikauf G. D. (2006). The Role of Metallothionein in the Pathogenesis of Acute Lung Injury. Am. J. Respir. Cell Mol. Biol. 34;73–82.

Xu J.B, Yuan X.F and Lang P.Z (1997). Determination of catalase activity and catalase inhibition by ultraviolet spectrophotometry, Chin. Environ. Chem, 16 ; 73–76.

Zare Ahad, Farzaneh Parvaneh, Pourpak Zahra, Zahedi Fatemeh, Moin Mostafa, Shahabi Shahram and Hassan Zuhair (2008). Purified Aged Garlic Extract Modulates Allergic Airway Inflammation in Balb/c Mice. Iran J Allergy Asthma Immunol September, 7(3);133-141.

Zatta P, Nicosia V and Zambenedetti P(1998). Evaluation of MAO activities on murine neuroblastoma cells upon acute or chronic treatment with aluminum(III) or tacrine, Neurochem. Int, 32 ; 273–279.

Ziu M. M, Giasuddin A.S. M and Mohammad A. R (1994). The effect of garlic oil (Allium Sativum) on dmba induced salivary gland tumorigenesis in rat. Journal of Islamic Academy of Sciences. 7,3; 189-192.

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Effect of Yeast as Feed Supplement on Behavioural and Productive Performance of Broiler Chickens

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Abstract: This study was conducted to evaluate the effects of new patent probiotic inactivated *Saccharomyces cerevisiae Var. ellipsoideus* (Thepax[®]) and other commercial yeast *"Saccharomyces cerevisiae"* either live or dry feed additives, on behavioral and productive performance of broiler chickens. A total of 496 day-old Cobb chicks were used and divided into 4 groups, 2 replicates for each. Chicks in group one were fed on commercial basal diet as a control group©, the chicks in other three groups were fed on the same diet enriched with 0.5 gm Live yeast / kg diet for group two (T1), 1 gm. dry yeast /kg diet for group three (T2) and 1 gm inactivated yeast /kg diet for group four (T3) (this dose of inactivated yeast was 0.5 g/ kg in grower diet). During 5 weeks experimental period, behavioral measurements as frequency and duration of feeding and drinking behavior; comfort behavior including wing and leg stretch, preening, ground scratch, body shaking and resting behaviour were observed and recorded. Broiler performance including weekly feed intake, weekly body weight gain, final feed intake, final body weight, feed conversion ratio, dressing weight, dressing percentage, mortality rate, and European efficiency index were calculated. Significant differences were observed between different yeast types in ingestive behavior, comfort behaviour, feed intake, final body weight, food conversion ratio, dressing weight, dressing percentage, mortality rate, and European performance index. It can be concluded that the inactivated yeast probiotic can be included in broiler diets for their beneficial effect and to improve their behavioral and productive performance.

1. Introduction

Probiotics firstly defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and or activity of bacteria in the colon **(Gibson and Roberfroid, 1995).** The mode of action of probiotics in poultry includes: (i) maintaining normal intestinal microflora to improve the health and wellbeing of the host (ii) altering metabolism by increasing digestive enzyme activity and decreasing ammonia production (iii) improving feed intake and digestion iv) stimulating the immune system **(Apata, 2008),** and (iv) adversely compete with pathogens for nutrients **(Biggs et al., 2007).** The probiotic microorganisms used in animal nutrition are mainly bacterial strains belonging to different genera, e.g. *Lactobacillus, Enterococcus*, *Pediococcus* and *Bacillus spp.* Other probiotics are microscopic fungi, including *Saccharomyces* cerevisiae yeasts. **Paryad and Mahmoudi (2008).** A few years ago active live yeast, has been documented as probiotic feed additive for poultry due to its improvement effect on performance characteristics. In Egypt, few studies have been conducted to investigate the effect of feeding yeast on performance of Broilers; so the objective of this study was to evaluate the effect of live yeast (1×10^7 cfu/gm), dry yeast "Yeastmax[®]" (1×10^5 cfu/gm) (from *unipharma company, Egypt*)

and the patent new inactivated *Saccharomyces cerevisiae Var. ellipsoideus Doxal strain's* "Thepax[®]", (1×10^{10} Cfu/ gm) (from Doxal company, Italy and Elyoser medicine trading company, Egypt) on behaviour patterns and productive performance of broiler chickens.

2. Materials and Methods

2.1. Birds and Housing

A total of 496 one day-old Cobb chicks were used in this study. All chicks were housed in a broiler house, Faculty of Veterinary Medicine, Cairo University, Egypt. On arrival, chicks were randomly housed in experimental pens (2 m x 2.10 m x 3 m) with stocking density 15/ m^2. Continuous lighting was provided throughout the experiment; the ambient temperature during brooding was 35°C at one day old and gradually decreased to 25°C on day 21 and then kept constant. Feed and water were provided ad libitum via trough feeders and bell drinker. The birds were vaccinated against Newcastle disease and infectious bronchitis on day 6 of age and against Gumboro on day 12 of age.

2.2. Experimental design

The study was conducted on one control group and 3 treatment groups, 2 replicates for each. The replicate was 62 chicks (each treatment consists of 124 chicks). All diets used were in mash form and formulated to meet the nutrient requirement of the

broiler chickens during a five weeks experimental period according to recommendations of the national research council **(NRC 1994).** Table1 presents the treatment of the groups with yeast as feed additives, and table 2 indicates the composition and nutritive value of the basal diet.

Table 1: The experimental groups treated with yeast as feed additives

Groups	Treatment
Group one (control)	Chicks fed on Basal diet without any additives
Group two (T1)	Chicks fed on Basal diet enriched with 0.5 g/kg live yeast(*Saccharomyces cerevisiae* 1 x 10^7 cfu/gm yeast) **Hosseini (2011)**
Group three (T2)	Chicks fed on Basal diet enriched with 1 g/kg dry yeast (Yeastmax, *Saccharomyces cerevisiae* 1 x 10^5 cfu/gm) Unipharma *company*
Group four (T3)	Chicks fed on Basal diet enriched with inactivated yeast (Thepax$^®$, *Saccharomyces cerevisiae* 1 x 10^{10} cfu/gm) in a dose of: -1 gm/ kg in starter diet and 0.5 g/kg in grower diet (Doxal Company , Italy and Elyoser medicine trading company, Egypt)

Table 2. Composition and nutritive value of starter, and grower diet used

	Components	Starter(Kg/100 kg)	Grower (Kg/100 kg)
Ingredients use in the diet	Yellow Corn	60.28	64.3
	Soya bean meal (47%)	34.25	29.28
	Safflower oil	1.51	2.49
	Na bicarbonate	0.18	0.07
	Sodium chloride	0.33	0.33
	DL-Methionine	0.16	0.15
	Lysine	0.18	0.21
	Di calcium phosphate	1.49	1.52
	Lime stone	1.33	1.34
	Premix	0.3	0.3
Total		100	100
Chemical analysis of diet	Metabolisable Energy (Kcal/kg)	2988	3083
	Crude Protein (%)	21	19
	Crude Fat (%)	4.83	5.79
	Fiber (%)	3.7	3.42
	Calcium (%)	0.9	0.9
	Phosphorus (total) (%)	0.73	0.7
	P. Available (%)	0.40	0.4

2.3. Measurements
2.3.1. Behavioral measurements,
The following behavioral parameters were observed and measured throughout the experiment; ingestive behaviour (feeding frequency, feeding duration, drinking frequency and drinking duration); comfort behaviour (wing and leg stretch, preening , ground scratch, Body shaking and resting behaviour **(Duncan, 1998).** All behavioral measurements were conducted according to **Altmann (1974)** through two methods; Daily focal samplings, for six birds per group were identified using special dyes, each bird observed 10 min/ session, two sessions/ day and three days/week; and Scan sampling were applied 2 times /day, 10 minutes / for each; so the total scan observation period was 20 minutes for each group/day.

2.3.2. Productive Performance:
Chicks were randomly weighed at the beginning of experiment, every week and at the end of experiment and also, the offered and remained feed was weighed weekly to calculate, initial body weight, weekly live body weight gain, final body weight, weekly feed intake, total feed intake, Food Conversion Ratio (FCR), and European efficiency index that calculated according to the equation below. Also dressing weight, dressing percentage and Mortality rate were calculated (Mahmood, et al., 2009).

$$\text{European efficiency Index} \quad \frac{A \times B \times 100}{C \times D}$$

A= Average bird final body weight
B= viability percentage (= 100- Mortality percentage)
C= Number of rearing days
D= Food conversion ratio
Results of European efficiency index   = > 300 excellent flock   280-300   very good flock 270-280   Good flock   260-270   Fair flock <   260   weak flock

2.4. Statistical Analysis
The data were subjected to statistical analysis using SPSS program (statistical Package for Social Science) for windows 17 (SPSS 17.1 2005), **Dytham (2003).** Descriptive statistics were used for the analysis of the data result as follow, means, and stander error. The analytical tests which used to compare between the different groups where T test, One way ANOVA , Post Hoc Tests, and Kruskal-Wallis Test. Statistical significant level was at $P \leq 0.05$.

3. Results
The results of the study were tabulated in tables 3, 4, 5 and illustrated in figures 1 and 2

Table 3. Effect of the Yeast types on frequency (no/time) of the different behaviour patterns

Behaviour patterns		Contorl	Live yeast T1	Dry yeast T2	Thepax T3
Ingestive behaviour	Feeding Beh.	5.95a	5.53a	7.00b	5.7a
	Drinking	7.47a	5.37b	4.82b	6.53a
Comfort behaviour	wing and Leg stretch	6.47a	5.65b	5.45b	6.95a
	Preening (P)	6.95a	6.17a	5.62a	5.45b
	Ground scratching (GS)	6.36a	5.4b	5.75b	6.67a
	Body shaking (BS)	6.55a	5.47a	5.45b	6.65a
	Resting Beh.(RB)	7.08a	5.63b	4.69b	6.79a

a, and b means in the same raw highly statistical significant difference at p ≤ 0.05

Table 4. Effect of the Yeast types on the duration "time spent/ Sec." of different behaviour patterns

Behaviour patterns		Contorl	Live yeast T1	Dry yeast T2	Thepax T3
Ingestive behaviour	Feeding Beh.	56.9a	58.9a	73.3b	53.6a
	Drinking	76.8a	54.2b	47.6b	63.3a
Comfort behaviour	wing and Leg stretch	67.6a	55.9b	52.2b	67.3a
	Preening	65.2 a	63 a	57.6 a	53b
	Ground scratching	62.6a	56.2b	59b	67.3a
	Body shaking	61.6a	53b	52b	65.2a
	Resting Beh.	61a	55b	51b	64a

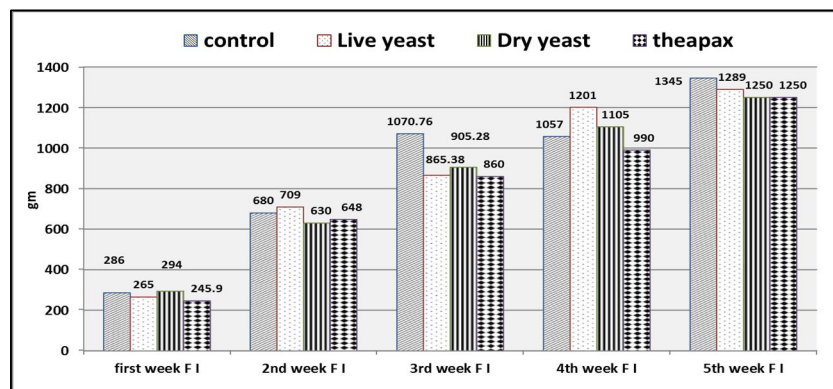a, and b means in the same raw highly statistical significant difference at p ≤ 0.05

Figure 1. Weekly Feed Intake for broiler chicks fed on live, Dry and inactivated yeast *"Thepax® enriched diet"*.
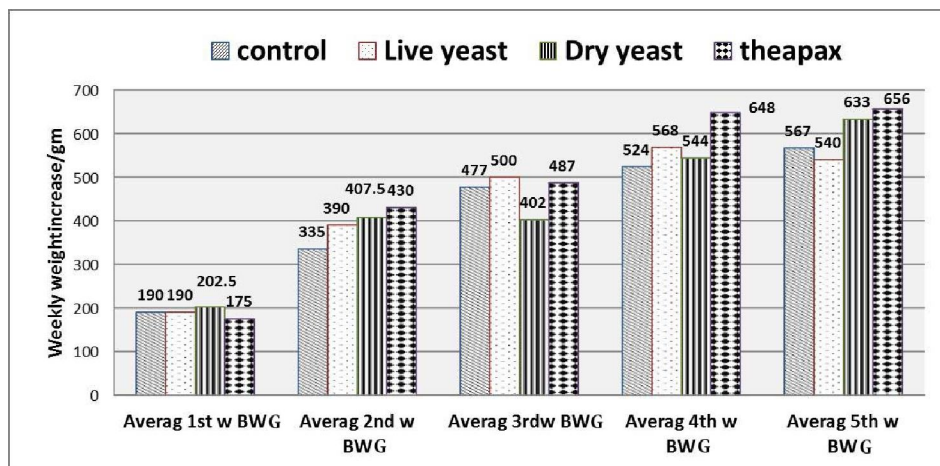

Figure 2. Weekly body weight gain for broiler fed live, Dry and inactivated yeast *"Thepax® "*enriched diet.

Table 5. Broiler performance fed on live yeast, Dry yeast and inactivated yeast *"Thepax®* enriched diet.

Parameters	Group "Mean+SE"			
	Contorl	Live yeast	Dry yeast	Thepax
Initial body weight "gm"	45	45	45	45
Final body weight "kg"	2.093 ± 0.033 [a]	2.188 ± 0.043 [a]	2.189 ± 0.035 [a]	2.396 ± 0.043 [b]
Total body weight gain "kg"	2.048 ± 0.027 [a]	2.143 ± 0.036 [a]	2.144 ± 0.032 [a]	2.351 ± 0.038 [b]
Total feed intake "kg"	4.438 ± 0.054 [a]	4.329 ± 0.062 [b]	4.184 ± 0.058 [b]	4.073 ± 0.052 [b]
Food conversion ratio	2.17 [b]	2.02 [b]	1.95 [b]	1.73 [a]
Post slaughter weight "kg"	1.517 ± 0.027a	1.649 ± 0.024 [b]	1.681 ± 0.028 [b]	1.950 ± 0.027 [b]
Dressing percentage	72.5 [a]	75.4 [b]	76.8 [b]	81.4 [b]
Mortality rate	11.5 ± 0.09 [a]	2.7 ± 0.025 [b]	1.8 ± 0.018 [b]	0.9 ± 0.03 [b]
European Efficiency Index	270	288	359	502

a,b means within a column were significantly different at P<0.05

4. Discussion
4.1. Behavior Measurements

As shown in table (3) and (4)**,** the results indicated that feeding behaviour (frequency and duration) was affected by the addition of yeast to the diet. This may related to the direct effect of probiotic by stimulating appetite of the host **(Nahashon et al., 1992 and 1993).** The birds in dry yeast group showed a significant higher feeding frequency and duration which may attributed to the vitamin mixture in the dry yeast "YEASTMAX", these vitamins have appetizing effect while in the control group, T1 group and T3 group there were no significance differences in feeding frequency and duration. Drinking behaviour (frequency and duration), was much higher in control group, followed by group T3 "Thepax", while the lower drinking frequency and duration recorded in T1 and T3 groups respectively without any significance difference between them.

The comfort behaviour patterns recorded were wing/ Leg stretch, Preening, body scratching, Body shaking and resting behaviour, as indicated in table 2 and 3, there were significance differences in different comfort behaviour, as T3 group showing higher wing/leg stretching, Body shaking and body scratching behaviors (frequency and duration); followed by control group, while the lower wing/leg stretching frequency and duration recorded in T1 and T2 groups, while the control group showing higher frequency and duration Preening behaviour. While control group showing higher Preening behaviour (frequency and duration) followed by T1 and lower preening behaviour was recorded in T3. Resting Behaviour, according to table 2 and 3, there was statistical significance difference, the higher resting behaviour recorded in control group, followed by T3 group. These results may related to the chemical analysis of inactivated yeast "Thepax ®", dry matter contain ß glucan 18 % stimulating broiler immune

system **(Zhang etal., 2005; Flickinger and Fahey, 2002),** which minimize the effect of stress and reflect on the comfort behaviour.

4.2. Performance measurements
4.2.1. Weekly Feed Intake "WFI" and weekly body weight gain

The results illustrated in figure 1 and 2 showed that, T3 "Thepax group" recorded the lowest feed intake within the first week followed by group T1 while the highest feed intake was recorded in control group. At the same time, average weekly body weight increase was higher in group T2 compared to both Control and T1 groups. These results related to the fact that the effect of probiotics depend on the activation and maintaining the normal flora according to **Apata (2008);** as the chicks at one day old have a sterile gastro intestinal tract and the normal flora begin to grow within two weeks according to **Kabir (2009).** So the effect of Thepax, dry yeast and live yeast to stimulate the growth and multiplication of normal flora began to be obvious from the 2nd week, so during the age 8-15 days the weekly feed intake began to increase in group T2 followed by group T3, control group and group T1 these increase reflect on the weekly body weight gain in group T3, T2, T1 and finally control group. These findings agree with **Hadj Ayed et al. (2010)** who found an increase in the relative body weights of chicks receiving a diet supplemented with yeast probiotic. **Haj Ayed et al. (2004)** found an improvement in broilers growth performances when the feed supplemented with a *Saccharomyces cerevisiae.*

In the third week the feed intake in control group was the highest , and achieve lowest weekly body weight gain, it is obvious that live yeast is the best in these period followed by inactivated yeast" THEPAX", this agree with **Kanat and Calialar (1996)** who reported that dry yeast effectively increases body weight gains without affecting

feed/gain ratio. During the fourth and fifth weeks of age, T3 group achieved the lowest weekly feed intake but gained the highest weekly body weight, this related to the fact that the inactivated yeast began to be highly effective after third weeks of age, it is may be explained by the content of the Thepax® "inactivated yeast" the cell wall contain 18 % Mannan oligosaccharide which responsible for the increase intestinal villus development and consequently stimulating broiler performance. Furthermore, the inactivated yeast constitutes a considerable source in nutrients especially the B complex vitamins, amino acids and enzymes which serve to improve chickens health, according to **Zhang et, al., (2005)**; and **Flickinger and Fahey, (2002).** The good result of inactivated Saccharomyces cerevisiae Var. ellipsoideus Doxal strain's "Thepax®" may related to that THEPAX cells are treated by Chitinase, an enzyme which is able to reduce, dramatically, their chitin content from 10 % to 2.7 % according to **Yiannikouris, et al (2004),** so the inactivated yeast cell become more digestible to the gut microflora reflect on their growth and number which stimulate appetite **(Nahashon et al., 1992 and 1993);** improve intestinal microbial balance **(Fuller 1989**); synthesize vitamins **(Coates and Fuller, 1977);** produce the digestive enzyme **(Gilliland and Kim 1984); (Saarela et al., 2000);** utilize indigestible carbohydrate and stimulate lactic acid production **(Bailey, 1987).**

4.2.2. Final performance Measurements

As shown in table 5 there was a highly statistical significance difference, T3 group achieve the higher the final body weight followed by T1 and T2 groups which nearly the same while control group given the lowest final body weight. T3 recorded total the lowest feed intake through the experimental while control group give the highest feed intake and this reflect on the food conversion rate for T3 and control groups (1.7 and 2.12, respectively) These results agree with **Hadj Ayed et al. (2010)** who found an increase in the mean body weights of chicks receiving a diet supplemented with yeast probiotic, also It has been reported by **Ignacio, (1995); and Onifade et al., (1998)** who reported that, feeding yeast to chicks improves body weight gain and feed/gain ratio. Also it was observed that there was a significance difference in dressing yield, T3 group achieve the higher post slaughter weight and dressing percentage followed by T2 group, this result agrees with **Paryad and Mahmoudi (2008)** who found that, supplementation of feed with inactivated Saccharomyces cerevisiae, reduces abdominal fat and also related to the fact recorded by **Ayed and Ghaoui (2011)** which stated that the presence of lipase enzyme in Thepax® that may

improve the digestion of lipids and limit their accumulation in the abdomen.

The mortality rate was much higher in control group 11.5 ± 0.09, followed by T1 group 2.7 ± 0.025 then T2 group 1.8 ± 0.018 and finally T3 group 0.9 ± 0.003, it was clear that the groups supplied by Saccharomyces cerevisiae showed low mortality rate than control group and this may related to the effect of saccharomyces cerevisiae on stimulating the immune system **(Toms and Powrie, 2001)**, reducing intestinal pH and release bacteriocins (**Rolfe, 2000**), compete with other pathogenic microbes for adhesive sites in intestine**(Dunham *et al.,* 1993),** this reflect on the birds immunity and resistance to diseases, as recorded by **(Newman, 1994);** and **(Spring et al., 2000**). Also it may be due to the percentage of ß glucan contents in inactivated Saccharomyces cerevisiae Thepax® about 18.2% which consequently stimulating broiler immune system **(Zhang et, al., 2005),** and **(Flickinger and Fahey, 2002).**

European Efficiency Index was affected by different additives, the T3 group achieves EEI 502 "excellent" these related to the high final body weight and low mortality rate, followed by T2 EEI 359 "excellent" then T1 288 "very good" and finally C group give EEI 270 "good" these related to the high mortality percentage in the control group than the other groups.

Supplementation of broiler feed with yeast has a positive effect on their performance, and behaviour; so it can be concluded that, the inactivated yeast probiotic "Thepax" can be included in broiler diets for their beneficial effect and improvement of behavioral and productive performance of broilers.

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References
1. Altmann J. Observational study of behaviour: sampling methods. Behaviour 1974; 49: 227–267.
2. Apata DF. Growth performance, nutrient digestibility and immune response of broiler chicks fed diets supplemented with a culture of *Lactobacillus bulgaricus*. J. Sci. Food Agric. 2008; 88:1253–1258.
3. Ayed MH, Ghaoui F. Efficiency of supplementing *Saccharomyces cerevisiae var. ellipsoideus* for improved growth performance and carcass yield in

broilers. Research Opinions in Animal & Veterinary Sciences 2011; 1(6): 371-374.

4. Bailey JS. Factors affecting microbial competitive exclusion in poultry overview-outstanding symposia in food science and technology. Food. Tec.1987; July: 88- 92.

5. Biggs P, Parsons CM, Fahey GC. The Effects of several oligosaccharides on growth performance, nutrient digestibility, and cecal microbial populations in young chicks. Poultry Science 2007; 86:2327–2336.

6. Coates ME, Fuller R. The genotobiotic animal in the study of gut microbiology. In: R.T.J.Clarke and T. Bauchop (Eds). Microbial ecology of the gut. Academic Press. London 1977; 311-346.

7. Duncan, I.J.H. Behavior and behavioral needs. *Poultry Science* 1998., 77: 1766-1772.

8. Dunham HJ, William C, Edens FW, Casas IA, Dobrogosz WJ. *Lactobacillus reuteri* immunomodulation of stressor associated disease in newly hatched chickens and turkeys. Poult. Sci. 1993; 72 (Suppl. 1): 103 (Abstr).

9. Dytham C. Choosing and Using Statistics: A Biologist's Guide. 2nd edition. By Blackwell, Oxford. 2003.

10. Flickinger EA, Fahey GC. Pet food application of inulin, oligo fructose and other oligosaccharides. British Journal of Nutrition 2002; 87:S297-S300.

11. Fuller R. Probiotics in man and animals: A review. J. Appl. Bacteriol. 1989; 66(5): 365-378.

12. Gibson RG, Roberfroid M. Dietary modulation of human colonic microbiota: Introducing the concept of prebiotics, J Nutr. 1995; 125:1401-12.

13. Gilliland SE, Kim SH. Effect of viable starter culture bacteria in yogurt on lactose utilization in humans. J. Dairy. Sci. 1984; 97: 1-6.

14. Hadj Ayed M, Kraiem K, Rekik B. Effects of incorporating safmannan in broiler diets on birds' performances and carcass parameters. XIIIth European Poultry Conference. 23-27 August,Tours, France. 2010.

15. Haj Ayed M, Laamari Z, Rekik B. Effects of incorporating an antibiotic "Avilamycin" and a probiotic "Activis" in broiler diets. Proceedings, Western Section, American Society of Animal Science 2004; Vol. 55.

16. Hosseini Seyyedmousa . The Effect of *Saccharomysec cerevisiae* on Blood Parameters of Broiler Chicken's. Global Veterinaria 2011; 7 (4): 411-414,

17. Ignacio ED. Evaluation of the effect of yeast culture on the growth performance of broiler chick. Poult. Sci. 1995; 74(Suppl. 1):19*6.*

18. Kabir Lutful SM. *Review* in the Role of Probiotics in the Poultry Industry. Int. J. Mol. Sci. 2009; 10: 3531-3546.

19. Kanat R, Calialar S. A research on the comparison effect on broiler chickens performance of active dried yeast and inactivated and stabilized probiotic yeast

20. Mahmood S, Hassan MM, Alam M, Ahmad F. Comparative Efficacy of *Nigella sativa* and *Allium sativum* as Growth Promoters in Broilers. Int. J. Agric. Biol. 2009; 11: 775–778.

21. Nahashon SN, Nakaue HS, Mirosh LW. Effect of direct-fed microbials on nutrient retention and production parameters of laying pullets. Poult.Sci. 1992 7; 1(suppl.1): 111 .

22. Nahashon SN, Nakaue HS, Mirosh LW. Effect of direct fed microbials on nutrient retention and productive parameters of Single Comb White Leghorn pullets. Poult. Sci. 1993; 72 (Suppl. 1): 87 (Abstr.).

23. National Research Council (NRC). Nutrient requirements of Poultry, 7th revised edition, National academy press, Washington. D.C. 1994.

24. Newman K. Mannan-oligosaccharides: Natural polymers with significant impact on the gastrointestinal microflora and the immune system. Pages 167–174 in Biotechnology in the Feed Industry. T. P. Lyons and K. A. Jacques, ed. Proceedings of Alletch's 10th Annual Symposium. Nottingham University Press, Nottingham, UK. 1994.

25. Onifade AA, Babatunde GM, Afonja SA,. Ademola SG, Adesina EA. The effect of a yeast culture addition to a low-protein diet on the performance and carcass characteristics of broiler chickens. Poult. Sci. 1998; 77(Suppl. 1):44. (Abstr.) .

26. Paryad A, Mahmoudi M. Effect of different levels of supplemental yeast (*Saccharomyces cerevisiae*) on performance, blood constituents and carcass characteristics of broiler chicks. African J. Agricultural Res. 2008; 3 (12): 835-842.

27. Rolf RD. The role of probiotic cultures in the control of gastrointestinal health. J. Nutr. 2000; 130: 3965-4025 .

28. Saarela M, Mogensen G, Fonden R, Matto J, Mattila-Sandholm T. Probiotic bacteria: safety, functional and technological properties. J. Biotechnol.2000; 84: 1975.

29. Spring PC, Wenk KA, Newman KE. The effects of dietary mannanoligosaccharides on cecal parameters and the concentration of enteric bacteria in the ceca of *Salmonella*-challenged broiler chicks. Poult. Sci. 2000; 79:205–211.

30. Toms C, Powrie F. Control of intestinal inflammation by regulatory T cells. Microbes Infect. 2001; 3: 929-935.

31. Yiannikouris A, François J, Poughon L, Dussap CG, Bertin G, Jeminet G, Jouany JP. Adsorption of zearalenone by β- D-glucans in the Saccharomyces cerevisiae cell wall. J. Food Prot. 2004; 67, 1195–1200.

32. Zhang AW, Lee BD, Lee SK, Lee KW, Song KB, Lee CH. Effects of yeast (*Saccharomyces cerevisiae*) cell components on growth performance, meat quality, and ileal mucosa development of broiler chicks. Poultry Science 2005; 84: 1015-1021.

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Phytoremediation Potentiality of *Cyperus articulatus* L.

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Abstract: The phytoremediation potentiality of *Cyperus articulatus* naturally growing in industrial wastewater was tested. Nine heavy metals were selected for this purpose; As, Cd, Cr, Cu, Fe, Hg, Mn, Ni and Pb. Metal concentrations were measured using the atomic absorption. The accumulation rates of the studied heavy metals showed considerable variations in the accumulation abilities according to the plant organ and type of heavy metals. Accumulation of iron recorded maximum values ranged between (105.5 and 900 μg/g d.wt.) in different plant organs of the studied species growing in wastewater, while minimum values were obtained for the accumulation of cadmium (0.9 to 1.95 μg/g d.wt.). In general the studied heavy metal accumulation can be arranged as follows: Fe > Cr > Cu > As > Mn > Pb > Hg > Ni > Cd. The "translocation factor" (TF) and "bioconcentration factor" (BCF) were calculated. TF was found to be less than 1 for all metal cases, which confirmed the significance of below-ground biomass as a heavy metal accumulator. The HPLC technique was used to prove and assess the effect of heavy metal accumulation in the different plant organs on the chemical components especially in the bellow-ground parts. The obtained results support the idea of using the study plant for phytoremediation in industrial wastewater.
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Keywords: Phytoremediation, heavy metals, HPLC technique, atomic absorption, industrial wastewater.

1. Introduction

Water pollution with heavy metals is one of the major hazards facing our environment and causes most serious environment problems throughout the world (Sundaramoorthy *et al*., 2010). The high concentration of dissolved heavy metals in drinking water may damage nerves, liver, bones, block functional groups of vital enzymes and are possible human carcinogens (Zhang *et al.*, 2012). Various industrial processes result in the generation of metal containing waste streams (Yadav *et al.*, 2012). The effluent discharging industries are distilleries, sugar mills, pulp and paper mills, detergent, chemical factories, textile dyeing industries, tanneries, electroplating, pharmaceuticals and dairy industries (Sundaramoorthy *et al*., 2010).

The removal of toxic heavy metals from industrial wastewater using conventional physico-chemical approaches such as adsorption (Dana and Sayari, 2012), oxidation - reduction and chemical precipitation, evaporation and membrane processes (Zhang *et al*., 2011). However, these techniques have certain disadvantages such as incomplete metal removal, high reagent and energy requirements and generation of toxic sludge that require disposal (Sekhar *et al*., 2003). In recent years, macrophyte-based wastewater treatment systems have several potential advantages compared to conventional treatment systems (Hafeznezami *et al.*, 2012). Phytoremediation is one of the best ecotechnologies in which the combined use of plants, soil amendments and agronomic practices are employed in order to remove the pollutants from the environment and decrease their toxicity (Salt *et al.,* 1998). The use of phytoremediators has been advocated because of rapid growth rates, achieving high levels of nutrient removal (Rahman and Hasegawa, 2011). Hyperaccumulators can tolerate, take up and translocate high levels of certain metals that would be toxic to most organisms. Many studies have been proposed for the use of phytoremediators to successfully improve the quality of contaminated waters and wastewaters for at least two decades (Zhang *et al*., 2010).

Moreover, proper selection of plant species for phytoremediation plays an important role in the development of remediation methods (Salt *et al.*, 1995). The search for indigenous plants, often better in terms of survival, growth and reproduction under metal-stressful field conditions may be an adequate approach to find plant species with metal resistance capabilities and even with the capacity to accumulate heavy metals at very high levels (Yoon *et al.*, 2006). Although there has been a continuing interest in this area, few studies have contributed to the evaluation of the phytoremediation potentiality of native species and the ability of these species to accumulate heavy metals in their belowground parts (roots) and the effect of these heavy metals on the chemical structure of different plant organs as compared to plants naturally growing in non polluted areas.

The aim of this study was to determine the accumulation of nine heavy metals, namely As, Cd, Cr, Cu, Fe, Hg, Mn, Ni and Pb in different plant organs of the native species *Cyperus articulatus*, naturally growing in industrial wastewater site and to relate that feature to the heavy metal content of the soil sediments and water. The present work evaluated the effect of heavy metal accumulation on the chemical structure of different plant organs using HPLC technique. The current study illustrated the potentiality of using *C. articulatus* as a phytoremediator.

2. Materials and Methods

2.1. Plant samples and soil sediment preparations

Biomass of *C. articulatus* samples were collected from the industrial wastewater pond at Sadat City, located about 75 km west of Cairo, Egypt. Soil sediment samples collected from the same pond at 20cm depth. As a control, plant samples were taken from a nearby fresh water canal. The plant samples washed several times by deionized water to remove extraneous and salts then separated to individual organs of inflorescences, culms, rhizomes and roots. Plant samples then dried in an oven at 50 ^{o}C for 48 hrs, chopped and sieved. The particles with an average 0.5 mm were used for obtaining powdered plant material and then ready for measuring heavy metal concentrations.

2.2. Atomic Absorption and heavy metal analysis

One milliliter of sulphuric acid and 15 ml of double distilled water were added to a Kjeldahl flask containing 0.5 g of dried and powdered material was incubated overnight at 80 ^{o}C. After that, 5 ml of acid mixture (nitric acid and perchloric acid in the ratio of 3:1) was added and then digested. The digested material was cooled, made up to 50 ml and filtered through Whatmann No. 42 filter paper. The sample was aspirated to an Atomic Absorption Spectrophotometer with air/acetylene flame and the readings were taken for each heavy metal separately according to suitable wave length as described in APHA (1998) by using atomic absorption spectrophotometer (Perkin Elmer, Model No 200, USA). This analysis was carried out in the Environmental Sciences Department, Faculty of Science, Alexandria University, Egypt. The "translocation factor" (TF) for metals within the studied species was calculated. TF is expressed by the ratio of metal concentration in the above and below-ground biomass. Similarly, the "bioconcentration factor" (BCF) was calculated, which is the ratio of metal concentration in the root to soil sediments (Rezaei and Rezaei, 2006).

2.3. HPLC analysis

Exact 1gram of oil sample was taken from each organ of *C. articulatus* samples and socked separately in 50% acetonitrile (10 ml). After vortex the samples were filtered in micro filter (45 μm). Samples were examined using a HPLC system (Hp 1050) with a UV detector at 220 nm. The separation was accomplished with a ODS, C18 (5 μm. 4 x 250 mm) column. The mobile phase consisted of eluent acetonitrile / water (70/30 v/v) to (95/5 v/v) through 5 min. The flow rate was 1 ml /min. The column temperature was 27 ^{o}C with an injection volume of 10 μl. This analysis was carried out in the Biotechnology Unit of Plant Pathology Institute, Agriculture Research Center, Egypt.

2.4. Analysis of data

Data were analyzed by ANOVA test to determine the significant differences among the mean values at the $P < 0.05$ probability level using a "general linear model" procedure of the Statistical Analysis System (SAS) program (SAS Institute, 1985).

Figure 1. *Cyperus articulatus* after Keith Bradley. (Photo downloaded from: http://www.flickr.com/photos/35605280@N05/6348976834/in/photostream/)

3. Study plant

C.articulatus (Cyperaceae) is a tropical, perennial, rhizomatous, helophytic hydrophyte (Gordon-Gray *et al*., 2006). It is a medicinal plant used to treat many diseases (headaches, migraine, epilepsy, etc.) in some African countries and in Amazonia (Adjanohoun *et al*., 1984; Ngo Bum *et al*., 1996). *C.articulatus* often occurs in almost pure stands in tropical and warm temperate localities that provide permanent water. It is distinguished by its robust, leafless culms up to 1600 x 8 mm that are septate-noded and solid-pithed. In life the nodes are not always clearly defined externally but may be detected by gentle finger pressure or longitudinal sectioning. On drying, with shrinkage pith, the septa stand out markedly. Bracts of the brown, branched, terminal inflorescences are short (5-9 mm), stiff and sharp and never exceed primary ray length. The subterranean,

curved stoloniferous rhizomes are scale-covered when young and terminate, at intervals, in erect, emergent culms. Corm development at the rhizome joints is not usually evident apart from occasional slight enlargements and we found no reference to corm production in the literature. In areas with seasonal climate, fluctuating water levels and greater competition, the plant faces is modified. Culms remain tall, but are slender with fewer septa. Occasionally short, inconspicuous leaf blades terminate the exposed lower leaf sheaths (Gordon-Gray *et al.*, 2006). Bracts are longer (20-36 mm), becoming leaf-like, but seldom exceed the inflorescence (Fig. 1).

4. Results and Discussion

The differences in the metal concentrations through different plant organs of *C.articulatus* growing in either wastewater or fresh water were demonstrated in Table 1. Obviously, metal concentrations of *C.articulatus* plant organs growing in wastewater attained relatively high values as compared to those growing in fresh water. As an example, the arsenic (As) concentrations of the measured plant samples growing in wastewater were found to be (258.5, 216.5, 256.5 and 147.2 μg/g d.wt.) for root, rhizome, culm and inflorescence; respectively and these values were greatly reduced into (55.26, 71.3, 67.05 and 74.1 μg/g d.wt.) for the corresponding plant organs growing in fresh water (*p<0.01*). These results if compared with arsenic content of sediments (254 μg/g d.wt.) and wastewater (10.01 μg/L.), it will confirm the phytoremediation potentiality of *C.articulatus* and that is in accordance with similar studies carried out by many authors for testing phytoremediation potentiality of other *Cyperus* species; Cradwell *et al.* (2002), proved the phytoremediation potentiality of *Cyperus eragrostis*, Deng *et al.* (2004) who proved the same potentiality for *Cyperus malaccensis* lam., and finally Marchand *et al.* (2010) and Soda *et al.* (2012) who tested the potentiality of *Cyperus alternifolius*. The concentration of the other metals in the present work follows the same trend (Table 1). Moreover, the metal accumulation rates by *C.articulatus* varied according to the type of heavy metal. Accumulation of iron recorded maximum values ranged between (105.5 and 900 μg/g d.wt.) in different plant organs of the studied species growing in wastewater, while minimum values were obtained for the accumulation of cadmium (0.9 to 1.95 μg/g d.wt.). The high concentration rates for some heavy metals in the present study might transport to the plant cells due to lack of selectivity in transmembrane (Soda *et al.*, 2012). Generally, the accumulation rates of *C.articulatus* toward the studied heavy metals can be arranged as follows: Fe > Cr > Cu > As > Mn > Pb > Hg > Ni > Cd. These results

confirmed by the previous findings by Kropfelova *et al.*, (2009) and Marchand *et al.*, (2010). Moreover, Liu *et al.* (2010) concluded that wetland species show considerable variations in the metal uptake and accumulation abilities.

Phytoremediation process includes phytoextraction, phytostabilization, phytovolatilization, phytotransformation, and rhizofiltration (Table 2). Phytoremediators initially accumulate heavy metals to their roots through phosphate uptake pathway and then translocate to the above ground parts (Rahman and Hasegawa, 2011). The amount of heavy metal translocated from underground to aboveground parts of the studied species indicates the phytoremediation efficiency of the plant. However, more than 54 and 51 % of total arsenic and iron; respectively, accumulated into the plant were stored in roots. In accordance, Rahman and Hasegawa, 2011, mentioned that few plants have the ability to translocate high amount of arsenic and iron from roots to shoots. On the contrary, most phytoremediators have shown the highest ability to accumulate and translocate heavy metals from roots to shoots (Ma *et al.*, 2001). Accordingly, *C.articulatus* in the present work showed higher metal accumulation in the aboveground than below-ground plant parts concerning cadmium, mercury, manganese and lead. In addition, in order to study the metal mobility, the "translocation factor" (TF) and "bioconcentration factor" (BCF) were calculated and provided in Table 3. The TF for As, Cd, Cr, Cu, Fe, Hg, Mn, Ni and Pd was found to be 0.52, 0.15, 0.54, 0.44, 0.42, 0.95, 0.17, 0.08 and 0.71; respectively by plant samples growing in wastewater. In other words, TF was found to be less than 1 for all metal cases, which confirmed the significance of below-ground biomass as a heavy metal accumulator and that, is in accordance with results obtained by Yadav *et al.* (2012). It is to be noted here that, the translocation factor for heavy metals recorded in samples of *C. articulatus* growing in fresh water showed relatively higher values as compared to that of plant samples growing in wastewater. TF for cadmium was 0.15 and recorded in wastewater plant samples and this value greatly increased into 9.33 for fresh water plant samples (Table 3). The result indicated metal accumulation capability of *C.articulatus*. The present study revealed that different plant organs had different capability for removing and accumulating the heavy metals and this confirmed and coincide with obtained results by Wojciechowska and Waara (2011). On the other hand, BCF of most metal cases except iron and mercury was more than 1. This explained the special accumulation nature of *C.articulatus* and agrees with similar results carried out by Yadav *et al.* (2012) on the removal of heavy metals by *Cyperus alternifolius.* In addition, the

BFCs of metals in hyperaccumulators are greater by some order than those in non-hyperaccumulators. A specific hyperaccumulator can concentrate more than 100 ppm Cd, 1000 ppm Co, Cr, Cu or Pd; or 10000 ppm Zn or Ni (Reeves, 2003). Many researchers reported that metal uptake and accumulation by plants in wetlands depends on their initial concentration in the water (Soda *et al*., 2012). They concluded that the higher metal concentration in water leads to higher uptake by plants. This poses as a reason for higher metal concentration recorded in the different plant organs of the studied species.

The HPLC analysis of *C.articulatus* rhizome growing in either fresh or wastewater were shown in figures 2 (a) and (b); respectively. Both chromatograms resulted in sharp, symmetric and well resolved peaks at a wavelength of 220 nm. Considering the HPLC chromatogram (a) and the library report given in Table (4), there were seven well defined sharp peaks at retention times of 17.293, 10.948, 10.819, 8.493, 8.246, 7.647 and 6.249 representing (Bis(2-ethylhexyl) phthalate), (9,12-octadecadienoic acid), (Octadecanoic acid), (Hexadecanoic acid), (palmitic acid), (methyl ester) and (Methyl N-(1H-2-oxo-4-pyrimidinyl) aminoacetate); respectively. On the other hand, the

HPLC chromatogram (b) and the library report given in Table (5), showed six sharp peaks at the following retention times; 17.282, 10.949, 10.819, 7.882, 7.659 and 4.698 for (di- (2-ethylhexyl) phthalate), (9,12-octadecadienoic acid), (Octadecanoic acid), (Hexadecanoic acid), (Palmitic acid methyl ester) and (Decanedioic acid); respectively. In other words, heavy metals changed the chemical components and causes disappearance of some components (e.g. Methyl N-(1H-2-oxo-4-pyrimidinyl) aminoacetate) and expression of the others (e.g. Decanedioic acid). The obtained results were confirmed by similar studies carried by Rani and Padmakumari (2012) on rhizomes of *Cyperus rotundus*. Moreover, the change in chemical components might be largely attributed to the internal degradation of complex organic and inorganic pollutants present inside plant tissues (Chandra *et al*., 2012). The HPLC chromatogram of inflorescence samples (Figure 2, c) and the given data in Table (6), showed only small weak peaks with exception of three small defined peaks at the following retention times; 17.294, 10.949 and 4.240. This might explained, as stated before, by the low metal accumulation rate of inflorescence as compared to other plant organs and that is in accordance with Sundaramoorthy *et al.* (2010).

Table 1. Heavy metal concentrations of *Cyperus articulatus* plant organs growing in wastewater and fresh water, soil sediments (μg/g d.wt.) and water samples (μg/L.). **Mean values** are given±*SD*. Results are means of three replicates.

Samples	As	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb
	147.2 [a b] ±4.0	**1.55 [a b] ±0.05**	**151.5 [a b] ±3.5**	**138.5 [a b] ±11.50**	**434.0 [a c] ±16.0**	**6.95 [a] ±0.25**	**35.7 [a b] ±1.70**	**1.15 [a] ±0.15**	**35.95 [a b] ±1.75**
Inflorescence•	74.1 [b c] ±2.0	0.00 ±0.00	62.75 [a b] ±2.7	79.33 [a] ±3.5	126.80 [a] ±6.4	2.04 [a] ±0.11	9.35 [a] ±2.10	0.00 ±0.00	3.43 [b c] ±0.88
	256.5 [a] ±3.50	**1.45 [a b] ±0.05**	**227.00 [a] ±27**	**237.50 [a] ±7.50**	**522.5 [a b] ±2.5**	**8.15 [a] ±0.35**	**70.5 [a] ±1.50**	**2.90 [a] ±0.10**	**48.0 [a b] ±2.00**
Culm•	67.05 [b] ±1.70	0.11 [b] ±0.05	45.40 [b] ±4.6	54.64 [a b] ±1.7	104.40 [a d] ±4.5	2.11 [a] ±0.23	12.26 [a] ±0.30	0.00 ±0.00	3.75 [b c] ±1.50
	216.5 [a] ±16.5	**0.90 [a] ±0.10**	**251.50 [a] ±8.5**	**258.5 [a] ±8.50**	**105.50 [a] ±1.5**	**5.40 [a] ±0.40**	**15.0 [a b] ±1.00**	**2.25 [a] ±0.15**	**83.50 [a] ±3.50**
Rhizome•	71.3 [b c] ±5.75	1.60 [a] ±0.20	52.31 [a b] ±6.8	89.86 [a b] ±5.4	76.41 [a] ±8.3	1.05 [a] ±0.10	17.3 [a b] ±1.20	0.63 [a] ±0.05	5.57 [b] ±1.96
	258.5 [a] ±2.50	**1.95 [a] ±0.15**	**329.00 [d] ±59**	**280.50 [a] ±3.50**	**900.0 [b c] ±20.**	**8.35 [a] ±0.25**	**20.5 [a b] ±1.50**	**3.45 [a] ±0.15**	**5.40 [b] ±0.40**
Root•	55.26 [b] ±0.75	0.13 [b] ±0.05	82.2 [a b] ±17.6	88.04 [a b] ±0.5	270.55 [a b] ±3.8	3.43 [a] ±0.35	11.66 [a] ±1.60	1.67 [a] ±0.13	0.38 [c] ±0.11
Sediments	254.0 [a] ±3.74	1.43 [a b] ±0.54	257.66 [a] ±6.12	250.60 [a] ±5.70	5398.3 [c] ±82.1	4.26 [a] ±4.05	59.1 [a] ±13.10	20.36 [a] ±4.02	36.33 [a] ±18.66
Wastewater	10.01 [c] ±4.38	0.06 [b] ±0.02	9.05 [b c] ±1.20	34.91 [b] ±14.5	124.80 [a] ±21.5	52.08 [a] ±17.37	1.30 [b] ±0.30	12.10 [a] ±1.71	25.58 [a] ±5.29
Fresh water	0.00 ±0.00	0.00 ±0.00	2.75 [c] ±0.25	0.00 ±0.00	7.70 [d] ±0.3	2.46 [a] ±0.38	0.00 ±0.00	0.00 ±0.00	6.83 [b c] ±0.23
	**	*	**	*	**	n.s.	*	n.s.	**

* *p*≤0.05, ** *p* ≤0.01, n.s. = non significant.•Heavy metal concentrations of *C.articulatus* plant organs growing in wastewater (μg/g d.wt.) are given in bolded format.

Table 2. Different phytoremediation processes (Vamerali *et al.,* 2010).

Phytoextraction	In this process, plants uptake pollutants from soil and water, and translocate to and store in the harvestable biomass of the plants. Phytoextraction aims to remove pollutants from the contaminated sites. This process is usually observed in hyperaccumulating plants resistant to the pollutants.
Phytostabilization	Plants reduce mobility and phytoavailibility of contaminants in the environment. This process does not remove pollutants from contaminated sites but reduce mobility and excludes metals from plant uptake.
Phytovolatilization	Hyperaccumulating plants uptake pollutants from soil and water, and translocate to the aerial parts of the plants, and volatilize the pollutants in the air.
Phytotransformation	This process is one kind of plant's defense mechanism to the environmental pollutants. The hyperaccumulating plants modify, inactivate, degrade (phytodegradation), or immobilize (phytostabilization) the pollutants through their metabolism.
Rhizofiltration	Usually aquatic plants perform this process. The hyperaccumulating aquaic plants adsorb and absorb pollutants from aquatic environments (water and wastewater).

Table 3. The translocation factor for metals within *C. articulatus* naturally growing in wastewater (TFW) and fresh water (TFF), the bioconcentration factor for metals within the plant in wastewater (BCFW) and fresh water (BCFF).

Metal	TFW	BCFW	TFF	BCFF
As	0.52	3.02	1.15	0.48
Cd	0.15	8.98	9.33	0.17
Cr	0.54	3.41	0.84	0.49
Cu	0.44	3.34	0.93	0.56
Fe	0.42	0.83	0.61	0.15
Hg	0.95	0.10	0.74	0.04
Mn	0.17	1.27	0.90	0.40
Ni	0.08	1.75	0.33	0.08
Pb	0.71	2.44	1.73	0.11

Table 4. Library report for the HPLC- Chromatogram of *C.articulatus* rhizome samples naturally growing in fresh water.

Peak#	RT	Area %	Library/ ID
1	4.251	23.53	z,z-10,12-hexadecadien-1-ol acetate
2	5.473	1.03	Tertradecanoic acid (CAS) ss myristic acid ss neo-fat 14 ss Univol U 316S ss n- Tetradecoic acid
3	6.249	0.71	Methyl N-(1H-2-oxo-4-pyrimidinyl) aminoacetate ss Methyl 2-[(1H-2-oxo-4-pyrimidinyl) amino]acetate
4	6.401	2.70	3-Eicosene, (E)-(+)- bicycle [5.1.0] octan-2-one
5	7.647	7.33	Hexadecanoic acid, methyl ester ss palmitic acid, methyl ester
6	7.870	14.70	Hexadecanoic acid, methyl ester ss palmitic acid, methyl ester (CAS) ss methyl palmitate ss metholene 2216 ss palmitic acid, methyl ester
7	8.246	10.42	Hexadecanoic acid (CAS) ss palmitic acid ss palmitinic acid ss n-hexadecoic acid pentadecanecarboxylic acid ss prifrac 2960 ss coconut oil fatty acids ss cetylic acid ss emersol 140 ss emersol 143
8	8.493	2.95	Hexadecanoic acid (CAS) ss palmitic acid ss palmitinic acid ss n-hexadecoic acid ss pentadecanecarboxylic acid ss 1- pentadecanecarboxylic acid ss prifrac 2960 ss coconut oil fatty acids ss cetylic acid ss emersol 140 ss emersol 143
9	10.220	1.90	(R)- (-)-14-methyl-8-hexadecyn-1-ol
10	10.455	1.97	Cyclopentadecanone, 2-hydroxy-6-octadecenoic acid,methyl ester
11	10.549	1.12	Methyl dihydromalvalate
12	10.690	0.91	Octadecanoic acid, methyl ester
13	10.819	6.23	Octadecanoic acid, methyl ester
14	10.948	12.80	9,12-octadecadienoic acid (z,z)
15	11.371	2.02	Octadecanoic acid (CAS) ss stearic acid ss n-octadecanoic acid ss PD 185 ss NAA 173 ss VANICOL ss Kam 2000 ss Kam 2000 ss Neo-fat 18 ss stearic acid ss hystrene ss stearex beads ss Hystrene
16	13.698	0.82	9,12,15-octadecatrienoic acid, methyl ester, (z,z,z)
17	14.109	0.86	1H-indene, 5-butyl-6-hexyloctahydro- ss Bicyclo[4.3.0]nonane, 3butyl-4-hexyl
18	14.309	1.30	Barbituric acid, 5-allyl-5-(cyclohex-2-en-1-yl) ss thialbarbitone oxygen analogue
19	16.647	0.99	Ergost-25-ene-3,5,6,12-tetrol, (3.beta., 5.alpha., 6.beta., 12.beta.)- 1,E-8,Z-10-Tetradecatriene
20	16.976	1.01	1-Hexacosene
21	17.293	4.69	Bis(2-ethylhexyl) phthalate

*Compounds are listed in order of elution from the eluting column.

Table 5. Library report for the HPLC- Chromatogram of *C.articulatus* rhizome samples growing in wastewater.

Peak#	RT	Area %	Library/ ID
1	4.698	4.34	Decanedioic acid, dimethyl ester
2	6.448	0.86	Butyric acid, 2,3- dichloro- (CAS) ss 2,3- dichlorobutyric acid ss But anoic acid, 2,3-dichloro-Butanoic acid
3	7.659	7.89	Hexadecanoic acid, methyl ester (CAS) ss Methyl palmitate ss Methyl hexadecanote ss Methyl n-hexadeca noate ss Uniphat A60 ss Metholene 2216 ss Palmitic acid methyl ester ss Palmitic acid, methyl ester ss n-Hexadecanoic acid methyl ester ss Palmitic acid
4	7.882	27.39	Hexadecanoic acid, methyl ester (CAS) ss Methyl palmitate ss Methyl hexadecanoate ss Methyl n-hexadecanoate ss Uniphat A60 ss Metholene 2216 ss Palmitic acid methyl ester
5	8.246	6.09	n- hexadecanoic acid (CAS) ss Palmitic acid ss n- hexadecanoic acid ss Pentadecanecarboxylic acid ss Prifrac 2960 ss Coconut oil fatty acids
6	8.493	9.33	Cetylic acid ss Emersol 140 ss Emersol
7	10.232	2.55	9,12-octadecadienoic acid (z,z)-, methyl ester ss methyl cis-9, cis-12- octadecadienoate ss linoleic acid, methyl ester
8	10.455	2.55	9-octadecenoic acid (z)-, methyl ester (CAS) ss methl oleate ss methyl cis-9- octadecenoate ss oleic acid methyl ester ss emery oleic acid ester
9	10.561	3.33	9-octadecenoic acid, methyl ester (CAS) ss methyl octade-9-enoate ss methyl -9- octadecenoate ss methyl oleate
10	10.690	1.10	Heptadecanoic acid, 16-methyl-, methyl ester
11	10.819	15.97	Octadecanoic acid , methyl ester (CAS) ss methyl stearate ss Stearic acid methyl ester ss kemester 9718 ss Stearic acid methyl ester
12	10.949	9.35	9,12- octadecadienoic acid (z,z) methyl ester
13	11.477	1.43	Octadecanoic acid
14	13.910	1.31	Eicosanoic acid, methyl ester (CAS) ss Arachidic acid methyl ester ss methyl eicosanoate
15	16.964	1.84	Docosanoic acid, methyl ester (CAS) ss methyl behenate ss methyl docosanoate ss Behenic acid methyl ester
16	17.282	4.67	di- (2-ethylhexyl) phthalate

*Compounds are listed in order of elution from the eluting column.

Table 6. Library report for the HPLC- Chromatogram of *C.articulatus* inflorescence samples growing in wastewater.

Peak#	RT	Area %	Library/ ID
1	4.240	80.72	(7R,8S)-cis-anti-cis-7,8-Epoxytricyclo[7.3.0.0(2,6)] dodecane
2	8.223	2.70	n-Hexadecanoic acid
3	8.317	2.64	Curan-17-oic acid,2,16-didehydro-19-hydroxy-, methyl ester, (20.xi.)-ss Echitamidine
4	9.292	3.55	Bis (5,5,5-trifluoro-4-oxopentan-2-n-propylene) amine ss 2-pentanone,4,4'-[iminobis(3,1-propanediylitrilo] bis [1,1,1-trifluoro- (CAS)]
5	10.949	3.40	9,12-octadecadienoic acid (z,z-CAS) ss Linoleic acid ss Linoleic ss Unifac 6550 ss Linolic acid ss Telfairic acid ss Grape seed oil ss Polylin No. 515 ss Cis,cis-Linoleic acid ss 9,12-octadecadienoic acid ss cis-9,cis-12-octadecadienoic acid
6	11.689	3.15	N-Benzyl Phthalimide ss 1H-Isoindole-1,3 (2H)-dione, 2-(phenylmethyl)- (CAS) ss Phthalimide, N-benzyl silane
7	17.294	3.85	1-(Methylpropyl)-4-(1',1',2'-trichloro-3'-ethylallyl)benzene

*Compounds are listed in order of elution from the eluting column.
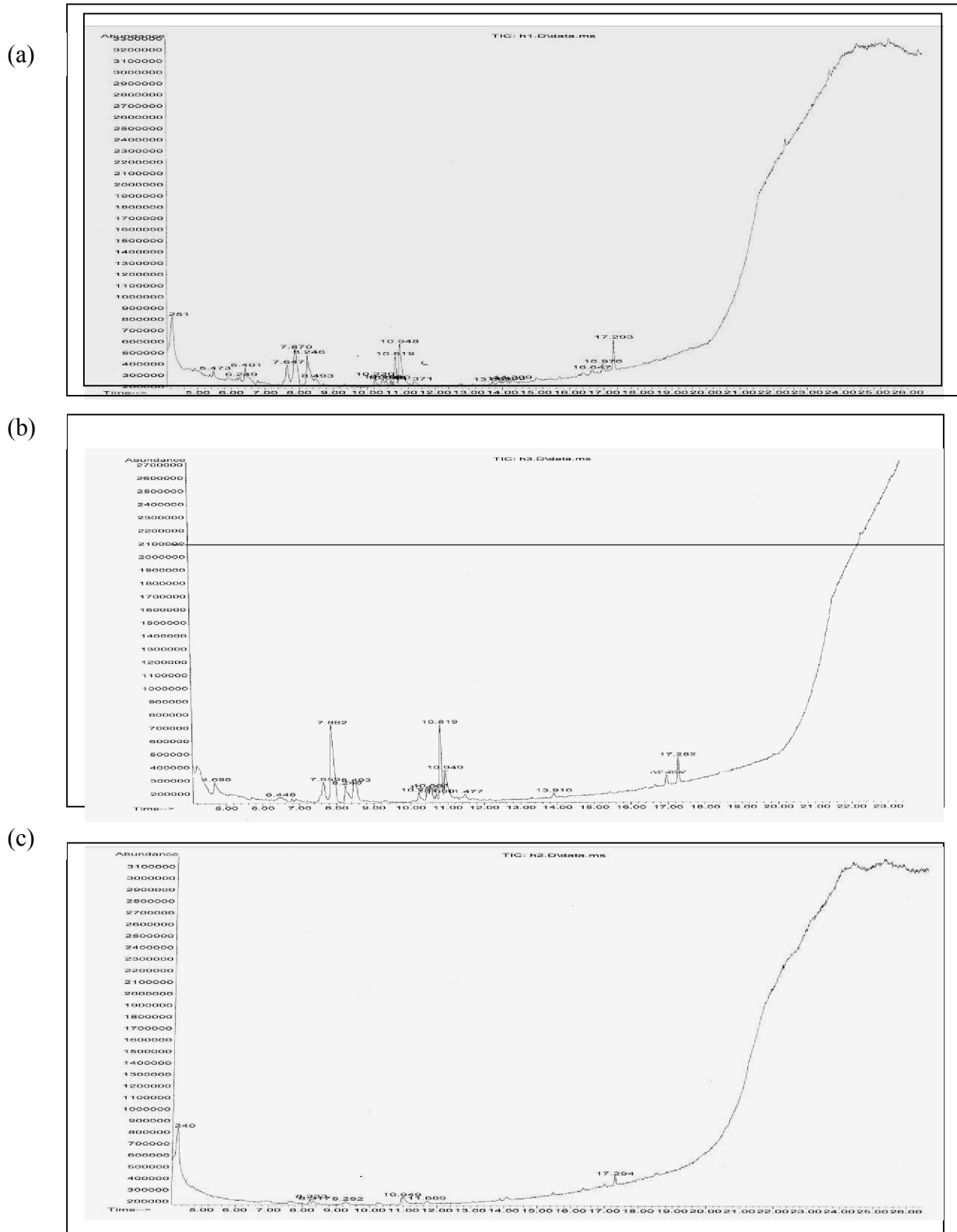
Figure 2. HPLC –Chromatograms of *C.articulatus* rhizome samples naturally growing in fresh water canal (a), naturally growing in wastewater (b) and inflorescence samples naturally growing in wastewater (c) at 220 nm.

5. Conclusion

It can be concluded that *Cyperus articulatus* has the potentiality for phytoremediation of different heavy metals *e.g.* As, Cd, Cr, Cu, Fe, Hg, Mn, Ni and Pb in wastewater. The species show considerable variations in the metal uptake and accumulation abilities according to the plant organ and the type of heavy metal. Heavy metal accumulation in the different plant organs changed their chemical components especially in the bellow-ground parts. Extra investigations on the remobilization and biomineralisation mechanisms of heavy metals are required.

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References

Adjanohoun E., Ake Assi L., Chibon P., De Vecchy H., Duboze E., Eyme J., Gassita J.N., Goudote E., Guinko S., Keita A., Koudogbo B., Le Bras M., Mourambou I., Mve-Mengome E., Nguema M.-G., Ollome J.-B., Posso P. and Sita P. (1984). Médecine Traditionnelle et Pharmacopée: Contribution aux études Ethnobotaniques et Floristiques du Gabon. Editions A.C.C.T., Paris, pp. 56-57.

APHA, AWWA (American Public Health Association, American Water Works Association) (1998). Standard Methods for the Examination of Water and Wastewater, 20th ed., Washington, DC.

Cardwell A.J., Hawker D.W. and Greenway M. (2002). Metal accumulation in aquatic macrophytes from southeast Queensland, Australia. Chemosphere 48: 653-663.

Chandra R., Bharagava R. N., Kapley A. and Purohit H.J. (2012). Characterization of *Phragmites cummunis* rhizosphere bacterial communities and metabolic products during the two stage sequential treatment of post methanated distillery effluent by bacteria and wetland plants, Bioresource Technology, 103: 78-86.

Dana E. and Sayari A. (2012). Adsorption of heavy metals on amine-functionalized SBA-15 prepared by co-condensation: Applications to real water samples, Desalination, 285: 62-67.

Deng H., Ye Z.H. and Wong M.H. (2004). Accumulation of lead, zinc, copper and cadmium by 12 wetland plant species thriving in metal-contaminated sites in China. Environ. Pollut. 132: 29-40.

Garbisu C. and Alkorta I. (2003). Basic concepts on heavy metal soil bioremediation. **Eur**. *J. Min. Proc. Environ. Protect.* 13: 58- 66.

Gordon-Gray K.D., Ward C.J. and Edwards, T.J. (2006). Studies in Cyperaceae in southern Africa 39: *Cyperus articulatus* L. and *Cyperus corymbosus* Rottb. *South African Journal of Botany* 72: 147-149.

Hafeznezami S., Kim J.L. and Redman J. (2012). Evaluating removal efficiency of heavy metals in constructed wetlands, J. Environ. Eng. 138: 475-482.

Kojima H. and Lee K.Y. (2001). Photosynthetic Microorganisms in Environmental biotechnology. Springer-verlag, Hong Kong Ltd., Hong Kong, pp.230.

Kropfelova L., Vymazal J., Svehla J. and Stichova J. (2009). Removals of trace elements in three horizontal sub-surface flow constructed wetlands in the Czech-Republic, Environmental Pollution 157: 1186-1194.

Liu J.G, Li G.H., Shao W.C., Xu J.K. and Wang D.K. (2010). Variations in uptake and transloction of copper, chromium, and nickle among nineteen wetland plant species, Pedosphere. 20: 96-103.

Ma L.Q., Komar K.M., Tu C., Zhang W., Cai Y. and Kennelley E.D. (2001). A fern that hyperaccumulates arsenic. Nature 409, 579.

Marchand L., Mench M., Jacob D.L. and Otte M.L. (2010). Metal and metalloid removal in constructed wetlands, with emphasis on the importance of plants and standardized measurements: A review. Environmental Pollution, 158: 3447-3461.

Ngo Bum E., Meier C.L., Urwyler S., Wang Y. and Herrling P.L. (1996). Extracts from rhizomes of Cyperus articulatus (Cyperaceae) displace [^{3}H]glycine binding from cortical membranes and selectively inhibit NMDA receptor-mediated neurotransmission. Journal of Ethnopharmacology 54:103-111.

Rahman A.M. and Hasegawa H. (2011). Aquatic arsenic: Phytoremediation using floating macrophytes. Chemosphere, 83: 633-646.

Rani M.P. and Padmakumari (2012). HPLC and reverse phase HPLC methods for the simultaneous quantification and *in vitro* screening of antioxidant potential of isolated sesquiterpenoids from the rhizomes of *Cyperus rotundus*, Journal of Chromatography B, 904: 22-28.

Reeves R. D. (2003). Tropical hyperaccumulators of metals and their potential for phytoextraction, Plant Soil, 249: 57-65.

Rezaei B. and Rezaei E. (2006). Simultaneous Determination of Trace Amounts of Nickel, Cobalt and Zinc in wastewater of a Galvanic Workshop by Using Adorptive Cathodic Stripping Voltammetry, J. Anal. Chem. 61: 262-265.

Salt D.E., Smith R.D. and Raskin I.(1998). Phytoremediation, Ann. Rev. Plant Physiol. Plant Mol. Biol. 49: 643-668.

Salt D. E, Blaylock M., Kumar P.B.A.N, Dushenkov V., Ensley B.D., Chet I. and Raskin I.(1995). Phytoremediation: a novel strategy for the removal of toxic metals from the environment using plants, Biotechnology 13: 468-474.

Sekhar K.C., Kamala C.T., Chary N.S. and Anjane Y. (2003). Removal of heavy metals using a plant biomass with reference to environmental control. Int. J. Miner. Process, 68: 37- 45.

Sundaramoorthy P., Chidambaram A., Sankar Ganesh K., Unnikannan P. and Baskaran L. (2010). Chromium stress in paddy: (i) Nutrient status of paddy under chromium stress; (ii) Phytoremediation of chromium by aquatic and terrestrial weeds, Comptes Rendus Biologies, 333: 597-607.

Soda S., Hamada T., Yamaoka Y., Ike M., Nakazato H., Saeki Y., Kasamatsu T. and Sakurai Y. (2012). Constructed wetlands for advanced treatment of wastewater with a complex matrix from a metal-processing plant: Bioconcentration and translocation factors of various metals in *Acorus gramineus* and *Cyperus alternifolius*, Ecol. Eng. 39: 63-70.

Vamerali T., Bandiera M. and Mosca G. (2010). Field crops for phytoremediation of metal-contaminated land, A review. Environ. Chem. Lett. 8: 1-17.

Vázquez M.D., Poschenrieder C. and Barceló J. (1992). Ultrastructural effects and localization of low cadmium concentrations in bean roots. *New Phytol.* 120: 215- 226.

Wojciechowska E. and Waara S. (2011). Distribution and removal efficiency of heavy metals in two constructed wetlands treating landfill leachate, Water Sci. Technol. 64: 1597-1606.

Xiaoe Y., Ying F., Zhenli H. and Peter J.S. (2005). Molecular mechanisms of heavy metal hyperaccumulation and phytoremediation. *Journal of Trace Elements in Medicine and Biology* 18: 339- 353.

Yadav A.K., Abbassi R., Kumar N., Satya S., Sreekrishnan T.R. and Mishra B.K. (2012). The removal of heavy metals in wetland microcosms: effects of bed depth, plant species, and metal mobility. Chemical Engineering Journal, doi: http://dx.doi.org/10.1016/j.cej.2012.09.039.

Yoon J., Cao X., Zhou Q. and Ma L.Q. (2006). Accumulation of Pb, Cu and Zn in native plants growing on a contaminated Florida sites, Sci. Total Environ. 368: 456-464.

Zhang C. B., Wang J., Liu W.L., Zhu S.X. , Liu D., Chang S.X., Chang J. and Ge Y. (2010). Effects of plant diversity on nutrient retention and enzyme activities in a full-scale constructed wetland. Bioresource Technology, 101: 1686-1692.

Zhang X., Yang L., Li Y., Li H., Wang W. and Ye B. (2012). Impacts of lead/zinc mining and smelting on the environment and human heath in China, Eniviron. Monit. And Assess. 184: 2261-2273.

Zhang Y., Zhang M., Yao M. and Li Y. (2011). A new technology of microbial fuel cell for treating both sewage and wastewater of heavy metal, Adv. Mater. Res. 156-157: 500-504.

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Transmission Spectrum of Intraocular Lenses by Ultraviolet Light Exposure

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Abstract: The transmission spectrum of five types of intraocular lenses (IOLs) was measured to assess visual performance after cataract surgery. A UV-Visible spectrometer was used to measure the transmission spectrum of IOLs after exposure to UV light with varying power and exposure time. For Samples (a) and (b), the transmittance is almost zero from 200 nm to 400 nm; the transmittance also decays in the visible region. For Samples (c) and (d), the IOLs cannot block the wavelength from 200 nm to 300 nm. For Sample (e), the IOL cannot block the wavelength from 200 nm to 400 nm. The transmittance of IOLs decays with increasing UV power and exposure duration.

1. Introduction

A cataract is one of the most serious blinding diseases in the world. Cataracts have become the leading cause of reversible loss of useful vision resulting in decreased contrast sensitivity [1, 2] and increased visual disability because of glare [3, 4]. Cataract surgery is usually combined with the implantation of an intraocular lens (IOL). UV light-filtering lenses play a key role in cataract surgery. Evidence shows that UV light causes cystoid macular edema and photic retinopathy. The absorption spectrum of IOLs is very important because UV light-filtering IOLs do not protect the retina from phototoxic damage by high-energy short-wavelength light. The crystalline lens gradually becomes yellow with age, thus reducing the transmission of blue light and preventing it from reaching the retina [5-14].

UV transmitting and UV-blocking IOLs are used widely today. UV-transmitting IOLs do not have chromophores. Colorless UV-blocking IOL chromophores absorb most UV radiation and possibly some violet light. The colors of IOLs are important because it affects the transmission spectrum. In this study, we measured the transmission spectrum of IOLs to assess visual performance after cataract surgery.

2. Experimental

Sample Preparation

Figure 1 shows the five types of IOLs. The samples are denoted as (a), (b), (c), (d), and (e).
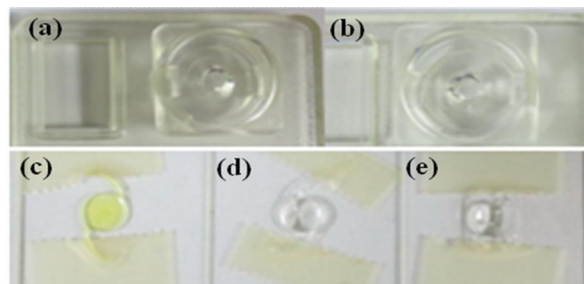
Figure 1: Five types of IOLs.

Setup

Figure 2 shows the experimental setup for the transmission spectrum measurement of IOLs. Non-polarized UV light was expanded and passed through a neutral density filter (NDF), which can adjust the intensity of UV light. A photodiode was linked to a computer to measure UV intensity. A UV-Visible spectrometer was used for measuring the transmission spectrum of IOLs after UV light exposure.

Procedures

(1) Exposure time was fixed at 1 min, and UV power was set to 0, 1, 5, 25, and 50 mW. The transmission spectrum of IOLs was measured from 200 nm to 1000 nm.

(2) Exposure time was changed from 1 min to 180 min, and UV power was changed to 0, 1, 5, 25, and 50 mW. A transmission intensity of 565 nm was observed.
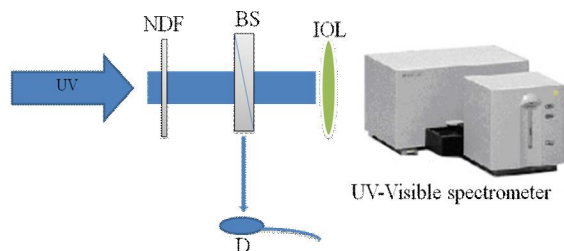
Figure 2: Experimental setup for the transmission spectrum measurement of IOLs. (Neutral density filter [NDF]; beam splitter [BS]; detector [D])

3. Results and Discussions

Figures 3(a) to 3(e) show the variations of the transmission spectrum for Samples (a) to (e). The transmittance approaches zero from 200 nm to 400 nm for Samples (a) and (b). The transmittance gradually decays with increasing UV power for Sample (a), and obviously decays when UV power is higher than 50 mW for Sample (b). For Samples (c), (d), and (e), the transmittance from 200 nm to 300 nm is relatively large. For Samples (c) and (d), the transmittance from 300 nm to 400 nm are almost zero; for Sample (e) the transmittance is nonzero. The transmittance decays rapidly under low UV exposure for Sample (c), decays when UV power is higher than 5 mW for Sample (d), and gradually decreases with increasing UV power for Sample (e).

Figures 4(a) to 4(e) show the variations of the transmission intensities at a wavelength of 565 nm with varying UV power and exposure time. The transmittance slightly decreases with increasing UV power (UV power is less than 50 mW). The transmittance rapidly decreases with a UV power of ~50 mW under an exposure time of ~50 min for Sample (a). When the exposure time is longer than 60 min, the transmittance is maintained at a stable level. For Sample (b), the transmittance gradually decreases with increasing UV power and exhibits a stable signal when UV exposure is longer than 60 min. For Sample (c), the transmittance rapidly decays if UV power is higher than 5 mW; the transmittance decays if UV power is higher than 5 mW. For Sample (e), the transmittance decays if UV power is higher than 25 mW.
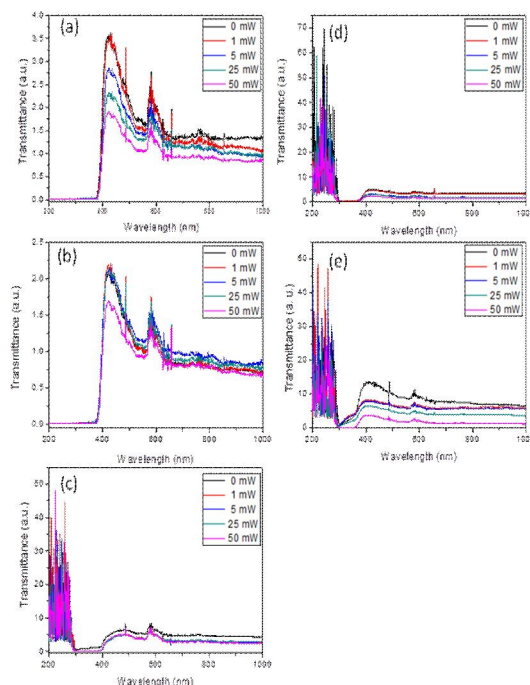
Figure 3: Variations of transmission spectrum corresponding to samples (a) to (e).
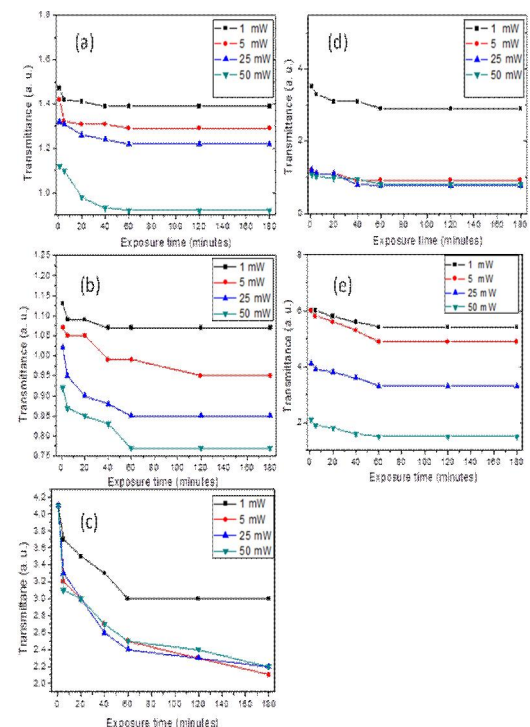
Figure 4: Variations of transmission intensities at a wavelength of 565 nm under different UV power and exposure time.

4. Conclusion

We measured the transmission spectrum of five types of IOLs. For Samples (a) and (b), the transmittance approaches to almost zero from 200 nm to 400 nm and decays in the visible region. For Samples (c) and (d), the IOLs cannot block the wavelength from 200 nm to 300 nm. For Sample (e), the IOLs cannot block the wavelength from 200 nm to 400 nm. The transmittance of IOLs decays with increasing UV power and exposure duration.

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References

[1] Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, et al. (2004) Global data on visual impairment in the year 2002. Bull WHO 82: 844–851.
[2] Ham WT, Jr., Mueller HA, Sliney DH (1976) Retinal sensitivity to damage from short wavelength light. Nature 260: 153–155.
[3] Tomany SC, Cruickshanks KJ, Klein R, Klein BE, Knudtson MD (2004) Sunlight and the 10-year incidence of age-related maculopathy: the Beaver Dam Eye Study. Arch Ophthalmol 122: 750–757.
[4] Taylor HR, West S, Muñoz B, Rosenthal FS, Bressler SB, et al. (1992) The longterm effects of visible light on the eye. Arch Ophthalmol 110: 99–104.
[5] Brockmann C, Schulz M, Laube T (2008) Transmittance characteristics ofultraviolet and blue-light-filtering intraocular lenses. J Cataract Refract Surg 34: 1161–1166.
[6] Mainster MA, Sparrow JR (2003) How much blue-light should an IOLtransmit? Br J Ophthalmol 87: 1523–1529.
[7] Niwa K, Yoshino Y, Okuyama F (1996) Effects of tinted intraocular lens on contrast sensitivity. Ophthalmic Physiol Opt 16: 297–302.
[8] Yuan Z, Reinach P, Yuan J (2004) Contrast sensitivity and color vision with ayellow intraocular lens. Am J Ophthalmol 138: 138–140.
[9] Schwiegerling J (2006) Blue-light-absorbing lenses and their effect in scotopic vision. J Cataract Refract Surg 32: 141–144.
[10] Pierre A, Wittich W, Faubert J, Overbury O (2007) Luminance contrast with clear and yellow-tinted intraocular lenses. J Cataract Refract Surg 33: 1248–1252.
[11] Hayashi K, Hayashi H (2006) Visual function in patients with yellow tinted intraocular lenses compared with vision in patients with non-tinted intraocular lenses. Br J Ophthalmol 90: 1019–1023.
[12] Rodriguez-Galietero A, Montes-Mico R, Munoz G, Albarrá´n-Diego C (2005) Comparison of contrast sensitivity and color discrimination after clear and yellow intraocular lens implantation. J Cataract Refract Surg 31: 1736–1740.
[13] Cionni RJ, Tsai JH (2006) Color perception with AcrySof Natural and AcrySof single-piece intraocular lenses under photopic and mesopic conditions. J Cataract Refract Surg 32: 236–242.
[14] Marshall J, Cionni RJ, Davison J, Ernest P, Lehmann R, et al. (2005) Clinical results of the blue-light filtering AcrySof Natural foldable acrylic intraocular lens. J Cataract Refract Surg 31: 2319–2323.

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The Potential Effects of Propolis against Monosodium Glutamate (MSG) Toxic Effects on Some Biochemical Aspects of Kidney

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Abstract: Monosodium glutamate (MSG) is the most commonly used flavoring agent all over the world. The current study was designed to investigate the protective and therapeutic effect of propolis against monosodium glutamate induced toxic effects on some biological aspects of kidney rats. Accordingly, a total number of fifty male albino rats were divided into five groups. The first group served as control, where the second group was administered propolis at an oral daily dose of 200 mg/kg/b. w. for eight weeks. The third group received MSG 1 g/kg /b. w. for eight weeks. The fourth group (protective group) was first administered propolis alone for 4 weeks, and secondly received MSG in association with propolis for 4 weeks. The fifth group (therapeutic group) was first given MSG alone for 4 weeks and was secondly administered propolis in association with MSG for 4 weeks. At the end of four and eight weeks, blood and kidney tissues were collected to study biochemical parameters and electrophoresis study. MSG administration exerted significant elevation of the mean body weight, absolute and relative kidney weights, serum urea, creatinine, sodium (Na^+), cholesterol, TG, HDL, LDL, VLDL and MDA activities and decrease in potassium (K^+), total protein, albumin and GSH levels. In the electrophoresis study, there was an increase in fraction 1 and 2 and a decrease in fractions 3, 4 and 5 in MSG group, while in the protective group, propolis extract showed significant improvement in the previous fractions. It may be concluded that the results confirm the toxic effect of MSG and the protective effect of propolis, especially when administrated as a protective substance than therapeutic.
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Key Words: Kidney, Monosodium glutamate, Propolis, Biochemical, Oxidative stress, Electrophoresis.

1. Introduction

Monosodium glutamate (**MSG**) is the sodium salt of the non-essential amino acid glutamic acid, one of the most abundant amino acids found in nature. MSG is most commonly used as a flavoring agent all over the world. When MSG is added to food, it provides a flavoring function similar to naturally occurring free glutamate which differ from the four classic tastes of sweet, sour, salt and bitter (*Egbuonu et al., 2010*). Despite its taste stimulation and improved appetite enhancement, reports indicate that monosodium glutamate is toxic to human and experimental animals (*Egbuonu et al., 2010*). The major adverse reaction of MSG might be either immunological reactions such as urticaria, angioedema, cutaneous allergic reaction and asthma, or non-immunological reaction, which include a variety of symptoms such as headache, myalgia, backache, neck pain, tingling and lushing chest heaviness (*Freeman, 2006*).

Propolis is a resinous hive product collected by honeybees from many plant sources (*Tan-No et al., 2006*). Historically it has been used for various purposes, especially as a medicine (*Ghisalberti, 1979*). Flavonoids and phenolics are the major complementary compounds of propolis (*Ivanovska et al., 1995*). Flavonoids are thought to be responsible for many of its biological and pharmacological activities including anticancer (*Padmavathi et al., 2006*), anti-inflammatory (*Paulino et al., 2008*), and antioxidant effects (*Nieva Moreno et al., 2000*). The pharmacological effects of bee propolis include reduction of the blood pressure, protection of the liver tissue, protection against stomach ulcer formation and maintenance of serum glucose (*Kedzia et al., 2007*). Hepatoprotective, renal protective and therapeutic effects of propolis ethanol extract were also reported (*Liu et al. 2005*).

Thus, the present study was designed to examine the possible protective and curative effect of propolis against MSG-induced renal toxicity and oxidative stress in weanling rats.

2. Material and Methods

Fifty weanling male albino rats (*Rattus norvegicus*) (75-95 g) were employed in the present study. They were housed in a well ventilated animal house vivarum of Zoology Department, Women collage, Ain Shams University and kept under the same environmental conditions. They were fed to appetite on standard laboratory animal diet and fresh tap water was at all times.

The rats were randomly assigned into five equal groups each containing 10 male rats. The first group *(Control group)* was left as normal control. The second group *(Propolis treated group)* orally received a daily dose of propolis (200 mg/kg b. w.) for four and eight weeks *(Bhadauria and Nirala, 2009)*. The third group *(MSG group)* was orally administered with 1g/kg b. w. *(Gomathi and Malarvili, 2009)* for 4 and 8 weeks. The fourth group *(Protective group)* received oral dose of propolis daily for 4 weeks then orally administered propolis and MSG for another four weeks. The fifth group *(Therapeutic group)* was treated with oral dose of MSG daily for 4 weeks then orally MSG and propolis for another 4 weeks.

Monosodium glutamate and propolis were purchased from Sigma chemical company (USA).

Biochemical and kidney protein electrophoresis analyses have been assessed. At the end of each experimental period (4 & 8 weeks), blood samples were collected from decapitated animals. The contents of serum urea and creatinine were assayed colorimetrically using commercial kits (Randox Ltd., Co. UK) *(Fawcett and Scott, 1960 and Seeling and Wust, 1969)*. Sodium (Na^+) and potassium (K^+) analysis were accomplished by emission flame photometry after suitable dilutions *(Tietz, 1983 and Tietz, 1976)* respectively. Serum total protein and albumin were assayed colorimetrically using commercial kits (Randox Ltd., Co. UK) *(Henry et al., 1974 and Doumas et al., 1971)* respectively**.** Serum total cholesterol *(Seidel et al., 1983)*, triglycerides *(Fossati and Prencipe, 1982)*, HDL-cholesterol *(Stein, 1986)* were estimated colorimetrically using commercial kits from Randox, Ltd., Co. (UK). LDL-cholesterol was calculated as per Assmann's equation *(Assmann et al., 1984)*. VLDL-cholesterol was calculated as per Assmann's equation *(Assman et al., 1984).*

After sacrifice, kidneys were excised at the end of each experimental period and washed with saline solution (0.9 % Na Cl). After washing, the kidneys were homogenized in ice-cold 0.25 M sucrose containing 1 mM diethylenetriamine penta-acetic acid (1:1 w/v). Each sample was then centrifuged for 20 min at 20.000 g. The supernatant was aspirated for measuring the content of reduced GSH *(Tietze, 1969)* and MDA *(Botsoglou et al., 1994)* by ELISA technique using commercial kits (IBL Gesellschsft, Hamburg, Germany).

Aqueous extracts were prepared from equal weights of kidney of rats of each group as described by *Jay (1964)*. The method used for electrophoresis was that of *Davis (1964)* with *Syn Gene, 4.01.02.*

Statistical Analysis:

All data were analyzed using the SPSS for windows software, version 10.0. Analysis of variance (ANOVA) which is an indication of the dispersion or difference between more than two means to the calculated standard deviation of this difference was assessed. *(Tello and crewson, 2003)*.

3. Result:

1- Determination of body weight, kidney weight and relative kidney weight:

The mean body weight of control group rats and those given propolis and MSG increased gradually throughout the experimental period. Yet the percentage of increase in body weight of MSG rats amounted to 6.1 % at the end of experimentation. The data also indicate gradual increase in the mean kidney weights of control and propolis groups throughout the experimental period with no significant differences in relative kidney weight. While, a partial improvement was recorded in mean body weight, kidney weight and relative kidney weight during protective group (Table 1).

Table (1): The protective and therapeutic role of propolis on body weight, kidney weight and relative kidney weight (g) against MSG treated male albino rats

Parameters	Group / Duration		Control group	Propolis group	MSG group	Protective group	Therapeutic group
Body weight	1st Day	Mean ± S. E. % of change	86.15^A_a±1.88 -2.21	84.25^A_a± 1.45 -2.80	83.74^A_a±1.48 -2.80	82.84^A_a±0.88 -3.84	83.71^A_a±2.05 -2.83
	4th week	Mean ± S. E. % of change	130.60^A_b±2.73	132.60^A_b±6.47 1.53	148.60^B_b±3.74 13.78	128.60^A_b±5.51 -1.53	151.80^B_b±5.19 16.23
	8th week	Mean ± S. E. % of change	167.20^A_c±10.70	162.40^{ACD}_c±3.66 -2.87	177.40^B_c±3.41 6.10	159.40^C_c±5.16 -4.67	166.00^{AD}_c±14.90 -0.72
Kidney weight	4th week	Mean ± S. E. % of change	0.884^A_a±0.078	0.918^A_a±0.058 3.85	0.920^A_a±0.052 4.07	0.974^A_a±0.050 10.18	1.044^B_a±0.056 18.10
	8th week	Mean ± S. E. % of change	1.060^A_b±0.033	1.004^A_b±0.021 -5.28	1.286^B_c±0.057 21.32	1.078^A_b±0.094 1.70	1.132^C_b± 0.063 6.79
Relative kidney weight	4th week	Mean ± S. E. % of change	0.643^A_a±0.047	0.690^A_a±0.011 7.31	0.619^A_a±0.028 -3.73	0.757^B_a±0.028 17.73	0.688^A_a±0.015 6.99
	8th week	Mean ± S. E. % of change	0.643^A_a±0.043	0.619^A_a±0.004 -3.73	0.725^B_b±0.033 12.75	0.676^A_b±0.022 5.13	0.682^A_a±0.011 6.07

A, B, C, D The groups in the same row with different letters are statistically significant (p < 0.05).

a, b, c The groups in the same column with different letters are statistically significant (p < 0.05).

2- Kidney function tests:
Serum urea, creatinine, sodium (Na⁺) and potassium (K⁺) levels:

Data recorded for the serum urea, creatinine, Na⁺ and K⁺ are presented by table (2). Normal rats showed more or less constant levels during the course of the study. Moreover, no remarkable changes were reported in propolis rat group. On the other hand, in MSG group, a significant elevation was realized in urea, creatinine and Na⁺ levels as compared with control group. In relation to the control rats a significant decrease in the serum K⁺ level was reported in the same group.

A considerable time dependent improvement was observed in protected rats group. Furthermore, a highly significant elevation took place in the levels of urea, creatinine and sodium, but significant depression in potassium level in the therapeutic group (group receiving oral dose MSG daily for four weeks then administered oral dose of MSG and propolis for four weeks) during the 4 weeks. A partial decline was recorded through the second interval period of 8 weeks. But, partial recovery occurred in potassium (K⁺) level (Table 2).

3- Protein profile testes:
Serum total protein (g/dl) and albumin (g/dl) levels:

On detecting the serum total protein and albumin level, the data are given in table (3). The control and propolis rats group designed more or less constant figures during the study period. In relation to the control rats a significant decrease in total protein level and in albumin level were reported in rats treated with MSG for 8 weeks. Furthermore, a slight decrease took place in serum total protein and albumin level in the protected rats group. Moreover, partial recovery occurred in the therapeutic rats group.

Table (2): The protective and therapeutic role of propolis on serum urea (mg/dl), creatinine (mg/dl), sodium (Na⁺)(meq/L) and potassium (K⁺)(meq/L) against MSG treated male albino rats.

Parameters	Group / Duration		Control group	Propolis group	MSG group	Protective group	Therapeutic group
Urea	4th week	Mean ± S. E. % of change	$15.21^A_a\pm0.32$	$15.91^A_a\pm0.39$ 4.602	$30.25^B_a\pm0.16$ 98.882	$16.21^A_a\pm0.68$ 6.575	$29.35^B_a\pm0.64$ 92.965
	8th week	Mean ± S. E. % of change	$15.13^A_a\pm0.51$	$16.01^A_a\pm0.32$ 5.816	$38.66^B_b\pm0.83$ 155.519	$17.54^A_a\pm0.50$ 15.929	$25.12^C_b\pm0.81$ 66.028
Creatinine	4th week	Mean ± S. E. % of change	$0.32^A_a\pm0.10$	$0.31^A_a\pm0.10$ -3.125	$0.85^B_a\pm0.23$ 165.625	$0.33^A_a\pm0.56$ 3.125	$0.82^B_a\pm0.22$ 156.25
	8th week	Mean ± S. E. % of change	$0.35^A_a\pm0.09$	$0.33^A_a\pm0.12$ -5.714	$0.95^B_b\pm0.31$ 171.429	$0.41^C_b\pm0.18$ 17.143	$0.71^D_b\pm0.48$ 102.857
Sodium (Na⁺)	4th week	Mean ± S. E. % of change	$133.82^A_a\pm0.56$	$131.70^A_a\pm0.32$ -1.584	$153.31^B_a\pm0.60$ 14.564	$134.56^A_a\pm0.57$ 0.553	$155.20^A_a\pm0.56$ 15.977
	8th week	Mean ± S. E. % of change	$132.70^A_a\pm0.31$	$132.41^A_a\pm0.35$ -0.219	$160.20^B_b\pm0.54$ 20.723	$139.32^C_b\pm0.53$ 4.989	$149.41^D_b\pm0.47$ 12.592
Potassium (K⁺)	4th week	Mean ± S. E. % of change	$4.15^A_a\pm0.32$	$4.20^A_a\pm0.29$ 1.205	$2.46^B_a\pm0.90$ -40.723	$4.50^A_a\pm0.91$ 0.843	$2.61^B_a\pm1.0$ -37.108
	8th week	Mean ± S. E. % of change	$4.16^A_a\pm0.40$	$4.14^A_a\pm0.33$ -0.481	$2.03^B_b\pm0.14$ -51.202	$4.21^A_a\pm1.5$ 1.202	$2.93^C_b\pm1.2$ -29.567

A, B, C, D The groups in the same row with different letters are statistically significant (*p* < 0.05).
a, b, c The groups in the same column with different letters are statistically significant (*p* < 0.05).

Table (3): The protective and therapeutic role of propolis on serum total protein and albumin (g/dl) against MSG treated male albino rats.

Parameters	Group / Duration		Control group	Propolis group	MSG group	Protective group	Therapeutic group
Total protein	4th week	Mean ± S. E. % of change	$6.21^A_a\pm0.13$	$6.19^A_a\pm0.10$ -0.322	$4.51^B_a\pm0.04$ -27.375	$6.21^A_a\pm0.06$ 0.000	$4.31^B_a\pm0.07$ -30.596
	8th week	Mean ± S. E. % of change	$6.24^A_a\pm0.12$	$6.27^A_a\pm0.11$ 0.481	$3.23^B_b\pm0.13$ -48.237	$5.83^A_a\pm0.07$ -6.571	$4.74^C_a\pm0.08$ -24.039
Albumin	4th week	Mean ± S. E. % of change	$186.31^A_a\pm2.41$	$187.92^A_a\pm2.56$ 0.864	$153.73^B_a\pm2.01$ -17.487	$185.21^A_a\pm2.39$ -0.590	$155.22^B_a\pm2.73$ -16.687
	8th week	Mean ± S. E. % of change	$188.70^A_a\pm2.94$	$190.42^A_a\pm2.39$ 0.912	$145.70^B_b\pm2.71$ -22.788	$182.41^C_a\pm2.66$ -3.333	$166.21^D_b\pm2.37$ -11.918

A, B, C, D The groups in the same row with different letters are statistically significant (p < 0.05).
a, b, c The groups in the same column with different letters are statistically significant (p < 0.05).

4- Lipid profile testes:
Serum cholesterol, T G, HDL, LDL and VLDL levels:

From the inspection of the data presented in table (4), no remarkable changes were noted in the level of serum cholesterol, triglyceride (TG), HDL, LDL and VLDL of normal control and propolis rats group. In MSG rats group for 8 weeks, a significant percentage elevation in the level of cholesterol, TG level, in HDL level, LDL level and VLDL level was recorded as compared to control rats (Table 4).

Moreover, a marked decrease occurred in lipid profile levels in the protected rats group (Rats receiving oral dose of propolis daily for four weeks then orally treated with propolis and MSG for four weeks).

In relation to MSG rats, it is clear from the data recorded that the best improvement occurred in the protected rats group at 8 weeks. A partial improvement was realized in lipid profile levels in the therapeutic rats group in serum cholesterol, TG, HDL, LDL and VLDL level that was time dependent (Table 4).

Table (4): The protective and therapeutic role of propolis on cholesterol, triglyceride (TG), high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) (mg/dl) against MSG treated male albino rats.

Parameters	Group / Duration	Control group	Propolis group	MSG group	Protective group	Therapeutic group
Cholesterol .	4th week — Mean ± S. E. / % of change	$55.21^A_a\pm0.51$	$54.31^A_a\pm0.20$ / -1.630	$80.25^B_a\pm0.41$ / 45.354	$53.21^B_a\pm0.33$ / -3.623	$79.21^B_a\pm0.35$ / 43.470
	8th week — Mean ± S. E. / % of change	$56.32^{AC}_a\pm0.32$	$53.91^A_a\pm0.41$ / -4.279	$92.29^B_b\pm0.32$ / 63.867	$59.76^C_a\pm0.50$ / 6.108	$75.61^D_a\pm0.41$ / 34.251
T. G	4th week — Mean ± S. E. / % of change	$62.21^A_a\pm0.24$	$58.21^A_a\pm0.30$ / -6.430	$126.43^B_a\pm0.90$ / 103.231	$59.10^A_a\pm0.65$ / -4.999	$123.40^B_a\pm0.50$ / 98.360
	8th week — Mean ± S. E. / % of change	$60.11^A_a\pm0.12$	$59.13^A_a\pm0.22$ / -1.630	$143.65^B_b\pm0.83$ / 138.979	$65.81^C_b\pm0.81$ / 9.483	$109.45^D_b\pm0.81$ / 82.083
HDL	4th week — Mean ± S. E. / % of change	$15.40^A_a\pm0.23$	$16.24^A_a\pm0.21$ / 5.455	$24.00^B_a\pm0.39$ / 55.844	$15.98^A_a\pm0.42$ / 3.766	$24.23^B_a\pm0.34$ / 57.338
	8th week — Mean ± S. E. / % of change	$16.40^A_a\pm0.35$	$17.40^A_a\pm0.39$ / 6.098	$25.58^B_a\pm0.23$ / 55.976	$18.42^A_a\pm0.37$ / 12.317	$22.12^B_a\pm0.30$ / 34.878
LDL	4th week — Mean ± S. E. / % of change	$45.85^A_a\pm0.32$	$45.92^A_a\pm0.32$ / -3.434	$59.76^B_a\pm0.35$ / 13.117	$44.59^A_a\pm0.40$ / -7.161	$59.38^B_a\pm0.56$ / 10.705
	8th week — Mean ± S. E. / % of change	$47.59^{AC}_a\pm0.41$	$45.56^A_a\pm0.39$ / -11.541	$68.68^B_b\pm0.38$ / 36.129	$50.28^C_b\pm0.50$ / 1.004	$55.97^D_b\pm0.49$ / 17.609
VLDL	4th week — Mean ± S. E. / % of change	$12.44^A_a\pm0.58$	$11.64^A_a\pm0.54$ / -6.431	$25.29^B_a\pm0.51$ / 103.296	$11.82^A_a\pm0.58$ / -4.984	$24.68^B_a\pm0.50$ / 98.392
	8th week — Mean ± S. E. / % of change	$12.02^A_a\pm0.54$	$11.83^A_a\pm0.49$ / -1.581	$28.73^B_b\pm0.58$ / 139.018	$13.16^A_a\pm0.54$ / 9.484	$20.86^C_b\pm0.53$ / 73.544

A, B, C, D The groups in the same row with different letters are statistically significant (p < 0.05).
a, b, The groups in the same column with different letters are statistically significant (p < 0.05).

5- Kidney Tissue (Oxidative stress parameters):
a- Tissue Glutathione (GSH) (μg/g protein) levels:

No remarkable changes were reported after rats were treated with 200 mg/kg b. w. propolis through the experimental duration (Table 5). In MSG rats group, a significant depletion in the content of tissue GSH was recorded. As mentioned in the data of treated rats (protective group) after 8 weeks, GSH levels were nearly similar to that in control group (Table 5). After treatment with MSG and propolis (therapeutic group) a significant decrease in the tissue GSH content occurred after 4 weeks. This level gradually declined after treatment with MSG with propolis, for 8 weeks as compared with control group (Table 5).

b- Tissue lipid peroxidation malondialdhyde (MDA) (mM/100g):

No changes were verified after the administration of propolis (200 mg/kg b. w.) for 4 and 8 weeks (Table 5). On the other hand, in MSG rats group a significant elevation was realized in tissue

MDA content as compared. These were later highly significantly increased with lapse of time at the last interval (8 weeks) (Table 5). Furthermore, protection was shown in the MDA content in protective rats group (Table 5).

6- Kidney protein electrophoresis:

Electrophoretic experimental pattern of kidney extract showed five protein fractions. Effect of groups on the protein fractions are the shown in table (6). There was no significant change in the five protein fractions in the group treated with propolis as compared with control group for 8 weeks accept fraction 1 (Table 6 and Fig. 1). In contrast, treatment with MSG for 8 weeks showed reduction or elevation in the factions of the different kidney proteins as shown in table (6) and figure (1). There was an increase in fractions 1 and 2 and a decrease in fractions 3, 4 and 5 in MSG group. In the protective group, the data in table (6) and figure (1) indicated that administration of propolis for four weeks followed by propolis and MSG for an extra 4 weeks

and sacrificed after 8 weeks, managed to protect all protein fractions. On the contrary, in the therapeutic group treated with MSG for 4 weeks followed by administration of MSG and propolis for 4 weeks and sacrificed after 8 weeks, fractions 1 and 2 showed increase, while there was a decrease in fractions 3, 4 and 5 as compared with control group (Table 6 and Fig. 1).

Table (5): The protective and therapeutic role of propolis on glutathione (GSH) (µg/g protein) and malondialdhyde (MDA) (mM/100g) against MSG treated male albino rats.

Parameters	Group / Duration		Control group	Propolis group	MSG group	Protective group	Therapeutic group
GSH	4th week	Mean ± S. E.	$20.23^A_a \pm 0.82$	$19.21^A_a \pm 0.75$	$12.51^B_a \pm 0.53$	$19.82^A_a \pm 0.56$	$12.20^B_a \pm 0.71$
		% of change		-5.042	-38.161	-2.027	-38.694
	8th week	Mean ± S. E.	$18.67^A_a \pm 0.71$	$18.50^A_a \pm 0.81$	$8.10^B_b \pm 0.60$	$18.61^A_a \pm 0.47$	$14.84^C_b \pm 0.54$
		% of change		-0.911	-56.615	-0.312	-20.514
MDA	4th week	Mean ± S. E.	$0.38^A_a \pm 0.12$	$0.40^A_a \pm 0.13$	$0.69^B_a \pm 0.22$	$0.36^A_a \pm 0.20$	$0.72^B_a \pm 0.26$
		% of change		5.263	81.579	-5.263	89.474
	8th week	Mean ± S. E.	$0.40^A_a \pm 0.14$	$0.41^A_a \pm 0.15$	$1.46^B_b \pm 0.25$	$0.47^C_b \pm 0.21$	$0.66^D_b \pm 0.31$
		% of change		2.500	265.000	17.500	65.000

A, B, C, D The groups in the same row with different letters are statistically significant ($p < 0.05$).

a, b, The groups in the same column with different letters are statistically significant ($p < 0.05$).

Table (6): The protective and therapeutic role of propolis on protein fractions of kidney extract (g/100g protein) against MSG treated male albino rats.

Groups / Fraction		Control group	Propolis group	MSG group	Protective group	Therapeutic group
Fraction 1	% Raw vol.	5.777	7.172	9.842	6.071	10.234
Fraction 2	% Raw vol.	25.506	23.999	36.677	26.207	32.443
Fraction 3	% Raw vol.	21.202	19.663	14.449	18.830	14.896
Fraction 4	% Raw vol.	34.871	36.063	30.774	34.948	31.866
Fraction 5	% Raw vol.	12.643	13.102	8.259	13.945	10.561
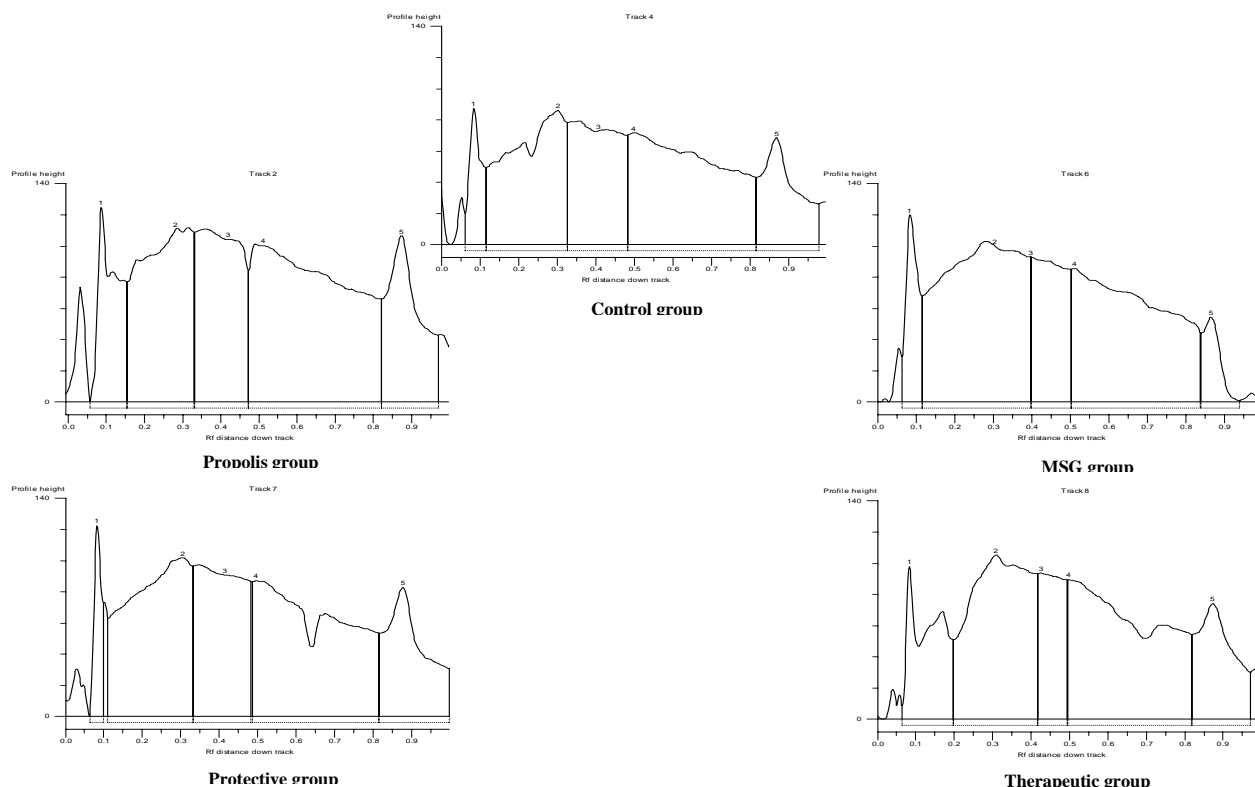
Figure (1): The protective and therapeutic role of propolis on the fractions of protein of kidney extract (g/100g protein) against MSG treated male albino rats.

4. Discussion:

Monosodium glutamate (MSG) is considered one of the most commonly used food enhancer in many types of food. MSG treatment provokes hormonal alterations and specific intestinal changes in smooth muscle reactivity to agonists. The administration of MSG in high concentrations or for long periods of time may cause tissue damage and mediate inflammation. In addition, it triggers the production of reactive oxygen species (ROS) coupled with impaired oxidant/antioxidant balance leading to a state of oxidative stress *(Lei et al., 2005)*. Oxidative stress and decreased antioxidative capacity participates in the progression and complications of renal diseases such as hyperlipoproteinemia or cardiovascular diseases *(Gazdikova et al., 2000)*.

Propolis or "bee-glue" contains a number of natural active constituents that have been shown to exert a variety of medical properties, such as anti-microbial activity *(Koo et al., 2000)*, protective effect against radiation-induced damage *(El- Ghazaly and Khayyal, 1995)*, anti-mutagenic effect *(Varanda et al., 1999)*, anti-hyperalgesic action *(De Campos et al., 1998)* and anti-inflammatory activity *(Ozturk et al., 2000)*. Most of these effects have been related to the anti-oxidant and free radical scavenging properties of propolis *(Basnet et al., 1997)*.

The present study showed that, there was significant increase in the final total body weight, kidney weight and relative kidney weight markedly noticed in group of rats treated with MSG. This increase may be due to increased food intake caused by the administration of MSG. Similar results have been reported by *Abass and Abd El-Haleem (2011)*.

Earlier report by *Kawakita et al. (2005)* explained that the potential explanation for MSG-obesity link lies in the alteration of regulatory mechanism that affect fat metabolism. It was also found that MSG causes obesity in lab rats by down regulating hypothalamic appetite suppression and, thus, increasing the amount of food consumed *(Hermanussen et al., 2006)*. In addition, MSG intake could induce an increase in energy intake *(Bergen et al, 1998)* which could lead to obesity *(Mozes et al., 2004)*. Also, *Shibata et al. (1995)* recorded an increase in kidney weights in both sexes of rats given MSG that was considered to be due to Na^+ intake in the regimen.

In the current study, the protective and therapeutic group showed partial decrease in total body weight as compared to the control group. Similarly, both absolute and relative kidney weights manifested partial decrease in protective group while there was an increase in the therapeutic one. Similar results were demonstrated by *Abo-Salem et al. (2009)* who revealed significant amelioration in both body and kidney weights in a dose-dependent manner. Recently, *Garoui et al. (2011)* in their studies on the dietary administration of propolis to cobalt-treated animals showed ameliorated food consumption of lactating rats and induced partial recovery of body and kidney weights of their pups.

Kidney is an organ of the excretory system in the human and high animal bodies. The kidney function can be measured by urea and creatinine clearance.

In the present study, administration of MSG resulted in impairment of some renal biomarkers reflected by the significant increase in urea, creatinine and sodium and decrease in potassium serum levels. These results are in agreement with *Vinodini et al. (2010)* and *Abass and Abd El-Haleem (2011)* who showed an increase in BUN and creatinine that proved that the damages caused by MSG even compromised the kidney function.

Thomas et al. (2009) attributed such increase to increase intake of amino acid, glutamate in the form of monosodium glutamate It has been suggested that an increase in blood urea nitrogen may reflect an accelerated rate of protein catabolism rather than decrease urinary excretion of urea.

Furthermore, the nonphysiologic urea concentrations were associated with increased levels of reactive oxygen species and the oxidative stress marker 8-oxoguanine in cultured cells, probably due to urea potential to increase carbamylation as well as carbonylation *(Zhang et al., 2004)*.

Serum sodium ion level was higher in the MSG rats group. The circulating MSG was dissociated in sodium (Na^+) and L-glutamate and crosses the mesothelial peritoneal cells and arrives at the bloodstream *(Walker and Lupien, 2000)*.

Kang et al. (2002) reported that hypernatremia is rare but does occur when there is loss of body fluids containing less sodium than plasma along with water intake restriction or if there is excessive sodium intake with limited liquid intake.

On the other hand, serum potassium level was decreased in MSG group, and it might be due to the following reasons: Potassium ions shift between muscle and extracellular fluid, increased renal excretion of potassium, increase in potassium ions uptake of erythrocytes and/or skin *(Ait-Boulahsen et al., 1989)*, or a reduced competition between H^+ and K^+ ions for urinary excretion and thereby increased urinary potassium loss *(Laiken and Fantesil, 1985)*.

In the group treated with propolis no remarkable changes in urea, creatinine, sodium and potassium serum levels was detected. While, improvement was observed in protected rats group in the same parameters. Results of the present study are in accordance with the findings of *Newairy et al. (2009)* and *Ramadan et al. (2010)*.

The present study corroborates the observations by *Garoui et al. (2011)* who reported that propolis ameliorated the kidney impairment induced by cobalt as suggested by a significant restoration of plasma urea, creatinine levels as well as the creatinine clearance. This might be due to the accelerated regeneration of parenchymal cells under the influence of various bioactive compounds like flavonoids and esters present in propolis that helped to prevent membrane fragility and subsequently decreased the leakage of marker enzymes into circulation *(Bhadauria et al., 2008)*.

Moreover, caffeic acid phenethyl ester (CAPE), a biological active component of propolis was found to improve renal function tests in a rat model with lithium-induced renal tubular damage and oxidative stress *(Bhadauria et al., 2008)*. Caffeic acid phenethyl ester, a major compound of propolis might be responsible to protect the increase in blood urea and tubular damage *(Ozen et al., 2004)*.

In the present study, no significant difference was determined in total protein and albumin level in propolis group *(Eraslan et al., 2007)*.

The present work on the kidney revealed that the administration of MSG for 4 and 8 weeks induced an obvious depletion in both total protein and albumin contents in the serum as compared to control. The decline in plasma total proteins after treatment with MSG was mainly due to the decrease in albumin *(Attia et al., 2008 and Newairy et al., 2009)*. So, the significant decrease in the concentrations of total proteins in rats treated with MSG particularly the albumin could be attributed on one hand to under nutrition and on the other hand to a reduction of the protein synthesis in the liver *(Cherroret et al., 1995)*.

In addition, this depletion was attributed to the decreased rate of polypeptide elongation, respiratory depression and decrease of t-RNA in liver *(El-Sherif et al., 2002)*.

Propolis extract in protective group showed significant improvement in the activity of both albumin and total protein compared with MSG group. Propolis caused an increase in both activities by maintaining the protein content towards control. These effects could be, at least partly, explained by the anti-oxidant capability of the extract *(Basnet et al., 1997)*.

The present investigation showed that propolis in the group administered MSG followed by propolis in association with MSG revealed minimal improvement in protein profile where there was decrease in albumin and total protein. This indicates that propolis was not efficient for use as a therapeutic agent.

In MSG rats group a significant percentage elevation of the levels of cholesterol *(Blackburn et al., 2003 and Obochi et al., 2009)*, TG, HDL, LDL and VLDL level was recorded as compared to control group. Present results are in agreement with *Thomas et al. (2009)* who noticed hyperlipidemia with significantly elevated levels of serum triacylglycerol and cholesterol in MSG group. A shift in glucose metabolism toward lipogenesis might account for the hyperlipidemia in MSG group *(Malik and Ahluwalia, 1994)*.

These disturbances in the lipid profile markers were due to the destruction of arcuate nucleus in the hypothalamus as a result of MSG administration which could function in the regulatory manner towards fat metabolism.

The effect of MSG on cholesterol levels could be attributed to the activation of the enzyme, 3-hydroxyl-3-methoxylglutamyl-COA reductase, HMGR, which catalyzed the rate limiting step of cholesterol synthesis (i.e., conversion of HMG-COA to mevalonate), by covalent modification, which converted the phosphorylated state (inactive) to dephosphorylated state (active) *(Obochi et al., 2009)*. The enzyme is most active in the dephosphorylated state *(Bernard et al., 2002)*. This in turn, increased the activity of HMGR, resulting in increased cholesterol synthesis. The activation of HMGR through dephosphorylation also increased the levels of insulin, which stimulated the removal of phosphates from the cells and thereby activated HMGR activity, resulting in increased cholesterol synthesis *(Bernard et al., 2002)*.

Insignificant changes were obtained in the propolis rats group throughout the experimental period in the level of serum cholesterol, triglyceride (TG), HDL, LDL and VLDL. Moreover, protection occurred in lipid profile levels in the protective group,while, a partial improvement was recorded in the therapeutic group in serum cholesterol, TG, HDL, LDL and VLDL levels *(Eraslan et al., 2007)*. Decrease in triglyceride and cholesterol levels following propolis intake may be concluded to be directly related to the influence of propolis itself on lipid metabolism.

Similarly, *Bhadauria et al. (2008)* showed dose dependent response and reduced elevated level of triglycerides, total and esterified cholesterol after toxicant exposure. It has been reported that antioxidants and flavonoids can act as inhibitors of lipid peroxidation (LPO) by scavenging polyunsaturated fatty acids peroxy radicals and interrupting the chain reactions *(Pascual et al., 1994)*. It is well-known that phenolic antioxidants can trap initiating radicals and/or propagating peroxyl radicals to break the peroxidation chain reaction to protect the cells from oxidation damage *(Maiti et al., 2005)*. CAPE can trap CCl_3 radical and/or CCl_3O_2 radical by donating a hydrogen to the radical to break the free

radical chain reaction that in turn forms a CAPE semiquinone radical, which can react with the second free radical to form the CAPE ortho-quinone *(Fang et al., 2002)*.

In the present investigation, a significant depletion in the content of tissue GSH was designated while a significant elevation was realized in tissue MDA content in MSG rats group as compared with the control group *(Yaqub et al., 2008 and Vinodini et al., 2010)*.

The decrease in GSH presented in the current study might reflect their direct reaction with the reactive oxygen species generated by MSG. Glutamate toxicity involves an imbalance in the hemostasis of cysteine, the precursor of GSH, leading to depletion of intracellular GSH levels and reduced ability to protect against oxidative injury in the cell and ultimately, cell damage. Moreover, lipid peroxidation may eliminate the active sulfhydryl group of GSH and other enzymes.

Oxidative stress and accumulation of free radicals seems to be responsible for MSG toxicity *(Attia et al., 2008)*. The formed free radicals react with polyunsaturated fatty acids in cell membrane producing lipid peroxides and membrane damage. In addition reactive oxygen species (ROS) generated by the toxic effect of MSG might have caused lipid peroxidation and GSH depletion, which are indicators of tissue damage.

NMDA receptors (one of glutamate receptors) have been found in extraneuronal tissues, including pancreatic α cells, the male lower urogenital tract, kidneys, lymphocytes, and megakaryocyte. There is scant evidence regarding its physiological function in extraneuronal tissues, especially in the kidneys. Over stimulation of NMDA receptors can modulate glutamate postsynaptic neurotransmission by generating Ca^{2+} channel openings, and by overloading *(Nagata et al., 1995)* and excessive reactive oxygen species generation *(Conn and Pin, 1997)*. Ischemia, followed by reperfusion, impairs kidneys and contributes to renal dysfunction *(Avshalumov and Rice, 2002)*. Ischemia-reperfusion or hypoxia-reoxygenation injury also evokes burst amounts of reactive oxygen species and Ca^{2+} overload in damaged renal tubules, triggering the entry of these tubular cells into apoptotic and necrotic cell death, and subsequently, to renal dysfunction *(Deng et al., 2002)*.

GSH can diminish oxidative stress either by protecting the detoxifying enzymes by increasing the efficacy of nicotine amide dinucleated phosphate (NADPH), or by helping in the elimination of compounds which produce peroxidation in the cell membranes *(Machlin and Bandich, 1987)*.

In the current work, no remarkable changes were reported after rats were treated with 200mg/kg b. w.

propolis in tissue MDA and GSH. Furthermore, protection was shown in protective rats group only and not the therapeutic one *(Ogeturk et al., 2005)*.

A possible mechanism of the protective effects of propolis is that several bioactive compounds present in it might protect oxidative damage by directly neutralizing reactive oxidants, increase the capacity of endogenous antioxidant defense and modulating the cellular redox state *(Moskaug et al., 2005)*. This might be due to the favorable capacity of propolis to pass through the membrane and to accumulate in both hydrophilic and hydrophobic environments for protecting cells against oxidative stress and scavenging free radicals *(Sun et al., 2000)*. Flavonoids and their esters in propolis are pharmacologically active molecules and have been hypothesized to influence the antioxidant activity of propolis *(Lahouel et al., 2004)*.

Propolis can control and modulate the metabolism of lipids leading to decreased outputs of lipid peroxidation and scavenge the free radicals in rats *(Sobocanec et al., 2006)*. The present work revealed minimal improvement in the MDA and GSH content of therapeutic rats group as compared with the control and propolis groups.

In the present study, MSG group showed increase in fractions 1and 2 and decrease in the fractions 3, 4 and 5 of the different kidney saturated protein fractions as compared with control group. This result is in agreement with *Madbouly (2005)* in her study on electrophoresis of liver protein fractions, where treatment of infected mice with mirazid caused decrease of Gamma-globulin of infected group, and induced increases in Beta, Albumin, Prealbumin and Alpha fractions. This decrease and increase in particular protein fractions may be related to the effect of MSG on the specific genes encoding for these fractions as demonstrated in a study by *Radwan (2005)* who revealed that coumarin caused qualitative and quantitative changes in tissues (brain, liver and kidney) protein fractionation pattern of chicken.

Furthermore, *Mansour et al. (2009)* showed that rats treated with profenofos showed a lower concentration of serum proteins and albumin accompanied by decreased globulin alpha 1 and beta along with an increased gamma 2 globulin. After exposure to profenofos α 2, β 1, γ 1 contents were decreased while α 1, β 2, γ 2 globulins were increased. These findings may be related to impact of profenofos towered the hepatic cells and immune system *(Yousef and salama 2009)*.

El-Behairy et al. (2009) investigated the effect of propolis as a prophylactic or therapeutic agent against Rift Valley Fever virus (RVF). The electrophoresis of serum proteins revealed that propolis had a potent antiviral effect as reflected by increased serum protein

concentrations. Also, they concluded that propolis was superior to RVF vaccine when used as a prophylactic and the use of propolis as prophylactic was better than its use as treatment.

Therefore, it may be collectively concluded that because propolis possesses a plethora of minerals, polyphenols and their esters, which may interfere with the formation of highly toxic free radicals to reduce oxidative stress, it can enhance the antioxidant defense mechanism to repair membrane damage.

In view of the findings of the current study, it may be concluded that propolis extract possess the ability to reverse MSG induced kidney oxidative injury as well as to regulate the metabolic enzymatic activities and major cellular components for maintaining proper functioning of the cells and may be considered as a protective agent against MSG induced toxic effects .On the other hand its role in therapy was of only limited value.

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References:
1. **Abass, M. A. and Abd El-Haleem, M. R. (2011):** Evaluation of Monosodium Glutamate Induced Neurotoxicity and Nephrotoxicity in Adult Male Albino Rats. *J. Am. Sci.,* 7 (8): 264-276.
2. **Abo-Salem, O. M.; El-Edel, R. H.; Harisa, G. I.; El-Halawany, N. and Ghonaim, M. M. (2009):** Experimental diabetic nephropathology can be prevented by propolis: Effect on metabolic disturbances and renal oxidative parameters. *Pak. J. Pharm. Sci.,* 22 (2): 205-210.
3. **Ait-Boulahsen, A.; Garlich, J. D. and Edens, F. W. (1989):** Effect of fasting and acute heat stress on body temperature, blood acid base balance and electrolytes status in chickens. *Comp. Biochem. Physiol.,* 94: 683-687.
4. **Assmann, G., Jabs, H. U., Kohnert, U., Nolte, W. and Schriewer, H. (1984).** LDL-cholesterol determination in blood serum following precipitation of LDL with poly vinyl sulfate. *Clin. Chem. Acta,* 140: 77-83.
5. **Attia, H. A.; Faddah, L. M. and Yaqub, H. (2008):** Trans-retinol Precursor and/or N-acetyl Cysteine Protects Against Monosodium Glutamte-induced Nephrotoxicity in Rats. *J. App. Sci. Res.,* 4 (12): 2108-2119.
6. **Avshalumov, M. V. and Rice, M. E. (2002):** NMDA receptor activation mediates hydrogen peroxide-induced pathophysiology in rat hippocampal slices. *J. Neurophysiol.,* 87: 2896-2903.
7. **Basnet, P.; Matsuno, T. and Neidlein, R. (1997):** Potent free radical scavenging activity of propol isolated from Brazilian propolis. *Z. Naturforsch.,* 52: 828-833.
8. **Bergen, H. T.; Mizuno, T. M. and Taylor, J. (1998):** Hyperphagia and weight gain after gold-thioglucose and monosodium glutamate: relation to hypothalamic neuropeptide. *Y. Endocrin.* 139: 4483-4488.
9. **Bernard, N. O.; Scialli, A. R. and Bobela, S. (2002):** The current use of estrogens for growth suppressant therapy in adolescent girls. *J. Pediat. Adolese Gynacol.,* 15: 23-26.
10. **Bhadauria, M. and Nirala, S. K. (2009).** Reversal of acetaminophen induced subchronic hepatorenal injury by propolis extract in rats. *Environ. Toxicol. Pharmacol.,* 27: 17–25.
11. **Bhadauria, M.; Nirala, S. K. and Shukla, S. (2008):** Multiple treatment of propolis extract ameliorates carbon tetrachloride induced liver injury in rats. *Food Chem. Toxicol.,* 46 (8): 2703–2712.
12. **Blackburn, P.; Lamarche, B.; Couillard, C.; Pascot, A. and Bergeron, N. (2003):** Post-prandial hyperlipidemia: another correlate of the "hypertriglyceride-mice waist" phenotype in men. *Atherosclerosis,* 171: 327-336.
13. **Botsoglou, N. A., Fletouris, D. J., Papageorgiou, G. E., Vassilopoulos, V. N., Mantis, A. J. and Trakatellis, A. G. (1994).** Rapid sensitive and specific thiobarbituric acid method for measuring lipid peroxidation in animal tissue, food and feed stuff samples. *J. Agric. Food Chem.,* 42: 1931-1937.
14. **Cherroret, G.; Capolaghi, B.; Hutin, M. F.; Burnel, D.; Desor, D. and Lehr, P. R. (1995):** Effects of postnatal aluminum exposure on biological parameters in the rat plasma. *Toxicol. Lett.,* 78: 119-125.
15. **Conn, P. J. and Pin, J. P. (1997):** Pharmacology and functions of metabotropic glutamate receptors. *Annu. Rev. Pharmacol. Toxicol.,* 37: 205-237.
16. **Davis, B. Z. (1964).** Disc electrophoresis. II– Method and application to human serum proteins. *Ann. N. Y. Acad. Sci.,* 121: 404.
17. **De Campos, R. O.; Paulino, N.; Da Silva, C. H.; Scremin, A. and Calixto, J. B. (1998):** Anti-hyperalgesic effect of an ethanolic extract of propolis in mice and rats. *J. Pharm. Pharmacol.,* 50: 1187-1193.
18. **Deng, A.; Valdivielso, J. M.; Munger, K. A.; Blantz, R. C. and Thomson, S. C. (2002):** Vasodilatory N-methyl-D-aspartate receptors are constitutively expressed in rat kidney. *J. Am. Soc. Nephrol.,* 13: 1381-1384.
19. **Doumas, B. T., Watson, W. A. and Biggs, H. G. (1971).** Albumin standard and the measurement of serum albumin with bromocresol green. *Clin. Chem. Acta,* 31: 87-95.
20. **Egbuonu, A. C. C.; Ejikeme, P. M. and Obasi, L. N. (2010):** Influence of sub-chronic oral exposure to high monosodium glutamate on some serum markers of the renal functions in male Wistar rats. *Afr. J. Biochem. Res.,* 4(9): 225-228.
21. **EL-Behairy, A. M.; Abdel-Aziz, S. A.; Habeeb, V. R. and Awad-Alla, K. Y. (2009):** Biochemical effects of propolis in albino rats infected with rift valley fever virus. *Egypt. J. Basic Appl. Physiol.,* 1 (8): (In Press).
22. **El-Ghazaly, M. A. and Khayyal M. T. (1995):** The use of aqueous propolis extract against radiation-induced damage. *Drugs Exp. Clin. Res.,* 21: 229-236.
23. **El-Sherif, F. G.; Gobri, M. S.; Zahran, W. M. and Abdel-Hamid, T. F. (2002):** Histological, histochemical studies and ATP-ase localization in the rat liver after morphine sulphates induction. *J. Egypt. Ger. Soc. Zool.,* 39: 175-187.
24. **Eraslan, G.; Kanbur, M. and Silici, S. (2007):** Evaluation of propolis effects on some biochemical parameters in rats treated with sodium fluoride. *Pesticide Biochem. Physiol.,* 88: 273–283.
25. **Fang, J. G.; Lu, M.; Chen, Z. H.; Zhu, H. H.; Li, Y.; Yang, L.; Wu, L. M. and Liu, Z. L. (2002):** Antioxidant

effects of resveratrol and its analogs against the free-radical induced peroxidation of linoleic acid in micelles. *Chem. Eur. J.,* 8: 4191–4198.

26. **Fawcett, J. K. and Scott, J. E. (1960).** A rapid and precise method for the determination of urea. J. Clinic. Path., 13: 156.

27. **Fossati, P. and Prencipe, L. (1982).** Serum triglycerides determined calorimetrically with an enzyme that produces hydrogen peroxide. *Clin. Chem.,* 28: 2077-2080.

28. **Freeman, M. (2006):** Reconsidering the effects of monosodium glutamate: a literature review. *J. Am. Acad. Nurse. Pract.,* 18 (10): 482-4826.

29. **Garoui, E.; Troudi, A.; Fetoui, H.; Soudani, N.; Boudawara, T. and Zeghala, N. (2011):** Propolis attenuates cobalt induced-nephrotoxicity in adult rats and their progeny. *Exp. Toxicol. Pathol.,* (In Press).

30. **Gazdikova, K.; Gvozdjkova, A. and Kucharska, J. (2000):** Malondialdehyde and selected antioxidant plasma levels in conservatively treated patients with kidney diseases. *Bratisl Lek Listy,* 101(9): 490-494.

31. **Ghisalberti, E. L. (1979):** Propolis: A review. Bee World 60, 59–84. Habig, W. H.; Pabst, M. J.; Jakoby, W. B.; (1974): Glutathione S-transferases. The first enzymatic step in mercapturic acid formation. *J. Biol. Chem.,* 249: 7130-7139.

32. **Gomathi, I. N. and Malarvili, T. (2009).** Effect of *Hibiscus rosasinensis* on carbohydrate metabolizing enzymes in monosodium glutamate induced obesity in female rats. *J. Cell Tissue Res*., 9 (3): 1969-1974.

33. **Henry, R. J., Cannon, D. C. and Winkelman J. W. (1974).** Quantitative colorimetric determination of total protein in serum. *Clinic. Chem. Prin. Tech.,* 2nd ed., New, York, Harper and Row, 411-421.

34. **Hermanussen, M.; Garcia, A. P.; Sunder, M.; Voigt, M.; Salazar, V. and Tresguerres, J. A. (2006):** Obesity, voracity and short stature: the impact of glutamate on the regulation of appetite. *Eur. J. Clin. Nut.,* 60: 25–31.

35. **Ivanovska, N. D.; Dimov, V. B.; Bankova, V. S. and Popov, S. S. (1995):** Immunomodulatory action of propolis. VI. Influence of a water soluble derivative on complement activity in vivo. *J. Ethnopharmacol.,* 47: 145.

36. **Jay, J. M. (1964)**. Release of aqueous extract by beef homogenates and factors affecting release volume. *Food Technol.,* 18: 1633-1636.

37. **Kang, S.; Kim, W. and Oh, M. S. (2002):** Pathogenesis and treatment of hypernatremia. *Nephron.,* 92 (1): 14-17.

38. **Kawakita, T.; Chiaki, S.; Shigeru, S.; Masahiro, T. and Shizuko, Y. (2005):** Monosodium Glutamate. Ullmann's Encyclopedia of Industrial Chemistry.

39. **Kedzia, B.; Iwaszkiewicz, J. and Geppert, B. (2007):** Pharmacological investigations on ethanolic extract of propolis. *J. Ocul. Pharmacol. Ther.,* 23 (1): 40-45. PMID:17341149.

40. **Koo, H.; Gomes, B. P.; Rosalen, P. L.; Ambrosano G. M.; Park, Y. K. and Cury, J. A. (2000):** In vitro antimicrobial activity of propolis and Arnica montana against oral pathogens. *Arch. Oral Biol.,* 45: 141-148.

41. **Lahouel, M.; Boulkour, S.; Segueni, N. and Fillastre, J. P. (2004):** The flavinoids effect against vinblastine, cyclophosphamide and paracetamol toxicity by inhibition of lipid-peroxydation and increasing liver glutathione concentration. *Pathol. Biol. (Paris),* 52: 314-322.

42. **Laiken, N. D. and Fantesil, D. D. (1985):** Potassium balance and the regulation of potassium excretion. In: Best and Taylor's Physiological Basis of Medical Practical. 11th

ed. John, B. west, ed. *Williams and Willkins, Baltimore, M. D.,* pp: 532-536.

43. **Lei, X. U.; Jie, S.; Ran, L. U.; Oing, J. I; and Jian-Guo, X. U. (2005):** Effect of glutamate on inflammatory responses of intestine and brain after focal cerebral ischemia . *World J. Gastroenterol.,* 11 (5): 733-736.

44. **Liu, C. F.; Lin, C. H.; Lin, C. C.; et al. (2005):** Protective effect of propolis ethanol extract on ethanol-induced renal toxicity: an in vivo study. *Am. J. Chin. Med.,* 33 (5):779-86. PMID:16265990.

45. **Machlin, L. and Bandich, A. (1987):** Free radical tissue damage: Protective role of antioxidant nutrients. *FASEB. J.,* 1: 441-445.

46. **Madbouly, S. M. (2005):** Electrophoretic and Histological Studies On Hepatic Schistosomiasis and its Treatment with Certain Drugs. *Egypt. J. Histol.,* 28 (2): 291-306.

47. **Maiti, K.; Mukherjee, K.; Gantait, A.; Ahamed, H. N. and Saha, B. P. (2005):** Enhanced therapeutic benefit of quercetin-phospholipid complex in carbon tetrachloride induced acute liver injury in rats: a comparative study. *Iranian J. Pharmacol. Ther.,* 4: 84-90.

48. **Malik, V. B. T. and Ahluwalia, P. (1994):** Studies on effect of monosodium glutamate (MSG) on various fractions of lipids and certain carbohydrate metabolic enzymes in liver and blood of adult male mice. *Toxicol. Lett.,* 74(1): 69-77.

49. **Mansour, M. K.; El-Kashoury, A. A. I.; Rashed, M. A. and Koretem, K. M. (2009):** Oxidative and biochemical alterations induced by profenofos insecticide in rats, *Natu. Sci.,* 7 (2): 1-15.

50. **Moskaug, J. O.; Carlsen, H.; Myhrstad, M. C. W. and Blomhoff, R. (2005):** Polyphenols and glutathione synthesis regulation. *Am. J. Clin. Nutr.,* 81: 277-283.

51. **Mozes, S.; Sefcikova, Z.; Lenharde, L. and Raeek, L. (2004):** Obesity and changes of alkaline phosphatase activity in the small intestine of 40- 80 day old subjects to early postnatal overfeeding of monosodium glutamate. *Physiol. Res.,* 53: 177-186.

52. **Nagata, O.; Li, W. M. and Sato, A. (1995):** Glutamate N-methyl-D-aspartate (NMDA) and non-NMDA receptor antagonists administered into the brain stem depress the renal sympathetic reflex discharges evoked by single shock of somatic afferents in anesthetized rats. *Neurosci. Lett.,* 201: 111-114.

53. **Newairy, A. A.; Salama, A. F.; Hussien, H. M. and Yousef, M. I. (2009):** Propolis alleviates aluminium-induced lipid peroxidation and biochemical parameters in male rats. *Food Chem. Toxicol.,* 47: 1093–1098.

54. **Nieva Moreno, M.; Isla, M.; Sampietro, A. and Vattuone, M. (2000):** Comparison of the free radical-scavenging activity of propolis from several regions of Argentina. *J. Ethnopharmacol.,* 71: 109-114.

55. **Obochi, G. O.; Malu, S. P.; Obi-Abang, M.; Alozie, Y. and Iyam, M. A. (2009):** Effect of Garlic Extracts on Monosodium Glutamate (MSG) Induced Fibroid in Wistar Rats. *Pak. J. Nutr.,* 8 (7): 970-976.

56. **Ogeturk, M.; Kus, I.; Colakoglu, N.; Zararsiz, I.; Ilhan, N. and Sarsilmaz, M. (2005):** Caffeic acid phenethyl ester protects kidneys against carbon tetrachloride toxicity in rats. *J. Ethnopharmacol.,* 97: 273–280.

57. **Ozen, S.; Akyol, O.; Iraz, M.; Sogut, S.; Ozugurlu, F.; Ozyurt, H.; Odaci, E. and Yildirim, Z. (2004):** Role of caffeic acid phenethyl ester, an active component of propolis, against cisplatin-induced nephrotoxicity in rats. *J. Appl. Toxicol.,* 24: 27-35.

58. **Ozturk, F.; Kurt, E.; Cerci, M.; Emiroglu, L.; Inan, U.; Turker, M. and Ilker, S. (2000):** The effect of propolis extract in experimental chemical corneal injury. *Ophthalmic Res.,* 32: 13-18.

59. **Padmavathi, R.; Senthilnathan, P.; Chodon, D. and Sakthisekaran, D. (2006):** Therapeutic effect of paclitaxel and propolis on lipid peroxidation and antioxidant system in 7,12-dimethyl benz(a)anthraceneinduced breast cancer in female Sprague Dawley rats. *Life Sci.,* 78: 2820-2825.

60. **Pascual, C.; Gonzalez, R. and Torricella, R. (1994):** Scavenging action of propolis extract against oxygen radicals. *J. Ethnopharmacol.,* 41: 9-13.

61. **Paulino, N.; Abreu, S. R.; Uto, Y.; Koyama, D.; Nagasawa, H.; Hori, H.; Dirsch, V. M.; Vollmar, A. M.; Scremin, A. and Bretz, W. A. (2008):** Anti-inflammatory effects of a bio available compound, Artepillin C, in Brazilian propolis. *Eur. J. Pharmacol.,* 587: 296-301.

62. **Radwan, S. A. (2005):** Evoked Alterations In Some Biochemical Parameters And Protein Electrophoretic Pattern Of Some Tissues Of Broiler Chicken Treated With Coumarin**.** *Egypt. J. of Hosp. Med.,* 21: 176-190.

63. **Ramadan, A; Soliman, G.; Mahmoud, S.; Nofal, S. and Abdel-Rahman, R. (2010):** Evaluation of the safety and antioxidant activities of Crocus sativus and Propolis ethanolic extracts. *J. Saudi Chem. Soci.,* (In Press).

64. **Seeling, H. P. and Wust, H. (1969).** Colorimetric method for determination of creatinine. *Arztl. Lab,* 15: 34.

65. **Seidel, J., Hagele, E. O., Zingenhorn, J. and Wahlfeld, A. W. (1983).** Reagent for the enzymatic determination of serum total cholesterol with improved lipolytic efficiency. *Clinic. Chem..,* 29: 1075-1080.

66. **Shibata, M. A.; Tanaka, H.; Kawabe, M.; Sano, M.; Hagiwara, A. and Shirai, T. (1995):** Lack of Carcinogenicity of Monosodium L-Glutamate in Fischer 344 Rats. *Food Chem. Toxic.,* 33 (5): 383-391.

67. **Sobocanec, S.; Sverko. V.; Balog, T.; Saric, A. A.; Rusak, G.; Likic, A. S.; Kusic, A. B.; Katalinic, A. V.; Radic, A. S. and Marotti, T. (2006):** Oxidant/antioxidant properties of Croatian native propolis. *J. Agric. Food Chem.,* 54 (21): 8018-8026.

68. **Stein, E. A. (1986).** Lipids, lipoproteins and apolipoproteins. In: Tietz, N.W. (Ed), Textbook of Clinical Chemistry, *W. B. Sounders Co. Philadelphia,* pp: 448-481.

69. **Sun, F.; Hayami, S.; Haruna, S.; Ogiri, Y.; Tanaka, K.; Yamada, Y.; Ikeda, K.; Yamaha, H.; Sujimoto, H.; Kaeai, N. and Kojo, S. (2000):** In vivo antioxidative activity of propolis evaluated by the interaction with vitamin C and E and the level of lipid hydroperoxides in rats. *J. Agri. Food Chem.,* 48 (5): 1462-1465.

70. **Syn Gene Gene Tools-File version:** *4.01.02–Serial No. 17292*14518*sme*mpsc.*

71. **Tan-No, K., Nakajima, T., Shoji, T., Nakagawasai, O., Niijima, F., Ishikawa, M., Endo, Y., Sato, T., Satoh, S. and Tadano, T. (2006).** Anti-inflammatory effect of propolis through inhibition of nitric oxide production on carrageenin induced mouse paw edema. *Biol. Pharm. Bull.,* 29 (1): 96-99.

72. **Tello, R. and Crewson, P. E. (2003).** Hypothesis testing II: means. Radiol., 227 (1): 1-4.

73. **Thomas, M.; Sujatha, K. S. and George, S. (2009):** Protective effects of *Piper Longum* Linn. On monosodium glutamate induced oxidative stress in rats. *Indian J. Exp. Biol.,* 47 (3): 186-192.

74. **Tietze, F. (1969).** Enzymic method for quantitative determination of nanogram amounts of total and oxidized glutathione: Applications to mammalian blood and other tissues. *Anal. Biochem.,* 27: 502-522.

75. **Tietz, N. W. (1976).** Fundamentals of Clinical Chemistry. 2nd Ed., *W. B. Saunders Co, Philadelphia,* pp: 878-878.

76. **Tietz, N. W. (1983).** Clinical guide to Laboratory Tests. *W.B. Saunders Co. Philadelphia,* p: 384.

77. **Varanda, E. A.; Monti, R. and Tavares, D. C. (1999):** Inhibitory effect of propolis and bee venom on the mutagenicity of some direct and indirect-acting mutagens. *Teratog. Carcinogen. Mutagen.,* 19: 403-413.

78. **Vinodini, N. A.; Nayanatara, A. K.; Ramaswamy, C.; Ranade, A. V.; Kini, R. D.; Damadara, G. K. M.; Ahamed, B.; Shabarinath, and Ramesh Bhat. (2010):** Study on evaluation of monosodium glutamate induced oxidative damage on renal tissue on adult Wistar rats. *J. Chin. Clin. Med.,* 5 (3): 144-147.

79. **Walker, R. and Lupien, J. R. (2000):** The safety evaluation of monosodium glutamate. *J. Nutr.,* 130 (45): 1049-1052.

80. **Yaqub, H.; Abdel Baky, N. A.; Attia, H. A. and Faddah, L. M. (2008):** Hepatoprotective Effect of N-acetyl Cysteine and/or β-Carotene on Monosodium Glutamate-Induced Toxicity in Rats. *Res. J. Med. Med. Sci.,* 3 (2): 206-215.

81. **Yousef, M. I. and Salama, A. J. (2009):** Propolis protection from reproductive toxicity caused by aluminium chloride in male rats. *Food Chem. Toxic.,* 471168-1175.

82. **Zhang, Z.; Dmitrieva, N. I.; Park, J. H.; Levine, R. L. and Burg, M. B. (2004):** High urea and NaCl carbonylate proteins in renal cells in culture and in vivo, and high urea causes 8-oxoguanine lesions in their DNA. *Proc. Natl. Acad. Sci. U S A.,* 101(25): 9491-9496.

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Relationship between Motivation, Self-concept, Attitude and Fluency of elementary school students

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Abstract: This study investigated the relationship between reading motivation, reading self-concept, reading attitude and reading fluency in the fourth and fifth grade years. The sample consisted of 375 students (N = 187 males and N= 188 female) were administered the Test of Motivation to Read, Reading Self-Concept, Reading Attitude and Reading Fluency. The specific question addressed was: what is the association between reading motivation, reading self-concept, reading attitude and reading fluency? In this study for analysis of data, applying correlation and hierarchical multiple regression, results showed that reading motivation, reading self-concept, reading attitude were related to reading fluency also results indicated no significant gender effects were found for either reading motivation or self-concept, attitude and fluency. This study adds to the literature of motivation, self-concept, attitude to read and reading fluency.

1. Introduction

Learning to read is a very hard task since it is multidimensional in character. Effective readers require to consistently and efficiently applying their knowledge of the phonology of the language to words during readings while constructing meaning. Meanwhile, readers continuously make and then confirm or disconfirm text predictions, summarize, make inferences, and draw conclusions. Metacognitive observing of one's individual accuracy with regard to word identification and comprehension is constant. Depending on the reading reason, readers are also adjusting their reading (relatively fast rates when skimming is needed; slower rates when attending to details for exam preparations) while organizing the information they commit to long-term memory [1].

Fluency, approved to be important to the instruction of reading, is regularly ignored in the classroom [2]. Fluency in reading refers to the reader's skill to read textbook easily, correctly, at a suitable speed, and with correct expression [3]. Reading speed, or the rate at which a reader reads, is an pointer of how smooth a reader is [4]. Quite spending a lot need resources on decoding, fluent readers are capable to free up their cognitive resources to allow further time for reading comprehension [5]. The ultimate goal for reading is comprehension of textbook, or accepting what is read [2]. The teaching of fluency not only is a valid instruction plan to achieve reading comprehension , the reported by National Reading Panel show that fluency is necessary in the development of reading [6]. "Students who do not increase reading fluency, no issue how bright they are, will maintain to read slowly and with large attempt" [2]. When children read fluently, they can focus further on comprehension and fewer on decoding [7]. Additionally, students who not succeed to obtain reading fluency by third or fourth grade will probability fall behind their peers in reading attainment [8]. In the current study, I examine motivation to read, reading self-concept, reading attitude and reading fluency of fourth and fifth grades students. What follows is a discussion of the need to investigate reading motivation, reading self-concept reading attitude and reading fluency.

2. Motivation

Numerous of educators and researchers know that motivation is key to excellent education [9], successful reading achievement [10], and enhanced comprehension of textbook [11]. Motivation is the "why of performance" [12]. Motivation also addresses what guides a student to attaining positive goals [13], makes them avoid certain states [14, 15], and clarifies how they feel about themselves [16, 17], or why they select to read [18-21]. The study by White [22] pointed out that the motivation theories of his time did not take into relation the fact that persons learn to do things that they definitely did not recognize how to do at birth, but motivation study has evolved pretty a bit since then [9, 23]. Appropriate a successful reader certainly falls in the type of tasks persons are not born to do [24].

Knowledge about reading is not a usual process [25], and it is probability that there are "multiple motivation ways" [26], that lead student performance. Other aspects play an element in improving reading skill. As Baker and Wigfield [27], observed, "because reading is an effortful action that students often select to do or not to do, it also needs motivation" (p. 452). More than four decades ago, Gagné [28], explained motivation in terms of motivation to achieve. Motivation to achieve is the need to be able to do something. Gagné predicted that "scheming and increasing motivation is quite the most serious matter facing schools" (p. 207). Exacerbating the difficulty of increasing motivation in students, said Gagné, is that sometimes the aims of learning are not readily clear to the students, and it develop into the responsibility of the educators and parents to help the child recognize that he/ she wants to study a task. Parents make a position in a child's motivation to read [29-31], however not always [21]. But, it is often the motivation skilled as a result of interactions with schools and motivation that effect future learning and influence a student's motivation [32].

Stipek [33], an additional proponent of attainment motivation, believed that persons perform based on a set of ideas and values that come from before experiences in achievement states. These experiences are refereed by the total of failure or success that students recognize. For the reason that the instant situations affect these experiences, motivation may show to be situational [33]. Approximately a decade later, Stipek [34], continued to support her theories of the consequence of motivation: "motivation is significant to learning because learning is an dynamic process involving conscious and deliberate activity, the most able students will not learn if they do not give attention and apply some attempt" (p. ix). Further theorists [14, 16], explained what they believe occurs when learners do pay attention and study their environments. Bandura [16], explained motivation in terms of what is educated in a social setting. This approach has come to be recognized as social learning theory [35]. Persons are able to learn during observation and are more probability to engage in the observed performance if they believe they are able of completing the performance [32, 36]. Learners' negative feelings about their skill as readers may move to how they see themselves in other learning states [18], which may guide to avoidance of these tasks [37].

Wigfield, Guthrie, Tonks, and Perencevich [38], noted that "level the reader with the strongest cognitive performance may not spend a lot time

reading if he/ she are not motivated to read" (p. 299). Teachers are attracted in why [39]. Completing positive tasks may afford the student with a feeling of agreement, which may go beyond the feelings of skill at having finished these tasks [22]. Intrinsic motivation theories attempt to talk to such parts of motivation, describing that when students are intrinsically motivated, they complete actions simply because they are interested in and enjoy the task [40]. Hussien [21], did a study concerning student motivation and reading achievement. The reason of her descriptive study was to look at the relationship between motivation to read and reading achievement. Hussien found that there was a relationship between students' motivation to read and their reading achievement. Based on her findings, Hussien suggested that students who were more motivated to read tended to be better readers and therefore motivation to read could be one of the reasons that influence reading achievement.

3. Self-Concept

Bracken [41], defines self-concept as "a multidimensional and context dependent learned behavioral pattern that reflects an individual's evaluation of past behaviors and experiences, influences an individual's current behaviors, and predicts an individual's future behaviors[42]. On the other hand, according to Marsh [43], self-concept is a person's perceptions regarding him or herself [42]. Zinkhan and Hong [44], note that "it is not an objective entity independent of the perceiver", instead the term denotes individuals' subjective thoughts toward themselves. In this sense, it is a unique sort of attitude. Different other attitudes which are perceptual products of an external object, self-concept is an image shaped by the very person holding the image."

Although generally self-concept has been conceptualized with a multidimensional perspective, some researchers discuss self-concept as a single variable, while yet others conceptualize it as having more than one component. Within the single self-construct tradition, self-concept has been labeled as "actual self", "real self", and "basic self", among others, and has been described as the perception of oneself. Within the multiple self-concept tradition, on the other hand, self-concept has often been treated as having two components: the actual self-concept and the ideal self-concept. The ideal self-concept has been labeled as "ideal self", "idealized self," and "desired self," and has been defined as "the image of oneself as one would like to be" [45].

Academic self-concept is defined as the awareness, information, views, and beliefs that

children hold about themselves as learners [46]. Chapman, Tunmer, and Prochnow [47], studied the relationship among reading performance and academic self-concept. They followed a sample of 5-year-old children across three years and, using the Reading Self - Concept Scale, classified the children as having positive, negative, or typical self-concepts. Children's pre-reading and reading skills were also evaluated, plus letter identification, phoneme deletion, sound matching, and reading comprehension. The results show that children with negative academic self-concepts entered kindergarten with significantly poorer basic reading skills, including phonological sensitivity and letter-name knowledge, than children with positive academic self concepts. Students with negative academic self-concepts confirmed additional pessimistic attitudes toward reading and felt less competent as readers than did students with positive academic self-concepts. In the second grade, the students with negative self-concepts viewed themselves as fewer proficient in reading, having more intricacy with reading, and liking reading fewer than students with positive academic self-concepts. These children also read lesser level books and carried out at lower levels on procedures of word recognition and reading comprehension [47]. These results are consistent with the theory that primary and continuing performance in learning to read is reflected in achievement-related self-perceptions, which are subsequently related to early reading skills.

4. Attitude

Attitudes are always towards something. It could be a physical object, a person, or something more abstract such as giving to charity. A later definition by Thurstone [48], gave at least some clarification to these issues. Thurstone defined an attitude as affect for or against a psychological object". This still implies cognition to the extent that psychological objects are the focus of attitudes, but attitudes are seen as primarily affect or emotion. Additionally, this affect may be positive or negative. Interpersonal attitudes may be positive or negative, for example, we like some people and dislike others. Perhaps the most famous definition of attitudes is that of Allport [49], who proposed that an attitude is "a learned predisposition to think, feel and behave toward a person (or object) in a particular way".

Developing an understanding of the attitudes that dominate in a community, which in turn influence the actions of its members, is critical if we are to bring about social change and evaluate the effectiveness of public policy in promoting an inclusive society [50].

Attitudes are referred psychological processes that are nearby in all people and are given expression or form when evoked by specific referents [51]. Attitudes are obtained during experience over time and are socially constructed. They can be measured a learned disposition or internal biasing system that focuses a person's attention and provide a structure within which he or she encodes experience and the guiding parameters for his or her behavior [52, 53]. Additionally, Yuker [54, 55], emphasized that attitudes are composed of positive and negative reactions toward an object, accompanied by beliefs that impel individuals to behave in a particular way. Makas, Finnerty-Fried, Sugafoos and Reiss [56], recommended that for a normal person, a positive attitude is generally conceptualized as being "nice" and "helpful" .

A National Survey The measurement of reading attitudes was not the only limitation of early research. The recruitment of small and homogenous samples of students was another significant limitation to the generalizability of results. In response to this limitation, McKenna, Kear, and Ellsworth [57], conducted the first national investigation of reading attitudes and recruited a demographically diverse sample of 18,185 students in grades one through six. Specifically, these researchers sought to examine: (a) developmental trends in recreational and academic reading across grade, and (b) differences between reading attitudes and reading ability. The aim of this study was to relationship between the motivation to read, reading self-concept, reading attitude and reading fluency of elementary school students. The research question and the research hypothesis were as follows:

Research Question: what is the association among reading motivation, reading self-concept, reading attitude and reading fluency?

Hypothesis 1. There will be a significant correlation between reading motivation, reading self-concept, reading attitude and reading fluency.

Hypothesis 2. Reading motivation, reading self-concept, and reading attitude are significant explanatory variable of reading fluency.

Method

This study is designed based on these theoretical foundations: first of all the independent variables (IV) and dependent variable (DV) are chosen based on literature, and then the descriptive method was selected as the research design. Numerous scientific regulations, especially social science and psychology, use this method to find a universal summary of the subject.

5. Participants

In this study between 13,000 students in the elementary schools in Ilam, Iran I selected sample size based cluster sample size and table of sample size by Krejcie and Morgan [58]. Participants in this study were 375 elementary school students from Ilam, Iran elementary schools, (N= 187male, N= 188 female), complete the questionnaires. The composition of the participants were 180 grade four (42.2%), and 195 grade five (45.7%). The mean age of participants was 11 years old, falling between 10 and 12 years old. The time for completed the questionnaires were about 90 minutes. The questionnaire used in this study composed five sections, including demographics information, reading attitudes, reading self-concept, reading motivation, and reading fluency. For demographic information section, students were asked to report their gender, age, and grade of education. In this study I employed attitudes, self-concept, motivation to read and reading fluency questionnaires and students completed respectively 20 items, 30 items, 54 items and 98 items.

6. Pilot study

The purpose of carrying out the pilot study was to evaluate the suitability and appropriateness of the use of the instruments. For the pilot study, 60 students in Ilam with similar characteristics to that of the participants in this study were selected randomly. The students consisted of 30 males and 30 female students. This study was carried out from 25 to 30 April, 2010. The reliability coefficient for each instrument used in this pilot study was also obtained. Cronbach's [59], alpha reliabilities of the Reading Fluency, Attitude, Self-concept and Motivation were found to be, 0.90, 0.84, 0.87 and 0.93, respectively. The results of the reliability Coefficient showed a high reliability for all these instruments, suggesting that these instruments were considered as appropriate to be employed further in this study.

7. Measures

7.1. Reading fluency. Reading Fluency measures the student's ability to read simple sentences quickly in the Subject Response Booklet, decide whether the statement is true, and then circle on Yes or No answers. The difficulty of the sentences gradually increases to a moderate level. The student attempts to complete as many items as possible within the time limit of 3 minutes. Reading Fluency has a median reliability of 0.90 in the age range between 6 to 19 years and 0.90 in the adult age range [60]. In this study, the Cronbach's alpha reliability for the scale was 0.85, whereas the test-retest reliability was 0.88.

7.2   Attitude. Mckenna and Kear [61], defined the Elementary Reading Attitude Survey (ERAS) as a 20-item survey that requests students to rate their own attitude towards reading; each item presents a brief, simply worded statement about reading followed by four pictures of the comic strip character, Garfield the cat, in varying pictorial poses. Percentile ranks can be obtained for two component subscales: recreational reading attitude and academic reading attitude. Recreational items focus on reading for fun outside the school setting while the academic subscale examines the school environment and the reading of schoolbooks. A total reading attitude percentile rank can also be computed as an additive composite of the recreational and academic scores [61]. Cronbach's alpha, a statistic developed primarily to measure the internal consistency of attitude scales [62] was calculated at each grade level for both subscales and for the composite score. These coefficients ranged from 0.74 to 0.89 [61]. The validity of the academic subscale was tested by examining the relationship of scores to reading ability. Teachers categorized norm-group children as having low, average, or high overall reading ability. Mean subscale scores of the high ability readers (M=27.7) significantly exceeded the mean of low ability readers (M=27<0.001); evidence that scores were reflective of how the students truly felt about reading for academic purposes. In this research, scores on the scale have acceptable reliability (Attitude=0.75).

7.3   Motivation Scale: The Motivation for Reading Scale was developed by Wigfield and Guthrie [63] to assess 11 dimensions of reading motivation. This scale has 54-items designed to assess the 11 different aspects of reading motivation. Children answered each item on a 1 to 4 scale, with 1=never, 2=seldom, 3=often and 4= always. The Motivation Scale was designed to assess the reading motivation of students in grades 3 to 6. Validity evidence includes an accumulation of research results that support hypotheses consistent with the construct being measured [64]. Test –retest reliability for the Motivation Reading Scale ranged from 0.69 to 0.97. For this study, the Cronbach's alpha reliability for the Reading Motivation Scale ranged from 0.76 to 0.88 and the test- retest reliability ranged from 0.76 to 0.90 respectively.

7.4. Reading Self-concept Scale: The Reading Self-concept Scale (RSCS) [65] was used as a measure of reading self-concept. The RSCS contains 30 questions, which were read aloud individually to

children who responded on a 5-point Likert scale (1. Never, 2. Seldom, 3. Sometimes, 4.Often, 5.Always). Response requirements were taught to children by means of 4 examples and 10 practice items, which took approximately eight minutes to complete. The RSCS was developed as part of a series of experimental studies in which previous research and theory in the areas of self-concept and reading were drawn upon. The RSCS measures reading and is suitable for ages 6 and above. The Cronbach's alpha coefficient score for the scale is 0.80. The RSCS was individually administered and administration time varied between 15 and 30 minutes for each participant. Each response was scored from 1 (low reading self-concept) to 5 (high reading self-concept) with the total scale score calculated as the mean value of the 30 responses. Responses to the RSC-difficulty were reverse scored; meaning difficulty is actually easiness in correlations. Mean scores for each of the three subscales were calculated in the same manner with a total of four scores calculated; Total-RSCS, Competence, Difficulty and Attitude. In this study, scores on all RSCS sub scales show acceptable reliability (Total-RSCS α=0.88; Attitude α=0.84; Difficulty α=0.71; Competency α=0.78).

8. Results

The reason of this study was to find out the unique and combined motivation, self-concept, and attitude to reading fluency in a group of students in the elementary schools. A descriptive design was used to assess 375 students, 187 (43.8%), male and 188 (44%), female between the ages of 10 and 12 years, on measures of reading motivation, reading self-concept, reading attitude and reading fluency scales. Multiple data analyses were conducted using SPSS for Windows to test the hypotheses of this study. All analyses were conducted with an alpha level of .05. Students' raw scores on all measures were used in the planned correlation and hierarchical multiple regression analyses.

A total screening of the data was at first done by investigating the univariate descriptive statistics output shown in Table 1. The reason for this first screening was to observe for reasonable means, standard deviations, standard error, maximums, and minimums.

Table 1. Descriptive statistics

	N	Min	Max	M	SE	Sd
Attitude	375	29	76	58.14	.69	13.28
Self-Concept	375	49	143	95.67	1.13	21.85
Motivation	375	103	177	135.5	1.1	21.38
Fluency	375	34	86	56.59	.57	11.12

A major mean of this study was to inspect the power of the relationship between each of the three predictor variables and reading fluency. To accomplish this aim, Pearson product moment correlations were conducted. All Pearson product moment correlations were based on the combined performance of the 375 students in grades four to five. Positive correlations were found between each of the three predictor variables (motivation, self-concept, attitude to read) and reading fluency in value from r=.33 to r=.81, p=<.01. Results for each of the planned correlation analyses will follow in relation to the first research hypotheses.

Hypothesis 1. There will be a significant correlation between reading motivation, reading self-concept, reading attitude and reading fluency.
The results of research hypothesis one as shown in Table 2, the three measures of reading motivation, reading self-concept, reading attitude showed, significant and positive correlations to reading fluency.

The result of correlation presented in Table 2. This result provides us with the correlation coefficient; the correlation coefficient is shown as a number between +1 and -1. The power of the correlation can be seen as when it gets nearer to either +1 or -1. The correlation coefficient also provides the direction of the relationship, either positive or negative. In this study, the correlation coefficient for attitude, self-concept, motivation, and fluency are shown in Table 2.

Table 2. Correlation between reading motivation and reading fluency

Measure	1	2	3	4
1. Attitude		.50*	.81*	.45*
2. Self-Concept	.50*		.57*	.33*
3. Motivation	.81*	.57*		.34*
4. Fluency	.45*	.33*	.34*	

*Correlation is significant at the .01 level.

Hypothesis 2. Reading motivation, reading self-concept, and reading attitude are significant explanatory variable of reading fluency.

To test research hypothesis two, the enter method for hierarchical multiple regression was used to find the best explanatory model of the relationships between reading motivation, reading self-concept, and reading attitude as significant explanatory variables of the reading fluency. Three explanatory variables were identified for the regression. The significant and trend variables were entered into the regression model in the order of the strength of their relationship to the dependent variable: reading motivation (r = .341, p =

.000), reading self-concept (r = .379, p = .001), reading attitude (r = .473, p = .000) until a significant F model with the highest R^2 and adjusted R^2 was produced. Collinearity statistics of variance inflation factor (VIF) and tolerance were used to test for multicollinearity. For hypothesis two, the VIF were less than 10 (range 1.000 to 3.22) and the tolerance was more than .10 (range. 311 to 1.000) indicating that multicollinearity was an issue. The effect size of the explanatory variables based on the standardized Beta coefficients (β) was: Reading motivation (β = .341, p = .000), reading self-concept (β = .203, p = .001), and reading attitude (β = .481, ρ = .000). According to the results, Hypothesis two was supported.   The result of hierarchical Multiple Regression presented in Table 3.

Table 3. Hierarchical Multiple Regression of Motivation, Self-Concept, Attitude and Fluency

Model	B	SE	β	T(p)	F(p)	R^2	Ad R^2
(Constrant)	32.58	3.47		9.38 (.01)			
Motivation	.180	.03	.34	6.99 (.01)	48.97 (.01)	.12	.11
(Constrant)	30.89	3.46		8.93 (.01)			
Motivation	.12	.03	.22	3.83 (.01)			
Self-Concept	.10	.03	.20	3.48 (.01)	31.25 (.01)	.14	.14
(Consttant)	35.10	3.37		10.43(.01)			
Motivation	-.08	.04	-.15	-1.79 (.07)			
Self-Concept	.09	.03	.17	3.11 (.01)			
Attitude	.40	.07	.48	6.17 (.01)	35.59 (.01)	.22	.22

This table shows that statistically significance between variables. The dependent variable is reading fluency.

9. Discussion

The reason of this research was to determine the part of components of reading motivation, reading self-concept, and reading attitude to reading fluency in group of students in the elementary schools. Hierarchical multiple regression analyses confirmed that the hierarchical multiple regression is used to explore the patterns of relationship between a number of predictor variables and one criterion variable. A detailed account and interpretation of the findings are discussed in relation to previous research about reading motivation, reading self-concept, and reading attitude with reading fluency in students of elementary schools. In this study results show that statistical significant difference between reading motivation, reading self-concept and reading attitude and reading fluency of elementary school students. The research hypotheses are: 1.There will be a significant correlation between reading motivation, reading self-concept, reading attitude and reading fluency. 2. Reading motivation, reading self-concept, and reading attitude are significant explanatory variable of reading fluency.

The research hypotheses are confirmed at ρ<.000. This study is in line with other researches [9-11, 21, 23, 39], that shows motivation is important factor to excellent education. The study by Hussion [21], shown that relationship between motivation and reading achievement. Stipek [34], based on motivation theory said: "motivation is important to learning because learning is an dynamic process involving conscious and deliberate activity, the most able students will not learn if they do not give attention and apply some attempt" Study on academic motivation demonstrate that the affective aspects of reading were recognized as significant correlates of skill development [63]. Theorists posited a variety of constructs to explain reading motivation and how it influences students' reading engagement [66], and educators became interested in learning how to motivate students to read [67]. In addition to motivation the other important factors for reading are self –concept and attitude. Some studies shows that the relationship among reading performance and academic self-concept [47]. The study by Quirk, et al., [10], shown that relationship between students' reading self-concept, and reading fluency. The study by Chapman, Tummer and Prochnow [47], show that students with negative academic self-concepts entered kindergarten with significantly poorer basic reading skills, including phonological sensitivity and letter-name knowledge, than students with positive academic self concepts. Students with negative academic self-concepts confirmed additional pessimistic attitudes toward reading and felt less competent as readers than did students with positive academic self-concepts.

Studies by McKenna, Kear, and Ellsworth [57], MacMillan, Widaman, Balow, Hemsley and Little [68], Worrell, Roth, and Babelko [69], shown that positive relationship between reading attitude and reading skills. McKenna, Kear, and Ellsworth [57], found significant developmental trends in reading attitudes indicating that despite initial positive attitudes toward recreational and academic reading, as grade levels rose, students reading attitudes steadily declined. Significant differences were also observed

between reading attitudes and ability to read. Students with low average reading ability reported more negative attitudes towards recreational reading than students with above or average reading ability. Further, the findings of a significant relationship between negative reading attitudes and low reading abilities served to support both previous research findings [e.g. 70]. MacMillan, et al., [68] found statistically significant group differences between students' attitudes towards reading and academic level. The results by Worrell, Roth, and Babelko [69], indicated that as a group, academically talented students demonstrated above average attitudes towards reading and consistent with previous investigations. Martinez, Aricak, and Jewell [71], found that reading ability and reading attitudes significantly predicted near-future reading achievement.

Conclusion

When I examined the fluency, motivation, self-concept, and attitude to read of 375 elementary students I employed correlation and hierarchical multiple regression techniques. This analysis added new dimensions to our understanding of this population's, motivation, self-concept, and attitude to reading in related to the reading fluency.

Recommendation for future

The implication from the results should not be widespread beyond the population studied. This research was performed in an elementary school. The relationships between the variables may be different for different populations. Additional, it might be useful to look at these constructs in to some extent younger students, as well, to examine the stability and longitudinal belongings of differing thinking. Continued examination of these constructs should focus on employing reliability and validity of instruments and apparent operational definitions of the constructs to help decrease any further problems made by using different terminology. This study suggests that understanding how students feel about themselves as a reader and the different goals they have for reading, may provide some approach into the behaviors they display, and in the end their reading achievement. Further, educators can support the progress of learning aims during permitting students to evaluate themselves, giving them autonomy and control, permitting supportive learning, permitting them to choose their difficulty level, and by individualizing instruction . It is important for teachers to understand the affective consequences involved in learning to read, or how difficulty in reading can lead to negative feeling and finally poor school results.

References

1. Grosser GS, Spafford CS: Dyslexia: Overview and treatment. In: *Innovations in clinical practice: A source book. Volume 18*, edn. Edited by VanderCreek L, Jackson T. Sarasota, FL: Professional; 2000: 417-440.
2. National Reading Panel: Education students to read: An evidence based assessment of the scientific research literature on reading Washington, DC: U.S: Government Printing Office; 2000.
3. Shanker JL, Ekwall EE: Locating and correcting reading difficulties. Upper Saddle River NJ: Merrill Prentice Hall; 2003.
4. Allington R: What really matters for struggling readers: Designing research based program. Boston, MA: Pearson A & B; 2006.
5. Sciences IoE: Reading first's impact. NCEE evaluation brief 2009-4054 (ED506347): National Center for Education Evaluation and Regional Assistance: Author; 2009.
6. National institude of child health development: Report of the National Reading Panel. Education students to read: An assessment of the scientific research literature on reading In. (NIH Publication NO. 00-4769) Washington DC: U.S.Government Printing Office; 2000.
7. Fluency instruction. [http://www.nifl.gov/partnershipforreading/explore/fluency.html]
8. Dudley AM, Mather N: Getting up to speed on reading fluency. In: *New England Reading Association Journal.* vol. 41; 2005: 22-27.
9. Schunk DH, Pintrich PR, Meece JL: Motivation in education: Theory, research,and applications, vol. 3. Columbus, OH: Pearson Education, Inc; 2008.
10. Quirk M, Schwanenflugel P, Webb M: A short-term longitudinal study of the relationship between motivation to read and reading fluency skill in second grade. *Journal of Literacy Research* 2009, 41:196-227.
11. Guthrie JT, Wigfied A: How motivation fits into a science of reading In: *Scientific Studies of Reading.* vol. 3; 1999: 199-205.
12. Covington MV: The will to learn: A guide for motivation young people. Cambridge, United Kingdom: Cambridge University Press; 1999.
13. Sansone C, Harackiewicz JM: Looking beyond rewards: The problem and promise of intrinsic motivation. In: *Intrinsic and extrinsic motivation: The search for optimal motivation and performance.* edn. Edited by Sansone, Marackiewicz JM. (pp.1-9). San Diego, CA: Academic Press; 2000.

14. Derville L: The use of psychology in teaching London: Longmans; 1966.

15. Onatsu-Arvilommi T, Nurmi JE: The role of task-avoidant and task-focused behaviors in the development of reading and mathematical skills during the first school year: A cross-lagged longitudinal study. *Journal of Educational Psychology* 2000, 92(3):478-491.

16. Bandura A: Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 1977, 84:191-215.

17. Renninger KA: Individual interest and intrinsic motivation. In: *Intrinsic and extrinsic motivation: The search for optimal motivation and performance.* edn. Edited by Sansone C, Harackiewicz JM. (PP.373-404). San Diego, CA: Academic Press; 2000.

18. Butkowsky IS, Willows DM: Cognitive-motivational characteristics of children varying in reading ability: Evidence for learned helplessness in poor readers. *Journal of Educational Psychology* 1980, 72(3):408-422.

19. Clifford MM, Chou FC: Effects of payoff and task context on academic risk taking *Journal of Educational Psychology* 1991, 83(4):499-507.

20. Gambrell LB, Palmer B, Codling R, Mazzoni S: Assessing motivation to read. In: *The Reading Teacher*. vol. 49; 1996: 518-533.

21. Hussien MG: The relationship between motivation to read and reading achievement in grades kindergarten through third. Retrieved from Dissertations & Theses@ Walden University database; 1998.

22. White R: Motivation reconsidered: The concept of competence. *Psychological Review* 1959, 66(5):297-333.

23. Covington MV: The will to learn: A guide for motivating young people. Cambridge, United Kingdom: Cambridge University Press; 1999.

24. Rasinski TV: The fluent reader. New York, NY: Scholastic Professional Books; 2003.

25. Lyon GR: Why reading is not a natural process. In: *LDA Newsbriefs*. vol. 38: Learning Disabilities Association of America; 2000.

26. Taboada A, Tonks SM, Wigfield A, Guthire JT: Effects of motivational and cognitive variables on reading comprehension. *Reading and Writing* 2009, 22(1):85-106.

27. Baker L, Wigfied A: Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading Research Quarterly* 1999, 34(4):452-477.

28. Gagne' RM: The conditions of learning New York, NY: Holt, Reinhart and Winston, Inc; 1965.

29. Baker L: The role of parents in motivating struggling readers. *Reading and Writing Quarterly* 2003, 19(1):87-106.

30. Baker L, Scher D: Beginning readers' motivation for reading in relation to parental beliefs and home reading experiences. *Reading Psychology* 2002, 23(4):239-269.

31. Morgan P, Fuch D: Is there a bidirectional relationship between children's reading skills and reading motivation? *Exceptional Children* 2007, 73(2):165-183.

32. Embrey SL: Skill versus Will: An Investigation of a Relationship between Motivation to Read, Oral Reading Fluency, and Demographics for Third-grade Elementary Students. Walden University; 2011.

33. Stipek DJ: Motivation to learn: From Theory to practice, 2 edn. Boston, MA: Allyn and Bacon; 1993.

34. Stipek DJ: Motivation to learn: Integrating theory and practice, 4 edn. Boston, MA: Allyn & Bacon; 2002.

35. Petri H: Motivation: Theory, Research, and Applications. In., 4 edn. Wadswordth: Belmont; 1991.

36. Bandura A, Schunk DH: Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology* 1981, 41(3):586-593.

37. Linnenbrink EA, Pintrich PR: The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading and Writing Quarterly* 2003, 19(2):119-137.

38. Wigfield A, Guthrie JT, Tonks S, Perencevich KC: Children's motivation for reading: Domain specificity and instructional influences. *Journal of Educational Research* 2004, 97(299-309).

39. Sullo B: Activating the desire to learn. Alexandria, VA: Association for Supervision and Curriculum Development; 2007.

40. Eccles JS, Wigfied A: Motivational beliefs, values, and goals. *Annual Review of Psychology* 2002, 53(109-132).

41. Bracken BA: Self-concept to reading scale. Ausin, TX: Pro; 1992.

42. Waugh RF: Measuring ideal and real self-concept on the same scale, based on a multifaceted, hierarchical model of self-concept. *Educational and Psychological Measurement* 2001, 61(1):85-101.

43. Marsh HW: Multidimensional, hierachical self-concept: theory and empirical justification. *Educational Psychology Review* 1990, 2:77-172.

44. Zinkhan GM, Hong JW: Self-concept and advertising effectiveness: A conceptual model of congruency, conspicuousness, and response mode. in (ed) In: *Advances in consumer.* edn. Edited by

Holman RH, Soloman MR. Provo, VT: Association for Consumer Research; 1991: 348-353.

45. Sirgy MJ: Self-concept in consumer behavior: A critical review. *Journal of Consumer Research* 1982, 9(december):287-300.

46. Chapman JW, Tunmer WE: Reading difficulties, reading-related self-Perceptions, and strategies for overcoming negative self-beliefs. *Reading and Writing Quarterly* 2003, 19:5-24.

47. Chapman W, Tunmer E, Prochnow E: Study about reading skills, self-concept and progrss in school self-concept. *Journal of Educational Psychology* 2000, 92:703-708.

48. Thurstone LL: Rank order as a psychological method. *Journal of Experimental Psychology* 1931, 14(Journal Article):187-201.

49. Allport GW: The spirit of prejudice in reading. MA: Addison-wesley; 1954.

50. Sigafoos J: Attitudes and perceptions past and present (editorial). *International Journal of Disability Development and Education* 1997, 44(Journal Article):93-95.

51. Antonak R, Livneh H: Measurement of Reading Attitude for students with disabilities. *Disability and Rehabilitation* 2000, 22:211-224.

52. Berry J, Dalal A: Disability attitude, belive and behaviors: Report on an international project in the people. In. Canada: Queen's University, Kingston; 1996.

53. Mihandoost Z: A meta-analysis review: Determining self-concept in pupils with and without learning disability. *Education Science and Psychology* 2011, 2(19):17-23.

54. Yuker H: The effects of contact on attitudes toward disabled persons: Some empirical generalisations. in H. E. yuker (ed.), attitudes toward people with disabilities (pp. 262–274). New York: Springer; 1988.

55. Mihandoost Z: Quantitive study on reading attitude: A meta-analysis of quantitve result. *Nature and Science* 212, 10(6):75-82.

56. Makas E, Finnerty-Fried P, Sugafoos A, Reiss D: The issues in disabilities scale: A new cognitive and affective measure of attitude toward people with disability. *Journal of Applied Behavioural Counselling* 1988, 19:21-29.

57. Mckenna C, Kear J, Ellsworth A: Reading attitude in students *Reading and Writing Quarterly* 1995, 30:934-955.

58. Krejcie RV, Morgan DW: Determining sample size for research activities. *Educational and Psychological Measurement* 1970, 30:607-610.

59. Cronbach J: Internal formation of analysis. *Psychometrika* 1951, 16(3):297-334.

60. Woodcock RW, Mather N, Schrank FA: Diagnostic Reading Battery. USA: Riverside Publishing; 2004.

61. McKenna MC, Kear DJ: Measuring attitude toward reading: A new tool for teachers. *The Reading Teacher* 1990, 43(Journal Article):626-639.

62. Cronbach LJ: Coefficient alpha and the internal structure of tests. *Psychometrika* 1951, 16(3)(Journal Article):297-334.

63. Wigfield, Guthrie: Motivation for reading: An overview. *Educational Psychologist* 1997, 32:57.

64. Messick DM: Equality, fairness, and social conflict. *Social Justice Research* 1995, 8:153-173.

65. Chapman, Tunmer: Reading self-concept scale.In R. Burden (Ed.), self-perceptions(PP.29-34). England: NFER-Nelson; 1995.

66. Wigfield A, Eccles JS, Rodriguez D: The development of children's motivation in school contexts. *Review of Rsearch in Education* 1998, 23:73-118.

67. Palmer BM, Codling RM, Gambrell L: In their own words: What elementary students have to say about motivation to read. *The Reading Teacher* 1994, 48:176-178.

68. MacMillan DL, Widaman KF, Balow I, H, Hemsley RE, Little TD: Differences in adolescent school attitudes as a function of academic level, ethnicity, and gender. *Learning Disabilities Quarterly* 1992, 15(1):39-50.

69. Worrell FC, Roth DA, Gabelko NH: Elementary reading attitude survey scores in academically taleted students. *Roeper Review* 2007, 29:119-124.

70. Wallbrown FH, Vance HH, Prichard KK: Discriminating between attitudes expressed by disableds. *Psychology in the Schools* 1979, 16(4):472-477.

71. Martinez RS, Aricak OT, Jewell J: Influence of reading attitude on reading achievement: A test of the temporal-interaction model. *Psychology in the Schools* 2008, 45(10):1010-1022.

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HRM Practices, Employee Motivation and its Effects on Perceived Performance

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Abstract: Aim of this paper is to study the relationship between human resources management practices and its impact on the level of performance.This paper is intended to investigate the impact of HRM Practices on employee motivation and study the effects of Motivation (Personal as well as infused by HRM practices being followed in some selected Public Sector Departments (PSDs) operating in Rawalpindi area.As we know, the performance of any organization is dependent on various factors like Organizational Support offered to the workers to perform their tasks, extra rolebehavior, commitment HRM or HRM Practices, reciprocities etc. But the main and most important player is the employee's Moral and Motivation. There are various theories prevail on the issue and the peers and practitioners are working to refine those, however, in the local context of Pakistan, there is a very little work has been undertaken in this regard. This study is aimed to fill the gap to some extent. Towards the end we will see the relevance and applicability of these internationally accepted concepts in the back drop of Pakistani PSDs operating in Rawalpindi.

1.   Introduction, Scope and Assumptions

The available literature and studies indicates that there is a considerable relationship between the two, human resources practices and perceived performance of the organization. The Motivation and Moral of employees has a direct bearing on the Outcome and efficiency of the orgs, and Public Sector Departments (PSDs) of Pakistan should not be an exception. Many enterprises limit their productivity to the acquisition of skills for the employees. Whereas, approximately 86% of productivity problems can be found in the work environment Of organizations. It is generally perceived that the work environment has effect on the performance of employees. The type of environment in which the workers work establishes the way in which such enterprises flourish (Akinyele Samuel Taiwo, 2009). In all types of organizations, realizing a change or reforms often suffers a dismal fate, notably because of the resistance pockets offered by the change agents themselves (Gilley et al., 2009). Especially in case of developing countries, where the lessons learnt from several decades of weak governance and public sector reforms show that high degree of failure is explained by their limited focus on technology enhancement and reform content – without adequately considering the approach of changing behavior and organizational culture, including individual incentives for transformation (e.g. Schacter, 2000; Easterly, 2001; Polidano, 2001; IEG, 2008a).In-fact, correct incentives are lacking in most of the public sector especially for low income countries. Particularly, the rapid growth of employment of the government service in many of these countries during the decade of 1970s - 1980s was facilitated by drastically reducing the salaries, mainly those at management level. The overstaffing and lowest salaries thus resulted in drastic consequences and adverse repercussions, which included extremely poor staff morale and a sharp decline in work effort, the recruiting became sufficiently difficult and retaining the vital technical and professional staff was further complicated. The non- transparent forms of compensation and remuneration, especially nonwage benefits in any form either in cash or in kind and strong incentives; added fuel to the ugly culture of accepting bribes (Lienert, 1998).

The bearing of human resource management (HRM) practices on the performance (ROI) of any organization or establishment has been a leading premise for the research scholars during last ten-twenty years. The results of most of the studies carried out on the topic were found encouraging, indicating positive relationship between HR practices and organization performance (Appelbaum et al. 2000; Dyer and Reeves 1995; Guest et al. 2000a, 2000b, 2000c). On the other hand, in case of developed economies, extensive research has been carried outon the operations of domestic firms (e.gin the US Japan and Europe) excluding Pakistan and other low income countries. However, in order to add more weight to the growing trend of research, more studies in diverse settings and particularly for the developing economies like Pakistan need to be performed. In order to seal this gap, this study is

undertaken to find out the linkages between Employee Motivation and perceived organization performance in the Local context. For better understanding the empirical relationship that how the employee's motivation yields substantial results this research has been conducted to experimentally investigates the association between employee perceptions for quality of working atmosphere and firm's performance. Similar studies in the field of psychology have been conducted to find out the connection between dissatisfying situations viz-a-viz the impact on employee behavior (e.g. Turnley et al., 2003; Eisenberger et al., 2001; Hagendoorn, 1998).

The **scope** of the study would be restricted to:-

- The PSDs operating in Rawalpindi area.
- A limited scale survey covering 4-5 PSDs and 100-125 Respondents.
- Where necessary, self administered questionnaire filling will be the choice for a way forward.
- The focus will be the PSD employees of grade 1 to grade 16.

Following are few **assumptions** made while undertaking the study:-

- The PSD employees are 'Self Motivated' (to any extent) and can be further motivated using HR Practices, however, these will be measured using appropriate questions and scale.
- The employees have a fair idea of 'What are the Performance parameters of their respective PSD?' and are able to comment on this aspect as their candid opinion.

2.   Literature Review

In the modern corporate world the top executives are focusing on to their HR functions for improving the company's performance (P. Morgan : 2001).In the recent past a mark increase in interest has been witnessed in the extent to which human resource systems have contributed to organizational effectiveness. As Pfeffer (1994, 1998) argues that the success in present day's hyper-competitive environment depends less on advantages which are less associated with access to capital, patents, technology, and economies of scale, and more on innovation, speed, and adaptability. Pfeffer further augment his arguments that these latter sources of competitive advantage are largely derived from the quality of the firm's human resources capital. Based on the similar arguments, Pfeffer (1994, 1998) and others (e.g., Becker, Huselid& Ulrich, 2001; Kochan&Osterman, 1994; Lawler, 1992; 1996; Levine, 1995) very strongly promoted that bigger firm investments for high performance and high

involvement human resource capital systems. The literature survey shows that actually, two possibilities of research exist. First, the human capital literature focuses on the effects of grooming, educating and training in modern Organization. Although empirical human capital research traditionally focuses on the earnings function of the individual worker, a stream of research is emerging that analyzes the effects of human capital investments at the Organization level. The second line of research has developed from the HRM or personnel economics literature (see Wood, 1999; Ichniowski& Shaw, 2003 for an overview of thesestudies).

Of-course a vide spread believe is "Greater employee involvement will only be achieved if we can ensure carefully managed HRM practices that strives for employee participation by integrating each individual employee is aligned with the organization perceptions and objectives and is stimulated   to achieve higher quality and productivity and finally the competitive advantage (John P. Morgan : 2001).There is a large and growing body of evidence that demonstrates a positive linkage between the development of human capital and organizational performance. The more and more emphasis on human capital in the growing and vibrant organizations amply imitate the view that the market share &value depends far less on tangible resources, and far more on intangible ones, especially the investment on human resource capital. Recruiting and retaining, being a major issue in most of the cases, for the best and efficient employees, needs to be amply addressed at highest level in any organization. The organizations also have to influence the skills, dexterity and capabilities of employees by encouraging personal and organizational learning, creating a supportive and encouraging environment, in which know-how must be produced, shared, contributed and applied throughout the organization covering all dimensions through breadth and width of complete spectrum of activities in a progressive organization. (Dr Philip Stiles and Somboon Kulvisaechana). While a majority of practitioners and authors including Guest, **argued that there was a need for (1) theory on HRM, (2) theory on performance, and (3) theory on how the two are linked** (Guest, 1997). Down the line, after fourteen years we observe only a modest progress on the three fundamental issues as advocated by Guest and others. Boselie, Dietz and Boon (2005) performed an investigative analysis and overviewed the associations between human resource management (HRM) practices and performance for 104 experiential articles published in well-known international refereed journals from 1994 to 2003. They came-up with crystal and clear findings and

pointed out that a crucial deficiency in the (that time) literature regarding alternative suppositions on the concept of HRM practices, the concept of performance and finding their mutual linkage (JaapPaauwe& Paul Boselie : 2009).

The topic is two dimensional i.e measuring the level of motivation and than determining its effects on the perceived organizational productivity and performance (in a lateral sense).If the employees are poorly motivated and their moral is down due to the deficiency in organizational systems, there exists a potential threat that the employees' talent can be wasted and even transferred to contenders. Motivation in its conventional sense, among management writers means, a process for stimulating the people to act to achieve the desired goals. It remains a crucial factor to judg the successful or unsuccessful management style in addition to determining the productivity and profitability. Generally, we judge managers by two important considerations i.e production and people, which are in turn based on the three main factors which are participative management, motivation and interpersonal competence. We believe that good managers focus mainly on the need for self-actualization and are equally interested in people and production alike. They are termed as high-task and high-relationship oriented. The average managers are mainly concerned with egoistic status and are high-task and low-relationship oriented. And lastly the poor managers, who are preoccupied by ego-status needs, safety and they are of low-task, least-relationship kind of individuals. Their guiding principals are personnel manual and written SOPsand they believe in simple goals of self-preservation.

Coming on to the question of "exactly what are the motivators?". There is no defined answer despite Herzberg's assertion to the contrary. We believe that, it depends mainly on different societies and different individuals, different organizations and job levels& positions. There are, certainly no common motivators for everyone and all the mankind nor is there a unique motivating force for every individual. It is a major issue that what kind of a mix of needs for what kind of individuals in what kind of society. In most parts of the world, there is no doubt that money or hard cash is a biggest motivator with regard to both the lower-level need satisfaction and the fulfillment of status and achievement goals. Secondly, in motivating employees, managers have to identify the operative needs and job-related goals of the employees. Or, they have to devise some goal-setting process with employees' participation which apparently is a difficult rout for the managers. (As advocated by LAMP LI in NEW ASIA COLLEGE ACADEMIC ANNUAL VOL. XIX)

On the other hand, we the management practitioners, must clarify our mind on the concept of Organization Performance because in studies on the HRM practices, a variety of indicators of an organization's performance can be used: like perceptual measures of organizations' performance (Delany &Huselid, 1996), financial measures such as organizations' profits (e.g. Terpstra&Rozell, 1993) or the value added or sales of the organization per employee (Black & Lynch, 2001; Cappelli&Neumark 2001), or physical measures of organizations' productivity (e.g. Arthur, 1994). A drawback of the perceptual measures is that it can be highly subjective both in the judgment of organization performance itself and in the selection of a comparator organization, which one can select to benchmark its own performance.

Hence other measures like financial and value-added, are affected by various systematic and ad-hoc factors for which the control is exceptionally difficult. Moreover, these measures, when practically adopted, are often highly volatile. In-fact, productivity is of elementary weight-age to the individual worker of whatever status, to the organization whether commercial or not and to the national economy at large and accordingly therefore, to the up-lift meant of the welfare of the citizen and the reduction if not total eradication of mass poverty (Yesufu, 2000; Akinyele, 2007).Physical measures of productivity do not have these disadvantages because they are straightforward in measuring productivity given the specific production process in a sector of industry (cf. Ichniowski& Shaw, 2003). In this study, in particular, we will therefore try to use a physical measure of productivity by asking people to gauge their own productivity on an even scale. Thus we will be following the studies those focused on a specific industry / organization (Arthur, 1994; MacDuffie, 1995; Ichniowski, et al., 1997). Hence the physical productivity which is directly related to the value added of the organization will be gauged viz-a-viz HR practices and Motivation level.

3.1 What is Motivation ?

What actually motivation is? How one can be motivated? How one can measure the 'Employee Motivation? How motivation is translated into individual and collective performance? To answer the above questions we will use Ejere (2010) Model which he introduced to help employee motivation:-

1. Carrot and Stick approach
2. Employee participation
3. Employee empowerment
4. Goal setting
5. Incentives
6. Job enrichment
7. Management by exception

8.   Management by objectives
9.   Quality control circles
10.   Quality of work life
11.   Sabbaticals
12.   Total quality management
The motivation pyramid (Figure 1) best explains that word MOTIVATION
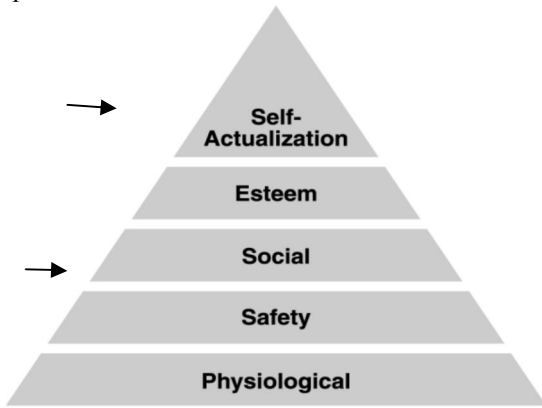
Figure 1 What is Motivation?
(http://users.dickinson.edu/~jin/motivation.html)

3.2 Theories on Measuring Performance of Public Sector

In any case, it is useful to know that the government agencies and bureaucracies differ from firms and other organizations in the private sector of the economy for which the many theories have been evolved. For instance, the fact that the output of public activities is not sold on the market or is not sold at its real price is the distinctive feature of what is commonly referred as the 'non market sector'. Consequently, the basic solution was, until recently, to evaluate the public sector production on the basis of the following equation: input = output.

A major obstacle to the introduction of performance related measures in the publicsector is the difficulty to measure government output as the objective function of public agencies and bureaucracies is multidimensional. The public administration science conception of the relationships between motivation, incentives and performance in the public sector is usually based on the idea thatin dividuals who work in the public sector have some specific characteristics. Thus, it isargued that preferences and work motivation of public sector employees differ fromthose of private sector employees. For instance, individuals working in the public sectorare assumed to have more pro-social inclinations (that is to be more altruistic) and to bemore risk-averse than employees of the private sector.

3.3   What Is The Nature Of The Relationship

Between Employee Motivation And Performance?

The most crucial part in our overview of issues relating to the Motivation and performance debate is of course the linkage between the two. In this paper we will be restricting ourselves to the most common model called five stage Guest Model as depicted in following figure:-
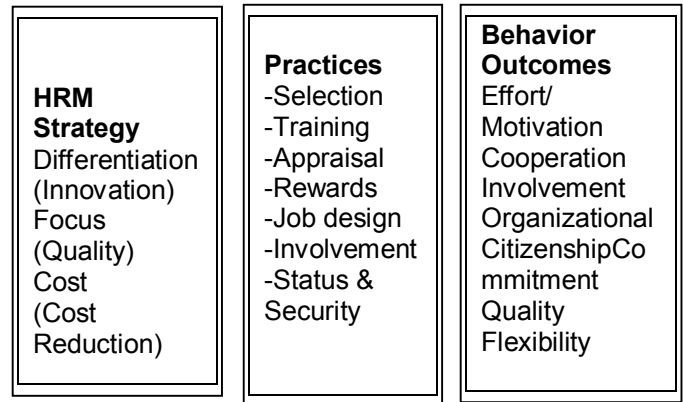
Figure 2 Conceptual Model of Guest

4. Research Methodology
4.1The Survey

A survey was conducted by way of administering questionnaires while secondary data was collected through books and the internet. Data was gathered from five Major Government Departments working in Rawalpindi. 20 questionnaires were first administered to test the understanding of the respondent after which the 80 more were distributed among the Government Employees. Spread on the whole spectrum / all possibilities i.e from Old to Young, Senior to junior in rank and length of service, covering Literate to illiterate. Only the methodology of the response, that was found necessary in some cases, was adjusted as Self Administered survey (where necessary). A total of 82 were retrieved from the respondents and out of these, 10 were answered incorrectly, thus making them unusable leaving the number of usable responses for the analysis a 72 representing 72%. The Government departments included Banks, Def Dept, Education Dept, Broadcasting Media (PTV and Radio Pakistan), Public libraries etc. The respondents were made up of Top Managers, Middle Managers, First – line Managers and Non Managers. The questionnaires comprised of, in total, 40 serial numbers covering 'Personal Details', 'Personal Motivation', 'HR Practices in the Dept' and 'Effect of HR on Motivation', and finally the 'Effects of Motivation on Perceived Performance of the Department. The respondents were asked to rank each feature to the extent that is considered to be

important on a scale of 7 points i.e. 7 (strongly agree), 6 (Agree), 5 (Somewhat agree), 4 (Neutral), 3 (Somewhat Disagree), 2 (Disagree)and 1 (Strongly Disagree). Descriptive statistics have been used to describe the basic features of the data collected through the questionnaire survey.

4.2 Research Hypothesis
H0:　　The 'HR Practices' being followed by PSDs of Rawalpindi Area, effect the 'Employee Motivation' and the 'Employee Motivation' can influence the 'Performance of Individual and Organization as a whole'.

H1:　　The 'HR Practices' and 'Personal Motivation' of Employees of PSDs in Rawalpindi Area, do not affect the 'Employee Motivation' and also the 'Employee Motivation' has no influence on the 'Individual and Organization's Performance'.

5. Data Analysis
5.1General
　　This is a descriptive study based mostly upon Self Administered Questionnaires. The population is all Major Government Departments with rank structure from Floor Manager / Supervisor

to Labour. A pilot study was carried out by administering 20 Questionnaires. Analysis of the data conformed the accuracy of the questionnaire and was followed by a detailed survey through 80 self administered Questionnaires distributed among Public Sector Employees in Education, Broadcast media, Defence Department etc. The Mean, Median, Mode, standard deviation, maximum and minimum were checked. On a scale of 1-7 the Personal Motivation's mean comes to 5.68 compared to 5.23 of 'Motivation Due to HR Practices' corresponding to more weight-age of personal motivation compared to 'Motivation due to HR Practices'. Similarly the Standard deviation of all variables varies from 0.97 (for Perceived Performance) to 1.25 (for Personal Motivation).

5.2 Correlation:
　　The definition of Correlation, as per Wikipedia is the dependence refers to any statistical relationship between two random variables or two sets of data. Correlation refers to any of a broad class of statistical relationships involving dependence and Correlations are useful because they can indicate a predictive relationship that can be exploited in practice.

Table - 1

	Gdr	Dept Work Exp	Pub Sect Work Exp	work hrs per week	Personal Motivation	HR Practices	Motivation due to HR Practice	Perceived Performance
Mean	0.82	7.54	9.54	36.63	5.68	5.45	5.23	5.34
Median	1.00	7.00	9.00	38.00	6.07	5.80	5.36	5.62
Mode	1.00	15.00	15.00	38.00	6.14	5.73	6.57	6.10
	Gdr	Dept Work Exp	Pub Sect Work Exp	work hrs per week	Personal Motivation	HR Practices	Motivation due to HR Practice	Perceived Performance
Standard Deviation	1.53	4.38	6.10	7.57	1.25	1.15	1.22	0.97
Minimum	0.00	1.00	1.00	6.00	1.29	1.40	1.57	2.68
Maximum	13.00	15.00	40.00	50.00	7.00	6.73	6.71	6.58
Count	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00

　　When we checked the 'Personal Motivation (PM)' against 'Gender' the relationship was very weak with a figure of 0.0251, thus suggesting that the PM is not dependent upon 'Gender'. Similarly the dependence of PM on other factors like 'Service Length in Present Department', 'Total Service length' and ''Working Hours in a Week', there is absolutely no dependence found between these. The Correlation figure comes to 0.0574, 0.05206 and -0.09202, showing no, very weak, or a weak negative relationship among these parameters.

　　Similarly when we checked the collected data for relationship of 'HR Practices (HRP)' with 'Gender', 'Service length' and 'Work Hours per Week' there is no relationship found between these like -0.0182, 0.0705 and -0.16845. But on the Contrast, when we checked the dependence of HRP on 'Personal Motivation' a figure of 0.86920 shows a very strong positive relationship between the two.

　　The data showed that the variable 'Motivation Due to HR Practices (MDHRP)' has absolutely no relationship with 'Gender', 'Service Length' etc but a sufficient correlation with 'Personal Motivation' having a figure of 0.75203. In accordance with the routine perception 'Motivation Due to HR Practices (MDHRP)' is closely related to HRP with a strong figure of 0.85806.

And finally for the 'Perceived Performance' no linkage with 'Gender' and 'Service Length' etc however, a sufficiently strong relationship has been found among the Public Sector Employees (in Rawalpindi / Islamabad) with HRP and MDHRP. Thus in commensuration with our basic Hypothesis (Topic of the Paper) 'The Perceived Performance of an organization in PSDs (of Rawalpindi region)' is strongly related to the 'HRP' and MDHRP' and is moderately related to 'Personal Motivation' as per the collected data of 72 respondents (Reference Table -2 below).

Table - 2. Correlation Between Variables

	Gender	Dept Work Exp	Pub Sect Work Exp	work hrs per week	Personal Motivation	HR Practices In The Dept	Motivation due to HR Practice	Perceived Performance
Gender	1							
Dept Work Exp	0.2666	1						
Pub Sect Work Exp	0.6988	0.7163	1					
Work hrs per week	-0.3762	0.0049	-0.08634	1				
Personal Motivation	0.0251	0.0574	0.05206	-0.09202	1			
HR Practices	-0.0182	0.0705	-0.07877	-0.16845	0.86920	1		
Motivation due to HR Practice	-0.0524	0.1197	-0.00808	0.00180	0.75203	0.85806	1	
Perceived Performance	-0.0001	0.2696	0.05417	-0.20094	0.56165	0.73142	0.75640	1

5.3 Summary

To summarize the above analysis:-

- The HR Practices are significantly positively correlated to Personal Motivation and Motivation due to HR Practices.
- Similarly the Motivation is Strongly correlated to the 'Perceived Performance' suggesting that the performance of PSDs is largely dependent upon the Motivation of employees.
- Hence the 'Employee Motivation' ensures betterPerformance of the employees working in PSDs.
- The individual Performance of the employee is finally translated into better ROI (Perceived Performance) of the Departmentin totality.

Table - 3

SUMMARY OUTPUTS	
Regression Statistics	
Multiple R	0.826124013
R Square	0.682480885
Adjusted R Square	0.647752232
Standard Error	0.577774706
Observations	72

5.4   Regressions – R^2

Now coming on to the 'Regressions – R^2' What Does Regression Mean?   Actually it is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (usually denoted by Y) and a series of other changing variables (known as independent variables). The figure of 68.248% variation (Reference

Table-3) is being explained by the Endogeneria Variable with respect to Exhogrent Variable, which is a good indicator of the correctness of the results. The Statistics is suggesting that the chosen model is appropriate for the study under discussion. We have also found that a negative relationship exists between 'Long Working Hours' with 'Employee Motivation' and in terns with 'Perceived Performance' which shows that due to long working hours the employee's De-Motivation increases and thus this de-motivation is further translated (naturally) into Lower Performance.

The coefficient of determination R^2 is the proportion of variability in a data set that is accounted for by a statistical model. In this definition, the term "variability" is defined as the sum of squares. The independent variables

are explaining 68.24% variation. The value of R Square shows a strong relationship between dependent and independent variables.

Table - 4

ANOVA					
	Df	**SS**	**MS**	**F**	**Significance F**
Regression	7	45.92167	6.560238	19.65181	9.0388E-14
Residual	64	21.36471	0.333824		
Total	71	67.28638			

5.5 Significance F

F-statistic is a value resulting from a standard statistical test used in ANOVA and regression analysis to determine if the variances between the means of two populations are

significantly different. For practical purposes, it is important to know that this value determines the P-value, but the F-statistic number will not actually be used in the interpretation here.The value of 'Significance F' proves that the chosen model is significant.

Table - 5

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.72719	0.56600	4.81840	0.00001	1.59649	3.85790
Gender	-0.04640	0.08320	-0.55772	0.57898	-0.21260	0.11980
Dept Work experience	0.04904	0.02856	1.71700	0.09082	-0.00802	0.10611
Pub Sec Work Exp	-0.00260	0.02941	-0.08841	0.92982	-0.06134	0.05614
working hrs per week	-0.02327	0.01068	-2.17947	0.03298	-0.04460	-0.00194
Personal Motivation	-0.19708	0.12619	-1.56182	0.12326	-0.44917	0.05501
HR Practices	0.37198	0.18596	2.00026	0.04972	0.00047	0.74348
Motivation due to HR Practices	0.42969	0.11667	3.68310	0.00048	0.19662	0.66276

5.6 t-stat

P-value or Significance,is the probability that an effect at least as extreme as the current observation has occurred by chance. The t-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate whenever you want to compare the means of two groups, and especially appropriate as the analysis for the posttest-only two-group randomized experimental design.

The values of 'Working hrs per week', 'HR Practices' and 'Motivation due to HR Practices' are -2.17947, 2.00026 and 3.68310 respectively showing that the perceived performance of PSD is negatively influenced by the number of working hours per week and strongly positively influenced by the HR Practices being followed in these departments. However, the most pronounced impact of 'Motivation Due to HR Practices' has been observed.

Therefore, we can wrap-up our analysis in the words of Rumelt (1991) who concluded that the external characteristics (Competition, Market factors and Industry dynamics) do not considerably influence the organization's performance. The most prominent among all, as a critical and differentiating aspect is the organization itself, how it is managed, the motivation level of its employees and how they are inspired to work for the achievement of organizational goals.

6. Future Work

After gone through this research, the author firmly believes that the subject needs more detailed data collection and data analysis. There exists a substantial vacuum and potential to crystallize the roadmap for PSDs in Pakistan to inculcate the modern management techniques among these departments. The in-depth and exhaustive research would be fruitful for improving the productivity of our Public Sector Organizations. The author intends to carryout following as his future work:-

- Same Study with larger sample size including all the Public Sector Departments (PSDs).
- Studying the existence of HR Practices being followed by the PSDs and the impact on effectiveness.
- The measurable outcomes of various PSDs may be studied and formalized.
- Sector wise (Education, Manufacturing, Services, Health etc) detailed studies with a view to measure the impact of HR practices on Motivation and Viz-a-Viz PSD's Productivity.
- Similar studies for the Private Sector organizations and suggest improvements to

achieve enhanced efficiency and improve productivity.

- Studies to suggest the top and middle managers in PSDs, how to influence the floor workers to increase the productivity of these departments.
- Studies to find out the actual motivators in the backdrop of Pakistani culture.
- Studies to suggest some tangible / measurable criteria to gauge the performance of PSDs in Pakistan.

7. Conclusion

The objective of the research was to ask the respondents from Public Sector Departments (in Rawalpindi) to state their perception about the HR practices being followed, their effect on Motivation and Perceived Performance of their respective Public Sector Department (in Rawalpindi).As the Questionnaire was divided in 5 Parts namely 'Demography', 'Personal Motivation' 'HR Practices Being Followed by the Department', 'Effects of these HRP on Employee Motivation' and finally 'The Effects on Perceived organizational Performance'. The 72 respondents out of 100responded correctly. The findings of this research suggest that the Guest Model of Figure 2 is equally applicable on the PSDs of Rawalpindi, because the 'Performance' is largely dependent on the HRPs being followed by the PSDs through Motivation.

The implications of those findings are that, for the employees to be more productive and work towards the goals and objectives of the department to witness performance and be competitive, managerial workers first need to satisfy the following: interesting work (self-actualization); job security (safety needs); full appreciation of work done (social; esteem needs), and they (interesting needs; job security; full appreciation of work done) need to be significantly fulfilled. Though this study highlights significant contributions to the field of human resource management, there are limitations to the study. The use of quantitative patterns in prospective study might bring about a more comprehensive explanation of the phenomenon under study. Gathering data was done from a few major PSDs working in Rawalpindi / Islamabad from 72 respondents only. There should be a collection of data from all PSDs from different regions in Pakistan to obtain important data for a constructive conclusion drawing.

But one thing which has been established is the applicability of Guest Model (Figure-2) in PSDs of Pakistan though on a limited scale. To find out more realistic situation the guidelines listed in Para 5 above may be found useful for further elaboration and making concrete recommendations for the PSDs

in Pakistan as a whole to improve the effectiveness and Productivity of the PSDs.

References

1. Richard E. Clark, 1998. Motivating Performance Diagnosing and Solving Motivation Problems and Opportunities University of Southern California
2. Appelbaum, E., T. Bailey, P. Berg and A. Kalleberg. 2000. Manufacturing competitive advantage: The effects of high performance work systems on plant performance and company outcomes. Ithaca, NY: Cornell University Press.
3. Arthur, J.B. 1994. Effects of human resources systems on manufacturing performance and turnover. Academy of Management Journal 37: 670–87.
4. Balasubramanian, A.G. 1994. Evolution of personnel function in India: A re-examination. Part I. Management and Labor Studies 19(4): 196–210.
5. Balasubramanian, A.G. 1995. Evolution of personnel function in India: A re-examination. Part II. Management and Labor Studies 20(1): 5–14.
6. Barak, M., T. Maymon and G. Harel. Teamwork in modern organizations: Implications for technological education. International Journal of Technology and Design Education 9: 85–101.
7. Bartel, A. 1994. Productivity gains from the implementation of employee training programs. Industrial Relations 33: 411–25.
8. Barney, J.B. 1991. Firm resources and sustained competitive advantage. Journal of Management 17: 99–120.
9. Blinder, A.S. 1990. Paying for productivity. Washington DC: Brookings.
10. Becker, B. and B. Gerhart. 1996. The impact of human resources management on organizational performance: Progress and prospects. Academy of Management Journal 39: 779–801.
11. Becker, B., M. Huselid, P. Pickus and M. Spratt. 1997. HR as a source of shareholder value: Research and recommendations. Human Resources Management Journal 31(1): 1–8.
12. Budhwar, P, and P. Sparrow. 1997. Evaluating levels of strategic integration and development of human resource management in India. International Journal of Human Resource Management 8: 476–94.
13. Cianni, M., and D. Wnuck. 1997. Individual growth and team enhancement: Moving toward new model of career development. Academy of Management Executive 11(1): 105–15.
14. Cully, M., S. Woodland, A. O'Reilly and S. Dix. 1999. Britain at work. London: Routledge.
15. Cutcher-Gershenfeld, J. 1991. The impact on economic performance of transformation in

workplace relations. Industrial and Labor Relations Review 44: 241–60.

16. Datt, R., and K.P.H. Sundharam. 1999. Indian economy. New Delhi: S. Chand.

17. Delaney, J.T., and M.A. Huselid. 1996. The impact of human resource management practices on perceptions of organizational performance. Academy of Management Journal 39: 949–69.

18. Delaney, J.T., D. Lewin and Ichniowski 1989. Human resources policies and practices in American firms. US Department of Labor: US Government Printing Office.

19. Delery, J.E., and D.H. Doty. 1996. Modes of theorizing in strategic human resource

20. Kuldeep Singh, Impact of HR practices on perceived firm performance in India Indian Institute of Management, Indore, India

21. Andries de Grip, IngeSieben December 2003: The Effects of Human Resource Management on Workers' Wages and Firm Productivity Research Centre for Education and the Labour Market . Faculty of Economics and Business Administration. Maastricht University Maastricht,

22. DEEPAK K. DATTA HRM AND FIRM PRODUCTIVITY: DOES INDUSTRY MATTER? School of Business University of Kansas Lawrence, KS 66045

23. Lamp Li HUMAN MOTIVATION IN THE WORK ORGANIZATION: THEORIES AND IMPLICATION

24. Abraham Maslow, "A Theory of Human Motivation," Psychological Review, July 1943, pp.370-396;

25. Harper & Row, Motivation and Personality, 1954.

26. Douglas McGregor, The Human Side of Enterprises, McGraw-Hill, 1960. pp. 47-49

27. RensisLikert, The Human Organization, McGraw-Hill, 1967.

28. Rob H. Kamery, EMPLOYEE MOTIVATION AS IT RELATES TO EFFECTIVENESS, EFFICIENCY, PRODUCTIVITY AND PERFORMANCE, Nova Southeastern University

29. Nowier Mohammed Al--Anzi , WORKPLACE ENVIRONMENT AND ITS IMPACT ON EMPLOYEE PERFORMANCE -A study submitted to Project Management Department in Saudi Aramco

30. Nwachukwu Prince Ololube, Teachers Job Satisfaction and Motivation for School Effectiveness: An Assessment: University of Helsinki Finland.

31. Wellington Didibhuku Thwala1, Lydia NthabisengMonese MOTIVATION AS A TOOL TO IMPROVE PRODUCTIVITY ON THE CONSTRUCTION SITE, Department of Quantity Surveying and Construction Management, University of Johannesburg,

32. Samuel Kwadwo Frimpong1, Luo Fan, Comparative Study on the Relationship Between Employee Motivation and Team Performance of the Banks in Ghana and China School of Management, Wuhan University of Technology, Wuhan, P.R. China,

33. AkahNdang William EMPLOYEE MOTIVATION AND PERFORMANCE Ultimate Companion Limited

34. Rehman. G, Malik .I.N &TajRizwan (2006). Psychological well-being and work motivation amongst Medical Professionals of Pakistan.Original article P.43.

35. Stroh, E.C. (2001). Personnel motivation :strategies to stimulate employees to increase performance

36. James L, Perry, Debra Mesch, Indiana University – Purdue University, Indianapolis, Laurie Paarlberg, San Francisco State University Motivating Employees in a New Governance Era: The Performance Paradigm Revisited

37. David Marsden and Ray Richardson, MOTIVATION AND PERFORMANCE RELATED PAY IN THE PUBLIC SECTOR: A CASE STUDY OF THE INLAND REVENUE Centre for Economic Performance, London School of Economics, Discussion Paper No.75, May 1992.

38. William N. Cooke, THE EFFECTS OF WORKPLACE CLIMATES ON EMPLOYEE PERFORMANCE CAPACITIES: A KNOWLEDGE-BASED PERSPECTIVE Michigan State University and DAVID G. MEYER University of Akron

39. JaapPaauwe, Paul Boselie (2009), HRM and Performance: What's Next? Working Paper 05 – 09 CAHRS at Cornell University

40. James L. Perry,Annie H. Katholieke and Lois R. Wise, Revisiting the Motivational Bases of Public Service: Twenty Years of Research and an Agenda for the Future , Indiana University, Bloomington

41. CONFERENCE PAPER #8, NOVEMBER 2006 INCENTIVE SYSTEMS: INCENTIVES, MOTIVATION, AND DEVELOPMENT PERFORMANCE (UNDP).

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Impact of E-Learning on Higher Education : Development of an E-Learning Framework

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Abstract: The Internet has a tremendous technological expanding power. It has the capability to transform not only the way people accept and adopt knowledge but also to change traditional methodology and architecture of education system around the world, mainly with the method of teaching and student interaction in and with subject materials and all related relevant information. E-learning is rapidly emerging as an education tool in Pakistan just like rest of the world that uses internet technology to provide knowledge and training in Pakistani industry in general and higher education institution in particular. Using Internet as an e-Learning delivery system has created a new concept, and new initiative in the mind of business market stakeholders as well as the education institution of Pakistan, indeed e-learning has provided a platform through which university has reached out of their geographical boundaries. This has not only given them a boost of reaching out for the students but also established themselves as global education institutions in their respective fields. This paper examines the issues surrounding the impact of e-Learning on graduate student and also to develop a framework for the higher education institution within the available resources in Pakistan IT infrastructure.

1. Introduction

In most of the counties of the world education (higher) is growing positively but at the same time higher education is badly hit by increasing education cost, cut to education budget and an increasing demand for distance learning are forcing educational stakeholders to re-visit the way education is delivered to students. To cater for the shifting environment, e-learning is mainly focusing on higher education which has created a new dimension in it and has given an opportunity to educational institutions as well as to students. E-learning, or internet learning, remote learning or electronic learning, has clarified in dissimilar ways in the literature /conceptually. Commonly, e-learning generally define *"instructional content or learning experience delivered or enabled by electronic technologies"* (Lai,Ong ,Wang, 2004). Some authors have given more restricted explanation / definition for e-learning, for example, limited / restricted e-learning information's transfer through internet (Al Jones, 2003). The description used generally for e-learning, and used on broader spectrum, I will use for the purpose of my paper. Which identify the internet, intranet / extranets, video and audio recorder, CD-ROM and TV interaction, Satellite transmission, not only for course transportation, but it also provide means for communication with participating students (Canada ,Industry, 2001). Additionally some definitions has been modified recently by including wireless and mobile, wifi in e-learning application

(Suhonen, Kinshuk, Sutinen, Goh, 2003).The hierarchy of electronic learning education system of Pakistan, mostly tilted toward the conventional distance learning in most of the educational institution, the system was initially introduce to permit students from far-flung distant and rural areas of Pakistan to gain admittance to education. The concept of e-learning has encouraged significantly with the passage of time. Technological boost has been one of the main inspirations for upward trend, which was started back in 1920's by integrating radio broadcasting (Umesh, Huynh, Valachich, 2003). In recent past, the inception of intranet has given a significant boost to the innovation of different methods of delivering the educational contents (McNeil, Gunasekaran, Shaul, 2002; Teo, Gay, 2006). With the passage of time, internet is getting thicker and thicker; more people are geting in to the cyber world, computer literacy increasing, equipment and access to internet cost (Huynh et al., 2003). These changes have provided educational institutions around the world in general and in Pakistan in particular golden opening for the provision of learning content beyond their physical boundaries.

2. Literature review

E-learning has used a different technology and technique for their contents delivery to the student around the world but broadly the same concepts are being followed in this regard. The variation in the technique of e-learning offering through a number of attributes, the details of

e-learning attributes listed in table, the attributes can be further distributed in two different classes of e-learning dimensions that are Synchronicity, independence, location and different modes. Each dimension is distributed in two different attributes which match their respective dimension.

E-learning can be distributed in to two types, one is real time, and synchronous the other is flex time, asynchronous. E-learning synchronous related to the technique and technology such as electronic white board and video conferencing (Romiszowski, 2004), for which students are required to be present during content delivery. Asynchronous applications on the other hand don't require on the spot presence of the students. Instruction and tutorial can be work through the screens at student convenience time and

place. Majority of the e-learning contents application is based on asynchronous model (Greenagel, 2002). Student's involvement in e-learning at the discretions of student, which are deferent location or same space and time. student can also work as a group on a given project (Gunaeesekaran et al., 2002). Distance learning courses can also be classified on the basis of level of partnership, some course need group learning like mutual discussion forums or blog or chat, the other level is totally independent, can be done individually, at the same time the delivery mode can be totally electronic (without a teacher or with) or it can be blended approach mix electronic and classroom. Blended approach is most used around the world commonly (Curt and Jack, 2001).

Table 1. **The dimensions, attributes of e-learning**

Dimensions	Attributes*	Meanings	Examples
Synchronicity	Asynchronous	Student received the course content at different time then delivery time.	Course content via e-mail
	Synchronous	Student received course content simultaneously at the time of delivery	Course content through website
Location	Same Location	Course content or application at the same physical location as that of the instructor	GSS usage to resolve a problem at the spot
	Distributed	Course content or application at the different physical location as that of the instructor/other students	GSS usage to resolve a problem at the different physical location
Independence	Individual	Individual student task to fulfill the given work	All students completed Distance learning segment in parallel
	Collaborative	Student work together with each other to fulfill knowledge tasks	Students join in blog to share their thoughts
Mode	Electronically only	Course content is delivered through e-learning applications and no face-to-face element in it	Distance powered technology Education
	Blended	e-learning blended learning, face to face	Course contents are blended with computer exercise

* Variety of sources have defined these attributes some are including (Ongs et al., 2004), (Curt and jack, 2001)

Each single course should always consist of only one/single attribute value from their respective dimension. But at the same time a particular course can be having several components, with attribute value different from each other. The example is, contents of the work can be synchronously given to the students and other asynchronously or the work may have some contents delivery from distance and other face to face in class room.

Different e-learning definition and variety of work has been done in regard to the market size and share e-education. However to estimate the market size is very difficult to determine. An estimation which believes that distance learning is one of the fastest growing sector of world education of $ 2.3 T USD. On line higher education business are

predictable to be growing to $ 69 B USD by year 2015 (Hezell Associate, 2005).

For the students and institutions perspective, growth in e-education is in general and higher education e-learning in particular is obvious. Education requirement is globally on increase. Only in USA high graduate enrollment increases from 56% to 67% in 2003 (Morrison, 2003). 70% new jobs created in Canada will require post secondary education certificate (Industrial Canada, 2001). Keeping in view the cost effect of new building and limited capacity of existing class rooms at colleges, universities, distance learning is an good option (Werbachs, 2000). To remain in market, and remain competitive, higher education colleges are offering distance learning courses to race with virtual higher education colleges. (Huynhs et al.2003).

3.E-learning stakeholders'
Motivations

In the organizational perspective, stakeholder is a community of any organization (Strickland and Thompsoen, 2001). In this way, the stakeholders of any distance learning system are the affecties of it. Different stakeholders are discussed in the following paragraphs.

Students

In relation to higher education, e-learning clients are the student of graduate or under graduate enrolled at a university.

Motivations

On reaching to higher studies, most of the learners are very enthusiastic to use distance learning. It may be traditional course components for some of the students. While for other the complete course may be entirely on line. Especially for the later group of students distance learning will facilitate them and give access to higher education courses, which were not possible geographically or due to time constrain (Huynhs et al., 2003; Kaebassi and Virvous, 2004).

Instructors

One of the main stakeholder in the e-learning implementation system is instructor, traditionally instructor share and give their experience in a typical class room or face to face teaching, on the other hand, by e-learning instructor can share their teaching skill and experience to outside world with multiple students irrespective of the class room boundaries.

Motivations

There could be multiple reasons for an instructor to be motivated and take courses through e-learning system of education. For example, their institution may motivate encourage or pressurize the instructor to take on the e-learning courses. At the same time instructor may want to address multiple students.

Educational institutions

When we talk of higher education, it consists of universities and colleges. Because of popularity of e-learning the number of online universities are also increasing in addition to the traditional universities in Pakistan.

Motivations

Normally educational institutions integrate different technologies in classrooms so that lecture delivery can be facilitated. They also give distance learning, to reached large number of desirable students, e-learning can be the best solution which can offer online different courses to the large number of students, the geographical boundaries have been removed by e-learning between institutions and colleges. (Youngs, 2001).

Content providers

The online courses can be shaped by the respective teachers or it can be managed from some outside. Encouragement to distance learning sector has twisted a market potential of commercializing knowledge contents. And this is very valid for the very basic courses which are offered consistently at multiple institutions. Intellectual capital rights in e-learning will be the main concern for content providers (Huynh et al., 2003).

Motivations

The content may be provided by the instructor in any institution or by some other resource; their inspiration must be to provide such system to the students which can bring effective learning in the institutions.

The motivations for any commercial course provider could be to get maximum profit by designing such a content which can be easily adopted by any university, may be with very little changes if required.

Technology providers

For e-learning delivery, technology providers will develop the technology which will enable e-learning access beyond the institutional boundaries. This included number of services, from e-learning courses, to a complete Learning Management Systems (LMS). Continue revolution in market of hardware/software and customer constant expectations has pressurized the technology providers to offer new product quickly (Huynh et al., 2003).

Motivations

Like contents provider, technology provider will also motivate to provide an e-learning environment to the students which bring effective learning in the institutions.

Accreditation bodies

Accreditation is an important organizational body which assesses institutions offerings to judge the quality of education. And make sure that these institutions fulfill the requirements.

Motivations

With the passage of time distance learning or electronic delivery grows. It is very important for accreditation bodies to encompass e-learning in their standards. By neglecting they will limit their accreditation sense which will remain focus till traditional educations components of any educational institution (CHEA, 2002a).

4 Khan's frame work

Different names have been given to e-learning activity like flexible, distributed and open, which also include, Web-Based Training (WBT),Web-Based instruction (WBI), Internet-Based Training (IBT), and E-Learning,(anyplace, anytime, anywhere learning), are the examples. Drawing,

preparing, execution and auditing of distributed, open and flexible learning architecture require keen analysis and investigation on its use of all the contents resources of applied techniques and internet interface to develop and modify the dimensions of online distance learning environments.

Khan has developed a frame work after considering all the important factors/dimensions of e-learning environment which reflect on various factors important to e-learning contents,

In totality Khan's e-learning framework has a great potential to give a comprehensive guide line on preparing online contents organizing e-learning material and planning a complete system. Also has the capability of checking distance learning techniques.

Figure 1. Badrul H. Khan E-Learning Frame Work

The hexagonal diagram of distance learning reflects teaching and learning. This hexagonal diagram of e-learning has addressed majority of the issues regarding student's scrutiny, targeting goal, medium, course and techniques, organizational issues regarding distance learning. It has also explained the technological issues on e-learning, infrastructure hardware and software planning and interface design. Distributions of information's and maintaining e-leaning environment has also explained in detail.

5. Research methodology

The research methodology of the study include two research activities consisting of semi structured interviews and questionnaires. The first stage of research consisted of the questionnaire which was asked and distributed amongst the under graduate / postgraduate and M.Phi /PhD students / faculty/ administration of different universities/colleges, the second phase conducted semi-structured interviews with the staff who were related to postgraduate courses; in the next phase semi-structured interviews taken from the sample of

e-Learning activities developers within the University. Questionnaire was distributed among 300 students. The questioners were randomly given to the students of different colleges and Universities of HEC Pakistan. Which are listed as following:-
 ➢ Military College of Signals
 ➢ College of Electrical and Mechanical Engineering
 ➢ Bahria University Islamabad Campus
 ➢ Military College Engineers
 ➢ UET Taxila
 ➢ UET Peshawar

Total of 300 questionnaires that were given to the students, only 205 were answered having a response rate of 68.3%. In the next step interview was conducted which involved the lecturers from the same colleges/universities, the next phase was to interview staff which help in the provision of e-Learning at the University.

Table **2.** Questionnaire distribution and response rate for study/Faculty/Administration.

Questionnaires	Under Grad/Psot Grad/M.Phill/PhD
Total distributed	300 *study/Faculty/Administration*
Total returned	205
Response ra	68.3%
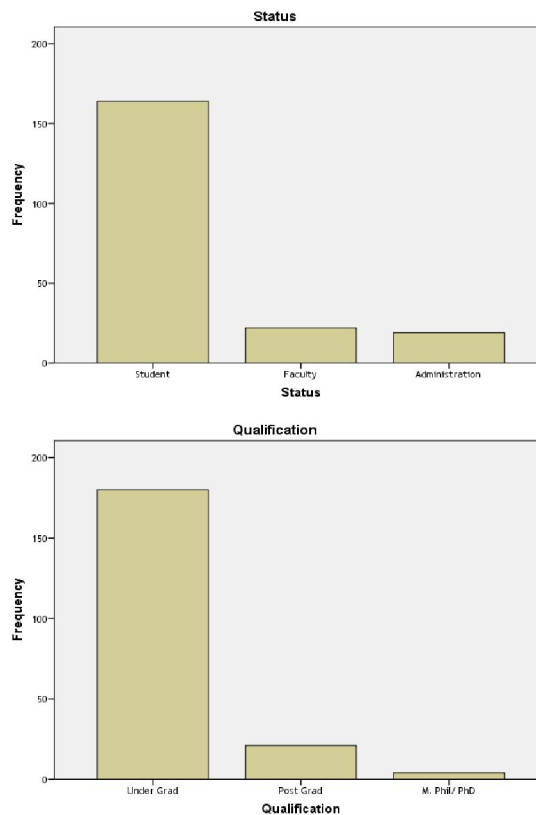
Figure **2.** Questionnaire distributions amongst study/Faculty/Administration.

6   Results and discussions
Graphical representation of results

The results are illustrated in figures 3-12.
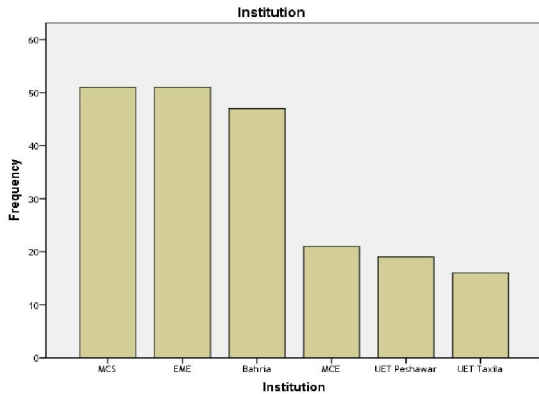
***Figure* 3.** Questionnaire distributions in Different universities / colleges.
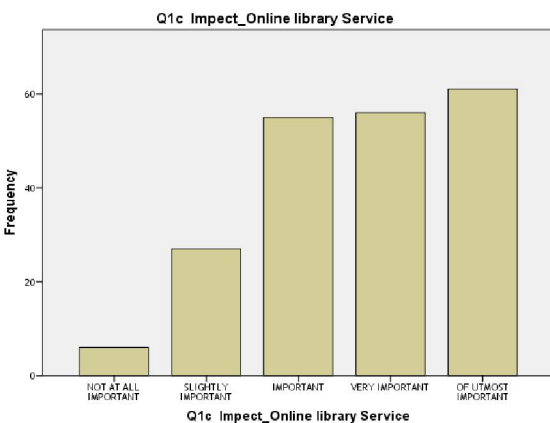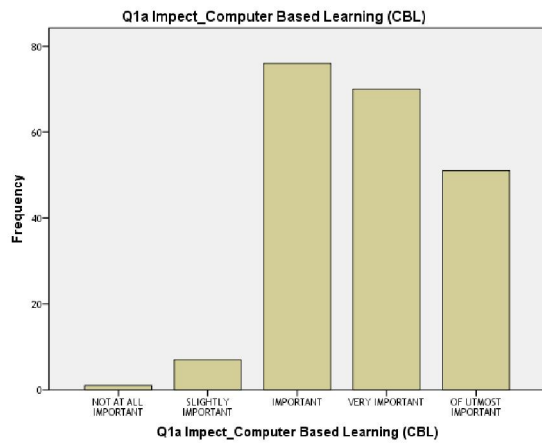
***Figure* 4.** Positive impact of Computer Based learning (CBL/Online library Service) on over all Students learning process.
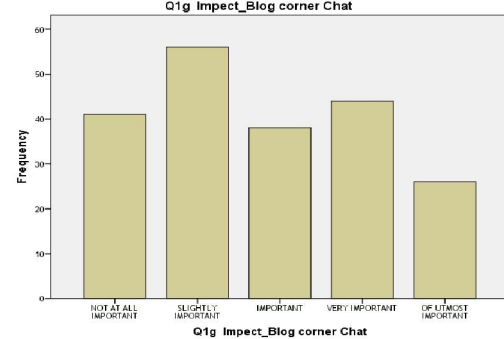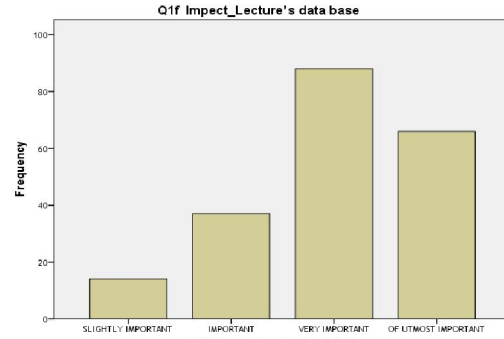
***Figure* 5.** Impact of available Lecture's data base/Blog corner Chat on over all Students learning.

The next main question was regarding the availability of e-learning modules in different universities and colleges. The data analysis reflected as under.
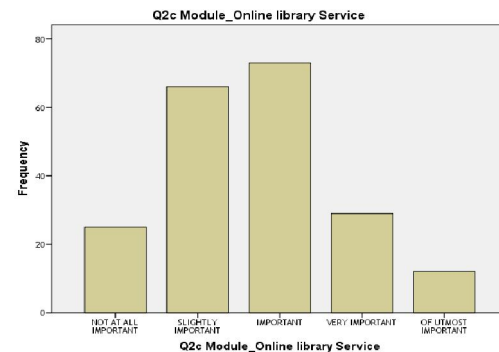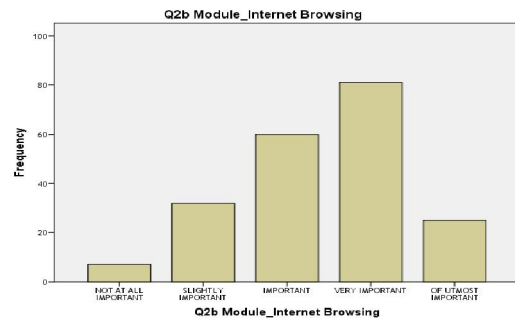
Figure 6 Availability of Internet Browsing and Online Library Service in institutions
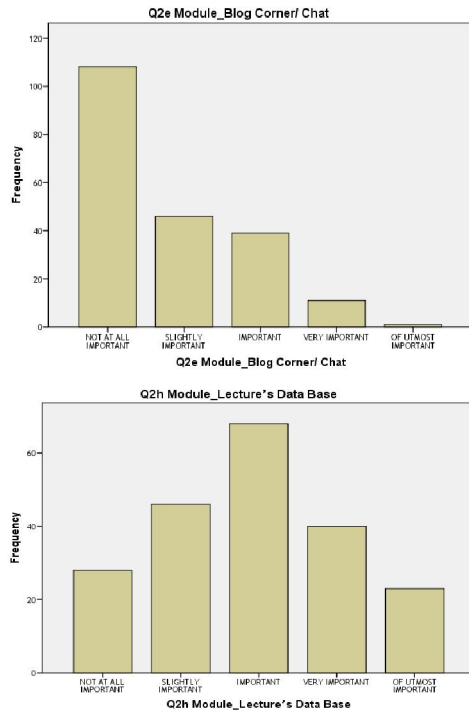
Figure 7 Availability of Blog Corner Chat and Lecture's Data Base in institutions.

Third main question was regarding the implementation factors of e-learning system in different universities and colleges. The data analysis reflected as under.
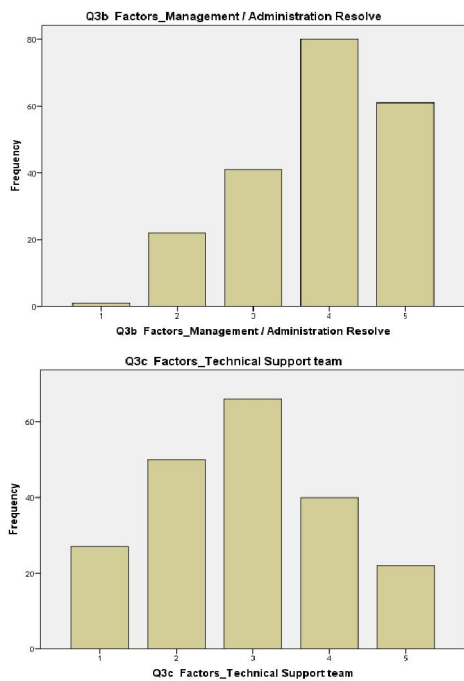
Figure 8 Importance of Management resolve and Tech support team for E-learning Implementation.
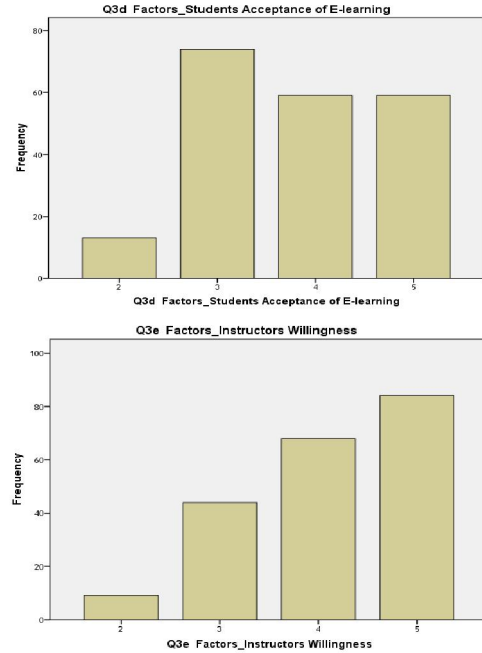
Figure 9 Importance of Student Acceptance and Instructors Willingness for E-learning Implementation.

Fourth main question was regarding the essential e-learning modules to design an e-learning web application in different universities and colleges. The data analysis reflected as under.
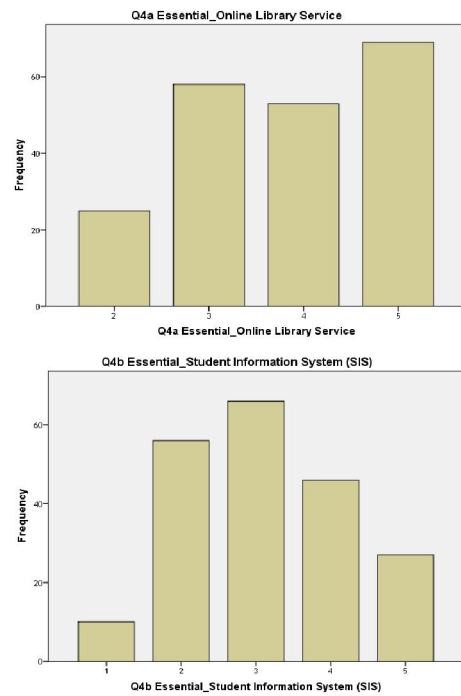
Figure 10 On line library Services and SIS are essential E-learning Modules for web application.
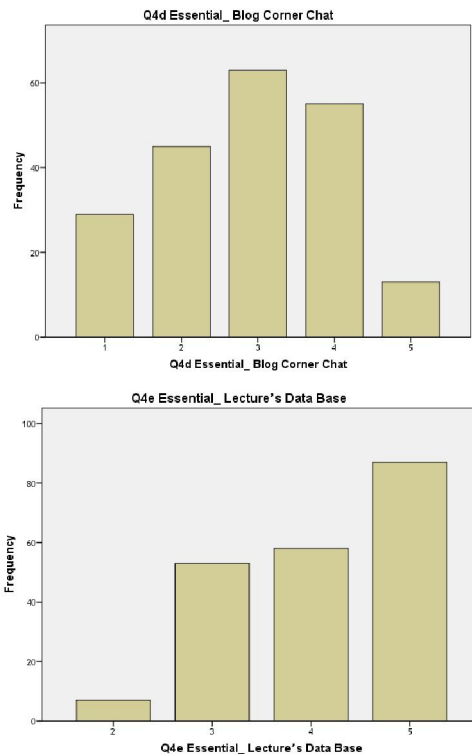
Figure 11 Blog Corner Chat and lecture's Data Base are essential E-learning Modules.

Figure 12 Web Base Training and E-mail Services are essential E-learning Modules.

Figure 13 E-Examination and help Desk are essential E-learning Modules for web application.

It can be seen that most of the 205 students i.e 68.3%, consider that there is generally lack of e-learning environment in their respective universities and colleges. Most of the students have at the opinion that availability of e-learning modules will be having good effect on their education process. 70% of the students are of the view that computer based learning (CBL) is required, 90% of the student are positive about online library, 80% have the opinion that lectures' data base including subject lectures and reference material will improve students learning. 50% student have shown their interest to have university / college Blog Corner Chat which will contribute in student learning. On the other hand available facilities are insufficient in universities and colleges from which students can get benefits. Only 15% e-learning web application is available in their respective campuses. According to survey only 10% Lecture data base is available to student, however Internet browsing are 80% available which is a positive sign, along with this 30% online library services are available to students. When student were asked to give their opinion about the important factor required for e-learning implementation, analysis says 70% is the management / administrations resolution required, 60% technical support, 62% student acceptance of e-learning and 72% instructors

willingness is required for implementations of e-learning Web applications.

At the same time student were asked to analyze the basic / essential required modules for an effective Web based e-learning applications, the date says, 80% online library service, 82% lecture data base 62% student information system (SIS). 42% college / university Blog Corner Chat, 30% college e-examinations and 52% student have the opinion that student help desk will make as effective e-learning Web base applications for any university / college to support students learning process.

7. Discussion and analysis of results

The results from this study show that generally there is a lack of e-learning facilities in Pakistani universities / colleges, which is as per the analysis affecting the students learning process. Only 30% of the overall e-learning facilities can be calculated that have been provided to students in their respective campuses. On the other hand majority of the students have the opinion that whatever facility is available that is not in a package shape but is in the form bits and pieces. It is further evident that almost none of the university / college have a complete e-learning web application. A high percentage of student have the opinion that some basic and important modules must be immediately implemented like, online library, lecture's data base e-mail services, e-examination and student help desk while interviewing the technical support team member, they have the opinion that management / administrations resolution is one of the main factor for e-learning web application implementation at the same time student acceptances of e-learning and instructor willingness is important. On the other hand administration / management have shown full resolution for implementation of e-learning modules but have shown some reservation regarding technical expertise availability and maintenance issues regarding the already installed modules in some of the universities / colleges at the same time management / administration have their opinion of misuse the modules by the students / technical staff. According to the questioners/ interviews from students, administration/ management as well as technical staff, e-learning web application must have some of the basic requirement which is very important for a good e-learning system.

There is a need to have e-mail facilities so that students can e-mail each other and so tutor may e-mail the course / group. The system must have online library so that irrespective of the distance and time student cab easily reached to the required information, along with this, Student Information System (SIS) need to be part of it, Lecture's data base

for easy retrieval of course content is also required, E-examination need to incorporate in e-learning package, university/colleges Blog Corner Chat for interaction and discussion forum, Web base e-learning training to bring acceptance for change, and last but not the least student help desk for resolving all issues and problem regarding e-learning web application and effective use. the main storage content must include lecture's data base (including subject lecture and reference material) along with e-mail, storage content services, on line library has given lots of importance during student questioner as well as interviews so a comprehensive online library service is considered to be the most powerful module for e-learning package. It appears from the interviews that only a few colleges / universities are given the online library facilities, and some of the e-learning modules, there is a strong impression in student community which feels the need for comprehensive e-learning web application to facilitate them in their learning process. Therefore I have made an effort to give a basic Frame work for the e-learning web base application which can be easily implemented in university/colleges especially in Pakistan's environment.

8 Developing an e-learning frame work for Pakistani environment

a. Badrul H. Khan e-learning frame work

The Khan framework is one of the most effective and comprehensive theoretical e-learning model. E-learning can be defined now as Badrul H. Khan stated: ''An innovative approach for delivering well designed, learner-centered, interactive, and facilitated learning environment to anyone, anyplace, anytime, by utilizing the attributes and resources of various digital technologies along with other forms of learning materials suited for open and distributed learning environment'' Khan has divided his framework in three segments, the first segment is related to education, which consist of Pedagogical, Evolution and Ethical. The other segment is related to technology and interface, the last 3rd portion is related to managerial issues, which includes management of resource and different elements of institutions resource support and management.

b. Modified frame work for Pakistani environment

I have made an effort to modify Khan Framework which can best suite Pakistani environment, there for i called this framework as reinforce framework for Pakistan. This based on all the important dimensions having some additional segments which are best suited for Pakistani environment.

Pakistani Hei Frame Work

ETHICAL

1-Social & Political Influence
2-Bias
3-Political Issues
4-Geo/Cultural/ Learning Diversity
5-Etiquette
6-Legal Issues
7-Info Accessibility
8-Religious Diversity

EVALUATION
1-Evaluation of Content Development Process
2-Evaluation of E-Learning Environment
3-Evaluation of E-Learning a the program & Institutional Level
4-Assessment of Learners

INSTITUTIONAL
1-Administrative Affairs
2-Academic Affairs
3-Student Services
4- Accreditation

INTERFACE DESIGN
1- Page and Site Design
2-Contents Design
3-Navigations
4-Accessibiltiy
5-Usability Testing

MANAGEMENT

1- Process, People and Product Field
2- Team for Management
3-Managing Development e-Learning Content
4- Environment for Managing e-Learning
5-Resources
6-Online VCLE
7-Physical Security

PEDAGOGICAL

1-Content Analysis
2-Audience Analysis
3-Goal Analysis
4-Design Approach
5-Instructional Strategies
6-Organization
7-Blending Strategies

TECHNOLOGICAL HR CAPACITY BUILDING
1-Academic staff
2-Instructors and IT staff

TECHNOLOGICAL
1-Infrastructure Planning& Wireless
2-Hardware
3-Software

Figure 14 Pakistani Higher Education Institution Frame Work

These differences are incorporated after deep analysis and concentrated efforts on e-learning process, and student demand in Pakistan. My deliberations have resulted in the following considerations:

1. I rearrange segment location by moving Technology dimension at the bottom, which means that the e-learning frame work is based on technology instead of management. Which support the entire e-learning activities and act as a pivotal role for the entire frame work..
2. Technological dimension is only explaining infrastructure planning, hardware and software, which i have expended to new upcoming technologies like Wireless technology and many more. This will directly affect the cost factor.
3. Content security is part of my modified frame work under the technology dimension to cater for any misadventure or disaster.
4. Institutions parameters are mainly focused on administration affairs, student affairs and services related to academics related to e-learning, which I think is missing a very important factor of accreditation, which I cater for modified frame work.
5. Human resources capacity building is also added which is not touched in Khan's frame work, for supporting hardware and software, human resources building up along with training of instructors / trainees is very important which has been catered in the modified framework.

Conclusion

E-learning applications are the requirement of the day; Timely response to the requirement will act as a launching pad for the Pakistani HEI learning capacity, and will give an opportunity to their student to stand parallel to the world demand. Majority of the colleges / universities have accepted Khan's framework into their system by modifying some of the parameters while implementing the main eight segments of the Khan's octagon. The main idea has implemented in one and other shapes and names. In this particular analysis I targeted on the Pakistani HEI environment in particular and almost all the effecting factors in the colleges/ universities education system, which are, shifting / changes in technologies, wireless, Wi-Fi boom and very critical human resources in the system. In my frame work learner and content are given much importance and learner centeredness concept has given by providing different resources, and contents availability in a digital environment. On the other hand learning environment and education system will continue to modify and purify, at the same time new frameworks and new models of education system will continue to changes and adjust to particular learning system, The given modified frame work is best suitable   model

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for Pakistani HEI, and will act as a bass line for new e-leaning education environment in Pakistan.

References

1. Arabasz, P., & Baker, M. (2003).*Respondent Summary: Evolving Campus Support Models for E-Learning Courses*,
2. *EDUCAUSE Center for Applied Research*, retrieved July 1, 2007
3. Chaney, E.G. (2002).*Pharmaceutical Employers' Perceptions of Employees or Applicants with E-Degrees Coursework*, Dissertation, Indiana State University, USA.
4. Dalziel, J. (2003). Open Standards versus Open Source in e-Learning. *Educause Quarterly, 4*, 4-7.
5. Friesen, N. (2005). Interoperability and Learning Objectives: An Overview of eLearning Standardization. *Interdisciplinary Journal of Knowledge and Learning Objects, 1*, 22-31.
6. Greenagel, F.L. (2002). *The illusion of e-learning: why we're missing out on the promise of technology*, retrieved July 1, 2007 from http://www.guidedlearning.com/illusions.pdf.
7. Gunasekaran, A., McNeil, R.D., &Shaul, D. (2002). E-learning: research and applications. *Industrial and Commercial Training, 34* (2), 44-53.
8. Hezel Associates (2005).*Global E-learning Opportunity for U.S. Higher Education*, retrieved July 1, 2007 from http://www.hezel.com/globalreport/.
9. Huynh, M.Q., Umesh, U.N., Valachich, J. (2003). E-Learning as an Emerging Entrepreneurial Enterprise in Universities and Firms.*Communications of the   AIS, 12*, 48-68.
10. Industry Canada (2001).*The E-learning E-volution in Colleges and Universities: A Pan-Canadian Challenge,* retrieved July 1, 2007 from http://www.cmec.ca/postsec/evolution.en.pdf.
11. Jack, Z., & Curt, U. (2001). Why blended will win. *Training and Development, 55* (8), 54-60. *Groups 3.1 and 3.3 Conference: ICT and the Teacher of the Future*, January 27-31, 2003, Melbourne, Australia.
12. Kinshuk, Suhonen, J., Sutinen, E., Goh, T. (2003).Mobile Technologies in Support of Distance Learning.*Asian Journal of Distance Education, 1* (1), 60-68.
13. Lee, M.K.O., Cheung, C.M.K., & Chen, Z. (2005). Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation. *Information & Management, 42*, 1095-1104.
14. Mahmod, R., Dahlan, N., Ramayah, T., Karia, M., &Asaari, N. (2005). Attitudinal Belief on Adoption of E-MBA
15. Program in Malaysia.*Turkish Online Journal of Distance Education, 6* (2), 1-10.
16. Morrison, J. (2003). U.S. Higher Education in Transition.*On the Horizon, 11* (1), 6-10.
17. *Ong, C.-S., Lai, J.-Y., & Wang, Y.-S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. Information & Management, 41 (6), 795-804.36*
18. Prensky, M. (2006).*Don't Bother Me Mom - I'm Learning*, St. Paul, MN: Paragon House.
19. Romiszowski, A. (2004). How's the E-learning Baby? Factors Leading to Success or Failure of an Educational Technology Innovation.*Educational Technology, 44* (1), 5–27.
20. Straub, D. (1989). Validating Instrument in MIS Research.*MIS Quarterly, 12* (2), 147–170.
21. Teo, C.B., & Gay, R.K.L. (2006).A Knowledge-Driven Model to Personalize e-Learning.*ACM Journal of Educational Resources in Computing, 6* (1), 1-15.
22. Weller, M. (2004).Models of Large Scale e-Learning.*Journal of Asynchronous Learning Networks, 8* (4), 83-92.
23. Woodill, G. (2004). *Where is the Learning in E-learning?* retrieved July 1, 2007 from http://www.elearningguru.com/wpapers/e-Learning_analysis.pdf.
24. Young, K. (2001). The Effective Deployment of e-Learning.*Industrial and Commercial Training, 33* (1), 5-11.
25. Brandon, B. (2004, May). Storyboards tailored to you: Do-it-yourself magic arrows. The e-Learning Developers' Journal. 1-8. Retrieved November 16,
26. Khan, B. H. (2005). Managing e-learning: Design, delivery, implementation and evaluation. Hershey, PA: Information Science Publishing.
27. Khan, B.H., *Flexible Learning in an Information Society* 2006: Information Science Publishing.

Prevalence of House Dust Mites in Two Levels of Dorms (Hotel and Motel) of Jaddah District Western Saudi Arabia

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Abstract: This study was designed to test the null hypothesis that the different level of the dorms has a real effect on the quantitative and qualitative existence of the house dust mites (HDM). Also to determine the most important factors that control the distribution and colonization of HDM. The study was conducted at Jeddah city western Saudi Arabia. 12 dorms were tested; 6 hotels and 6 motels. The samples were collected twice a month along three months (Dec, Jan., Feb. 2009). Mites were separated using modified Berleses tunnel. Ten species of HDM were extracted from studied dwellings . The mite assembelage in motels was dominated by *Dermatophagoides pteronyssinus* (23.7%). In hotels to the mite collection was co-dominated by *D. pteronyssinus* (27.6 %) and *D. farinae* (21.8 %). The mean total individuals in motels was 5012 individuals per 50 grams of dust in correspond to 2149 individuals per 50 grams of dust in the hotels. Up to 66.6% of the motels had a population of more than 100 individuals per 1 gram of dust, however non of the studied hotels embraced more than 50 individuals per 1 gram of dust. In conclusion the level of the dorms had a clear effect on the quantitative existence of HDM, but a qualitative effect can not be identified. Also, it was speculated that the most frequent cleaning as well as density and economic status of residents were the main factors matched with a direct impact on the mite contamination rate of the dorms.

Keywords: House Dust Mite; Dorms; Hotel; Motel); Saudi Arabia

1. Introduction

House dust mites are ubiquitous in public buildings and homes worldwide. They are medically important creatures, where many species are the source of allergens that sensitize and induce allergic reactions in genetically predisposed persons (**Arlian, 2000 & 2002**). The most prevalent allergy-causing mites in homes differ geographically between homes within a geographical region and among areas within a home (**Arlian at al., 2002; Edrees 2009**).

Indoor relative humidity, temperature and enough food are generally considered to be the most important factors determining community composition and population dynamics of the major groups of dust arthropods. The optimum condition for development being between 18 – 27 °C (**Soltani et al., 2011**) with a relative humidity of 70% - 75% (**Valero and Serrano, 2004**). Their major food source is skin scales, textile fibres, food crembs, hair and wood pets fungi, plant pollen and organic deprise (**Vande Lustgraat, 1978; Edrees, 2009 and Soltani et al., 2011**).

Under optimal breeding conditions about 5000 of house dust mite individuals may be present in just 1g of mattress dust but up to 15600 has been recorded (**Soltani et al., 2011**). It has also been shown that rugs constitute a suitable habitat for house dust mites (**De Boer, 1990; De Boer and Kuller, 1995**). **De Boer et al. (1999)** mentioned that a rug from the living room floor of a dutch home was found to contain more than 10.000 individuals/m2 in early April. **Edrees (2009)** recorded that about 115 mites/g of dust and 90 mites/g of dust was extracted from carpet floor of bedroom and living room of healthy persons homes in middle region of Jeddah respectively. However in the same area carpets from the bedroom and living room floors in asthmatic person homes were found to contain 321 mites/g of dust and 593 mites/g of dust respectively. Densities above 100 mites/g of dust are considere as a risk factor for sensitization to allergies such as rhinitis, conjunctivitis, atopic eczema and asthma, whereas 500 mites/g of dust is a major risk factor in acute asthma in those allergic to HDM (**Korsgaard, 1983; Arlian et al., 1992; Service, 2004; Soltani et al., 2011**).

Most surveys of house dust mite fauna conducted around the world report that the allergy-producing mites are worldwide species that occur in homes, schools, churches, day care centers, office workplace; seats in automobiles; clothes; stuffed toys, banks; libraries, museums, hotels and ski lodges and other public places (**Arlian et al., 2002**).

With respect to mites found in dwellings a survey of 41 dwellings in upper Silesia, Poland **Solarz (1998)** found the most to be infected with both *D. farinae* and *D. pteronyssinus*. The former was the most abundant species overall, but in some

dust samples, *D. farinae* was the predominant species (33.3 %) while in other samples *D. pteronyssinus* was more prevalent (27.5%). In some cases both species were equally prevalent. **Soleimani and Rafinejad (2008)** studied the fauna of house dust mites in hotels an inns of Bandar Abbas Iran, they indicated that the rate of house dust mites infections were 91.8, 85.7; 8.2, 10.9 and 0, 3.4% for *D. pteronyssinus*, *D. farinae* and *Cheyletus malaccensis*, respectively.

It is important to know the major mite breeding locations and which mite species are present in a public places when performing diagnostic testing prescribing immunotherapy. Although the presence of numerous dwellings dorms in Jeddah city western Saudia Arabia due to the religious tourism, no study on such medically important organisms have been conducted about the distribution, abundance and diversity in such public buildings. Accordingly this study was achieved in Jeddah city to test the null hypothesis that the different level of the dorms has a real effect on the quantitative and qualitative existence of the house dust mites, hence on the identification of the most important factors that control the distribution and colonization of such microarthropod organisms.

2.Materials and Methods

The present study was conducted at Jeddah city, western Saudi Arabia. The house dust mite samples were collected from 12 dorms (6 hotels and 6 motels). Using a vacuum cleaner (Boch 191 T) with disposable bag, dust was sampled from known area of carpet floor (4 m^2 for 5 min.) from six randomly selected rooms inside each dorm. The samples were collected twice a month along three months, Decembre, January and February, 2009. Mites were separated using modified Berleses funnel as recommended by **Al-Assiuty *et al.*(1993)** and **Edrees, 2009**.

Site description:

12 dorms of Jeddah city were tested. The city is located in a coastal region. It has a hot and humid climate. The tested dorms represented two levels:

The lower level group "Motels"

Six motels were selected. These were in "Slums" i.e. areas of a low quality living conditions, at Al- Hendawya and Bab Sherif areas, as here the buildings were more than 25 years old. The room temperatures in these buildings ranged between 24- 26 °C. the humidity level ranged between 72- 75 %. The buildings usually comprised of three floors and the floors were made of cement covered with old chappy rugs. The rug thickness was 3 centimetres. Each room contained 4 wood beds. During the study season the average number of the dwellers was almost 335 person per motel per month. Some of the rooms contained fans, while others contained old fashioned air conditions. The average amount of dust collected each time ranged between 5- 10 g/m^2. Cleaning was done once or twice a month, using vacuum cleaners, however without using any detergents either nor the floors or the furnitures.

The higher level group "Hotels"

This group comprised six hotels, these were almost four-star-hotels in semi-publio areas, not so far from Bab-Sherif area. The buildings ranged between 10- 15 years of age. The room temperature ranged between 22- 25 °C, and the humidity level ranged between 65- 70 %. Each building comprised of 3 floors, and the floors were made ceramic covered with carpets of 4 cm thickness. Each room contained 4 wood beds. The average number of the dwellers was 180 person per hotel per month. The rooms contained modern air conditions. The average amount of dust collected was 2 g/m^2. Cleaning was done on weekly regular basis using vacuum cleaners, detergent and liquid cleaners were usually used for cleaning.

Statistical analysis

The pooled data (count per $4m^2$x 6 rooms x 3 months) was determined per 50 gram of dust. Data of population densities were logarithmically transformed to achieve homogeneous variance. Means of house dust mite density between and within the two levels of the chosen dorms were compared by non-parametric Kruskal- wallis test. Bray- Curtis similarity index was used to measure the degree of overlap between house dust mite compositions in different dorms (**Krebs, 1999**). This index was calculated for all building pairs using the pooled community data per dwelling. To test if the mite assemblage was affected by the environmental variables and to determine which parameter(s) were responsible a PCA bi-plot of samples and species was made and environmental variables were included.

3. Results

All house dust mite species extracted from the two chosen groups of dorms were counted and identified. Tables 1&2 list the species composition per building. Ten species of HDMs were represented at the 12 sampling sites. The mite assemblage in motels was dominated by *Dermatophagoides pteronyssinus* (23.65 % of the total individuals) and in hotels mite collection was co-dominated by *Dermatophagoides pteronyssinus* (27.6% of the total individuals) and *Dermatophagoides farinae* (21.8 % of the total individuals) (Tables 1&2 and Fig. 2). All the recorded species occurred at all sites and there was no difference in species richness and species diversity among the dorms of the same level, motels or hotels. However, species richness differed significantly among the two levels of dorms (Tables 1&2).

The density of the collected HDM from motels differed significantly (*P*<0.01) as compared with that of recorded from hotels. Since the mean total individuals in motels was 5012 ind/50 g of dust correspond to 2149 ind/50 g of dust in hotels. Kruskal- Wallis test also was applied to the data pooled overall sampling months. This showed no significant differences (*P*> 0.05) between dorms of the same level, with exception of dorms H5 and H6 in hotel group and dorms M3 and M6 in motel group, where densities found to be significantly differed, since the least population densities were achieved in these dorms (Fig. 1).

Similarity in species composition between pair wise assemblages was analysed using the Bray-Curtis similarity index. Table 3 shows a strong overlapped figures between dorm pairs within the same level. The Bray-Curtis similarity index ranged from 0.74 to 0.93 within hotels and from 0.79 to 0.94 within motels. However, the Bray-Curtis similarity index between communities at different levels of dorm pairs was significantly lower (similarity ranged from 0.46 to 0.75) than within the same level.

In order to evaluate the structure of the house dust mite assemblages, further HDM species were numerically arranged in descending order and a rank abundance curves (Figs. 3a, 3b and 3c) were made for both levels of dorms. Figs. 3 a&b represents the data of the higher and lower level of dorms (hotels and motels). There was a linear decrease of log abundance with species rank, which is consistent with the geometric series model for community structure. Figure 3c indicates the rank abundance lines of all chosen dorms. It was clearly that the bundle of lines does not functionally separate according to the differences between dorms, this may indicates that there is no effect on the dominance structure of mite assemblages.

To describe the relationships among the number of individuals of every dominant mite species (4 species from hotels and 5 species from motels) and environmental variables; i.e. occupant density, age of building, relative humidity, dust quantity, cleaning and carpet sickness, an ordination diagram using PCA was made (Fig. 4). Data show a strong positive association of *Dermatophagoides pteronyssinus* with carpet sickness and cleaning manner. However, *Aleuroglyphus ovatus* showed a positive correlation with occupant density, relative humidity, dust quantity and building age. Little effect of the chosen factors on *Dermatophagoides farine* could be observed.

Figure 5 shows a biplot of the first two axes of the PCA, position of the sampling sites and their associations with the five dominant mite species in both levels of dorms. The two arbiterary curves in the figure separated mostly between hotel-group (1-6 open circles), right area of the graph and motel-group (7-12 open circles) left area of the graph. Also, between the position of the five dominant species (open triangles), the overlapped area (shaded area) comprised the shard four dominant species in both levels of dorms these are: *Dermatophagoides pteronyssinus*, *D. farinae*, *Cheyletus malaccensis*, *Aleuroglphus ovatus*. The fifth dominant species *Suidasia nesbettii* lies out of overlapped area to the left side graph where it was more associated to the lower level of dorms (motels). It is interesting to note that the functional position of each studied dorm among the graph (Fig. 5) was the total number of the individuals of the dominant species in each dorm of hotels and motels.

As for the association between the abundance of HDM individuals with the environmental variables figure 6 shows that buildings exposed to a regular cleaning manner using vacuum cleaners, and/or detergent and liquid cleaners (hotels 5 and 6 and motels 9 and 12, Fig. 6) showed the least number of house dust mites. However, the largest individual number in motel 10 (Fig. 6) was found to be strongly associated to the dust quantity, high relative humidity and high resident number.

4.Discussion

The house dust mite fauna in the hotels and the motels had not been studied previously in Saudi Arabia. In this study ten HDM species in the two levels of dorms were recorded. The most common allergy-causing mites that occur in different studied dorms were; *Dermatophagoides pteronyssinus* (23.7% in the motels and 27.6% in the hotels) and *D. Farinae* (18.9% in the motels and 21.8% in the hotels) but other species were also well represented especially *Cheyletus malaccensis*, *Aleuroglphus ovatus* and *Suidasia nesbettii*. **Arelian *et al.* (2002)** indicated that most surveys of mite fauna conducted around the world report that the two species *D. pteronyssinus* and *D. farinae* were usually both present in a region and occur together in homes although one species was usually the more prevalent. **Solaz (1998)** surveyed 41 dwellings in upper Silesia, Poland. It was found that the most surveyed dwelling were co-infested with both *D. pteronyssinus* and *D. farinae*. The latter species was the most abundant overall, but in some dust samples it was the predominant species (33.3%) while in other samples *D. pteronyssinus* was more prevalent (27.5%). In the most recent study, the rate of house dust mite infections in hotels and inns of Bandar Abbas Iran for *D. pteronyssinus*, *D. farinae* and *Cheyletus malaccensis* were 91.8, 85.7; 8.2, 10.9 and 0, 3.4% respectively (**Soleimani and Rafinejad, 2008**).

Table 1. List of house dust mite species and the total number of individuals /sample (50g of dust) and their relative contributions in the six hotels.

Species	H1	RC %	H2	RC %	H3	RC %	H4	RC %	H5	RC %	H6	RC %	Total	RC %
Dermatophagoides pteronyssinus	659	27.98	515	21.4	606	25.95	580	24.59	748	41.6	448	27.33	592.7	27.58
Dermatophagoides farinae	500	21.23	667	27.71	580	24.84	457	19.37	314	17.46	287	17.51	467.5	21.76
Cheyletus malaccensis	282	11.97	337	14	267	11.43	317	13.44	95	5.284	193	11.78	248.5	11.56
Suidasia nesbettii	267	11.34	235	9.763	264	11.31	257	10.89	146	8.12	133	8.115	217.0	10.1
Carpoglyphus lactis	150	6.369	139	5.775	204	8.737	112	4.748	132	7.341	164	10.01	150.2	6.988
Blomia tropicals	141	5.987	157	6.523	111	4.754	127	5.384	100	5.562	115	7.016	125.2	5.825
Aleuroglyphus ovatous	129	5.478	148	6.149	94	4.026	175	7.418	73	4.06	58	3.539	112.8	5.251
Acarus siro	117	4.968	109	4.528	80	3.426	148	6.274	113	6.285	183	11.17	125.0	5.817
Blomia freeman	63	2.675	52	2.16	70	2.998	115	4.875	47	2.614	30	1.83	62.83	2.924
Tyrophagus putrescentiae	47	1.996	48	1.994	59	2.527	71	3.01	30	1.669	28	1.708	47.17	2.195
Total	2355	100	2407	100	2335	100	2359	100	1798	100	1639	100	2149	100
Shannon diversity index(H')	H' = 2.014		H' = 2.003		H' = 1.991		H' = 2.096		H' = 1.849		H' = 2.038		H' = 2.027	
Equitability	J = 0.874		J = 0.870		J = 0.865		J = 0.910		J = 0.803		J = 0.885		J = 0.880	
Species richness	SR = 1.159		SR = 1.156		SR= 1.160		SR = 1.159		SR = 1.201		SR = 1.216		SR = 1.173	

Table 2. List of house dust mite species and the total number of individuals /sample (50g of dust) and their relative contributions in the six motels.

Species	M1	RC %	M2	RC %	M3	RC %	M4	RC %	M5	RC %	M6	RC %	Total	RC %
Dermatophagoides pteronyssinus	1258	23.73	1465	27.05	1028	26.35	1231	21.29	1279	23.86	852	19.76	1186	23.65
Dermatophagoides farinae	1092	20.6	985	18.19	645	16.53	1242	21.48	992	18.5	755	17.51	951.8	18.99
Cheyletus malaccensis	601	11.34	500	9.234	516	13.22	817	14.13	459	8.562	713	16.54	601.0	11.99
Suidasia nesbettii	845	15.94	727	13.43	408	10.46	857	14.82	922	17.2	542	12.57	716.80	14.3
Carpoglyphus lactis	169	3.188	449	8.292	136	3.485	318	5.5	266	4.962	125	2.90	243.80	4.865
Blomia tropicals	79	1.49	82	1.514	59	1.076	48	0.895	66	1.531	62.670	1.25		
Aleuroglyphus ovatous	538	10.15	448	8.273	458	11.74	582	10.07	637	11.88	423	9.812	514.3	10.26
Acarus siro	260	4.905	283	5.226	221	5.664	254	4.393	278	5.186	279	6.472	262.50	5.237
Blomia freeman	142	2.679	141	2.604	127	3.255	92	1.591	141	2.63	109	2.528	125.30	2.501
Tyrophagus putrescentiae	317	5.98	335	6.187	321	8.227	330	5.707	339	6.323	447	10.37	348.20	6.947
Total	5301	100	5415	100	3902	100	5782	100	5361	100	4311	100	5012	100
Shannon diversity index(H')	H' = 2.024		H' = 2.051		H' = 2.049		H' = 2.023		H' = 2.035		H' = 2.083		H' = 2.056	
Equitability	J = 0.879		J = 0.891		J = 0.890		J = 0.879		J = 0.884		J = 0.905		J = 0.893	
Species richness	SR = 1.049		SR = 1.047		SR = 1.088		SR = 1.048		SR = 1.048		SR = 1.075		SR = 1.056	

Table 3. The degree of overlap between house dust mites composition in different dorms   (6 hotels and 6 motels) calculated for all building pairs using Bray-Curtis similarity index.

Dorms	H1	H2	H3	H4	H5	H6	M1	M2	M3	M4	M5	M6
H1		0.903	0.93	0.921	0.823	0.781	0.615	0.606	0.751	0.579	0.610	0.707
H2			0.895	0.890	0.742	0.761	0.625	0.615	0.754	0.588	0.620	0.717
H3				0.889	0.785	0.771	0.612	0.603	0.743	0.575	0.604	0.703
H4					0.775	0.776	0.616	0.607	0.740	0.571	0.605	0.697
H5						0.829	0.507	0.499	0.631	0.474	0.502	0.589
H6							0.468	0.465	0.575	0.442	0.468	0.531
M1								0.912	0.847	0.938	0.943	0.843
M2									0.832	0.883	0.922	0.820
M3										0.799	0.830	0.892
M4											0.917	0.821
M5												0.813
M6												

▢ Within the same level (hotels H1- H6)

▢ Within the same level (motels M1- M6)

▢ Between the two levels motels and hotels
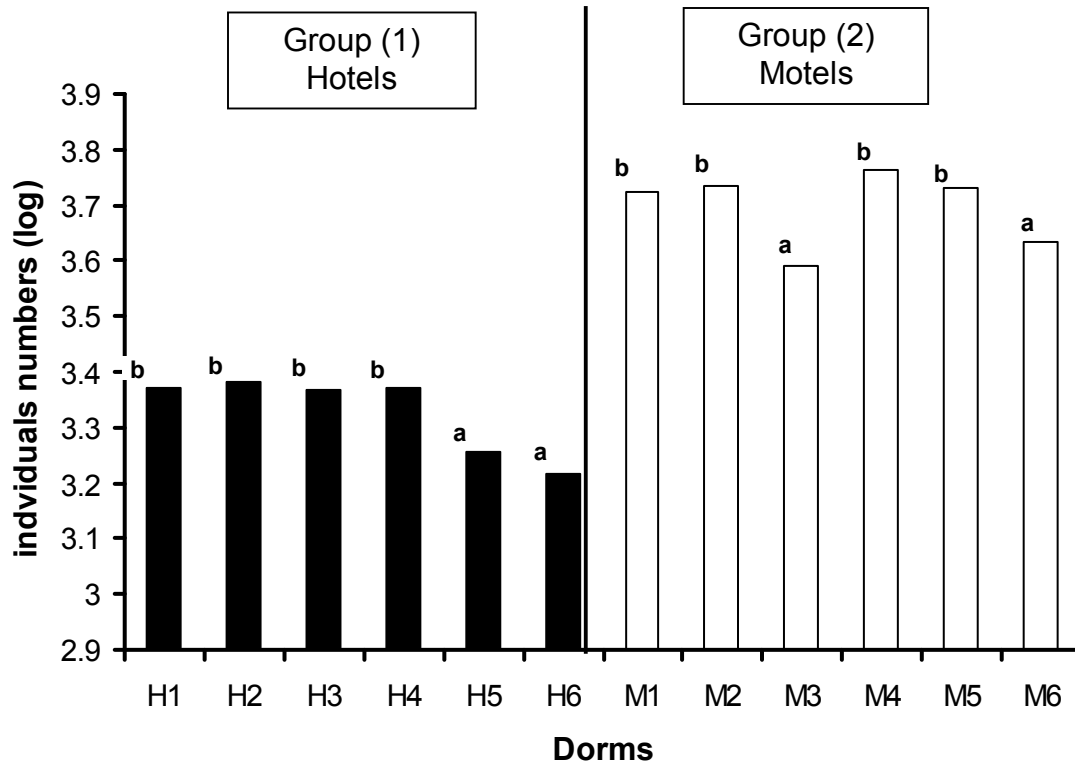
Figure 1. The population density per 50 gram of dust of the total mites (10 species) in the 6 motels and 6 hotels (H1- H6) and six motels (M1- M6). The same letters of a and b indicate insignificant difference between each pairs among each group and vice versa
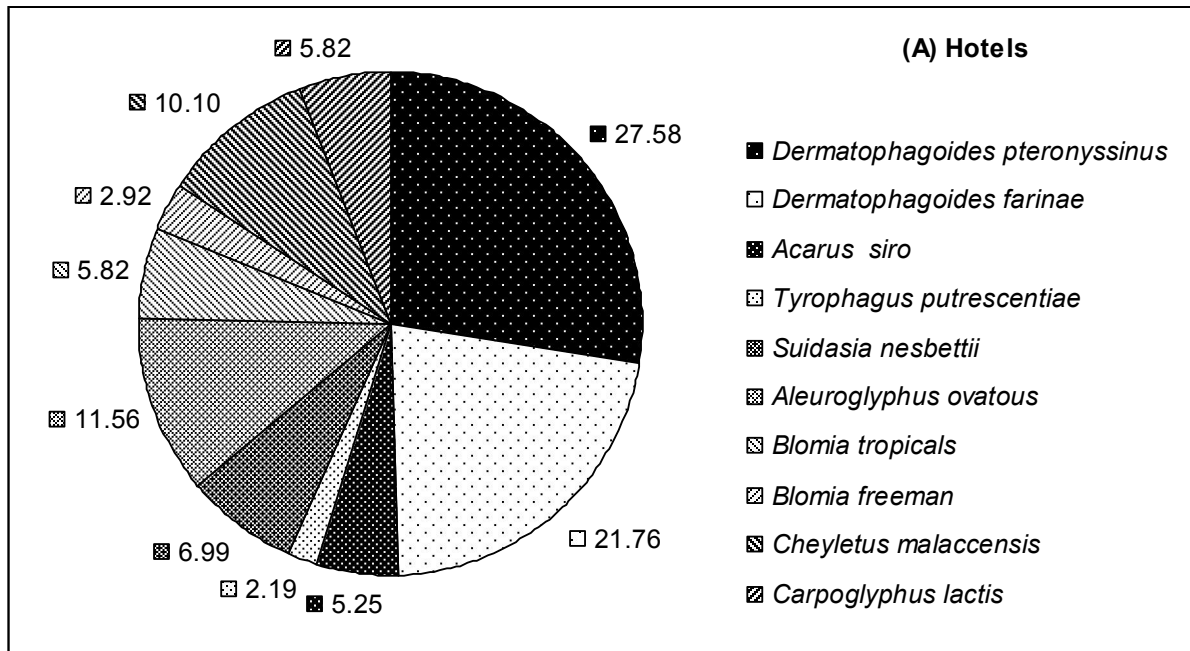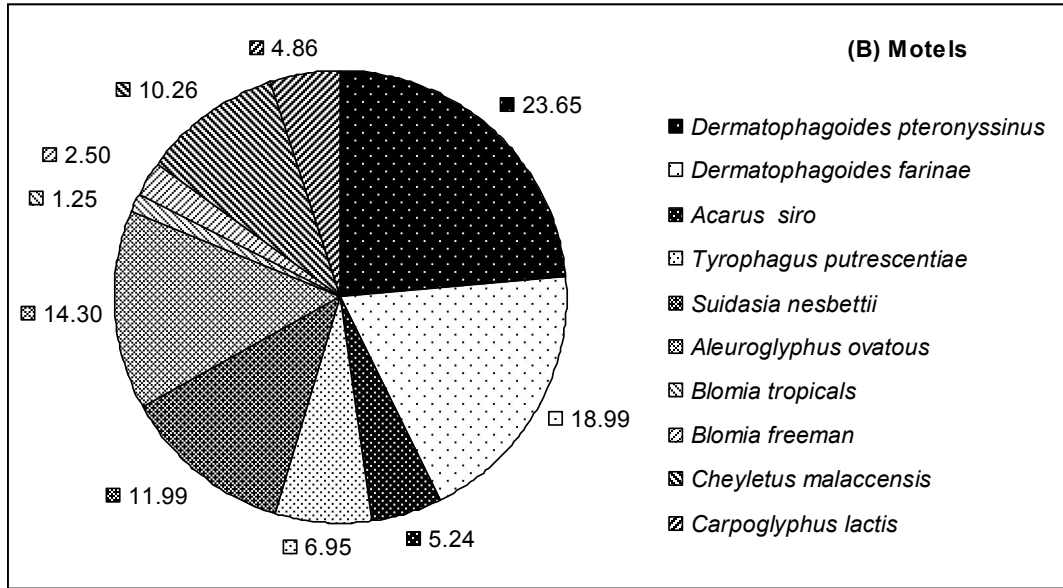
Figure 2. The relative occurrence of the ten species of the house dust mite individuals from (A) Hotels and (B) Motels.
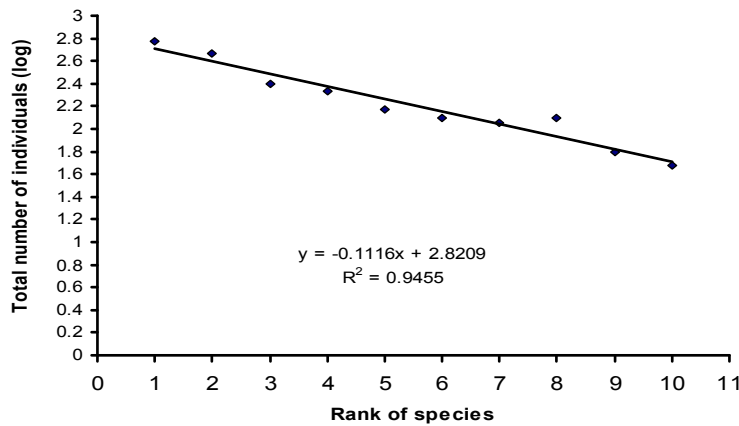
Figure 3a. Rank abundance of the total house dust mite assemblages at hotels
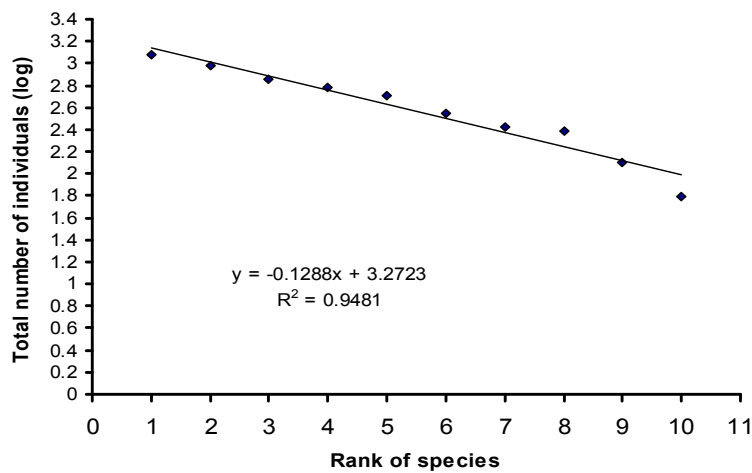
Figure 3b. Rank abundance of the total house dust mite assemblages at Motels
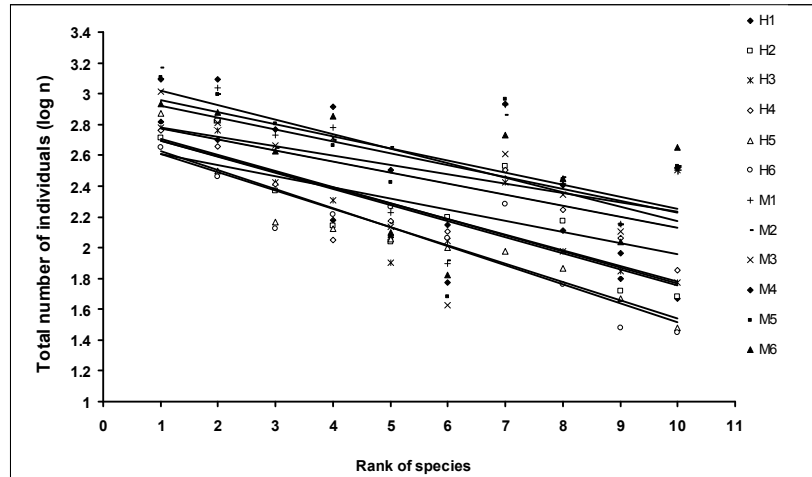
Figure3c. Regression lines for the rank abundance relationships of house dust mite communities at all 12 dorms (6 hotels (H1-H6) and 6 motels (M1 – M6).
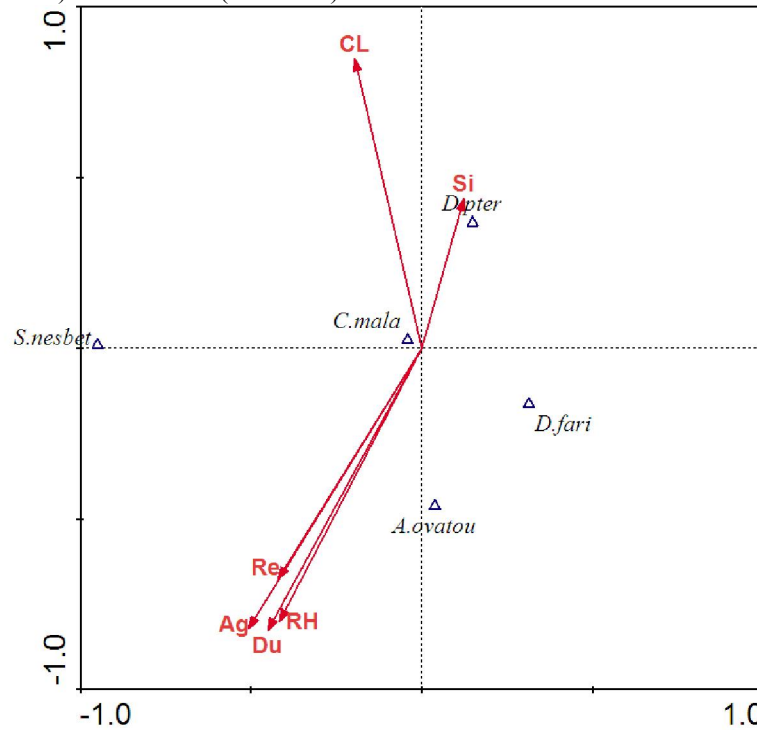
Figure 4. Ordination of the truncated house dust mite assemblages, Showing the position of the five dominant species and their associations with six environmental variables (Rc= occupant density, Ag = age of building, RH= relative humidity, Du= dust quantity, CL= cleaning and Si= Carpet sickness). Species are indicated by open triangles and environmental variables by arrows.
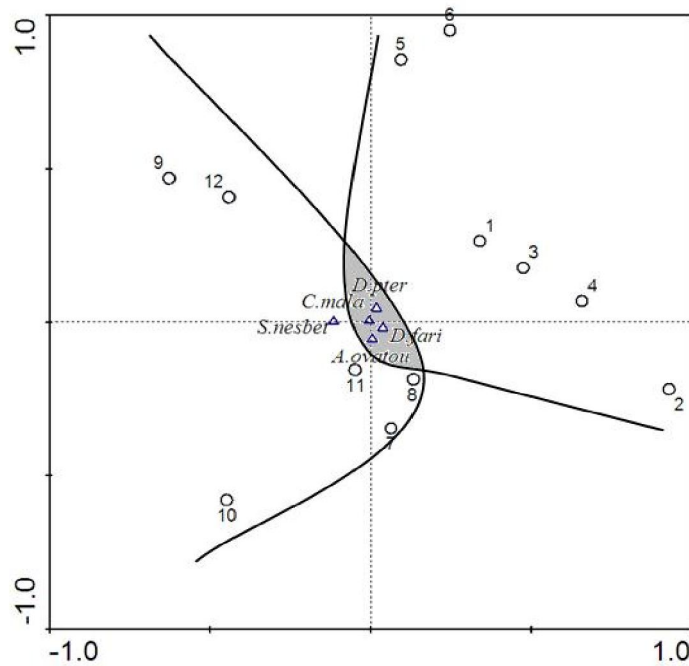
Figure 5. Shows a biplot of the first two axes of PCA position of the sampling sites and their associations with the dominant mite species in both levels of dorms.

for explanation legend figure 6.
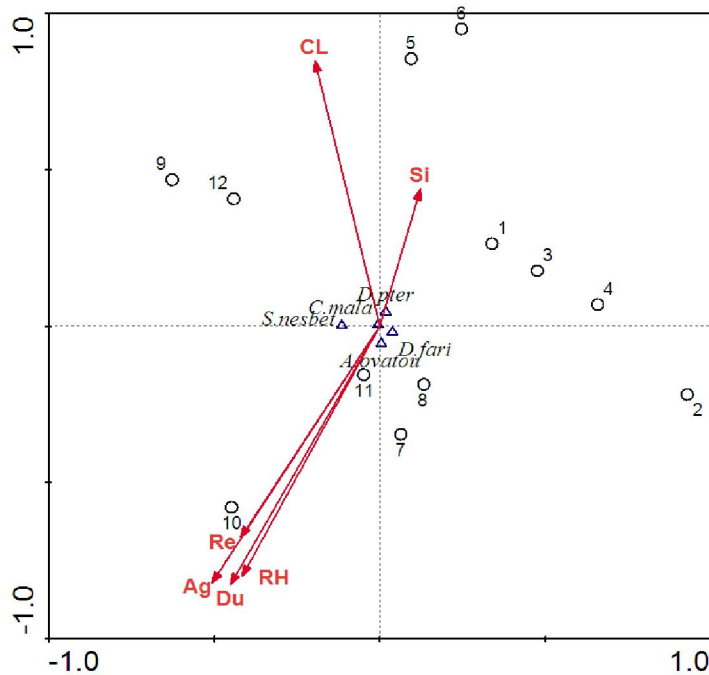
Figure 6. Ordination of the truncated house dust mite asseamlages (five dominant spp.) Showing the position of (sample sites) and their associations with environmental variables and the position of the five dominant speciesSites are indicated by open circles (1- 6 hotels, 7-12 motels). Mite species by open triangulars and environment al variables by arrows. for explanation legend figure 4.

In the current study as mentioned above *Cheyletus malaccensis* was found to reach a high level of relative dominance (11.6% in the hotels and 12% in the motels). However, **Soleimani and Rafinejad (2008)** found this species among three mite species in relatively low number as a rare species in the inns in Bandar Abas- Iran. It could be indicated that this mite has been reported to be predaceous mite on several other mite species. It is suggested that the pattern of the high number of its representatives in the present data match the high species richness (9 spp.) that may support a successful life for such predatory mite via a more diverse prey.

The data of this study showed that the motels appear to have the largest abundance of the total mites (5012 ind/50 g of dust) in correspond to 2149 ind/50 g of dust in the hotels. Obviously the two levels of dwellings surveyed in this study differed not only in mite abundance but also in various other habitat factors known to influence HDM developments such as the cleaning and sanitation manner, dust quantity, resident density and their economic status, relative humidity and ventilation, floor covering. Numerous studies demonstrate the relation between HDM occurance and building disinfectants (**Schober *et al.*, 1987**) vacuuming and ventilation (**Tovey and Marks, 1998**) and humidity (**Lintner *et al.*, 1993**). **Tovey *et al.*, 1998** stated that dry vacuum cleaners are useful to pick up excess dust and to reduce reservoirs allergy-causing mites.

With respect to the impact of the resident density and their economic status on the house dust mite abundance. **Valero and Serrano (2004)** indicated that house dust mites feed mainly on flakes of human skin. A single adult person sheds between 0.5-and 1 g per day, enough to feed 100.000 house dust mites a day. On the other hand, in the most recent study **Soltani *et al.* (2011)** mentioned that HDM frequency different between eastern and western areas in Iran, this pattern matches the economic status of residents in these areas. This may indicate direct impact of economic condition and life style on the mite contamination rate. The fact that live mites were found on clothing (**Neal *et al.*, 2002**) is evidence that clothing is a vehicle for mite dispersal and colonization in such public dormes specially the low level buildings (motels).

It is also evident that carpets serve as a major reservoir of many indoor allergy-producing mites. On sampling with a vacuum cleaner carpet yield more dust, this will reduce mite abundance. Cleaning on weekly regular basis using detergent and liquid cleaners, this achieves a significant reduction in such mites. A dry indoor relative humidity through a good ventilation will reduce mite density.

In this study up to 66.6% of the motels had a population density of more than 100 individuals per 1 gram of dust, however non of the studied hotels was found to housed more than 50 individuals per 1 gram of dust. Densities above 100 mites per 1 gram of dust are consider as the threshold at which mite allergen concentration is clinically important (**Korsgaard, 1983; Arlian *et al.*, 1992**). This suggests that the most allergic genetically predisposed residents in the motels in Jeddah city are exposed to a risk factor for sensitization to allergens produced from mites.

Conclusion:

The level of dorms had a clear effect on the quantitative existence of the house dust mites but a qualitative effect cannot be identified. Also, it was speculated that the most frequent cleaning of as well as density and economic status of residents were the main factors matched with a direct impact on the mite contamination rate of dorms.

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References
Al-Assiuty M. I. M., Bayomi B. M., Khalil M. A., and Van Straalen N. M. (1993): The influence of vegetations type on seasonal abundance and species composition of soil fauna at different localities in Egypt. Pedobiologia, 37: 210 – 222.

Arlian L. G. (1992): Water balance and humidity requirements of house dust mites. Exp Appl Acarol., 16: 15 – 35.

Arlian L. G. (2000): Mites are ubiquitous: are mite allergens, too? Ann Allergy Asthma Immunol., 85: 161 – 163.

Arlian L. G. (2002): Arthropod allergens and human health. Ann Rev Entomol., 47: 395 – 433.

Arlian L. G., Bernstein D., Bernstein I. L., Friedman S., Grant A. (1992): Prevalence of dust mites in homes of people with asthma living in eight different geographic areas of the United States J Allergy Clin Immunol., 90: 292 – 300.

Arlian L. G., Morgan M. S., and Neal J. S. (2002): Dust mite allergens: Ecology and distribution. Current Allergy and Asthma reports, Current Science Inc., 2: 401 – 411.

De Boer R. (1990): The control of house dust mite allergens in rugs. J Allergy Clin Immunol., 86: 808 – 814.

De Boer R. and Kuller K. (1995): Winter survival of house dust mites (Dermatophagoides spp) on the ground floor of Dutch houses, Proc. Exp. Appl. Entomol. NEV Amsterdam, 6: 47 – 52.

De Boer R., Wietske A. D., Hoeven V., and Kulle K. (1999): The control of house dust mites in rugs through wet cleaning Mo. Sby- Year Book, Inc. Amesterdam, pp: 1214 – 1217.

Edrees N. (2009): Distribution dynamics of dust mites in two locations of patient homes with respect to the allergical kind. American- Eurasian J. Agric.& Environ. Sci., 6(6): 680 – 688.

Korsgaard J. (1983): House dust mites and absolute indoor humidity. Allergy, 38(2): 85 – 92.

Krebs C. H. (1999): Ecological methodology 2nd Ed Addison Wesley Longman, Inc. Jim Green.

Lintner T. J., and Brame K. A. (1993): The effect of season, climate and air conditioning on the prevalence of Dermatophagoides mite allergens in household dust. J. Allergy Clin Immunol., 91: 862 – 867.

Neal J. S., Arlian L. G., and Morgan M. S. (2002): Relationshipp among house dust mites, Der 1, Fel d1, and Can f1 on clothing and automobile seats with respect to densities in houses. Ann Allergy Asthma Immunol., 88: 410 – 415.

Schober G., Wetter G., Bischoff E., Van Bronswijk J. E., and Kniest F. M. (1987): Control of house dust mites Pyroglyphidae with home disinfectants. Experimental & Applied Acarology, 3: 179 – 189.

Service M. W. (2004): Medical entomology for students, 3rd edn. Cambridge University Press, Cambridge.

Solarz K. (1998): The allergenic acarofauna of house dust from dwelling, hospitals, libraries and institutes in Upper Silesia (Poland). Ann Agric Environ Med., 5: 73 – 85.

Soleimani M., and Rafinegad J. (2008): House dust mite contamination in hotels and inns in Bandar Abbas, South of Iran. Iran J Environ Health Sci Eng., 5(3): 207 – 210.

Soltani A., Azizi K., Saleh V., and Dabghmanesh T. (2011): The funa and distribution of house dust mites in residential homes of Bandar Abbas District, Southern Iran. Exp. Appl Acarol., 54: 269 – 276.

Tovey E., and Marks G. (1998): Methods and effectiveness of environmental control. J Allergy Clin Immunol., 103(2)1: 179 – 191.

Valero A., and Serrano C. (2004): Are environmental controls effective for house dust mite allergies? Arch Bronconeumol., 40(9): 389 – 391.

Van de Lustgraat B. (1978): Ecological relationships between xerophilic fungi and house dust mites (Acarina: Pyroglyphidae). Decologia (Berlin), 33: 351 – 359.

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Improving the Modified Gause – Seidel Method for M - Matrices

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Abstract: In1994, M. Usui et al. have reported the modified Gauss-Seidel method with a preconditioner $(I + U)$. The preconditioning effect is not observed on the n-th row. In this paper, to deal with this drawback, we propose a new preconditioner. In addition, the convergence and comparison theorems of the proposed method are established.

1- Introduction:

We consider the following linear system:

$$AX = b, \qquad (1)$$

where $A \in R^{n \times n}$, $b \in R^n$ are given and $x \in R^n$ is unknown. For simplicity, let $A = I - L - U$, where I is the identity matrix, L and U are strictly lower and strictly upper triangular matrices, respectively.

Now, consider a preconditioned system of (1):

$$PAX = pb, \qquad (2)$$

where P is a non-singular matrix. To effectively solve the preconditioned linear system (2), a variety of preconditioners have been proposed by several authors $[1 - 8,11]$ and the references therein. The preconditioning effect is not observed on the last row of matrix A. For example, the preconditioner $P_{U_1} = I + U$ In [11] where U is a strictly upper triangular part of $-A$.

In 2009, Zheng et al. [4] proposed the following two preconditioners:

$$P_{max} = I + S_{max} + R_{max}$$

and

$$P_R = I + S_{max} + R$$

where

$$S_{max} = \begin{cases} -a_{i,k_i} & i=1,\dots,n-1, j>i; \\ 0, & Other\ Wise, \end{cases}$$

$$K_i = min\{j | max | |a_{i,j}| | i < n\}$$

and

$$(R_{max})_{i,j} = \begin{cases} -a_{n,k_n} & i=n, j=K_n \\ 0, & Other\ Wise \end{cases}$$

with $K_n = min\{j | |a_{n,j}| | = max\{|a_{n,l}|, l = 1, \dots, n-1\}\}$

and

$$(R)_{i,j} = \begin{cases} -a_{i,j} & i=n, 1 \le j \le n-1, \\ 0, & Other\ Wise \end{cases}$$

The comparison result between the preconditioners P_{max} with P_R [4] shows that the preconditioner P_R is better than P_{max} for solving the preconditioned linear system (2).

In this paper, we propose the following a preconditioner: $\qquad (3)$

$$\qquad (4)$$

$P_U = (I + U + R)$

$$= \begin{pmatrix} 1 & -a_{12} & -a_{13} & \cdots & -a_{1n} \\ 0 & 1 & -a_{23} & \cdots & -a_{2n} \\ \vdots & \ddots & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & \ddots & -a_{n-1n} \\ -a_{n1} & -a_{n2} & \cdots & -a_{nn-1} & 1 \end{pmatrix}$$

Then AU can be written as follows:

$AU = (I + U + R)A$

$= I - L - U + U - UL - U^2 + R - RL - RU = M_U - N_U,$

where

$$M_U = \left(I - D - L - E + R - \acute{D} - \acute{E}\right), N_U = F + U^2$$

and D, E and F are the diagonal, strictly lower triangular and strictly upper triangular parts of UL, while $\acute{D}$ and $\acute{E}$ are the diagonal, strictly lower triangular parts of $R(L + U)$, respectively. If M_U is nonsingular, the MGS iterative matrix is $T_U = M_U^{-1} N_U$.

2- Preliminaries:

In this section, we present some notation, definitions and lemmas.

For $A = (a_{i,j}), B = (b_{i,j}) \in R^{n \times n}$, we write $A \geq B$ if $a_{i,j} \geq b_{i,j}$ holds for all $i, j = 1, 2, \ldots, n$. Calling A nonnegative if $A \geq 0 (a_{i,j} \geq 0; i, j = 1, 2, \ldots, n)$. $\rho(.)$ denotes the spectral radius of a matrix.

Definition 2.1. A matrix A is a L-matrix if $a_{i,j} > 0; i = j = 1, \ldots, n$ and $a_{i,j} \leq 0$ for all $i, j = 1, 2, \ldots, n; i \neq j$. A nonsingular L-matrix A is a nonsingular M-matrix if $A^{-1} \geq 0$.

Definition 2.2. Let A be a real matrix. Then

$$A = M - N$$

is called a splitting of A if M is a nonsingular matrix. The splitting is called

(a) regular if $M^{-1} \geq 0$ and $N \geq 0$;

(b) weak regular if $M^{-1} \geq 0$ and $M^{-1}N \geq 0$;

(c) nonnegative if $M^{-1}N \geq 0$;

(d) M-splitting if M is a nonsingular M-matrix and $N \geq 0$.

Lemma 2.1 ([14]). Let $A \in R^{n \times n}$ be nonnegative $n \times n$ matrix. Then

(a) A has a positive real eigenvalue equal to its spectral radius $\rho(A)$;

(b) for (A) , there corresponds an eigenvector $X > 0$;

(c) $\rho(A)$ is a simple eigenvalue of A ;

(d) $\rho(A)$ increases when any entry of A increases.

Definition 2.3. We call $A = M - N$ the Gauss-Seidel splitting of A, if $M = (I - L)$ is nonsingular and $N =$. In addition , the splitting is called

(a) Gauss-Seidel convergent if $(M^{-1}N) < 1$;

(b) Gauss-Seidel regular if $M^{-1} = (1 - L)^{-1} \geq 0$ and $N = U \geq 0$.

Lemma 2.2 ([17]). $A = M - N$ be an M-splitting of A. Then $\rho(M^{-1}N) < 1$ if and only if A is a nonsingular M-matrix.

Lemma 2.3 ([15]). Let A and B be $n \times n$ matrices. Then AB and BA have the same eigenvalues, counting multiplicity.

Lemma 2.4([10]). Let A be a nonsingular M-matrix, and let

$A = M_1 - N_1 = M_2 - N_2$ be two convergent splitting, the first one weak regular and the second one regular. If $M_1^{-1} \geq M_2^{-1}$, then

$$\rho(M_1^{-1}N_1) \leq \rho(M_2^{-1}N_2) < 1.$$

3. Comparison Theorems

In this section, we compare such MGS method with the classical Gauss-Seidel method and the MGS method with the preconditioner $P_{U_1} = I + U$ ([11]), respectively.

To prove the theorems, we need some results.

We firstly prove that $A_{U_1} = M_{U_1} - N_{U_1}$ and $A_U = M_U - N_U$ are both regular and Gauss-Seidel convergent splitting.

For the preconditioner $P_{U_1} = I + U$ the preconditioned matrix $A_{U_1} = (I + U)A$ can be written as

$$A_{U_1} = M_{U_1} + N_{U_1} = (I - D - L - E) - (F + U^2).$$

In which D, E and F are defined as in section1. Hence, if $\sum_{k=i+1}^{n} a_{i,k} a_{k,i} \neq 1 (i = 1,2,...,n-1)$, Then, the MGS iterative matrix T_{U_1} for A_{U_1} can be defined by

$$T_{U_1} = M_{U_1}^{-1} N_{U_1} = (I - D - L - E)^{-1}(F + U^2)$$

as $(I - D - L - E)^{-1}$ exists. There is the following result:

Lemma 3.1. Let $A = I - L - U$ be a nonsingular M-matrix. Assume that $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \le i \le n - 1$. Then $A_{U_1} = M_{U_1} - N_{U_1}$ is regular and Gauss-Seidel convergent.

Proof. We observe that when $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \le i \le n - 1$, the diagonal elements of A_{U_1} are positive and $M_{U_1}^{-1}$ exists. It is known that (see ([18]) an L-matrix A is a nonsingular M-matrix if and only if there exists a positive vector y such that $Ay > 0$. By taking such y, the fact that $I + U \ge 0$ implies $A_{U_1} y = (I + U)Ay > 0$. Consequently, the L-matrix A_{U_1} is a nonsingular M-matrix which means $A_{U_1}^{-1} \ge 0$. Since $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1$ we have $(I - D)^{-1} \ge I$.

As strictly lower triangular matrix $L + E$ has nonnegative elements, by Neumann's series, the following inequality holds:

$$M_{U_1}^{-1} = [I + (I - D)^{-1}(L + E) + \{(I - D)^{-1}(L + E)\}^2 + \cdots$$

$$+ \{(I - D)^{-1}(L + E)\}^{n-1}](I - D)^{-1} \ge 0$$

On the other hand, it is easy to see that $N_{U_1} = F + U^2 \ge 0$ .Thus,

$A_{U_1} = M_{U_1} - N_{U_1}$ is a regular and Gauss-Seidel convergent splitting by Definition 2.3 And Lemma 2.2. ■

Theorem 3.2. Let A be a nonsingular M-matrix, assume that $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \le i \le n - 1$ and $0 \le \sum_{k=1}^{n-1} a_{n,k} a_{k,n} < 1$, then $A_U = M_U - N_U$ is regular and Gauss-Seidel convergent splitting.

Proof. We observe that when $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \le i \le n - 1$ and $0 \le \sum_{k=1}^{n-1} a_{n,k} a_{k,n} < 1$, the

diagonal elements of A_U are positive and M_U^{-1} exists. Similar to the proof of Theorem 3.1, We can show that

$A_U = (I + U + R)A$ is a nonsingular M-matrix when A is a nonsingular M-matrix. Thus, $A_U^{-1} \ge 0$. When $0 \le \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \le i \le n - 1$ and $0 \le \sum_{k=1}^{n-1} a_{n,k} a_{k,n} < 1$, we have $D + \acute{D} < I$, so that $(I - D - \acute{D}) \ge 0$. Hence,

$$M_U^{-1} = [(I - D - \acute{D}) - (L - R + E + \acute{E})]^{-1}$$

$$= [I - (I - D - \acute{D})^{-1}(L - R + E + \acute{E})]^{-1}(I - D - \acute{D})^{-1}$$

$$= \{I + (I - D - \acute{D})^{-1}(L - R + E + \acute{E}) + [(I - D - \acute{D})^{-1}(L - R + E + \acute{E})]^2 + \cdots$$

$$+ [I - (I - D - \acute{D})^{-1}(L - R + E + \acute{E})]^{n-1}\}(I - D - \acute{D})^{-1} \ge 0$$

It is easy to see that $N_U = F + U^2 \ge 0$.

Therefore, $A_U = M_U - N_U$ is a regular and Gauss-Seidel convergent splitting by Definition 2.3 And Lemma 2.2. ■

Theorem 3.3. Let A be a nonsingular M-matrix. Then under the assumptions of Theorem 3.2, the following inequality holds:

$$\rho(T_U) \le \rho(T) < 1$$

where, $T = (I - L)^{-1} U$ is the iterative matrix of the classical Gauss-Seidel method for $A = I - L - U$.

Proof. Since A is a nonsingular M-matrix, the classic Gauss-Seidel splitting $A = (I - L) - U$ of A is clearly regular and convergent.

For $M_U = I - D - L - E + R - \acute{D} - \acute{E}$ and $N_U = F + U^2$ by Theorem 3.2 we know that $A_U = M_U - N_U$ is a Gauss-Seidel convergent splitting.

To compare $\rho(T_U)$ with (T) , we have

$$A = (I + U + R)^{-1} M_U - (I + U + R)^{-1} N_U.$$

If we take $M_1 = (I + U + R)^{-1}M_U$ and $N_1 = (I + U + R)^{-1}N_U$, then $\rho(M_1^{-1}N_1) < 1$ since $M_U^{-1}N_U = M_1^{-1}N_1$. Also, we have

$$M_1^{-1} = M_U^{-1}(I + U + R)$$

$$= (I - D - L - E + R - \acute{D} - \acute{E})^{-1}(I + U + R)$$

$$\geq (I - D - L - E + R - \acute{D} - \acute{E})^{-1}$$

$$= [\, I - \left(I - D - \acute{D}\right)^{-1}\left(L - R + E + \acute{E}\right)]^{-1}\left(I - D - \acute{D}\right)^{-1}$$

$$\geq [\, I - \left(I - D - \acute{D}\right)^{-1}\left(L - R + E + \acute{E}\right)]^{-1}$$

$$\geq (I - L)^{-1},$$

If follows from Lemma 2.4 that $\rho(M_1^{-1}N_1) \leq \rho(M^{-1}N) < 1$. Hence,

$\rho(M_U^{-1}N_U) \leq \rho(M^{-1}N) < 1$, i.e., $\rho(T_U) \leq \rho(T) < 1$.

Next, we give a comparison theorem between the MGS method with the preconditioners P_U and P_{U_1}, respectively.

Theorem 3.4. Let A be a nonsingular M-matrix. Then under the assumptions of Theorem 3.2 and $a_{n,j}\sum_{k=1}^{n-1}a_{n,k}a_{k,n} \leq \sum_{k=1}^{n-1}a_{n,k}a_{k,j},\ 1 \leq j \leq n-1$, we have

$$\rho(T_U) \leq \rho(T_{U_1}) < 1$$

Proof. For the matrices M_{U_1}, M_U , N_{U_1} and N_U in the splitting of matrices $P_{U_1}A = M_{U_1} - N_{U_1}$ and $P_U A = M_U - N_U$, they can be expressed in the partitioned forms as follows:

$$M_{U_1} = I - D - L - E = \begin{pmatrix} \widehat{M} & q \\ u^T & 1 \end{pmatrix},$$

$$M_U = M_{U_1} + RA = \begin{pmatrix} \widehat{M} & 0 \\ V^T & v_n \end{pmatrix},$$

$$N_U = N_{U_1} = \begin{pmatrix} \widehat{N} & W \\ 0 & 0 \end{pmatrix},$$

where

$$\widehat{M} = (\widehat{m}_{i,j})$$
$$,\widehat{m}_{i,j} = \begin{cases} 0, & 1 \leq i < j \leq n-1, \\ 1 - \sum_{k=i+1}^{n}a_{i,k}a_{k,i}, & i = j, \\ a_{i,j} - \sum_{k=i+1}^{n}a_{i,k}a_{k,j}, & j < i \leq n-1, \end{cases}$$

$$u^T = (a_{n,1}, \dots, a_{n,n-1}),$$

$$V^T = (v_1, \dots, v_{n-1})$$

$$v_j = a_{n,j} - \sum_{k=1}^{n-1}a_{n,k}a_{k,j}\ (1 \leq j \leq n-1)$$

$$v_n = 1 - \sum_{k=1}^{n-1}a_{n,k}a_{k,n}$$

$$W = (\omega_1, \dots, \omega_{n-1})^T$$

$$\omega_i = -a_{i,n} + \sum_{k=i+1}^{n}a_{i,k}a_{k,n}\ (1 \leq i \leq n-1)$$

and $\widehat{N} \geq 0$ is an $(n-1) \times (n-1)$ strictly upper triangular matrix.

Direct computation yields

$$M_{U_1}^{-1} = \begin{pmatrix} \widehat{M}^{-1} & 0 \\ -u^T\widehat{M}^{-1} & 1 \end{pmatrix} \text{ and}$$

$$M_U^{-1} = \begin{pmatrix} \widehat{M}^{-1} & 0 \\ -v_n^{-1}V^T\widehat{M}^{-1} & v_n^{-1} \end{pmatrix}$$

therefore ,

$$N_{U_1}M_{U_1}^{-1} = \begin{pmatrix} \widehat{T}_{U_1} & W \\ 0 & 0 \end{pmatrix} \geq 0$$

and

$$N_U M_U^{-1} = \begin{pmatrix} \overline{T}_U & v_n^{-1}W \\ 0 & 0 \end{pmatrix} \geq 0$$

where $\widehat{T}_{U_1} = \widehat{N}\widehat{M}^{-1} - Wu^T\widehat{M}^{-1}$ and $\overline{T}_U = \widehat{N}\widehat{M}^{-1} - Wv_n^{-1}V^T\widehat{M}^{-1}$. Since both the lower-right corner of $N_U M_U^{-1}$ and $N_{U_1}M_{U_1}^{-1}$ have zeros, $\rho(N_U M_U^{-1})$ and $\rho(N_{U_1}M_{U_1}^{-1})$ exist in $\overline{T}_U$ and $\widehat{T}_{U_1}$, respectively. That is, $\rho(N_U M_U^{-1}) = \rho(\overline{T}_U)$ and $\rho(N_{U_1}M_{U_1}^{-1}) = \rho(\widehat{T}_{U_1})$. By simple computation, we know that $\overline{T}_U \leq \widehat{T}_{U_1}$ under the assumption $a_{n,j} - \sum_{k=1}^{n-1}a_{n,k}a_{k,n} \leq \sum_{k=1}^{n-1}a_{n,k}a_{k,j},\ 1 \leq j \leq n-1$. Hence by Lemma 2.1 , we have

$$\rho(N_U M_U^{-1}) = \rho(\overline{T}_U) \leq \rho(\widehat{T}_{U_1}) = \rho(N_{U_1}M_{U_1}^{-1}).$$

Therefore , by Lemma 2.3 we immediately know that

$$\rho(M_U^{-1}N_U) = \rho(N_U M_U^{-1}) \leq \rho(N_{U_1}M_{U_1}^{-1}) = \rho(M_{U_1}^{-1}N_{U_1})\text{, which means that } \rho(T_U) \leq \rho(T_{U_1}).$$

4. Comparison Theorems

In this section, we discuss a comparison with P_U and P_R. The comparison result show that the preconditioner P_U is better than P_R for sloving the preconditioned linear system (2).

Theorem 4.1. Let A be a nonsingular M-matrix. If $0 \leq \sum_{k=i+1}^{n} a_{i,k} a_{k,i} < 1, 1 \leq i \leq n-1$ and $0 \leq \sum_{k=1}^{n-1} a_{n,k} a_{k,n} < 1$ and $0 \leq a_{i,k_i} a_{k_i,n} < 1, 1 \leq i \leq n-1$, then $\rho(T_U) \leq \rho(T_R) < 1$

Proof. For $M_U = I - D - L - E + R - \acute{D} - \acute{E}$ and $N_U = F + U^2$ by Theorem 3.2 we know that $A_U = P_U A = M_U - N_U$ is a Gauss-Seidal convergent splitting. For $M_R = I - \acute{D} - L - \acute{E} + R - \acute{D} - \acute{E}$ and $N_R = U - S_{max} + \acute{F} + S_{max} U$ that $\acute{D}, \acute{E}$ and $\acute{F}$ are respectivly the diagonal, strictly lower triangular and strictly upper triangular parts of $S_{max} L$, and $\acute{D}$ and $\acute{E}$ are the diagonal, strictly lower triangular parts of $R(L + U)$, respaectivly. From [4] we know that $A_R = P_R A = M_R - N_R$ is a Gauss-Seidel convergant splitting. To compare $\rho(T_U)$ with $\rho(T_R)$, we consider the following splitting of A:

$$A_U = P_U A = M_U - N_U$$

$$(I + U + R)A = M_U - N_U$$

$$A = (I + U + R)^{-1} M_U - (I + U + R)^{-1} N_U$$

that we take $M_1 = (I + U + R)^{-1} M_U$ and $N_1 = (I + U + R)^{-1} N_U$

and

$$A_R = P_R A = M_R - N_R$$

$$(I + S_{max} + R)A = M_R - N_R$$

$$A = (I + S_{max} + R)^{-1} M_R - (I + S_{max} + R)^{-1} N_R$$

If we take $M_2 = (I + S_{max} + R)^{-1} M_R$ and $N_2 = (I + S_{max} + R)^{-1} N_R$, then $\rho(M_1^{-1} N_1) < 1$ and $\rho(M_2^{-1} N_2) < 1$ since $M_U^{-1} N_U = M_1^{-1} N_1$ and $M_R^{-1} N_R = M_2^{-1} N_2$.

Then $A = M_1 - N_1 = M_2 - N_2$ are two convergant splittings.

Since matrices $L, D, \acute{D}, E, \acute{E}, R, \acute{D}$ and $\acute{E}$ are positive and $D \geq \acute{D}$ and $E \geq \acute{E}$, we have $-D \leq -\acute{D}$ and $-E \leq -\acute{E}$. Then the following inequality holds:

$$I - D - L - E \leq I - \acute{D} - L - \acute{E}$$

and we have:

$$I - D - L - E + R - \acute{D} - \acute{E} \leq I - \acute{D} - L - \acute{E} + R - \acute{D} - \acute{E}.$$

Therefore

$$(I - D - L - E + R - \acute{D} - \acute{E})^{-1} \geq (I - \acute{D} - L - \acute{E} + R - \acute{D} - \acute{E})^{-1}$$

Also, $P_U = I + U + R$ and $P_R = I + S_{max} + R$ are positive matrices and we have

$$I + U + R \geq I + S_{max} + R \qquad (6)$$

from (5) and (6) the following relation holds:

$$(I - D - L - E + R - \acute{D} - \acute{E})^{-1}(I + U + R)$$

$$\geq (I - \acute{D} - L - \acute{E} + R - \acute{D} - \acute{E})^{-1}(I + S_{max} + R)$$

and we know that

$$M_1^{-1} = (I - D - L - E + R - \acute{D} - \acute{E})^{-1}(I + U + R)$$

and

$$M_2^{-1} = (I - \acute{D} - L - \acute{E} + R - \acute{D} - \acute{E})^{-1}(I + S_{max} + R)$$

Then, from (7), $M_1^{-1} \geq M_2^{-1}$ it follows from Lemma 2.4 that

$\rho(M_1^{-1} N_1) \leq \rho(M_2^{-1} N_2) < 1$. Hence, $(M_U^{-1} N_U) \leq \rho(M_R^{-1} N_R) < 1$, i.e., $\rho(T_U) \leq \rho(T_R) < 1$. ∎

5. Numerical Examples

Example 5.1. Consider the following matrix,

$$A = \begin{pmatrix} 1 & -0.2 & -0.3 & -0.1 & -0.2 \\ -0.1 & 1 & -0.1 & -0.3 & -0.1 \\ -0.2 & -0.1 & 1 & -0.1 & -0.2 \\ -0.2 & -0.1 & -0.1 & 1 & -0.3 \\ -0.1 & -0.2 & -0.2 & -0.1 & 1 \end{pmatrix}$$

by computation, we have

$\rho(M^{-1} N) = 0.460779 > \rho(M_U^{-1} N_U) = 0.156956$
and

$\rho(M_{U_1}^{-1} N_{U_1}) = 0.186007 > \rho(M_U^{-1} N_U) = 0.156956$ and

$\rho(M_R^{-1}N_R) = 0.257251 > \rho(M_U^{-1}N_U) = 0.156956$.

***Example* 5.2**. Let the coefficient matrix A given by

$$A = \begin{pmatrix} 1 & 0 & -0.1 & -0.2 & 0 & 0 & -0.4 & -0.1 & -0.1 \\ -0.1 & 1 & 0 & 0 & -0.3 & -0.1 & -0.1 & 0 & -0.2 \\ -0.1 & -0.2 & 1 & 0 & -0.1 & 0 & -0.3 & 0 & 0 \\ 0 & -0.1 & -0.1 & 1 & 0 & -0.1 & -0.4 & 0 & -0.1 \\ -0.2 & 0 & -0.1 & 0 & 1 & 0 & -0.4 & -0.1 & -0.1 \\ -0.1 & 0 & 0 & -0.1 & 0 & 1 & -0.3 & 0 & -0.2 \\ -0.2 & -0.2 & 0 & -0.1 & 0 & 0 & 1 & -0.2 & -0.1 \\ -0.1 & 0 & 0 & -0.2 & -0.2 & -0.1 & 0 & 1 & -0.3 \\ 0 & 0 & -0.1 & -0.2 & 0 & 0 & -0.1 & -0.3 & 1 \end{pmatrix}$$

Obviously, from numerical results, we have $\rho(T_U) \leq \rho(T_R)$ and

$\rho(T_U) \leq \rho\left(T_{U_1}\right) \leq \rho(T)$, we have $\rho(T_U) = 0.414255$, $\rho(T_R)$=0.478073 , $\rho\left(T_{U_1}\right) = 0.421223$ and $\rho(T) = 0.670704$.

References

[1] A. D. Gunawardena, S. K. Jain, L. Snyder, Modified Itrative Methods For Consistent Linear Systams, Linear Algebra Appl. **154 − 156(1991)123 − 143**.

[2] H. Kotakemori, K. Harada, M. Morimoto, H. Niki, A Comparison Theorem For The Iterative Mathod With The Preconditioner ($I + S_{max}$), J. Comput. Appl. Math. **145(2002)373 − 378**.

[3] J. P. Milaszewicz, Impriving Jacobi And Gauss-Seidel Iterations, Linear Algabra Appl. **93(1987)161 − 170**.

[4] B. Zheng, S. X. Miao, Two New Modified Gauus-Seidel Methods For Linear System With M-Matrices, J. Comput. Appl. Math. **233(2009)922 − 930**.

[5] T. Kohono, H. Kotakemori, H. Niki, Improving Th Modified Gauss-Seidel Method For Z-Matrices, Linear Algabra Appl. **267(1997)113 − 123**.

[6] H. Kotakemori, H. Niki, N. Okamoto, Accerated Iterative Method For Z-Matrices, J. Comput. Appl. Math. **75(1996)87 − 97**.

[7] H. Niki, K. Harada, M. Morimoto, M. Sakakihara, The Survey Of Preconditioners Used For Accelerating The Rate Of Convergence In The Gauss-Seidel Method, J. Comput. Appl. Math. **164 − 165(2004)587 − 600**.

[8] W. Li, A Note On The Preconditioned Gauss-Seidal (GS) Method For Linear Systems, J. Comput. Appl. Math. **182(2005)81 − 90**.

[9] J. H. Yun, A Note On Preconditioned AOR Method For L-Matrices, J. Comput. Appl. Math. **220(2008)13 − 16**.

[10] Z. I. Wozniki, Nonnegative Splitting Theory, Japan J. Industrial Appl. Math. **11(1994)289 − 342**.

[11] M. Usui, H. Niki, T. Kohno, Adaptive Gauss-Seidel Method For Linear Systyems, Int. J. Comput. Math. **51(1994)119 − 125**.

[12] H. Wang, Y.T. Li, A. New Preconditioned AOR Iterative Method For L-Matrices, J. Comput. Appl. Math. **229(2009)47 − 53**.

[13] H. Niki, T. Kohono, M. Morimoto, The Preconditioned Gauss-Seidel Method Faster Than The SOR Method, J. Comput. Appl. Math. **219(2008)59 − 71**.

[14] R. S. Varga, Matrix Iterative Analysis, Pre Ntice, Englewood Cliffs, Nj, **1981**.

[15] F. Zhang, Matrix Theory, Springer, **1999**.

[16] D. M. Young, Itreative Solution Of Large Linear System, Academic Press, New York, **1971**.

[17] W. Li, W. W. Sun, Modified Gauss-Seidel Type Methods And Jacobi Type Methods FOR Z-Matrices, Linear Algebra Appl. **317(2000)227 − 240**.

[18] A. Berman, R. J. Plemmons, Nonnegative Matrices In The mathematical Sciences, Academic Press, New York, **1979**.

[19] Y. Z. Song, Comparisons Of Nonnegative Splittings Of Matrices, Linear Algebra Appl. **154 − 156(1991)433 − 455**.

[20] H. Schneider, Theorems On M-Splittings Of A Singular M-Matrix Which Dapend On Graph Structure, Linear Algebra Appl. **58(198**4**)407 − 424**.

A study on genetic diversity in lentil genotypes using seeds morphologic and protein traits

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Abstract: The following research tries to study the relation and correlation between grain yield and other quantitative traits in lentil using 29 lentil genotypes (including 26 foreign genotypes and 3 control genotypes). The research was conducted in Ardabil Agriculture and Natural Resources Research through augmented method in randomized complete block design in three replications, during 2011. During the agricultural season, certain traits such as green percentage, days to flowering, number of hooks, hook size and grain yield were measured. Subsequent to the variance analysis, data related to the control cultivars, and also estimation of blocks effects and amending each studied treatment on the studied traits, the relation between evaluated traits and grain yield were studied. Results suggested that there is a positive significance relation between the green percentage, hook size, plant height, 100 pods weight, 100 seeds weight, biomass and number of filled pods on the one hand and the grain yield on the other. Step-by-step multiple Regression results indicated that among the studied traits, biomass and number of secondary branches explain more than 84% of the grain yield changes so that, the increase in biomass and decrease in number of secondary branches, increase the yield. Cluster analysis divided studied genotypes into three groups in which, the first group with genotype numbers of 1, 5, 6, 9, 10, 11, 14, 15 and 21 was the best group. According to the protein data, the highest number of protein band (22) were observed in genotype numbers of 8, 21 and control genotype number of 27 while the lowest number of protein band (16) were observed in genotype numbers of 19 and 20, so that bands numbers of 2, 3, 5, 7, 8, 13, 14, 15 and 16 with respective molecule weight of 118.35, 112.71, 99.77, 86.17, 80.09, 44.58, 42.46, 40.43 and 38.51 KD a were diagnosed as polymorphism bands. According to the protein data, genotypes were divided into three groups in which the third group with 12 genotypes of 1, 2, 3, 4, 5, 6, 11, 12, 13, 15, 20 and 22 had a higher value as the delayed, high yielding and long-legged genotypes along with most of studied traits. The farthest distances from protein bands were related to the genotypes numbers of 23 with 14, 17, 18 and 19. Results suggested that grouping based on morphologic data was to 35% consistent with protein data.

Introduction

Morphological indicators indicate the variety in shape or yield in plants. Emergence of awn, pigments, reaction to hormones, herbicides and diseases are among such indicators. However, phenotypic assessments have limited application due to the environment effects on gene expression, dominance and epistatic effects, presence of pleiotropy, changes in gene penetration, dependence on the tissue and developmental stages, assessment tests being time consuming and the limited genetic information obtained (Musavizade, 2006). Protein indicators represent the variation in protein products of genes. Isozyme and endosperm protein compounds are of this type. There are some biochemical methods presented based on electrophoresis of seed proteins and enzymes whose usefulness have been proved in the analysis of genetic diversity. Using various alleles of one or multi-locus forms, these methods identify the differences between seed storage proteins or coded enzymes. Using biochemical methods could omit the environmental effects. However, its usefulness is limited due to its inability to detect low levels of diversity, limited genome coverage, non-random distribution and its limitations in number (Bozorgi, 1994). In most cases, seeds are considered as the sources for protein, for they represent a certain stage in a plant lifetime. For instance, varieties related to a leaf growth could limit their protein pattern for taxonomic purposes. In addition, seeds are great protein sources and obtain enough protein for electrophoresis. The main reason to use seed stored proteins electrophoresis patterns in categorization is due to proteins being relatively direct products of genes. Hence, it is believed that these patterns could represent criteria in genetic similarities and differences among comparing plants. Using seeds protein patterns in systematic studies is based on this

assumption that proteins of various individuals, various populations and various species are similar if they maintain a similar move in a gel and they produce bands with almost the same width and intensity after staining. Each band is studied as a separate trait and it is assumed that these traits are the relatively direct products of genes. The main method for assessing protein similarities among populations and taxa is to use a similarity criterion (Rahiminejad, 1999). Simple counting of the ratio in which "a" indicates the number of common bands and "b" indicates the total of bands found in two populations or taxa, is the common method for showing the protein similarities. It should be mentioned that this method does not lead into genetic distance (Sahai and Rana, 1977). Seeds proteins electrophoresis is a suitable method for obtaining systematic quantitative information from macromolecules. Also, the pollen protein is used in few cases. Sometimes a mixture of protein essences related to two taxa is put in the stream to assess if bands separate or have a side by side migration. This method could provide the potentiality for a more pure side by side assessment, comparing to putting separate essences and side by side in a gene form (Rahiminejad, 1999). Seed protein profile could contain 20 or more single bands. Band patterns complexity could result in difficulties in interpreting information. Also, by increasing in the number of band and studied populations, the accuracy must be increased, as well. Considering the aforementioned difficulties in seeds protein profiles scores, the stability of mature seed storage protein stability is not affected by the seasonal, environmental and seed longevity fluctuations. Also, these profiles are unique to each species (Ladizinskey and Hymowit, 1979). The main objectives in this research include studying genetic affinity in some lentil genotypes, using seeds morphological traits and seeds protein storages.

Material and methods

In this experiment were used of lentil genotypes (including 26 foreign genotypes and 3 control genotypes). Seed samples were produced, of beans Research Center Agriculture and Natural Resources in Ardebil province east Cost of Iran.

Experimental procedure

We used Pilot project used augmented design as a randomized complete block design with three replications a split-plot design with three replications

Traits

Traits Average based on 10 plant competitors who were randomly selected and analyzed following measurements: green Percent, days to flowering time, number of hooks, hook size, grain yield per unit area, days to reach a plant height, Height, lowest pod, harvest index, number of filled pods per plant, empty pods per plant, seed number per 100 pods, number of primary branches per plant, number of secondary branches per plant, biomass and seed weight.

Protein Extraction

In this stage, 20 healthy and medium seeds from each genotype are selected and after separating lemma and palea, they were pounded between oil-paper. The pounded materials from each genotype were poured in an Eppendorf pipette and each sample specifications were recorded on each sample. 400 microliters of the extracted solution were added to each sample. (0.1 mililiter of solution for 8 mg of the sample) While gels were polymerized, protein extraction operation was done. After adding extracted solution on pounded samples, Eppendorf pipettes are immediately shaken by shaker so that the pipettes contents are fully mixed. During the two hours of protein extraction, the aforementioned operations were done 3 to 4 times until the protein extraction was fully done. After two hours, centrifuge was done for 10 minutes in 10,000 rpm at 4 °C. Solid matters were completely settled, after centrifuge. 200 microliters of supernatant was taken form the solution on Eppendorf pipettes and transferred to the new Eppendorf pipettes by preserving the genotypes traits (extracted protein was preserved at -20 °C)

Proteins Electrophoresis Part

In electrophori studies also, 29genotypes were studied. It is proved that seeds storage protein variety is used in SDS-PAGE for identifying various genotypes and the most common technique used for analyzing mixed protein is the SDS-PAGE method in which proteins are separated based on their sizes (Shehata, 2004).

Bands Identification:

Jaccard similarity coefficient is calculated from the following:

In which, "a" is the control bands in both species and "b" is the number of unique bands in the first species and "c" is the number of unique bands related to the second species.

Protein Bands Cluster Analysis

To conduct the analysis, bands zero and one matrix in NTSYS 2.02e was used. To determine the distance between genotypes simple matching similarity coefficient was used. And to merge the clusters UPGMA method was used.

Results and Discussion
Cluster Analysis Based on Morphological Traits

To study and categorize the studied cultivars, Ward method was used in cluster analysis based on assessed traits in 3groups. Specifications for each cluster are presented below:

- First group includes 9 genotypes (1, 5, 6, 9, 10, 11, 14, 15 and 21) which are high yielding and legged, and also, they obtain a high value in biomass, number of full pods, weight of 100 grains, pod lower height, green percentage, number of empty pods, number of primary and secondary branches among other clusters. (Table 1)
- Second group includes 17 genotypes (2, 3, 4, 7, 8, 12, 13, 16, 17, 18, 19, 20, 22, 23, 24, 25 and 26) which are late flowering and late crop, and also, they obtain a high value in the number of hooks, harvest index and primary and secondary branches among other clusters.
- Third group included the control genotypes (27, 28 and 29) which obtain lower values in all studied traits among studied genotypes.

Hence, it could be concluded that among the aforementioned groups, the first group with genotypes of 1, 5, 6, 9, 10, 11, 14, 15 and 21 is the best group.

Study of Seed Storage Protein Variety Using SDS-PAGE Electrophoresis

During this study, all stored proteins were extracted from seeds. The gel derived from total proteins electrophoresis was coded based on presence or absence of bands (protein pattern). Presence of band was presented by "1" and absence of bands was presented by "0" and a matrix was finally formed.

Protein bands map is presented in Figure 2. Number of bands presence according to the genotypes is presented in Table 2. Bands' molecular weight and their FRs are presented in Table 3. 23 bands were totally studied in this research, whose molecular weight had a change range between 17 to 127.5 KD and their RFs had a change range between 0.27 and 0.98.

The highest number of bands (22) was observed in genotypes of 8 and 21 and control genotype of 27 and the least number of bands (16) was observed in genotypes of 19, and 20. Band numbers of 12, 11, 10, 9, 6, 4, 1, and 17 to 23 with molecular weight of 49.15, 52.89, 58.31, 64.29, 92.72, 104.76, 127.35, 35.79, 33.29, 30.17, 26.06, 23.63, 20.92 and 18.97, respectively, were common between all genotypes. Other bands showed polymorphisms of presence or absence type. Bands number of 2, 3, 5, 7, 8, 13, 14, 15 and 16 showed polymorphisms with molecular

weight of 118.38, 112.71, 99.77, 86.17, 80.09, 44.58, 42.46, 40.43, and 38.51, respectively.

Analysis of Seed Storage Proteins Cluster:

Various cluster analysis methods were reported for protein patterns data (Huff et al., 1993; Liu et al., 1994; Wu & Lin, 1994; Peakall et al., 1995; Huff, 1997). for choosing the categorization method, the Cophenetic coefficient was calculated using NTSYSc 2.02e software whose highest value was related to UPGMA method, based on Jaccard similarity matrix (r=0.79) (Jaccard, 1908). (Table 3) According to the results, the 29 genotypes are divided into 3 groups, so that, the first group included 7 genotypes of G7, G8, G27, G21, G9, G10 and G23 which had a medium yield with medium traits.

The second group included 10 genotype's of G14, G28, G25, G26, G29, G24, G16, G17, G18 and G19 which were late flowering genotypes with highest harvesting index and weight of 100seeds. They were low in other studied traits.

The third group included 12 genotypes of G1, G22, G11, G13, G15, G12, G20, G2, G3, G4, G5 and G6 with highest number of members which were late crop, high yielding and legged. Also, they obtained high values in studied traits. (Table 4)

Comparing the results for categorizations derived from electrophoretic data cluster analysis and categorizations derived from morphologic data cluster analysis, it could be observed that around 10 genotypes are categorized in one group. In other words, categorizations based on morphological traits and protein bands had a consistency at 35%. Similarity coefficient between genotypes based on protein bands were calculated by Jaccard method:

$$\text{Jaccard Coefficient} = \frac{a}{a+b+c}$$

In which, "a" is the control bands in both species and "b" is the number of unique bands in the first species and "c" is the number of unique bands related to the second species (Moqaddam et al., 1994).

It should be mentioned that these coefficients vary between the range of 0.667 and 1. The higher the similarity coefficient between two genotypes, the more the similarity between two genotypes is higher based on protein bands and biochemistry. According to Table 5, the least similarity coefficient was between genotypes of 23 and 14, 17, 18 and 19 and 27 and 8, and 19 and 20 and 7 with 17 and 9 with 18 which show a great difference between genotypes on seed total proteins. To achieve the maximum HYTHROSIS in hybridizations, genotypes, which have the highest difference on protein bands electrophoretic patterns, are mixed.

Table 1: Average traits to distinguish clusters from a cluster analysis of genotypes

Group	Number of genotype	Weight of 100grains	Bio mass	Secondary branches	Primary branches	Seed in 100 pods	Number of empty pods	Number of full pods	Harvest index	Height lowest pod	Height	Days to reach	Yield	Hook sizes	Number of hooks	Flower development	Germination
1	9	04.7	02.1	00.4	00.4	52.265	60.7	80.51	44.60	65.13	82.42	11.2	85.2	00.2	45.2	62.75	27.90
2	17	64.6	72.7	23.4	23.4	47.259	70.10	89.43	85.70	38.13	64.42	14.2	83.1	00.2	00.2	52.78	44.75
3	3	11.4	77.4	00.2	00.2	83.125	68.3	11.23	08.28	90.6	98.20	06.1	34.1	33.1	00.1	33.75	50.92
Total	29	50.6	21.8	93.3	93.3	52.247	01.9	19.44	20.63	79.12	45.40	02.2	10.2	89.1	34.2	29.77	81.81

Table 2: Number of protein electrophoresis to separate bands of lentil genotypes

Genotype	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	L1	L2	L3
Band	18	19	19	19	20	20	21	22	20	19	17	18	17	17	17	17	18	16	16	22	18	19	18	19	19	19	22	17	20

Table 3: bands observed in the electrophoresis of proteins - the molecular weight and relative mobility

Band	Number of Presence	Relative mobility	Molecular weight (KD)
1	29	0.27	127.35
2	14	0.30	118.35
3	8	0.31	112.71
4	29	0.34	104.76
5	4	0.36	99.77
6	29	0.39	92.72
7	28	0.41	86.17
8	6	0.44	80.09
9	29	0.52	64.29
10	29	0.56	58.31
11	29	0.60	52.89
12	29	0.62	49.15
13	14	0.66	44.58
14	23	0.68	42.46
15	27	0.70	40.43
16	12	0.71	38.51
17	29	0.74	35.79
18	29	0.77	33.29
19	29	0.80	30.17
20	28	0.86	26.06
21	29	0.90	23.63
22	29	0.94	20.92
23	29	0.98	18.97

Table 4 - Average cluster analysis groups separately assessed properties

Group	Number genotype	Weight of 100grains	Biomass	Secondary branches	Primary branchs in 100 pods	Seed of empty pods	Number of full pods	Harvest index	Height lowest pod	Height	Days to reach	Yield	Hook sizes	Number of hooks	Flower development	Germination
1	7	6.4	832	7	3.9	239.3	12.8	44.2	51.7	12.6	40.1	198.1	218.1	1.9	2.1	76.3	84.6
2	10	6.7	753.4	6.5	3.7	239.4	8.2	38.6	82.2	11.8	38.1	192.6	192.8	1.8	2.4	78.6	79.8
3	12	6.4	872.4	8	4.2	259.1	7.5	48.9	54.1	13.8	42.6	213.7	219.8	2	2.4	76.8	81.9
Total	-	6.5	821.6	7.2	3.9	247.5	9.5	44.2	63.2	12.8	40.5	202.6	210.0	1.9	2.3	77.3	81.8
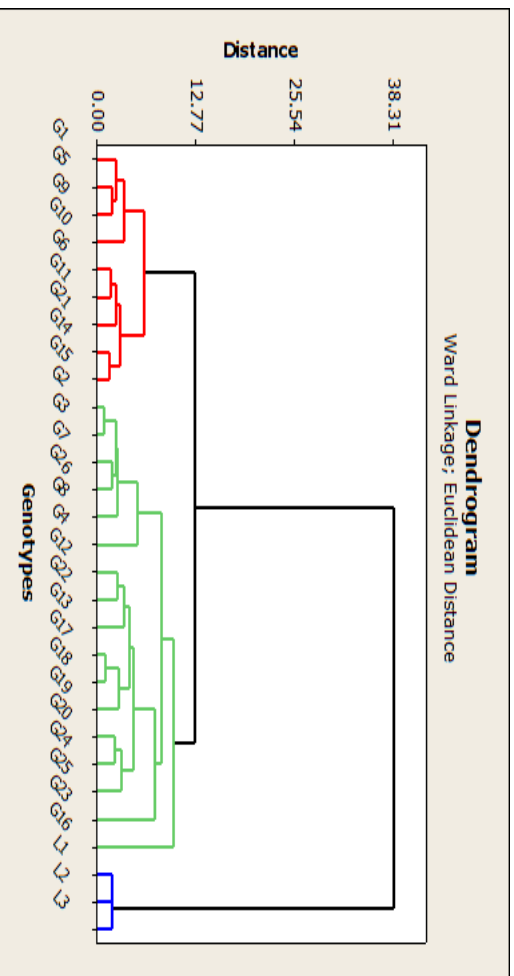
Figure 1: Dendrogram resulting from cluster analysis of minimum variance method (ward) in the genotypes studied and evaluated based on the properties
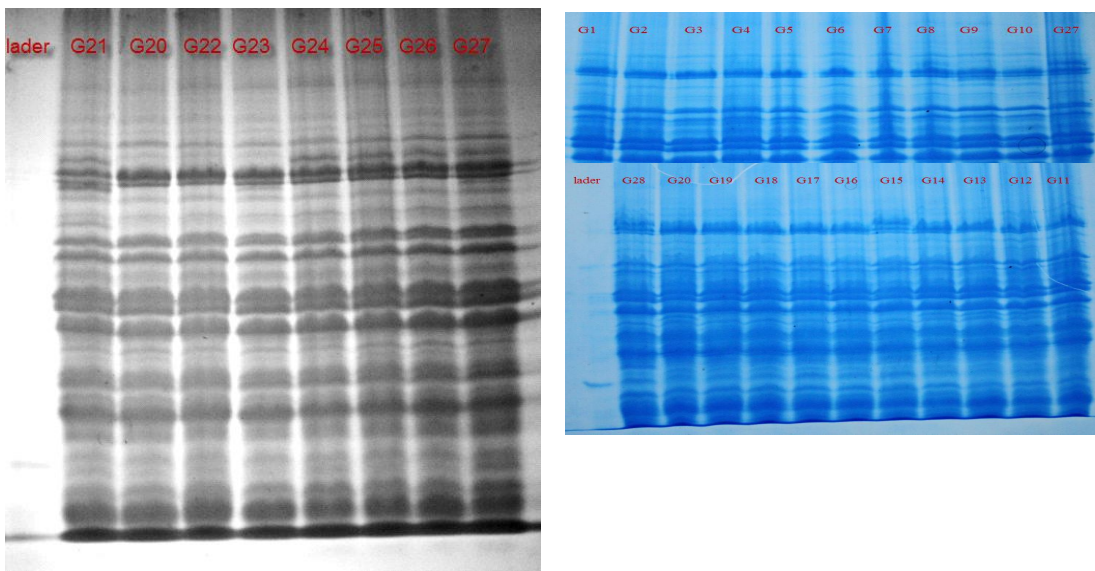
Figure 2: The pattern of protein bands
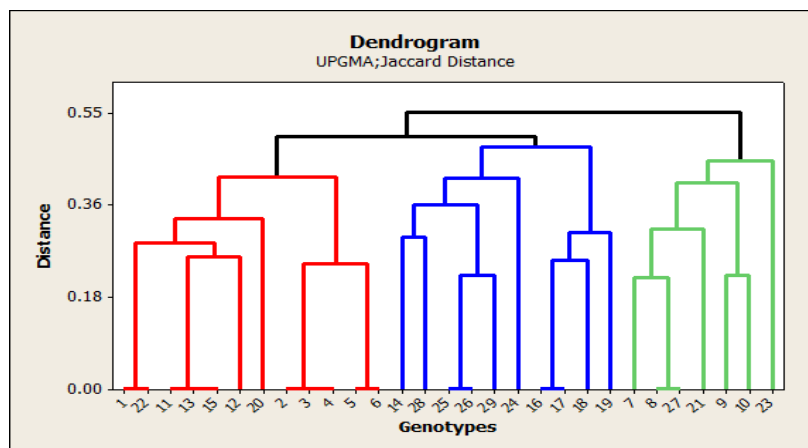
Figure 3: Dendrogram derived from UPGMA cluster analysis in lentil genotypes based on electrophoretic banding patterns

	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	L1	L2	L3
G1	1																												
G2	0.947	1																											
G3	0.947	1.000	1																										
G4	0.947	1.000	1.000	1																									
G5	0.900	0.950	0.950	0.950	1.000																								
G6	0.900	0.950	0.950	0.950	1.000	1.000																							
G7	0.857	0.905	0.905	0.905	0.952	0.952	1.000																						
G8	0.818	0.864	0.864	0.864	0.818	0.818	0.826	1.000																					
G9	0.900	0.857	0.857	0.857	0.909	0.909	0.955	0.864	1.000																				
G10	0.947	0.900	0.900	0.900	0.857	0.857	0.905	0.773	0.850	1.000																			
G11	0.944	0.895	0.895	0.895	0.850	0.850	0.810	0.818	0.850	0.895	1.000																		
G12	0.895	0.850	0.850	0.850	0.900	0.900	0.857	0.773	0.810	0.850	0.944	1.000																	
G13	0.944	0.895	0.895	0.895	0.850	0.850	0.810	0.773	0.850	0.895	1.000	0.944	1.000																
G14	0.842	0.800	0.800	0.800	0.762	0.762	0.727	0.773	0.762	0.800	0.889	0.842	0.889	1.000															
G15	0.944	0.895	0.895	0.895	0.850	0.850	0.810	0.773	0.850	0.895	1.000	0.944	1.000	0.889	1.000														
G16	0.842	0.895	0.895	0.895	0.850	0.850	0.810	0.773	0.762	0.889	0.889	0.842	0.889	0.889	0.889	1.000													
G17	0.842	0.895	0.895	0.895	0.850	0.850	0.810	0.773	0.762	0.889	0.889	0.842	0.889	0.889	0.889	1.000	1.000												
G18	0.800	0.850	0.850	0.850	0.900	0.900	0.857	0.818	0.727	0.762	0.842	0.895	0.842	0.842	0.842	0.944	0.944	1.000											
G19	0.789	0.842	0.842	0.842	0.800	0.800	0.762	0.727	0.714	0.750	0.833	0.789	0.833	0.833	0.833	0.941	0.941	0.889	1.000										
G20	0.889	0.842	0.842	0.842	0.800	0.800	0.762	0.727	0.800	0.842	0.941	0.889	0.941	0.833	0.941	0.833	0.833	0.789	0.778	1.000									
G21	0.818	0.864	0.864	0.864	0.826	0.826	0.870	0.913	0.909	0.864	0.773	0.739	0.773	0.773	0.773	0.773	0.773	0.739	0.727	0.727	1.000								
G22	1.000	0.947	0.947	0.947	0.900	0.900	0.857	0.818	0.900	0.947	0.944	0.895	0.944	0.842	0.944	0.842	0.842	0.800	0.789	0.889	0.818	1.000							
G23	0.850	0.810	0.810	0.810	0.857	0.857	0.818	0.783	0.857	0.800	0.800	0.850	0.800	0.714	0.800	0.714	0.714	0.762	0.667	0.750	0.783	0.850	1.000						
G24	0.800	0.850	0.850	0.850	0.810	0.810	0.773	0.818	0.727	0.762	0.842	0.800	0.842	0.842	0.842	0.842	0.842	0.800	0.789	0.789	0.818	0.800	0.762	1.000					
G25	0.850	0.810	0.810	0.810	0.857	0.857	0.818	0.864	0.773	0.810	0.895	0.947	0.895	0.895	0.895	0.800	0.800	0.850	0.750	0.842	0.783	0.850	0.810	0.850	1.000				
G26	0.850	0.864	0.864	0.864	0.909	0.909	0.955	1.000	0.826	0.864	0.773	0.818	0.773	0.773	0.773	0.773	0.773	0.818	0.727	0.727	0.913	0.818	0.783	0.818	0.864	1.000			
L1	0.818	0.864	0.864	0.864	0.909	0.909	0.955	1.000	0.826	0.864	0.773	0.818	0.773	0.773	0.773	0.773	0.773	0.818	0.727	0.727	0.913	0.818	0.783	0.818	0.864	0.864	1.000		
L2	0.842	0.800	0.800	0.800	0.850	0.850	0.810	0.773	0.762	0.800	0.889	0.944	0.889	0.889	0.889	0.889	0.889	0.944	0.833	0.833	0.696	0.842	0.800	0.750	0.895	0.895	0.826	1.000	
L3	0.810	0.773	0.773	0.773	0.818	0.818	0.783	0.826	0.818	0.773	0.850	0.900	0.850	0.850	0.850	0.762	0.762	0.810	0.714	0.800	0.826	0.810	0.857	0.810	0.950	0.950	0.773	0.850	1.000

Table 5: Jaccard similarity coefficient based on the studied genotypes

Conclusion:

According to cluster analysis results, the first group with genotypes of 1, 5, 6, 9, 10, 11, 14, 15 and 21was the best group.

The most remote distance on protein bands was related to the genotype numbers of 12 and 14, 17, 18 and 19.

The highest number of bands (22) was observed in genotypes of 8 and 21 and control genotype of 27 and the least number of bands (16) was observed in genotypes of 19, and 20.

Bands number of 2, 3, 5, 7, 8, 13, 14, 15 and 16 showed polymorphisms with molecular weight of 118.38, 112.71, 77.99, .1786, 80.09, 58.48, 46.42, 43.40, and 51. 38, respectively.

The third group included 12 genotypes of G1, G22, G11, G13, G15, G12, G20, G2, G3, G4, G5 and G6 with highest number of members which were late crop, high yielding and legged. Also, they obtained high values in studied traits.

categorizations based on morphological traits and protein bands had a consistency at 35%

References

1- Bozorgi, A. 1995. DNA molecular markers in plant breeding. Journal of Construction Research, No. 22, Spring 1373.

2- Huff, D. R., R. Peakall, and Smouse. P. E. 1993. RAPD variation within and among natural populations of outcrossing buffalograss [Buchloë dactyloides (Nutt.) Engelm.]. Theor. Appl. Genet. 86: 927–934. Huff, D.R., 1997. RAPD characterization of heterogeneous perennial ryegrass cultivars. Crop Science, 37: 557-594.

3- Jaccard, P. 1908. Nouvelles researches sur la distribution florale. Bull. Soc. Vaudoise Sci. Natl. 44: 223- 270.

4- Ladizinsky, G., and Hymowitz, T. 1979.Seed Protein Electrophoresis in Taxonomicand Evolutionary Studies. Theor. Appl.Genet., 51:145-151.

5- Liu, Z-H., Jarret, R L., Duncan, R R and Kresovich, S. 1994. Genetic relationship and variation among ecotypes of seashore paspaium (Paspalum vaginaturn) determined by random amplifiecl polymor pHic DNA markers. Genome 37: 101 1-1017.

6- Moghaddam, M, Mohammadi, SA. and Aghaei, M. 1995. Introduction to multivariate statistical methods (translation). Leading publisher of science.

7- Mousavi Zadeh, SA. 2007. Study of genetic diversity of morphological and molecular markers using onions Iran. PhD thesis, Faculty of Agriculture, Tabriz University.

8-Peakall, R, Smouse, P. Eo and Huff, D. R. 1995. Evolutionary implications of allozyme and RADP variation in diploid populations of dioecious buffalograss Buchloe dactyloides. Molecular Ecology, 4: 135-147.

9-Rahimi Nejad, M., 1995, Plant Molecular systematic, Isfahan University Press, 506 pages.

10-Sahai, S. and Rana, R.S. 1977. Seed proteinhomology and elucidation of species relationships in Phaseolus and Vigna species. New Phytol., 79: 527-34.

11-Shehata, M.M. 2004. The roles of seed proteins and RAPD-PCR in genotyping variabilities of some wheat (Triticum vulgare L.) cultivars. Pak. J. Biol. Sci., 7: 984-994.

12-Wu, L. and Lin.IL.1994. Identimg buffalograss (Buchloe dactyloides Nutt. Engelrn) Cultivar breeding b e s using random amplified polymor pHic DNA (RAPD) markers. J. Am. Soc. Hort. Sci. 119: 126-130.

History of Timurid architecture in second half of 14th and 15th Century
In Khorasan and Transoxiana

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Abstract: Timurid architecture, in many aspects, is impressed by Seljuq to Ilkhan architecture, which is viewed by the experts as normal substitute of Ilkhan architecture. In this paper, by use of historical evidences and monuments remained from Timurid dynasty and mentioning significant initiations of this period; it is suggested that the developed Timurid architecture differs from Ilkhan one from the type point of view, grade and rank. Also, the role of Timur in creating the new style of 'Timurid architecture' is identified and its features are classified in order to draw a distinction between Timurid architecture and previous styles. Here, the effects of Timurid style architecture on the architecture in next eras have also been studied. Timurid dynasty as an important part of the history of architecture due to its current geographical extent and political borders has less been studied by the researchers, since historical buildings of Timurid dynasty are located in a variety of countries such as Iran, Afghanistan, Uzbekistan and Turkmenistan, where are hard to access. This paper, by presenting introducing historical evidences, identifies the style and characteristics of Timurid architecture and will expose it to be criticized further by the experts.
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Keywords: history, Timur, Timurid architecture, architectural style, Khorasan, Transoxiana

INTRODUCTION

Timurid architecture is usually thought of as an achievement of Iranian architects delegated to Transoxiana (*Mawarannahr*). For example, Timurid buildings in Herat (Afghanistan) have many similarities to those in Khorasan (Iran). The major Timurid architectural style emerged within a triangle of three cities; Mashhad, Samarkand and Herat. Emphasis on maximum greatest, attention to variety both in- and outdoor, logical and proportionate design, introduction of new types of domes and arches, and richness of color decorations are important features of Timurid architecture style, which originated from Iran and fruited in Central Asia. Architecture of 15th century in Central Asia, known by researchers 'consensus as the climax of Islamic architecture in the region, has an inseparable link to Timurid clan. For better understanding of Timurid architecture, it would better consider the geographical scope of study as vast as possible. Current political borders between Iran, Afghanistan, and Central Asia (in the former Soviet Union) are a great obstacle to reaching an accurate understanding of the situation of Timurid architecture. For this reason, perhaps it would be better to use a composite term: 'Iranian world'. It should be borne in mind that Khorasan borders in middle centuries were far beyond present eastern borders of Iran and it covered many parts of Afghanistan and Central Asia.

Timurid era was a brilliant period from the viewpoint of national cultural and artistic development. In particular, a large number of monuments were created in architecture and associated arts, and innovations were made in order to uplift the art of this country. Timur was a cruel man, but since he visited other countries during his wars, he got familiar with their architecture and certain arts and tried to find a social and cultural reputation for himself, thus he commanded to separate artists and professionals from prisoners of war and sent them to his centers of government such as Samarkand and other adjacent areas to produce artistic monuments and artifacts. On one hand, this resulted in architectural development, and some scientific experiences were expanded on the other.

PROBLEM EXPRESSION AND METHODOLOGY

In the present paper, a historical base research methodology was carried out. In this method, all materials are prepared by referring to historical texts, old historians' books and ancient documents on historical buildings and monuments, and conclusions are made based on analysis of historical texts and remaining monuments leading to answers to requested questions.

By establishing a comparison between Timurid architecture and its predecessor, i.e. Ilkhan's, this paper aims to find appropriate responses for these questions.

- Does Timurid dynasty have a distinct style of architecture to be distinguished from other styles? If yes, then what are the characteristics of this style?
- What was the impression of Timurid architecture on its successor, i.e. Safavid dynasty?

DISCUSSION

The most outstanding artistic monuments dating back to MpngolianIlkhan dynasty in Iran are those buildings in this period, but in this regard it is important to pay attention to an issue and that is Iranian architecture in Ilkhanate era was affected by foreign elements less than

other arts. In fact, architectural style in Ilkhan era was directly adopted from the style of constructions in Seljuq. In other words, Seljuq architecture is a primary form of Ilkhan style" (Wilber, 1995). Bayani is a researcher who has conducted many researches on Timurid architecture. She writes in 'al-e-Jalayer': "when Ilkhanate sultans adopted Islam as their religion and began to establish ties with European and oriental states such as China, a great evolution appeared in Iranian Architecture while the phenomena of the styles from recent to 8th century, that is, the peak of its magnificence still continued until Timur came to throne and brought a new style" (Bayani, 1967).

Bayani holds that Timurid architecture has new style compared to older ones, and writes conclusively in her book that this new style has been created, when Timur came to throne. Timur started his bloody attacks from Iran, and obviously was has first field of battle was Khorasan. Two main factors were main motives for him to attack Iran. First, chaotic interior situation of Iran, of which Timur was fully aware and second, tendency and even invitation of some Iranian high authorities for him to enter Iran. "After Shah Mansour was murdered, Al-e-Mozafar was dethroned and Persia and Persian Iraq were totally occupied by Great GurkanianTimur and his eldest sons in 795" (Dolatshah Samarkandi, 2007).

In Isfahan, ruled by Shah Shojaa Mozafari, an awful catastrophe happened after the people of Mashhad resisted and a number of his army were killed. Under commands of Timur, seventy thousand of people were decapitated, the heads of which formed the material to construct a "pate minaret" (Nezamodin Shami, 1937). Pate minaret was a row of human skulls in between to rows of soil and mud. The range of so large that Khandamir-famous Tumrid historian- says; "in Isfahan, no one survived but Zayandehrud" (Khandamir, 1984).

All historians of Timurid era have precisely recorded Timur's wars and his bloodsheds. After Timur captured new lands, he sent architects and artists to Samarkand. The aim Timur claimed for sending artists to Samarkand was to change that city to the most beautiful capital of world. His intent was certainly not only the pleasure from beauties those artists created by constructing such buildings, but it was creation of such artistically gigantic buildings that terrified his subordinates. Sharafodin Ali Yazdi writes in Zafarname; "he (Amir Timur) opened an independent space in his mind for masons. Thus, his primary constructional activities appeared through giving great deal of importance to Agh Sarai porch in Sabz city and subsequently through commands to destroy and re-construct buildings, which displayed his special glory" (Sharafodin Ali Yazdi, 1957).

Russian orientalist, Bartold, believes that architecture in Timurid era has a new style and he writes in his book (Ulugh Beg and his period); "Timur's services for from the perspective fa constructed in this period in Samarkand were achieved by Iranian architects; from experts' standpoint in magnificence they were superior to Iranian architecture" (Bartold, 1957). Timur particularly favored development of the city of Samarkand and as Sharafodin

Ali Yazdi quotes; "for this purpose, he had gathered experienced engineers and swift architects from Persia, Iraq, Azerbaijan, Darussalam and other countries to the capital". (Sharafodin Ali Yazdi, 1957).

Clavijo, Spanish ambassador, who visited Tumirid palaces in 1404, describes them surprising as Kesh palace in Sabz, the ruins of which reflect its ancient magnificence. About Kesh palace, Mazaheri mentions; "magnificent portals and porches of this palace are also reminders of Sassanid dynasty". (Mazaheri, 1997). As we know, Sassanid dynasty prior to Islam was characterized with masons such as Ctesiphon, which was a symbol of glorious architecture at that time.

To have an evident and glorious architecture, a change in plan and structure was necessary leading to modifications in indoor and outdoor dimensions. At that time, architectural decorations developed in an unusual form and new methods were devised in decorations. Cambridge in Timurid History declares; "polychromic decoration of facades was unique feature of Iranian architecture. Gold and paintings were also used. Hence, in 15th century stucco boss decorations increased, on which was subsequently covered by paintings and gold".

In spite of the fact that Iranian governors and Timurid princes honored the artists, this group and their monuments were somehow at stake. For instance, Khafi, a famous historian in Timurid dynasty writes: "in 807, when Timur returned Samarkand and saw that the porch of 'Saray Mulk Khanum Madrasa' had been built higher than Jameh Mosque, treated two architects of that building (Khajeh Davood and Mohammad Jaled) with anger and ordered them to be executed" (Khafi, 1960).

The largest unique mason of that era was Timur's Jameh Mosque (Friday Mosque) in Samarkand, which named it BibiKhanum Mosque (for his wife) as shown in figure1. This mason was constructed by using the materials plundered from attack to India in 1399-1404. Harold Lamb says about this mosque; "Timur decided to construct a new and renowned mason in memory of victory over India, apparently he had made up his mind before entering Samarkand" (Harold Lomb, 1957).

Figure1. Bibikhanym mosque, Samarkand, Uzbekistan

Ulugh Beg was the biggest and most perfect sample of Timurid madrasas (schools). Sheila Beller describes the architecture of this building; "the mason is a triangle, 81m long, 56m wide with four minarets at each corner.

Elevated portal of this madrasa is 35m high" (Beller and Bloom, 2003).

Hillenbrand writes in 'Aspects of architecture in Timurid dynasty;"Timurid evolved architecture differs with Ilkhanate architecture with respect to type or grade"(Hillenbrand, 2008).

Taking a look at important buildings of Timurid dynasty such as Shahr e Sabz (Kesh) palaces, BibiKhanum Mosque or tomb of the Mausoleum of Khawaja Ahmed Yasawiin Turkistan deliberate choice of gigantic sizes is a major feature of Timurid masons. Parabolic and denticulate domes are another feature of architecture of that era, seen in Gur-e Amir and Goharshād shrine. Several examples of the mentioned pointed are shown in figure 2, 3, 4, 5 and 6.

Timurid architects fundamentally altered traditional arching techniques, which were the legacy of their ancestors and introduced a kind of two-shell dome found in Shah-i-Zinda Ensemble. Once, Timur ordered to kill the architect of his mosque in Samarkand because he was not satisfied by his work.

Another time he charged a group of master to build a labor-intensive mason and warned them if they can not finish the work in ten days, the all will be killed. The group by night and day work, half of which was carried out under the light of torches, could fulfill the order few hours before the deadline. For these reasons, Timurid masters invented some tricks to coat vast highly decorated surfaces. Decorations of walls played an important role and apparently, paintings were neither drawn by hand or instrument but by templates. Pirnia states about Timurid architecture; "in the past, brick facades were together with masonry and the structure became more stable and the façades were more lasting, but in Timurid procedure the building was primarily finished with adobe or brick without any façades, then decorations and façades were added" (Pirnia, 2003). About this, Wilber says; "in Timurid dynasty, as finishing terminated, decorator groups including brick workers, tile-trimmers, painters, calligraphers, etc. came to work (Wilber, 1995). Timing was highly effective in creating Timurid style. At that time, there a need for constructing a variety of structures that had to be prepared at the soonest possible time. Therefore, construction hastened, and use of identical architectural elements as decorations became prevalent.
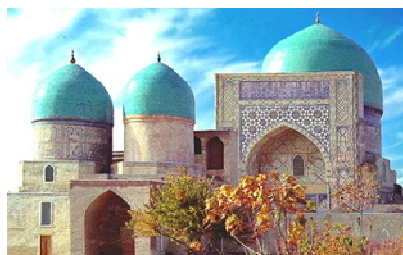
Figure2. Kokgumbaz mosque, Samarkand, Uzbekistan

Figure3. Tomb of Amir (Goore Amir), Uzbekistan

Figure4. Goharshad mosque, Mashhad, Iran
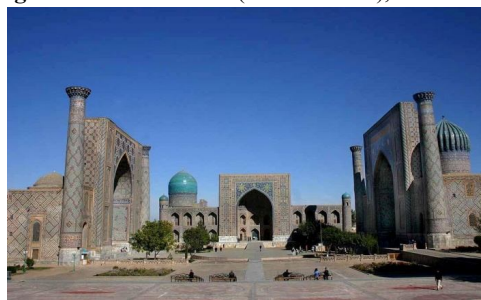
Figure5. Rigestan square, Uzbekistan

Figure6. Herat mosque, Herat, Afghanistan

CONCLUSIONS

To answer the answer to the first question, most researchers and historians contemporaneous to Timur believed that he played a significant role in creating large-scale architecture in order to terrify his subordinates and display the power of his empire. This led to changes in architecture of that period and in introducing a new style. It is obvious that such style never appeared with his vivid authority and influence. In brief, the style and features of Timurid architecture are as follows:

1. Exterior and apparent magnificence of the building as the most important feature of this period.
2. Decorative work apart from the building skeleton
3. High porches and minarets
4. Extensive use of azure color in tile work
5. Innovation of new types of arches and domes as well as high drums
6. Use of gold color or its streaks in painting and tiling
7. Introduction of special patterns in tile work, plasterwork and painting

As an answer to the second question, it is noteworthy that Ilkhanate architecture is exactly the identical to Seljuk's. As it is seen in historical books, Mongolians spend most of their time in battles, but in Timurid dynasty despite a large number of wars and bloodsheds, Timur and his descendants were interested in art and literature. This resulted in changes in Timurid architecture, making it different with previous architectural styles.

For the third question, spread and development of Timurid architectural style throughout the world via migration of architects and artists, who created these kinds of masons, to other regions, also via the information architects of other regions obtained from visiting these masons in Central Asia and receiving their plans. Abundance and high quantity of glorious buildings and frequent construction of them under the rule of Timur in the capital of this powerful king led to royal architectural style, which then became a model other regions and even future dynasties. Dynasties including Safavids, Ottomans and Barbarians ruling these regions not only pursued Timur'sapproach for establishing a capital to exhibit their power but they followed his universal thoughts.

REFFERENCES

1. Bartold V., 1997, Ulugh Beg va zaman wey, Ahmadipour, H (translated in persian), Chehreh Publisher, Tabriz, Iran.
2. Bayani. S, 1967. History of Al e Jalyer, University of Tehran Publications, Tehran, Iran.
3. Pirnia M, 2003. Stylistics of Iranian architecture, Pajoohandeh Publications, Tehran, Iran, 2nd Ed.
4. Khafi, F, 1960, 1962. Majmal Fasihi, Corrected by Mahmood Farrokh, Toos Publisher, Mashhad, Iran.
5. Khandamir, G, 1984. Habib o Seir, edited by Mohammad Dabir Siaghi, Khayam Publisher, Tehran, Iran.
6. Samarkandi, D, 2007. TazkeratoShoara, Research Center for human sciences and cultural studies, Tehran, Iran.
7. Sharafodin Ali Yazdi, 1957. ZafarNameh. Amir Kabir Publications, Tehran, Iran, 2nd Ed.
8. Beller S.S and Bloom J.M, 2003, Art of Islamic architecture in Iran and Central Asia in Ilkhanate and Timurid dynasties, Ministry of Culture and Islamic Guidance, Tehran, Iran
9. Mazaheri, M, 1997. Architecture in Timurid era. Journal of Jeleveh Honar, no 8 and 9.
10. Nezamodin Shami, 1937. ZafarNameh. Al-Sharghieh Institute, in attempt of Phillix Tower, Sharghiyeh Institute, Prague, Republic of Czechoslovakia.
11. Wilber, D, 1995, Architecture of Iran and Tooran. Publication of Cultural Heritage Organization, Tehran, Iran.
12. Lomb, H, 1957, Tamerlane, Amir Kabir Press Institute, Tehran, Iran.
13. Hillenbrand, R, 2008. Aspects of Timurid architecture in Central Asia, Journal of Golestan Honar, no.14.

Response to grain yield in different varieties of maize (*Zea mays* L.) In soil salinity in the Astara region

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ABSTRACT: To study the effect of salinity experiment was performed in Astara region. Cultivars included cultivated in two pieces of land in Astara: one with normal soil and the other with salty soil. Maize cultivars were experimented in three replications on the basis of randomized complete block design. During the experiment, yield characteristics such as ear length, number of rows in ear, Number of grains per row, Number of grains per ear, Biomass per plant, Biological yield in plot and Grain yield in plots were measured. In Saline conditions, the maximum ear length was seen in KSC689; which with other genotypes was difference significant. In The number of rows per ear in both normal and salt stress, a significant difference was observed between genotypes. The minimum number of rows per ear was observed in SC604. Grain weight per ear showed significant difference. Maximum grain weight in ear in normal conditions was observed in S.C704; that with all other varieties showed significant difference. The highest yield was observed in normal conditions in S.C704, that with KSC689, KSC647, SC301 and SC540 showed no significant difference. Lowest yield in saline conditions was observed in SC301.
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Key words: Salinity, Maize, grain yield, Biomass

INTRODUCTION

Maize (*Zea mays* L.) occupies a key position as one of the most important cereals both for human and animal consumption and grown under various conditions in different parts of the world. Maize grain has high food value and its oil is used for cooking purposes while green fodder is quite rich in protein (Dowswell *et al*., 1996).

Earth is a predominantly salty planet, with most of its water containing about 3% NaCl. This concentration of salt has rendered the land very salty. It is projected that about 900 m ha land is affected due to salt, which considerably poses a serious threat to agricultural productivity (Flowers and Yeo, 1995; Munns, 2002) because most agricultural crops will not grow under conditions of high salt concentration. Hence, the existing salinity is a great challenge to food security. The productivity of crops is adversely affected by high salt content in most of the soils (Alam *et al*., 2000). Approximately, 7 % of the world's land area, 20 % of the world's cultivated land, and nearly half of the irrigated land is affected with high salt contents (Szabolcs, 1994; Zhu, 2001). In view of another projection, 2.1% of the global dry land agriculture is affected by salinity (FAO, 2003). More than 800 million hectares of land throughout the world are salt affected, either by salinity (397 million ha) or the associated condition of sodicity (434 million ha) (FAO, 2005). This is over 6% of the world's total land area. Most of this salinity, and all of the sodicity, is natural. However, a significant proportion of cultivated agricultural land has become saline because of land clearing or irrigation. Of the 1500 million ha of land farmed by dry land agriculture, 32 million ha (2%) are affected by secondary salinity to varying degrees. Of the current 230 million ha of irrigated land, 45 million ha are salt-affected (FAO, 2005). High amounts of salts in soils, taking into account both human made and naturally occurring salinization, are responsible for yield reduction on one third of the global arable land. Effects of salinity are more obvious in arid and semiarid regions where limited rainfall, high evapotranspiration, and high temperature associated with poor water and soil management practices are the major contributing factors

(Azevedo Neto *et al.*, 2006). The evaporation rate is generally high and exceeds that of precipitation in such regions. Thus, the insufficient rainfall together with high evaporative demand and shallow ground water in most locations enhances the movement of salts to the soil surface.

Improper irrigation practices and lack of drainage have aggravated the problem leading to significant reductions in crop productivity (FAO, 2003). Selection and breeding have always been the common practices by man for the purpose of high yields and better quality of crops. Selection of crops was also made with reference to environmental conditions and the properties of soil. Historical record show a shift in agriculture in the Tigris-Euphrates basin of ancient Mesopotamia from the cultivation of wheat to the more salt tolerant barley as the fertile but poorly drained soils became increasingly saline (Jacobsen and Adams, 1958). This dynamic problem seems to be more severe when we have a glance at the increasing population, particularly in the third world countries.

Materials and Methods

To study the effect of salinity experiment was performed in Astara region. Cultivars included S.C301, S.C604, S.C540, KSC689, KSC647, S.C704, K3545.6 and Ossk602 and they were cultivated in two pieces of land in Astara: one with normal soil and the other with salty soil. Maize cultivars were experimented in three replications on the basis of randomized complete block design. During the experiment, yield characteristics such as ear length, number of rows in ear, Number of grains per row, Number of grains per ear, Biomass per plant, Biological yield in plot and Grain yield in plots ($4m^2$) were measured.

Statistical analysis of the numbers was done on the basis of randomized complete block design. The average of attendances was calculated on the basis of Duncan method at 5% probability level.

Results and Discussion

Between traits under study, between the environments, between genotype and the interaction genotype and environment, a significant difference was found (Tables 1). Ear length, as one of the yield indicators decreased with increasing salinity. Maximum ear length, in no-stress conditions in genotypes KSC689, K3545.6 and S.C704 respectively 69.55,19.20 and 19.37 cm was observed; that there was no significant difference between them. The minimum length of the ear, in SC301 was found; that was difference significant at the 5% level. Similar results were gained by Blanco et al (2008) and it was shown that together with increase in saltiness dry mass of ear wood, dry mass of leafs and stems, whole dry mass and plant height were reduced significantly.

In Saline conditions, the maximum ear length was seen in KSC689; which with other genotypes was difference significant. In The number of rows per ear in both normal and salt stress, a significant difference was observed between genotypes. Maximum number of rows per ear was observed in OSSK502 in normal conditions; which there were no significant difference with SC540. The minimum number of rows per ear was observed in SC604. Grain weight per ear showed significant difference. Maximum grain weight in ear in normal conditions was observed in S.C704; that with all other varieties showed significant difference. In Salinity conditions SC604, had the highest grain weight in ear; And with varieties S.C704, K3545.6 and KSC689 showed no significant difference. Between varieties, in total biomass per plot, was seen significant difference in normal and saline conditions. The highest biomass was observed in KSC689 which showed no significant difference with S.C704 (Tables 2). Minimum amount of this trait was obtained in SC604 of stress conditions. In plant biomass significant differences were observed between varieties. Maximum plant biomass was seen in KSC689. That with K3545/6 and S.C704 showed no significant difference. The highest yield was observed in normal conditions in S.C704, that with KSC689, KSC647, SC301 and SC540 showed no significant difference. Lowest yield in saline conditions was observed in SC301. Maximum number of grains per row in S.C704 and K3545.6 was observed. That with KSC689 showed no significant difference. The minimum numbers of grains per row were obtained in KSC647 in saline condition. Salinity reduced the number of seeds in row in all genotypes. Maximum number of grains per ear was observed in S.C704 with 610.4. That with K3545.6, Ossk502, KSC689 and SC540 had no significant difference at the 5% level. The lowest number of grains in ear in salty condition was observed in SC301.

Table 1 - Analysis of variance for maize varieties

Mean Square

Source	DF	Grain weight in ear	Number of grains / row	Number rows/ear	Ear length	Number of grains / ear	Biomass per plant	Biological yield in plot	Grain yield in plots
Location	1	**504.8228	**394.979	*100.33	**211.364	**271.344917	**254.613027	**951.1234	**445.2
Error	4	431.2168	071.21	570.2	139.4	633.14860	413.40406	253.21	044.0
Variety	7	**715.5303	**783.116	**752.13	**155.31	**198.25974	**181.83199	**012.68	ns053.0
LV	7	**893.2099	*222.32	ns837.1	**605.3	*014.10853	ns201.13073	ns475.18	ns034.0
Error	28	386.369	309.12	288.1	092.1	838.3881	097.7390	911.9	029.0
CV%		68.17	24.13	35.7	05.7	38.14	14.18	92.22	88.15

ns. Non-significant,
* significant at 5%
**, significant at 1%

Table 2- Mean comparison traits in eight varieties of maize

	Cultivars	Grain weight in ear(g)	Number of grains/row	Number of rows/ear	Ear length (cm)	Number of grains/ear	Biomass per plant (g/plot)	Biological yield in plot (Kg/plot)	Grain yield in plots (Kg/plot)
Normal	1-KSC689	[bc]7.156	[ab]57.35	[bcd]90.15	[a]55.20	[ab]3.592	[a]3.774	[a]79.26	[ab]832.1
	2-KSC647	[h]60.60	[de]31.23	[bc]85.16	[def]40.15	[cdef]428	[d]297	[efgh]73.12	[abc]516.1
	3-OSSK502	[defg]4.115	[cd]39.29	[a]02.19	[bc]62.17	[ab]582	[bc]8.580	[bc]84.20	[bc]408.1
	4-K3545.6	[ab]7.180	[a]40.37	[cde]25.15	[a]69.19	[ab]570	[a]9.734	[bcde]77.17	[bc]470.1
	5-S.C704	[a]1.202	[a]93.38	[cde]37.15	[ab]37.19	[a]4.610	[ab]695	[ab]39.23	[a]383.2
	6-SC604	[cd]4.144	[cd]36.29	[def]13.14	[cde]19.16	[cde]3.431	[bc]551	[efgd]76.13	[bcd]264.1
	7-SC301	[defg]109	[cde]03.24	[bcd]87.15	[efg]57.14	[def]4.389	[bc]540	[cdef]25.16	[ab]945.1
	8-SC540	[cde]7.126	[bc]08.30	[ab]82.17	[cd]13.17	[abc]5.540	[c]3.522	[bcd]92.18	[ab]772.1
-	1-KSC689	[efgh]29.91	[cd]90.28	[cde]62.15	[cd]75.16	[bcd]3.484	[bc]063.542	[fgh]935.10	[cde]859.0
	2-KSC647	[h]34.64	[ef]21	[bc]43.16	[i]703.9	[def]6.372	[d]2.283	[hi]661.7	[cde]952.0
	3-OSSK502	[h]06.56	[ef]24.18	[cde]38.15	[i]653.9	[fg]7.309	[d]23.271	[ghi]907.7	[e]607.0
	4-S.C704	[gh]69.85	[cde]65.23	[ef]52.13	[gh]08.13	[efg]349	[cd]827.425	[ghi]947.9	[de]689.0
	5-K3545.6	[fgh]73.89	[def]65.22	[f]82.12	[fg]65.13	[efg]2.318	[cd]323.431	[efgh]349.12	[cde]036.1
	6-SC604	[cdef]8.124	[cde]65.24	[f]38.12	[gh]23.13	[efg]5.330	[d]157.307	[i]493.4	[de]731.0
	7-SC301	[h]13.63	[f]16.16	[def]01.14	[i]873.8	[g]8.248	[d]167.332	[ghi]164.9	[e]491.0
Salinity	8-SC540	[h]08.69	[ef]56.20	[bc]76.16	[h]51.11	[def]5.374	[d]33.294	[hi]825.6	[e]519.0

* Different letters indicate significant differences at the level of 5%

References:

1. Alam, S. M., A. Ansari and M. A. Khan. 2000. Nuclear Institute of Agriculture, Tando Jam, available at http://www.pakistaneconomist.com/issue2000/issue19&20/i&e3.htm

2. Azevedo Neto, A. D., J. T. Prisco, J. Eneas-Filho, C. E. B. Abreu and E. G. Filho. 2006. Effect of salt stress on antioxidative enzymes and lipid peroxidation in leaves and roots of salt-tolerant and salt-sensitive maize genotypes. Env. Exp. Bot. 56: 87-94.

3. Blanco, F., M. V. Folegatti., H. R. Gheyi., P. D.Fernandes. 2008. Growth and yield of corn irrigated with saline water. Sci. Agric. (Piracicaba, Braz.) ., v.65, n.6, p.574-580.

4. Dowswell, R. C., R. L. Paliwal and Ronald-Cantrell. 1996. Maize is the third World Winrock Development-Oriented Literature Series, West view Press, Boulder, Colo. Pp 268.

5. F. A. O. 2003. Global network on integrated soil management for sustainable use of salt-affected soils. Rome, Italy: FAO Land and Plant Nutr. Manag. Service. http://www.fao.org/ag/agl/agll/spush

6. F. A. O. 2005. Global network on integrated soil management for sustainable use of salt-affected soils. Rome, Italy: FAO Land and Plant Nutr. Manag. Service. http://www.fao.org/ag/agl/agll/spush

7. Flowers, T. J. and A. Yeo. 1995. Breeding for salinity resistance in crops. Where next? Aust. J. Plant Physiol. 22: 875-884.

8. Jacobsen, T and R.M. Adam. 1958. Salt and Silt in Ancient Mesopotamian Agriculture. Science 19. 182: 1257-1258.

9. Munns, R. 2002. Comparative physiology of salt and water stress. Plant, Cell Environ. 25:239-250.

10. Szabolcs, I. 1994. Soils and salinization. In Handbook of Plant and Crop Stress. Ed. M. Pessarakali. Pp. 3-11. Marcel Dekker, New York.

11. Zhu, J. K. 2001. Plant salt tolerance: regulatory pathway, genetic improvement and model systems. Trends Plant Sci. 6: 66-71.

Samarkand Jame' Mosque (BibiKhanym Mosque)

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Abstract: The most important mason remaining from Timurid dynasty is BibiKhanym Mosque or Timur'sJame Mosque. Timur named this mosque after his legendary wife, BibiKhanym. Construction of this mosque altered architectural style and played an important role in introducing new operational approaches for building Jame' mosques. In this paper, important characteristics of this historical mosque have been presented by further research, study and introduction of this mason. Some designing innovations for this building include four minarets at external corners and a pair of minarets at both sides of southern porch, which was prevalent in Iranian architecture in eastern areas. For example, other innovations including design and construction of two domes behind east and west porches of mosques such as Imam Mosque in Isfahan were taken into consideration.

Introduction

Timurid era is an important part of the history of Iranian architecture, which has not been considered sufficiently by Iranian researchers and scholars, since firstly in Iranian architectural methodology and its classification, Timurid architecture is a subset of Azeri architecture, receiving little attention as a subset. In other word, at that time, it was located at a world-wide Iran, the geographical extent of which was much more widespread than current political borders. For example, Khorasan's boundaries in medieval were far beyond eastern part of present Iran, covering many parts of Afghanistan, Central Asia and former Soviet Union. Today, this mason lies in Uzbekistan and it is not subject to Iranian researchers due to lack of easy access. Historical masons of Timurid dynasty changed the Iranian architectural style in a comprehensive and lasting manner. These changes are particularly obvious in terms of new techniques of arching and creation of interior spaces as well as application of colorful tiles especially in azure. Timurid masons were indeed the most beautiful samples of the use of coloring in architecture, constructed up to now.

Religion had a flourishing status in Timurid Khorasan (Hillenbrand, 2007). Timur and his clan highly respected sadat (plural form of sayyed i.e. Prophet Muhammd's descendants). In the book of "Timurid Architecture in Khorasan" O'Kane has mentioned; Sultan Hossien was greatly fond of sayyeds, as his ancestors were. He built a Darossyadah (House of Sayyeds), which had a preacher. Also, he ordained an appropriate fund to feed the pour and dervishes, but at that the number of those who claimed to be on the profitable position of sayyeds grew so much that the head of seyyeds (Naqib) entrusted to prepare a genealogical tree to distinguish true sayyeds from false ones (O'Kane, 1987). Certainly, Amir Timur used religion to canonize his regime. Construction of big mosques such as BibiKhanym Mosque was a sign to show off the power of his empire. Timur chose artists and architects among prisoners of war and sent them to Samarkand to make his capital bigger and more beautiful by producing artistic architectural monuments. In constructing BibiKhanym Mosque, Indian, Azerbaijani and Iranian bricklayers, stonecutters and artists were used. Research on this mosque can be a good way to identify Timurid architecture.

History of the mason and historical background

This mosque was built under the order of Amir Timur and according to the literatures and it was named for the sake and in the name of his -seemingly, Chinese- wife (Manzo, 2003).

The name of architect and designer is not obvious and in historical texts someone called Muhammad Jaled has been mentioned, who was in charge for building the mason. He endeavored a lot in building and founding the mosque and made his utmost efforts in beautifying and decorating it, where he erected four minarets. He was boasting to all architecture masters as if no one else could afford such a huge work (Ibn Arabshah, 1960).

The earthquake, which occurred in Samarkand in 1897, demolished important and elevated parts of the structure (Wilberand Golombek, 1989). The mosque was reconstructed in 1970s. This mosque has been regarded as one of the most important Timurid masons and some

views it as the most magnificent mason of this epoch; a symbol of his power and tendency to dignify his monuments (Blair and Bloom, 2009) and expressed that Samarkand was a jewel for the orient and BibiKhanym Mosque was its jewel (Bulatova and Shishkina, 1986).

Ibn Arabshah briefly states in "The Wonders of Destiny.." how the mosque was constructed. "Timur passed by a mosque in India, which its beauty attracted his sight, its ceiling and portico were in the most perfect state. The courtyard and walls were made by white marble. Those figures pleased him so that he decided to build a similar one in Samarkand. Then he selected a place and ordered to establish a mosque with marbles the sameway. This work was assigned to one of his companions-Muhammad Jaled. He endeavored a lot in building and founding the mosque and made his utmost efforts in beautifying and decorating it, where he erected four minarets. He was boasting him to all architecture masters as if no one else could afford such a huge work. Soon, Timur appreciated him and gave him a high-level position (Ibn Arabshah, 1960).

Yazdi states how Timur decided to begin constructing Jame Mosque in Samarkand in 1398."as inferred from the holy verse 'only he shall visit the mosques of Allah who believes in Allah and the latter day' constructing a mosque is a sign of inherent true belief and divine characters and giving credence to afterlife. The great Tamerlane, in invading India, when he was destroying the foundations of polytheism and demolishing fire temples and pagodas, intended to build a Friday mosque in Samarkand. On one Sunday in Ramadan, 801 HQ, in a blessed day he gathered artists and skillful masters to design it and outstanding laborers and professionals of many countries to found it. Almost 200 Stonecutters from Azerbaijan, Fars and India and other countries were working in the mosque and 500 were cutting stones from mountains...".

The interesting point that both Yazdi and Ibn Arabshah's reports hinted at was design and construction of four minarets, which seemed new to both historians. To decorate the mosque, all around the wall-interiorly and exteriorly- was decorated with cut stone, on which Al-Kahf Chapter and some other holy verses were engraved. It is possible that abundant use of stones and choice of stony structures for the shabistan was inspired of Indian masons; however, definitely Iranian architects have been used to build domes and porches as shown in figures1, 2 and 3. Apparently, this resulted in two types of structure in the mosque's plan which is presented in figure 4 and 5 respectively.

Figure1. BibiKhanym Mosque

In Yazdi and Ibn Arabshah's- two historians at that time-writings, when Timur returned to Samarkand after the war and observed that the mosque portal was higher than the tall madras built under orders of BibiKhanym opposite the mosque, he got annoyed and ordered to execute Muhammad Davood and Muhammad Jaled, who were in charge to supervise the construction in his absence. He also ordered to destroy mosque's portal and rebuild it.

The text of Ibn Arabshah's report states that "When Timur returned of travel and was informed of what had happened in his absence, went to see the mosque. As soon as he saw it, ordered to fell Muhammad Jaled and drag him on the ground, while his feet were tied and invaded his family and property".

Most importantly, the queen, Timur's wife, had collected architects and engineers to build a madrasa opposite the mosque. They founded it firmly and erected its portico. In firmness it was more lasting and in height it was higher than the mosque. Timur was a brutal person and no one could stand against him, those who did this were either suppressed or beheaded. There was no difference between stranger and relative or friend and foe. When he saw the elevation of the madrasa opposite his mosque got so annoyed that did what mentioned above to the miserable supervisor.
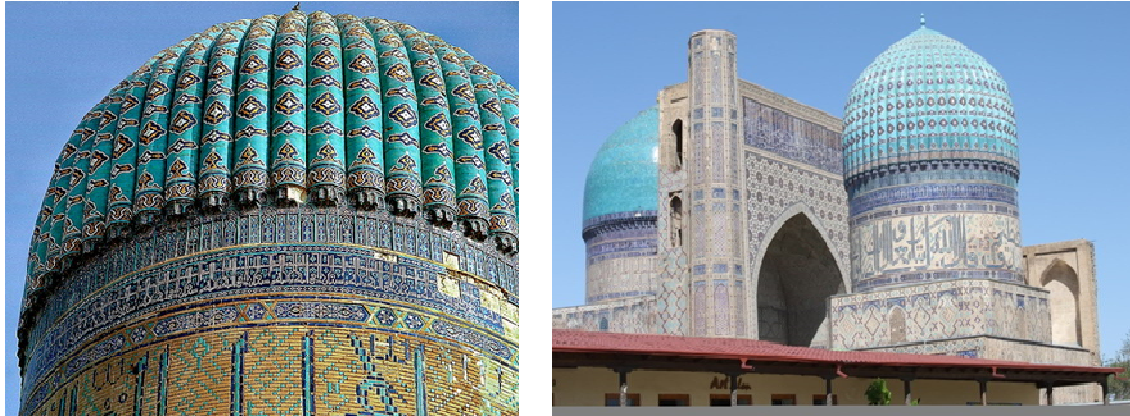
Figure2. Dome of BibiKhanym Mosque

Figure3. Painting of Behzad, building of BibiKhanym Mosque

The stones were heavy, so burdensome that he was not able to bear it. Timur failed to collapse that mason and the fracture was still evident. Then he asked his companions to surround it and say prayer there. This went on until in his life and after he died. When the people were saying their prayer there, they were frightened that God's fear may cause a stone fall from the ceiling (Ibn Arabshah, 1960).

After construction of the mosque finished in 1401, constructional activities started there again, which there are many theories for it. In historical texts, insufficient height and glory of arc former and portal is one reason for further activities (Yazdi, 1986). In Ibn Arabshah's book, structural weaknesses have been pointed in some parts such as dome chamber (Ibn Arabshah, 1960). Pugachenkova believed constructional activities were for increasing sections of the building including dome chamber and entranceway. She reminded that the entranceway was rebuilt (Pugachenkova, 2007).
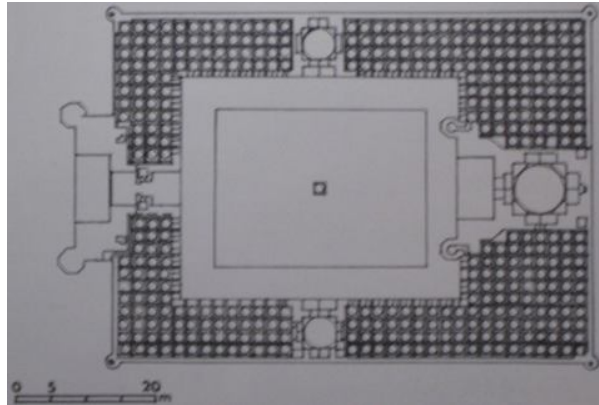
Figure4. Plan of BibiKhanym Mosque

Architectural characteristics of BibiKhanym Mosque

Use of denticulate domes is another form of innovations and features of architecture in this era, applied in this mosque. Gur-e-Amir dome is also one of the most famous domes of this kind. Another innovation in this mosque is two domes behind eastern and western porches. Mosaic tile-worked seven-colored tiles were used for decorating exterior surfaces, but for interior surfaces mainly plasterwork were used. Engraved stones have been mounted on the entranceway portal and on the epigraphs together with gilded pieces (Golombek and Wilber, 1989) since gilded decorations had flourished in this era. To design the architectural form of the mason, a plan consisting four porches and dome chambers were used, inherited from Seljuq architecture.

A pair of minarets on both sides of the entrance porch was common in Ilkhanate era. In this mosque, one more pair of minarets was used each on a side of the porch of Kiblah Shabistan.
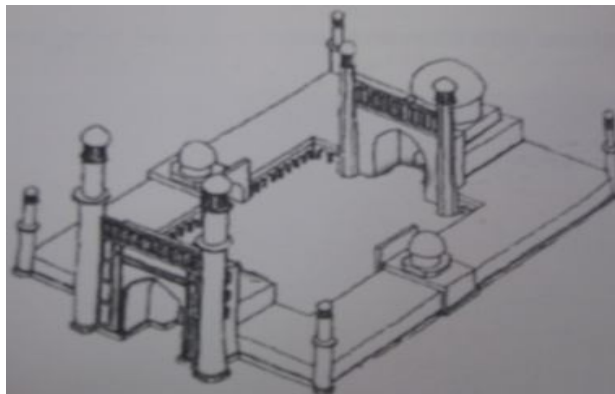
Figure5. 3D of BibiKhanym Mosque

Conclusion:

At the present paper a deep research in historical documents has been carried out to find the methodology of Timurid architecture characteristics. For this case the Bibikhanym Mosque which is the biggest and greatest architectural mason building of Timurid era was selected for detailed study. The obtained results of the study show and suggest that this mosque as a symbol of Timurid architectural is capable to compare with Isfahan Jame' Mosque which is the evolution of Iranian history and a perfect sample, methodology and modifications of Timurid architecture. The evidence of this study showed that this mosque is the best found in the biggest and most magnificent mosque of that period.

References

1. Ibn Arabshah, S, 1960. "Ajaib al-maqdur fi nawa'ibTimur: The Wonders of Destiny Concerning the Calamities Wrought by Tamerlane", translated by Nejati M.A, Tehran
2. O'Kane, B, 1987. "Timurid Architecture in Khurasan",translated by HashemiGolpayegani M.M. Publication organization of Ministry of Culture and Islamic Guidance, Tehran
3. Blair and Bloom, 2009."The Grove encyclopedia of Islamic art and architecture, Iran and central Asia", translated by Akhshini A, Foundation of Islamic Research, Mashahad

4. Pugachenkova, G.A, 2007. Masterpieces of Central Asia, translated byTabatabaie S.D. FarhangestanHonar, Tehran
5. Manzo J.P, 2003, "The Art of the Central Asia".translated byHashemiGolpayegani M.M.AstanGhodRazavi Press, Mashahad
6. Wilber D. and Golombek L. 1989. "The Timurid Architecture of Iran and Turan", translated byAfsar K. and Kiani M.H. Jahad Daneshgahi, Tehran
7. Hillenbrand R, 2007."Islamic Architecture: Form, Function and Meaning", translated by EtesamI. PardazeshvaBarnameriziShahri Company, Tehran
8. Yazdi S.A, 1957. "ZafarNameh", Vol.2,translated by Abbasi M. Amir Kabir Press, Tehran
9. Bulatova.V and Shishkina.G, 1986. "Samarkand: A Museum in the Open", Tashkent, Uzbekistan

Effect of planting date and plant density on morphological traits and yield of four varieties of canola (*Brassica napus* L.) in Astara region

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Abstract: In order to determine of plant density and planting date on morphological traits and yield of Canola a field experimental was conducted in 2008 at Astara region in a Split plot factorial in complete block design with four varieties and three replicates. Treatments were: planting date (08/10/13 and 08/10/28) and two level plant density (42 and 84 plants per m^2). Mean comparison showed that in plant height, Global with 91.91 cm, maximum height and Falcon with 80.46cm height had the lowest (Table 2). Falcon with a 6/729 cm maximum length pods and PF7045 with 5.615 cm, had the lowest pod length. Mean comparison of Variety showed that maximum plant height, yield in plant, biomass plant, yield in plot, oil percentage and number of pods per plant was obtained in Global. Comparison of interaction between Planting date and density, for number of pods per plant showed that the highest number of pods per plant was obtained the first and the second density.

Introduction

Canola (*Brassica napus* L.) is a valuable oil seed that has attracted the attention of many people in recent years. This plant has been given a great importance in the plan for "oil seed import reduction". The canola plant, on account of enjoying high percentage of oil and protein, was ranked third and second, respectively among the oil seeds. This plant grows annually in the favorable weather conditions. The meal and oil are two products extracted from this plant. The canola seed contains 40-50 percent oil (Crubbens and Denton, 2004). Canola oil contains a desirable profile of saturated fatty acids (7%) and high level of unsaturated fatty oleic acids (about 61%) and medium level of unsaturated fatty linoleic acids (21%) and linoleic acid (11%). This plant can easily be placed in alternation with cereals as a one-year autumnal oil-seed plant. Different researches indicate that through the delay in the sowing date, there occurs a decline in the pod number per plant (Asgari and Moradi, 2008), pod number per plant(Angadi et al, 2003), plant height, pod number(Nanda et al,1999), stem number per plant (Ozer, 2003) and finally seed yield and oil quality (Hocking, 2001; Miralles et al, 2001). Christmas (1996) observed that different canola genotypes do not respond so much to the weather conditions. Also Sun et al. (1991) announced that, like different species, different genotypes adapt themselves to specific climatic conditions. Jasinska et al. (1989) reported that seed yield decreased with delay in sowing date. Also Taylor and Smith (1992) concluded that seed yield declined when sowing date is delayed. Johnson et al. (1995) evaluated three canola cultivars at four sowing dates and found that seed yield was the highest at the first two sowing dates. Shafique et al. (1999) in Pakistan evaluated ten canola varieties and reported that delaying sowing date significantly decreased

plant growth and consequently low yield. Kirkland and Johnson (2000) stated that seed yield was greater in the early sowing dates and smaller in the later sowing dates. Horton (2006) found that highest yield of canola was observed from earlier sowings. Growth and yield are functions of a large number of metabolic processes, which are affected by environmental and genetic factors. Gross (1963), reported in the effect of planting date on the growth stages of spring canola that by delaying in planting date, the required time for vegetative and reproductive growth gets shorter which leads to decrease in total performance. Campbell and Kondra (1978), reported that the time of advent of the first flower or vegetative period is the determining factor for maturity, that is: the longer this period, the shorter the duration of next periods (reproductively to maturity); if the reproductive period gets shorter, performance of the crop would be lower. Mahmud Abadi et al (2008) studied the various types of autumnal canola in the region of Bojnoord. They reported that delay (from September 30th to October 26th) in planting the most of its types, leads to a decrease in the plant height and biological performance. To determine the best date for canola planting, an experiment was conducted in the region of Ardabil. Researchers found that planting date of September 20th and 30th, with an average of 3095 and 3036 kg per hectare, respectively are more than planting date of October 10th with the performance of 2390 kg per hectare (Amiri et al, 2008). Saberi et al. (2008) studied the effect of planting date of the yield and grain yield components of various types of canola in the region of Birjand. The obtained results suggested that planting dates of 16.6 and 26th of October has no significant difference in grain yield; and October 6th has the maximum of yield level (1730 kg / ha). Barati et al (2008) conducted a test in the region of

Bojnoored to study the effect of planting date on the growth indices in the various types of canola. Their results suggested that planting date of September 30th, comparing to October 25th and November 11th, is the best planting time because it does not meet the cold season. Various tests in different regions emphasize on the planting of canola in September.

The researches mentioned above show that for reaching to the maximum yield in each region, an optimal density is needed. On the other hand, this amount changes under the effect of different conditions, Changing in the seed or density ratio causes the change of maturity time and/or the way of harvest, so that moisture of seed decreases in harvest time or density increases (Ghosh and Mukhopadhyay ,1994). In researches of Clorke and Simpson (1978), the maximum yield was obtained from the minimum amount of seed (1.5 k/ha) and they concluded that producing of subshrubs and pod, neutralizes the effect of density decrease and the yield is remained fixed or it does not change drastically, but Morrison (1990), reported the increasing of yield under the influence of increasing of density. The decrease of "row spacing" causes increasing of plant spacing on row, and more consistent distribution of them, and it consequently leads to competition decreasing and yield increasing.

An experiment to study the Effects of sowing date and plant density on some morphological traits of canola cultivars was conducted at the Astara region, Guilan, Iran.the purpose of this study was to understand morphological changes in different cultivars at planting dates and plant density.

Materials and Methods

This experiment conducted with 4 varieties Falcon, PF7045, Jerriss and Global on two planting dates (08.10.13 and 08.10.28) and two level plant density (42 and 84 plants per m^2) in a sandy soil. Experiment was conducted in Astara region in a Split plot factorial in complete block design with three replicates. Four varieties as main plots were arranged in main plots and planting dates and density factorial experiment were split into subplots. In this experiment, plant height, Pod length, Seed weight per plant, 1000 grain weight, Number of pods per plant, number of seeds per pod,Biomass per plant,% Oil and yield were measured. After removal of border effects, measurements were carried out on area of 1 m^2 each plot. The data were statistically analyzed by computing MSTAT-C package program with randomized block design.

Results and Discussion

ANOVA with split-plot factorial experiment was conducted in the normal data in randomized complete block and F tests were significant for most traits (Table 1). Mean comparison showed that in plant height, Global with 91.91 cm, maximum height and Falcon with 80.46cm height had the lowest (Table 2). Falcon with a 6.729 cm maximum length pods and PF7045 with 5.615 cm, had the lowest pod length. Planting date in traits of biomass per plant, yield per plot, plant height, number of pods per plant, seeds per pod and seed oil showed a significant difference at the level of 1%. In terms of plant height, no significant difference was observed between the Global and Jerriss. Interaction between varieties and sowing dates showed that maximum plant height, in Global and in first planting date is achieved; that with Jerriss and Falcon varieties, in first planting date was not significant (Table 3). Finally, we can say that the maximum plant height is achieved in the first planting date (Table 4). Increasing plant density increased plant height (Table 5). Mean comparison of Variety showed that maximum plant height, yield in plant, biomass plant, yield in plot, oil percentage and number of pods per plant was obtained in Global. Interactions mean comparison shows that the highest this traits was obtained in the first planting date. In the first planting date, plant biomass (10.15 g), seed yield per plot (333.302 g), number of pods per plant and seeds per pod were the highest. Comparison of planting date in varieties for number of pods per plant showed that no significant differences between the two varieties PF7045 and Global of Planting date (Table 3). Comparison of interaction between Planting date and density, for number of pods per plant showed that the highest number of pods per plant was obtained the first and the second density. Comparison interaction variety and density showed the highest biomass per plant was obtained in second density in Global. Effect of plant density in biomass per plant, yield per plot, number of pods per plant and oil percentage showed significant differences at the level of 1%. Maximum weight of 1000 grains, in Global and in first planting date is achieved. The highest biomass per plant (879.14 g) was obtained in the first density. The highest biomass and yield per plot are obtained in second density. The highest percentage of oil in Global variety was found with 40.26 percent that with other varieties, there were significant differences at the level of 1%. Between varieties in terms of yield per plot, significant differences were observed. Early planting time causes more aggregative absorption of solar radiation and thermal units by plant which leads to height, subshrub and leaf number and consequently biological yield increases. These results are in accordance with the researches of Hodyson (1979), Genkins and Liech (1986), Degendayt and Kondra (1987), Chay and Thurling(1989), Schmidt(1992), Ghosh and Mukhopadhyay(1994). The obtained results correspond with the results obtained by the researches of Norton *et al(1991)*, Taylor and Smith (1992), Gross (1963), Yousuf and Bullock (1993), Darby (1994), Singh *et al*.(1996).

Table 1. Analysis of variance on mean of squares of measured traits on canola

variety	Number of seeds/Pod	Number of pods/ plant	Pod length(cm)	Oil%	Yield / plot(g)	Biomass /plant(g)	Yield / plant(g)	Plant height(cm)
Falcon	20.73^B	54.72^C	6.729^A	48.75^B	238.3^C	10.28^B	2.162^C	80.46^C
PF7045	16.74^C	81.98^A	5.615^C	47.72^C	275.9^B	11.29^B	3.035^B	$83.15B^C$
Jerriss	25.95^A	68.14^B	6.354^B	48.71^B	257.8^{BC}	16.33^A	3.889^A	88.12^{AB}
Global	20.21^B	84.16^A	6.112^B	49.26^A	327.1^A	17.33^A	3.897^A	9191^A

** and *: Significant at 0.01 and 0.05 probability levels.

Table 2- Mean comparison traits in four varieties of canola

variety	planting dates	Plant height(cm)	Number of pods/ plant	1000 grain weight(g)	Biomass /plant(g)	Yield / plant(g)	Yield / plot(g)
Falcon	08.10.13	90.94^{ABC}	61^D	2.122^{CDE}	11.9^{DE}	2.767^C	296.3^{BC}
	08.10.28	69.98^E	48.42^E	2.48^{BCD}	8.667^F	1.557^D	180.2^E
PF7045	08.10.13	84.46^{CD}	82.92^A	2.282^{BCDE}	13.17^{CD}	2.653^C	327.6^B
	08.10.28	81.84^D	80.66^A	2.605^{ABC}	9.417^{EF}	3.417^B	224.2^D
Jerriss	08.10.13	92.95^{AB}	71.88^{BC}	2.052^{DE}	16.17^{ABC}	2.777^C	219.7^D
	08.10.28	83.29^D	64.40^{CD}	2.69^{AB}	16.50^{AB}	5.002^A	295.8^{BC}
Global	08.10.13	95.88^A	79.84^{AB}	2.978^A	19.17^A	4.763^A	365.7^A
	08.10.28	87.94^{BCD}	88.46^A	2.830^E	15.50^{BC}	3.030^{BC}	288.6^C

* Different letters indicate significant differences at the level of 5%

Table 3 - mean comparison of interaction variety and sowing date

s.o.v	DF	Yield / plot	Yield / plant	Biomass /plant	Number of seeds/Pod	Number of pods/ Plant	Oil%	Pod length	1000 grain weight	Plant height
replication	2	111.249	0.084	0.869	4.363	10.716	0.018	0.087	0.044	0.763
variety	3	**17464.965	**8.29	**150.242	**173.127	**560.515	**4.944	**2.615	^{ns} 0.044	*312.923
error	6	388.848	0.047	3.669	2.239	18	0.008	0.131	0.077	47.426
date	1	**36476.213	0.002^{ns}	** 79/825	**73.507	^{ns} 37.031	**1.613	^{ns} 0.145	^{ns} 0.022	**1272.25
var*date	3	** 23735.819	**10.001	^{ns} 11.464	20.483^{ns}	**61.464	**8.801	^{ns} 0.044	**1.952	**178.609
density	1	** 22568.013	^{ns} 0.169	**54.827	^{ns} 5.031	*66.977	** 3.162	^{ns} 0.023	0.001^{ns}	91.964^{ns}
var* density	3	** 9180.806	** 1.279	**35.466	^{ns} 8.720	**62.585	** 0.426	^{ns} 0.068	**2.841	^{ns} 63.94
date*density	1	**51945.156	^{ns} 0.142	^{ns} 0.0005	^{ns} 2.921	*57.597	** 3.741	^{ns} 0.267	^{ns} 0.009	28.985 ^{ns}
date* density* var	3	**2353.962	^{ns} 0.830	^{ns} 5.317	*45.712	^{ns} 24.103	** 1.744	^{ns} 0.224	**0.725	**150.406
error	24	888.877	0.162	6.082	7.855	12.022	0.007	0.150	0.145	33.423
%CV		10.85	12.39	17.86	13.40	4.80	0.18	6.25	16.02	6.73

* Different letters indicate significant differences at the level of 5%

Table 4 - mean comparison of traits at different planting dates

planting dates	Plant height(cm)	Number of pods/ plant	Number of seeds/Pod	1000 grain weight	Oil%	Biomass /plant	Yield / plant	Yield / plot
08.10.13	91/059	74	22/145	2/385	48/795	15/10	3/282	302/333
08.10.28	80/762	74/49	19/67	2/401	48/428	12/521	3/251	247/2

Table 5 - mean comparison of traits at different plant density

density	Plant height (cm)	Number of pods/ plant	Number of seeds/ Pod	1000 grain weight	Oil%	Biomass /plant	Yield / plant	Yield / plot
84 plant/m^2	87/295	69/88	21/232	2/385	48/355	12/742	3/186	296/45
42 plant/m^2	84/526	74/61	20/584	2/375	48/868	14/879	3/347	253/083

References:

1. Amiri S, Siadat A, Khanzadeh H, Jahani Y .2008. Determination of suitable planning date for canola varieties in the region of Ardabil. The summary of the articles of the Tenth Congress of Agriculture and Plant Breeding Science of Iran, 2008 August 19th-20th, Karaj.

2. Angadi, S.V., H.W. Cutforth, B.G. McConkey and Y. Gan, 2003. Yield adjustment by canola grown at different plant population under semiarid conditions. Crop Sci., 43: 1358-1366.

3. Asgari, A. and A. Moradie-dalini, 2008. Evaluation, yield components and vegetative characters of rapeseed cultivars in different planting date. Seed and Plant J., 23: 419-430.

4. Barati M, Azizi M, Gazanchian A .2008. Evaluation of correlation coefficients of different characteristics about 8 types of canola in the optimal and delayed planting dates. The summary of the articles of the Tenth Congress of Agriculture and Plant Breeding Science of Iran, 2008 August 19th-20th, Karaj.

5. Campbell DC, Kondra ZP .1978. Relationships among growth Patterns, yield, yield components of Rapeseed. Canadian Journal of Plant science.58: 87-93.

6. Chay P, Thurling N .1989. Variation pod length in spring Rape (*Brassica napus*) and its effect on seed yield component. Journal of Agricultural Science, 113: 139-147.

7. Christmas, E.P., 1996. Evaluation of planting date for winter canola production in Indiana, pp: 139-147. In: J. Janhc, (ed.) progress in new crops. ASHS press, Alexandria, AV.

8. Clarke JM, Simpson GM .1978. Growth analysis of Brassica napus CV. Tower. Canadian Journal of Plant Science. 58: 587-595.

9. Crubbens, G.T.H. and O.A. Denton, 2004. Plant Resources of Tropical Africa. 2 Vegetables, PROTA foundation, Wageningen, Netherlands /Backhuys Publishers, leiden, Netherlands / CTA, Wageningen Netherlands, pp: 668.

10. Darby RJ .1994. Effects of methods of cereal straw disposal, seed bed preparation and sowing method on the establishment, yield and oil content of winter oil seed Rape (*Brassica napus*). Journal of Agricultural Science. 122: 393-404.

11. Degendayt DF, Kondra ZP .1987. The influence of seeding date and seeding rate on seed yeild and seed component of five genotypes of Brassica. Canadian Journal of plant Science. 67: 175-183.

12. Genkins PD, Leich MH .1986. Effect of sowing date on the growth and yield of winter oil seed Rape (B. napus). Journal of Agricultural Science. 105: 405-402.

13. Ghosh D, Mukhopadhyay D .1994. Growth and productivity of Indian Rapeseed (Brassica compestris L.) growth under short and mild winter condition of west Bengel. Indian Journal of Agricultural Research. 28: 239-244.

14. Gross ATH .1963. Effect of planting date on yield, plant height, flowering and maturity of Rape and Turnip Rape. Agronomy Journal, 56: 76-78.

15. Hocking, P.J., 2001. Effect of sowing time on nitrate and total nitrogen concentration in field-grown canola (*Brassica napus* L.) and implications for plant analysis. J. Plant Nutrition, 24(1): 43-59.

16. Hodyson AS .1979. Rape seed adaptation Northern New South Wales III. Yield, yield component and grain guality of Brassica compestris and Brassica napus in Relation to planting date. Australian Journal of Agricultural Research. 30: 19-27.

17. Horton, D.S., 2006. Determination of optimum planting date of seven species of winter oil seeds in Mississippi, The ACSSA-SSSA.

International Annual Meeting .http://a-c-s.confex.com/crops/ 2006am/techprogramstaticfiles/ banner.jpg.

18. Jansinka, Z., A. Kotecki; W. Malarz, A. Horodyski, B. Musnicka, C. Musnicki, M. Jodlowski, W. Budzynski, K. Majkowski; E. Wrobel and B. Sikora, 1989. Effect of sowing date and sowing rate on the development and seed yields of winter rape cultivars. Buile. Institi. Hodowli - I - Aklimatyzacji Roslin., 169: 111-119.

19. Johnson, B., K. Muckay, A. Schneiter, B. Hanson and B. Schatz, 1995. Influence of planting date on canola and crambe production. J. Prod. Agric., 8: 594-599.

20. Kirkland, K. and E. Johnson, 2000. Alternative seeding dates affect canola yield quality, Canad. J. Pl. Sci., 80: 713-719.

21. MahmudAbadi A, Azizi M, Gazanchian A .2008. The effect of planting date on the agriculture of different types of winter canola in the region of Bojnoored. The summary of the articles of the Tenth Congress of Agriculture and Plant Breeding Science of Iran, 1387 August 19th-20th, Karaj.

22. Miralles, D.J., B.C. Ferro and G.A. Slafer, 2001. Developmental responses to sowing date in wheat, barly and rapeseed. Field Crops Res., 71: 211-223.

23. Morrison M, Mcvetty BE, Scarth R .1990 a. Effect of row spacing and seeding rates on summer rape in Southern Manitoba. Canadian Journal of Plant. Science. 70: 127-137.

24. Nanda, R., S.C. Bhargava, D.P.S. Tomar and H.M. Rawson, 1999. Phenological development of *Brassica compestris*. Field crops Res., 46(1-3): 93-103.

25. Norton GP, Bilsborrow E, shipway PA .1991. comparative physiology of divergent types of

winter rape seed. Proceeding of GCIRC congress. 1051-1055.

26. Ozer, H., 2003. Sowing date and nitrogen rate effects on growth, yield and yield components of two summer rapeseed cultivars. European J. Agronomy, 19(3): 453-463.

27. Saberi MH, Ramezani R, Decembermjuo M, Tajalli V .2008. The effects of planting date on the yield and yield components of canola types (*Brassica napus* L.) in the region of Birjand. The summary of the articles of the Tenth Congress of Agriculture and Plant Breeding Science of Iran, 2008 August 19th-20th, Karaj.

28. Schmidt WH .1992. " Canola, Ohio's newest crop". Proceeding institute of canola conference. Saskatoon, Canada. 53-64.

29. Shafique, M., M. Anwar, M. Ashraf and B. Moula, 1999. The impact of sowing time on aphid management of canola varieties, Pak. K. of Zool., 31: 361-363.

30. Singh S, Pannu RK, chand M .1996. Effect of sowing time on radiation characteristic and heat unit requirement of Brassica genotypes. Crop Research 11: 145-150.

31. Sun, W.C., Q.Y. Pan and Y.P. Yang, 1991. *Brassica* and *Brassica* related oilseed crops in Gansu, china. Pp1130-1135. In:Mc Gregor, D. I. (ed.) proceedings' of the Eighth International Rapeseed congress, Saskatoon, Canada.

32. Taylor, A.J. and C.J. Smith, 1992. Effect of sowing date and seeding rate on yield and yield components of irrigation canola growth on red-brown earth in South Eastern Australia, Aust. J. Agric. Res., 7: 1629-1641.

33. Yusuf RI, Bullock DG .1993. Effect of several production factors on two varieties of Rape seed in central of United States. Journal of Plant Nutrient: 1279-1288.

The Relationship between perceived organizational support and organizational trust among male   high school teachers in the city Isfahan in academic years 2011-2012

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Abstract: The present study aimed to determine the relationship between perceived organizational support and organizational trust among male high school teachers in Isfahan using a descriptive-correlation method. The study population consisted of all high school male teachers in the city in academic years 2011-2012 and they were 3932 people. Using Cohen et al,. Proposed table and a stratified random sampling method, proportional to the size of this study, 350 people were chosen to participate. The instruments used in this study were Aizenbergr et al,. organizational support (1986) and Sashkin organizational trust inventory (1988), respectively. Face and content validity of both questionnaires were confirmed by faculty advisors and several experts. Validity of the questionnaire was .91 for institutional support questionnaire and .78 for organizational trust questionnaire using Cronbach's alpha coefficient, showing the high validity of the research instruments. In order to analyze data, descriptive statistics and inferential statistics, including Pearson correlation, ANOVA and post hoc test were used. Results of the research main question showed that there is a significant relationship between perceived organizational support and organizational trust $(0.01 > P, r=0.398)$. The results also showed that there is a significant relationship between perceived organizational support and trust including the stability in managers behavior to different people $(0.01 > P, r=0.160)$, the stability of the manager's behavior in different situations $(0.01 > P, r=0.399)$, accuracy of information given by managers $(0.01 > P, r=0.475)$, true discourse of the manager to predict future $(0.01 > P, r=0.405)$, manager's promise and activity consistency$(0.05 > P, r=0.123)$, true discourse of manager to predict future outcome $(0.01 > P, r=0.484)$ and reliability of the manager $(0.01 > P, r=0.259)$. The results showed that there is no significant relationship between perceived organizational support and Manager's stability to different people $(0.05 > P, r=0.006)$, stability in manager's speech in various positions $(0.05 > P, r=0.019)$ and manager speech compliant with his past behavior $(0.05 > P, r=0.078)$. There was no significant difference between the respondents comment in any aspect of demographic factors, except of the degree of trust variable.

Introduction

Investigating on evolution of human resource management indicates that attention to human and human indicators in the world of organization and management has been the spotlight of management experts for a long time. This attention has increased day to day so that today manpower is called organizations' customers. This means that in the new age, necessity of accountability to basic needs of staff is in the first place in every organization, because reaching organization goals depends on meeting logical, legitimate desires and goals of human resources. In this regard, one of the man issues which must be considered is paying attention to staff and creating a supportive atmosphere. Organizational support of staff causes elevating mood and job satisfaction which are very effective and important in organization's high efficiency.

In Sundquist & Yang's viewpoints, perceived support can be investigated as one of the most important social units where people spend most of their times. Perceived organizational support is a state which based on it, one feels organization considers him as an important, useful and remarkable man and needs to his services(Sundquist&Yang,2006). According to organizational support theory, when an organization pays attention to common values and wellbeing of staff, they feel a high level of

perceived organizational support (Rhoades & Eisenberger, 2002). Staff with high level of perceived organizational support, has more commitment to organization, make effort for it and have a higher level of job satisfaction (Zampetakis et al, 2009). There is less probability to see the absence of such staff or also to secede (Eisenberger et al, 1986).

Staff, who experiences a deal amount of perceived organizational support, feels that they must play role in regard to proper attitudes and behaviors in organization so that their actions would be in direction of their desired organization's benefits, thereby makes up organization's support (Eisenberger et al, 1997).

Lamastro believes that perceived organizational support provides increasing productivity performance to help colleagues, organization progress, emotional commitment to organization and organizational citizenship behavior. Perceived organizational support is considered as the concept of social wealth. Social wealth refers to goodwill, friendship, mutual empathy, and social interaction between groups of people who form a social unit(Lamastro,2000). The main reflection in perceived organizational support is that family, friends and colleagues are very important possessions and people will get needed support from them in necessary situations with respect to internal trust to them (Hanifan, 1916).

Organizational support structure is criteria based which staff evaluates organization's emotional commitment to them. Some actions such as staff needs and recognizing their abilities and actions are some of these criteria. Staff who has high level of perceived organizational support, believes that organization pays attention to them and compensates to their remarkable actions. In contrast, staff who has low level of perceived organizational support believes that organization managers do not understand them, do not know their certain needs and prefer to replace them with another (Eisenberger et al, 1986).

Generally, staff who perceives high levels of organizational support more likely will have higher commitment and job satisfaction feeling and also more readiness to do meta-role behaviors or organizational citizenship than those who feels organization does not value them a lot (Organ, 1988). Trust is also other consequences of perceived organizational support in addition to job satisfaction and commitment.

Robbins believes mutual trust among members is one of the main features of organizations which have a great performance. That is, members believe on each other's ability and honesty a lot. Belief is a critical phenomenon which takes a lot of time to create but it is easy to undo and it is not so simple work to regain it(Robbins,2008). In Sergiovani's viewpoint trust is necessary to ethical leadership and organization management(Sergiovani,1992). Levin explains an assurance which is perceived by staff is a sign of effect of trust element. Also, conducted studies on trust indicate that trust is based on experience and is learnt(Levin,1999).

Trust increases efficiency of communications and also organizational cooperation. It is also recognized as an important fundamental factor in level of efficiency or manager efficiency, staff satisfaction and their commitments and performance (Ellonen et al, 2008). Trust causes improvement and promotion of managers and staff, as in such environment, ideas is freely exchanged, and open relationships associated with respects are in organization. Humans need trust from birth to death; trust is a feeling that is required in family, school, work life and among friends (Erden & Erden, 2009).

Trust has different dimensions. In a categorization which is done by Sashkin trust has been divided to ten dimensions including "constancy in manager's behavior to different people, constancy in manager's speech to different people, constancy in manager's behavior in different situations, constancy in manager's speech in different situations, appropriateness in proposed information by manager, consistence in manager's speech with his past behavior, accuracy in manager's speech to anticipate future behavior, consistence in manager's promise, accuracy in manager's speech to participate future results, and reliability to manager"(Sashkin,1988).

In organizations where trust is low, staff acts in a higher level of stress, are not involved in making decisions, are incriminated when wrong decisions are adapted, behave with suspicion and distrust, meets communicational barriers, does not receive honest and open information and as a result, making decision process becomes weak, decisions quality come down, staff focus on work is divested and finally efficiency is reduced. In addition, in lack of trust, innovation is also low. In such organizations, staff is scared about failing of new plans, being excommunicated by managers and colleagues (Baird & Amand, 1995). This is while Toreh believes that trust is a main core for contemporary managers' performance(Toreh,2005). One of the most important performances of contemporary

managers is investigating on organization capital which is human resources. Some investigations have been conducted in regard to perceived organizational support and trust as effective components of internal issues in organizations. Annmalaei (2010), Saekoo et al (2011) and Ngang (2012)'s researches are some conducted ones in this field.
Research questions

Main question
Is there any relation between perceived organizational support and organizational trust among teachers of male high schools in Isfahan city?
Secondary question
Is there any relation between perceived organizational support and trust dimensions (constancy in manager's behavior to different people, constancy in manager's speech to different people, constancy in manager's behavior in different situations, constancy in manager's speech in different situations, appropriateness in proposed information by manager, consistence in manager's speech with his past behavior, accuracy in manager's speech to anticipate future behavior, consistence in manager's promise, accuracy in manager's speech to participate future results, and reliability to manager)?

Method of study, community, sample, sampling method, study tools

Method of present study is correlational – descriptive. Statistical community in this study is all teachers of male high schools in number of 3932. In present study, estimation of sample content was 350 people, using Cohen et al (2000) table. Method of sampling in this study is Stratified random method corresponding to the content. Tools used in the present study are two questionnaires on organizational support and organizational trust.
Eisenberger et al (1986) questionnaire on organizational support: this questionnaire contains 34 closed-answer questions based on Lickrate's five-degree scale. Reliability coefficient of the questionnaire was calculated in terms of Cronbach's alpha using software SPSS and was estimated 0.91.
B: Sashkin (1988) questionnaire on organizational trust: this questionnaire contains 50 closed-answer questions based on Lickrate's five-degree scale. Reliability coefficient of the questionnaire was also calculated in terms of Cronbach's alpha and was estimated 0.78.

Results
Is there any relation between perceived organizational support and organizational trust among teachers of male high schools in Isfahan city?

Table (1) correlation coefficient between perceived organizational support and organizational trust

Perceived organizational support			
Statistical indicator			
	Correlation coefficient	Square of the Correlation coefficient	Significance level
Organizational trust	** 0.398	0.158	0.001
		P< 0.01	

The data in table (1) shows that correlation coefficient between perceived organizational support and organizational trust is meaningful. According to coefficient of identification (r^2), variance of perceived organizational support and organizational trust was 15.8%.
2. Is there any relation between perceived organizational support and trust dimensions?

Table (2) correlation coefficient matrix between studied variables

Variables	Correlation coefficient	Square of the Correlation coefficient	Significance level
constancy in manager's behavior to different people	** 0.160	0.026	0.005
P< 0.01			
constancy in manager's speech to different people	- 0.006	0.000	0.916
P< 0.05			
constancy in manager's behavior in different situations	** 0.399	0.159	0.001
P< 0.01			
constancy in manager's speech in different situations	0.019	0.000	0.746
P< 0.05			
appropriateness in proposed information by manager	** 0.475	0.226	0.001
P< 0.01			
consistence in manager's speech with his past behavior	0.078	0.006	0.178
P< 0.05			
accuracy in manager's speech to anticipate future behavior	** 0.405	0.164	0.001
P< 0.01			
consistence in manager's promise	** 0.123	0.015	0.033
P< 0.05			
accuracy in manager's speech to participate future results	** 0.484	0.234	0.001
P< 0.01			
reliability to manager	** 0.259	0.067	0.001
P< 0.01			

Discussion

Analyzing the data indicated that there is a relation between perceived organizational support and most of the components and job trust dimensions (accuracy in manager's speech to anticipate future, constancy in manager's behavior in different situations, reliability to manager, constancy in manager's behavior to different people, accuracy in manager's speech to anticipate future behavior, appropriateness in proposed information by manager, consistence in manager's promise) except these dimensions (constancy in manager's speech to different people, constancy in manager's speech in different situations, consistence in manager's speech with his past behavior). Therefore, it can be mentioned that job trust increases by increasing the level of organizational support. On the other hand,

managers who are more supportive can create a more reliable atmosphere. This conclusion is in the same direction of Annamalaei, Saekoo et al and Ngang studies. The result of Annamalaei's study states that there is a positive and strong relation between organizational trust and job satisfaction with job performance(Annamalaei,2010). According to their study, Saekoo et al indicated that there is a positive relation between perceived organizational support and trust, and perceived organizational support impacts on trust, but perceived organizational support does not impact job commitments as much as trust(Saekoo et al,2011). Ngang's study results indicated that ninety percent of the studied high schools have a desired level of organizational trust and there is a positive and so strong relation between perceived organizational

support and trust which is about .075(Ngang,2012).

This study results showed that there is a positive and meaningful relation between perceived organizational support and constancy in manager's behavior to different people, in this case, staff considers manager behavior fair and just and without any exemption for some staff and concludes that Criterion governs in their respective organization, therefore their trust to manager will increase in dimension of behavioral constancy. Also, there was a positive and meaningful relation between perceived organizational support and manager's behavior constancy in different situations. Lacking of incoherence between manager actions in different situations, appropriateness between speech and perseverance are features that lead to staff trust on manager. Supportive managers are usually those who have enough recognition about the situation, have analytical skills avoid from wishful statements, monitoring in behavior and action and put improvement patterns based on thought. According to this study, there is a positive and meaningful relation between perceived organizational support and appropriateness in manager's proposed information. It is obvious that efficiency and effectiveness duties need accurate, in time, clear and exact information. Therefore, managers cannot support their staff but prevent providing them with information. As, any kind of growth, development and alignment with organization goals depends on related organizational information. There is a positive and meaningful relation between perceived organizational support and accuracy in manager's speech to anticipate future. Accuracy in manager's speech to anticipate future is of abilities which represent the level of manager's honesty and personal commitment. Managers, who have a higher level of this ability, have certainly more acceptability and reliability among their staff. It is obvious, the more commitments and promise a manager has, the more reliability he has among their staff.

There was a positive and meaningful relation between perceived organizational support and consistence in manager's promise. One of the most useful and the simplest ways of encouraging reliability is meeting commitments by manager. The process of leading staff to meeting commitments and doing tasks in their best way requires having high commitment by managers and those who have power. In addition, there was a positive and meaningful relation between

perceived organizational support and accuracy in manager's speech to anticipate future results. Managers who have prospective science can usually anticipate future changes, warn consequences of actions. Manager's experiences and sources as well as proficiency provide this perspective for staff that managers anticipated realistically and can anticipate future results based on managerial awareness without speculation. There was also a positive and meaningful relation between perceived organizational support and reliability. Staff who has usually organizational support, trusts on manager's honesty and upright and act completely in a valuable and secure manner and is appreciated by manager. When staff feels that manager supports them, pays attention to them, neglects their mistakes, assists them in difficulties, and understands their logical long absences and emphasizes on their role, trusts on manager more, as a result, consider this supportive atmosphere as an element of trust.

The study findings indicate that 2nd, 4th and 6th questions of the study on presence of a positive and meaningful relation between perceived organizational support and components of organization reliability are not validated. There was not a meaningful relation between perceived organizational support and constancy in manager's speech to different people. Investigating the results seems managers do not have speech constancy with others by two personal or organizational reasons. Personally, some reasons such as being fickle, lack of independence in different affairs, quick and hasty decisions, lack of expertise, lack of access to accurate, updated and exact information, and organizationally, some reasons such as over centralization, being ad hoc in some rules and regulations, having political attitude, lack of reliability and make action in risky circumstances can cause such conditions. A set of these conditions leads fading manager's constancy in speech and weakens staff trust in this dimension. In present study, there was not a meaningful relation between perceived organizational support and constancy in manager's speech in different situation, the reason seems lay in selection mechanism of manager. In structural dimension, selection mechanism of manager seems in educational units has some inefficiency in recent years which is result of unusual politicization in government organizations and moving away from the meritocratic.

References

Annamalai T.2010.The mediating effects of perceived organizational support on the relationships between organizational justice,trust and performance appraisal in malaysian secondary schools.European Journal of Social Sciences-Volume 13.Number 4:623-632.

Baird A, Amand R. 1995. Trust within the organization. Momograph, Issue 1.

Cohen L,Manion L &Morrison.2000.Research methods in Education-by Routledge Falmer.5 th edition 36.

Eisenberger R, Huntimgton R, Hutchison S, Sowa D. 1986. perceored organizational support; Journal of Applied psychology, Vol. 71. Available from:www.apa.org/pubs/journals

Eisenberger R,Cummings J,Armeli S,Lynch PD.1997."Perceived Organizational Support,dicretionary treatment,and jab satisfaction",Journal of Applied Psychology,82(5),812-820.Available from:www.elsevier.com.

Ellonen R,Blomqvist K,Pumalainen K.2008.The role of trust orgaizational innovative-ness.European Journal of innovation mamagement vol.11,No.2,pp:160-181.Available from:http://www.Emeraldinsight.com.

Erden A, Erden H. 2009. predicting organizational trust level of scool managers and teachers at elementary schools. Procedia social and behavioral sciences 1. pp: 2180-2190. Available from: http://www.elsevier.com.

Hanifan LJ. 1916. Therual school community center. Annuals of American Acadamy of pditical and science, 67:130-137.

Lamastro V.2000.Commitment and Perceived Organizational Support,National Forum,V 13,N.3.http://national forum.com/tocaer 10e3.html.

Levin SL. 1999. Development of an in strument to measure organizational trust. Doctorl dissetion, the george washing ton university, dissertation abstract International, 60-02 A. 481.

Ngang TK.2012.Relationship between perceived organizational support and trust with teachers commitment.Universiti Sains Malaysia 11800 Minden Penang,malaysia.

Organ Dw. 1988. Organizational citizenship behavior: the good soldier syndrome. LexingtonBooks.Available from:http://www.elsevier.com/locate/jwb.

Rhoades L,Eisenberger R.(2002)Perceived Organizational Support:A review of the literature.Journal of Applied Psychology 87(4),608-714.Available from: www.apa.org/pubs/journals

Robbins SP.2002.Organizational behavior.NewDehli:Practice,Hall of India.

Saekoo A.2011.Exammining the effect of trust,Procedural justice,Perceived organizatinal support,commitment,and job satisfaction in Royal Thai Police.Journal of Academy of Business and Economics Publisher.

Sergiovanni C,Start R.1992.Supervision human perpectives.3 thedition ,.New York:Mc graw Hillinc.

Sundquist K,Yang M.2006.Linking social capital and self-related heath:Amultilevel analysis of 11.175 men and Woman in Sweden.Health and Place,13,324-334.

The visionary leaders.Trainer guide.organizational design and developmen Sashkin.1988. New York.

Toreh N.2005. Identifying factors associated with organizational citizenship behavior and organizational performance. Master's Thesis, Padis Qom University of Tehran University.

Zampetakis LA,Beldekos P,Moustakis VS.2009."Day-to-day"entrepreneurship within organization:The role of trait Emotional Intelligence and Perceived Organizational Support.European Management Journal 27,165-175. Available from:www.elsevier.com.

Effects of geomorphologic characteristics on the hydrological response of Varband river basin, South of Iran

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Abstract: Water resource management in a basin depends upon the hydrological response of upstream basin area. Upstream basin area may produce different amounts of run-off for a given rainfall based on its hydrologic response. Present communications show the importance of geomorphologic characteristics in understanding the hydrologic response of a basin. This study is carried out through Geomorphologic Instantaneous Unit Hydrograph (GIUH) analysis, wherein Horton's morphometric ratios were used to define the drainage network in comparison with Snyder, SCS and Triangle unit hydrographs for determination of shape and dimensions of the outlet runoff hydrograph in the Varband river basin located in Fars province in Iran. Comparison of calculated and observed hydrographs showed that GIUH had the most direct agreement in two parameters of peak time and peak flow of direct runoff. Also, GIUH indicated the least amount of main relative and square error. Results also showed the efficiency of GIUH ratio for Snyder, SCS and Triangle hydrographs in the basin are 91.06, 99.11 and 88.64, respectively. The study shows the length ratio (RL) significantly influences the hydrologic response of the river basin. Hence, computation of this parameter should be included in the flood analysis of any rivers.

INTRODUCTION

Water resource management is one of the main challenges in the social-economic development of the countries located in Southeast Asia. Introduction of mechanized equipment, artificial fertilizers, herbicides, pesticides and new cultivars has led to an increase in productivity of between 400 and 500% (Hafner, 2003; Bakker et al., 2005a).Hence, in the last decade, there has been a great concern about severe effects of land use changes, and forest and farming destruction on water resources and occurrence of hydrologic hazards (Thanapakpawin,et al.2006). Runoff production is an important process in land degradation causing soil erosion and influencing the soil water balance and hydrology of catchments. (Descheemaeker, et al.,2006).

However, they are not the only factors producing such hazards. Geomorphologic factors can also influence on the hydrologic regime changes of river basins. Since it is possible to quantify geomorphic variables in a basin with regard to the present facilities such as remote sensing data, which can be extracted through aerial photos and satellite images, it is necessary to use calculating methods and prepare instant unit hydrograph to overcome the difficulty of the assessment of runoffs with varied return periods. Unless we use such methods, there is no possibility of an accurate assessment of floods for reducing probable losses, nor designing hydrologic formations.

Lack or low accuracy of rainfall data, high cost, lack ofinformation of catchments and long waiting time in obtaining results are the major problems in hydrological predictions (Maheepala et al., 2001; Vaes et al., 2001; Lopez et al., 2005 Bhadra et al., 2008. Vahabi and Ghafouri, 2009). Hydrological response of a river basin is defined by the production of run-offs against a given rainfall, which in turn is characterized by soil characteristics and basin geomorphology. Soil characteristics control infiltration loss, whereas the distribution of remaining 'rainfall excess' is governed by basin geomorphology. Hydrological response of a river basin is a function of relationship between basin geomorphology (catchment's area, shape of basin, topography, channel slope, stream density and channel storage) and its hydrology (Snyder, 1938; Loukas et al., 1996; Shamseldin and Nash, 1998; Ajward et al., 2000; Hall et al., 2001; Jain and Sinha, 2003; Nourani et al., 2008).

A major emphasis in geomorphology over the past six decades has been on the development of quantitative physiographic methods to describe the evolution and behavior of surface-drainage networks (Horton, 1945; Leopold and Maddock, 1953, Leopold and Wolman, 1957; Abrahams, 1984). These parameters have been used in various studies of geomorphology and surface-water hydrology, such as flood characteristics, sediment yields, and evolution of basin morphology (Jolly, 1982; Ogunkoya et al., 1984; Aryadike and Phil-Eze, 1989; Jenson, 1991; Breinlinger et al., 1993).

Geomorphologic factors play an important role in the assessment of pedology, geology, lithology, land structure, ground aquifers, and many other cases pertinent to hydrology. In this study, we have greatly emphasized on the role of landforms and other related factors and finally the environmental conditions of the region while paying attention to the following cases:

- assessment of the basin with an emphasis on morphometric features
- analysis of waterway networks in the eroded parts of the basin
- quantitative features of waterway networks
- flow features of the main river and its tributaries and the way of producing sediments in the basin

Waterways constitute a small area of a basin while they provide one of the most important and basic Geomorphologic and hydrologic issues especially since Robert Horton (1945) carried out several studies on this ground and published his results. Quantitative explanations offered by him are significant guidelines for the study of a comprehensive geomorphic system. Hence, the method offered by him and then by Strahler (1957) was developed and completed. Of course, some scholars such as Abraham (1984), Gardiner and Park (1978), and Smart (1972) have also performed the same studies.

Cudennec et al (2004) investigated the geomorphologic explanation of the unit hydrograph concept and concluded the use of geomorphologic parameters provides deterministic explanation of the assumption of the unit hydrograph and geomorphologic unit hydrograph theories. Sorman (1995) applied the GIUH model to estimate the peak discharges resulting from various rainfall events for basins in Saudi Arabia and concluded that the length ratio (R_L) significantly influenced on the hydrologic response of a river basin and it must be considered for flood-forecasting studies of any rivers. Hall et al (2001) did regional analysis using the GCIUH (Geomorphoclimatic Instantaneous Unit Hydrograph) in the southwest of England. In this study, rainfall excess duration was divided into several time increments, with separate IUHs being generated for each interval. Results showed fine time interval captures the shape of the runoff hydrographs. Jain et al (2000) worked on a rainfall-runoff modeling using GIUH in Gambhiri catchment in western India. Results showed the peak characteristics of the design flood are more sensitive to various storm patterns.

When the active power of water is adequate to remove bed materials, first-grade waterways appear. The amount of runoff able to remove sediments is considered as a function of climatic and geomorphologic characteristics. Analysis of the results and experiences indicates that the soil appearing in the region is due to soft stones with low penetrability, which produces much runoff compared to soils with coarse gravels. This feature is more evident in a semiarid climate.

Iran is the second largest country in the Middle East and almost 87% of the land area is located in arid and semiarid regions (Rangavar, 2004). Recent studies represent the total volume of annual precipitation is almost 430 billion m^3, out of which about 20% is lost in the form of flash floods (Foltz, et. al. 2008).

In this article, we have focused on logical relationships between geomorphologic parameters and the hydrologic response of Varband river basin at the southern part of Iran. Finally, using these relations and instant Unit Hydrograph theory, we could estimate the hydrograph of floods due to rainfalls on the surface of the basin.

METHODS AND MATERIALS

Studyarea

Varband River basin is located in the south of Fars province, Iran. It comprises 925.5 km^2 distributed within 14 sub-basins and extends between 27°34′ to 27°49′ N latitude and 53°56′ to 54°34′ E longitude (Fig. 1). The highest point in the basin is 2190 m above sea level, and its lowest point is 870 m above sea level. Mean annual rainfall is around 244 mm, mostly concentrated in the rainy season from December to February.

Geomorphologic Instantaneous Unit Hydrograph

The concept of Geomorphologic Instantaneous Unit Hydrograph (GIUH) is essentially based on this fundamental idea and has provided the first analytically developed model to calculate river hydrograph from Horton's morphometric parameters. In the GIUH model, uniform distribution and instantaneous imposition of unit 'rainfall excess' over the basin is assumed. Thus, GIUH is independent of rainfall characteristics and loss parameters. Further assumption is made that the incoming discharge due to this rainfall excess is filling a bucket at the outlet and the rate of filling of a bucket at the outlet of a basin will give the hydrograph. The GIUH is defined as the probability density function for the time of arrival of a randomly chosen drop to the trapping state (bucket). The bucket at the outlet will start empty and will reach a final volume equal to the total volume of rainfall excess over the basin. The total volume yielded as output up to a certain time t will be given by, volume $[V_{(t)} = q_{(t)}d_t]$. The derivative of the observed $V_{(t)}$ gives the hydrograph of discharge $q_{(t)}$ resulting from the rainfall input. This hydrograph $q_{(t)}$ is the IUH of the river. General equations of GIUH are a function of Horton's numbers, i.e. bifurcation ratio (R_B), area ratio (R_A), length ratio (R_L), length of highest-order stream (L_Ω) and mean velocity of stream flow (v). Therefore, it provides a theoretical link between hydrology and geomorphology, and can be used

to analyze the geomorphic control on basin hydrology. Basic hydrologic and geomorphologic data of Varband river basin are listed in Table 1.

Hydrograph yielded by rainfall falling instantly and steadily on the whole surface of the basin and the area under its curve equals to the unit depth of the runoff (Rudriguez-Iturb and Valdès, 1979). In the instant unit hydrograph, the duration of rainfall is divided into very short intervals and the rainfall-runoff relation is calculated momentarily.

Therefore, the hydrograph extracted by this method has no limitation of consistency. Since, geomorphologic parameters of the basin were constant and it was possible to measure them on topographic maps and aerial pictures quickly and accurately, we could offer an artificial unit hydrograph theory.

With different methods of extracting artificial hydrograph, we can determine artificial unit hydrograph features based on geomorphologic characteristics of the basin (Mays and Taur, 1980). In this research, using this method and calculating artificial unit hydrograph, we compared geomorphologic instant unit hydrograph, and Shneider, SCS, and triangular methods with observational hydrograph. The most important advantage of the above theory compared to the experimental methods was the lack of changes in intensity and duration of rainfalls so that we could achieve the hydrologic reaction function of the basin in a particular shower with less error (Gupta & Wimer (1983), Zelazinskey (1986), Vandertake and Bras (1990), Jin (1993), Shennel & Sivapallan (1994), and Kilgur (1997)).
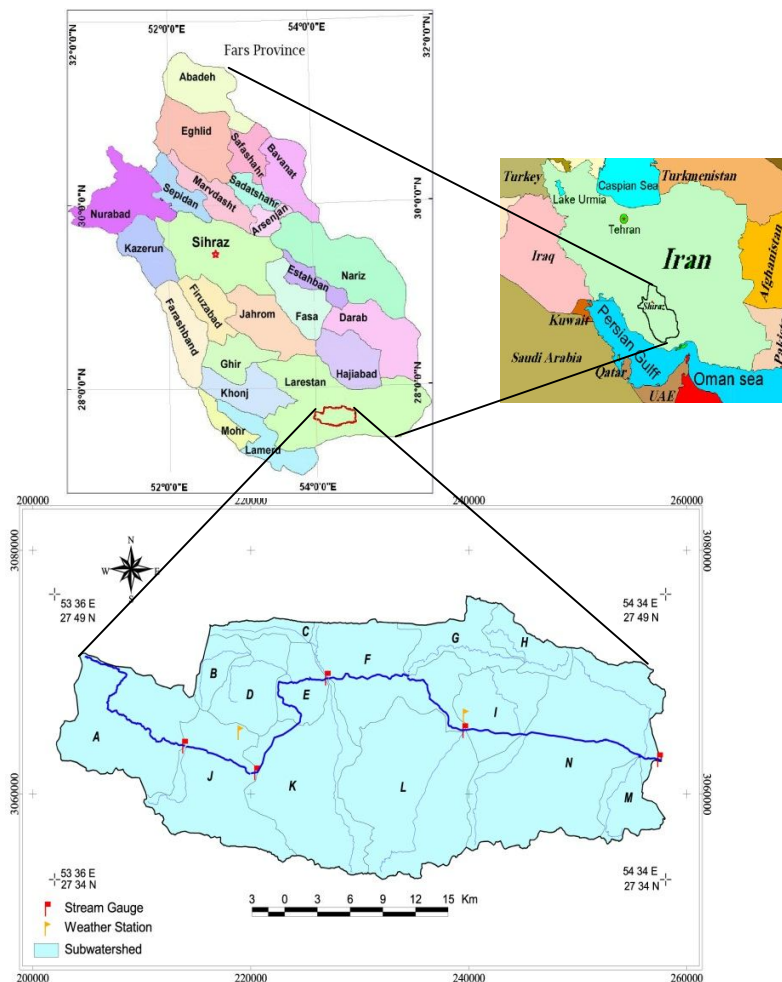
Fig. 1. Study location and Varband river system with its main tributaries.

Table 1. Hydrologic and geomorphologic characteristics of Varband river basin

Parameter	Value	Parameter	Value
Basin area	925.5	Mean slope	16.5%
Average infiltration rate	0.3cm/h	Mean annual rainfall	244mm

Input parameters for GIUH	Definition		Value
Bifurcation ratio (RB)	RB = Nu–1/Nu; Nu = No. of streams of order u		4.02
Length ratio (RL)	$RL = Lu/Lu$–1; Lu = Length of streams of order u		1.3
Area ratio (RA)	$RA = Au/Au$–1; Au = Area of streams of order u		3.9
Length of main channel ($L□$)	Length of the highest order stream		42.5km
Average stream velocity			1.05m/s

Model performance measures

To evaluate the suitability of the method for the basin of interest, three criteria were chosen to analyze the degree of goodness of fit. These criteria are Mean Relative Error (*MRE*) and Mean Square Error (*MSE*) based on the following equations:

$$R_{Ei} = \frac{O - P}{O} \times 100$$
(1)

$$RME = \frac{1}{n} \sum_{i=1}^{n} R_{Ei}$$
(2)

$$S_{Ei} = \left[\frac{(Q_{oi} - Q_{ci})}{Q_{oi}} \right]^2$$
(3)

$$MSE = \frac{1}{n} \sum_{i=1}^{n} S_{Ei}$$
(4)

where, *MRE* is mean relative error percentage, n is number of estimation, R_{Ei} is the percentage of relative error in each estimation of the related parameter (here four parameters of peak time, base time, peak volume and discharge rate of flood have been considered). *O* is the observed values, *P* is the calculated values, *MSE* is mean of power 2 error, S_{Ei} is sum of squares of errors between observed and calculated hydrographs in each time interval, Q_{oi} is dimension of observed hydrograph and Q_{ci} is dimension of calculated hydrographs.

To determine percentage of superiority of the models in estimating outlet hydrograph dimensions, the mean of power 2 of error of efficiency of each model with respect to other models has been used based on the following equation:

(MSE_2/MSE_1) ×100 = Ratio of estimating 1 percentage efficiency of estimating 2

Sensitivity Analysis

Further work is continuing to analyze the influence of individual morphometric parameters on flood characteristics. In order to assess the GIUH model's sensitivity to different parameters, a series of sensitivity analyses were performed. Performing sensitivity analyses is a method to identify the input parameters that have the biggest impact on model predictions. As each variable was allowed to vary, all others were held constant. As each parameter was evaluated, the impacts on the peak flow rate, the time to peak and the overall hydrograph shape were examined. The channel flow velocities and geomorphologic ratios were investigated by multiplying the base value by 0.5, 1.0, 1.5, and 2.0 in order to evaluate how the peak flow rate, time to peak and general hydrograph shape were affected by the changes in these parameters. In order to test the GIUH model's responsiveness to different excess rainfall intensities, unit hydrographs were developed for 0.03 cm/hr, 0.05 cm/hr, 0.1 cm/hr, and 0.15 cm/hr.

RESULTS AND DISCUSSION

Dimensions of calculated outlet hydrographs by different methods were compared with observed hydrograph for 1hr time durations (see Fig. 2).

Performance of the model was also checked with respect to the peak discharge (Qp) and the time to peak (tp) of different storm events. It was found that the study basin is a sixth order basin. Also, it is observed that the bifurcation ratio, length ratio and area ratio, which are non-dimensional characteristics, are 4.2, 1.03 and 3.9, respectively, for the study basin. These values are within the limits, which have already been reported in the literature. Table 2 gives hydrograph dimensions in SCS, Snyder and Triangle methods in the study basin. It demonstrates that a comparable level of performance was achieved for all methods. Also, agreement between hydrographs with respect to the peak discharge has negligible errors while with regards to peak arrival time, it shows more differences. This may be because of the peak

flow dependence on excess rainfall intensity. The amounts of *MSE* and *MRE* of each method for the study basin are observed inTable 3. Results show the efficiency of extracted hydrographs in different methods by two indices of *MRE* and *MSE*. As we can see, performance of the methods on the largest events is better. Amounts of MSE for geomorphologic, Snyder, SCS and Triangle models in the study basin are 0.215, 19.634, 21.37 and 19.11 percent, respectively. Amounts of *RME* for geomorphologic, Snyder, SCS and Triangle models in the study basin are 8.524, 72.04, 77.64 and 73.63 percent, respectively. The result shows the efficiency of extracted hydrographs in different methods by two indices of *MRE* and *MSE*.

Table 4 presents relative efficiency of methods in estimating dimensions of outflow in the study basin. For this purpose, *MSE* of each model was used. Results show the efficiency of GIUH method ratio to other models. Comparison of the estimated hydrographs of the studied models with observed hydrographs showed the efficiency of geomorphologic model ratio to Snyder, SCS, and Triangle in the study basin are 91.06, 99.11, 88.642 and 48.195,respectively. Compared with other models (based on this study) in the study basin, the geomorphologic model is the most efficient model to estimate flood discharge. Also, Results showed a high agreement of GIUH, SCS, Snyder and Triangular methods with the observed hydrograph in the parameter of outlet runoff. Generally, comparison of obtained results of the methods under study shows that GIUH method is more efficient than other methods. Thus, the GIUH model can be adapted as a standard tool for modeling rainfall-runoff transformation process in basins with no data.
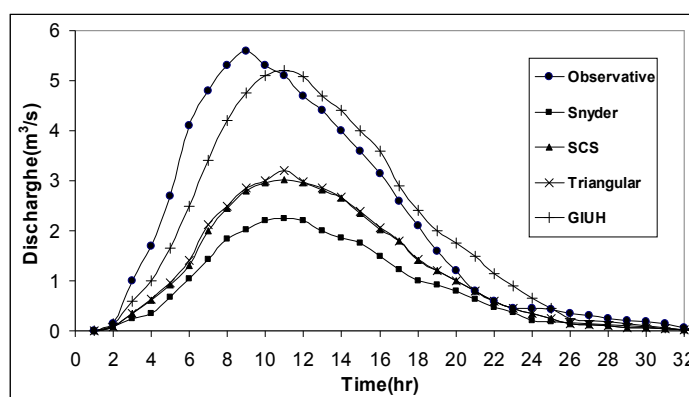
Fig. 2. Comparison of observed and calculated hydrographs of different models.

Channel velocity estimate is an important variable in estimating the time-area curve and the resulting runoff hydrograph. While keeping geomorphic parameters fixed, the channel velocity was varied from 50% to 200% of the base channel velocities calculated in Table 3. Despite large changes in the channel velocities, the peak flow rate varied less than 30% (see Fig. 3a). Changes in the channel velocity did have an impact on the hydrograph timing. As the channel velocity increased, the hydrograph shifted to the left and occurred earlier. As the channel velocity increased, the time to the peak discharge decreased from 2.75 hours to 2 hours. Lower velocity values are corresponding to low stage indicating the lean period. Higher velocity values indicate higher stage periods.As shown in Figure 3a, increase in average channel velocity causes a significant increase in the peak of hydrograph (Q_P) with less time to peak (t_P). This finding is in good agreement with that obtained by Kilgore (1997) and Jain et al. (2003).

Because there is a good deal of uncertainty in the estimate of the rainfall excess intensity, the effects of different rainfall excess intensities were investigated by allowing the intensity to vary from 0.03 cm/hr to 0.15 cm/hr. As the intensity of rainfall excess increased, the resulting hydrographs showed less attenuation and a higher, faster peak flow rate (see Fig. 3b).

Table 2. Hydrograph dimensions in SCS, Snyder and Triangle methods in Varband river basin

Date	Methods							
	Flood		SCS		Snyder		Triangle	
	$Qp(m^3/s)$	$tp(hr)$	$Qp(m^3/s)$	$tp(hr)$	$Qp(m^3/s)$	$tp(hr)$	$Qp(m^3/s)$	$tp(hr)$
1991/05/12	12.10	8.30	18.33	5.69	17.33	9.67	17.83	5.69
1992/06/20	12.55	8.10	3.35	3.14	2.35	5.17	2.85	3.14
1993/06/04	11.70	6.50	6.35	3.49	2.35	5.17	5.85	3.49
1994/03/27	2.12	8.20	19.13	5.32	1.81	8.92	18.63	5.32
1994/07/22	3.89	5.70	17.49	4.13	2.04	7.05	21.00	4.13
1995/08/27	5.81	5.84	3.35	3.71	2.35	5.17	2.85	3.71
1996/07/02	2.85	5.90	3.47	4.50	1.94	7.79	4.97	4.50
1996/07/12	1.75	6.11	5.21	3.34	2.32	5.36	6.71	3.34
1999/05/10	1.90	6.23	8.91	4.64	2.19	6.11	9.41	4.65
2001/09/26	11.50	4.65	3.35	2.94	2.35	5.17	2.85	2.95
2002/08/20	1.86	4.53	5.22	4.60	2.22	5.92	6.72	4.60
2003/07/07	1.38	6.24	23.22	4.77	2.22	5.92	22.72	4.77
2004/06/20	3.30	8.88	16.03	4.94	2.10	6.67	21.53	4.94
2004/09/20	3.66	5.94	3.33	2.64	2.33	5.28	2.83	2.64
2005/04/30	13.05	6.87	5.35	3.35	2.35	5.17	4.85	3.35
2005/07/12	10.68	5.47	14.00	4.75	1.90	8.17	19.50	4.75
2005/09/21	1.68	6.31	6.66	7.44	1.66	10.42	6.15	7.44
2006/07/02	1.90	5.21	3.43	4.10	2.43	4.79	2.93	4.10
2006/08/05	2.20	5.70	3.22	4.28	2.22	5.92	3.72	4.28
2007/08/08	8.30	6.13	3.43	3.14	2.43	4.76	2.93	3.14
2007/09/02	2.04	5.76	18.00	4.63	1.90	8.17	19.50	4.63

Table 3. Amounts of (*MSE*) and (*MRE*) for Varband river basin

Event	Geomorphologic	Snyder	SCS	Triangular
1991/05/12	0.08	27.35	38.81	32.83
1992/06/20	0.01	0.45	2.80	1.38
1993/06/04	0.06	10.97	18.60	7.91
1994/03/27	0.02	31.13	43.28	36.95
1994/07/22	0.31	33.52	33.52	39.56
1995/08/27	0.53	0.24	0.255	3.04
1996/07/02	0.04	5.54	1.83	8.15
1996/07/12	0.73	5.38	1.74	7.95
1999/05/10	0.44	9.65	9.65	13.01
2001/09/26	0.02	0.36	2.57	1.22
2002/08/20	0.01	6.59	2.45	9.40
2003/07/07	1.19	115.07	137.52	52.23
2004/06/20	0.95	18.99	28.71	78.47
2004/09/20	0.01	0.19	2.058	0.87
2005/04/30	0.02	4.64	9.96	7.05
2005/07/12	0.030	22.14	32.5	27.09
2005/09/21	0.03	5.57	11.28	8.17
2006/07/02	0.05	0.28	2.33	1.05
2006/08/05	0.07	3.39	3.39	5.48
2007/08/08	0.04	0.33	2.48	1.15
2007/09/02	0.06	35.46	24.55	41.67
RME	8.52	72.04	77.64	73.63
MSE	0.21	19.63	21.37	19.11

Table 4. Relative efficiency of estimator (1) to estimator (2) in estimating runoff in Varband river basin

Estimator(2) Estimator(1)	Geomorphologic	Snyder	SCS	Triangular
Geomorphologic	1	0.01	0.01	0.01
Syder	91.06	1	0.91	1.02
SCS	99.11	1.08	1	1.11
Triangular	88.64	0.97	0.89	1

As the rainfall excess intensity increased, the time to peak decreased from 2.5 hours to 1.5 hours. This finding is in agreement with that obtained by Kilgore (1997).

Effects of different rainfall excess durations were investigated by allowing the duration to vary from 2 to 8 hours. As the duration of rainfall excess increased, the resulting hydrographs showed a higher, faster peak flow rate (see Fig. 3c). As the rainfall excess duration increased, the time to peak decreased from 2.5 hours to 1.8 hours.

Effects of different geomorphologic ratios (R_L, R_A and R_B) were investigated by allowing the geomorphologic ratios to vary from 1.5 to 6. Our preliminary results suggest that out of the three Horton morphometric ratios, R_L influences Q_P and t_P most significantly. Our analysis predicts higher Q_P for higher R_L. This demonstrates the influence of particular morphologic parameters on flooding behavior of individual basins. As the length ratios (R_L) increased, the resulting hydrographs showed a higher, faster peak flow rate (see Figs 3d, e, f). As the length ratio increased, the time to peak decreased from 2.5 hours to 2.1 hours. This finding is in agreement with that obtained by Sorman (1995) and Jain et al. (2003). Also, as the area ratio and the bifurcation ratio increased, the time to peak increased from 2.5 to 2.8 hours.

CONCLUSIONS

In case of outlet runoff values, all the tested methods have high agreement with the observed hydrograph. When the number of events increases, the estimation accuracy, and the efficiency and precision of excess water estimation increase. Our results are validated by comparison with the result of flood frequency analysis based on observed data. Due to simplicity of the proposed method in comparison with other methods in flood estimation and since lower design risk is desired, it can be used for a basin with no data. Compared with synthetic unit hydrographs, this method (GIUH) has better estimation of time to peak and peak discharge. Hence, the prediction performance of the developed GIUH was evaluated by comprising the peak discharge (Qp) and time to peak (tp). Compared to traditional methods, the proposed method can be used for precise investigation of morphogenetic characteristics and their effects on basin hydrology. Using the proposed method, contributions and participations of different tributaries to flood hazard in the river basin can be well understood. The effect of individual morphogenetic parameters on flood discharge can be provided by the proposed method. In order to identify the input parameters that had the biggest impact on the GIUH model, a series of sensitivity analyses were performed.
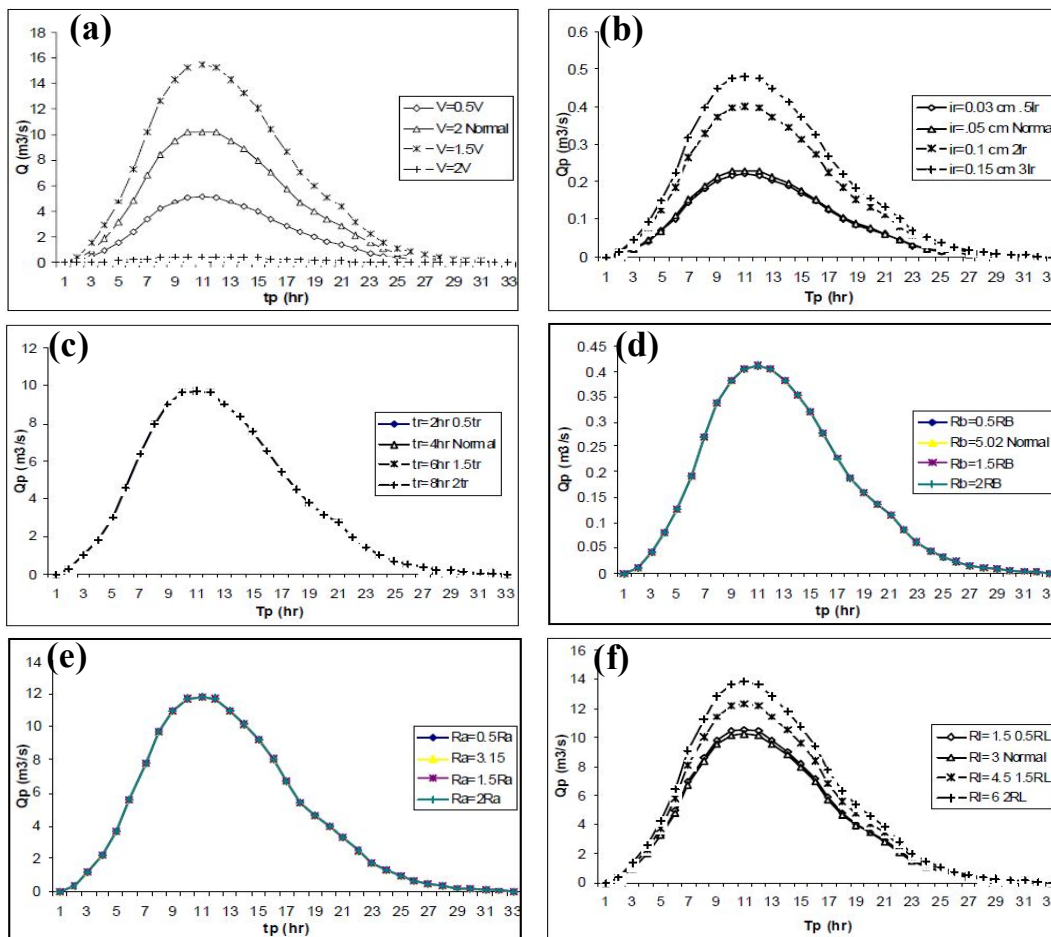
Fig. 3. Sensitivity of model response to variations.

The channel velocity and rainfall excess intensity had the biggest influence on the peak flow rate. Also the channel velocity and rainfall excess intensity had the greatest effect on the time to peak prediction. When a sensitivity analysis was performed, the channel velocity had the most influence over the time to peak. It appeared that changes in channel velocity affected the time to peak to a much greater extent than the peak flow rate. The higher the channel velocity, the lower the cumulative travel time and eventually the lower the time to peak. On the other hand, changes in the overland flow velocity had more impact on the peak flow rate than on the time to peak. Hence, it is worth mentioning that the geomorphologic unit hydrograph is not linear because its main characteristics, Q_p and t_p vary with the velocity V of the main river course. The effect of velocity on GIUH reflects the dynamics of hydrological response of basin.

Excess rainfall intensity was found to have a big impact on both the time to peak flow rate and the peak flow rate. Increasing the excess rainfall intensity caused an earlier and larger peak flow rate. The rainfall excess intensity is an important parameter for estimating the peak flow rate and the time to peak. Care should be taken when selecting a technique to estimate the rainfall excess.

Length ratio (R_L) is an important parameter for estimating the peak flow rate and the time to peak in the GIUH model. The length ratio significantly influenced the hydrologic response of the study basin. Area ratio (R_A) and bifurcation ratio (R_B) are important parameters only for estimating the time to peak in the GIUH model. Variations in GIUH parameters with respect to velocity reflect the dynamic behavior of the hydrological response of Varband river basin in different periods.The developed model when applied to predict storm runoff on Varband river basin, performed well as it yielded the model estimated values in reasonably close agreement to the corresponding observed values.

REFERENCES

Abrahams A. D. (1984) Channel networks: A geomorphological perspective. *Water Resources Research*, Vol. 20(2), 161-168.

Ajward M. H. & Muzik I. (2000) A Spatially Varied Unit Hydrograph Model. *Journal of Environmental Hydrology*, Vol. 8(7), 1-8.

Aryadike R. N. C. & Phil-Eze P.O. (1989) Runoff response to basin parameters in southeastern Nigeria. *Geografiska Annaler. Series A*, Vol. 71, 75-84.

Bakker M. M., Govers G., Ewert F., Rounsevell M. & Jones R. (2005) Wheat variability as a function of climate, soil and economic variables along a climatic gradient. *Agriculture, Ecosystems and Environment*, Vol. 110, 195-209.

Bhadra A., Panigrahy N., Singh R., Raghuwanshi N.S., Mal B.C. & Tripathi M.P. (2008) Development of a gemorphological instantaneous unit hydrograph model for scantily gauged watersheds. *Environmental Model Software*, Vol. 23(8), 1013-1025.

Breilinger R., Duster H. & Weingartner R. (1993) Methods of catchment characterization by means of basin parameters (assisted by GIS) - empirical report from Switzerland. *Report - UK Institute of Hydrology*, Vol. 120, 171-181.

Cudennec C., Fouad Y., Sumarjo Gotot I. & Duchesne J. (2004) A Geomorphological Explanation of the Unit Hydrograph Concept. *Hydrological Processes*, Vol. 18(4), 603-621.

Descheemaeker K., Muys B., Nyssen J., Poesen J., Raes D., Haile M. &Deckers J. (2006) Litter production and organic matter accumulation in exclosures of the Tigray highlands, Ethiopia. *Forest Ecology and Management*, Vol. 233(1), 21-35.

Foltz R.C. (2002) Iran's water crisis: Cultural, political and ethical dimensions. *Journal of Agricultural Environment Ethics*, Vol. 15(4), 357-380.

Gardiner V. & Park C. C. (1978) Drainage basin morphometry: review and assessment. *Progress in Physical Geography*, Vol. 2(1), 1-35.

Gupta V. K. & Waymire E. (1983) On the formulation of an analytical approach to hydrologic response and similarity at the basin scale. *Journal of Hydrology*, Vol. 65, 95-123.

Hafner S. (2003) Trends in maize, rice, and wheat yields for 188 nations over the past 40 years: a prevalence of linear growth. *Agriculture, Ecosystems and Environment*, Vol. 97(1-3), 275-283.

Hall M.J., Zaki A. F. & Shahin M. M. A. (2001) Regional analysis using the Geomorphoclimatic Instantaneous Unit Hydrograph. *Hydrological Earth System Sciences*, Vol. 5(1), 93-102.

Horton R. E. (1945) Erosional development of streams and their drainage basins: Hydrophysical approach to quantitative morphology. *Geological Society of America Bulletin*, Vol. 56, 275-370.

Jain V. & Sinha R. (2003) Derivation of Unit Hydrograph from GIUH Analysis for a Himalayan River. *Water Resources Management*, Vol. 17(5), 355-376.

Jain S.K., Singh R.D. & Seth S.M. (2000) Design flood estimation using GIS supported GIUH approach. *Water Resources Research*, Vol. 14, 369-376.

Jenson S. K. (1991) Applications of hydrologic information automatically extracted from digital elevation models. *Hydrological Processes*, Vol. 5, 31-41.

Jin Ch. X. (1993) Determination of Basin Lag time in Rainfall-Runoff Investigations. *Hydrological Processes*, Vol. 7(4), 449-457.

Jolly J. P. (1982) A proposed method for accurately calculating sediment yields from reservoir deposition volumes. In Recent developments in the Explanation and Prediction of Erosion and Sediment Yield, Proceedings of Exeter Symposium, July, IAHS Publication, Vol. 137, 153-161.

Kilgore J. L. (1997) Development and Evaluation of a GIS-based spatially distributed Unit Hydrograph Model. M. S. thesis, Biological Systems Engineering Dept., Virginia Tech, Blacksburg.

Leopold L. B. & Maddock J. T. (1953) The hydraulic geometry of stream channels and some physiographic implications. U.S. *Geological Survey Professional Paper*, Vol. 252, 1-57.

Leopold L. B. & Wolman M. G. (1957) River channel patterns: Braided, meandering, and straight. U.S. *Geological Survey Professional Paper*, Vol. 282(B), 39-85.

Lopez V., Napolitano F. & Russo F. (2005) Calibration of a rainfall-runoff model using radar and rain gauge data. European Geology advances, *Advances in Geosciences*, Vol. 2, 41-46.

Loukas A., Quick M.C. & Russell S.O. (1996) A physically based stochastic-deterministic procedure for the estimation of flood frequency. *Water Resources Management* , Vol. 10(6), 415-437.

Maheepala U. K., Takyi A. K. & Perera B. J. C. (2001) Hydrological data monitoring for urban storm water drainage systems. *Journal of Hydrology*, Vol. 245, 32–47.

Mays L. W. and Taur C. K. (1980) Optimization of Unit Hydrograph Determination. *Journal of the Hydraulics Division*, ASCE Vol. 106(1):85-97.

Nourani V., Singh V. P., Alami M. T. & Delafroz H. (2008) Geomorphological Runoff Routing Modeling Based on Linear Reservoirs Cascade. *Journal of Applied Sciences*, Vol. 8(9), 1660-1667.

Ogunkoya O. O., Adejuwon J. O. & Jeje L. K., (1984) Runoff reponse to basin parameters in southwestern Nigeria. *Journal of Hydrology*, Vol. 72, 67-84.

Rangavar A., Nurberdiev M. & Rojkov V. A. (2004) Rainwater harvesting for establishment of artificial pastures on eroded lands in arid regions (Case study in Khorasan, Iran). In: International workshop on water harvesting and sustainable agriculture. Moscow, Russia, 7 September 2004. 55th IEC Meeting.

Rodriguez-Iturbe I. & Valdès J. B. (1979) The geomorphologic structure of hydrologic response. *Water Resources Research*, Vol. 15(6), 1409–1420.

Shamseldin A. Y. & Nash J. E. (1998) The geomorphological unit hydrograph-a critical review. *Hydrological Earth System Sciences*, Vol. 2(1), 1-8.

Smart J. S. (1972) *Channel networks. In Advances in Hydroscience* (ed. Chow, V. T.), Academic Press, New York. 8, 305–346.

Snell J. D. & Sivapalan M. (1994) On geomorphological dispersion in natural catchments and the geomorphological unit hydrograph. *Water Resources Research*, Vol. 30(7), 2311–2323.

Snyder F. F. (1938) Synthetic Unit Graphs. Trans. AGU. Vol. 19, 447–454.

Sorman A. U. (1995) Estimation of peak discharge using GIUH model in Saudi Arabia. *Journal of Water Resources Planning and Management*, Vol. 121(4), 287–293.

Strahler A. N. (1957) Quantitative analysis of watershed geomorphology. *Transaction of American Geophysical Union*, Vol. 8(6), 913–920.

Thanapakpawin P., Richey J., Thomas D., Rodda S., Campbell B. & Logsdon M. (2006) Effects of land use change on the hydrologic regime of the Mae Chaem river basin, NW Thailand. *Journal of Hydrology*, Vol. 334, 215–230.

Vaes G., Willems P. & Berlamont J. (2001) Rainfall input requirements for hydrological calculations. *Urban Water*, Vol. 3(1-2), 107–112.

Vahabi J. & Ghafouri M. (2009) Determination of Runoff Threshold Using Rainfall Simulator in the Southern Alborz Range Foothill-Iran. *Journal of Environmental Sciences*, Vol. 3(2), 193–201.

Vandertake L. D. and Bras R. L. (1990). In Corporating hill slope effects into the geomorphologic IUH. *Water Resources Research*, Vol. 26(10), 2393–2400.

Zelazinski J. (1986) Application of the geomorphological IUH theory to development of forecasting models in Poland. *Hydrological Science Journal*, Vol. 31(26), 263-270.

Developing a Forecasting Model for Asphalt Rutting Potential Using Gyratory Compactor Parameters

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ABSTRACT: Rutting is one of the most important deteriorations in flexible pavements which a significant amount of maintenance and rehabilitation funds are consumed for repairing it annually. On the other hand lack of a simple test to determine specimen resistance to permanent deformation as the main reason for asphalt rutting is sensible in Superpave first level mix design which owes considerable advantages in comparison with the marshall method. Prevalent methods of evaluating rutting potential of asphalt mixtures are usually expensive and time consuming. Mentioned parameters illustrates the necessity of developing a simple method, not only having fine precision but also be able to predict specimens rutting performance in the short term in laboratory. In this research two types of aggregates (silica and calcareous base), two types of gradation, two types of bitumen, two types of filler and three bitumen contents were used to prepare specimens. After modeling gyratory shear stress, the model and gyratory compaction slope parameters were used to develop two mathematical models to estimate specimen wheel Track apparatus rut depth. These models were validated using ANN and GA and make it possible to evaluate rutting potential while preparing specimens in laboratory to determine optimum bitumen content. Hence not only expensive instruments for rutting test aren't necessary but a considerable reduction in mix design procedure time is gained.

Keywords: Rutting, Gyratory Compaction Machine, Wheel Track Apparatus, Shear Stress Curve

1. Introduction

A rut is a surface depression in the wheel path due to cumulative permanent deformations which can lead to pavement drainage capacity reduction, hydroplaning, raise in deterioration rate due to moisture and increase in fatigue cracking of flexible pavements as a result of thickness reduction in rutted location [1]. Rutting could be a result of mixture volume reduction (pavement consolidation due to traffic (figure 1)), asphalt permanent deformation in a constant volume (plastic deformations as a result of shear stresses in asphalt mixtures (figure 2)) or a combination of these reasons [2]. Among different layers exposed to rutting, asphalt layer owes high share, hence noticing permanent deformations of asphalt mixtures because of low shear stress is an important issue in presenting the appropriate mix design procedure [3].

Different researches used various methods to evaluate asphalt mixtures rutting potential. Dynamic creep test is used widely in Finland, Sweden and Australia while LCPC wheel trucker is used more in Austria, France, Hungary, Romania and Switzerland. Hamburg Wheel Tracking Device and Georgia Loaded Wheel Tester are used for rutting performance evaluation in many countries in the world. Wheel Trucker applies wheel cyclic load to the specimen and the rut depth is recorded after 8000 cycles in a specific temperature. It is proofed that rut depth is related to specimen shear strength inversely. Although it is a simple test, but it is time consuming and the instrument used for loading is expensive. So developing a method to determine asphalt mixture shear strength in less time with cheaper equipments seems necessary.

2. Problem Definition

2.1. Research Targets

Asphalt mixtures low quality plays an important role in mixture rutting. Aggregates rotational or transitive movement in asphalt mixture due to insufficient compaction leads to permanent deformation occurrence along shear plates [4]. So compaction as the most effective parameter in aggregates structure and positioning in mixture has an important effect on mixture resistance to permanent deformation and rutting [5]. According to previous researches, a disadvantage of Marshall method is compacting procedure which doesn't simulate real condition fine [6]. Gyratory Compacting Machine, the result of 40 years researches in rotational compacting system were used by SHRP[1] in SUPERPAVE[2] mix design procedure. This design method has three levels which are categorized based on traffic and load. First SUPERPAVE level (AASHTO MP2, PP28) is for traffic with less than 1000000 ESAL[3] including volumetric analysis and simple tests [7]. This level which is noteworthy level for engineers because of being simple and economical consideration doesn't include asphalt performance tests. To complete first level design in these method simple tests should be used to evaluate asphalt mixture workability such as rutting resistance [8].

In this paper it is tried to develop predicting models of rutting performance by preparing specimens with a wide range of aggregate types and gradations, bitumen types and contents and filler types and testing them by wheel trucker, so the mixture rutting performance can be predicted during mixture preparation before production without consuming considerable time and cost.

2.2. Literature Review

Lack of a test with mentioned properties to predict asphalt mixtures rutting strength in 1st level caused validated research centers such as NCHRP[4] and FHWA[5] and FAA[6] to start a spread

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[1] Strategic Highway Research Program
[2] SUPerior PERforming asphalt PAVEment
[3] Equivalent Single Axle Load
[4] National Cooperative Highway Research Program
[5] Federal Highway Administration
[6] Federal Aviation Administration

researches in this field [9-11]. Other studies with this target and using SGC output data will be mentioned in this section:

2.2.1. Studies on Compaction Slope in SGC[7]
The first idea of using compaction slope was developed for the first time in 2000 [12]. Later studies showed compaction slope is an index of aggregates internal friction [13]. So this parameter can't be used singly to predict asphalt shear strength performance.

2.2.2. Studies Considered a Specific Part of Compaction Slope
Researches define various indexes for asphalt rutting resistance with studying volumetric mass against gyration curve. One of these parameters was TDI[8] which is assumed as compaction curve integral from 4% to 2% voids. DEI[9] was defined as 8% to 4% voids in mentioned curve and CEI[10] as compaction start to 8% voids integral. Models based on these indexes were affected by aggregates positioning in molds greatly and wide tests showed this models aren't reliable [14-15].

2.2.3. Studies on Shear Parameters During Compaction
Gyratory Maximum shear strength, gyration corresponding with maximum shear and gyratory shear slope were defined using gyratory shear stress curve. Studies in Florida and Michigan University showed although there is a relation between these parameter with APA[11] rut depth, but developed models have no convenience correlation coefficient and aren't applicable in practically [16].

2.3. Research Assumptions
Asphalt rutting is cumulative deformation due to base and subbase layers consolidation, abrasion and permanent deformation in asphalt layer. The main reason of rutting is asphalt permanent deformation [17]. This parameter was studied in this research under 50°C temperature. Various materials, gradation, bitumen and filler were used in this study to increase applicability of research results.

3. Methodology
3.1. Materials Selection and Related Tests
Rudehen Asbcheran mine (east of Tehran) and Rivand mine (Sabzevar) were used for limestone aggregates and silica aggregates source respectively. Minimum Percentage of Fracture, Maximum Abrasion, Maximum Water Absorption, Minimum Adhesion in Bitumen-Aggregate System, Minimum Sand Equivalent and Minimum Sulfate Soundness Value tests results were in the standard range. Saveh mine rock powder and Qom limestone powder passed from 0.075mm sieve were used as two filler types in specimen preparation procedure. PI and Hydrometry test results located in standard range either. Bitumen was supplied from Pasargad Oil Company in tow types of 60-70 and 85-100. Penetration, Saybolt Forol Viscosity, Softening Point, Ignition Point, Specific Gravity, Weight Loss and Ductility performed for both types and results passed Code234 (Iranian Pavement Code [18]) requirements.

3.2. Optimum Bitumen Content Determination
3.2.1. Gradation
Middle range of number 4 and 5 continuous gradations were used according to table 1 [18].

3.2.2. OBC Determination and Specimen Naming
Since various types of gradation, filler, bitumen and aggregates, 288 specimens were prepared for OBC using marshal method and finally 16 bitumen contents were determined as table 2. Combination of two letters and two numbers was used for specimen naming. From left to right, first character shows aggregate type (S for silica base aggregate and A for limestone base aggregate), second character is a number shows gradation

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[7] Superpave Gyratory Compactor
[8] Terminal Densification Index
[9] Densification Energy Index
[10] Compaction Energy Index
[11] Asphalt Pavement Analyzer

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number (4 for gradation number 4 and 5 for gradation number 5), third character is the filler type (P for rock powder and A for limestone powder) and the forth character is the bitumen type (6 for 60-70 bitumen and 8 for 85-100 bitumen).

3.3. Preparing Specimens for Tests
3.3.1. Choosing Gyration Number
Gyratory Compaction Machine was used for compacting specimens. 8, 95 and 150 gyrations were chosen for N_{ini}, N_{des} and N_{max} respectively according to table 3 for ESAL equal to 10^6.

3.3.2. Determining Number of Specimens for Research
To perform rutting test, due to various parameters, 144 specimens were prepared totally with OBC, 0.5% less and 0.5% more bitumen content with SGC. To validate test results 3 specimens were made for each similar condition.

3.4. Gyratory Parameters
3.4.1. Shear Stress Modeling Parameters
Shear stress versus gyration number is one of the output curves of gyratory compactor. To gain more parameters from gyratory output curves and since it is proofed shear stress is related to rutting inversely, gyratory shear stress were modeled versus gyration number as independent parameter. Following logarithmic model seemed to be the best models after testing all models:

$$G_S = K1 \, Ln(N) + K_2 \qquad (1)$$

In which Gs is gyratory shear stress in a defined N.
Graphs such as figure 3 were drawn for all 144 specimens and the result of modeling is shown in table 4. As it is clear in this table more than 96.5% of models have more than 75% correlation coefficient.
Maximum shear (S_m) is the other variable which can be determined by the presented model except K_1 and K_2.

3.4.2. Compaction Slope Parameter
One of the parameters measured by gyratory in each cycle is specimen height. Since specimen height is distinguish in each cycle and constant specimen weight and specimen cross section, compaction slope can be determined using eq. (2). Studies showed compaction slope is related to aggregates internal friction directly [19]. So it can be effective in mixtures shear strength:

$$K = \frac{\%G_{des}}{\log(N_{des})} \frac{\%G_{ini}}{\log(N_{ini})} * 100$$

(2)
in which:

$$\%G_{mm,Ndes} = \frac{G_{mb}}{G_{mm}} \qquad (3)$$

$$\%G_{mm,Nini} = \%G_{mm,Ndes} * \frac{h_{des}}{h_{ini}}$$

$\%G_{(mm),Ndes}$ and $\%G_{(mm),Nini}$: Asphalt mixture maximum specific gravity in initial gyration and design gyration respectively,

h_{ini} and h_{des}: Specimen height in N_{ini} and N_{des} during compaction respectively,

G_{mb} and G_{mm}: Bulk and maximum specific gravity respectively.

3.4.3. Other Parameters
Other parameters like air voids in initial and design gyration (Va_{ini} and Va_{des}), gyration number in which maximum shear stress is given ($N-S_m$), Voids in mineral aggregates (VMA), height and density variations were determined for each specimens which only K, K_2 and S_m introduced as effective parameters in sensitivity analysis.

3.5. Rutting Test
Rutting test was performed for each specimen in 50°C, under 700kpa pressure and 60 loads per second as loading rate and the

rut depth after 8000 cycles were recorded. The results could be seen in table 5.

4. Presenting Laboratory Model
4.1. Developing a Model using SPSS 19

Predicting a variable behavior using other variables behaviors is the target of regression. It means to recognize the relation between effective parameters (x) and affected parameters (y) and to ensure a meaningful correlation between variables and finally to estimate a variable using another one. Correlation Coefficient (R^2) is a parameter which illustrates a relation between model results and actual results. Two assumptions are considered in regression as H_0 and H_1:

$$H_0: R=0 \text{ and } H_1: R \neq 0 \quad (5)$$

H_0 assumption should be rejected using sig F change coefficient. Whatever this coefficient is less, R^2 meaningfulness is more and so the model is more validated. This coefficient should be less than 0.05 since reliability is considered as 95% in this model. Statistical analysis results of 144 data series in SPSS 19 is listed in table 6 and two models were gained as following:

4.1.1. Model Number 1
According to tables 7 and 8, eq. (6) is the output model:

$$WT = 0/009 K_2 - 0/285 K \quad (6)$$

In which:
WT: Rut depth of Wheel Trucker, mm
K: Gyratory Compaction Slope from eq. (2)
K2: Gyratory Shear Stress Curve Y-Intersect from eq. (1)
As it is obvious from tables 7 and 8, R^2 is 0.921 for this model which is meaningful in 95% reliability level.

4.1.2. Model Number 2
According to tables 9 and 10, eq. (7) is determined:

$$WT = -0/376 K + 0/008 S_m \quad (7)$$

In which:
WT: Rut depth of wheel Trucker, mm
K: Gyratory Compaction Slope from eq. (2)
S_m: Maximum Shear Stress in Gyratory Curve
As it is obvious from tables 9 and 10, R_2 is 0.92 for this model which is meaningful in 95% reliability level.

4.2. Validating the models using ANN
ANN[12] is a simulation of brain nerve and has learning, generalization, and decision making power like human's brain. In designing the network, after defining a dynamic system mechanism, the model is trained and system mechanism is saved in model memory, so this memory is used to estimate new cases. Neural networks have been used in various aspects of pavement engineering such as estimating asphalt dynamic and elasticity modulus [20-21], bitumen properties effect on asphalt features [22] and Mixture Compaction Quality Control [23].

A neural network is composed from several processors which are called neurons or nodes. Each neuron is connected to other neurons with oriented lines having specific weight. Weight shows the amount of information used by network to solve the problem. Neurons are organized in groups called layers. Generally there are two layers to connect network with out of it as input layer (to get input data) and output layer to transfer answers out of network. Other layers between these two layers are called hidden layers. Network input and output layer number depends on dependent and independent variables of the desired relation respectively. Both models in this paper have two independent variables and one dependent variable, so the network in both of them has two input neurons and one output neuron (figure 4).

Figure 5 shows input (I) and output (O) and a hidden neuron structure. B and w parameters could be set up and f function type

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[12] Artificial Neural Network

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is selected by designer so the neuron output is desired. Determining b and w for total network is called network training. Network output is compared with actual observations and error is calculated in training process. Coefficients are modified based on this error. Whatever root mean square error (RMSE) is closer to zero, error is less, so the model is better.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(x_i - y_i)^2}{n}}$$
(8)

R^2 is the statistical index to validate output accuracy which whatever closer to 1, more precise the model is.

$$R^2 = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 (y_i - \bar{y})^2}}$$

MATLAB 2008 software was use for coding the network. About 67% of data were used for training the network after normalizing by eq. (10) and remained data were used for validation.

$$X_n = (x - x_{min}) / (x_{max} - x_{min}) \quad 0 \leq X_n \leq 1$$
(10)

4.2.1. Neural Network results for model number 1 (WT=0.009K_2-0.285K)
Considering two neurons in input layer and one in output and using 5, 10, 15 and 20 neurons in median layers, results were obtained as table 11 and figure 6. R^2 were determined as 0.8578 in best structure in validation phase as it is stated in table.

4.2.2. Neural Network results for model number 2 (WT=-0.376K+0.008S_m)
Neurons and layers number were assumed as the network for model number 1 and the results are illustrated in table 12 and figure 7. R^2 was determined as 0.8846 in best structure in validation phase as it is clear in table.

4.3. Validating models Using GA
Genetic Algorithm (GA) is a method of optimizing and validating data which using a natural inception performs based on evolution principle (Survival of the fittest). GA applies survival fittest rule on a set of solutions to obtain better answers. Better estimations of solutions are calculated using a selection process proportional to answer costs in each generation and reproduction selected answers with functions imitated from natural genetic. Hence the new generation is more compatible with problem condition after this process. Independent variables should be determined such that less variation existed between actual answer and estimated answer of dependent variable of that model in each step of evolution (figure 8). MATLAB 2008 software was used for coding and Excel 2007 for comparing the results in this study.

3.4.1. GA results for model number 1 (WT=0.009K_2-0.285K)
As it is illustrated in figure 9, 0.965 is obtained as determination coefficient for this model.

3.4.2. GA results for model number 2 (WT=-0.376K+0.008S_m)
As it is illustrated in figure 10, 0.8575 is obtained as determination coefficient.

5. Conclusion
One of the most important consequences of this study is shear stress modeling versus gyration number. It was proofed that logarithmic model results in the best trend. This curve has two main parts. The first part can be named as compaction phase, which has an intense slope. Shear stress variation in this part is more than condensation part. Voids variation of first part is more that the second one too. Two models for predicting rut depth were presented using Y-Intercept of this relation, compaction slope and maximum shear stress. Compaction slope coefficient is negative in both of the models. In other words specimens with more compaction slope are more resisted to rutting which is due to more internal friction and structural establishment of them. Maximum

shear stress positive coefficient and shear stress curve intercept of these models states that asphalt mixtures with more shear stress in compaction phase are exposed to rutting more. Simply means more shear stress in condensation phase in comparison with compaction phase shows more shear strength of the mixture.

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7. References

1. Ameri, M. Moghaddas Nejad, F. Mirzahoseini, R. (2010). "Presenting a Prediction Model for Asphalt Mixture Rutting Using Marshall Mix Design Parameters and Parameters Effect on Flow", 5th National Conference on Civil Engineering, Ferdowsi University of Mashhad, Mashhad, Iran.

2. Drakos, C., R. Roque, and B. Birgisson, (2001). "Effects of Measured Tire Contact Stresses on Near Surface Rutting", Transportation Research Record No. 1764, Transportation Research Board, Washington, DC, pp. 59-69

3. Drakos, Chirstos. A, "Identification of A physical Model to Evaluate Rutting Performance of Asphalt Mixture", A dissertation presented to the graduate school of the University of Florida in partial Fulfillment of the requirements for the Degree of Doctor of Philosophy University of Florida 2003.

4. Ameri, M. Moghaddas Nejad, F. Mirzahoseini, R. (2009). "Gradation Type and VMA Effects on Rutting Potential of HMA and Presenting a Rutting", Jaddeh Scientific and Promoting Magazine, Vol 66, Summer 2009, pp 5-12

5. Sheng Hai Fan, Ling Lin, (2011) "Investigations and Countermeasures Analysis of Rutting in Highway Asphalt Concrete Pavements", Advanced Materials Research, Advances in Civil Engineering, Vol.255 – 260, pp. 3263-3267.

6. Mohammadzadeh, M. Latifi, M. Mohammad Zadeh, M. (2008). "Comparing Marshall and Gyratory Mix Design Methods to Prepare Laboratory Specimens for Evaluating Asphalt Mechanical Behavior", 4th National Conference on Civil Engineering, University of Tehran, Tehran, Iran.

7. American Association of State Highway and Transportation Officials, "Standards Specifications For Transportation Materials and Method of Sampling and Testing"; 29th edition, 2009.

8. Iran Ministry of Road and Transportation, Deputy of Education Research and Technology, Transportation Research Institute (TRI), (2005), Investigation about Performance based Asphalt Mix Design for Implementation an Appropriate Method in Iran, 1st Edition, page 151.

9. Kevin McGarvey, Michael Panko, Casey Hurt, Yusuf Mehta, Beena Sukumaran. (2010) "Use of the Superpave Gyratory Compactor as a Predictor of Field Performance", 2010 FAA Worldwide Airport Technology Transfer Conference, Atlantic City, New Jersey, USA, April 2010.

10. Mc Gennis, R. B , R.M. Anderson, T. W. Kennedy and M. Solaimanian. Background of Superpave Asphalt Mixture Design & Analysis, FHWA – SA – 95 – 003, November 2004.

11. Witczak, M. W., K. Kaloush, T. Pellinen, M. EL – Basyoung, and H.Von Quintus, "Simple Performance Test for Superpave Mix Design ", NCHRP Report 465, Transportation Research Board, Washington, D. C., 2002.

12. Corte J, Serfass J. "The French approach to asphalt mixture design: A Performance related system of specification", Proceedings of the Association of Asphalt Paving Technologists, Vol. 69, 2000.

13. Anderson, R.M., Christensen, W. D. and Bonaquist, R., "Estimating the Rutting Potential of Asphalt Mixtures Using Superpave Gyratory Compaction Properties and Indirect Tensile Strength", Association of Asphalt Paving Technologists-Proceedings of the Technical Sessions, Vol. 72, 2003.

14. Reynaldo Roque, Bjorn Birgisson, Daniel Darku, Christos A. Drakos, "Evaluation of Laboratory Testing System for Asphalt Mixture Design and Evaluation", Volume II, Department of civil & Coastal Engineering, University of Florida, September 2004.

15. Archilla, A.R, "Use of Superpave Gyratory Compaction Data for Rutting Prediction" University of Hawaii at Manoa, Journal of Transportation Engineering, ©ASCE / September 2006.

16. You, Z., Barak, J. W. (2009) "Development of Specification for the Superpave Simple Performance Tests (SPT)", Department of Civil and Environmental Engineering Michigan Technological University, Project No. RC-1532 May 16th, 2009.

17. Iran Ministry of Road and Transportation, Transportation Research Institute (TRI), (2009), Effect of Gradation Type and Void in Asphalt Concrete on Rutting and Bleeding in Iran Roads, 1st Edition.

18. Vice Presidency for Strategic Planning and Supervision, The Ministry of Roads and Urban Development, Asphalt Institute of Iran, (2011). Iran Highway Asphalt Paving Code, No. 234, 1st Edition.

19. Samer Dessouky, Lubinda F. Walubita, Vivekram Umashankar, Xiaodi Hu, Brandon Jamison, Fujie Zhou, Tom Scullion, Amy Epps Martin, "New Generation Mix-Designs: Laboratory Testing and Construction of The APT Test Sections", Texas Transportation Institute, Project 0-6132, March 2010.

20. Chun Hua Hu, "Prediction of Resilient Modulus for Hot Mix Asphalt Based on Artificial Neural Network", Advanced Materials Research (Volume 304), July, 2011, pp 18-23.

21. Maryam S. Sakhaeifar, B. Shane Underwood, Y. Richard Kim, Jason Puccinelli, Newton Jackson," Development of Artificial Neural Network Predictive Models for Populating Dynamic Module of Long-Term Pavement Performance Sections", Transportation Research Record: Journal of the Transportation Research Board, Volume 2181 / 2010, pp 88-97.

22. Serin, S. Morova, N. Terzi, S. Sargin, S. , "Amount of Bituminous Effects on Asphalt Concrete Strength with artificial intelligence and statistical analysis methods", International Symposium on Innovations in Intelligent Systems and Applications (INISTA), 15-18 June 2011, pp 329-334.

23. Beainy, F., Commuri, S. Zaman, M., "Asphalt Compaction Quality Control Using Artificial Neural Network", 49th IEEE Conference on Decision and Control (CDC), Dec. 2010, pp 4643 – 4648.

8. Tables
Table 1. Aggregates gradation for Binder and Topka layers [18]

Sieve Specification			Number 4 Continuous Gradation			Number 5 Continuous Gradation		
mm	Sieve Number	Inches	Passed Range (Weight %)	Passed (Average weight %)	Remained (Weight %)	Passed Range (Weight %)	Passed (Average weight %)	Remained (Weight %)
19	-	3/4	100	100	0	-	-	-
12.5	-	1/2	90-100	95	5	100	100	0
9.5	-	3/8	-	-	-	90-100	95	5
4.75	4	-	44-74	59	36	55-85	70	25
2.36	8	-	28-58	43	16	32-67	49.5	20.5
1.18	16	-	-	-	-	-	-	-
0.6	30	-	-	-	-	-	-	-
0.3	50	-	5-21	13	30	7-23	15	35.4
0.15	100	-	-	-	-	-	-	-
0.075	200	-	2-10	6	7	2-10	6	9

Table 2. Determined OBC for 16 various asphalt mixture combination

Limestone Specimen Specification	A4P6	A4P8	A5P6	A5P8	A4A6	A4A8	A5A6	A5A8
OBC	5.81	5.70	5.92	5.80	6.16	5.90	6.24	6.00
Silica Specimen Specification	S4P6	S4P8	S5P6	S5P8	S4A6	S4A8	S5A6	S5A8
OBC	5.05	4.96	5.24	5.02	5.40	5.15	5.45	5.25

Table 3. N_{ini}, N_{des} and N_{max} in SGC

ESAL 10^6	Maximum Design Temperature Average											
	< 39 ℃			39-40 ℃			41-42 ℃			43-44 ℃		
	N-initial	N-design	N-max	N-initial	N-design	N-max	N-initial	N-design	N-max	N-initial	N-design	N-max
< 0.3	7	68	104	7	74	114	7	78	121	7	82	127
0.3-1	7	76	117	7	83	129	7	88	138	8	93	146
1-3	7	86	134	8	95	150	8	100	158	8	105	167
3-10	8	96	152	8	106	169	8	113	181	9	119	192
10-30	8	109	174	9	121	195	9	128	208	9	135	220
30-100	9	126	204	9	139	228	9	146	240	10	153	253
>100	9	143	235	10	158	262	10	165	275	10	172	288

Table 4. Determining Correlation Coefficient of presented model for all gyratory shear stress curves (144 specimens)

Correlation Coefficient (R^2)							Total
R^2 Range	100-95	95-90	90-85	85-80	80-75	<75	
Number of Specimens	79	34	10	11	5	5	144
Percent	54.86	23.61	6.94	7.64	3.47	3.47	100

Table 5. Gyratory compactor and rutting test results for 144 specimen

Limestone Specimen Number		Bitumen Percent (Pb)	Difference With OBC	Rut Depth (mm)	K	K1	k2	Maximum shear (Sm)	Limestone Specimen Number		Bitumen Percent (Pb)	Difference With OBC	Rut Depth (mm)	K	K1	k2	Maximum shear (Sm)
1	A4P6			3.19	10.644	75.684	740.68	1065	1	S4P6			8.71	8.314	55.653	828.82	1074
2	A4P6	5.3	-0.5	4.63	10.984	63.005	775.03	1065	2	S4P6	4.6	-0.5	7.35	7.595	56.488	843.56	1086
3	A4P6			2.84	10.400	45.680	810.94	1019	3	S4P6			8.20	8.416	56.842	816.65	1067
1	A4P6			2.82	11.168	65.583	785.62	1083	1	S4P6			5.59	8.432	52.113	858.15	1085
2	A4P6	5.8	0.0	4.34	10.693	67.488	773.39	1065	2	S4P6	5.1	0.0	7.91	8.837	56.950	845.34	1043
3	A4P6			3.85	10.964	53.719	787.96	1026	3	S4P6			6.06	7.860	53.417	861.33	1094
1	A4P6			5.78	11.122	63.118	770.88	1038	1	S4P6			3.80	7.771	45.727	889.35	1086
2	A4P6	6.3	0.5	3.49	10.304	67.758	736.96	1074	2	S4P6	5.6	0.5	6.47	8.347	54.959	841.50	1076
3	A4P6			7.05	7.944	50.292	806.88	1068	3	S4P6			9.55	7.483	37.180	917.44	1077
1	A4P8			2.69	11.668	66.131	788.85	1099	1	S4P8			7.11	7.824	54.572	846.07	1076
2	A4P8	5.2	-0.5	2.91	10.896	43.520	832.17	1016	2	S4P8	4.5	-0.5	3.71	7.740	50.098	843.66	1053
3	A4P8			3.55	11.166	58.347	805.52	1052	3	S4P8			3.97	7.978	55.757	831.18	1073
1	A4P8			3.18	10.687	62.514	768.71	1044	1	S4P8			5.97	7.705	46.592	859.18	1055
2	A4P8	5.7	0.0	2.65	10.866	49.968	829.30	1037	2	S4P8	5.0	0.0	4.34	7.950	46.117	851.23	1043
3	A4P8			4.07	10.846	49.920	820.97	1041	3	S4P8			6.35	8.167	49.670	859.26	1068
1	A4P8			3.46	10.732	62.964	753.15	1043	1	S4P8			11.57	9.609	50.594	926.20	1141
2	A4P8	6.2	0.5	3.97	9.834	38.115	844.82	1019	2	S4P8	5.5	0.5	5.84	8.454	45.644	873.38	1071
3	A4P8			6.53	9.637	24.287	724.04	845	3	S4P8			5.64	8.116	44.116	882.81	1073
1	A5P6			1.38	10.064	35.803	686.45	845	1	S5P6			7.17	7.535	51.705	848.93	1070
2	A5P6	5.4	-0.5	1.38	9.938	41.004	699.90	873	2	S5P6	4.7	-0.5	5.44	7.650	55.055	854.55	1089
3	A5P6			3.45	10.273	50.201	666.07	876	3	S5P6			4.47	7.615	50.070	842.45	1052
1	A5P6			1.93	10.710	45.989	702.50	908	1	S5P6			6.09	7.408	45.921	885.91	1083
2	A5P6	5.9	0.0	0.92	10.522	47.167	711.08	930	2	S5P6	5.2	0.0	5.11	7.176	39.374	894.97	1061
3	A5P6			5.70	7.093	19.041	707.10	813	3	S5P6			3.43	7.502	42.900	876.46	1055
1	A5P6			3.09	9.848	42.946	664.93	869	1	S5P6			6.99	6.826	25.900	921.59	1046
2	A5P6	6.4	0.5	0.92	9.977	42.742	665.33	863	2	S5P6	5.7	0.5	8.38	7.237	33.478	927.13	1073
3	A5P6			6.94	6.157	18.223	744.45	831	3	S5P6			7.26	7.195	32.190	925.66	1070
1	A5P8			2.53	10.018	32.200	686.87	827	1	S5P8			6.31	7.561	56.582	832.66	1080
2	A5P8	5.3	-0.5	1.45	8.240	28.287	725.44	863	2	S5P8	4.5	-0.5	5.73	8.233	57.658	824.05	1076
3	A5P8			2.72	8.646	38.997	688.40	860	3	S5P8			3.62	7.533	55.142	833.91	1079
1	A5P8			2.95	7.623	22.200	725.51	836	1	S5P8			3.99	7.751	55.123	849.76	1094
2	A5P8	5.8	0.0	3.58	7.167	23.188	733.71	837	2	S5P8	5.0	0.0	3.92	7.348	49.202	878.74	1089
3	A5P8			4.22	6.604	24.064	708.59	818	3	S5P8			6.62	7.385	48.443	882.77	1088
1	A5P8			9.14	6.077	19.468	734.99	827	1	S5P8			7.25	7.343	40.508	909.04	1080
2	A5P8	6.3	0.5	6.72	9.969	48.067	632.33	866	2	S5P8	5.5	0.5	5.47	7.109	37.800	913.79	1074
3	A5P8			13.27	6.842	55.394	621.48	900	3	S5P8			7.58	7.396	45.272	889.75	1085
1	A4A6			5.09	6.278	45.333	788.59	990	1	S4A6			8.75	7.278	44.642	838.27	1034
2	A4A6	5.7	-0.5	5.08	6.361	47.952	791.61	1007	2	S4A6	4.9	-0.5	6.62	7.348	49.778	812.62	1031
3	A4A6			8.34	6.227	45.878	785.93	989	3	S4A6			3.96	8.920	54.293	792.75	1025
1	A4A6			4.59	6.311	45.086	793.47	995	1	S4A6			2.96	7.842	50.787	828.35	1049
2	A4A6	6.2	0.0	4.58	6.476	45.550	797.19	1001	2	S4A6	5.4	0.0	2.29	7.972	46.869	838.26	1041
3	A4A6			8.07	6.519	46.688	775.64	987	3	S4A6			0.45	7.825	47.945	832.71	1040
1	A4A6			7.87	6.839	46.198	791.65	993	1	S4A6			3.15	9.377	51.503	809.15	1025
2	A4A6	6.7	0.5	6.06	6.379	43.376	803.55	995	2	S4A6	5.9	0.5	3.68	7.987	43.781	839.74	1028
3	A4A6			3.85	6.581	46.846	785.41	992	3	S4A6			2.40	8.249	46.984	827.45	1029
1	A4A8			6.60	8.878	54.751	802.55	1041	1	S4A8			5.24	7.262	50.224	799.32	1020
2	A4A8	5.4	-0.5	10.79	8.998	49.545	805.27	1016	2	S4A8	4.7	-0.5	4.50	6.715	47.873	821.86	1031
3	A4A8			11.40	9.767	59.956	764.72	1029	3	S4A8			2.71	6.669	42.862	830.72	1016
1	A4A8			6.33	10.230	52.048	789.95	1008	1	S4A8			5.54	8.100	50.815	820.90	1040
2	A4A8	5.9	0.0	6.40	6.252	44.600	781.24	980	2	S4A8	5.2	0.0	5.12	8.138	51.271	800.58	1022
3	A4A8			4.47	9.826	49.696	794.99	1007	3	S4A8			2.51	7.687	50.807	817.65	1037
1	A4A8			10.61	6.404	49.918	785.22	1010	1	S4A8			4.51	8.145	44.199	831.48	1019
2	A4A8	6.4	0.5	5.96	9.608	42.519	814.84	992	2	S4A8	5.7	0.5	7.45	8.412	53.902	791.64	1031
3	A4A8			3.74	6.443	45.230	800.04	998	3	S4A8			2.08	8.566	47.613	824.49	1026
1	A5A6			5.88	9.162	58.800	786.82	1046	1	S5A6			3.43	7.181	52.829	830.95	1068
2	A5A6	5.7	-0.5	5.85	7.767	49.741	817.90	1037	2	S5A6	5.0	-0.5	4.17	6.371	48.049	837.75	1052
3	A5A6			4.70	8.636	53.797	795.13	1031	3	S5A6			1.88	6.558	49.410	841.82	1061
1	A5A6			5.85	8.514	47.230	829.10	1029	1	S5A6			3.38	7.511	51.732	824.75	1052
2	A5A6	6.2	0.0	4.75	8.818	45.953	819.07	1010	2	S5A6	5.5	0.0	3.83	7.106	48.058	830.22	1046
3	A5A6			5.88	8.459	41.592	841.39	1016	3	S5A6			3.14	7.578	49.802	840.59	1058
1	A5A6			6.63	8.486	45.060	813.30	1016	1	S5A6			3.50	8.144	44.640	831.34	1020
2	A5A6	6.7	0.5	8.87	8.303	38.636	849.80	1025	2	S5A6	6.0	0.5	4.15	7.789	48.327	825.28	1037
3	A5A6			7.88	8.642	46.524	812.35	1020	3	S5A6			2.76	7.727	43.582	839.48	1026
1	A5A8			6.44	8.127	57.619	793.34	1049	1	S5A8			5.35	7.087	49.989	795.55	1017
2	A5A8	5.5	-0.5	5.86	8.377	56.843	803.52	1052	2	S5A8	4.8	-0.5	6.01	7.263	45.765	829.78	1032
3	A5A8			7.48	8.658	55.392	801.11	1038	3	S5A8			5.70	7.111	48.880	818.43	1035
1	A5A8			5.83	8.893	44.277	822.64	1007	1	S5A8			3.05	7.976	56.738	815.88	1068
2	A5A8	6.0	0.0	6.30	9.154	47.371	825.33	1026	2	S5A8	5.3	0.0	4.36	8.579	54.157	815.37	1052
3	A5A8			4.77	9.313	55.743	781.31	1025	3	S5A8			2.42	7.850	47.826	827.37	1040
1	A5A8			10.12	8.752	28.280	867.92	995	1	S5A8			3.68	9.010	55.236	797.11	1034
2	A5A8	6.5	0.5	7.94	8.830	32.669	854.94	999	2	S5A8	5.8	0.5	4.22	8.661	52.333	811.74	1038
3	A5A8			6.36	9.200	35.573	840.55	995	3	S5A8			3.03	8.845	52.256	808.50	1032

Table 6. Parameters statistical analysis in SPSS 19 results

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
WT	144	12.82	0.45	13.27	5.1768	2.32230	5.393
k	144	5.59	6.08	11.67	8.3197	1.34949	1.821
k1	144	57.46	18.22	75.68	47.6105	9.78674	95.780
k2	144	305.65	621.48	927.13	809.1351	58.07185	3372.339
Sm	144	328.00	813.00	1141.00	1018.2569	69.97280	4896.192

Table 7. Model Number 1 statistical specification summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics Sig. F Change
1	0.921	0.848	0.845	2.22973	0.000

Table 8. Model Number 1 independent parameters coefficients

Model		Un standardized Coefficients		Standardized Coefficients	T	Sig.	0.95 % Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	k	-0.285	0.114	-0.423	-2.493	0.014	-0.511	-0.059
	k2	0.009	0.001	1.332	7.846	0.000	0.007	0.012

Table 9. Model Number 2 statistical specification summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics Sig. F Change
2	0.920	.847	0.845	2.23541	0.847

Table 10. Model Number 2 independent parameters coefficients

Model		Un standardized Coefficients		Standardized Coefficients	t	Sig.	0.95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
2	k	-0.376	0.127	-0.559	-2.967	0.004	-0.626	-0.125
	S_m	0.008	0.001	1.465	7.780	0.000	0.006	0.010

Table 11. Neural Network Run Output for Model Number 1 (for 5, 10, 15 and 20 neurons in a hidden layer)

Neural Network Structure	Training Phase		Validation Phase
	R^2	RMSE	R^2
2-5-1	0.6403	0.0192	0.5411
2-10-1	0.7942	0.0120	0.7509
2-15-1	0.8491	0.0091	0.8438
2-20-1	08698	0.0085	0.8578

Table 12. Neural Network Run Output for Model Number 2 (for 5, 10, 15 and 20 neurons in a hidden layer)

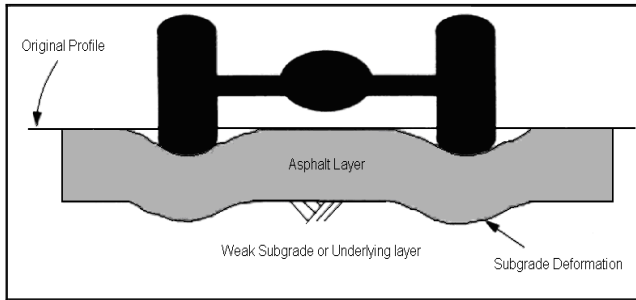| Neural Network Structure	Training Phase		Validation Phase
	R^2	RMSE	R^2
2-5-1	0.6282	0.0197	0.4578
2-10-1	0.7892	0.0171	0.5985
2-15-1	0.8595	0.0112	0.7809
2-20-1	0.8900	0.0085	0.8846

9. Figures

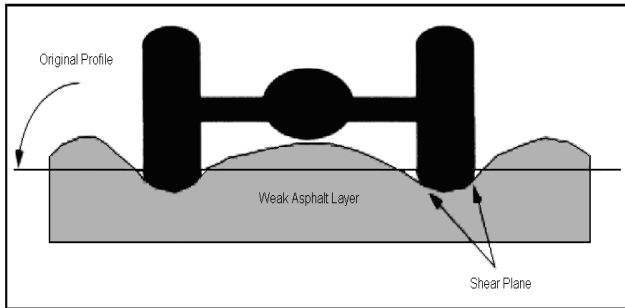**Fig 1**. Rutting due to underneath layer deformation

Fig 2. Rutting in asphalt layer due to lack of shear strength
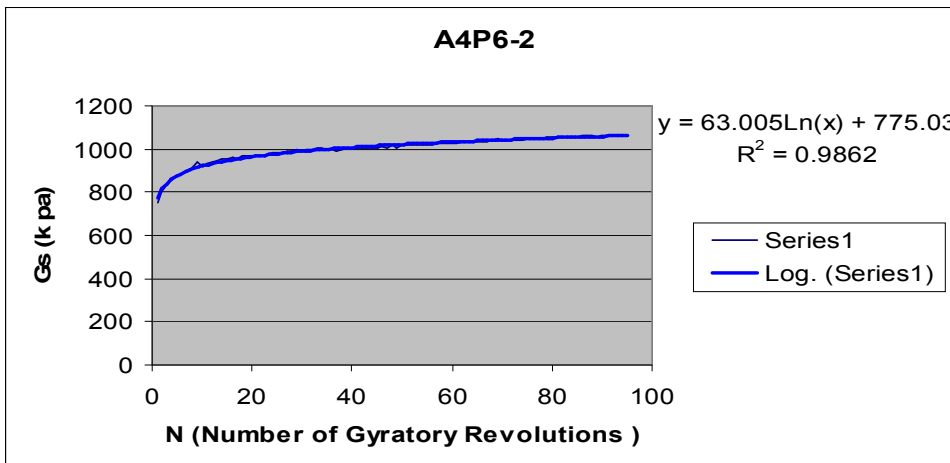

Figure 3. Shear stress modeling versus gyration number (for one of the limestone specimens, gradation number 4, rock powder as the filler and 60-70 bitumen)
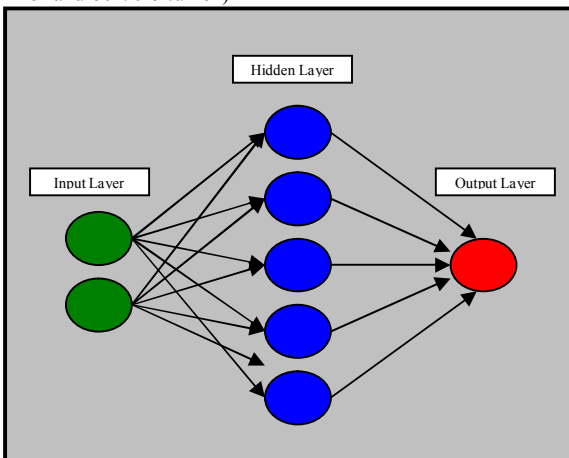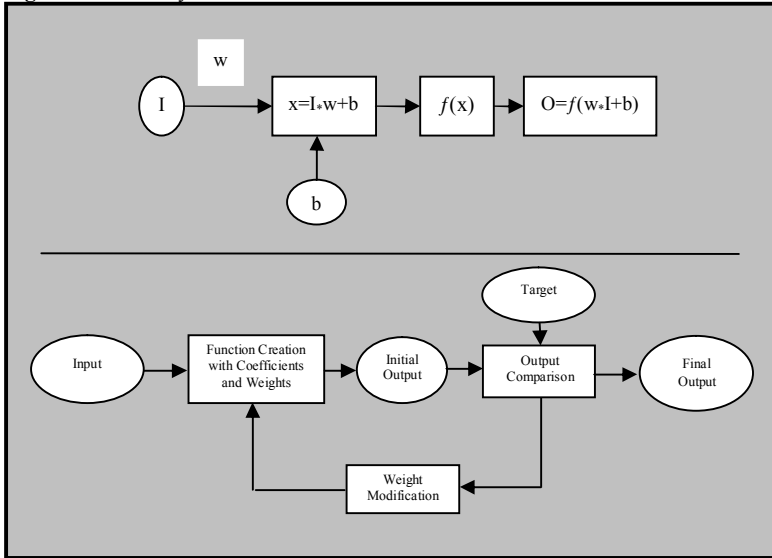
Figure 4. ANN Layers
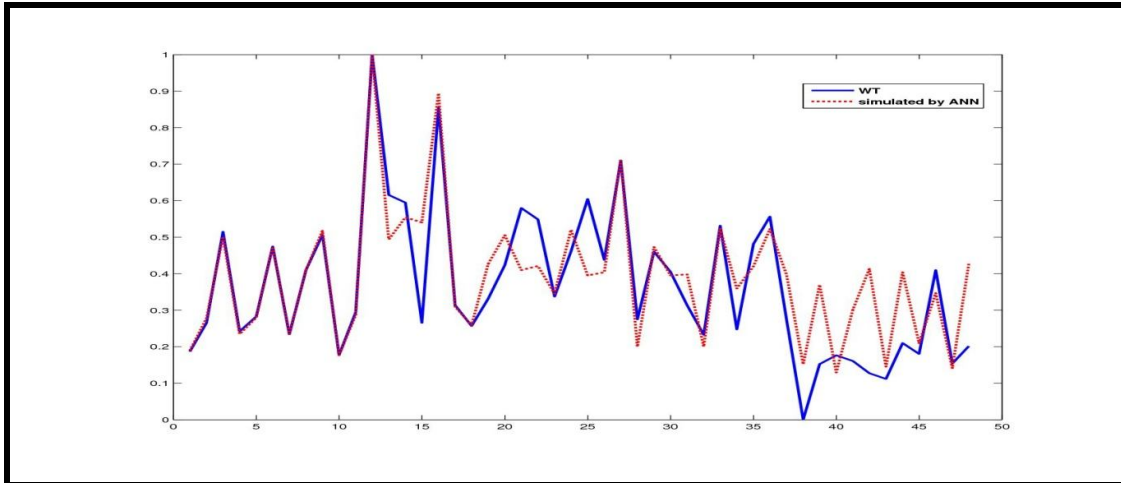

Figure 5. Neural Network Architecture

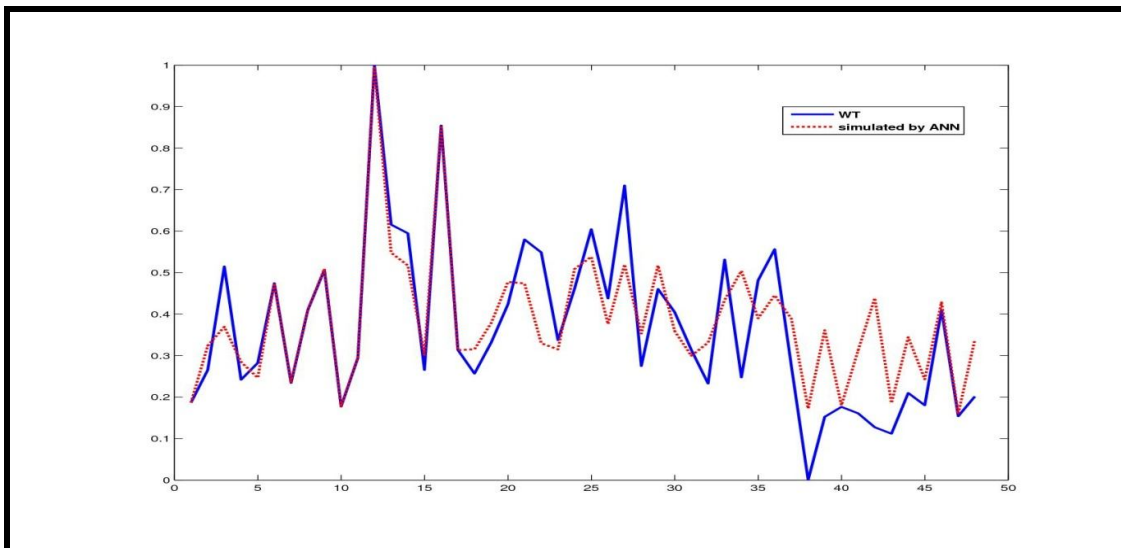**Figure 6.** 1-20-2 structure curve in validation phase of model number 1 (best structure with R^2=0.8578)

Figure 7. 1-20-2 structure curve in validation phase of model number 2 (best structure with R^2=0.8846)
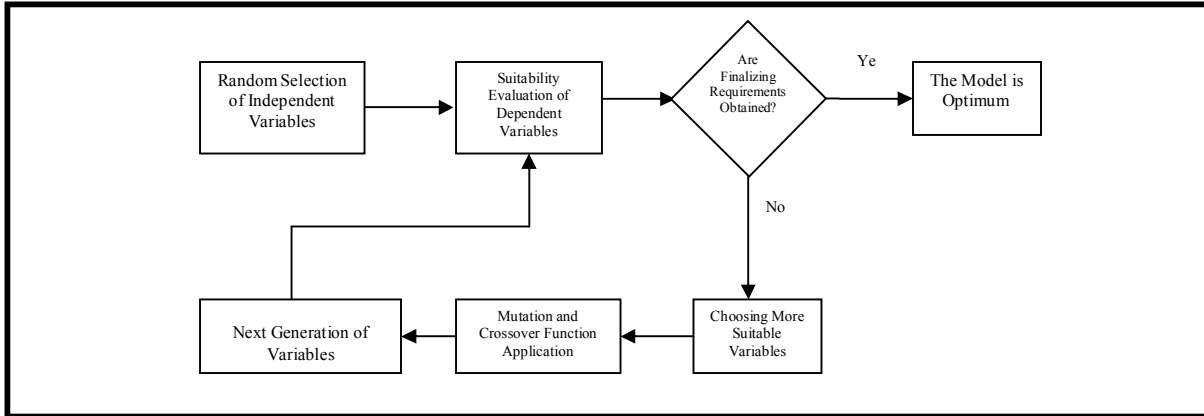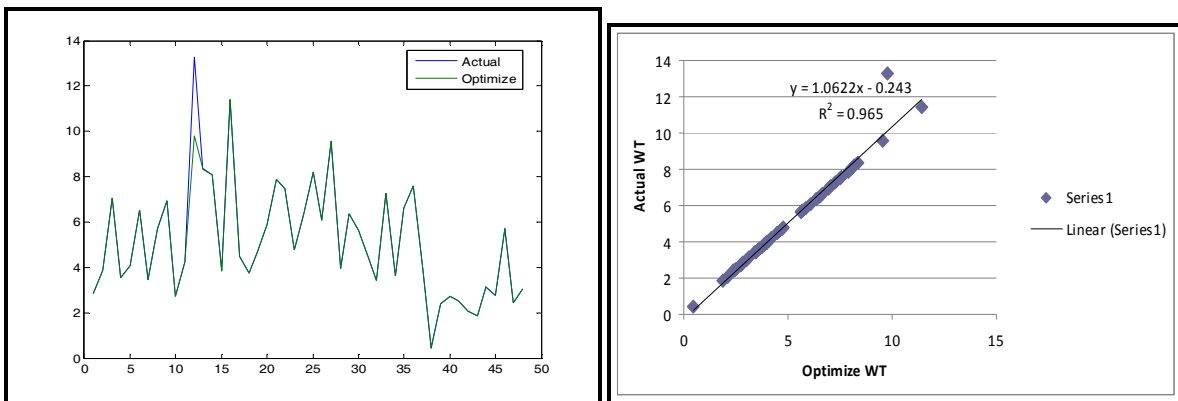
Fig 8. Applied GA Flowchart

Fig 9. a) Regression on actual and estimated values of model number 1, b) Comparison between actual and estimated values of model number 1 during evolution
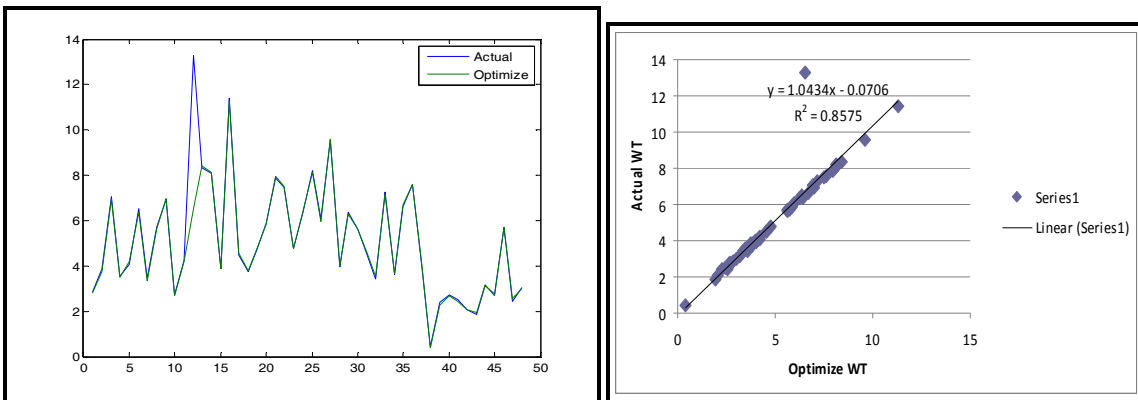

Fig 10. a) Regression on actual and estimated values of model number 2, b) Comparison between actual and estimated values of model number 2 during evolution

Relationship between mental health and happiness, achievement motivation and academic success of male and female students of Islamshahr Azad University

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Abstract: Increasing mental health is one of the main components in the process of raising the quality of university education. Considering this issue provides mental health in society. Male and female students' Pathology is a new discussion that has recently been considered in universities. Psychological and emotional problems, educational problems and educational failure, the establishment of poor intellectual and political factions, drug addiction and other possible injuries must be needed to attention. Such damage has suffered enormous material and spiritual to the education and the university's environment, and it can convert safe and scientific area of university to inappropriate and unsafe. The aim of this study is to analyze and compare the mental health and happiness, achievement motivation and academic success of boys and girls students. The results show that According to the problems, difficulties and possible damage associated with male students, they don't have similar conditions with girls' students in terms of mental health and happiness, achievement motivation and academic success. So it will have more problems in different aspects of psychological trauma, social, educational and political.

1. Introduction

The trend of mental health and considering this issue as a major factor in university is not only a matter on campus that couldn't be solved with just a few solutions, but also all factors involved in the University such as Professors, administrators, govern behavior of natural and mental environment, parents and most importantly the student himself must pay attention to this matter in a continuous interaction. If we don't consider creating a platform in university to promote the mental health, both students and ultimately society will suffer irreparable harm. Human is Complex with many different aspects that his life will be sustained in relating to relative balance of the different dimensions (Wells & Hatton, 2004). One of these dimensions is mental health that the workbook of World Health Organization defines it as follow:
Mental health is the perfect condition of welfare and Biological- mental and social prosperity, and the absence of this is not disease or disability. Also, mental health in its general concept is defined as having thought's health, mental balance and positive psychological characteristics and it is necessary to clear the ways to achieve mind and spirit health for Individual

and social growth and evolution of human. Also, in its specialized concept is a field of health care that educated people with specific skills and experience, by adopting scientific methods, teach it to people (Mellings & Alden, 2000).
The meaning of mental health is the prevention of mental disorders. The prevention in its wide sense is to create factors and circumstances that is the complement of health and norm life and for this reason the treatment of mental disorders is as a part of this activity. One of the most important factors associated with mental health is happiness (Skitka, 2002).
The main objective of the study is to investigate the relationship between mental health and happiness, achievement motivation and academic success among male and female students of ISLAMSHAR Azad University of Tehran. The Secondary objectives of this study are as follow:

1- Identifying the effective factors of students' mental health.
2- Primary prevention in mental health (i.e. preventing from damage and malicious threats such as depression, anxiety, anger and loneliness).

2. Literature review

Effective factors in students' mental health
Mental health is influenced by many factors that are not inevitable and can't be separated, although they have been considered individually. This means that balance mental of people in individual factors or environmental conditions as interaction factors, can be changed, and if the influence of these factors to be more, the impact and threat will be more (Lobban et. al, 2002). Factors such as; not satisfied expectations, frustration, stress, learning, social problems and social media and…, are the most important factors affecting mental health.

Most psychiatrist, consider the ability of adaptation, flexibility in fair and reasonable judging in the face of deprivation and pressures as mental health criteria (Zohar, 1991). The concept of achievement need was introduced for the first time by Murray in 1938 (Meehl, 1992). According to Murray achievement need is; trying to succeed in any situation, so that its performance could be evaluated, according to some high standards. This concept means motivation in deals with some significant obstacles and fight against what is known difficult.

Mental health is essential and includes all aspects of everyday life, school, university, work, and what should be considered in mental health are competence, personality and human dignity and whenever these components don't be considered, emotional balance and Human Relations improvement doesn't give us its main meaning among us (Flavell & Miller, 1998). Another point in this definition is that the creation of mental health, is not in decreasing of disease symptoms, but is in creating of potential, physical and mental ability to cope with stress, caused by social life, that is so important, and create fertility and coordination for society and economy.

Ankstion in 1964 extended the concept of achievement motivation. Ankstion believes that difference in required to progress between individuals can be explained by disagrees' need like the assumption of a need to avoid failure. According to Ankstion, some people are successful oriented and some of them are anxious, because of failure. Ankstion believes that the desire to achieve success is affected by the probability of success and its gravity.

Research hypothesis
  1- Mental health of male students in compared to female students is significantly lower.
  2- Achievement motivation of male students in compared to female students is significantly lower.
  3- Educational performance of male students in compared to female students is significantly lower.

3. Methodology

This study is a descriptive comparison. The statistical population of this study is included all male and female students enrolled in the College of ISLAMSHAR (Tehran unit), comprise from 2011 to 2012 academic year, that have studied at least two halves of the academic year. The statistical sample are (N = 200) of male and female students that were studying in College of ISLAMSHAR (Tehran unit), that were selected.

Various tools were used for data collection, including:
  1- General Health Questionnaire (GHQ); This questionnaire has 28 questions that were formulated in 1979 by Goldberg & Hiller, which has four sub-scales: 1- somatic symptoms, 2- Anxiety Symptoms, 3- social function, and 4- depression Symptoms.
  2- Achievement motivation test (ACMT); This test has a 50 three choice question and is based on sentence completion method that means the respondent after reading an incomplete sentence must complete the sentence with half of three options.
  3- In addition, the performance of male and female students was computed on the basis of their scores on the questionnaire were asked.

Reliability and validity of the test instrument
Cronbach's alpha coefficient for General Health Questionnaire reliability is 0.91. According to the Dadsetan the Cronbach's alpha coefficient for Achievement motivation test is 0.76 and Reliability was calculated by the Guttman and Spearman Brown method is also 63%.

4. Results

According to the information obtained by distributed questionnaire, psychological problems of male and female students are as table 1:

Table 1; Frequency distribution of male and female students' psychological problems

Variable	Male		Female	
	Frequency	%	Frequency	%
Depression	58	0.22	39	0.26
Anxiety	67	0.26	34	0.23
Impaired social interaction	15	0.06	3	0.02
Somatization	27	0.10	17	0.11
Lack of mental health	39	0.15	24	0.16
Low Achievement Motivation	10	0.04	3	0.02
Educational performance	46	0.18	31	0.21

The results of chi-square test show that the anxiety, depression, somatic complaints, and impaired social interactions in male students were significantly more than female students. Also, the educational performance of female students is more than male students and Achievement motivation of male students is lower than female students (see table 2).

Table 2; the results of χ^2 test

Variable	Group	χ^2	SD	df	t(p)
Depression	Male	4.47	4.85	97	2.99(<0.01)
	Female	3.28	2.05		
Anxiety	Male	5.5	3.8	97	2.88(<0.01)
	Female	4.13	2.53		
Impaired social interaction	Male	5.93	2.8	97	3.07(<0.01)
	Female	4.12	3.23		
Somatization	Male	6.51	3.27	97	4.39(<0.01)
	Female	4.71	2.21		
Lack of mental health	Male	28.71	9.74	97	2.82(<0.01)
	Female	24.31	11.47		
Low Achievement Motivation	Male	20.82	5.78	97	2.75(<0.01)
	Female	18.36	4.8		
Educational performance	Male	14.33	0.98	97	3.21(<0.01)
	Female	15.84	1.3		

As can be seen in table 2, T-test results show that the mean of each variable of anxiety, depression, somatization and abnormal social interaction in male students is more severely than female students. The results also show that achievement motivation and academic performance of male students is significantly lower than female students (p<0.01).

According to table 3 happiness comparisons of male and female students show that there is no significant difference between male and female students' happiness.

Table 3; happiness T-test scores of male and female students

Group	Frequency	Mean	SD	df	t	Sig
Female	50	111.64	18.26	98	0.58	P<0.05
Male	50	109.78	12.88		0.58	
Dependent variable= Happiness				N=100		

Data analysis shows that there is a significant relationship between mental health and happiness. Therefore, if a person has a higher mental health, the rate of his happiness will increase and also, Person's happiness will bring higher mental health for him or her. In explaining these findings, we see that, usually people are looking for happiness and happiness is more important in people's lives, while the experience of stress, significantly lead to reduce happiness; it means

that if a person experience more stress, the level of his happiness will be reduced and mental health will be threatened, and by increasing psychological health, high levels of self-efficacy and sense of happiness will be increased (Hartman, 2001).

Also a Significant relationship between happiness and psychosomatic symptoms is considered. This is a reason that psychologists want to understand the causes of happiness and its related processes. Mental health is one of the issues that its relationship happiness can be useful in defining happiness dimensions.

In fact, with increasing happiness, not only mental health will increase, but also Life been sweeter and more suitable platform for the growth and prosperity and ability of people in the various fields such as efficient and effective interpersonal relationships, life satisfaction and job satisfaction will be provided.

5. Conclusion

Today, according to the importance trend of creating healthy social, cultural and educational spaces in developed and developing countries communities or the countries those are passing from traditional to the modern industrial era, it seen necessary that various Institutions and organs provide development facilities in different layers of society to attain the great goals that one of the most important of these facilities is supplying mental health is individual and society. Now considering the importance of addressing mental health issues in today's young people living of society will be underlying the formation of the future with the lower problems.

However a person is closer to his human nature, therefore he or she can be closer to his mental health. One of the goals of mental health is creating the best and most desirable form of social behavior through the utilization of the innate talents for normal life and prevents mental illness. The results also show that the mental health of female students is significantly more than male students (p<0.01). As observed above, the psychological problems of male students are significantly more than female students (p<0.01). Also the mean of scores academic performance and achievement motivation variables of male students significantly lower than female students. According to these findings, the study confirmed all three hypotheses. The psychological and educational problems of male student can be due to the stress caused by educational expenses and fees, the sense of difference and discrimination in terms of educational facilities, welfare and negative self-evaluation and inappropriate comparison with female students.

Influence of principles and religious it is not only spiritual aspects, but also it affects the type of person's thinking, social life and relationships, physical and

mental health. Studies show that people who believed the origin (believe in God), regardless of religion, have healthier thought and behavior than those who without a belief or weak faith (Sewanson, 1990).

Therefore, students need to be taught somehow to improve environmental, social and also educational religious needs especially about their life skills and equipped them against malicious threats and vulnerabilities (drug abuse, delinquency, depression, anxiety, etc.), in order to pass this period when face with these problems, be able to react effectively.

Research limitation and practical recommendations
Gathering information through the questionnaire and the lack of cooperation of some students were the limitations of this study.

Providing counseling and support services for male students, Taking independent dormitory environment for them, Identifying psychological problems through core counseling in university, constitute training workshops in the field of mental health are the recommendations of this research.

References:

1. Flavell, J. H., & Miller, P. (1998). Social cognition. In W. Doman (Series Ed.) & D. Kuhn & R. Siegler (Vol. Eds.), Handbook of child psychology: Vol. 2. Cognition. Perception and language (5th ed., pp. 951-898). New York: Wiley.

2. Hartman H. J. (2001). Metacognition in learning and instruction: Theory, Research, and Practice. Chapter 8 Dordrecht, the Netherlands: Kluwer Academic Publishers. PP. 33-68.

3. Lobban, F. Haddock, E. Einderman, P. & Wells, A. (2002). The role metacopinitive beliefs in auditory hallucination. Personality and Individual Differences. 32(6): 1351-1363.

4. Meehl, P. E. (1992), "Needs (Murray, 1938) and state-variables (Skinner, 1938).", *Psychological reports* **70** (2): 407–50.

5. Mellings, T. M. B. & Alden, L. E. (2000). Cognitive processes in social anxiety: the effects of self-focus, rumination and anticipatory processing. Behaviour Research and Thrapy, 38, 243-257.

6. Sewanson, C. (1990). What is metacognition? Journal of Educational Psychology, Vol 211, 114-123.

7. Skitka, L. J. (2002). Do the means justify the ends, or do the ends justify the means? Value protection model of justice. Reasoning. Personality and Social Psychology Bulletin, 28, 452-461.

8. Wells, A. & Certwright-Hatton, S. (2004). A short form of metacognitons puestionnaire. Behaviour Research and therapy, 42(40): 385-396.

9. Zohar, A. (1991). Theacher's Metacognitive knowledge and the in Struction of Higher Order Thinking, Teaching and Teacher Education, Vol 42, 29-38.