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A review of the present state of art in FPGA-Based AddersNasser Lotfivand^{1,a}, Mohd Nizar Hamidon^{1,2,b}, Maryam Mohd Isa^{2,c}, Nasri Sulaiman^{2,d}, Vida Abdolzadeh^{3,e}¹ Institute of Advanced Technology, University Putra Malaysia, 43400 Serdang, Selangor, Malaysia² Department of Electronic Engineering, University Putra Malaysia, 43400 Serdang, Selangor, Malaysia³ Department of Computer Engineering, Tabriz Branch, Islamic Azad University, Tabriz, Iran^a Ahoora4444@hotmail.com, ^b mnh@eng.upm.edu.my, ^c misa@eng.upm.edu.my, ^d nasri@eng.upm.edu.my, ^e S.V.Abdolzadeh@laut.ac.ir

Abstract: Adders are the most fundamental arithmetic circuits that are used in processors and play key role in VLSI circuits. Power consumption and speed of these circuits are important quality factors for high performance integrated processing circuits. Floating-point operators, integer multipliers, and modular adders need large adders. On the other hand, Field programmable gate arrays (FPGAs) due to the excellent features such as low power consumption, flexibility, reusability, reasonable cost, easy upgrading, have become a favored platform for VLSI design. At this article recent advances and state of the art techniques in FPGA-Based Adders are reviewed.

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Keywords: Adder; FPGA; FPGA-Based Adder

1. Introduction

Adders are building block in digital processing systems. Design and implementation of these circuits have received much research attention from designers. A large spectrum of architecture is available for adders such as ripple-carry, carry-look-ahead, carry-skip adders [1], [2]. Utilizing of each approach in design is depending on the application, throughput and latency. When base on the application the latency is not design major factor ripple-carry architecture can be used while the other two architectures are proper to perform high throughput with small latency. In some of systems assigned adders are expected to have high throughput while latency is not so limitation factor, at such systems it may be commodious to follow architectures that are less complicated than carry-skip or carry-look-ahead adders [1], [2].

In this paper, we discuss the various designs of FPGA-based adders.

2. FPGA technology

Nowadays Field Programmable Gate Array (FPGA), have produced in varicose processing platforms, with high speed microprocessors, memories and data transfer links. FPGAs have an array of logic modules, programmable routing resources and input/output blocks. FPGAs in compare with CPU have low power dissipation. CPUs run applications as a flow of instructions but FPGA segments application into several optimized and independent logic blocks. A study about CPU and FPGA has been done in [4].

3. State of art FPGA-based adders

One of the earliest structural algorithm and design procedure for a 32-bit FPGA-based adder was introduced by Hashemian (1995). This algorithm was based on the carry select technique and for fast response operands was divided into slices. The slice carries by a parallel processing technique were transferred into a multiplexer based structure. By this parallel processing, the final carry terms was produced logarithmically, rather than linearly. This logarithmic approach was for the carry propagation delays decreasing while the data size increase. Base on this algorithm one gate delay is added to the overall time for the addition with each doubling of the operand size [5].

A fault-tolerant adder was offered by Alderighi et al. (2001). On this design fault tolerance at lower design costs and by shifting and rotating the operands given in input to the replicated ALUs, and by adopting a scheme for the full-adder block was accomplishing [6].

Morris et al. (2005) reported two FPGA-based reduction methods for reducing multiple sets of sequentially delivered, floating point values in optimal time without stalling the pipeline. The serial method was a time-division multiplexed implementation of a full binary reduction tree (figure 1). In the parallel method two α -stage adders had used. One of the adders was for reducing all the values for a given set. After arriving the last value in a set, there were multiple partial reductions in the pipeline, if all adders were busy, new values were buffered until an adder became available [7].

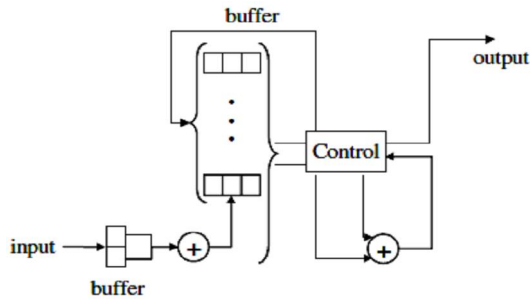


Figure 1: Serial Reduction Architecture

A design methodology for floating-point adder with leading-one predictor (LOP) was presented by Malik & Ko (2005). Figure 2 shows an implementation of this algorithm. LOP was for prediction of the shift amount for post normalization in parallel with the addition. Shifter was for pre-normalization and post-normalization. The LOP was the critical path for the addition operation [8].

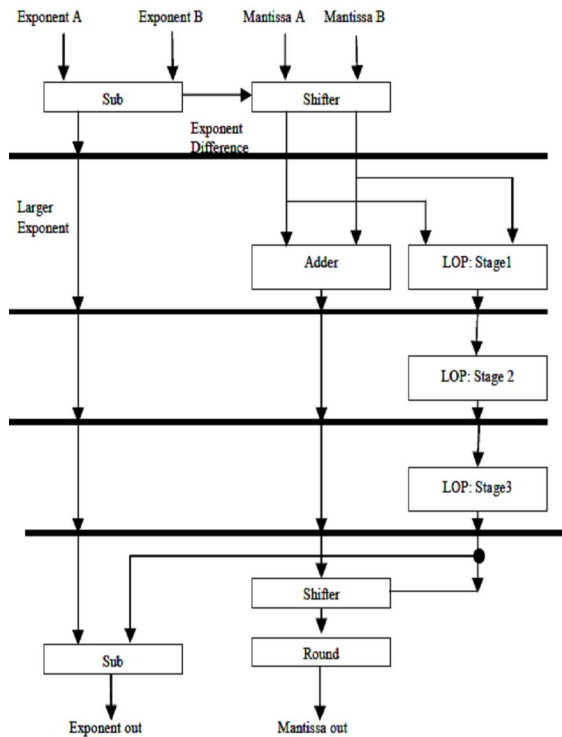


Figure 2: implementation of floating point adder algorithm

Figure 3 depicts Maslennikova et al. (2006) offered structure for the q-operands multi-operand modular adders. These adders were based on a carry-

propagate adder tree and had read-only memory (ROM) units for correction of partial results [9].

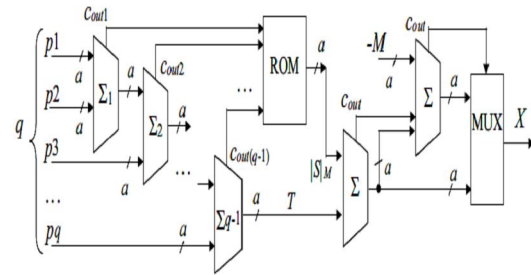


Figure 3: multi-operand modular adders' structure

For designing floating point components in FPGAs, Karlstrom et al. (2006) offered a method. This method was based on using parallel normalization approach to reduce the number of pipeline stages needed to perform the normalization operation. Figure 4 shows the adder architecture. In the first step, the operands are compared and swapped (if require) and the smallest number enters the path with the alignment shifter. Also the implicit one is added at this step, if the input operands are non-zero. In the second step, by the exponent difference, the smallest number is shifted down so that the exponents of both operands match. Add or sub operations are executed in the next step. The final step is the normalization. At this method, due to the earlier comparison and swap step, sub operation never causes a negative result [10].

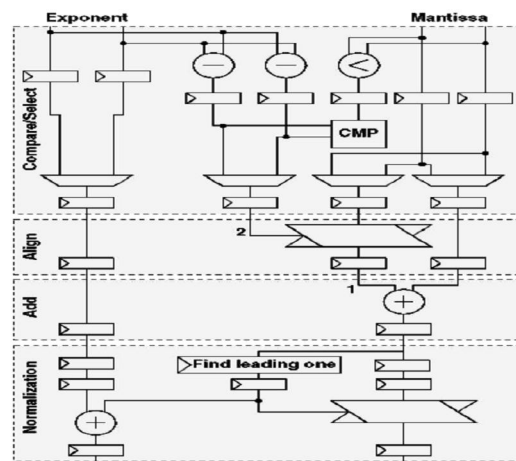


Figure 4: Karlstrom's adder architecture

Kikkeri & Seidel (2007) reported a double precision floating-point adder on the full gate-level verification and FPGA implementation without considering parameterized floating-point adder implementations. For optimization in the design several methods such as nonstandard separation into two paths, unification of rounding cases for addition and subtraction, sign magnitude computation of a difference based on one's complement subtraction, and circuits for approximate counting of leading zeros from borrow-save representation had used [11]. Ng et al. (2008) described an adder for bit-stream signal processing. This circuit was customized for quad-level sigma-delta modulated signals (figure 5). This adder was based on ripple carry adder and one bit of output was fed back to the adder to suppress the truncation error [12].

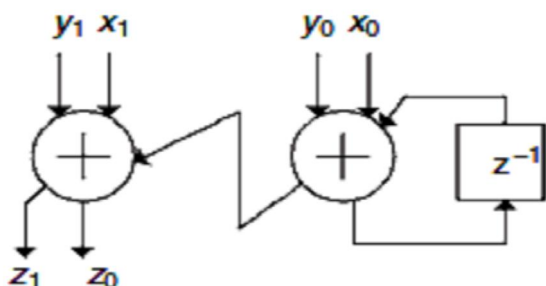


Figure 5: Quad-level bit-stream adder

A 3-input floating-point adder was reported by Guntoro & Glesner (2008). With the purpose of distributing the critical paths and improving the performance the design was based on a 5-level pipeline stage [13]. Malik et al. (2008) studies showed that the standard floating-point adder algorithm is area-efficient, but has more levels of logic and greater overall latency. Leading-one predictor algorithm adds parallelism to the design and thus reduces levels of logic significantly, but because of added hardware and significant routing delays it does not significantly improve overall latency in FPGAs [14].

Yousuf & Najeeb-ud-din (2008) introduced a methodology for carry select adder. In this methodology, sum was calculated for carry-in of '0' and other sum for carry-in of '1'. These sums were calculated by making use of one XOR gate and an inverter. Final sum-out was obtained by making use of multiplexer whose strobe signal was the carry of the previous stage (Cin). Likewise, Carry-out is generated by making use of a multiplexer whose strobe signal is Sum0. Further; optimization of the proposed logic was made by replacing each logic

element of the proposed logic with NAND gates. Figure 6 illustrate a carry select adder [15].

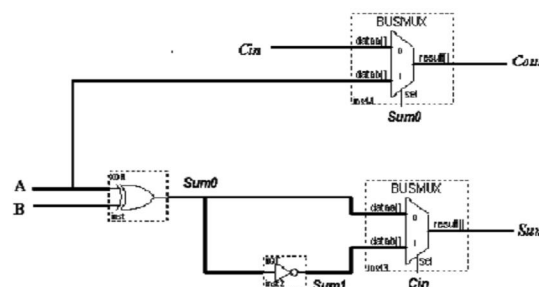


Figure 6: Basic Carry Select Adder Cell

A study on the carry-chain type BCD adders was reported by Biou et al. (2009). Base on this study for big operands the decimal adder works faster than an equivalent binary implementation and furthermore the coding / decoding processes are no more needed. The time delays for BCD adders are slightly better while the hardware requirements, depending on algorithm selection, range from three to four times that of a binary ripple-carry adder. For very great numbers the time saving is more significant [16].

Ortiz et al. (2009) by taking advantage of the specialized carry-logic studied implementations of carry-save adders on FPGA devices. They showed that it is possible to implement redundant adders with a hardware cost close to that of a carry propagate adder. Specifically, for 16 bits and bigger word lengths, redundant adders are clearly faster and have an area requirement similar to carry propagate adders. Among all the redundant adders had been studied, the 4:2 compressor was the fastest one, presented the best exploitation of the logic resources within FPGA slices and the easiest way to adapt classical algorithms to efficiently fit FPGA resources [17]. Liu et al. (2009) different parallel prefix trees used in the design of an end-around carry (EAC) adder targeting FPGA technology [18].

Kamp et al. (2009) introduced adders with a redundancy in representation to eliminate carry propagation, providing near constant addition delay irrespective of the operand width [19]. Rani et al. (2009) introduced a fast adder based on Quaternary Signed Digit (QSD) number system. In QSD, each digit can be represented by a number from -3 to 3 and carry free addition and other operations on a large number of digits such as 64, 128, or more can be implemented with constant delay and less complexity [20].

Bystritskaya et al. (2010) investigated 36-bit ripple-carry, carry-skip, carry-select and carry-look-ahead adders intended for using in field programmable gate arrays. This study showed that

36-bit ripple carry adder has the maximal delay but, in spite of its minimal size, parameter β (β equals to a product of maximal delay and a total number of transistors of adder) is maximal, i.e. the advantage in area does not compensate for the loss in speed. Carry-select adder has maximal parameter β amongst the remaining adders: its size is maximal, but speed is less than that shown by carry-look-ahead adder. The usage of such adder is not profitable in presence of any limiting factors [21].

Bhattacharjee et al. (2011) did a study on low power arithmetic circuits for digital signal processing (DSP) applications in respect to delay, power requirement and implementation costs of the different 8, 16, 32 and 64 bit circuits that can be realized for implementing the basic fixed-point arithmetic units in FPGA [22]. Nguyen et al. (2011) did a study on FPGA-specific arithmetic optimizations for the mapping of carry select and carry-increment adders targeting the hardware carry chains of FPGAs. Different trade-offs between latency and area was explored [23].

Preußner et al. (2011) presented the carry-compact addition scheme. While its central concept was inspired by the carry look-ahead addition, it was distinguished by its internal use of compacted pseudo-addends and its selective formation of compaction groups. A carry-compact addition already outperforms the basic ripple-carry adder for operand widths starting at 50 bits [24].

Martinez et al. (2012) introduced a fault tolerant parallel-prefix adder with capability of both fault detection and correction. This design was using a Sparse Kogge-Stone (SKS) Adder. In figure 7 red highlighted parts shows the error correction and detection logic [25].

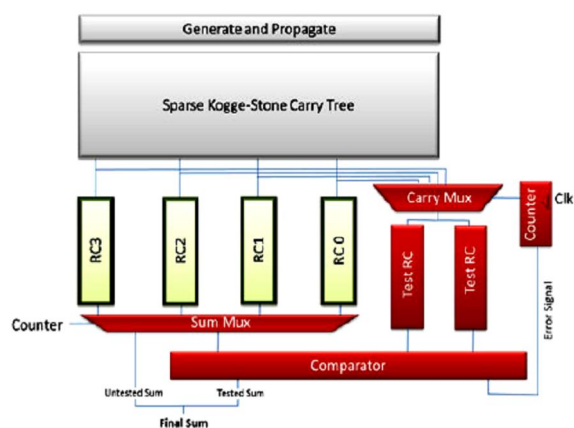


Figure 7: Block diagram of Fault Tolerant Sparse Kogge-Stone Adder

4. Conclusion

The recent growth in the number of available resources on FPGAs makes them excellent candidates in many computing applications. FPGA can be used for the applications that require high speed, high precision floating point arithmetic. At this article the state of art techniques in FPGA-Based Adders was discussed.

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References

1. J.M. Muller, *Arithmetique des Ordinateurs* (Paris: Masson, 1989).
2. I. Koren, *Computer Arithmetic Algorithms* (Englewood Cliffs, N.J.: Prentice-Hall, 1993).
3. Hartenstein R., A decade of reconfigurable computing: a visionary retrospective, Proc. Conf. On Design, Automation and Test in Europe, 2001, 642 – 649.
4. Craven S., P. Athanas, Examining the Viability of FPGA Supercomputing, Journal on Embedded Systems, 2007, doi:10.1155/2007/93652
5. Hashemian R., An algorithm and design procedure for high speed carry select adders using FPGA technology, Proc. 37th Midwest Symposium on Circuits and Systems, 1994.
6. Alderighi M., D'Angelo S., Metra C., Sechi G.R., Novel fault-tolerant adder design for FPGA-based systems, Proc. 7th Conf. On-Line Testing Workshop, 2001, 54-58.
7. Morris G.R., Zhuo L., Prasanna V.K., High-performance FPGA-based general reduction methods, Proc. 13th IEEE Conf. on Field-Programmable Custom Computing Machines, 2005, 323 – 324.
8. Malik A., Seok-Bum Ko, Effective implementation of floating-point adder using pipelined LOP in FPGAs, Proc. Conf. on Electrical and Computer Engineering, 2005, 706 – 709.
9. Maslennikova N., Maslennikow O., Berezowski R., Lienou J.-P., Design of Fpga-based Multi-operand Modular Adders For Residue Number System Converters, Proc. Conf. on Mixed Design of Integrated Circuits and System, 2006, 264 – 268.
10. Karlstrom P., Ehliar A., Liu D., High Performance, Low Latency FPGA based

- Floating Point Adder and Multiplier Units in a Virtex 4, Proc. Conf. on Norchip, 2006, 31 – 34.
11. Kikkeri N., Seidel P.-M., An FPGA Implementation of a Fully Verified Double Precision IEEE Floating-Point Adder, Proc. IEEE Conf. on Application -specific Systems, Architectures and Processors, 2007, 83 – 88.
 12. Ng C.W., Wong N., Ng T.S., Quad-level bit-stream adders and multipliers with efficient FPGA implementation, Electronics Letters, 44(12), 2008, 722 – 724.
 13. Guntoro A., Glesner M., High-performance fpga-based floating-point adder with three inputs, Proc. Conf. on Field Programmable Logic and Applications, 2008, 627 – 630.
 14. Malik A., Dongdong Chen, Younhee Choi, Moon Lee, Seok-Bum Ko, Design tradeoff analysis of floating-point adders in FPGAs, Canadian Journal of Electrical and Computer Engineering, 33(3), 2008, 169 – 175.
 15. Yousuf R., Najeeb-ud-din, Synthesis of carry select adder in 65 nm FPGA, Proc. IEEE Conf. on TENCON, 2008, 1 – 6.
 16. Bioul G., Vazquez M., Deschamps J.P., Sutter G., Decimal addition in FPGA, Proc. 5th Conf. on Programmable Logic, 2009, 101 – 108
 17. Ortiz M., Quiles F., Hormigo J., Jaime F.J., Villalba J., Zapata E.L., Efficient Implementation of Carry-Save Adders in FPGAs, Proc. 20th IEEE Conf. on Application-specific Systems, Architectures and Processors, 2009, 207 – 210.
 18. Feng Liu, Forouzandeh, F.F., Mohamed, O.A., Gang Chen, Xiaoyu Song, Qingping Tan, A Comparative Study of Parallel Prefix Adders in FPGA Implementation of EAC, Proc. IEEE Conf. on Digital System Design, Architectures, Methods and Tools, 2009 , 281 – 286.
 19. Kamp W., Bainbridge-Smith A., Hayes M., Efficient implementation of fast redundant number adders for long word-lengths in FPGAs, Proc. Int. Conf. on Field-Programmable Technology, 2009, 239 – 246.
 20. Rani R., Singh L.K., Sharma N., FPGA implementation of fast adders using Quaternary Signed Digit number system, Proc. Int. Conf. on Emerging Trends in Electronic and Photonic Devices & Systems, 2009, 132 – 135.
 21. Bystritskaya N.A., Smolyannikov I.A., Kurganskii S.I., Investigation of properties of 36-bit adders for creation of DSP blocks on FPGA, Proc. Int. Conf. on Micro/Nanotechnologies and Electron Devices (EDM), 2010, 143 – 146.
 22. Bhattacharjee S., Sil S., Basak B., Chakrabarti A., Evaluation of power efficient adder and multiplier circuits for FPGA based DSP applications, Proc. Int. Conf. on Communication and Industrial Application (ICCIA), 2011, 1 – 5.
 23. Hong Diep Nguyen, Pasca B., Preusser T.B., FPGA-Specific Arithmetic Optimizations of Short-Latency Adders, Proc. Int. Conf. on Field Programmable Logic and Applications (FPL), 2011, 232 – 237.
 24. Preußner T.B., Zabel M., Spallek R.G., Accelerating Computations on FPGA Carry Chains by Operand Compaction Preusser, Proc. 20th IEEE Symposium on Computer Arithmetic (ARITH), 2011, 95 – 102.
 25. Martinez Chris D., Bollepalli L. P. Deepthi, Hoe David H. K., A fault tolerant parallel-prefix adder for VLSI and FPGA design, Proc. 44th Southeastern Symposium on System Theory (SSST), 2012, 121 – 125.

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Use Mobility Devices Services on Semantic Web

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Abstract: Growingly, companies are looking for methods to provide client with higher levels of personalization that capture different elements of a user's operation context, such as position, currently tasks that client engaged in, user's colleagues and friends who can access to different Classified data about client. These different tasks have different sources which may vary from client to client and time to time. Managing the Virtual content to mobility devices client based on their references and positions are now a leading trend in a mobility devices electronic commerce. These features will operate in semantic virtual services. In this structure computers will be able to analyze, process, and reason about the contents of Virtual pages. In this method we should have a standard and unique language so service stations broadcast their services in description logic based ontology language. To achieve these goals different telecommunication technologies have been used Describing context, evaluating it, identifying the most relevant data and then reasoning and filtering through the contextual data and introducing relevant telecommunication technologies are the most aspect in this paper.

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Keywords: Position Based Services, Mobility devices commerce, Ontology, Privacy, RFID, Semantic Virtual Services

1. Introduction

The industry is struggling to implement methods that can decrease project time and cost, and improve productivity and performance. The main need for new methods to face these challenges has long been recognized. Recently we have also seen a movement in the construction industry towards using methods that influence and effect on the internet operation system, in this method evaluation of mobility devices technology from second generation network (2G=GSM) towards 2.5G (GPRS, EDGE), 3G (UTMS) and wireless broad band access technologies such as WiFi, WiMax, RFID are take placed to allow their client to use virtual services and semantic virtual services through mobility devices. Managing and sailing the Virtual content to mobility devices client, based on their preferences and positions are becoming now a leading trend in a mobility devices electronic commerce (m-commerce). Most of the Virtual content today is designed for human understanding, while computer programs (e.g. software agents) have no indication of its meaning. The vision of the Semantic Virtual is bringing meaning to the virtual and enabling computer programs to analyze, process, and reason about the content of Virtual pages. Nowadays, the common data like stock quotes, flight data and online data bases in all of fields are available and Software agents, may automatically access these services. When ontology is attached to a Virtual service to

describe its meaning then this service is called a Semantic Service [1].

2. METHODOLOGY

2.1. The Semantic: web The Semantic Virtual is an extension of the current Virtual in which data is given well-defined meaning, better enabling computers and people to work in cooperation. It is based on the idea of, having data on the Virtual defined and linked such that it can be used for more effective discovery, automation, integration, and reuse across various applications.[2]

2.1.1. The Semantic Virtual architecture

The Semantic Virtual architecture is based on number of layers, including:

XML, Namespace and Schema layer for defining contents and rules.

RDF, is a conceptual data layer on top of XML. RDF is application and domain neutral, and defines a metadata layer and domain specific vocabulary. RDF model can be used to describe anything that has a Universal Resource Indicator (URI).

Ontology Vocabulary is RDF enhancement regarding relations between concepts, description logic, etc. Virtual Ontology Language (OWL) is one of the ontology definition languages. Logic layer define rules for dynamic inference and definition of

hierarchies and processing of schemas and instances.

Proof and trust layers involve rating of sources and processes and monitoring of logical steps.

2.1.2. Ontology architecture

- Controlled vocabulary
- Concept taxonomy
- Other relations between concepts

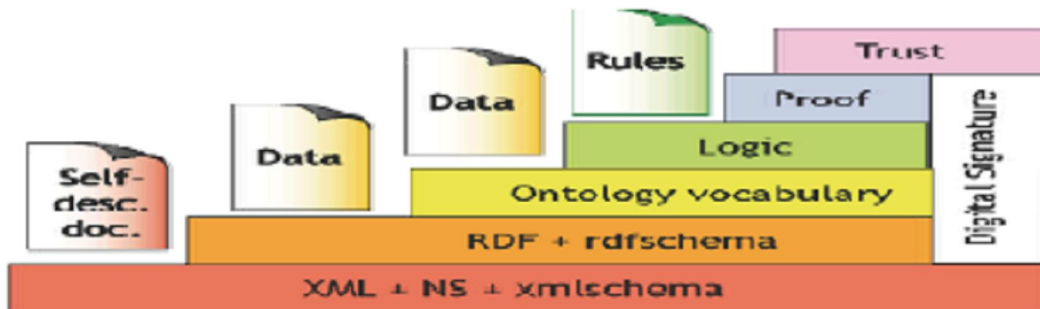


Figure 1: The Semantic Virtual Architecture (Source : W3c,2001)

2.2. Virtual Services

Virtual services are self-contained, self-describing, modular applications that can be published, located and invoked across the Virtual. Once a Virtual service is deployed, other applications (and other virtual services) can discover and invoke the deployed service regardless of operating system or programming language. Typical Virtual Services architecture consists of three entities:

- Service providers
- Service requestors (or clients)
- Service registries

Service providers publish their services through agents who maintain registries that clients can look up. The API (Application Programming Interface) for registering services is called Universal Discovery and Description Interface (UDDI). This API enables an enterprise to describe its businesses, its services and how they wish to undertake transactions, search for other businesses that provide desired services and integrate with these businesses to undertake a transaction, if desired. Service requestors (Human client or agents) search services in registries and invoke these services using a Virtual Interface (WSDL). [3]

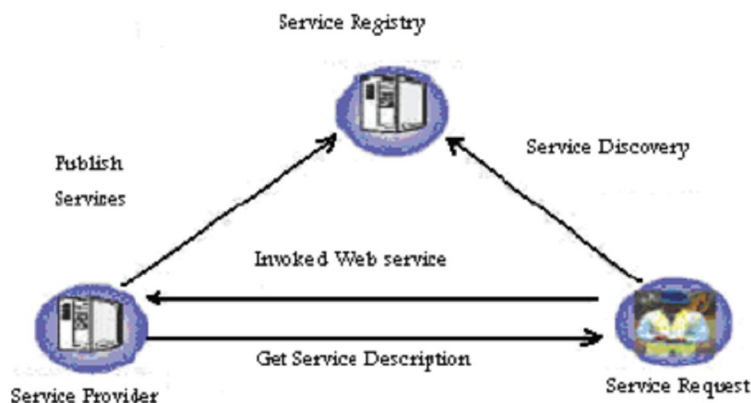


Figure 2: Key Component of virtual services Architecture

2.3. Agent System Operations

An agent is a self-contained program can control its own decision-making and acting based on perception of its environment, in search of one or more objectives. In many cases, several agents are required to work in concert, resulting in a multi-agent system (MAS). A typical scenario is naturally distributed in terms of geography, knowledge,

function, expertise and data. Agents can access to data about client in the environment and typically access to public virtual services, semantic virtual comments, public ontologism and other public resources such as list of restaurants, gas stations and public weather forecasting virtual services which are position based services.[4]

2.4. Semantic Virtual Based Services

The vision of Semantic Virtual based services combines the key technology elements of the Semantic Virtual, Virtual Services and Agents. Semantic Virtual increases the utility of Virtual Services by expressing how terms relate to each other and by enabling dynamic arrangement of new

services.[5] *2.4.1 Methods and needs* Having a standard syntax, and one or more standard vocabularies, so search engines, producers and consumers all speak the same language

Lots of resources

Acknowledgment and trust



Figure 3: Position Based Services on mobility devices

3. USE OF SEMANTIC VIRTUAL TECHNOLOGY FOR CONTEXT-AWARE DATA IN MOBILITY DEVICES

Semantic web is a powerful concept that empowers many applications that would not otherwise be able to operate in pervasive environments. Context aware applications use environmental factors such as: time, user's position, current and future events, and other client in the environment [3]. Describing context, evaluating it, identifying the most relevant data and then reasoning and filtering through the contextual data and technologies of them are the most relevant aspect in this paper. Architecture of the context-aware data providing system contains these components: communication components, controlling components, service components (Request Analyzer, Reasoner,

HTML Creator) and data components. [6] Semantic virtual services can automatically be discovered and accessed by agents. Access to a user's contextual resource is controlled according to user's specified privacy preferences (including context sensitive preferences such as colleagues have access to user's position only if they have a meeting with him in the next hour) by privacy rules client ensure that data about them is only disclosed to authorized parties. By semantic virtual services mobility devices client can use different services which based on Position Based Services and merge Privacy and Context Awareness, such as their position the activities they are engaged in who their friends and colleagues are, where the nearest restaurants or gas stations are as well as a number of other contextual attributes and references.[7]

3.1. POSITION BASED SERVICES

Introduction with advances in wireless Internet and mobility devices computing, position-based services (LBS) are emerging as key value added services for telecom operators to deliver. LBS enable them to provide personalized position-aware content to subscribers using their wireless network infrastructure. Besides telecom operators, more and more service providers such as public wireless LAN providers, enterprises, and others are developing and deploying position-aware services for consumers and employees to gain more revenue and productivity. [7] These position-aware service providers are facing both technical and social challenges, such as positioning in various environments using different locating mechanisms, position tracking, the data delivery model, privacy issues, and the development of new LBS applications that succeed at delivering more business impact and value. It has been realized that different interfaces and technologies should be considered as the enabling infrastructure to support the different players, so that a service provider can efficiently, effectively, and quickly develop and deploy LBS applications and support innovative position-aware applications. These services are useful for gathering data about, local restaurant recommendations or directions to the closest gas station, or traffic, weather data and self tour guided. Multiple position sensing technologies like, GPS, GSM, WLAN, and Bluetooth and new technologies, like at present WiMax or RFID, are using in these cases. Hardware devices and Software components, their interfaces and architecture have to be able to deal with changing conditions to make mobility devices Position –Based Services highly available.

3.1.1 Position sensing technologies

In this section some of wireless telecommunication technologies will be described such as GSM/GPRS/UMTS, WiFi, WiMax, GPS and eventually RFID. *What is GSM/GPRS/UMTS: GSM: Global System for Mobility devices?* It is the second generation of mobility devices network after analog mobility devices systems it is based on circuit switches and specially uses for voice because the it has low bit rate of data (max. bit rate:9.6 kbps) *GPRS: GPRS: General Packet Radio Service* GPRS represents the first packet-based technology for evolution from 2G (GSM) networks to 2.5G networks. Data speeds in this generation are:

theoretical : up to 171.2 Kbps

practical: 40-60 Kbps

UMTS: Universal Mobility devices Telecommunication System

Maximum bandwidth in the third generation networks is 2Mbits/sec.

GPS: The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS was developed by the United States Department of Defense (DOD), for its tremendous application as a military locating utility. The DOD's investment in GPS is immense. Billions and billions of dollars have been invested in creating this technology for military uses. However, over the past several years, GPS has proven to be a useful tool in non-military mapping applications as well. We can use GPS for position base services, logistic services and so on. *RFID Structure?* The abbreviation RFID (radio frequency identification) has come to signify system solutions for tracking and tracing objects both globally and locally using RFID tags. RFID is one of several technologies collectively known as Auto-ID procedures – procedures for identifying objects automatically. It bridges the gaps to IT systems that were previously bridged by manual data entry. Track and trace describes the process of tracking and locating products automatically within supply chains. In this process, RFID technology requires RFID antennas and readers, for instance at warehouse entrances and logistics hubs. The antennas could, of course, be connected to mobility devices. Nokia is the first company to provide a cell phone with an RFID reader, which could prove attractive to consumers and industry alike. When the movement of containers or other mobility devices objects is being tracked, a different Auto-ID technology comes into play such as the global positioning system (GPS). This technology has become familiar through its use in vehicle navigation systems. It is used to locate objects around the globe, and is not discussed further here. GSM, GPRS, UMTS, or the INMARSAT satellite communications system is used to transfer localization or RFID data when mobility devices are being used. Permanently installed RFID antennas have either a cable connection or a wireless WLAN connection to “back-end” systems, where the data received is processed further. (Other technologies such as GPS or position-based services can, of course, also be used for such purposes.) An RFID system consists of two main components, tags and readers. A tag (also called transponder or transceiver) is a small device equipped with a microchip carrying data and an antenna. There are two types of tags; active and passive. Antennas are connected to electronic control devices: the readers. They generate electromagnetic fields, via which data is received from or transmitted to RFID tags. Data is transferred without a line of sight to the tag. Note, however, that unfavorable conditions can cause transmission problems with certain technologies, such as metallic

environments or liquids. Tags and readers/writers must have compatible frequencies.

3.2. A Semantic based Privacy Framework for Virtual Services

Another area that the semantics can be exploited is for protecting user's privacy when accessing the Virtual services. There are some important considerations in developing privacy mechanisms:

- Only the minimal relevant data should be provided to the Virtual service to prevent disclosing unnecessary personal data. As an example, a user may have to provide her credit card number when invoking a purchasing "service" but may prefer not to so for example for a "reservation" service.
- Another critical issue is not to overwhelm the client while declaring their privacy preferences. Indeed declaring privacy preferences on the basis of service instances maybe quite cumbersome and sometimes even not possible. A user may not in advance know which service she will need.
- The process should be automatic requiring minimal user interaction.

3.3. Results

A major task of the Reasoner is discovering virtual resources that suit the user's interests. Each virtual resource contains metadata which describes the content of the virtual resource and which is noted in RDF. The reasoner has to send queries to virtual resources to detect whether the content is suitable to a given interest or not. These queries are modeled in RDQL

4. HOW EMPLIMENT SEMANTIC VIRTUAL FOR CONTEXT-AWARENESS

powerful database is the first need to have .In addition, it should provide a unified and secure semantic interface to all user's personal resources, enabling agents in the system and modify data about the user subject to the user's privacy preferences (e.g. not just determining whether the user is available between 3 and 4pm but also possibly, scheduling a meeting at that time).

4.1. Knowledge of customer

The knowledge about the user, personal resources and preferences falls into four categories:

Static knowledge
Dynamic knowledge
Service invitation

Privacy preferences

The main steps in implementing of context-awareness It can be categorized into six steps, such as:

Asserting the query's context
Authorization of the who request
Invoking personal resources as Virtual services
Checking whether the query is allowable
Application of Obfuscation Rules
Generate an answer

5. RELATED WORK

5.1. Cooltown Project by the HP labs

In this project, L3S Research Center discusses its ongoing implementation of a semantic virtual scenario. Visitors of the L3S Research Center should be able to make a self-guided tour by equipping them with a Pocket PC. On their tour they are provided with context-aware data about researcher projects and knowledge about the respective domain. The scenario is based on the Cooltown Project by the HP labs.

5.2. My Campus project by the ISRI -School of Computer Science Carnegie Mellon

University this research is being conducted in the context of my Campus, a property semantic virtual environment to enhance everyday campus life at Carnegie Mellon University. In my Campus, client can acquire (or subscribe) to different sets of task-specific agents that help them with different tasks. The e-Wallet serves as a repository of static knowledge about the user just like .Net Passport, except that here knowledge is represented using OWL. [7]

5.3. Cyber guide, Guide and the Pinpoint Tourist Guide

Cyber guide [8], Guide [9] and the Pinpoint Tourist Guide [10] offer data to tourists, taking into account their current (semantic) position.

6. Summery

Networks, such as GSM, GPRS, UMTS, GPS and also RFID and other WLAN and Wimax technologies, Semantic Virtual Services emerge as the answer to efficiently provide intelligent mobility devices collaboration support to mobility devices construction workers. By bringing together necessary technology threads including semantic virtual, Virtual Services and Agent technologies with telecommunication technologies.

References

- [1] Fabien L. Gandon and Norman M. Sadeh "semantic Virtual Technologies to Reconcile Privacy and Context Awareness", December 2003 CMU-ISRI-03-107.
- [2] Kone Mamadou Tadiou "Semantic Virtual services Interaction" Department of Computer science.
- [3] Vagan TerziyanData, "Architecture for Mobility devices P-Commerce: Multilevel Profiling Framework" Technology Research Institute, University of Jyvaskyla.
- [4] Omair Javed, "Semantic VirtualMobility devices Internet Technical Architecture" Institute of Software Systems Tampere University of Technology.
- [5] D. Rebolj and K. Menzel, "SEMANTIC VIRTUAL BASED SERVICES FOR INTELLIGENT MOBILITY DEVICES CONSTRUCTION COLLABORATION, 2004 at <http://www.itcon.org/2004/26>.
- [6] "LORE:An infrastructure to support position-aware services" by Y.Chen, X.Y.Chen, F.Y.Rao, X.L.Yu, Y.Li, D.Liu.
- [7] "Using Semantic Virtual Technologies for context-aware Data Providing to Mobility devices Devices" Fabian Abel: Institute Knowledge Based Systems, Jan Brase: L3S Research Center <http://www.fiercewireless.com>.
- [8] Mithun Sheshagiri, Norman Sadeh and Fabien Gandon, "Using Semantic Virtual Services for Context-Aware Mobility devices Applications."
- [9] Abowd, G. D.; Atkeson, C. G.; Hong, J.; Long, S.; Kooper, R.; Pinkerton, M, 1997: Cyberguide: A mobility devices context-aware tour guide. ACM Wireless Networks, 3: 421-433
- [10] Cheverst, K.; Davies, N.; Mitchell, K.; Friday, A.; Efstratiou, C., 2000: Developing a Contextaware Electronic Tourist Guide, in Proc. of CHI'00, ACM Press.
- [11] Roth, J.: Context-aware Virtual Applications Using the PinPoint Infrastructure, IADIS Intern. Conference WWW/Internet 2002, Lisbon, Portugal, Nov. 13-15 2002, IADIS press, 3-10.

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Effect of Phosphatic Fertilizers on Chemical Composition and Total Phosphorus Uptake by Wheat (*Triticum aestivum* L.)

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Abstract: Wheat (*Triticum aestivum* L.) was grown in earthen pots containing soil of Balkasar Soil Series (Sandy Loam) in green house at the Department of Soil Science and SWC, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi during Rabi season, 2007. The Crop was treated with two levels of Phosphorus (40 and 80 kg P ha⁻¹) in the form of SSP, TSP, NP and DAP. A basal doze of 100 kg N and 60 kg K ha⁻¹ was applied as urea and murate of potash (MOP) respectively. Chemical composition of wheat plants showed that all the parameters were significantly improved by addition of P except the Phosphorus concentration (%) in wheat straw and potassium conc. (%) in wheat grain. Similarly Phosphorus uptake was increased with the increased level of phosphorus application. It was concluded from the study that different sources and levels of phosphorus has significant effect on the NPK contents of wheat and total P uptake by wheat plants. Among all the sources and levels of phosphorus, 80kg P ha⁻¹ as single superphosphate (SSP) showed superiority over triple superphosphate (TSP), nitrophos (NP) and diammonium phosphate (DAP) on phosphorus deficient soil of Balkasar area of Tehsil Chakwal.

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1. Introduction

Wheat is the main staple food for most of the population and largest grain source of the country. It occupies the central position in formulating agricultural policies. It contributes 12.5 percent to the value added in agriculture and 2.6 percent to GDP (Economic Survey 2011-12). The average yield of wheat (*Triticum aestivum* L.) in Pakistan (2451 kg ha⁻¹) is low as compared to world average(3086 kg ha⁻¹) or even to its neighboring countries like India (2802 kg ha⁻¹), and china (4762 kg ha⁻¹) (MINFA, 2010). Wheat is cultivated on an area of 1.43 million hectares in rain-fed area and the average yield is static at around 1.0 t ha⁻¹ for almost 20 years (MINFAL, 2001), which is quite low. Drought, nutritional stress including widespread nutrient deficiencies (Rashid, 1994) and low and unbalanced use of fertilizer (NFDC, 1997) are the major limiting factors causing less wheat production under rain-fed conditions. Among different factors, the role of nutrients is well recognized in crop production. The inadequate supply of the essential plant nutrients in soil is growth limiting factor towards its production. Among all the elements required by a plant, phosphorus (P) is one of the most important nutrient for crop production and emphasis is being given on the sufficient use of P fertilizer for sustainable crop production (Ryan, 2002). Phosphorus plays a vital

role in several key physiological processes viz; photosynthesis, respiration, energy storage, cell division, cell enlargement etc. phosphorus is essential for seed formation and root development (Memon *et al*, 2001). The consumption of major nutrients (N, P and K) in Pakistan though increased substantially but did not show a balance growth. Since introduction in early 1950, nitrogen consumption showed a consistent growth rate, which peaked at 2 million nutrient tones in 1998-99, whereas phosphorus and potassium showed a slow growth rate and thereby only 435 thousand tones phosphate and 26 thousand tones of potash was consumed in 1998-99 (Ahmad, 2000). The nutrient balance sheet shows a negative balance for P indicating more removal and less addition to the soil. Low P use was mainly due to increased price hike of phosphate compared to nitrogen fertilizers during the last two decades that deter the small or low income farmers to apply fertilizers proportionally (Ahmad, 2000). But during the last year (2009-2010) Nitrogen off - take increased by 15.4 percent while that of phosphate by 66.2 percent. Main reasons for increased off - take of fertilizers were affordable price of DAP and higher support price of wheat. (MINFA, 2010). There are several kinds of inorganic phosphatic fertilizers manufactured by industries in different grades of elements essential for plant growth. These inorganic

fertilizers include single super phosphate (SSP), TSP, MAP, DAP and nitrophos (NP). In Pakistan the major inorganic phosphatic fertilizers are: TSP, DAP, SSP, MAP and NP. Single superphosphate and NP are manufactured locally. However DAP is imported from other countries such as Jordan, USA, Morocco etc. Soils of Pakistan are alkaline and mostly calcareous in nature and P fixation is a serious problem in these soils (Sharif *et al.*, 2000). According to NFDC (2003), 93 percent of Pakistani soils are P deficient. Phosphatic fertilizers are applied to soil to enhance the production of crops. The application of P fertilizers to calcareous soils, with pH levels greater than 7.5 has been problematic mainly due to P fixation. When P is applied to the soil, the plant takes up only small percentage; the remainder is either permanently or temporarily fixed in forms varying in plant availability. The temporarily fixed P, also called residual P, becomes available with time, but at slow rates (Sharif *et al.*, 2000). The phosphorus fertilizer use can help to reduce the adverse effect of drought under rainfed conditions. The Potash and Phosphate Institute (PPI, 1999) reported that phosphorus, in balanced soil fertility program, increase water use efficiency and helps crop to achieve optimal performance under limited moisture conditions. As wheat is staple food of Pakistan and Phosphatic fertilizers are very expensive therefore it is essential to know the effects of the P sources and levels on NPK Contents of wheat plants and total P-uptake by wheat plant on phosphorus deficient soil.

2. Material and Methods

A pot experiment was conducted to compare the effect of different phosphatic fertilizers on wheat crop in Balksar soil series of Tehsil Chakwal. The study was conducted in green house at the Department of Soil Science and SWC, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi during Rabi season, 2007. For this, bulk soil sample from 0-30 cm depth was brought from farmer's field of Balksar area of Tehsil Chakwal. Soil sample was air dried, ground, passed through a 2 mm sieve and mixed thoroughly. Ten kg of the prepared soil was packed in each earthen pot having height and diameter of 18 and 12, inches respectively. The pots were lined with polythene bags. Eight seeds of wheat (cv. GA 2002) were sown on 20th November, 2006. Phosphorus was applied at the rate of 40 and 80 kg P ha⁻¹ in the form of SSP, TSP, NP and DAP. A basal doze of 100 kg N and 60 kg K ha⁻¹ was applied as urea and murate of potash (MOP) respectively. Thinning was conducted on 22nd December, 2006 and four plants per pot were grown. Distilled water was used to bring the soil to 50 percent of maximum water holding capacity by weighing the pots as and when required. One plant per pot was harvested at 80

days growth while three plants were harvested at maturity on Saturday, May 5, 2007 at 137 days growth. Experiment was laid out in completely randomized design (CRD) with three replications.

Soil sample collected from the farmer's field of Balksar soil series was air dried, ground, passed through a 2 mm stainless steel sieve and mixed thoroughly. This soil sample was used for physio-chemical analysis like soil texture, macronutrients (P, K), electrical conductivity (EC_e), soil pH_s, and organic matter (OM) at the beginning of experiment (Table 1). The soil used for the experiment was sandy loam in texture, alkaline in reaction (pH=7.92), poor in organic matter (0.40%), adequate in potassium (92 mg kg⁻¹) and low in available phosphorus (4.6 mg kg⁻¹). Particle Size Analysis was done by Bouyoucus Hydrometer Technique (Bouyoucus, 1962). Soil paste was prepared and saturation extract was obtained. Then the pH was determined with a pH meter (Page *et al.*, 1982) and Electrical conductivity was measured by using electrical conductivity meter (Page *et al.*, 1982). Organic matter was determined by using Walky and Blake method (Page *et al.*, 1982). Available Phosphorus was measured by spectrophotometer (Olsen, 1982). Extractable potassium was determined by using flame photometer (Knudsen *et al.*, 1982). The Total nitrogen and total phosphorus were determined colorimetrically (Anderson and Ingram, 1993). For determination of potassium, plant material was dry ashed and K was determined by Flame Emission spectroscopy (Winkleman *et al.*, 1990).

2.1 Statistical Analysis

The data collected for various parameters were subjected to Analysis of Variance (ANOVA) and the means obtained were compared by LSD at 5 percent level of significance (Steel and Torrie, 1980).

3. Results and Discussion

The data obtained were subjected to statistical analysis using MSTAT software. The conclusion drawn from the investigations are summarized as under.

3.1 Basic Soil Analysis

Soil sample collected from the farmer's field of Balksar soil series was air dried, ground, passed through a 2 mm stainless steel sieve and mixed thoroughly. This soil sample was used for physio-chemical analysis like soil texture, macronutrients (P, K), electrical conductivity (EC_e), soil pH_s, and organic matter (OM) at the beginning of experiment (Table 3.1). The soil used for the experiment was sandy loam in texture, alkaline in reaction (pH=7.92), poor in organic matter (0.40%), adequate in potassium (92 mg kg⁻¹) and low in available phosphorus (4.6 mg kg⁻¹).

Table 1: Basic Soil Analyses of the Selected Soil

Parameters	Units	Values
Sand	%	90.14
Silt	%	7.92
Clay	%	1.94
Textural Class		Sandy Loam
PH _s		7.90
EC _e	dS m ⁻¹	1.48
Organic Matter	%	0.40
Available Phosphorus	mg kg ⁻¹	4.6
Extractable Potassium	mg kg ⁻¹	92

3.2 Effect on Chemical Composition of Wheat Plants

Chemical composition of wheat plants showed that nitrogen conc. (%) in wheat grain and straw was significantly affected by different P sources. It was also noticed that nitrogen conc. (%) in wheat grain and straw was increased with the increased level of phosphorus application. At low level, NP and DAP showed superiority over SSP and TSP. At high level, SSP, NP and DAP showed the similar results which may be due to equal supply of phosphorus. While nitrogen conc. (%) in wheat straw showed that at low level of P fertilizer application, SSP and NP showed superiority over TSP and DAP. At high level, NP and DAP showed high nitrogen conc. (%) in wheat straw. The results are in line with findings of Raghbir *et al.* (2004) who observed that nitrogen conc. (%) of wheat grain and straw increased significantly and subsequently with increasing doses up to 40 mg P kg⁻¹ soil application.

Phosphorus concentration in plant is a good criterion to observe the efficiency of optimum phosphorus level in soil. Analysis of variance showed that phosphorus conc. (%) in wheat grain increased significantly with the use of phosphorus fertilizer. Different P sources significantly affected the phosphorus conc. (%) in wheat grain and it was increased with the increased level of phosphorus application. At both levels DAP showed maximum P conc. (%) in wheat grain. Phosphorus concentration in plant can be related to phosphorus extraction power of roots from soil. Normally plant roots having wider contact with soil are better extractor of phosphorus from soil and feed well to above ground plant parts. This is true for extensive root system (Tisdale *et al.* 1993). Adequate phosphorus concentration in wheat grain is 0.42 percent (PPI, 1995). The similar type of results was also observed by Singh *et al.* (2005) who observed that grain yield and seasonal accumulation of P by wheat were higher for higher P rates. All the treatment for phosphorus concentration in wheat straw did not differ

significantly from each other. Phosphorus concentration (%) in wheat straw was not significantly affected by different P sources and levels but at both levels DAP showed maximum P conc. (%) in wheat straw. The increased concentration at higher rates of phosphorus might be due to better supply of phosphorus in the growing medium. The behavior of all the P sources was quite similar and none of the phosphorus material used in the study could prove superiority. Alam and Shah (2002) observed that phosphorus rates increased both dry matter and phosphorus accumulation by plant.

Potassium conc. (%) in wheat grain showed that at low level of P fertilizer applications, DAP showed superiority over SSP, TSP and NP. At high level, SSP showed high K conc. (%) in wheat grain. Potassium conc. (%) in wheat straw was significantly affected by different P sources. Potassium conc. (%) in wheat straw increased with the increased level of phosphorus application. At low level, DAP showed superiority over SSP, TSP and NP but at high level, SSP showed greater K conc. (%) in wheat straw. Sharma and Naredo (1999) observed that seed and straw P and K contents, straw N contents increased with increasing phosphorus level.

3.3 Effect on Phosphorus Uptake (mg pot⁻¹) by Wheat Plants

Data on the effect of different P sources and levels on P uptake (mg pot⁻¹) by wheat grain is depicted in Table 3. It was found that each additional level of P had profound effect on its uptake. Phosphorus uptake by wheat grain was significantly affected by different P sources. Phosphorus uptake was increased with the increased level of phosphorus application. At low level, DAP showed maximum P uptake by wheat grain but at high level, SSP showed better P uptake. Uptake of P is most rapid in wheat from jointing stage to anthesis, complete growth stages and 75 percent of the P uptake is translocated to the grain at maturity (Fageria *et al.*, 1997). He also pointed out that phosphorus uptake by grain is the product of grain yield and the concentration of P in grain. It is stated that the amount of P removed on an average yield of harvested grain varies from 7–15 kg P ha⁻¹ and out of this, 2–8 kg P ha⁻¹ is returned back to the soil in the form of crop residues which are left in the field (Hanway and Olsen, 1980). The present results are supported with the findings of Rehman *et al.* (2004) and Goudidng *et al.* (1994) who reported an increase in P uptake with increase in phosphorus supply.

Table 2: Effect of different phosphatic fertilizers on chemical composition of wheat plants

Treatments	Sources and Levels of phosphorus	N conc. (%) in wheat grain	N conc. (%) in wheat straw	P conc. (%) in wheat grain	P conc. (%) in wheat straw	K conc. (%) in wheat grain	K conc. (%) in wheat straw
T ₁	Control	3.11 c	0.39 b	0.25 c	0.027 a	0.33 c	1.84 e
T ₂	40 kg P ha ⁻¹ as SSP	3.34 b	0.46 a	0.31 bc	0.030 a	0.37 b	2.16 c
T ₃	40 kg P ha ⁻¹ as TSP	3.36 b	0.45 a	0.32 abc	0.033 a	0.38 ab	2.11 d
T ₄	40 kg P ha ⁻¹ as NP	3.37 b	0.46 a	0.31 bc	0.031 a	0.38 ab	2.13 cd
T ₅	40 kg P ha ⁻¹ as DAP	3.37 b	0.44 a	0.32 abc	0.035 a	0.39 ab	2.22 b
T ₆	80 kg P ha ⁻¹ as SSP	3.44 a	0.44 a	0.37 ab	0.036 a	0.40 a	2.43 a
T ₇	80 kg P ha ⁻¹ as TSP	3.42 a	0.44 a	0.36 ab	0.036 a	0.37 ab	2.41 a
T ₈	80 kg P ha ⁻¹ as NP	3.43 a	0.46 a	0.38 ab	0.036 a	0.37 ab	2.42 a
T ₉	80 kg P ha ⁻¹ as DAP	3.43 a	0.47 a	0.39 a	0.037 a	0.38 ab	2.42 a
LSD Value		0.031	0.097	0.07671	0.05404	0.031	0.031

- The means having different letter are probability significantly different from each other at 5% level of

Table 3: Effect of different phosphatic fertilizers on phosphorus uptake (mg pot⁻¹) by wheat plants

Treatments	Sources and Levels of phosphorus	P-uptake (mg pot ⁻¹) by wheat grain	P-uptake (mg pot ⁻¹) by wheat straw	Total P-uptake (mg pot ⁻¹) by wheat plants
T ₁	Control	30.62 e	6.71 c	37.33 e
T ₂	40 kg P ha ⁻¹ as SSP	63.77 d	12.43 b	76.20 d
T ₃	40 kg P ha ⁻¹ as TSP	64.76 d	13.35 b	78.11 d
T ₄	40 kg P ha ⁻¹ as NP	63.10 d	12.63 b	75.72 d
T ₅	40 kg P ha ⁻¹ as DAP	70.62 d	13.94 b	84.55 d
T ₆	80 kg P ha ⁻¹ as SSP	120.8 a	22.22 a	143.1 a
T ₇	80 kg P ha ⁻¹ as TSP	92.81 c	20.54 a	113.3 c
T ₈	80 kg P ha ⁻¹ as NP	98.67 bc	20.86 a	121.5 bc
T ₉	80 kg P ha ⁻¹ as DAP	115.2 ab	21.87 a	137.1 ab
LSD Value		18.58	3.492	21.07

- The means having different letter are probability significantly different from each other at 5% level of

Phosphorus uptake by wheat straw is the product of straw yield and P concentration in straw, which is depicted in the Table 3. Phosphorus uptake by wheat straw was increased with increasing levels of P fertilizers. Different P sources and levels significantly affected phosphorus uptake by wheat straw. At low level, DAP showed maximum P uptake by wheat straw but at high level, SSP showed better P uptake. The results are in line with findings of Alam and Shah (2002) who observed that P uptake by plants at pre booting stage was higher from SSP and DAP than all other treatments.

Phosphorus uptake by grain and straw of wheat is collectively known as total phosphorus uptake by wheat plants. The amount of total P uptake by wheat depends upon the production level, amount of applied P and soil type (Fageria *et al.*, 1997). Phosphorus uptake by wheat plants was significantly affected by different P sources and phosphorus uptake was increased with the increased level of phosphorus application. At low level, DAP showed maximum P uptake by wheat grain but at high level, SSP showed better P uptake. Phosphorus removal by wheat with an average yield of 3 Mg ha⁻¹ was 27 kg P

ha⁻¹ and 5 Mg ha⁻¹ removed 60 kg P ha⁻¹ (FAO, 1984). Alam (1995) also showed that the application of 25mg P kg⁻¹ soil significantly increased the dry matter, straw and grain yields as well as total P uptake by wheat crop. Similar findings were also reported by Siddique (1998) who observed that increasing P has significant effect on P efficiency, P uptake, P stress factor and P harvest index.

Conclusion and Recommendation

It was concluded from the study that phosphorus application at the rate of 80kg P ha⁻¹ as single superphosphate (SSP) showed better results as compared to triple superphosphate (TSP), nitrophos (NP) and diammonium phosphate (DAP) on phosphorus deficient soil of Balksar area of Tehsil Chakwal. This superiority of SSP over the other three sources could be due to presence of more Ca content and better water solubility of phosphate compound. Single superphosphate can be used on all crops and soils as a basal dressing. Its use for ailing saline/sodic soils is, however, preferred because of the ameliorative effect ascribable to its 46% gypsum content and highly acidic nature (pH 2.0). This product is also manufactured locally and easily

available to farmers. However as it contains less percentage of phosphorus therefore its storage and transportation cost is high as compared to other sources. However, further investigations are required to verify this fact.

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References

- Ahmed, N. 2000. Integrated plant nutrition management in Pakistan Status & opportunities. In: Proc. of Symp. on integrated plant nutrition management. NFDC, Islamabad: 18-39.
- Alam, S. M. 1995. Growth and P uptake Behaviour of wheat and Triticale as affected by P fertilization. Pak. J. Soil Sci. 10 (1-4): 63-65.
- Alam, S. M. and S. A. Shah. 2002. Phosphorus uptake and yield of wheat as influenced by integrated use of phosphatic fertilizers. Paper presented at 9th Int. Cong. Soil Sci. Soc. Pakistan held at NIAB, Faisalabad from March 18-20, 2002.
- Anderson, J. M and J. S. I. Ingram. 1993. Tropical Soil Biology and Fertility. A Handbook of Methods. C. A. B. International, Wallingford, U.K. 70-74 and 82-87.
- Anonymous, 2011-12. *Economic Survey*. Government of Pakistan, Economic Advisors Wing, Finance Division, Islamabad, Pakistan
- FAO. 1984. Fertilizer and Plant Nutrition Guide. FAO Bulletin No.9. United Nations, Rome.
- Fageria, N.K., V.C. Baliger and C.A. Jones, 1997. Growth and mineral nutrition of field crops. 2nd Ed. Marcel Dekker, Inc. NY, USA.
- Hanway, J.J. and R.A. Olsen. 1980. Phosphate situation of corn, sorghum, soybeans and small grains. In proc. "Role of phosphorus in Agriculture". Khawaneh et al. (Ed) p.681-692.
- Knudsen, D., G. A. Peterson and P. F. Pratto. 1982. Lithium, Sodium and Potassium. In: A. L. Page, R. H. Miller and D. R. Keey (eds). Methods of Soil Analysis Part 2. Amer. Soc. Agron. No.9. Madison, Wisconsin, USA. 228-238.
- Memon, K.S. and Rashid, 2001. Phosphorus plays vital role in several physiological processes. In: Soil Science. National Book Foundation Islamabad, pp:291-294.
- MINFAL, 2001. Agricultural Statistics of Pakistan, 2000-01. Ministry of Food, Agriculture and Livestock, Govt. of Pakistan Islamabad.
- MINFA, 2010. Agricultural Statistics of Pakistan, 2009-10. Ministry of Food and Agriculture, Govt. of Pakistan Islamabad.
- NFDC, 1997. Fertilizer Review, 1996-97. National Fertilizer Research and Development Centre. P & D Divi. Govt. of Pakistan, Islamabad
- NFDC, 2003. Fertilizers and their use in Pakistan. An extension guide (Nisar A. and M. Rashid Ed). National Fertilizer Development Centre, Islamabad, Pakistan.
- Olsen, S. R and L. E. Sommers. 1982. Phosphorus. In: A. L. Page, R. H. Miller and D. R. Keey. eds. Methods of Soil Analysis Part 2. Amer. Soc. Agron. No.9. Madison, Wisconsin, USA. 403-427.
- Page, A. L., R. H. Miller and D. R. Keeney (eds) 1982. Methods of Soil Analysis Part-2. Amer. Soc. Agron. Madison, Wisconsin, USA.
- Phosphate and Potash institute (PPI). 1995. International Soil Fertility Manual. 655 Engg. Drive, Suite 110, Norcross, GA, 30092-2843, USA.
- Phosphate and Potash institute (PPI). 1999. Phosphorus and Water Use Efficiency. Better crops. 83 (1): 25-25.
- Raghib Singh., S. K. Bhadra., S. Mohinder and M. L. Dixit. 2004. Effect of applied phosphorus on yield, elemental composition and establishment of its critical limit for wheat. Annals of Agri Bio Res. 9(1): 107-11.
- Rashid, A. 1994. Annual report of micronutrient project, Land Resources Research Institute, NARC, Islamabad.
- Rehman, O. U., A. M. Ranjha, M. A. Gill and S. M. Mehdi. 2004. Phosphorus requirement of wheat using Modified Freundlich Model in Rasulpur Soil Series. Pak. J. Agri. Sci., Vol. 41 (1-2).
- Ryan, J., H. Harris, and A. Matar. 2002. Soil and plant nitrogen studies in the two-course wheat rotation. In Farm Resources Management Programme. 85-91.
- Sharif, M., M. S. Sarir and F. Rabi. 2000. Biological and chemical transformation of phosphorus in some important soil series of NWFP. Sarhad J. Agri.16 (6):587-592.
- Sharma, K. N. and K. N. Namdeo. 1999. Effect of biofertilizers and phosphorus on NPK contents, uptake and grain quality of soybean (*Glycine max* L.) and nutrient status of soil. Crop Res. Hisar. 17(2): 164-169. (CAB ABSTRACT 1998/08-2000/04).
- Siddique, M. 1998. Wheat genotypes response to deficiency and adequate phosphorus levels. Thesis M.Sc (Hons). Dept. Soil Sci., Univ. Agri., Faisalabad.
- Singh D. K., P. W. G. Sale and R. R. Routley. 2005. Increasing phosphorus supply in subsurface soil in northern Australia: rationale for deep placement and the effects with various crops. : Plant and Soil. 269(1/2): 35-44
- Steel, R. G. D and J. H. Torrie. 1980. Principles and Procedures of Statistics, 2nd ed. McGraw Hill Book Company Inc., New York. 507.
- Tisdale, S. L., W. L. Nelson, J. D. Beaton and J. L. Havlin. 1993. Soil fertility and Fertilizers. 5th Ed. Macmillan Pub. Co. NY, USA.
- Winkelman, G. E., Amin, R., Rice, W. A. and Tahir, M. B., 1990. Methods Manual Soil Laboratory. BARD Project, PARC, Islamabad, Pak.

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The role of information technology in urban management and stable development

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Abstract: This study explores the role of information technology in urban management and stable development. According to cities has been developed increasingly today, it also impresses increase of cities population and it makes numerous problems for management of cities and in parallel stable development in the world. In recent decades, advent of information and communication technology as well as electronic city, electronic municipality and citizen, cheers the scholars in the international scientific community that the phenomenon of new information and communication technology can make modern management system to manage cities. Also, this system helps to stable development of cities. The purpose of this study is to explain the role of information technology in urban management and stable development. Current study findings showed that information and communication technology play a major role in management and stable development of cities.

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Keywords: information technology, urban management, stable development, electronic city

1. Introduction

City is a social and economic phenomenon that as much as it gets bigger, because of problems, its management becomes more difficult. In current conditions, some factors such as increasing poverty and social and economic injustice, population growth, increasing urbanization and air and environment pollution and traffic caused by vehicle on the one hand, and getting more complex life in modern cities compare to traditional cities on the other hand, make many problems for citizens and city managers to manage cities. Various theories have been proposed to solve problems in development. According to theoretical efforts concerning the definition of development and explanation of its basic aspects, stable development is now as a concept accepted by most of international agencies and researchers. Electronic city is one of the emerging concepts that emerged by advances in information and communication technology and has ability to solve many complex and complicated problems of life and urban governance to achieve stable development in metropolitan areas. Creating and designing electronic cities and promoting information and communication technologies in discussions of architecture and urban and rural construction, urban people are not forced to commute constantly. Less displacement has considerable benefits in terms of economic, social and environmental, because for example, it cause less gasoline consumption is obtained from the national capital (i.e. oil). In addition, we need to build and expand roads less, the environment also has less

vehicle traffic, and air pollution and traffic caused by vehicles have been reduced.

2. The concept of information technology

What should be acknowledged is that, IT has created developments in all areas of human social and economic and affect on communities so that the world is becoming an information society from the traditional and industrial societies with tremendous speed today [1]. The term information technology or information and communication technology, in recent two decades has found its global position as an innovative, emerging and powerful [2].

It seems different applications of It, will be affected all routines of communities directly or indirectly soon. Influence speed and spread of this phenomenon is high so that now expected major changes occur in the structures of cultural, economic, social and political as well as in the traditional foundations of society governance, and a new system of management would be introduced. Influence of information and communication technology and its applications caused to world leaders held two important meetings (in Geneva and Tunis in 2003 and 2005) to form the basis of information community and prepared principal and scientific programs for international information community to prepare themselves for more changes. Most of developed countries (that have acceptor systems to deal with new technology) have been accepted benefits and risks of ICT and its applications and use it. Some developing or poor countries which don't have enough information about benefits and opportunities of this technology or necessary

economic facilities to utilize this phenomenon, couldn't progress in this area. There are countries don't have financial problems, but they consider this emerging phenomenon ideologically and cause delay and prevent their people to use it. Unfortunately, this approach cause irreparable damage imposed to the society [3].

Therefore, information technology is a branch of technology for study, designing, development, implementation, support and manage computer-based information systems, particularly software hardware computer applications as well as quick access to information and doing routines regardless geographical distances and time limitation.

Compared to other technologies, information technology also has the following features:

- The ingredient is information or mind raw material
- It can improve by computers
- The final product is an abstract product
- It doesn't have location restrictions
- It doesn't have devastating impact on environment [4].

2.1. A stud on E-City

The term "electronic city" was proposed in 1994 and in a conference about Digital city. This program administered in 1996 in some European cities like Helsinki and Amsterdam [5]. One of concepts has been studied widespread in advanced societies in recent decades and has been implemented successfully in some countries is electronics city. Electronic city development is a highly regarded issue has made to increase opportunities for people life environment, working and recreation in the world. Creating electronic city affect on economic, social, political and cultural aspects of the city [6]. Electronic city is such a city has telecommunication and has controlled by ICT department to exchange information. In an electronic city not only citizens use virtual city, ministries and electronic organizations but also they do their routines such as daily purchases through network. It should be noticed that the electronic city is a real city has various citizens, offices, organizations and etc. In an electronic city that just certain communications and social interactions and provide a major part of their daily needs is done through the Internet. Most features of this informing network can be searched in the urban transport network and informing about disaster. When disaster occurs resorting to this system can manage occurred disaster as soon as possible [7].

Thanks to electronic city, participation in local government, improvement of local service increase operational performance and official would be easier [8]. This city is a favorable environment for living,

recreation, work and effort. People in electronic cities have more time for fun and relaxation and economic development and productivity in such cities are more than in current traditional cities. There are many jobs in electronic cities and obviously it can solve unemployment problem [9]. Therefore, it will affect on economic, social, cultural, and political areas for the city. In economic case of e-commerce, electronic banking city commercial relationship with neighboring countries and other parts of the world would be some of its effects. During the past 20 years, a global approach was to be an informatics society and today a more advanced society is which can generate and exchange information faster and have more features. According to new technologies make social life more complex, we need to facilitate the various affairs of life and regardless to technology, we can't do, follow and implement them [10]. Electronic city implementation has also many effects in cultural case, for example, transparency, informing, virtual training for citizens in general and specific areas, publishing digital medias for citizens, publishing updated news and information and many other cultural effects [11]. Therefore, the electronic city is a city where citizens access the services they need to perform their tasks directly, seven-twenty four, secure, reliable and fast.

3. Urban Management

"Urban management" is a base concept that first was expressed in local government reforms and geographical concepts in 1970. Basically, urban management as an institutionalized concept was flourished from mid-1980 when it used to defend and support the developing world along some key international donor organizations [12].

Thanks to urban management, local government enables to provide favorable performance in order to improve economic and social conditions in the city [13]. Local governments that provide urban services, play the major role in urban management. Urban management is an essential element of good urban governance [14]. Several definitions of urban management is presented that some of them are mentioned below: urban management is to organize factors and resources to respond to different needs of citizens [15]. Urban management is as an effort to coordinate and integrate public and private actions in order to overcome to problems that urban citizens face to, and create more competitive, fairer and more stable conditions among the cities [16]. Stern defines urban management as: to play an active role in developing, managing and coordinating resources to achieve the objectives of urban development [17].

All these definitions imply on urban management flexibility because urban management system is consisting of integrated components and elements

that must be interact and communicate each other and what is now important to lead this system is its ability to flexibility [18]. Urban management also is consisting of various parts of like departments, organizations and depended organizations that interact with each other as unique structure.

Up to now, urban management approach has emphasized to the following factors:

1- To improve local government through decentralization in purpose to making decision to allocate the resources to stakeholder, and emphasize on their participation;

2- To Change approaches from community-based to economic-based approach, economic development stimulating, enhance efficiency and productivity, combining formal and informal sector, etc;

3- Emphasize on the role of the market as well as accepting the role of government as regulator, to promote participation; to coordinate with the main groups of strategic management. [19].

3.1. Urban Management Objectives

The goals evaluate management. There is no problem or opportunity without them. They specify what concerns there are about the activities occur in the city. Explicitly, urban management favorability would be evaluated against its objectives. Despite the infinite variety of goals that can be considered for urban management, there is a set of core goals related to poverty reduction and improving quality of life, urban productivity and protect the city's physical environment [20]. Therefore, the objectives of urban management are:

1- To improve the working and living conditions of all citizens respect to low-income individuals and groups.

2- To encourage stable economic and social development

3- To protect the physical environment of the city

That means urban management, is in contact with human body in urban construction and considers its effects on people life and the social environment. In one hand, it considers economic and social development by stable patterns of equality and decides to spread justice and equality. [21]

Three mentioned purposes are all related. For example, productive investment and job and income creation leads people life to be upgraded. However, the future economy of cities is threatened by non-performance infrastructure and poor health services or conditions

4. Sustainable Development

According to cities have been developed increasingly, cities population increased and air pollution has emerged in the cities and it makes challenge for scholars in academic areas. One of

these concepts have been accepted by most academic areas is the concept of stable development. The long-term development, sustainable, popularized in our common future, a report published by the World Bank Commission on Environment and Development (WCED) in 1987. Also known as the Brundtland report, our common future, including the "classic" definition of sustainable development: "development that meets present needs without compromising the ability of future generations to meet their own needs" [22]. Acceptance of the report of the assembly of the United Nations (UN) gave the long-term policy relevance; and in 1992 the leaders to establish the principles of sustainable development in the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, also known as the Rio Summit and the Summit of the Earth [23]. As human welfare includes social and economic aspects, the concept of stable development also includes environmental aspects as well as social and economic aspects [24].

Therefore, the main three parameters of stable development are:

- Economic development
- Environment protection
- Social development

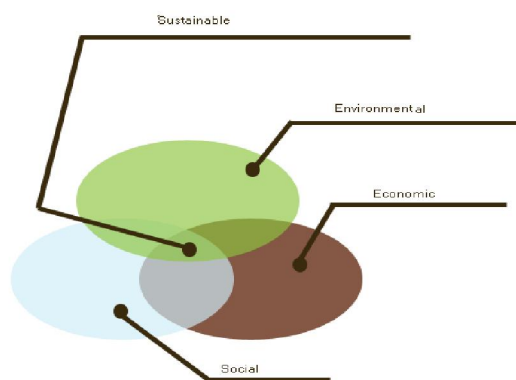


Figure 1- stable development parameters

In technical terms, stable development can be defined as a development path whose welfare optimization would not result welfare reduction in the future. Stepping in this path requires eradicating the extravagances results in destroying the natural resources and Environments [25].

Today, the necessity of stable development is an issue that everyone agrees on it. Human activities on Earth, using resources in the current way, endanger opportunities and facilitates of the future generations. Cities are the main place for human activities and count as the largest consumer of natural resources, so, to achieve the highest possible stability is vital in the cities. Cities stability is not merely related to

environmental issues but also to achieve to economic dynamics, livable environment and social equality. Development is a qualitative concept and it can be considered equivalent to increasing the quality of life. It includes issues such as health, education, welfare, freedom of speech, rights, etc [26].

Although the term stable development has been used in Cocoyoc Declaration on Environment in early 1970s and this term roots from ecologic development approach which has brought to world protection strategy, [27] but it forms by formation of the world independent commission on environment and develop and report stable development principles [28].

5. The role of information technology in urban management and sustainable development

Using information and communication technology play a major role in solving metropolises problems. It plays a vital role especially in urban management, urban economy, generating jobs and promoting culture level of citizens [29].

Each organization structure has its own special features and our attitude should be match to these features. As mentioned above, in the hyper industrial and virtual era, the way exchanges and policies governs how organizations and their functions operate, is not useful without interference and without the influence of technology and knowledge.

To describe urban management structure, the following principles can be noticed:

- 1- The needs of citizens always should be identified and discovered.
- 2- The organization output should be converged according to expectations of citizens and be tried to coordinate them.
- 3- Pests in urban management structure should be identified and actions should be taken to eliminate it.
- 4- Knowledge should be Institutionalized in both learning and implementation phases.
- 5- Technology should be used as an appropriate lever in order to achieve designed objectives in the urban management and providing appropriate services proper compliance with policies and management structure. It shouldn't be used merely as a luxury management tool and to lag from globalization only as a definition, but in the true way, otherwise, not only it's not an effective tool to achieve goals but also it cause a heavy financial burden on the management structure that removing it and returning to traditional structure has more economic benefits.
- 6- Comparing between the way to allocate methods and manners and to adapt manufacturing processes and organization levers and effectiveness of industry and organization in order to apply IT

management in correct way and special conditions should be considered And comparison with other organizations and industries and ranked and rated appropriately, should be placed early in the municipal services [30].

All the factors mentioned, can be appropriate and effective solution in order to thee dynamics and growth in providing urban services. The point should be considered more is that the fundamental change realized when, after management structure Institutionalized and modified, we are changing and moving toward providing services in order to solve problems and to gain favorability for citizens in municipalities. Information technology is able to reduce about 70% of urban traffic and if citizens use information technology and internet for more information about services, vehicle traffic would be low.

This issue will largely prevent environmental pollution. In France, first, before leaving home, active citizens examine all the paths they want to go, check the type of services or goods they should receive and if necessary reserve them through connecting to an inexpensive high-speed internet. Obviously, this citizen plays an important role in reducing energy consumption and savings it, exposures environmental to damage and risk less and helps to achieve to stable development and good urban management.

6. Conclusions

Modern cities have grown inharmoniously and their population is growing. In addition, air pollution has been increased due to increasing urban traffic. In other words, today, citizens and city officials make many problems in the management of modern cities and air pollution threatens the environment. Thanks to technology revolution and advancement of information technology, using information technology is the best way to manage cities in order to achieve urban development goals. Because creating electronic city and electronic municipality that they are result of information technology, causes citizens access to their needed services directly, safe, reliable, quickly and 7-24, and physical offices replace by digital offices and organizations such as municipality, public transportation, regional water organization, etc provide their services virtually and using facilitates such as ICT for citizens.

In such circumstances, citizens would be able to do their services daily purchases through the internet. All these issues reduce urban commuting and in parallel vehicle traffic would be reduced. Therefore, using and improving information technology is a way to improve decision making process more reliable and safer in order to provide stable development and

urban management. Information technology is a powerful tool to solve problems of urban management and stable development. In current circumstances, countries need to use information technology to manage cities and to achieve stable development. Otherwise, they will suffer irreparable damages.

References

- [1] UNCTAD, "Electronic Commerce and Development", Internet Version, 2002.
- [2] Jalali, Ali Akbar, "Electronic city", Third edition, Tehran, Iran University of Science and Technology publication, 2005
- [3] Jalali, Ali Akbar, "Electronic city", Takfa Periodicals publication, number 2, pages 72-74, khordad 2007
- [4] Thomas N. Hubbard, "The demand for monitoring technologies", Quarterly Journal of Economics, page 533-560, may 2000.
- [5] Zeynali Azim A & et al, "Electronic city: A City of Today and Tomorrow", J. Basic. Appl. Sci. Res., 2(7), 6615-6621(2012)
- [6] A. Zangabadi, S. & et al, "An Analysis of Adopting Information Technology in Cities : (A case study: Isfahan City)", Proceedings of 4th International Conference on Islamic World Geographers, Zahedan, Iran, 2010
- [7] Sar afrazi Mehrdad, Memarzadeh Gholamreza, "Paradigm of electronic city as an essential in the establishment of electronic municipality", Fourth International Conference on ICT management, conference hall of international Olympic hotel, February 18-19, Tehran, pages 6-8, 2007
- [8] Building an Information and Technology Vision for Toronto, October 2002, 2
- [9] Reddick, C., "Citizen interaction with e-government: From the streets to servers," Government Information Quarterly, 22: 38-57, 2002
- [10] Savej and Alen, "Urban Sociology", Translated by Pour reza Abolghasem, organization of study about human sciences books in universities, Tehran, page 86, 2001
- [11] King, S., "Citizen as customers: Exploring the future of CRM in UK local government," Government Information Quarterly, 24, 47-63, (2007)
- [12] Jenkins P, "Urban management, urban poverty and urban governance: planning and land management in Maputo", Environment & Urbanization , 12(1), 137-152 (2000)
- [13] Bačlija I, "Urban management in a European context", Urbani izziv, (22) 2, 137- 146 (2011)
- [14] ANCHOR Institute Kolkata, City/Urban Management, Supported by United Nations Development Programme Through Department of Personnel & Training, Govt. of India New Delhi, 6-27 (2003).
- [15] Sarrafi, Mozaffar et. al, "The concept, principles and challenges of urban management", urban management Periodicals publication, number 2, Ministry of Interior, Iran Municipalities and Rural managements Organization, 2000
- [16] Momeni M.& et. al, Urban Management based on Citizen Participation to Enhance Quality of Life in Tehran, CHANGE FOR STABILITY: Lifecycles of Cities and Regions, 20 (2), 1079-1085 (2011)
- [17] Zarrabi Asghar, Jamali nejad Mahdi, "The role of coordinated urban in establish to social security" ; Case Study: Isfahan, urban management Periodicals publication, number 26, fall and winter, page 225- 240, 2010
- [18] Reseni J, Bishoon J, "System thinking approach", Jahanbegloo, Amir hossein, development and concept publication, Tehran, page 62, 1991
- [19] Post J, "Urban management in an unruly setting: the African case" in Third World Planning Review, 19(4), 347-366 (1997).
- [20] UNDP, Cities People and Poverty New York, 1991
- [21] Kazemian GH , Saeed Rezvani N, promise, the feasibility of assigning new duties to Municipalities, second edition, published by the municipalities, 56, (2003)
- [22] WCED, "Our Common Future, Oxford University", Oxford, 43, 1987
- [23] "Sustainable Development: From Brundtland to Rio 2012", United Nations Headquarters, New York, 1-26, September 2010
- [24] Fu-chenlo, Peter j. Marcotullio, "Globalization and the Sustainability of Cities in the Asia Pacific Region", United Nations University Press, Tokyo, 2001
- [25] Kirkpatrick C. & et al, "Development of criteria to assess the effectiveness of national strategies for sustainable development", Institute for Development Policy and Management, University of Manchester, 2, 2001
- [26] Hossein zadeh Dalir K, "Regional planning", direction production, page 93, 2001
- [27] Barrow C.J., "Sustainable Development: Concept, value and practice", TWPR, 17(4), 1995.
- [28] Roseland M, dimension of eco-city, cities, 2003
- [29] Harati, S, "Solving urban problems through information and communication technology", Tehran, International Journal of Communication Center, number 46, 2007
- [30] Jalali Lavasani, E, Najafi, M, "Dimensions of the application of information technology in urban management structure(Urban management system 137)", Second International Conference on Electronic Municipality, Iran Municipalities and Rural managements Organization, April 11-12, Tehran, pages 17-18, 2009.

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Polarization Dependence of Polymer Surface Relief Gratings

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Abstract: We report the polarization dependence of surface relief grating (SRGs) based on azo dye-poly(methyl methacrylate). The S-polarized and P-polarized writing beams were introduced into the sample and fabricated the surface relief gratings (SRGs). The He-Ne laser with S-polarization or P-polarization was served as a probe beam and measured the first order diffraction of SRGs. The results showed that the diffraction efficiency was highly correlated with the polarization of writing beams. The atomic force microscopy was employed to observe the morphology of SRGs, and the depths of SRGs can be obtained a relative high value for the P-polarization of writing beams. [Ying-Chuan Wang, **Polarization Dependence of Polymer Surface Relief Gratings**. *Life Sci J.* 2012;9(3):1255 -1257] (ISSN:1097-8135). <http://www.lifesciencesite.com>.

Keywords: polarization, surface relief gratings, the diffraction efficiency, atomic force microscopy

1. Introduction

In the past several years, azo polymers have shown to offer many interesting applications, such as optical data storage, optical switching devices, diffractive optical elements, integrated optical devices, polarization splitters and electro-optical devices [1-6]. It is well-established that following excitation of azo dye and trans-cis isomerization, thermal diffusion enables rotation of azo dye in the bulk. Photoinduced surface relief gratings (SRGs) is an important result of molecular translation control using optical fields. With the irradiation of an interference pattern on azo dye molecules, the alignment of the chromophores can be induced and the modification of the surface can be controlled [8-13]. SRGs has the following properties: (1) It can be fabricated upon azobenzene functionalized polymers such as side-chain azo polymers. (2) The diffraction efficiency and the depth of SRGs depend on the energy of writing beams and the polarization of the writing beams. (3) SRGs is highly stable below the glass transition temperature T_g .

In this study, the polarization dependence of SRGs is discussed. The surface relief gratings based on azo dye doped polymer film with a single pulse writing is fabricated. The first order diffraction efficiency depends on the polarization of writing beams and probe beam is studied. The depths of inscribed surface relief gratings (SRGs) depends on the polarization of writing beam is also discussed.

2. Experimental

Sample Fabrication

Samples were spin-coated films of the azo-dye molecule Disperse Red 1 (DR1) in poly(methyl-methacrylate)(PMMA). The weight concentration of

DR1 and PMMA are 7wt% and 93wt%, respectively. The excitation and isomerization from trans to cis form and the absorption spectrum of DR1 are shown in Figure 1(a) and 1(b). The absorption peak is around 500 nm. First, we dissolved DR1 and PMMA in toluene, and the azo dye in polymer solutions were filtered by filter with 0.2 μm . The solutions were spin-coated on the glass substrate. The thickness of the films were about 3 μm .

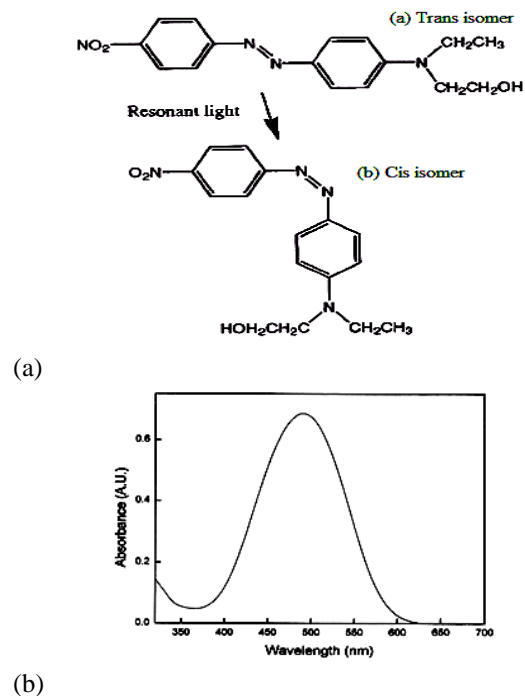


Figure 1 (a) The isomerization from trans to cis form of DR1 (b) The absorption spectrum of DR1

Setup

Figure 2 shows the experimental setup for the fabrication of surface relief gratings in azo dye DR1 doped poly(methyl-methacrylate) (PMMA) thin film. Two simultaneously incident pump pulses derived from a Nd:YAG laser were operated at a wavelength of 532 nm. The pump beams were S-polarization or P-polarization and crossed in the sample with an irradiance of 3.0 mJ/cm^2 for each pulse. As the writing pulses acted on the sample with a single shot, the surface relief gratings were formed. Then S-polarized or P-polarized He-Ne probe laser was incident normally on to the sample and the first order of diffraction efficiency was measured with a photodiode and recorded with an oscilloscope.

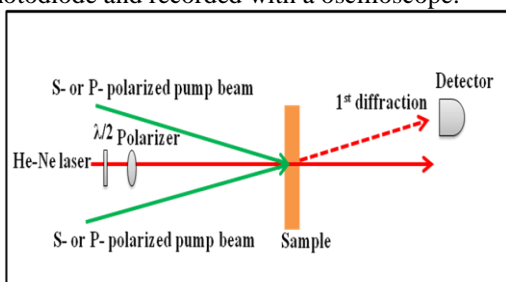


Figure 2 Experimental setup for the fabrication of surface relief gratings.

3. Results and Discussions

Figure 3 plots the polarization dependence of the pump beams on the diffraction efficiency with the S-polarized probe beam. The influence of the S- or P-polarized pump beams on the grating diffraction efficiency, P-polarized pump lasers interferences producing surface gratings with diffraction efficiency 3.0 times larger than S-polarized ones. This result indicates that the intensity modulation by the two incident pump beams play an important role for the fabrication of SRGs. The SRGs were stable, and the diffraction efficiency retained the same value even after six months.

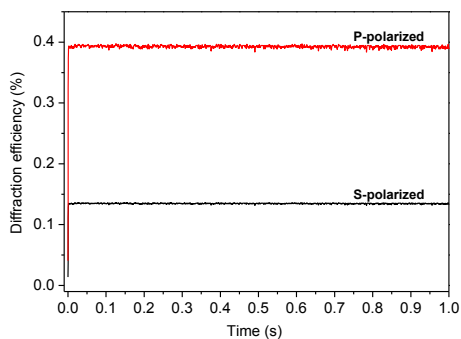


Figure 3 The polarization dependence of pump beams on the diffraction efficiency

The diffraction efficiency depended on the polarization of pump/probe beams were shown in Table. 1. The higher diffraction efficiencies were obtained when P/S or P/P polarized pump/probe beams were used. The diffraction efficiency for P/S or P/P beams are around 3 times larger than that of S/S or S/P polarizations. The diffraction efficiency depended on the polarization of pump beams, but less affected by the polarization of probe beams.

Table. 1 The polarization dependence of pump/probe beams on the diffraction efficiency

Polarization of Pump/ Probe beams	Diffraction efficiency (%)
S/S	0.13
S/P	0.12
P/S	0.39
P/P	0.37

The morphologies of inscribed surface relief gratings for P- or S- polarized pump beams were shown in Figure 4. The surface relief gratings were recorded with a spatial period of $\sim 12 \mu\text{m}$ and the surface modulations were 1.51 and $0.53 \mu\text{m}$ for the P- and S- polarized pump beams, respectively. The ratio of surface modulation was also consistent with the ratio of the first-order diffraction efficiency.

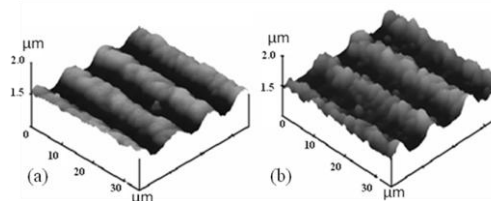


Figure 4. The morphologies of inscribed surface relief gratings for (a) P- or (b) S- polarized pump beams

4. Conclusion

In this study, we report the polarization dependence of surface relief gratings (SRGs) based on azo dye-poly(methyl methacrylate). The diffraction efficiency for P-polarized pump beams was about 3.0 times larger than that of S-polarized pump beams. The diffraction efficiency was independent of the polarization of probe beam. The ratio of surface modulation was also consistent with the ratio of the first-order diffraction efficiency.

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References

- [1] T. Todorov, L. Nikolova, N. Tomova, *Appl. Opt.* 23 (1984) 4309.
- [2] P. Rochon, J. Gosselin, A. Natansohn, S. Xie, *Appl. Phys. Lett.* 60(1992) 4.
- [3] Z. Sekkat, M. Dumont, *Appl. Phys. B* 54 (1992) 486.
- [4] R. Loucif-Saïbi, K. Nakatani, J.A. Delaire, M. Dumont, Z. Sekkat, *Mol. Cryst. Liq. Cryst.* 235 (1993) 251.
- [5] C. Fiorini, F. Charra, J.-M. Nunzi, P. Raimond, *J. Opt. Soc. Am. B* 14(1997) 1984.
- [6] P. Rochon, E. Batalla, A. Natansohn, *Appl. Phys. Lett.* 66 (1995) 136.
- [7] A.-C. EtileÂ, C. Fiorini, F. Charra, J.-M. Nunzi, *Phys. Rev. A* 56(1997) 3888.
- [8] D.Y. Kim, L. Li, J. Kumar, S.K. Tripathy, *Appl. Phys. Lett.* 66 (1995)1166.
- [9] D.Y. Kim, L. Li, X.L. Jiang, V. Shivshankar, J. Kumar, S.K. Tripathy, *Macromolecules* 28 (1996) 8835.
- [10] C. T. Kuo, S. Y. Huang, *Appl. Phys. Letters* **89** (2006)111109.
- [11] S.Yu.Huang, B.Y. Huang, W.C. Hung, K.Y. Yu, W. S. Cheng, C.T. Kuo, *Optics Com.* **284** (2010) 934.
- [12] C. Fiorini, N. Prudhomme, G. de Veyrac, I. Maurin, P. Raimond, J.-M. Nunzi, *Synthetic Metals* **115** (2000) 121.
- [13] Ying-Chuan Wang, *Life Science Journal*, **9(2)** (2012) 1196.

Correlation of the Leptin-to-Adiponectin Ratio (LAR) with Insulin Resistance in Lean and Obese Saudi Females with Type 2 Diabetes

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Abstract: Objectives: The role of various adipokines as a link between obesity and diabetes mellitus has recently been better elucidated. The aim of this study was to investigate the correlation of the leptin/adiponectin ratio (LAR) with insulin resistance in obese and diabetic Saudi females. **Methods:** This study included 373 Saudi females divided into two groups: type 2 diabetic (n=196) and normal control (n=177). The groups were further divided according to BMI into normal obese (n=85), normal non-obese (n=92), diabetic obese (n=118) and diabetic non-obese (n=78) subgroups. For all studied groups, levels of leptin, adiponectin, insulin and C-reactive protein were measured using (ELISAs). The glucose, triglyceride, cholesterol, LDL and HDL levels were determined using colorimetric assays, and the homeostasis model assessment ratio (HOMA-IR) was determined using a formula derived from fasting insulin and glucose levels. **Results:** The leptin levels were significantly higher and the adiponectin levels were significantly lower in the diabetic group compared to the normal control group (P value < 0.05). The LAR showed a significant positive correlation with the HOMA-IR ($r=0.129$, $P=0.01$) and a highly significant positive correlation with BMI, glucose, cholesterol, LDL and insulin ($r=0.220$, $P=0.00$; $r=0.135$, $P=0.009$; $r=0.201$, $P=0.000$; $r=0.215$, $P=0.000$; and $r=0.212$, $P=0.000$, respectively). There was a statistically significant difference among all subgroups for the LAR ($F=20.60$, $P=0.00$) and for the HOMA-IR ($F=17.73$, $P=0.001$). **Conclusion:** The LAR has the potential to become a new laboratory marker for insulin resistance in patients with obesity and type 2 diabetes mellitus.

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Key words: the Leptin-to-Adiponectin Ratio (LAR), Insulin Resistance, Obesity, Diabetes, Lean, Homeostatic Model Assessment of insulin resistance (HOMA-IR)

Abbreviations: The Leptin-to-Adiponectin Ratio (LAR), type 2 diabetes mellitus (T2DM), the homeostasis model assessment ratio (HOMA-IR), triglycerides (TG), C-reactive protein (CRP), High density lipoproteins (HDL), Low Density Lipoproteins (LDL)

1. Introduction

White adipose tissue is storage and release site for fatty acids and a major secretory organ for many proteins known as 'adipokines'. The types of adipokines include proinflammatory cytokines, chemokines, acute-phase proteins, adiponectin and leptin [1]. Obesity is closely related to insulin resistance, glucose intolerance and type 2 diabetes. The mechanisms linking insulin resistance and obesity are not yet fully understood, but adipose tissue may play a role in this association because it is an active metabolic organ that releases different adipocytokines. Leptin and adiponectin, two of the most abundant adipocyte products, are thought to link obesity, insulin resistance, and related disorders [2]. Unlike other adipocytokines such as leptin, interleukin 6, and resistin, adiponectin levels decrease with increased adipose tissue [3]. Circulating adiponectin levels lower than the control level have been observed in human subjects with any of obesity, type 2 diabetes mellitus, and

cardiovascular disease [4]. Leptin, identified from the ob/ob mouse (the animal model that is genetically susceptible to obesity), regulates body weight, modulating appetite and energy expenditure by acting on the hypothalamus and inhibiting the release of neuropeptide Y in mice and humans [5]. The effects of adiponectin and leptin on energy metabolism differ; leptin improves insulin sensitivity through activation of adenosine monophosphate-activated protein kinase (AMPK), which controls the cellular concentrations of malonyl-CoA, thereby inhibiting acetyl-CoA carboxylase [6]. As a result, both intracellular malonyl-CoA and the lipogenesis associated with increased fatty acid beta-oxidation decrease. Adiponectin enhances insulin sensitivity through activation of AMPK [7] and also affects hepatic glucose production by decreasing the mRNA expression of two essential gluconeogenesis enzymes: phosphoenolpyruvate carboxykinase and glucose-6-phosphatase [8].

Insulin resistance is particularly prevalent in obese humans, and an independent association between insulin resistance and elevated plasma leptin levels has been reported [9]. Another study showed a negative correlation of serum adiponectin levels and body mass index BMI and a positive correlation between serum leptin levels and BMI [10]. Evaluation of the leptin/adiponectin ratio (LAR) has been suggested as a useful parameter for assessing insulin resistance in patients with and without diabetes [11-13]. Inoue *et al.* [11, 12] reported that the LAR was a more effective measure of insulin resistance than either adiponectin or leptin alone, and it was a more sensitive and reliable marker of insulin resistance than the homeostasis model assessment of insulin resistance (HOMA-IR) in subjects without hyperglycemia, as well as in type 2 diabetics. Our aims were to evaluate the utility and potential benefits of determining the correlation between the LAR and the HOMA-IR as a measure of insulin resistance in obese and lean diabetic females and to assess the correlation between the LAR and other measures, such as glucose, triglycerides (TG), cholesterol, LDL, HDL, insulin and C-reactive protein (CRP).

2. Subjects and Methods:

2.1. Study population

This study was cleared by the Faculty of Medicine Ethics Review Board for Human Studies at Umm Al-Qura University and has complied with the principles laid down in the Declaration of Helsinki, adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964, and recently amended at the 59th World Medical Assembly, Seoul, Korea, October 2008. All subjects provided signed informed consent for participation in the study as required.

The subjects (n=373) were adult Saudi females aged 30-60 years. They were divided into two groups. The type 2 diabetic group (n=196) attended diabetic clinics at Al-Noor Specialized Hospital, Al-Zaher Hospital or Al-Khansah Hospital in the Makkha region, KSA from September 2009 to September 2011. This group was further divided into two subgroups according to BMI: diabetic obese (Dob) (n=118) and diabetic non-obese (Dn) (n=78). The subjects were considered non-obese if their BMI was 18-25 and obese if their BMI was above 30. The control group (n=177) was composed of females who were clinically free; they were subdivided into two groups according to BMI: normal obese (Nob) (n=85) and normal non-obese (Nn) (n=92). The exclusion criteria for all groups were pregnancy, hypertension, endocrinal disorders, hormonal therapy and lipid-lowering medications.

2.2. Measurement of anthropometric and metabolic characteristics

For all subjects, comprehensive questionnaires were used to collect medical information. Complete history was obtained, physical and clinical examinations were performed. Measurements of height and weight were performed to the nearest 0.1 kg and 0.5 cm, respectively. BMI was calculated as weight (kg) divided by height (m) squared. Blood samples were collected from subjects after overnight (12 hours) fasting using BD vacutainer serum tubes. The samples were transported in portable insulated bags containing ice packs (at 0-4°C) and processed by centrifugation within (2 hours) of collection. The serum was stored at (-70° C) until its use in subsequent assays.

The concentration of leptin (ng/mL) was determined using ELISA kits provided by Millipore (Missouri, USA). The concentrations of adiponectin (µg/ml) and insulin (µU/mL) were determined using sandwich ELISAs with kits provided from ALPCO Diagnostics (North Carolina, USA). The concentration of CRP was also measured using ELISA kits from Chemi-Con (Temecula, USA). All procedures in the manufacturer's instructions were followed, and quality control measurements were within the ranges recommended by the manufacturer. The minimum detectable concentration for the leptin kit was 0.25 ng/mL, and its intra-assay and inter-assay coefficients of variation (CVs) ranged from 3.0% to 6.2%. The minimum detectable concentration for the adiponectin kit was 0.15 ng/mL, and its intra-assay and inter-assay coefficient of variation (CVs) ranged from 2.9% to 6.6%. The adiponectin values in this study represented the total measurements of trimer, hexamer and high molecular weight (HMW) forms of adiponectin in blood plasma. Fasting blood glucose was determined using a glucose oxidase assay and the serum concentrations of LDL cholesterol, HDL cholesterol and triglycerides (TG) were determined using colorimetric enzyme kits from Spinreact (Bas Gerona, Spain). The insulin resistance indices were calculated using the formula described by Matthews *et al.* [14]: insulin resistance (HOMA-IR) = fasting glucose (mg/dl) x fasting insulin (µU/mL) / 405.

2.3. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 17.0 for Windows (SPSS Inc., Chicago, IL, USA). A value of $P < 0.05$ was considered statistically significant for all analyses. The data are presented as the mean and standard deviation. Spearman correlation coefficients (r) were used to describe the association between the variables.

Student's t-test for independent samples and one-way analysis of variance (ANOVA) were used to compare the results of different subgroups.

3. Results

3.1. Characteristics of all groups

The studied subjects were all Saudi females. The mean age \pm SD of each group was as follows: healthy non-obese (Nn) women, 40.86 ± 10.88 years; healthy obese women (Nob), 47.08 ± 13.99 years; diabetic non-obese (Dn) women 45.64 ± 12.79 years; and diabetic obese (Dob) women, 44.55 ± 10.07 .

3.2. Correlation analysis of different parameters

Pearson bivariate correlation analyses for adiponectin, leptin and other parameters revealed that leptin had a highly significant positive correlation with BMI, cholesterol, TG, LDL, CRP and the LAR ($r=0.560, P=0.00$; $r=0.420, P=0.00$; $r=0.240, P=0.00$; $r=0.240, P=0.000$; $r=0.372, P=0.00$; and $r=0.402, P=0.000$, respectively) and a highly significant negative correlation with adiponectin ($r=-0.268$; $P=0.000$). Adiponectin had a highly significant negative correlation with BMI, glucose, cholesterol, TG, LDL, insulin, CRP, the LAR and the HOMA-IR ($r=-0.328, P=0.000$; $r=-0.261, P=0.001$; $r=-0.208, P=0.003$; $r=-0.203, P=0.000$; $r=-0.343, P=0.000$; $r=-0.176, P=0.001$; $r=-0.343, P=0.003$; $r=-0.301, P=0.000$; $r=-0.166, P=0.001$; and $r=-0.268, P=0.000$, respectively) (Table-1). The LAR had a significant positive correlation with the HOMA-IR, BMI, glucose, cholesterol, LDL and insulin ($r=0.129, P=0.01$; $r=0.220, P=0.00$; $r=0.135, P=0.009$; $r=0.201, P=0.000$; $r=0.215, P=0.000$; and $r=0.212, P=0.000$, respectively), but the LAR also had a significant negative correlation with HDL ($r=-0.144, P=0.005$). The HOMA-IR had a highly significant positive correlation with BMI, glucose, LDL, insulin, and CRP ($r=0.158, P=0.002$; $r=0.372, P=0.00$; $r=0.256, P=0.00$; $r=0.931, P=0.000$; and $r=0.186, P=0.00$, respectively). The HOMA-IR also had a significant negative correlation with HDL and adiponectin ($r=-0.152, P=0.003$; and $r=-0.166, P=0.001$, respectively) (Table-2).

3.3. Significant differences for the LAR, the HOMA-IR and all other parameters in studied groups and subgroups

The independent samples t-test revealed a significant statistical difference (P value < 0.05) between the control group and the diabetic group for adiponectin, leptin, glucose, HDL, triglycerides, insulin, the LAR and the HOMA-IR, but cholesterol, LDL and C-reactive protein showed non-significance differences (Table 3).

The independent samples t-test was used to compare the normal obese (Nob) and normal non-obese (Nn) control subgroups. There was a significant difference for leptin, adiponectin, cholesterol, TG, insulin, CRP, the LAR and the HOMA-IR, but there was no significant difference for HDL, LDL and glucose (Table-4). Comparing the diabetic obese (Dob) and diabetic non-obese (Dn) subgroups revealed a significant difference for leptin, LDL, triglycerides, cholesterol and the LAR but no significance difference for adiponectin, HDL, glucose and the HOMA-IR (Table 5).

One-way ANOVA was used for comparison of the LAR and HOMA-IR between the normal obese and non-obese subgroups and between the diabetic obese and non-obese subgroups (Table 6). The analysis revealed that there was a statistically significant difference between the four groups, as determined by the one-way ANOVA for the LAR ($F=20.60, P=0.000$) and the HOMA-IR ($F=17.73, P=0.001$). Turkey's post-hoc test revealed that there was a statistically significant difference for the LAR among the normal control non-obese (2.74 ± 1.22), the normal obese ($6.37 \pm 3.50, P=0.01$), the diabetic non-obese ($10.94 \pm 3.55, P=0.041$) and the diabetic obese subgroups ($14.52 \pm 7.7, P=0.00$). There was also a significant difference among the normal obese, the diabetic non-obese ($P=0.041$) and the diabetic obese subgroups ($P=0.00$). Additionally, there was a significant difference between the diabetic non-obese and the diabetic obese ($P=0.00$) subgroups. For the HOMA-IR, post-hoc tests revealed that there was a statistically significant difference between the normal control (1.9374 ± 0.93), the normal obese ($4.29 \pm 1.04, P=0.024$), the diabetic non-obese ($9.22 \pm 2.76, P=0.00$) and the diabetic obese ($10.5 \pm 5.76, P=0.00$) subgroups. There was also a significant difference among the normal obese, the diabetic non-obese ($P=0.006$) and the diabetic obese subgroups ($P=0.00$), but there was no statistically significant difference between the diabetic non-obese and the diabetic obese subgroups ($P=0.146$).

Table 1: Pearson Correlation of leptin, adiponectin, with various parameters

Parameters	Leptin		Adiponectin	
	r	P value	r	P value
BMI	.560	.000**	-.328	.000**
Glucose	.113	.030*	-.261	.000**
Cholesterol	.420	.000**	-.208	.000**
TG	.240	.000**	-.203	.000**
LDL	.240	.000**	-.343	.000**
HDL	-.056	.279	.120	.021*
Insulin	.094	.070	-.176	.001**
CRP	.372	.000**	-.343	.000**
LAR	.402	.000**	-.301	.000**
HMOA-IR	.060	.249	-.166	.001**
Leptin	-	-	-.268	.000**
Adiponectin	-.268-	.000**	-	-

* P value significant at ≤ 0.05 .**Table 2: Pearson Correlation of LAR, HMOA-IR, with various parameters**

Parameters	LAR		HMOA-IR	
	r	P value	r	P value
BMI	.220	.000**	.158	.002**
Glucose	.135	.009**	.372	.000**
Cholesterol	.201	.000**	.061	.242
TG	.058	.267	.069	.181
LDL	.215	.000**	.256	.000**
HDL	-.144	.005**	-.152	.003**
Insulin	.212	.000**	.931	.000**
CRP	.069	.185	.186	.000**
LAR	-	-	.129	.012*
HMOA-IR	.129	.012*	-	-
Leptin	.402	.000**	.060	.249
Adiponectin	-.301-	.000**	-.166	.001**

* P value significant at ≤ 0.05 **Table 3: Correlation of leptin, adiponectin, lipid profile, Insulin , C reactive protein, LAR and HOMA-IR in normal control and diabetic groups.**

Parameters	Normal Control N (n=177)	Diabetic D (n=196)	P. value
BMI	27.81±11.32	34.9 ±7.37	0.000*
Adiponectin (µg/ml)	7.71± 2.90	4.75 ±1.15	0.000*
Leptin (ng/ml)	22.66± 10.40	33.96 ±14.32	0.032*
Glucose (Mg/dl)	94.62 ±19.36	149.41±21.50	0.000*
Cholesterol (Mg/dl)	132.45 ±46.73	160.41 ±56.33	0.335
Triglyceride(Mg/dl)	130 ±33.27	174 ±45.75	0.000*
LDL(Mg/dl)	99.45 ±19	143± 22.41	0.161
HDL(Mg/dl)	46.46 ± 8.23	40.21± 5.48	0.039*
Insulin (µU/mL)	12.86 ±2.33	30.31± 8.25	0.000*
CRP (µg/ml)	7.073± 3.90	11.35± 2.41	0.048 *
LAR	3 .43 ± 1.70	9 .96 ± 4.32	0.000*
HOMA-IR	3.06 ± 1.04	11.2 ± 4.33	0.000*

* P value significant at ≤ 0.05

Table 4: Correlation of leptin, adiponectin, lipid profile, Insulin, C reactive protein, LAR and HOMA-IR in normal obese and non obese control subgroups

Parameters	Control non-obese Nn (n=92)	Control obese Nob (n=85)	P. value
BMI	20.40 ± 2.71	35.37 ± 5.8	0.000*
Leptin (μ/l)	18.80± 9.17	25.25 ± 10.77	0.000*
Adiponectin (μ/l)	7.27 ± 4.29	4.85 ± 2.71	0.000*
LDL (μ/l)	95.74 ± 14.2	103.15 ± 22.5	0.064
HDL (μ/l)	46.90 ± 6.43	46.02 ± 9.76	0.535
Triglyceride(mg/dl)	117 ± 38.9	143.15 ± 19.33	0.001*
Cholesterol (mg/dl)	101.92 ± 16.77	162.99 ± 47.20	0.000*
Glucose (mg/dl)	88.35 ± 15.8	100.9 ± 20.7	0.108
Insulin (μU/mL)	8.88 ±3.53	17.18 ±6. 23	0.000*
CRP (μg/ml)	4.88 ± 2.94	7.44 ± 3.57	0.048*
LAR	2.74± 1.22	6.37± 3.50	0.000*
HOMA-IR	1.93 ± 0.93	4.29± 1.04	0.000*

*P value significant at ≤ 0.05

Table 5: Correlation of leptin, adiponectin, lipid profile, Insulin, C reactive protein, LAR and HOMA-IR in Diabetic obese and non obese subgroups

Parameters	Diabetic non-obese Dn (n=78)	Diabetic obese Dob (n=118)	P. value
BMI	25.66 ± 2.70	35.85 ± 4.74	0.000*
Leptin (μ/l)	22.20 ± 12.22	34.03± 14.4	0.001*
Adiponectin (μ/l)	2.98 ± 1.55	2.56 ± 1.57	0.692
LDL (μ/l)	133.38 ± 22.9	150 ± 19.4	0.000*
HDL (μ/l)	40.60 ± 5.81	39.93 ± 5.27	0.634
Triglyceride(mg/dl)	131.72 ± 36.95	183 ± 49.59	0.007*
Cholesterol (mg/dl)	152.42 ± 21.70	180.67 ± 64.63	0.000*
Glucose (mg/dl)	153.28 ± 51.32	146.6 ± 51.9	0.396
Insulin (μU/mL)	24.48 ± 9.38	34.16 ± 14.23	0.001*
CRP (μg/ml)	5.73 ± 3.10	11.76 ±3.40	0.030*
LAR	10.94 ± 3.55	14.52 ± 7.7	0.000*
HOMA-IR	9.22 ± 2.76	10.5 ± 5.76	0.071

* P value significant at ≤ 0.05

Table 6: One-way ANOVA for comparison of LAR, HMOA-IR Cholesterol and CRP in all subgroups.

Variables	Subgroups	Subgroups	P Value
LAR	NN	Nob	0.001*
		Dnob	0.041*
		Dob	0.000*
	Nob	Dnob	0.035*
		Dob	0.000*
		Dnob	0.000*
HMOA-IR	NN	Nob	0.024*
		Dnob	0.000*
		Dob	0.000*
	Nob	Dnob	0.006*
		Dob	0.000*
		Dnob	0.146

Light shaded rows indicate comparisons of variables in Normal obese in relation to other subgroups; dark shaded rows indicate comparisons of variables in Diabetic non obese in relation to other subgroups. Non shaded areas indicate comparison of normal non-obese in relation to other subgroups

* P value significant at ≤ 0.05

4. Discussion

Obesity is a major risk factor for insulin resistance and type 2 diabetes. The recent focus on adipose tissue as an endocrine organ that secretes signaling proteins, collectively termed adipokines, has prompted current interest in the association of adipokines with insulin resistance and type-2 diabetes. Our results revealed that leptin was significantly high and adiponectin was significantly low in the diabetic group compared to the normal group and in the normal obese subgroup compared to the normal non-obese subgroup. However, leptin and adiponectin did not reach a statistically significant level in the diabetic obese subgroup when compared to the diabetic non-obese subgroup. These findings were in agreement with those of other researchers, who found high leptin and low adiponectin levels in obese and type 2 diabetic patients [15,4]. Adiponectin decreases as body mass index BMI increases, and it is negatively correlated with insulin resistance [16, 17, 4]. Similarly, Considine *et al.* reported that, in obese people, the expression of leptin in adipose cells and the concentration of leptin in blood were significantly high; therefore, leptin can be used as a sensitive chemical marker for the diagnosis of obesity and obesity-related diseases [18]. In contrast to leptin, adiponectin was under-expressed in obese patients with insulin resistance, type 2 diabetes and coronary heart disease [19].

Our results showed a highly significant negative correlation for leptin and adiponectin in all studied groups. Meanwhile, leptin was positively correlated with BMI, and adiponectin was negatively correlated with BMI. Leptin was positively correlated with glucose, TG, cholesterol and LDL, but adiponectin was negatively correlated with glucose, TG, cholesterol and LDL and was positively correlated with HDL. Previous studies in Japanese individuals have shown that the adiponectin concentration was negatively correlated with body mass index BMI; accordingly, it was lower in obese subjects than in lean subjects [20, 16]. Inoue *et al.* [17] reported that adiponectin and leptin levels tend to be correlated with BMI, TG and HDL in an opposite manner.

Leptin and adiponectin are each known to be involved in the pathogenesis of obesity [21]. In obesity-related conditions such as metabolic syndrome and type 2 diabetes mellitus, leptin levels are higher and adiponectin levels are lower; thus, the LAR could be relatively high [22]. Insulin resistance plays an important role in the pathogenesis of obesity, metabolic syndrome and type 2 diabetes mellitus. Therefore, quantitative measurements of insulin resistance are clinically meaningful and may help researchers to better understand the etiology of these conditions. The most established quantitative

measurements of insulin resistance are the hyperinsulinemic-euglycemic clamp, the minimal model assessment and the homeostatic model assessment (HOMA) methods [23]. Thus we evaluated the correlation of the LAR with measures of insulin resistance to determine calculated value of HOMA-IR using the formula derived from fasting insulin and glucose levels described by Matthews *et al.* [14]. Our results for the LAR in all groups showed a highly significant positive correlation with the HOMA-IR and with BMI. These findings were in agreement with other studies that have shown that the LAR is as strongly associated with the hyperinsulinemic-euglycemic clamp, the gold-standard measure of insulin resistance, as it is with other currently used parameters, such as fasting insulin or the HOMA-IR levels in the Ely and European Group for the Study of Insulin Resistance (EGIR) [24]. Moreover, some studies have reported that the LAR was a more effective indicator of insulin resistance than adiponectin, leptin, or the HOMA-IR in non-diabetic healthy Korean males [25] and type 2 diabetes patients [26,11,13]. The LAR was reported to be a more sensitive and reliable marker of insulin resistance than the HOMA-IR in patients with elevated FPG levels and type 2 diabetes mellitus [12]. Recently, Kotani and Sakane [27] reported that the LAR could serve as a clinically useful marker for detecting metabolic syndrome in the general Japanese population. Our results showed that the LAR had a highly significant positive correlation with glucose, cholesterol, LDL and insulin and a highly significant negative correlation with HDL. These findings were in agreement with those of Yoon *et al.* [28], who reported that the LAR had more predictive power than the HOMA-IR for the lipid components of metabolic syndrome such as TG and HDL cholesterol because the LAR is based on the presence of leptin and adiponectin. Both of these adipokines are closely linked to fat metabolism and indicate an enhancement of the oxidation of fatty acids in peripheral tissues by AMPK [6, 7], resulting in an improvement of insulin resistance and obesity. Therefore, lipid metabolism linked to the LAR could provide a different explanation than insulin resistance for the pathophysiology of metabolic syndrome [28].

ANOVA tests of the LAR showed a highly significant difference among all subgroups, while the HOMA-IR exhibited no significant difference between the obese and non-obese type 2 diabetics. This result may indicate that the LAR was better than the HOMA-IR at discriminating diabetic from non-diabetic females. Interestingly, Oda *et al.* [26] reported that the LAR may be an excellent clinical predictor for insulin resistance in diabetic patients, and they stated that, if diabetic patients are evaluated

for insulin resistance using the HOMA-IR, it is essential that their fasting plasma glucose is greater than 140 mg/dL to avoid erroneous results [29]. Our study demonstrated that the LAR was more closely correlated with insulin resistance than with leptin, adiponectin alone or the HOMA-IR. Indeed, several investigators reported that the HOMA-IR and insulin levels do not correlate significantly, particularly in individuals with impaired glucose tolerance [30] and in elderly patients with poorly controlled type 2 diabetes mellitus [31]. Ono *et al.* [32] reported that the HOMA-IR is a useful index for determining insulin resistance in obese patients with type 2 diabetes mellitus at FPG range of 80-170 mg/dL.

Our results showed that the LAR was associated with the calculated value of insulin resistance, the HOMA-IR. The LAR was more closely correlated with insulin resistance than with leptin, adiponectin alone or the HOMA-IR in all studied groups; therefore, we concluded that the LAR has the potential to become a new laboratory marker for insulin resistance in patients with obesity and Type 2 diabetes mellitus.

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References

- [1] Trayhurn P, Wood IS (2005). Signalling role of adipose tissue: adipokines and inflammation in obesity. *Biochem Soc Trans*; 33:1078–1081.
- [2] Matsuzawa Y, Shimomura I, Kihara S, *et al.* (2003). Importance of adipocytokines in obesity-related diseases. *Horm Res*; 60 Suppl 3:56–9.
- [3] Ryan AS, Berman DM, Nicklas BJ, Sinha M, Gingerich RL, Meneilly GS, *et al.* (2003). Plasma adiponectin and leptin levels, body composition, and glucose utilization in adult women with wide ranges of age and obesity. *Diabetes Care*; 26:2383–8.
- [4] Weyer C, Funahashi T, Tanaka S, Hotta K, Matsuzawa Y, Pratley RE, *et al.* (2001). Hypoadiponectemia in obesity and type 2 diabetes: close association with insulin resistance and hyperinsulinemia. *J Clin Endocrinol Metab*; 86:1930–5.
- [5] Jequier E. (2002). Leptin signaling, adiposity, and energy balance. *Ann N Y Acad Sci*; 967: 379–88.
- [6] Minokoshi Y, Kim YB, Peroni OD, Fryer LGD, Müller C, Carling D. (2002). Leptin stimulates fatty-acid oxidation by activating AMP-activated protein kinase. *Nature*; 415:339–43.
- [7] Yamauchi T, Kamon J, Minokoshi Y, Ito Y, Waki H, Uchida S, *et al.* (2002). Adiponectin stimulates glucose utilization and fatty-acid oxidation by activating AMP-activated protein kinase. *Nat Med*; 8:1288–95.
- [8] Kadowaki T, Yamauchi T. (2005). Adiponectin and Adiponectin Receptors. *Endocr Rev*; 26:439–51.
- [9] Segal KR, Landt M, Klein S. (1996). Relationship between insulin sensitivity and plasma leptin concentration in lean and obese men. *Diabetes*; 45:988–91.
- [10] Yadav A, Jyoti P, Jain SK, Bhattacharjee J. (2011). Correlation of adiponectin and leptin with insulin resistance: a pilot study in healthy north Indian population. *Indian J Clin Biochem*; 26(2):193–6.
- [11] Inoue M, Maehata E, Yano M, Taniyama M, Suzuki S. (2005). Correlation between the adiponectin-leptin ratio and parameters of insulin resistance in patients with type 2 diabetes. *Metabolism*; 54:281–6.
- [12] Inoue M, Yano M, Yamakado M, Maehata E, Suzuki S. (2006). Relationship between the adiponectin-leptin ratio and parameters of insulin resistance in subjects without hyperglycemia. *Metabolism*, 55:1248–54.
- [13] Zaletel J, Barlovic DP, Prezelj J. (2010). Adiponectin-leptin ratio: a useful estimate of insulin resistance in patients with type 2 diabetes. *J Endocrinol Invest*; 33(8):514–8.
- [14] Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Teacher DF, Turner RC, (1985): Homeostasis model assessment: insulin resistance and b cell function from fasting plasma glucose and insulin concentration in man. *Diabetologia*; 28:412–419.
- [15] Matsubara M, Maruoka S & Katayose S. (2002). Inverse relationship between plasma adiponectin and leptin concentrations in

- normal-weight and obese women. *European Journal of Endocrinology* 147:173–180.
- [16] Hotta K, Funahashi T, Arita Y, *et al.* (2000). Plasma concentrations of a novel, adipose-specific protein, adiponectin, in type 2 diabetic patients. *Arterioscler Thromb Vasc Biol*;20:1595–9.
- [17] Soebijanto N, Waspadji S. (2010). Adiponectin levels and its role in insulin resistance among adult women with metabolic syndrome. *Acta Med Indones*; 42(4):187-91.
- [18] Considine RV, Sinha MK, Heiman ML, Kriauciunas A, Stephens TW, NyceMR, *et al.* (1996). Serum immunoreactive-leptin concentration in normal-weight and obese humans. *N Engl J Med*;334:292 - 5.
- [19] Lihn AS, BruunJM, He G, Pedersen SB, Jensen PF, Richelsen B. (2004). Lower expression of adiponectin mRNA in visceral adipose tissue in lean and obese subjects. *Mol Cell Endocrinol*; 219:9–15.
- [20] Arita Y, Kihara S, Ouchi N, *et al.* (1999). Paradoxical decrease of an adipose-specific protein, adiponectin, in obesity. *BiochemBiophys Res Commun*; 257:79–83.
- [21] Oh DK, Ciaraldi T, Henry RR. (2007). Adiponectin in health and disease. *Diabetes ObesMetab*;9:282-9.
- [22] Satoh N, Naruse M, Usui T *et al.*, (2004). Leptin-to-adiponectin ratio as a potential atherogenic index in obese type 2 diabetic patients. *Diabetes Care*; 27:2488–2490.
- [23] Wallace TM and Matthews DR. (2002) .The assessment of insulin resistance in man. *Diabet Med*;19:527-34.
- [24] Finucane FM, Luan J, Wareham NJ, Sharp SJ, O’Rahilly S, Balkau B, Flyvbjerg A, Walker M, Hojlund K, Nolan JJ; European Group for the Study of Insulin Resistance: Relationship between Insulin Sensitivity and Cardiovascular Disease Risk Study Group, Savagem DB. (2009). Correlation of the leptin:adiponectin ratio with measures of insulin resistance in non-diabetic individuals. *Diabetologia*; 52: 2345-9
- [25] Seung-Hyun Ko. (2010). The Adiponectin/Leptin Ratio and Metabolic Syndrome in Healthy Korean Adult Males, *Korean Diabetes J*;34:220-221.
- [26] Oda N, Imamura S, Fujita T, Uchida Y, Inagaki K, Kakizawa H, Hayakawa N, Suzuki A, Takeda J, Horikawa Y, Itoh M. (2008). The ration of leptin to adiponectin can be used as an index of insulin resistance. *Metabolism*; 57:268-73.
- [27] Kotani K and Sakane N (2011). Leptin:Adiponectin Ratio and Metabolic Syndrome in the General Japanese Population *Korean J Lab Med*;31:162-166.
- [28] Yoon J.-H., Park J.K., Sung S.O., Lee K.H., AhnS,G,*et al.*(2011). The ratio of serum leptin to adiponectin provides adjunctive information to the risk of metabolic syndrome beyond the homeostasis model assessment insulin resistance: The Korean Genomic Rural Cohort Study, *Clinica Chimica Acta*; 412: 2199–2205.
- [29] DeFronze RA, Ferrannini E, Simonson DC. (1989). Fasting hyperglycemia in non–insulin-dependent diabetes mellitus contributions of excessive hepatic glucose production and impaired glucose uptake. *Metabolism*;38:387-95.
- [30] Ferrara CM, Goldberg AP. (2001). Limited value of the homeostasis model assessment to predict insulin resistance in older men with impaired glucose tolerance. *Diabetes Care*; 24:245- 9.
- [31] Katuki A, Sumida Y, Urakawa H, Gabazza EC, Murashima S, Morioka K, *et al.* (2002). Neither homeostasis model assessment nor quantitative insulin sensitivity check index can predict insulin resistance in elderly patients with poorly insulin resistance in elderly patients with poorly controlled type 2 diabetes mellitus. *J Clin Endocrinol Metab*;87:5332- 5.
- [32] Ono T, Shiga N, Tanabe Y, Umemura S. (1999). The fasting-plasma glucose range in which insulin resistance measured by homeostasis model assessment correlates with euglycemic clamping. *J Jpn Diabet Soc*;42:1005-11.

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The Effect of Undifferentiated Mesenchymal Bone Marrow Stem Cells on the Healing of Fresh Extraction Bony Sockets

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Abstract: Background: Mesenchymal Bone marrow stem cells (MBM SCs) have been shown to repair bone defects in various animals. Porous scaffolds for bone tissue engineering play an important role in both cell targeting and transplantation. They serve as carriers to transfer cells and bioactive materials to defect sites. The present investigation was undertaken to study the effect of polymer scaffolds seeded with mesenchymal bone marrow stem cells (MBM SCs) on the quantity and quality of bone formation in recently extracted bony socket. **Methods:** The present study was carried on 10 dogs divided according to the follow up period into two groups with 5 dogs in each group. Group (A) was followed for 1.5 months, while group (B) was followed for 3 months. MBM SCs from the femur's cortex were cultured and seeded on polymer scaffolds. After extraction of the lateral incisors, seeded polymer scaffolds were inserted in the left sockets which served as the experimental sites, while unseeded scaffolds were inserted in the right sockets which served as the control sites. At the end of the follow up period, the animals were sacrificed and sections stained for histological evaluation. **Results:** Polymer scaffolds seeded with MBM-SCs resulted in a significantly greater mean bone area percentage and showed more prevalence of mature lamellar newly formed bone than unseeded scaffolds after insertion in fresh extracted bony sockets at all evaluation intervals. **Conclusion:** Bone marrow stem cells provide an effective therapeutic approach for the regeneration of alveolar bone defects.

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Key words: Bone regeneration, stem cells, tissue engineering, alveolar sockets

1. Introduction

Bone maintenance after tooth extraction has a significant impact on the functional and esthetic outcomes of future treatment.^{1,2} The attention of investigators has been directed to new technologies as bone tissue engineering, which has been emerging as a valid approach to the current therapies for bone regeneration.³

The basic concept of utilizing mesenchymal stem cells (MSCs) and autologous bone marrow (BM) aspiration to treat bone defects has several advantages. Osteoblast's differentiation from MSCs is very well described and standardized in many protocols. Mesenchymal bone marrow stem cells (MBM-SCs) can also be isolated by means of minimally invasive procedures from BM, requires only a small amount of tissue from the patient and this approach can restore bone defects without incurring donor site morbidity.^{4,5} Stem cells are highly expandable in culture and have been used in the treatment of various tissues and organs. Their capacity to undergo extensive replication without losing their multi-potential capability makes them an attractive cell source for cell-based therapeutic approaches.⁶

In bone tissue engineering, material scientists attempt to make biocompatible and biodegradable

scaffolds with appropriate porosity, mechanical strength and hydrophobicity comparable to native bone materials.⁷ They also try to provide a framework for three-dimensional organization of the developing tissue. Scaffolds can deliver MSCs into a graft site, facilitate their retention and distribution into the new tissue area matrix and provide space in which vascularization, new tissue formation and remodeling can take place.⁸ Poly(lactide-co-glycolide) (PLGA) polymer scaffolds are suitable for tissue-engineering applications,^{9,10} have been studied for drug delivery and have been approved by the Food and Drug Administration.⁹⁻¹¹ The polyglactin vicryl mesh combines glycolide and lactide at a ratio of 9:1. It is a co-polymer consisting of the rapidly degrading glycolic acid and the slower degrading and more hydrophobic lactic acid and it degrades by non-enzymatic hydrolysis creating by-products eliminated from the body in the form of carbon dioxide and water. The advantages of fiber meshes are a large surface area for cell attachment and a rapid diffusion of nutrients in favor of cell survival and growth.^{12,13}

The aim of the present investigation was to study the effect of polymer scaffolds seeded with MBM SCs on the quantity and quality of bone formation in recently extracted bony sockets.

2. Materials and Methods

I-Study group and design:

The present study is a split mouth experimental study performed on ten 9 months old mongrel dogs, weighing 7-9 kg, in an orally and systemically health condition. The dogs were treated according to the guidelines approved by the Institutional Animal Care and Use Committee of Cairo University and the animal research protocol was approved by the Ethics Committee of the National Research Center, Cairo, Egypt. The ten dogs were divided according to the follow up period into two groups (A) and (B) with five dogs in each group: Group (A) was followed up for 1.5 month, and Group (B) for 3 months. In both groups, the left and right upper lateral second incisors were extracted. Each animal received two scaffolds. The left socket side was chosen to be the experimental site, where a polymer scaffold seeded with MBM-SCs was inserted while the right side served as the positive control site, where an unseeded polymer scaffold was inserted. At the end of the follow up period the animals were sacrificed by IV injection of concentrated sodium thiopental for histological evaluation.

II-Stem Cell Preparation:

a- Bone marrow (BM) Aspiration and MSCs Expansion :¹⁴

Under general anesthesia by IM injection of a compound of ketamine (22 mg/kg b.wt.) and xylazine (0.2 mg/kg b.wt.), a 14-gauge needle was used to penetrate the cortex of the femur of each dog, and about 10 ml of BM was drawn in a syringe containing 1500 U of heparin. BM aspirate was collected into a 50 ml tube, containing 30 ml Dulbecco's Modified Eagle's medium (DMEM, Sigma, Australia) and heparin (100U/mL). The mixture was centrifuged at 400 g without acceleration or brake for 35 min at 20°C on density gradient media (Ficoll-Paque; GE Healthcare, Waukesha, WI) and the top layer of fat containing plasma was discarded. Cells located at the interface between the BM sample and gradient media were collected, washed with Dulbecco's phosphate-buffered saline (DPBS), (Invitrogen, Carlsbad, California, USA) and re-centrifuged at the same speed. After determination of cell viability and the number of viable cells by trypan blue staining, the cells were re-suspended in DMEM, supplemented with 10% fetal bovine serum (FBS), (USDA, Gibco, Grand Island, NY, USA) and antibiotics (penicillin 10 000 U/ml, streptomycin 10 000 ug/ml, amphotericin B 25ug/ml). The nucleated cells were plated in tissue culture flasks at 2.5 X 10⁵/cm² and incubated at 37°C in a humidified atmosphere containing 5% CO₂. On the fourth day of culture, the non-adherent cells were removed along with the change of medium. The culture

medium was changed every 3 days until the outgrown cells reached 90% confluence. On the 18th day, the adherent colonies of cells were trypsinized, counted and sub-cultured at 90% confluence. Cells were passaged to the subculture 2 so that sufficient number of cells was available to continue the experiment described below. Cells were identified as being MSCs by their morphology which was fusiform, their adhesiveness, and their power to differentiate into osteocytes and neurocytes.^{15, 16} Kinetic quantitative determination of alkaline phosphatase was carried out in the medium of differentiated osteocytes using a commercial kit provided by Stanbio laboratory, Boerne, TX, USA. Differentiation into neurocytes was confirmed by detection of nerve growth factor gene expression in cell homogenate.¹⁷

b- Seeding Procedure:¹⁸

Second passage dog MBM SCs were used for the seeding procedures. Prepared polymer scaffolds were sterilized by soaking in 95% ethyl alcohol for 30 minutes. The polymer scaffold used was polyglactin 910 vicryl mesh, which features a weight of 53.6 g/m² and has an average pore size of 500 micrometers (Ethicon Inc, J&J, Sommerville, NJ, USA). Scaffolds were then transferred to 24 well tissue culture plates, one scaffold in each well. All scaffolds were washed with DPBS for 1 hour, and the DPBS was changed every 15 to 20 minutes. All DPBS were aspirated and scaffolds were pre-wetted with 2 ml supplemented culture media.

For the experimental scaffolds, 500 µL of media containing MBM SCs (9.4 x 10⁶ cells/mL) was added to each well, 1 scaffold per well. The following day, the media and unattached cells were aspirated, then 500 µL of fresh culture medium was added to each well and the number of unattached cells was calculated. This procedure was repeated every 2 days until the seventh day. The seeded scaffolds were monitored daily with a phase contrast microscope. On the seventh day, scaffolds were used for the animals after adherence of cells to the mesh scaffold was completed. As for the control scaffold, culture media without BM-MSCs were added to the control scaffolds.

III-Dental surgical procedure:

The surgical procedures were performed under general anesthesia by IM injection with a compound of Ketamine (22 mg/kg b.wt.) and xylazine (0.2 mg/kg b.wt.). The systemic anesthesia was complemented with infiltration anesthesia to ensure local hemostasis. Prophylactic IM antibiotics were administered and 2% chlorohexidine solution was topically applied. After dental extraction scaffolds were inserted, then labial flaps were raised to cover the alveolar sockets and the scaffolds. The flaps were then sutured using 4-0 black silk suture. Postsurgical management included IM

administration of antibiotics, pain killers, a soft diet and a daily application of 2% chlorohexidine solution during the healing period. Observation of the surgical sites with regard to oral health, maintenance of the suture line closure and edema was done every day until suture removal and at least twice weekly thereafter.^{19, 20}

IV. Histological evaluation:

Specimens from both control and experimental sites were taken and fixed in 10% formalin for one week, then decalcified and processed according to a standardized protocol (IHC Research AID laboratory, Cairo, Egypt). Sections were cut (5 μ m thick) and stained with H&E and Masson Trichrome and examined with Olympus CX20 microscope attached to a camera and computer. All the stained sections were analyzed by image analyzer computer system using the Image J software (NIH version v1.45e, USA), capable of performing high speed digital image processing for the purpose of tissue measurements. A millimeter scale was also photographed at the same magnification of the captured photomicrographs (10 x) to allow further conversion of the measurements obtained from the camera in pixels into micrometers. Image J software was calibrated and the image opened on the computer screen for pre-analysis adjustments. For histomorphometric analysis the most representative five fields were captured and the surface area percentage of bone was measured.

Histomorphometric readings were compared in both groups of experimental and control sites and analyzed using SPSS version 18. Data were presented as mean and standard deviation (SD) values. Student t test was carried out to compare between the mean bone area percentage which represents the area of trabecular bone including both mineralized and osteoid tissue expressed as percentage of the total tissue area. P value < 0.05 was considered significant.

3. Results

I-Histological findings:

The structural bony changes were studied in both groups (A) and (B) at experimental and control sites

A-Analysis of sections taken from experimental sites in group (A) i.e. after 1.5 months:

Most cases showed more prevalence of bone than that seen at the same time interval in the control group. This bone ranged from thick interconnected trabeculae to mature lamellar bone. Osteoblastic rimming showed the active engagement in bone formation. Widened osteocytic lacunae were seen as well as irregular marrow spaces. Congested dilated blood vessels and angiogenesis increased markedly reflecting the persistent attempt of the tissues to heal. Mild

inflammatory response was detected in most cases. Finally, signs of remodeling were reflected by the mild osteoclastic activity in the form of few sporadic osteoclasts (Figures 1, 2).

B- Analysis of sections taken from experimental sites in group (B) i.e. after 3 months:

After three months interval there was an increase in the thickness of bone. Larger areas of regular concentric lamellae could be seen. Osteoblastic rimming was still clearly demarcated. Remodelling was still distinguished from the osteoclastic activity. Mild to moderate inflammatory response could be seen. Extravasated blood cells and congested dilated blood vessels were the main vascular hallmarks. Masson Trichrome stain revealed that most of the cases showed calcified bone rather than osteoid tissue (Figures 3, 4).

C- Analysis of sections taken from control sites in group (A):

The main picture was that of compactly packed granulation tissue composed of newly formed collagen fibers, fibroblasts and blood vessels. Unconnected spicules of bone were interspersed within the granulation tissue. Moderate inflammatory response was verified. Blood vessels were dilated. Evidence of bone formation was detected. Areas of woven bone and osteoblastic rimming showed in some cases. Angiogenesis increased markedly reflecting the persistent attempt of the tissues to heal (Figures 5, 6).

D- Analysis of sections taken from control sites in group (B):

The main picture showed increased thickness of woven bone showing and larger regions of lamellar bone organization could be detected. Irregular marrow spaces were seen with osteoblastic rimming and wide osteocytic lacunae were seen. Extensive fibrous and mesenchymal activity were also demonstrated (Figures 7, 8).

Statistical Comparison between experimental and control sites in the same group revealed the following:

In Group (A) after 1.5 months, the mean area percentage of the newly formed bone areas was 52.346 % in the experimental sites, while it was 22.908% in the control sites. There was a very significant increase in the mean area percentage of the newly formed bone in the experimental sites when compared with the control sites. ($p=0.0028$) (Table1).

In Group (B) after 3 months, the mean area percentage of the newly formed bone was 61.768 % and 44.244% in the experimental and control sites respectively. There was a significant increase in the mean area percentage of the newly formed bone in

the experimental sites when compared with the control sites ($p=0.0144$), (Table 1).

Statistical Comparison between experimental sites in group (a) & (b) and control sites in group (a) & (b) revealed the following:

There was no significant difference in the mean area percentage of newly formed bone

between group (A) experimental sites at 1.5 months and group (B) experimental sites at 3 months, ($p=0.194$), while there was a significant increase in the mean area percentage of newly formed bone at group (B) control sites at 3 months when compared to group (A) control sites at 1.5 months ($p=0.038$), (Table 2).

Table 1: Comparison of the histometrical mean value of bone area percentage between group (A) experimental sites and control sites (at 1.5 month) and between group (B) experimental sites and control sites (at 3 months).

	Time	Group	N	Mean	±S.D.	P
Group A	1.5month	Experimental	5	52.35	17.65	0.003*
		Control	5	22.91	19.19	
Group B	3 Months	Experimental	5	61.77	11.09	0.014 *
		Control	5	44.24	11.73	

*Significant at $P < 0.05$

Table 2: Comparison of the histometrical mean value of bone area percentage between group (A) experimental sites and group (B) experimental sites and between group (A) control sites and group (B) control sites

Group		N	Mean	±S.D.	P
Group A:	Experimental	5	52.35	17.65	0.194
Group B:	Experimental	5	61.77	11.09	
Group A:	Control	5	22.91	19.19	0.038*
Group B :	Control	5	44.24	11.73	

*Significant $P < 0.05$

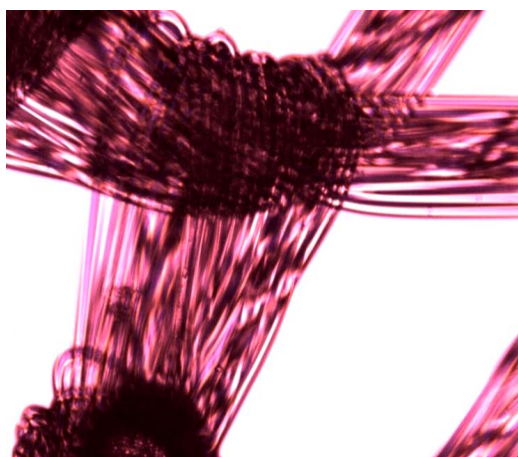


Figure 1. Polyglactin vicryl mesh in culture medium without MBM SCs under a phase contrast microscope

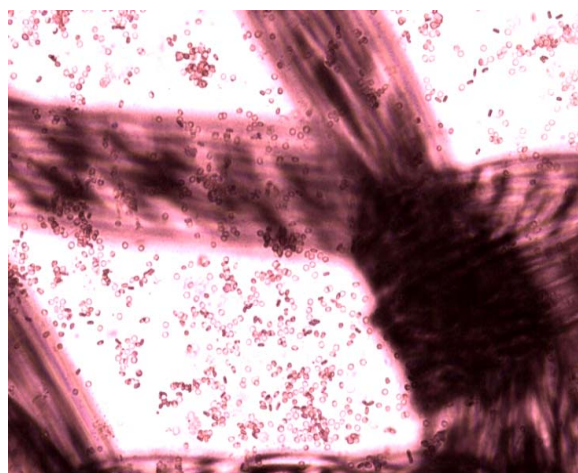


Figure 2. Polyglactin mesh seeding in culture medium containing MBM SCs for 2 days under a phase contrast microscope.

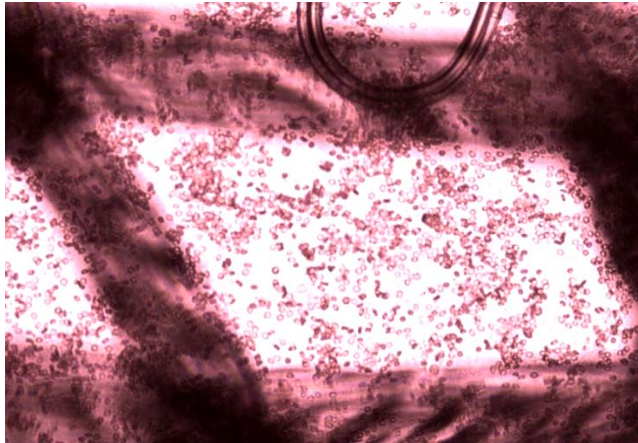


Figure 3. Polyglactin mesh after seeding in culture containing MBM SCs for 7 days under a phase contrast microscope

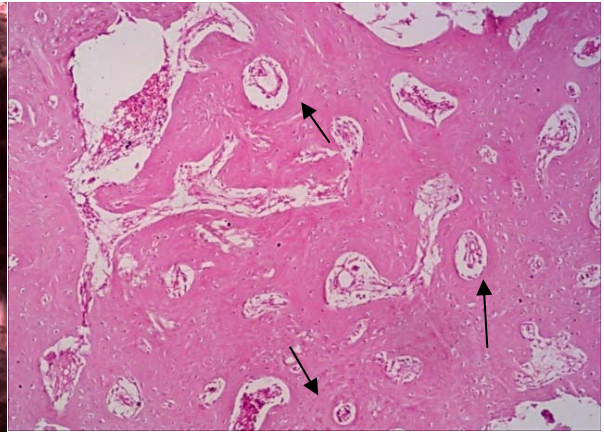


Figure 6. A photomicrograph of group (B) experimental specimen, showing arrangement of lamellae in concentric manner around bone marrow cavities (arrows) H&EX100

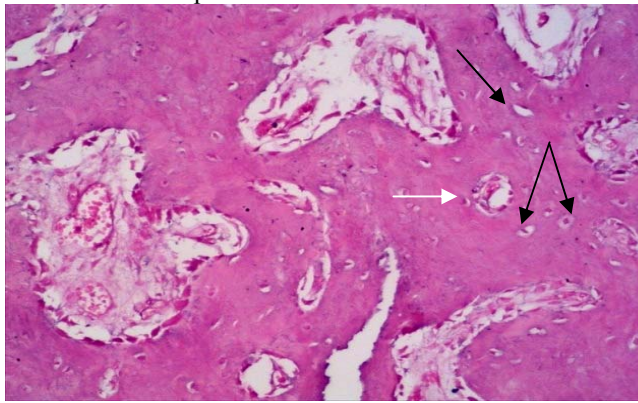


Figure 4. A photomicrograph of group (A) experimental specimen showing osteoblastic rimming of marrow cavities, congested blood vessels, wide osteocytic lacunae (black arrows) and lamellar organization of osteocytes (white arrow). H&EX200

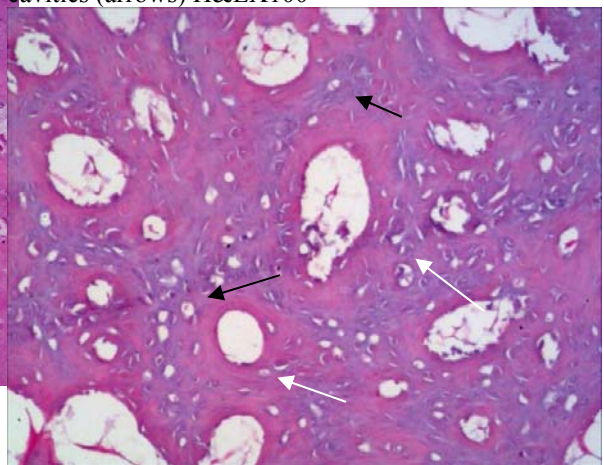


Figure 7. A photomicrograph of group (B) experimental specimen showing mature lamellar bone (RED) (white arrows) surrounding marrow cavities and less organized woven bone (BLUE) (black arrows). Masson Trichrome X 200.

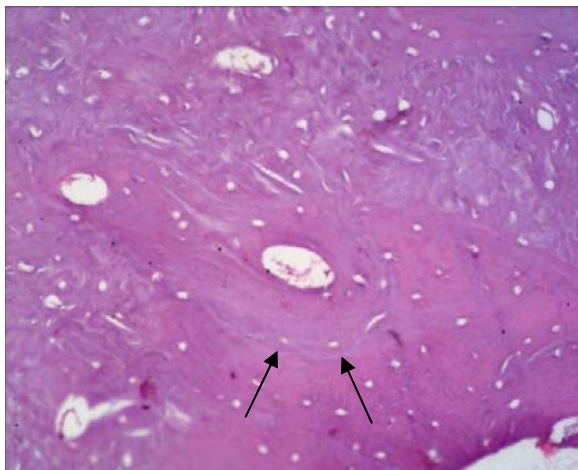


Figure 5. A photomicrograph of group (A) experimental specimen showing a mixture of woven bone and the more regular concentric lamellar bone (arrows) (Masson trichrome x200)

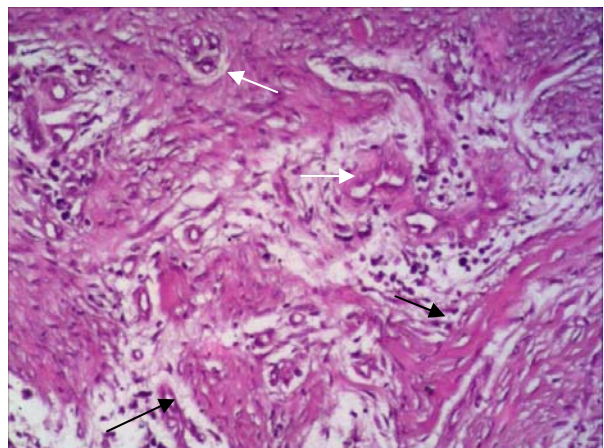


Figure 8. A photomicrograph of group A control specimen showing unconnected spicules of woven bone (black arrows) interspersed within the granulation tissue. Note the angiogenic activity (white arrows) and moderate inflammatory response.(H&E X200)

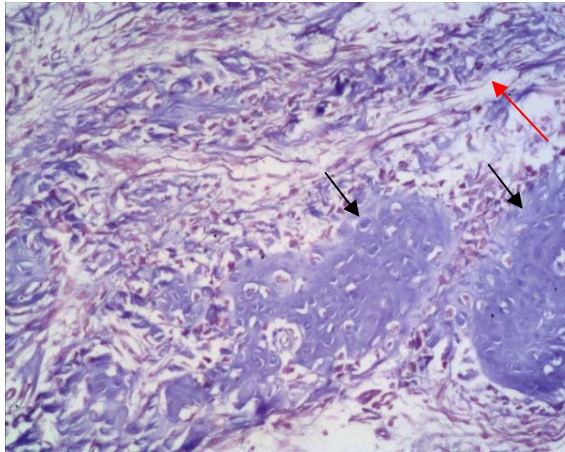


Figure 9. A photomicrograph showing irregular woven bone spicules rimmed by osteoblasts (black arrows), as well as densely packed collagen fibers (red arrows), (Masson Trichrome x200)

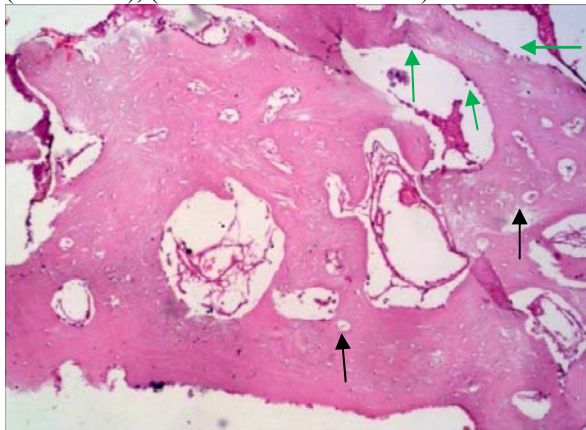


Figure 10. A photomicrograph of a specimen of group (B) control specimen showing woven bone with wide osteocytes (black arrows) and irregular marrow spaces. Note the osteoblastic rimming (green arrows) and sporadic lamellar organization (red arrows). (H&EX100)

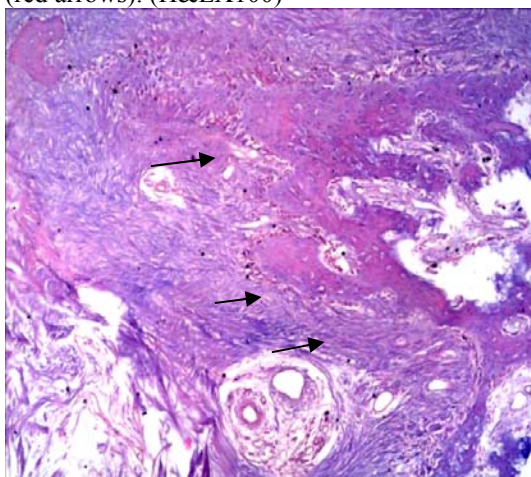


Figure 11. A photomicrograph of group (B) control specimen showing woven bone with wide osteocytes forming thickened irregular trabeculae. Note the widespread osteoblastic rimming (black arrows) and the dense fibrous background. (Masson Trichrome x100)

4. Discussion

Tissue engineering has been emerging as a valid approach to the current therapies for bone regeneration. Its approaches have recently proven to be very effective in bone regeneration and the successful repair of bone defects has been demonstrated in large animals like canines, goats and sheep. In particular stem cell-based therapies have shown great promise in regenerative medicine and continue to generate wide interest in future clinical applications.^{21, 22, 3}

In the current study, MBM SCs seeded on polymer scaffolds were inserted in fresh extracted bony sockets of upper lateral incisors in the experimental sites in mongrel dogs to demonstrate the ability of these cells to enhance bone healing and increase the amount of formed bone. The results were compared with unseeded polymer scaffolds inserted in fresh extracted bony sockets of upper lateral incisors in the positive control sites. Several studies have highlighted the potential for choosing alveolar socket defect models when histologically evaluating bone tissue-engineered constructs. The surgical procedure is simple, with limited risk of infection, and a similar intervention by grafting is advocated clinically.²³ De Kok *et al.*¹⁹ stated that an alveolar socket model may be an appropriate model for initial clinical investigation of MSCs-mediated bone repair.

In the present research a polyglactin vicryl mesh was used as a polymer scaffold on which MBM-MSCs were seeded. This type of scaffold has been used for many years as substitute for natural tissue, as it is absorbable over 45 -60 days and highly biocompatible.^{24, 25}

The histological results showed more prevalence of mature lamellar newly formed bone in the experimental sites than in the control sites in both groups. This denotes that the addition of MSCs to the PLGA scaffold resulted in more formation of better bone quality when placed in fresh extracted alveolar bony sockets than using the scaffold alone, which demonstrates the success of these cells in regenerating the bone defect. These findings are in line with Yang *et al.*²⁶ who investigated the effect of MBM SCs in enhancing bone regeneration in critical-sized rat calvarial defects and showed that stem cells' group produced more and higher quality mature lamellar bone compared to the control group.

One of the most important capabilities of MSCs is their migration capacity in response to signals produced by an injured bone.²⁷ In 2009, Granero-Molto *et al.*²⁸ stated that at the injury site, MSCs could help in repair in two ways; first by differentiating into tissue cells in order to restore lost morphology and function and second by secreting a wide spectrum of bioactive factors that help creating a repair environment owing to their anti-apoptotic and immune-regulatory properties by stimulating the proliferation of endothelial

progenitor cells. Hence, we can deduce that the local microenvironment and surrounding tissues may have provided the nutrients, growth factors and extracellular matrices necessary to support differentiation of the transplanted MSCs. This was also concluded by Krause *et al.*²⁹

On the other hand one can attribute the improved results observed in the experimental sites of both groups in the present study solely to the bone forming capacity of MSCs, a conclusion that was also drawn by Pieri *et al.*³⁰ who showed that MSCs in combination with platelet-rich plasma-fluorohydroxyapatite (PRP-FHA) enhanced the amount of newly formed bone in the minipig mandible compared with PRP-FHA alone, with a similar effect to autogenous bone graft.

From the obtained results, it could also be assumed that polyglactin scaffolds may have provided an optimal support for MSCs in cell-guided regeneration. This was also suggested by other investigators who used polyglactin mesh for cell transplantation therapy and engineering of various tissues.³¹⁻³³ According to other studies, the surface of the polymer scaffold may also serve as a site on which various bioactive molecules from the wound site become concentrated, including growth factors and adhesion molecules matrix.^{34,35} The complete closure of all alveolar bone sockets filled with unseeded polyglactin vicryl mesh in control sites in group (B) indicated that it did not hamper the physiologic bone healing response. The histological findings of our study suggest the complete resorption of the polymer scaffolds as there were no residuals evident in the histological sections.

Our results are also supported by Holy *et al.*³⁶ who showed that it is possible to induce bone regeneration, by combining cells isolated from the bone marrow with PLGA biodegradable scaffolds. Their results have shown significant bone regeneration in MSC-based PLGA scaffolds compared with PLGA alone in 1.2 cm bone defects in a rabbit femur. Moreover reported enhanced bone formation was reported in MSCs-containing transplants as early as 6 weeks after implantation in a mouse mandible compared with MSCs-free transplants.³⁶

While some authors stated that engineered bone tissue can be used to repair clinical alveolar cleft bone defects,³⁸ others suggested that tissue-engineered bone may be sufficient for predictable enhancement of bone regeneration around dental implants when used simultaneously with implant placement.³⁹ The higher percentage of new bone obtained in the MSCs treated sites in the present study is consistent with previous studies, who used MSCs in enhancing bone regeneration in various animal models.^{21,40,41} The findings of the current study also confirm previous reports in which the use of a cell transplantation approach combining

different types of scaffolds with osteogenic cells could repair surgically created defects with comparable effect to autologous bone graft.^{42,43}

On the contrary, the results of the present study do not agree with Henkel *et al.*⁴⁴ who grafted minipig mandibular defects with a bioactive matrix (60% hydroxyapatite and 40% β -tricalcium phosphate) alone or mixed with MSCs and found that the addition of MSCs did not enhance new bone formation after an implantation period of 5 weeks. The authors observed that the nutrition of the cultured osteoblasts seeded in the carrier material was insufficient for complete ossification to occur. Also in contrast to our study, Simsek *et al.*⁴⁵ found no significant difference in the amount of alveolar bone formation in class II furcation defects in dogs in the three groups involved in their study, where one group was treated with both MSCs and platelet rich plasma (PRP), another group treated with PRP alone and a third group treated with autogenous bone transplantation.

On the other hand Nasiff *et al.*⁴⁶ stated that MBM SCs possess osteogenic features *in vitro* and *in vivo* in conjunction with polymer scaffolds which can have diverse clinical application in maxillofacial bone regeneration. In addition, it was found that using nano-fibered scaffold puramatrix seeded with MBM SC in dogs' mandible can give higher bone implant contact around dental implants than using the puramatrix scaffold alone.⁴⁷ MSC transplantation was also shown to promote peri-implant bone regeneration and it was suggested to use this approach in clinical settings to enhance bone regeneration and healing in patients with poor bone quality.

Since our histological findings showed that there was no significant difference in the mean area percentage of bone between experimental sites after 1.5 months interval and those after 3 months, we may postulate that the application of MBM SCs to enhance bone regeneration could allow the insertion of dental implants as soon as 1.5 month postoperatively and thereby improving the psychological state of the patients as well as enhancing dental implant treatment outcomes in terms of bone quality and quantity.

Conclusion

Our histological findings show that implantation of PLG scaffolds seeded with MBM SCs immediately after extraction resulted in increase in the amount of the newly formed bone in fresh extraction alveolar bone sockets. MSC may therefore provide an effective therapeutic approach for the regeneration of alveolar bone defects. The procedure is efficient, exhibits low morbidity of the collection site, and is free from diseases incurred by transmission of pathogens. The conduction of further clinical trials on a larger scale with the

application of additional diagnostic tools are recommended.

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References

- Nemcovsky CE, Serfaty V. Alveolar ridge preservation following extraction of maxillary anterior teeth: Report on 23 conservative cases. *J Periodontol.* 1996; 67: 390-395.
- Wiesen M, Kitzis R. Preservation of the alveolar ridge at implant sites. *Periodontol Clin Invest.*, 1998; 20:17-20.
- Honsaweka S, Parkpianb V. Tissue engineering for bone regeneration: stem cells and growth factors in biomaterial scaffolds. *Asian Biomed.*2007;1:229-238
- Pittenger MF, Mosca JD, Mcintosh KR. Human mesenchymal stem cells for cartilage, bone, fat and stroma. *Curr Top Microbiol Immunol.*, 2000; 251: 3–11.
- Jäger M, Jelinek E, Wess K, *et al.* Bone marrow concentrate: a novel strategy for bone defect treatment. *Curr Stem Cell Res Ther.*, 2009; 4:34-43.
- Pittenger MF, Mackay AM, Beck SC, Jaiswal RK, Douglas R, Mosca JD, Moorman MA, Simoneti DW, Craig S, Marshak DR. Multilineage potential of adult human mesenchymal stem cells. *Science*, 1999; 284: 143-147.
- Lee SH, Shin H. Matrices and scaffolds for delivery of bioactive molecules in bone and cartilage tissue engineering. *Adv Drug Deliv Rev.*, 2007; 59:339–359
- Muschler GF, Nakamoto C, Griffith LG. Engineering principles of clinical cell-based tissue engineering. *J Bone Joint Surg Am.*, 2004; 86A:1541-1558.
- Honda M, Yada T, Ueda M, Kimata K. Cartilage formation by cultured chondrocytes in a new scaffold made of poly(L-lactide-epsilon-caprolactone) sponge. *J Oral Maxillofac Surg.*, 2000; 58:767-775.
- Sarazin P, Roy X, Favis BD. Controlled preparation and properties of porous poly(L-lactide) obtained from a co-continuous blend of two biodegradable polymers. *Biomaterials*, 2004;25: 5965-5978.
- Jang JH, Shea LD. Controllable delivery of non-viral DNA from porous scaffolds. *J Control. Release*, 2003; 86:157-168.
- Lyn Jansen P, Klingeb U, Anurovd M, Titkovad S, Mertensc PR, Jansenb M. Surgical mesh as a scaffold for tissue regeneration in the esophagus. *Eur Surg Res* 2004;36:104–111.
- Liu X, Ma PX. Polymeric scaffolds for bone tissue engineering. *Ann Biomed Eng.*, 2004; 32:477-486.
- Abdel Aziz MT, Atta HM, Mahfouz S, Fouad HH, Roshdy NK, Ahmed HH, Rashed LA, Sabry D, Hassouna AA, Hasan NM. Therapeutic potential of bone marrow-derived mesenchymal stem cells on experimental liver fibrosis. *Clin.Biochem.*, 2007; 40: 893-899.
- Jaiswal N, Haynesworth S, Caplan A, Bruder S. Osteogenic differentiation of purified, culture-expanded human mesenchymal stem cells in vitro. *J Cell Biochem.*, 1997; 64:295–312.
- Hou L, Cao H, Wang D, Wei G, Bai C, Zhang Y, Pei X. Induction of umbilical cord blood mesenchymal stem cells into neuron-like cells in vitro. *Int J Hematol.*, 2003; 78: 256–261.
- Yamazoe K, Mishima H, Torigoe K, Iijima H, Watanabe K, Sakai H, Kudo T. Effects of atelocollagen gel containing bone marrow-derived stromal cells on repair of osteochondral defect in a dog. *J Vet Med Sci.*, 2007; 69:835–839.
- Guangpeng Liu, Li Zhao Wenjie Zhang Lei Cui Wei Liu Yilin Cao. Repair of goat tibial defects with bone marrow stromal cells and beta-tricalcium phosphate. *J Mater Sci: Mater Med.*, 2008; 19:2367–2376.
- Dai KR, Xu XL, Tang TT, Zhu ZA, Yu CF, Lou JR Zhang X. Repairing of goat tibial bone defects with BMP-2 gene-modified tissue-engineered bone. *Calcif Tissue Int.*, 2005; 77:55-61.
- Kim CS, Choi SH, Chai JK, Cho KS, Moon IS, Wikesjö UM, Kim CK. Periodontal repair in surgically created intrabony defects in dogs: influence of the number of bone walls on healing response. *J Periodontol.* 2004 Feb;75:229-35
- Schliephake H, Knebel JW, Aufderheide M, Tauscher M. Use of cultivated osteoprogenitor cells to increase bone formation in segmental mandibular defects: An experimental pilot study in sheep. *Int J Oral Maxillofac Surg.*, 2001; 30:531-537.
- Carmagnola D, Berglundh T, Lindhe J. The effect of a fibrin glue on the integration of Bio-Oss with bone tissue. An experimental study in labrador dogs. *J Clin Periodontol.*, 2002;29: 377-383.

23. De Kok IJ, Drapeau SJ, Young R, Cooper LF. Evaluation of mesenchymal stem cells following implantation in alveolar sockets: a canine safety study. *Int J Oral Maxillofac Implants*, 2005; 20: 511-518.
24. Lloyd SL, Cross W. The current use of biomaterials in urology. *European Urology Supplements* 1 (2002) 2-6 (Ethicon Inc a Johnson and Johnson company Somerville, NJ 08860-0151).
25. Balashi TJ, Hernandez RE, Cutler RH, Hertzog CF. Treatment of osseous defects using Vicryl mesh (polyglactin 910) and the Bränemark implant: a case report. *J Oral Maxillofac Implant*, 1991; 6 :87-91.
26. Yang S, Leong KF, Du Z, Chua CK. The design of scaffolds for use in tissue engineering. Part I. Traditional factors. *Tissue*, 2001;7(6):679-689.
27. Fox JM, Chamberlain G, Ashton BA, Middleton J. Recent advances into the understanding of mesenchymal stem cell trafficking. *Br J Haematol.*, 2007; 137(6): 491-502.
28. Granero-Molto F, Weis JA, Miga MI, Landis B, Myers TJ, O' Rear L, Longobardi L, Jansen ED, Mortlock DP, Spagnoli A. Regenerative effects of transplanted mesenchymal stem cells in fracture healing. *Stem Cells*, 2009;27:1887-1898.
29. Krause DS, Theise ND, Collector MI, Henegariu O, Hwang S, Gardner R, Neutzel S, Sharkis SJ. Multi-organ, multi-lineage engraftment by a single bone marrow-derived stem cell. *Cell*, 2001; 105:369-377.
30. Pieri F, Lucarelli E, Corinaldesi G, Fini M, Aldini NN, Giardino R, Donati D, Marchetti C. Effect of mesenchymal stem cells and platelet-rich plasma on the healing of standardized bone defects in the alveolar ridge: a comparative histomorphometric study in minipigs. *J Oral Maxillofac Surg.*, 2009; 67:265-272.
31. Sittinger M, Reitzel D, Dauner M, Hierlemann H, Hammer C, Kastenbauer E, Planck H, Burmester GR, Bujia J. Resorbable polyesters in cartilage engineering: affinity and biocompatibility of polymer fiber structures to chondrocytes. *J Biomed Mater Res.*, 1996; 33:57-63.
32. Cao Y, Rodriguez A, Vacanti M, Ibarra C, Arevalo C, Vacanti CA. Comparative study of the use of polyglycolic acid, calcium alginate and pluronics in the engineering of autologous porcine cartilage. *J Biomater Sci., Polym Ed.* 1998; 9:475487.
33. Brown AN, Kim BS, Alsberg E, Mooney DJ. Combining chondrocytes and smooth muscle cells to engineer hybrid soft tissue constructs. *Tissue Eng.* 2000 Aug; 6: 297-305.
34. Goldberg VM, Stevenson S, Shaffer JW. Biology of autografts and allografts. In: Friedlander GE, Goldberg VM, editors. *Bone and cartilage allografts: biology and clinical applications*. Park Ridge, IL: American Academy of Orthopaedic Surgeons; 1991.p. 3-13.
35. Lane JM, Cornell CN, Werntz JR, Sandhu HS. Clinical application of biosynthetics. In: Friedlaender GE, Goldberg VM, editors. *Bone and cartilage allografts: biology and clinical applications*. Park Ridge, IL: American Academy of Orthopaedic Surgeons, Park Ridge, 1991.p. 279-94.
36. Holy CE, Fialkov JA, Davies JE, Shoichet MS. Use of a biometric strategy to engineer bone. *J Biomed Mater Res A* 2003; 65: 447-453.
37. Mankani MH, Kuznetsov SA, Wolfe RM, Marshall GW, Robey PG. *In vivo* bone formation by human bone marrow stromal cells: Reconstruction of the mouse calvarium and mandible. *Stem Cells* 2006; 24:2140-2149.
38. Chai G, Zhang Y, Hu XJ, Wang M, Liu W, Cui L, Cao YL. [Repair alveolar cleft bone defects with bone marrow stromal cells]. *Zhonghua Zheng Xing Wai Ke Za Zhi* 2006 ; 22:409-411.
39. Ito K, Naiki T, Ueda M. Simultaneous implant placement and bone regeneration around dental implants using tissue-engineered bone with fibrin glue, mesenchymal stem cells and platelet-rich plasma. *Clin. Oral Implants Res.*, 2006; 17: 579-586.
40. Abukawa H, Shin M, Williams WB, Vacanti JP, Troulis MJ. Reconstruction of mandibular defects with autologous tissue engineered bone. *J Oral Maxillofac Surg.*, 2004; 62:601-606.
41. Yuan J, Cui L, Zhang WJ, Liu W, Cao Y. Repair of canine mandibular bone defects with bone marrow stromal cells and porous beta-tricalcium phosphate. *Biomaterials* 2007; 28 :1005-1013.
42. Yamada Y, Nagasaka T, Baba S.: Osteogenic potential of injectable tissue-engineered bone: A comparison among autogenous bone, bone substitute (Bio-oss), platelet-rich plasma, and tissue-engineered bone with respect to their mechanical properties and histological findings. *J Biomed Mater Res A* 2005; 73:63-72.
43. Hour R, Chen F, Yang Y, Cheng X, Gao Z, Yang HO, Wu W, Mao T. Comparative study between coral-mesenchymal stem cells-rhBMB-2 composite and autobone-graft in rabbit critical-sized cranial defect model. *J Biomed Mater Res A* 2007; 80:85-93.

44. Henkel KO, Gerber T, Dörfling P, Gundlach KK, Bienengraber V. Repair of bone defects by applying biomatrices with and without autologous osteoblasts. *J Craniomaxillofac Surg.*, 2005 ; 33:45-49.
45. Simsek SB, Keles GC, Baris S, Cetinkaya BO. Comparison of mesenchymal stem cells and autogenous cortical bone graft in the treatment of class II furcation defects in dogs. *Clin Oral Investig.*, 2012 Feb;16:251-8.
46. Nassif L, Jurjus A, Nassar J, Ghafari J, Sabban Mel Enhanced *in-vivo* Bone Formation by Bone Marrow Differentiated Mesenchymal Stem Cells Grown in Chitosan Scaffold. *J Bioengineer & Biomedical Sci.*, 2011, 1:1-6
47. Kohgo T, Yamada Y, Ito K, Yajima A, Yoshimi R, Okabe K, Baba S, Ueda M. Bone regeneration with self-assembling peptide nanofiber scaffolds in tissue engineering for osseointegration of dental implants. *Int J Periodontics Restorative Dent.* 2011; 31:e9-16
48. Gao C, Seuntjens J, Kaufman GN, Tran-Khanh N, Butler A, Li A, Wang H, Buschmann MD, Harvey EJ, Henderson JE. Mesenchymal stem cell transplantation to promote bone healing. *J Orthop Res.*, 2012; 30:1183-9

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Effect of catch areas on chemical composition and heavy metals concentration of chub mackerel (*Scomber japonicus*)

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Abstract: The chemical composition and heavy metals content of chub mackerel caught at two different areas were investigated. Jeju mackerel (J-mackerel) showed a higher percentage of crude fat and lower moisture, crude protein, and ash compared to Pusan mackerel (P-mackerel) ($p < 0.05$). The fatty acid composition of J-mackerel showed higher levels of 14:0, 18:1n-7, 20:1n-9, 18:3n-3, and 20:5n-3 compared to P-mackerel ($p < 0.05$). Total amount of amino acid in J-mackerel was 177.35 ± 3.63 mg/g and that in P-mackerel was 213.05 ± 9.06 mg/g. There were significant differences in aspartic acid, glutamic acid, alanine, and leucine ($p < 0.01$). P-mackerel had significantly higher contents of Cd, Cr, Cu, Hg, and Zn compared to J-mackerel ($p < 0.05$). The heavy metals contents of both P- and J-mackerel were less than maximum levels in the Korea Food Code.

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Keywords: Chub mackerel; proximate composition; fatty acid; amino acid; metal content

1. Introduction

Fish is a globally important food resource and especially oily fish is rich in very long-chain n-3 polyunsaturated fatty acids such as eicosapentaenoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA). Chub mackerel (*Scomber japonicus*) is considered traditionally to be “blue” oily fish and is essentially a near coastal species, with a vertical distribution ranging at depths between 0 and 300 m. Adults carry out reproductive migrations from deeper shelf-break waters to shallow coastal areas [1]. World captures of chub mackerel reached 3.4 million ton in 1978; since then, they have been decreasing to a minimum of 1.2 million ton in 1991 but, in recent years, have slightly recovered up to 1.9 million ton in 2008 [2]. The production of chub mackerel reached 0.18 million ton, making up 14.3% of the coastal and offshore capture. The highest production area of chub mackerel in Korea is Pusan with about 0.16 million ton in 2009, followed by Jeju Island [3]. It is recommended that the consumption of 2 servings per week of fish high in EPA and DHA is associated with a reduced risk of both sudden death and death from coronary artery disease in adults [4].

Heavy metals have been recognized as the most important pollutants in the coastal sea. The major sources of pollution include effluent discharges by industries, atmospheric depositions of pollutants, and occasional accidental spills of toxic chemicals. It has been known that a diet high in fish was linked to beneficial outcomes for an increasing number of diseases and medical conditions [5]. However, fish also contains heavy metals such as Hg, Pb and Cd and especially Hg is a well-known and widespread

environmental neurotoxicant [6]. Fish like chub mackerel being a favorite food of people in Korea, the high consumption of it could lead to chronic disorders if this fish would contain high concentrations of these heavy metals. Therefore, it is important to determine heavy metal concentrations in fish muscle. For this reason, the aim of this study was to determine total concentrations of As, Cd, Cr, Cu, Hg, Ni, Pb and Zn, and chemical composition as well in muscle of chub mackerel caught at two different regions because chub mackerel from Pusan and Jeju are commonly caught and consumed in Korea.

2. Material and Methods

2.1. Samples

Fresh chub mackerel were purchased in the Jagalchi fish market of Korea. Catch information was confirmed by the Suhyup which is a fish vendor. Chub mackerels were caught at offshore from Jeju (126°0'–126°5'E, 33°0'–33°5'N, J-mackerel) and Pusan (130°0'–130°5'E, 34°5'–35°0'N, P-mackerel) of Korea. J- and P-mackerel were sampled from February 2011. The sizes in the experiments were as follows: total length 34.3 ± 0.4 cm and total weight 375.0 ± 17.2 g for J-mackerel; total length 33.0 ± 0.7 cm and total weight 332.5 ± 24.7 g for P-mackerel. Mackerel were gutted, eviscerated, and filleted on two sides. Mackerel fillets were cut into small pieces, homogenized in a homogenizer (HMF-985, Hanil, Korea), packed separately in polyethylene packs and stored at -20°C until used analyses of chemical compositions and metals content.

2.2. Analysis of proximate composition

Moisture content was determined by drying sample in an oven at 105°C until constant weight was obtained. Crude fat was determined using the Soxhlet extraction method. Crude protein content was determined by the Kjeldahl nitrogen using a 6.25 conversion factor. Ash content was determined by incineration in a muffle furnace at 550°C for 24 h [7].

2.3. Measurement of fatty acid composition

Sample lipids were extracted with chloroform-methanol (2:1 v/v) according to the method of Bligh and Dyer [8]. Fatty acid methyl esters were prepared with 14% BF₃/methanol and analyzed with a gas chromatograph (CP-3380, Varian, USA) using a flame-ionization detector, as described previously [9].

2.4. Analysis of amino acid

The sample was hydrolysed with 6 N HCl at 110°C for 24 h. The hydrolysed sample was dried in a rotary vacuum evaporator. The residue was then dissolved in distilled water and filtered through a 0.2 µm glass filter. The amino acid profiles of an aliquot were determined using an amino acid analyzer (L-8800, Hitachi, Japan).

2.5. Measurement of metals content

Mercury content was measured using a direct mercury analyzer (Milestone Sorisole, Bergamo and Italy) without chemical pre-treatment. The other metals (As, Cd, Cr, Cu, Ni, Pb, and Zn) were ashed in a muffle furnace at 500°C for 24 h. Ashes were dissolved with the smallest amount of nitric acid and the resulting solution brought up to 50 mL with twice distilled water. The other metals were determined using inductively coupled plasma (Optima 3000DV, Perkin-Elmer, USA).

2.6. Statistical analysis

Data were presented as mean ± standard deviation (SD). Significant differences between J- and P-mackerel were tested using the independent samples *t*-test (SPSS Inc., Chicago, IL, USA) and *p* < 0.05 was considered significant.

3. Results and Discussion

3.1. Proximate composition

The average contents of moisture, crude fat, crude protein, and ash in J-mackerel were 61.06 ± 3.53, 19.58 ± 3.19, 18.83 ± 0.39, and 1.31 ± 0.14%, respectively; those in P-mackerel were 67.71 ± 0.82, 9.04 ± 1.66, 21.90 ± 0.58, and 1.77 ± 0.12%, respectively. There were significant differences in crude fat and ash between J- and P-mackerel (*p* < 0.05). J-mackerel showed a higher percentage of crude fat and lower moisture, crude protein, and ash

compared to P-mackerel. The results obtained confirmed a reverse correlation between moisture and crude fat percentages. In generally, fish shows a negative correlation between muscle lipid content and muscle texture [10, 11]. Chub mackerel from the Bungo Channel of Japan had tougher muscle than that from the Kumanonada Sea, and the difference in muscle texture was speculated to be due to the difference in exercise intensity between these two sea areas [12]. Osako et al. [13] found that the crude lipid content of horse mackerel caught offshore from Tsushima of Japan was higher than that of Nagasaki. The reason for this could be that there are many eddies and upwelling streams offshore from Tsushima that create ocean currents.

Table 1. Comparison of fatty acid composition (area%) of J-mackerel and P-mackerel.

Composition ¹	J-Mackerel	P-Mackerel
14:0	3.97 ± 0.51 ²	2.79 ± 0.14*
16:0	21.74 ± 0.61	20.87 ± 1.14
18:0	6.45 ± 0.34	7.48 ± 0.29*
20:0	0.16 ± 0.16	0.83 ± 0.38
22:0	2.27 ± 0.53	1.51 ± 0.72
Total SFA	34.59 ± 0.41	33.47 ± 0.18*
16:1n-7	4.41 ± 0.67	3.64 ± 0.03
18:1n-9	14.54 ± 2.00	17.70 ± 0.66
18:1n-7	3.68 ± 0.29	3.00 ± 0.15*
20:1n-9	2.27 ± 0.16	1.92 ± 0.07*
22:1n-9	0.15 ± 0.15	0.33 ± 0.01
Total MUFA	25.04 ± 2.95	26.59 ± 0.68
18:2n-6	2.22 ± 0.02	ND
18:3n-3	1.82 ± 0.12	0.75 ± 0.06**
20:4n-6	1.80 ± 0.00	1.58 ± 1.23
20:5n-3	9.54 ± 0.28	7.71 ± 0.36**
22:4n-6	ND	0.35 ± 0.01
22:5n-3	1.58 ± 0.03	1.97 ± 0.05**
22:6n-3	23.41 ± 3.16	27.58 ± 0.01
Total PUFA	40.37 ± 3.36	39.94 ± 0.86
Total n-3 PUFA	36.35 ± 3.34	38.01 ± 0.36
Total n-6 PUFA	4.02 ± 0.02	1.93 ± 1.22
Total lipid (g/100g)	11.85 ± 3.23	5.33 ± 1.18*

¹SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; ND, not detected.

²Data were presented as mean ± SD (N = 3); **p* < 0.05, ***p* < 0.01 significantly different as compared to J-mackerel

3.2. Fatty acid composition

Fatty acid composition of J- and P-mackerel is shown in Table 1. There were considerable differences in the fatty acid composition between J- and P-mackerel. The difference for the percentages of total saturated fatty acids (SFA) was significant (*p* < 0.05), but there were no significant differences in the percentages of total monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA). J-mackerel

showed higher percentages of 14:0, 18:1n-7, 20:1n-9, 18:3n-3, and 20:5n-3 compared to P-mackerel ($p < 0.05$). The most commonly occurring PUFA were EPA and DHA and the differences for 18:3n-3, 20:5n-3, and 22:5n-3 between J- and P-mackerel were significant ($p < 0.01$). The fatty acid composition of seafood and marine food ingredients is generally characterized by a relatively low content of saturated fatty acids. A relationship between high intake of SFAs and development of cardiovascular disease is generally accepted, and it is recommended to have a low intake of SFA [4]. The present study indicated that J-mackerel had a significantly higher percentage of SFA than P-mackerel. However, the beneficial effects of fish have traditionally been ascribed to the n-3 PUFA, particularly EPA and DHA. Both epidemiological and interventional studies have demonstrated preventative effect of n-3 PUFA on various diseases [14]. In addition to providing EPA and DHA, regular fish intake may facilitate the displacement of other foods higher in saturated and trans fatty acids from the diet, such as fatty meats and full-fat dairy products. Likewise, just as with PUFA, MUFA also show a marked intra and inter species variation. Unlike SFA percentages, the percentages of MUFA and PUFA were not that different between J- and P-mackerel. Recently, a study on seasonal variations demonstrated that MUFA percentages of chub mackerel were the highest on August, while the percentages of PUFA were the highest in April. The major contributing factors to the seasonal variation of PUFA amounted to 20:5n-3 and 22:6n-3 [15]. The fatty acid composition might be related to the changes in nutritional habits of the fish. Fish lipids differ from those of land animals basically in their richness of very long chain fatty acids. These fatty acids are derived from the trophic chain, due to principally to the richness in algae and marine plankton.

3.3. Amino acid composition

Fish constitutes an important source of protein for many people throughout the world. Protein quality is determined by the content of essential amino acids and the bioavailability which can be absorbed and utilized. Amino acid composition of J- and P-mackerel is shown in Table 2. Total amount of amino acids in J- mackerel was 177.35 ± 3.63 mg/g and that in P-mackerel was 213.05 ± 9.06 mg/g. The main amino acids were glutamic acid, followed by lysine, aspartic acid, and leucine in decreasing amounts. There were no significant differences in tyrosine, phenylalanine, histidine, and proline. Fish muscle contains all of the essential amino acids (EAA) and can be regarded as a complete protein source. The protein quality of most

fish may exceed that of terrestrial meat and be equal to an ideal protein. The present study demonstrated that the percentage of EAA in total amino acids (TAA) was 55% and the ratio of EAA to non-essential amino acids (NEAA) was 0.8. FAO-WHO recommended that the percentage of EAA in TAA and ratio of EAA to NEAA approximated to the reference values of 40% and 0.6, respectively [16]. A recent study demonstrated that consumption of mackerel protein led to reduced expression of tumor necrosis factor- α and interleukin-6 in adipose tissue, suggesting that fish proteins carry anti-inflammatory properties that may protect against obesity-linked metabolic complications [17].

Table 2. Comparison of amino acid composition (mg/g) of J-mackerel and P-mackerel

Composition ¹	J-Mackerel	P-Mackerel
Essential		
Arginine	10.11 ± 0.13^2	$12.23 \pm 0.31^{**}$
Histidine	11.95 ± 0.21	12.77 ± 1.02
Isoleucine	9.01 ± 0.23	$10.90 \pm 0.34^{**}$
Leucine	15.08 ± 0.31	$18.30 \pm 0.54^{**}$
Lysine	18.93 ± 1.26	$23.12 \pm 2.01^*$
Methionine	5.54 ± 0.16	$6.70 \pm 0.33^*$
Phenylalanine	8.25 ± 0.78	9.86 ± 1.17
Threonine	8.84 ± 0.03	$10.85 \pm 0.33^{**}$
Valine	10.97 ± 0.18	$13.18 \pm 0.51^*$
Total EAA	98.68 ± 3.30	$117.92 \pm 6.55^*$
Non-essential		
Alanine	9.74 ± 0.04	$11.48 \pm 0.26^{**}$
Aspartic acid	18.48 ± 0.23	$22.55 \pm 0.63^{**}$
Glutamic acid	26.70 ± 0.02	$33.04 \pm 0.58^{**}$
Glycine	7.07 ± 0.27	$7.92 \pm 0.02^*$
Proline	6.86 ± 0.13	7.91 ± 0.59
Serine	7.66 ± 0.09	$9.38 \pm 0.14^{**}$
Tyrosine	2.17 ± 0.31	2.86 ± 0.35
Total NEAA	78.67 ± 0.33	$95.13 \pm 2.52^{**}$
TAA	177.35 ± 3.63	$213.05 \pm 9.06^*$
EAA/TAA $\times 100$	55.63 ± 0.72	55.33 ± 0.72
Total NEAA /total EAA	0.80 ± 0.02	0.81 ± 0.02

¹EAA: essential amino acids; NEAA: non-essential amino acids; TAA: total amino acids.

²Data were presented as mean \pm SD ($N = 3$); * $p < 0.05$, ** $p < 0.01$ significantly different as compared to J-mackerel.

Table 3. Comparison of metals content (mg/kg) of J-mackerel and P-mackerel

Metal	J-Mackerel	P-Mackerel
As	0.045 ± 0.007^1	0.053 ± 0.001
Cd	0.004 ± 0.000	$0.006 \pm 0.000^{**}$
Cr	0.063 ± 0.003	$0.077 \pm 0.002^{**}$
Cu	0.247 ± 0.045	$0.551 \pm 0.114^*$
Hg	0.039 ± 0.000	$0.073 \pm 0.009^*$
Ni	0.003 ± 0.001	0.003 ± 0.001
Pb	0.004 ± 0.002	0.007 ± 0.003
Zn	2.204 ± 0.127	$2.896 \pm 0.094^{**}$

¹Data were presented as mean \pm SD ($N = 3$); * $p < 0.05$, ** $p < 0.01$ significantly different as compared to J-mackerel.

3.4. Heavy metals concentrations

Monitoring the content of metals in fish is important in order to evaluate the possible risk of fish and other organism consumption for human health. As shown in Table 3, the order of the metal concentrations was significantly Zn>Cu>Cr>As and Hg. P-mackerel had higher content of As, Cd, Cr, Cu, Hg, Pb, and Zn compared to those of J-mackerel. The differences between J- and P-mackerel were statistically significant for Cd, Cr, Cu, Hg and Zn ($p < 0.05$). In general, contents of Zn and Cu are higher than Pb and Cd in fish muscle. The essential metals, such as Zn and Cu, are regulated to maintain a certain homeostatic status in fish. On the contrary, the non essential metals, such as mercury and lead, have no biological function or requirement and their contents in fish muscles are generally low^[18]. The Food Code of Korea specifies that, for this type of food, the contents of Hg and Pb should be less than 0.5 mg/kg wet weight^[19]. Even though there is consistent evidence for beneficial effects of modest fish consumption, there are possible risks and adverse effects associated with fish. The main concern has been the presence of environmental contaminants. The greatest public and scientific attention has been on methyl mercury, a component that represents a permanent threat to human health. There are health advisories in place to limit consumption of particular types of seafood, and some researchers have discussed that the levels of environmental contaminants in some species may offset the benefits of several compounds such as n-3 PUFA and selenium^[20, 21]. Interestingly, Ouedraogo and Amyot^[22] investigated effect of dietary habits such as cooking methods and food components on fish mercury bioavailability. They found that mercury bioaccessibility from mackerel can be reduced by cooking and by the co-ingestion of tea and coffee.

As fish is staple food for human, the accumulation of metals exceeding the permissible limits is a serious health concern. The present study thus highlighted the heavy metal concentrations of chub mackerel caught at two different areas in order to evaluate their nutritional value. Among non-essential metals, Hg concentrations of P-mackerel were determined to be the highest levels in this study. The metals contents of both P- and J-mackerel were less than maximum levels in the Korea Food Code. The present study may be useful for possible health risks of fish consumption in Korea. Of course, it is just first step so that fish contamination levels should be carefully monitored on a regular basis.

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References

1. Perrotta RG, Vinñas MD, Hernández DR, Tringali LS. Temperature conditions in the Argentine chub mackerel (*Scomber japonicus*) fishing ground: Implications for fishery management. *Fish Oceanogr* 2001; 10: 275-283.
2. Food and Agriculture Organization (FAO). Fisheries and aquaculture department. <http://www.fao.org/fishery/species/3277/en> (Accessed March 7, 2011).
3. Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF). Food, agriculture, forestry and fisheries statistical yearbook 2010. MIFAFF Press. Seoul, Korea. 2010: 284.
4. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Flanklin B, Kris-Etherton P, Harris WS, Howard B, Karanja N, Lefevre M, Rudel L, Sacks F, Van Horn L, Winston M, Wylie-Rosett J. Diet and life style recommendations revision 2006: a scientific statement from the American heart association nutrition committee. *Circulation* 2006; 114: 82-92.
5. Darr AS, Singer PA, Persad DL, Pramming SK, Matthews DR, Beaglehole R, Bernstein A, Borysiewicz LK, Colagiuri S, Ganguly N, Glass RI, Finegood DT, Koplan J, Nabel EG, Sarna G, Sarrafzadegan N, Smith R, Yach D, Bell J. Grand challenges in chronic non-communicable disease. *Nature* 2007; 450: 494-496.
6. Mahaffey K, Clickner R, Jeffries R. Adult women's blood mercury concentrations vary regionally in United States: Association with patterns of fish consumption (NHANES 1999-2004). *Environ Health Perspect* 2009; 117: 47-53.
7. Korean Society of Food Science and Nutrition (KFN). Handbook of experiments in food science and nutrition. Hyoil Press. Seoul, Korea. 2000: 96-128.
8. Bligh EG, Dyer WJ. A rapid method of total lipid extraction and purification. *Can J Biochem Phys* 1959; 37: 911-917.

9. Salem N, Reyzer M, Karanian J. Losses of arachidonic acid in rat liver after alcohol inhalation. *Lipids* 1996; 31: S153-S156.
10. Thakur DP, Morioka K, Itoh Y, Obatake A. Lipid composition and deposition of cultured yellowtail *Seriola quinqueradiata* muscle at different anatomical locations in relation to meat texture. *Fish Sci* 2003; 69: 487-494.
11. Kim TJ, Bae JH, Yeo HK, Shim KB, Jeong HJ, Cho YJ. Quality evaluation of red seabream, *Pagrus major* by physicochemical method. *J Korean Aquaculture* 2004; 17: 173-179.
12. Ando M, Oishi K, Mochizuki S, Tsukamasa Y, Makinodan Y. Effect of inhabited sea area on meat firmness and its post-mortem change in chub mackerel during chilled storage. *Fish Sci* 2002; 68: 1337-1343.
13. Osako K, Yamaguchi A, Kurokawa T, Kuwahara K, Saito H, Nozaki Y. Chemical components and body color of horse mackerel caught in different areas. *Fish Sci* 2002; 68: 587-594.
14. Larsen R, Eilertsen KE, Elvevoll EO. Health benefits of marine foods and ingredients. *Biotechnol Advances* 2011; 29: 508-518.
15. Bae JH, Lim SY. Effect of season on heavy metal contents and chemical compositions of chub mackerel (*Scomber japonicus*) muscle. *J Food Sci* 2012; 77: T52-T57.
16. Food and Agriculture Organization-World Health Organization (FAO-WHO). Energy and protein requirements. FAO-WHO Press. Rome, Italy. 1973.
17. Pilon G, Ruzzin J, Rioux LE, Lavigne C, White PJ, Froyland L, Jacques H, Bryl P, Beaulieu L, Marette A. Differential effects of various fish proteins in altering body weight, adiposity, inflammatory status, and insulin sensitivity in high-fat-fed rats. *Metabolism* 2011; 60: 1122-1130.
18. Huang WB. Heavy metal concentrations in the common benthic fishes caught from the coastal waters of eastern Taiwan. *J Food Drug Anal* 2003; 11: 324-330.
19. Korea Food and Drug Administration (KFDA). Food Code. Korea Foods Industry Association (KFIA) Press. Seoul, Korea. 2010: 20-21.
20. Carbanero AI, Madrid Y, Camar C. Mercury-selenium species ratio in representative fish samples and their bioaccessibility by an in vitro digestion method. *Biol Trace Elem Res* 2007; 119: 195-211.
21. Domingo JL. Omega-3 fatty acids and the benefits of fish consumption: is all that glitters gold? *Environ Int* 2007; 33: 993-998.
22. Ouedraogo O, Amyot M. Effects of various cooking methods and food components on bioaccessibility of mercury from fish. *Environ Res* 2011; 111: 1064-1069.

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Changes in the phenolic composition of citrus fruits and leaves prepared by gamma irradiation of budsticks

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Abstract: Citrus mutants were induced by the irradiation of citrus budsticks with 120 Gy of cobalt (⁶⁰CO) gamma irradiation. Three mutant plants demonstrating improved fruit quality were selected and compared with wild-type citrus plant for evaluation of the phenolic composition, such as total phenolics, total flavonoids, flavonoid distribution and D-limonene. The results show that irradiation induced changes in total phenolic and flavonoid contents of the fruit peel and pulp, and leaves of citrus mutants, as well as in D-limonene content. HPLC analysis demonstrated that hesperidine, narirutin and rutin were variably distributed in citrus mutants. The obtained results implicate that gamma irradiation may contribute to variations in phenolic composition.

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Keywords: citrus; mutation; gamma irradiation; phenolic compounds

1. Introduction

Gamma irradiation has been used as an effective plant breeding method, which can greatly induce high mutation numbers and modify physiological characteristics to create new mutants with improved properties (Naito et al., 2005; Predieri, 2001; Sarto et al., 2006). Free radicals produced by gamma irradiation can cause changes in structure, function and metabolism of plant cells, which resultantly produce higher amounts of commercially useful metabolites and develop economically significant varieties (Kim et al., 2004; Wi et al., 2007). Many useful mutants were obtained by gamma irradiation at vegetative propagated plants (Ahloowalia and Maluszynski, 2001; Predieri, 2001).

Citrus fruits rank first in the world with respect to production among the fruits (Terol et al., 2010). The citrus crop is also a valuable contributor to the economy of Jeju island, Korea, with annual yields of more than 0.6 million tons. Citrus fruit production and market demand depends on several factors like life cycle of fruit-bearing trees, disease resistance, extended harvesting period, maximum yield of higher fruit qualities (e.g., size, color, texture and nutritional value of fruit) are important considerations. To meet the requirements of the fruit industry and the consumers, citrus mutation breeding approach via gamma ray irradiation to develop new citrus cultivars has steadily increased (Bermejo et al., 2011; Chaudhuri, 2002; Deng, 2005; Ling et al., 2008; Raza et al., 2003; Wu, 1986). However,

limited information exists on the potential and extent of enhancing production of citrus secondary metabolites using gamma irradiation, even though many of the effects of gamma irradiation on seedlessness, pollen germination, fruit quality and growth of citrus have received considerable attention (Bermejo et al., 2011; Chaudhuri, 2002; Raza et al., 2003; Wu, 1986). In the present study, the levels of bioactive constituents were thus analyzed for non-irradiated and irradiation-induced citrus in order to compare their properties and changes.

2. Material and Methods

2.1. Gamma irradiation and plant maintenance

The citrus cultivar, *Citrus unshiu* Marc. cv. Miyagawa, which is most widely cultivated in Jeju island, Korea, was selected as the original plant materials for mutational breeding experiments. One year old shoots of citrus were exposed to gamma irradiation at the doses of 120 Gy from cobalt (⁶⁰CO) source at the Institute for Nuclear Science and Technology, Jeju National University and were then grafted onto one year old sour orange (*C. aurantium* L.) seedling. Afterwards, young irradiated tree were maintained for about 1 year at nursery and then selected mutant plants were moved to the main garden in Subtropical Horticulture Research Institute at Jeju National University where the rest of the study was carried out. Both citrus wild-type (WT) and mutant (Mut) plants were managed in same way with respect to fertilization, irrigation and disease control.

The growing conditions and degree of ripeness at harvest were controlled to eliminate the effects of environmental conditions on the different WT and Mut cultivars.

2.2. Sample preparation

Fully mature citrus fruits with leaves were harvested on ripening in November, 2010. Three different Mut cultivars were used in the present study. According to the morphological characteristics, including fruit shape, size and color, and contents of sugar and acid, which were determined in detail as described previously (Oh and Kim, 2011), test subjects were divided into four groups: WT, citrus derived from non-irradiated shoots; Mut I, citrus mutants with comparatively high sugar/acid ratio; Mut II, citrus mutants with red color; Mut III, citrus mutants with rough shape. The fruit peel and pulp, and leaves of WT and Mut citrus were separated, dissected, weighed, lyophilized and then ground into a fine powder using a blender. Portions (25 g) of the powdered samples were successively extracted with 250 mL of methanol in the 25 °C shaking incubator for 24 h and subsequently purified by using a 0.45 µm membrane filter (Waters, Milford, MA, US), which were stored at 4 °C until further use.

2.3. Analysis of total phenolic and flavonoid contents

Contents of total phenol and flavonoid were determined by the modified method described previously (Senevirathne et al., 2010). For total phenol quantitation, 30 µL of citrus WT and Mut methanolic extracts were mixed thorough with 30 µL of 95% ethanol, 150 µL of distilled water, 15 µL of Folin-Ciocalteu reagent and 30 µL of saturated sodium carbonate solution (5%). After 60 min standing, the absorbance was read at 725 nm against a blank in a Spectra MR microplate reader (Dynex Technologies, Inc., Chantilly, VA, US). Content of phenols was calculated on the basis of the calibration curves of gallic acid, and was expressed as mg gallic acid per 100 g dry matter. To determine total flavonoids, each extract in methanol (15 µL) was mixed with 4.5 µL of 5% NaNO₂, 60 µL of distilled water and 4.5 µL of 10% AlCl₃. After incubation for 6 min, 60 µL of NaOH solution (4%) was added to the mixture and made up to a final volume of 150 µL with distilled water. The absorbance was measured 15 min later at 510 nm. Content of flavonoids was calculated on the basis of the calibration curves of rutin and was expressed as mg rutin per 100 g dry matter.

2.4. HPLC analysis of flavonoids

A 20 µL aliquot of citrus WT and Mut methanolic extracts was injected into a Shim-pack VP-ODS (C₁₈) column (4.6 m × 150 mm × 5 µm; Shimadzu, Tokyo, Japan) of the Waters high performance liquid chromatography (HPLC) system equipped with a 626 pump, a 486 UV-VIS detector and autosampler (Waters, Milford, MA). The mobile phase for the HPLC system was (A) water/acetic acid (99.5/0.5, v/v); (B) acetonitrile/acetic acid (99.5/0.5, v/v) at a flow rate of 1 mL/min. The mobile phase program consisted of four periods: 0-10 min, 20% A; 10-16 min, 45% A; 16-20 min, 75% A; and 20-22 min, 20% A. The column was operated at 40 °C, and the eluent was monitored with a single-channel UV detector at a wavelength of 280 nm. The flavonoids were identified by comparing their retention times and UV spectra with those of authentic standards (ChromaDex, Irvine, CA, US). The content of each flavonoid was calculated from the integrated peak area if the sample and the corresponding standard.

2.5. GC-MS analysis of D-limonene

A Shimadzu QP2010 Ultra gas chromatographic mass spectrometric (GC-MS) system, autosampler and real time analysis software were used for the analysis. A Restek Rtx-5MS capillary column (30 m × 0.25 mm i.d. × 0.25 µm) was used for separation. The injector temperature was 250°C. The temperature program was started at 50 °C for 2 minute and heated at 10 °C/min to 80 °C, increased by 20 °C/min up to 140 °C and then by 40°C/min up to 280 °C. Sample injection was done in split mode (split ratio 20:1). High purity helium was used as carrier gas at a flow rate of 1 mL/min. Mass spectrometry was run in full scan mode (m/z 45-500) with 200 °C MS source temperature and 2.5 minutes solvent cut time. D-limonene was identified by comparing the retention times and mass spectra obtained with those of authentic standard (Sigma).

2.6. Statistical analysis

Results are presented as means ± standard deviation. Statistical comparisons were made by analysis of variance (ANOVA) procedure followed by a Duncan's multiple range tests (SPSS 12.0). *P* < 0.05 was considered significantly different. After multiple comparisons, the means in the following table and figures were followed with different small letter "a-d" based on their values and statistical differences.

3. Results and Discussion

Data in Figure 1 show that the Gamma irradiation significantly affected the total phenolic and flavonoid content of citrus when compared with

WT samples. The peel and pulp extracts of citrus Mut I and II had significantly higher total phenolic content than the extracts of citrus WT, whereas lower total phenolic content was noted for those of Mut III (Figure 1A). The citrus Mut I peel had the highest total phenolic content (23786 mg/100 g) which is 37% higher than that of WT peel (Figure 1A). Total flavonoid content in the peel (6766–7126 mg/100 g) and pulp (4874–5685 mg/100 g) of citrus WT, Mut I and Mut II were almost in the similar quantity (Figure 1B). However, the flavonoid contents of citrus Mut III peel and leaves were significantly higher than those of WT, while flavonoid content of Mut III pulp was significantly lower ($p < 0.05$) (Figure 1B). In this study, citrus peel and pulp extracts had relatively higher total phenolic and flavonoid contents as compared with the leaf extracts, except that of Mut III group (Figure 1).

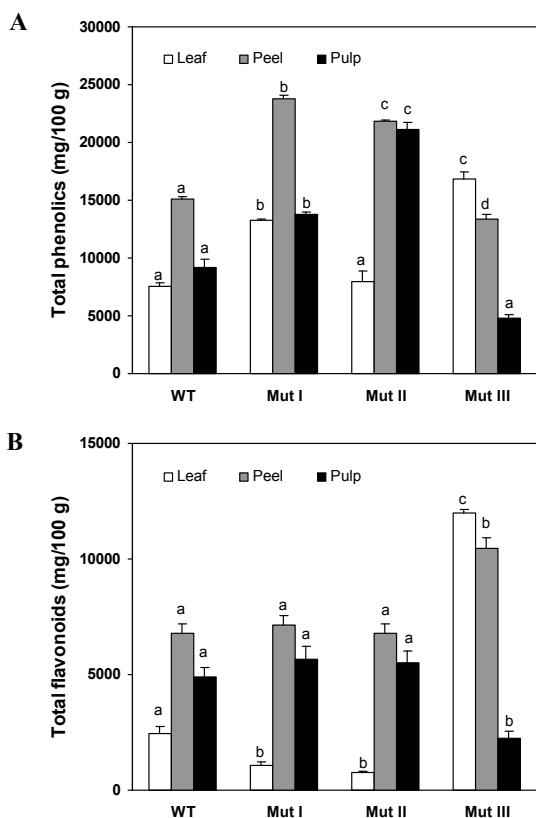


Fig. 1. Total phenolic (A) and flavonoid (B) contents in the leaves, peel and pulp extracts of citrus derived from non-irradiated and irradiated shoots. Data presented are in mean \pm standard deviation ($n = 3$) which with different letters above the bars are significantly different at $p < 0.05$.

Flavonoids are a widely distributed group of phenolic compounds, which have a wide range of biological effects, such as inhibition of key enzymes in mitochondrial respiration, protection against coronary heart disease and anti-inflammatory, antitumor, and antimicrobial activities (Wang et al., 2008). Citrus fruit contains high levels of the flavanones, as well as flavonol, which are very rare in other plants (Gattuso et al., 2007). In the present study, four flavanones (naringin, neohesperidin, hesperidin and narirutin) and one flavonol (rutin) were identified in leaf extracts, while hesperidin, narirutin and rutin were the main flavonoids detected in citrus peel and pulp extracts (Table 1). The amounts of hesperidin in peel (340.3-573.7 mg/100 g), pulp (105.4-276.3 mg/100 g) and leaves (248.3-829.5 mg/100 g) of citrus in this work were the highest compared to amounts of other flavonoids. The amounts of naringin, hesperidin and rutin were significantly lower but narirutin was significantly higher in leaf extracts of all Mut groups than WT ($p < 0.05$). Neohesperidin occurred in the leaf extracts of all experimental groups with similar distribution patterns (42.0-43.3 mg/100 g) (Table 1). Here, obtained results of peel and pulp showed that these two parts had very similar flavonoids tendencies without remarkable differences although peel contained higher level of investigated flavanones than pulp. The peel and pulp of all Mut groups (78.5-93.7 and 93.4-132.2 mg/100 g, respectively) contained significantly higher concentration of narirutin than those of WT (60.8 and 92.4 mg/100 g, respectively); In the peel and pulp of Mut III, the flavanone glycoside pattern consisted predominantly of hesperidin and narirutin, and their contents were significantly higher than WT ($p < 0.05$). Hesperidin has been reported to reduce plasma/hepatic cholesterol (Montforte et al, 1995; Manach et al, 2003) and to suppress the oxidative stress *in vitro* and *in vivo* (Miyake et al, 1998). Furthermore, it has been shown to protect animals against chemically induced several cancers (Tanaka et al, 1997; Berkarda et al, 1998). Narirutin has been demonstrated to have an anti-allergic properties (Kubo et al, 2004) and therapeutic effect on bronchial asthma (Funaguchi et al, 2007).

Citrus oils are mixtures of volatile components of terpenic hydrocarbon and oxygenated compounds (Cano and Bermejo, 2011). D-limonene is the principle component of citrus oil, ranging from 88% to 95%, which is often used as an additive in food products and fragrances, natural pesticide and insect repellent (Cano and Bermejo, 2011). It has also been studied for its anti-carcinogenic properties (Crowell and Gould, 1994).

Table 1. Flavonoid content (mg/100 g dry weight) in the leaves, peel and pulp extracts of citrus derived from non-irradiated and irradiated shoots

Group	Flavanone						Flavonol glyside
	Naringin	Neohesperidin	Hesperidin	Narirutin	Naringenin	Hesperetin	Rutin
Leaves							
WT	30.9±3.04 ^a	43.3±1.43	829.5±1.86 ^a	18.8 ± 0.65 ^a	nd*	nd	254.1±2.07 ^a
Mut I	20.6±1.43 ^b	42.0±1.66	292.9±2.02 ^b	22.0 ± 1.16 ^b	nd	nd	186.6±1.76 ^b
Mut II	21.7±1.13 ^b	42.0±2.50	293.9±1.47 ^b	26.8 ± 0.91 ^c	nd	nd	134.1±2.72 ^c
Mut III	17.4±0.48 ^c	43.3±0.79	248.3±1.29 ^d	23.1 ± 0.30 ^b	nd	nd	186.4±0.99 ^b
Peel							
WT	nd	nd	463.1±1.11 ^a	60.8±1.51 ^a	nd	nd	65.7±0.47 ^a
Mut I	nd	nd	573.7±3.71 ^b	93.7±0.61 ^b	nd	nd	72.1±0.93 ^b
Mut II	nd	nd	340.3±5.94 ^c	111.3±1.23 ^c	nd	nd	64.0±0.87 ^c
Mut III	nd	nd	546.6±3.38 ^d	78.5±0.61 ^d	nd	nd	66.1±0.63 ^a
Pulp							
WT	nd	nd	178.8±0.43 ^a	92.4 ± 0.59 ^a	nd	nd	65.7 ± 0.47 ^a
Mut I	nd	nd	145.1±1.35 ^b	93.4 ± 0.16 ^a	nd	nd	72.1 ± 0.93 ^b
Mut II	nd	nd	105.4±0.67 ^c	131.9 ± 0.60 ^b	nd	nd	64.0 ± 0.87 ^c
Mut III	nd	nd	276.3±2.07 ^d	132.2 ± 1.53 ^b	nd	nd	66.1 ± 0.63 ^a

* Not detected; ^{a-d} Values with different superscripts in a column are significantly different ($p < 0.05$)

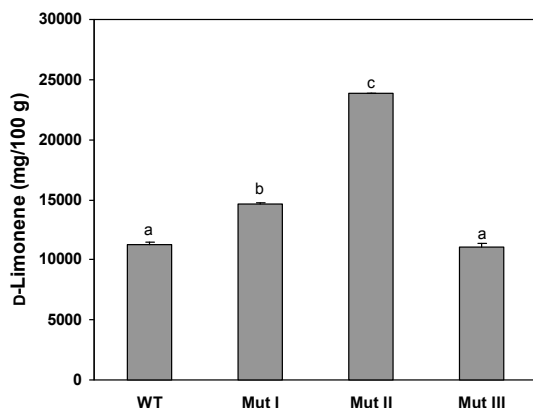


Fig. 2. D-limonene content in the leaves (A) and peel (B) extracts of citrus derived from non-irradiated and irradiated shoots. Data presented are in mean ± standard deviation ($n = 3$) which with different letters above the bars are significantly different at $p < 0.05$.

The gas chromatographic profiles and D-limonene content are presented in Figure 2 in values of milligrams per 100 gram of peel (dried weight). Mut I (14679 mg/100 g) and II (23844 mg/100 g) displayed significantly higher D-limonene values than WT (11222 mg/100 g) ($p < 0.05$). However, Mut III (11108 mg/100 g) showed similar content with WT with no significant differences (Figure 2).

In this current study, we examined the influence of gamma irradiation on the phenolic constituents of citrus. Overall, gamma irradiation

causes biochemical changes in the fruits and leaves, and seem to be able to influence the synthesis of phenolic compounds, which have been recognized as important due to their bioactive role and health benefits although it would be necessary to carry out more analyses, and with citrus mutants obtained from radiation breeding programs, to elucidate conclusive values.

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References

- Ahloowalia BS, Maluszynski M. Induced mutations-A new paradigm in plant breeding. *Euphytica* 2001; 118: 167-73.
- Berkarda B, Koyuncu H, Soybir G, Baykut F. Inhibitory effect of hesperidin on tumour initiation and promotion in mouse skin. *Res Exp Med* 1998; 198: 93-9.
- Bermejo A, Pardo J, Cano A. Influence of gamma irradiation on seedless citrus production:

- pollen germination and fruit quality. *Food Nutr Sci* 2011; 2: 169-80.
4. Cano A, Bermejo A. Influence of rootstock and cultivar on bioactive compounds in citrus peels. *J Sci Food Agric* 2011; 91: 1702-11.
 5. Chaudhuri SK. A simple and reliable method to detect gamma irradiated lentil (*Lens culinaris*.) seeds by germination efficiency and seedling growth test. *Radiat Phys Chem* 2002; 64: 131-6.
 6. Crowell PL, Gould MN. Chemoprevention and therapy of cancer by d-limonene. *Crit Rev Oncog* 1994; 5:1-22.
 7. Deng XX. Advances of citrus breeding in the world. *Acta Horti Sin* 2005; 32: 1140-6.
 8. Funaguchi N, Ohno Y, Asai T, Yuhgetsu H, Sawada M, Takemura G, Minatoguchi S, Fujiwara T, Fujiwara H. Narirutin inhibits airway inflammation in an allergic mouse model. *Clin Exp Pharmacol Physiol* 2007; 34: 766-70.
 9. Gattuso G, Barreca D, Gargiulli C, Leuzzi U, Caristi C. Flavonoid Composition of Citrus Juices. *Molecules* 2007; 12: 1641-73.
 10. Kim JH, Baek MH, Chung BY, Wi SC, Kim JS. Alterations in the photosynthetic pigments and antioxidant machineries of red pepper (*Capsicum annuum* L.) seedlings from gamma-irradiated seeds. *J Plant Biol* 2004; 47: 314-21.
 11. Kubo M, Fujita T, Nishimura S, Masashi T, Hideaki M, Takeshi G, Norimichi T, Katsuaki S, Naoki U. Seasonal variation in anti-allergic activity of citrus fruits and flavanone glycoside content. *Nat Med* 2004; 58: 284-94.
 12. Ling APK, Chia JY, Hussein S, Harun AR. Physiological Responses of Citrus sinensis to Gamma Irradiation. *World Appl Sci J* 2008; 5: 12-9.
 13. Manach C, Morand C, Gil-Izquierdo A, Demange BC, Rémésy C. Bioavailability in humans of the flavanones hesperidin and narirutin after the ingestion of two doses of orange juice. *Eur J Clin Nutr* 2003; 57: 235-42.
 14. Miyake Y, Yamamoto K, Tsujihara N, Osawa T. Protective effects of lemon flavonoids on oxidative stress in diabetic rats. *Lipids* 1998; 33: 689-95.
 15. Montforte MT, Trovato A, Kirjavainen S, Forestieri AM, Galati EM, Lo Curto RB. Biological effects of hesperidin, a citrus flavonoid. Hypolipidemic activity on experimental hypercholesterolemia in rat. *Il Farmaco* 1995; 50: 595-9.
 16. Naito K, Kusaba M, Shikazono N, Takano T, Tanaka A, Tanisaka T, Nishimura M. Transmissible and nontransmissible mutations induced by irradiating Arabidopsis thaliana pollen with gamma-rays and carbon ions. *Genetics* 2005; 169: 881-9.
 17. Oh SK, Kim JH. Current state of citrus mutation breeding (2010). *J Asian Agri Biotech* 2011; 27: 67-71.
 18. Predieri S. Mutation induction and tissue culture in improving fruits. *Plant Cell Tiss Org* 2001; 64: 185-210.
 19. Raza H, Khan MM, Khan A. Seedlessness in Citrus. *Int J Agri Biol* 2003; 5: 387-91.
 20. Robbins RJ. Phenolic acids in foods: an overview of analytical methodology. *Journal of agricultural and food chemistry* 2003; 51: 2866-87.
 21. Sarto Y, Shirasawa K, Takahashi Y, Nishimura M, Nishino T. Mutant selection from progeny of gamma-ray-irradiated rice by DNA heteroduplex cleavage using brassica petiole extract. *Breeding Sci* 2006; 56: 179-83.
 22. Senevirathne M, Kim SH, Kim YD, Oh CK, Oh MC, Ahn CB, Je JY, Lee WW, Jeon YJ. Effect of far-infrared radiation drying of citrus press-cakes on free radical scavenging and antioxidant activities. *J Food Eng* 2010; 97: 168-76.
 23. Tanaka T, Makita H, Kawabata K, Mori H, Kakumoto M, Satoh K, Hara A, Sumida T, Tanaka T, Ogawa H. Chemoprevention of azoxymethane-induced rat colon carcinogenesis by the naturally occurring flavonoids, diosmin and hesperidin. *Carcinogenesis* 1997; 18: 957-65.
 24. Terol J, Soler G, Talon M, Cercos M. The aconitate hydratase family from Citrus. *BMC Plant Biol* 2010; 10: 222.
 25. Wang YC, Chuang YC, Hsu HW. The flavonoid, carotenoid and pectin content in peels of citrus cultivated in Taiwan. *Food Chem* 2008; 106: 277-84.
 26. Wi SG, Chung BY, Kim JS, Kim JH, Baek MH, Lee JW, Kim YS. Effects of gamma irradiation on morphological changes and biological responses in plants. *Micron* 2007; 38: 553-64.

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Light and Electron Microscopic Study on the Effect of Different Forms of Allopurinol on the Kidney and Liver of Adult Male Albino Rat

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Abstract: BACKGROUND: Allopurinol is used in the treatment of gout, leishmaniasis, renal stone formation and in prophylaxis of hyperuricemia and its complications associated with radiation therapy. Allopurinol is associated with multiple side effects in certain cases which include glomerulonephritis, nephritis, elevated hepatic enzymes, hepatic necrosis, leucopenia, purpura and allergic diseases. Little researches showed that a steep dose-response relationship exists between allopurinol and its side effects. Some of these researches on the microcapsulation of allopurinol, which can reduce its side effects to a great extent. The aim of the present study was to investigate and compare the effects of sustained release microcapsule, no uric allopurinol and pure allopurinol on the kidney and liver of adult male albino rats. MATERIAL AND METHODS: The present study was conducted on 40 adult male albino rats of Sprague-Dawley strain (from Assiut University animal house). The rats were randomly classified into four groups (ten rats each). The control group, rats of which were left in animal house without any treatment and received vehicle only. The three treated groups received three different forms of allopurinol at dose 25 mg/kg of body weight daily for 14 consecutive days. Group II (the sustained release allopurinol microcapsule group) rats of which were given the allopurinol microcapsule suspension which proved sustained release. Group III (the No-Uric group) rats of which were given no-uric suspension. Group VI (the pure allopurinol group) rats of which were given pure allopurinol suspension. Both kidneys and liver of the four groups were removed from the animals and processed for routine histological and electron microscopic examination. FINDINGS: Kidney and liver of group II (the sustained release allopurinol microcapsule group) is more or less similar to the control group. In group III (the No-Uric group) and group IV (the pure allopurinol group) the glomerular space is significantly dilated, the proximal convoluted tubules are significantly reduced in their epithelial height and areas of hemorrhage observed between the tubules and deposits inside the loop of Henle. The electron microscopic picture of the glomeruli shows partial thickening of the glomerular basement membrane, disturbed capillary endothelium, irregularity of the minor processes of the podocytes and areas of glomerular sclerosis. The proximal and distal convoluted tubules shows cytoplasmic vaculation, cytoplasmic dense bodies, degenerated mitochondria and decrease basal enfolding. The proximal convoluted tubules shows destruction of the microvilli. The liver of group III (the No-Uric group) and group IV (the pure allopurinol group) shows areas of hemorrhage both in the central part of the hepatic lobule and on the peripheral part. The electron microscopic picture of the hepatocytes show vacuolated cytoplasm, necrotic changes and the cord pattern is disturbed. The electron microscopic picture of the hepatocytes show marked reduction of the cytoplasmic organelles, degenerative changes in the mitochondria and little amount of rough endoplasmic reticulum. The nucleus is shrunken, little chromatin material and the nuclear membrane is irregular. CONCLUSION: the sustained release microcapsule allopurinol may lead to prolonged activity with avoidance of renal and hepatic side effects of frequent administration of allopurinol. These results may have clinical significance in the prevention of some side effects of allopurinol on kidney and liver.

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Keyword: Light and Electron Microscopic; Kidney; Liver; Allopurinol; Albino.

1. Introduction

Allopurinol is a xanthine oxidase inhibitor used widely in treatment of gout, leishmaniasis, renal stones and complications associated with radiation therapy (Martindale, 1999; Tausche *et al.*, 2008 and Aldaba-Muruato *et al.*, 2012). Allopurinol is widely used and generally well-tolerated (Dawson *et al.*, 2009 and Woo *et al.*, 2012). However, in certain cases it may have toxic effects, such as vasculitis, toxic epidermal necrolysis, eosinophilia, hepatitis, reduced renal function and bone marrow suppression, known as allopurinol hypersensitivity syndrome (Liu *et al.*, 2008; Teo *et al.*, 2011 and Biagioni *et al.*, 2012).

But this syndrome is rare (Arabi *et al.*, 1996; El-Gibaly, 1998 and Horiuchi *et al.*, 2000). Several studies in the past two decades have suggested that elevated serum uric acid levels are associated with cardiovascular diseases (Viazzi *et al.*, 2006; Lippi *et al.*, 2008; Neogi *et al.*, 2011 and Krishnan *et al.*, 2011). Simultaneous reduction in uric acid levels by allopurinol might contribute to the reduction in its side effects (Stocker & Keaney, 2004; Glantzounis *et al.*, 2005 and Puddu *et al.*, 2012).

George *et al.* 2006 showed that a steep dose-response relationship exists between allopurinol and its effects on endothelial dysfunction in patients with chronic heart failure.

Limited work has been reported on the different forms of allopurinol, which can reduce the side effects of the drug to a great extent (Spiegel & Abd-El-Fatah, 1977 and El-Gibaly *et al.*, 2003).

Various techniques of sustained release microcapsulation can be employed for the production of multiparticulated sustained-released polymeric drug delivery system (Deasy, 1984 and Arshady, 1989). The oil-in-water meltable disperse-phase encapsulation method has been reported to be simple and useful in the preparation of beeswax matrix microspheres loaded with appropriate drugs without using harmful organic solvents (Bodmeier *et al.*, 1992; Adeyeye and Price, 1994; Giannola *et al.*, 1995 and Uddin *et al.*, 2001).

Aim of this Work:

The aim of the present work is to investigate and compare the effects of different forms of allopurinol in adult male albino rat's kidney and liver.

2. Material and Methods

The present study was conducted on 40 adult male albino rats of Sprague-Dawley strain (from Assiut University animal house). Rats were selected for age (2-3 months) and weight (150-200 grams). They were put at constant normal temperature with the natural light dark cycle. Manipulations throughout test were carried out by the same person. The rats were fed a standard diet of commercial rat chow and tap water and left to acclimatize to environment for two weeks prior to inclusion in the experiment. All experiments were performed during the same time of day, between 10 am and 1pm to avoid variations due to diurnal rhythms.

The rats were randomly classified into four groups (ten rats each) and received the tested compound by gastric intubation (in 0.1 M NaHCO₃ containing 0.02% of Tween 80, PH 7.4). All treatments were administered into rats following 12 hours of fasting. All the materials used in this study were of analytical reagent grade and were used as received.

Group I: is the control group, rats of which was left in animal house without any treatment and received vehicle only.

Group II: is the sustained release allopurinol microcapsular group, rats of which was given the allopurinol microcapsule suspension (mean size 120 µm) (1 gm / 20 ml) at dose 25 mg/kg of body weight daily for 14 consecutive days.

Group III: is the no-uric group, rats of which was given No Uric 100 mg tablet in the form of suspension by mouth (100 mg/12 ml) at dose 25 mg/kg of body weight daily for 14 consecutive days.

Group IV: is the pure allopurinol group, rats of which was given pure allopurinol suspension (8 mg/ ml) at dose 25 mg/kg of body weight daily for 14 consecutive days.

Preparation of allopurinol loaded microparticle formulations:

Microparticle formulations are produced using the modified emulsion encapsulation procedure adopted (Vilivalam and Adeyeye, 1994). The microparticles formulations were prepared by melting the wax components (4g), unless otherwise specified, consisting of beeswax and wax modifiers. This constitutes the organic or oil phase. The drug was dispersed in the respective molten wax (in a 1:4 drug to wax ratio) under continuous stirring using a magnetic stirrer (J.P. Selecta, s.a., Spain) until a homogeneous blend was attained. This mixture was then poured into 100 ml of the encapsulation dispersant (PF-68: 0.25g) solution (aqueous phase) with constant stirring using a mechanical stirrer (Wheaton Instrument, Millville, NJ, USA) at a predetermined speed of 400 rpm to form an oil-in-water emulsion. During the emulsification step (1 min), the temperature of the aqueous phase was kept slightly higher (~5°C) than the highest melting point of any of the oil phase. The molten mass upon dispersion in the aqueous medium formed a spherical oily particle, which solidified enveloping the drug upon rapid cooling of the emulsion using chilled water (4 °C). The resultant microparticles were then filtered extensively washed with deionized water and air dried at room temperature for 48hrs.

Histological Methods:

Liver and kidney were removed from the animals and fixed in 10% formaldehyde, dehydrated in ascending grades of alcohol, and then after embedded in paraffin wax. Serial sections (10 µm) thickness were prepared and stained with Haematoxylin and Eosin stain and others by Van Gisson stain, then examined by light microscopy (Drury & Willington, 1980 and Bancroft & Stevens, 1982).

Other specimens of the kidney and liver were prepared for electron microscopic study according to (Griffith *et al.*, 1973). The specimens were fixed in 2.5% gluteraldehyde for 2 hours. Then washed 3 times (5 minutes each) in phosphate buffer and were postfixed in 1% osmium tetroxide for 2 hours, then washed 3 times (5 minutes each) in phosphate buffer. The specimens were dehydrated in ascending grades of ethyl alcohol: 50%, 60%, 70%, 80 %,90 % and in absolute alcohol (two changes, 30 minutes each), then in propylene oxide (two changes, 30 minutes each). They were ultimately immersed in a propylene-epon mixture (1:1) for 24 hours. The specimens were embedded in plastic capsules containing epon and left to polymerize in an incubator at 60 °C for 3 days. The ultrathin sections were stained with 1% uranyl acetate and 1% lead citrate and examined by transmission electron microscope.

Morphometric Methods:

The glomerular diameter, glomerular space and the tubular epithelial thickness (of the proximal convoluted tubules) were measured by using a scale slide and Lucida lens. Five slides from each animal were used for these measurements. The slides were chosen from mid area of the kidney and the hilum was taken as a guide for this site. The equation used was: $Magnification = Image\ length / Natural\ length$.

Statistical analysis of the data was done using student t-test and the data expressed in mean and standard deviation.

3. Results

Kidney Results

The structure of the kidney of the rats received the microcapsular allopurinol preparation is more or less similar to the control group both by Haematoxylin and Eosin stain (fig. 1,2, 9&10) and also by Van Gisson stain (fig. 5,6, 13&14). The glomeruli are surrounded by proximal and distal convoluted tubules. The glomerular capillaries have darkly-stained nuclei. The glomerular capsule is surrounded by the glomerular space that lined externally by flat darkly stained nuclei. The afferent arteriole is adherent to one pole of the glomerulus. The proximal convoluted tubules stained more deeply relative to the distal tubules and have an obvious brush border. The proximal convoluted tubules tend to be larger in diameter and more irregular than those of distal convoluted tubules. The distal convoluted tubules are paler and the nuclei of their cells appear more regularly arranged (fig. 1 & 2). The glomerular capillaries are composed of condensed capillary tuft with deeply stained nuclei and deeply stained cytoplasm. The parietal part of glomerular capsule show flat darkly stained nuclei (fig. 1 & 2).

The glomeruli of the rats received no-uric and pure allopurinol show significant dilatation of their glomerular space (fig. 3& 4 and tab. 1) on comparing with the control rats. They also show significant reduction in their size (Figs 3& 4 and Tab. 1) on comparing with the control rats.

The proximal convoluted tubules of the rats received no-uric and pure allopurinol show significant reduction in epithelial thickness on comparing with the control rats (Figs. 3&4 and Tab. 1), and areas of hemorrhage (Figs. 7, 8, 11 & 12) in between them. Casts inside the loop of Henle (Figs. 15&16) also observed.

The electron microscopic picture of the renal glomeruli of the rats received no-uric and pure allopurinol show partial thickening of the glomerular basement membrane, disturbed capillary endothelium, irregularity of the minor processes of the podocytes and areas of glomerular sclerosis (Figs. 27 and 28) comparing with the control animals (Fig. 25). The electron microscopic picture of the renal glomeruli of the rats received the sustained release microcapsular preparation (Fig. 26) is more or less similar to the control group (Fig. 25).

The electron microscopic picture of the proximal convoluted tubules of the rats received no-uric (Fig. 31) and pure allopurinol (Fig. 32) show vacuolated cytoplasm, cytoplasmic dense bodies, bizarre shape mitochondria, secondary lysosomes, partial loss of the apical microvilli and decrease basal infolding. The nucleus is shrunken and the nuclear membrane is irregular comparing with the control animals (Fig. 29). The electron microscopic picture of the proximal convoluted tubules of the rats received the sustained release microcapsular preparation (Fig. 30) is more or less similar to the control group.

The electron microscopic picture of the distal convoluted tubules of the rats received no-uric (Fig. 35) and pure allopurinol (Fig. 36) show vacuolated cytoplasm, less cytoplasmic organelles, cytoplasmic dense bodies, degenerated mitochondria and decrease basal infolding. The nucleus is shrunken and the nuclear membrane is irregular comparing with the control animals (Fig. 33). The electron microscopic picture of the distal convoluted tubules of the rats received the sustained release microcapsular preparation (Fig. 34) is more or less similar to the control group.

Table (1):- The mean values of the glomerular diameter, glomerular space and tubular epithelial height (of the proximal convoluted tubules) of the control group compared with that of the sustained release microcapsule group, no-uric group and pure allopurinol group.

	Control (C)	Micro-capsule (M)	No-uric (N)	Pure-drug (P)	CvM	CvN	CvP
Glomerular Diameter	50.7 μ ± 1.9	49.5 μ ± 1.8	46.0 μ ± 2.1	45.6 μ ± 2.8	0.1 ^{ns}	0.001 ^{**}	0.004 ^{**}
Glomerular space	11.1 μ ± 1.6	11.7 μ ± 1.2	12.5 μ ± 1.3	12.5 μ ± 1.3	0.09 ^{ns}	0.03 [*]	0.04 [*]
Epithelial height	11.7 μ ± 1.2	11.49 μ ± 1.0	10.1 μ ± 0.9	10.1 μ ± 1.4	0.6 ^{ns}	0.01 [*]	0.03 [*]

Liver Results

In the control group the liver cords arranged in rays around the central vein. The central vein is lined by healthy flattened endothelial cell and is surrounded by healthy liver cell cords (Figs. 17&21).

The histological picture of the rats received sustained release microcapsules preparation is more or less similar to the control group both by Haematoxylin and Eosin stain (Fig. 18) and by Van Gisson stain (Fig. 22).

The histological picture of the rats received no-uric and pure allopurinol show areas of

hemorrhage between the cords near to the central vein. The central veins are dilated, liver cords are of disturbed pattern. The hepatocytes are vacuolated with necrotic changes (Figs. 19, 20, 23&24).

The electron microscopic picture of the hepatocytes of the rats received no-uric (Fig. 39) and pure allopurinol (Fig.40) show marked reduction of the cytoplasmic organelles, destructive

mitochondria and little amount of the endoplasmic reticulum. The nucleus is shrunken, little chromatin material and the nuclear membrane is irregular comparing to the control animals (Fig. 37). The electron microscopic picture of the hepatocytes of the rats received the microcapsular preparation (Fig. 38) is more or less similar to the control group.

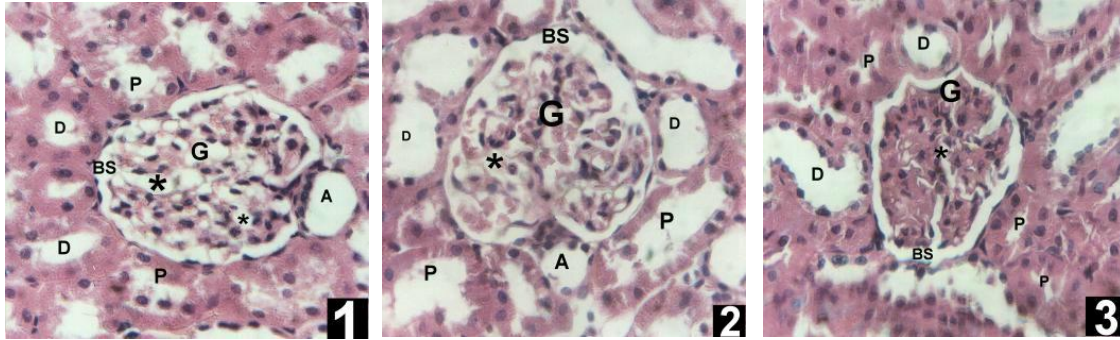


Fig. (1) shows: glomerulus (G), proximal convoluted tubules (P), distal convoluted tubules (D), glomerular capillaries (*), glomerular space (BS) and afferent arteriole (A) of control albino rat kidney. (Hx&E X 400)
Fig. (2) shows: glomerulus (G), proximal convoluted tubules (P), distal convoluted tubules (D), glomerular capillaries (*), afferent arteriole (A) and glomerular space (BS) of albino rat kidney receiving sustained release microcapsules preparation of allopurinol. (Hx&E X 400)
Fig. (3) shows: glomerulus (G), proximal convoluted tubules (P), distal convoluted tubules (D), glomerular capillaries (*), glomerular space (BS) of albino rat kidney receiving no-uric preparation. (Hx&E X 400)

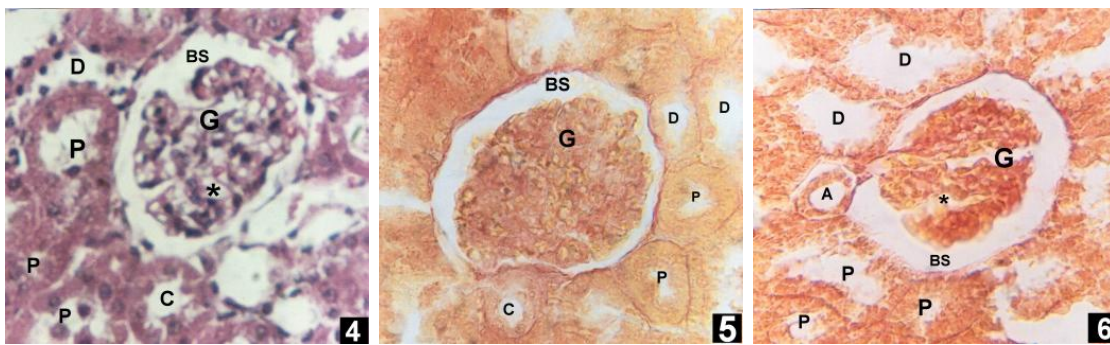


Fig. (4) shows: glomerulus (G), proximal convoluted tubules (P), distal convoluted tubules (D) and glomerular space (BS) of albino rat kidney receiving pure allopurinol preparation. The glomerular capillaries (*) are lined by more compact cells relative to the control with deeply-stained nuclei and cytoplasm. (Hx&E X 400)
Fig. (5) shows: glomerulus (G), the proximal convoluted tubules (P), distal convoluted tubules (D), collecting tubules (C) and glomerular space (BS) of control albino rat. (Van Gisson X 400)
Fig. (6) shows: glomerulus (G), proximal convoluted tubules (P), distal convoluted tubules (D), glomerular capillaries (*), glomerular space (BS), afferent arteriole (A) of albino rat kidney receiving sustained release microcapsule preparation. (Van Gisson X 400)

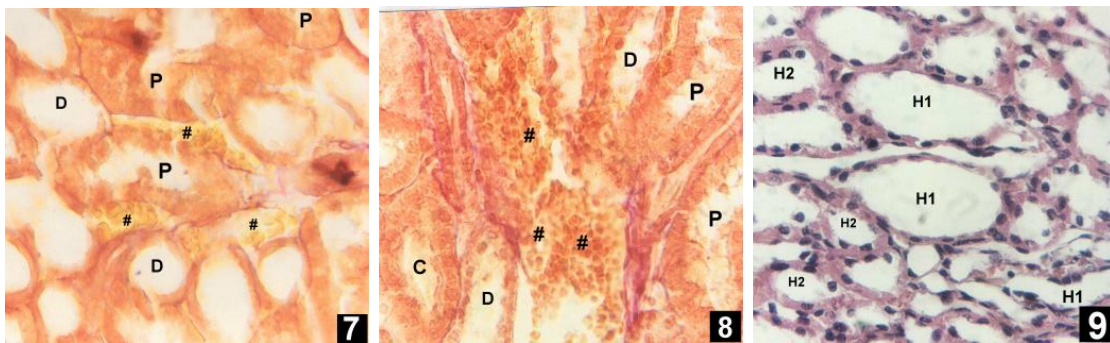


Fig. (7) shows: areas of hemorrhage (#) in between the proximal (P) and distal (D) convoluted tubules of albino rat kidney receiving no-uric preparation. (Van Gisson X 400)
Fig. (8) shows: the areas of hemorrhage (#) in between the proximal (P) and distal (D) convoluted tubules of the kidney of albino rat receiving pure allopurinol preparation. (Van Gisson X 400)
Fig. (9) shows: ascending loop of Henle (H1) lined by squamous epithelium and descending loop (H2) lined by columnar epithelium of control albino rat kidney. (Hx&E X 400)

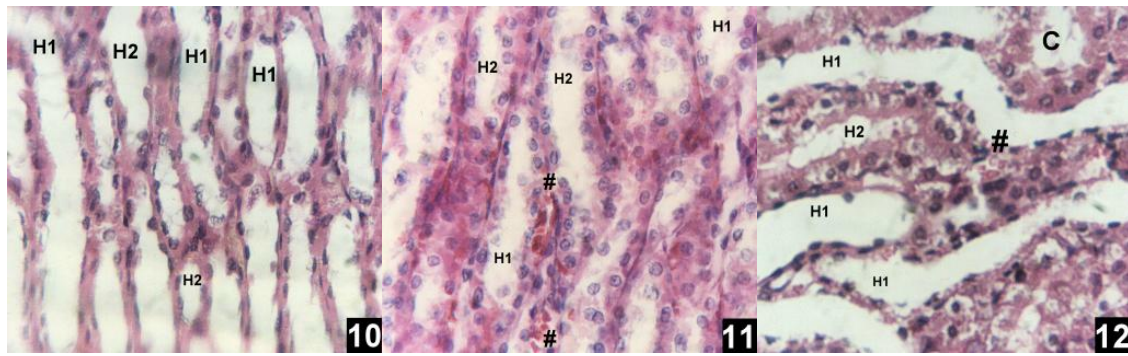


Fig. (10) shows: the ascending loop of Henle (H1) and the descending loop (H2) of albino rat kidney receiving sustained release microcapsule preparation. (Hx&E X 400)
Fig. (11) shows: ascending loop of Henle (H1), descending loop (H2) and areas of hemorrhage (#) in between of albino rat kidney receiving no-uric preparation. (Hx&E X 400)
Fig. (12) shows: the ascending loop of Henle (H1), the descending loop (H2) and areas of hemorrhage (#) in albino rat kidney receiving pure allopurinol preparation. (Hx&E X 400)

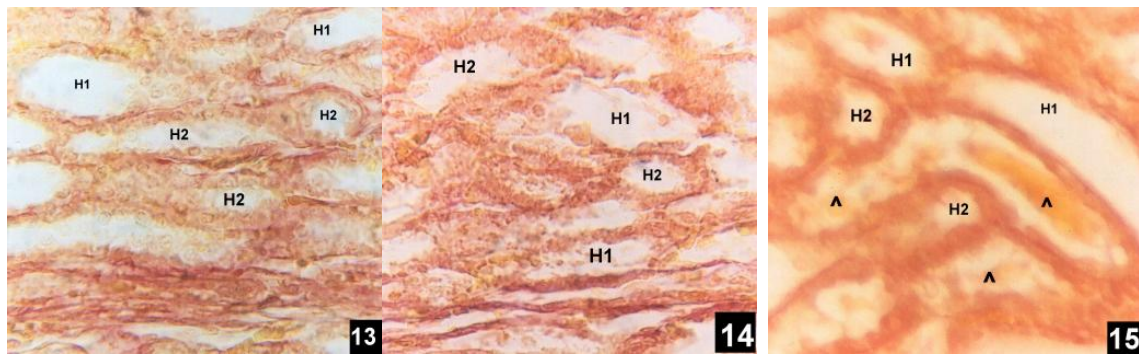


Fig. (13) shows the ascending loop of Henle (H1) and the descending loop (H2) of control albino rat kidney. (Van Gisson X 400)
Fig. (14) shows: the ascending loop of Henle (H1) and the descending loop (H2) of albino rat kidney receiving sustained release microcapsule preparation. (Van Gisson X 400)
Fig. (15) shows: collections (^) inside the ascending (H1) and the descending loop (H2) of albino rat kidney receiving no-uric preparation. (Van Gisson X 400)

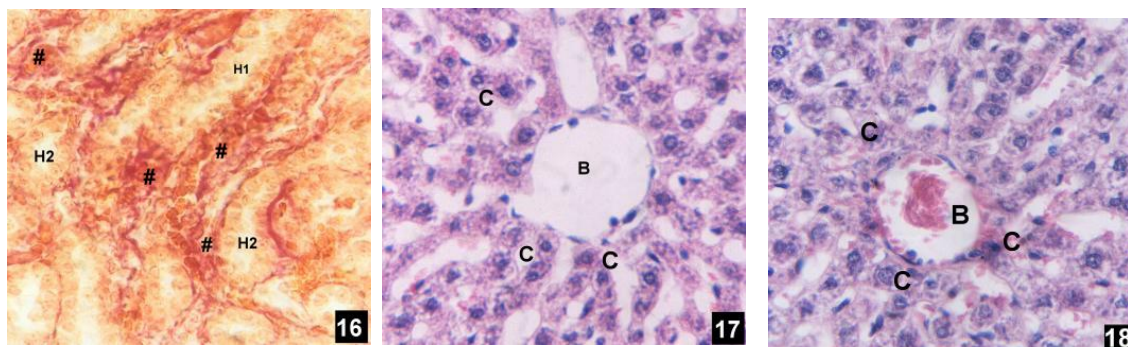


Fig. (16) shows: areas of hemorrhage (#) in between the ascending loop of Henle (H1) and the descending loop (H2) of albino rat kidney receiving pure allopurinol preparation. (Van Gisson X 400)
Fig. (17) shows: central vein (B) surrounded by liver cell cords (C) in part of hepatic lobule of control albino rat liver. (Hx&E X 400)
Fig. (18) shows: central vein (B) surrounded by healthy liver cell cords (C) in part of hepatic lobule of albino rat liver receiving sustained release microcapsule preparation. (Hx&E X 400)

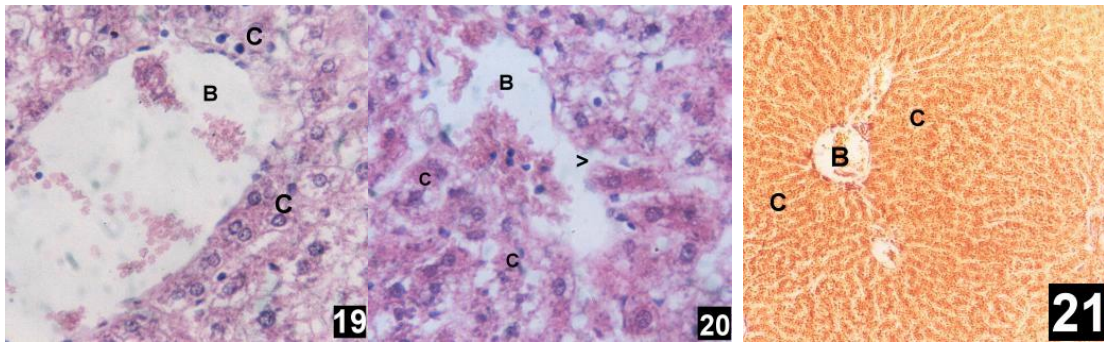


Fig. (19) shows: dilated central vein (B) lined by interrupted endothelium, areas of hemorrhage between the disrupted liver cell cords (C) in part of hepatic lobule of albino rat liver receiving no-uric preparation. (Hx&E X 400)

Fig. (20) shows: areas of hemorrhage between the disrupted liver cell cords (C) and dilated central vein (B) lined by interrupted endothelium (>) in part of hepatic lobule of albino rat liver receiving pure allopurinol preparation. (Hx&E X 400)

Fig. (21) shows: central vein (B) surrounded by healthy liver cell cords (C) in part of hepatic lobule of control albino rat liver. (Van Gisson X 100)

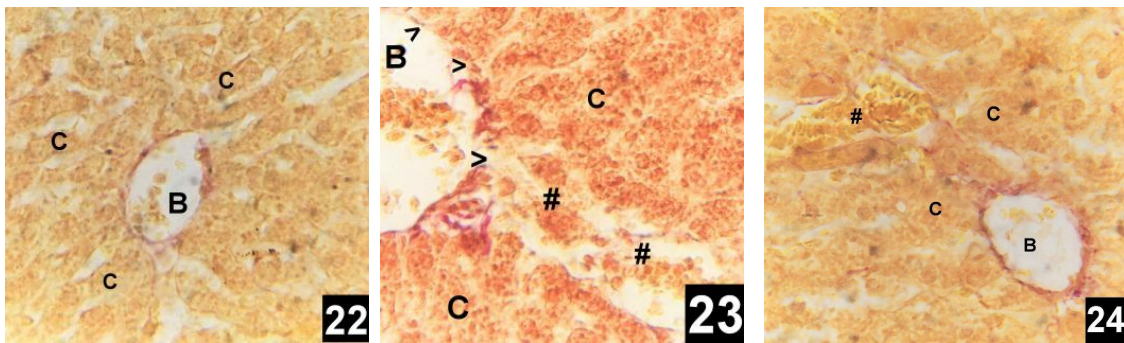


Fig. (22) shows: central vein (B) surrounded by healthy liver cell cords (C) in part of hepatic lobule of albino rat liver receiving sustained release microcapsule preparation. (Van Gisson X 400)

Fig. (23) shows: central vein (B), areas of hemorrhage (#) between the disrupted liver cell cords (C) in part of hepatic lobule of albino rat liver receiving no-uric preparation. (Van Gisson X 400)

Fig. (24) shows: central vein (B) with interrupted endothelium and disrupted cords (C) in part of hepatic lobule of albino rat liver receiving pure allopurinol preparation. (Van Gisson X 400).

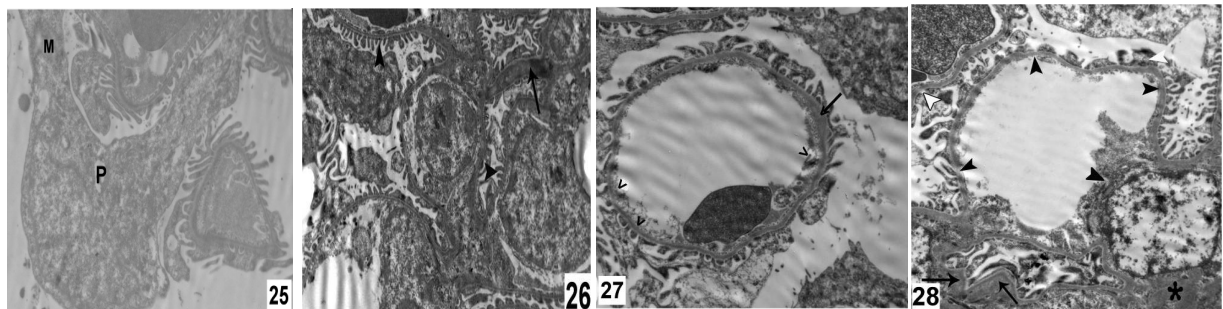


Fig. (25): an electron micrograph of the cell body of the podocyte (P) of the renal glomerular capillary and its major process (M) of control albino rat kidney. (Uranyl acetate and lead citrate X 5800)

Fig. (26):- An electron micrograph of the renal glomerular capillary of rat received microcapsular preparation showing an area of partial thickening of the basement membrane (arrow) and regular minor processes of podocytes (arrow heads). (Uranyl acetate and lead citrate X 4800)

Fig. (27):- An electron micrograph of the renal glomerular capillary of rat received no-uric preparation showing partial thickening of the basement membrane (arrow) and disrupted capillary endothelium (>). (Uranyl acetate and lead citrate X 7200)

Fig. (28):- An electron micrograph of the renal glomerular capillary of rat received pure allopurinol preparation showing partial thickening of the basement membrane (arrow), disrupted capillary endothelium (black arrow heads) and irregular minor processes of podocytes (white arrow heads). The asterisk (*) points to an area of sclerosis. (Uranyl acetate and lead citrate X 7200)

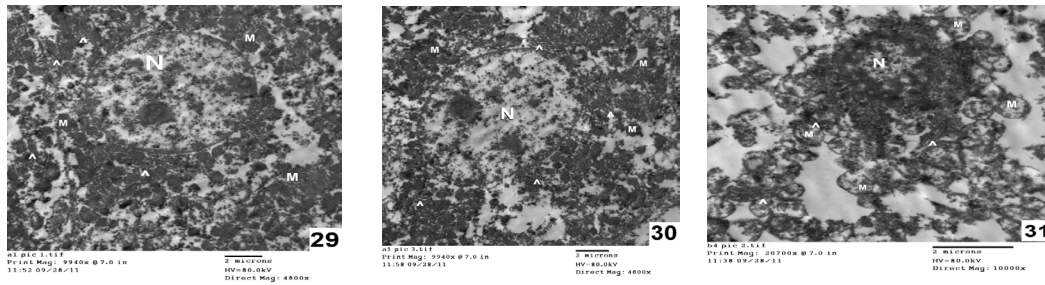


Fig. (29):- An electron micrograph of the proximal convoluted tubule cell of control albino rat kidney shows the open-face nucleus (N) with well defined nuclear membrane and basement membrane (B). The cytoplasm contains large number of normal mitochondria (arrow) and regular microvilli (M). (Uranyl acetate and lead citrate X 4800)

Fig. (30):- An electron micrograph of the proximal convoluted tubule cell of rat received microcapsular preparation showing rounded nucleus (N) with abundant nuclear sap and well defined nuclear membrane. The cytoplasm contains large number of elongated mitochondria (arrow) and regular apical microvilli (M). (Uranyl acetate and lead citrate X 4800)

Fig. (31):- An electron micrograph of the proximal convoluted tubule cell of rat received no-uric preparation showing rounded nucleus (N) with abundant nuclear sap and well defined nuclear membrane. The cytoplasm contains large number of bizarre shaped mitochondria (arrow), wide cytoplasmic spaces (*), electron dense bodies (-) and partial loss of apical microvilli (M). (Uranyl acetate and lead citrate X 4800)

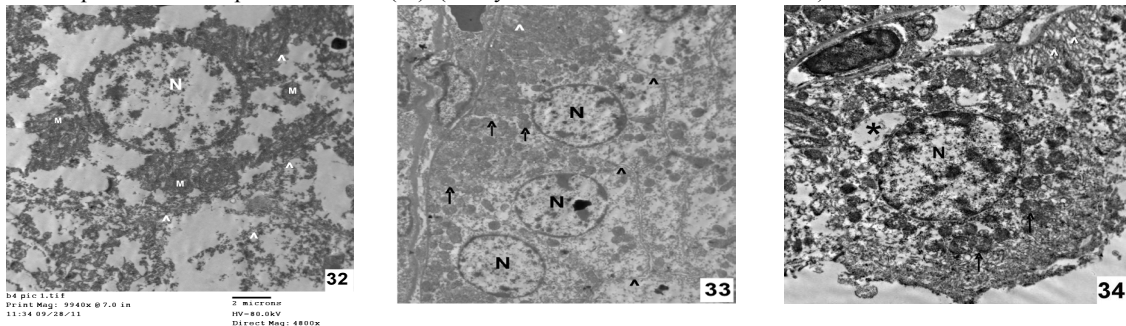


Fig. (32):- An electron micrograph of the proximal convoluted tubule cell of rat received pure allopurinol preparation showing rounded small nucleus (N) with abundant nuclear sap and well defined nuclear membrane. The cytoplasm contains large number of bizarre shaped mitochondria (arrow), wide cytoplasmic spaces (*), secondary lysosomes (^) and partial loss of apical microvilli (M). (Uranyl acetate and lead citrate X 7200)

Fig. (33):- An electron micrograph of the cell lining of the distal convoluted tubule of control albino rat kidney shows rounded nucleus (N) with well defined nuclear membrane and abundant nuclear sap. The cell border is well defined (black arrow heads). The cytoplasm contains regular mitochondria (arrow) inside regular basal infolding (white arrow heads). (Uranyl acetate and lead citrate X 2900)

Fig. (34):- An electron micrograph of the cell lining of the distal convoluted tubule of rat received microcapsular preparation showing rounded nucleus (N) with well defined nuclear membrane and abundant nuclear sap. The cytoplasm contains normal mitochondria (arrow) inside regular basal infolding (white arrow heads) and cytoplasmic spaces (*). (Uranyl acetate and lead citrate X 7200)

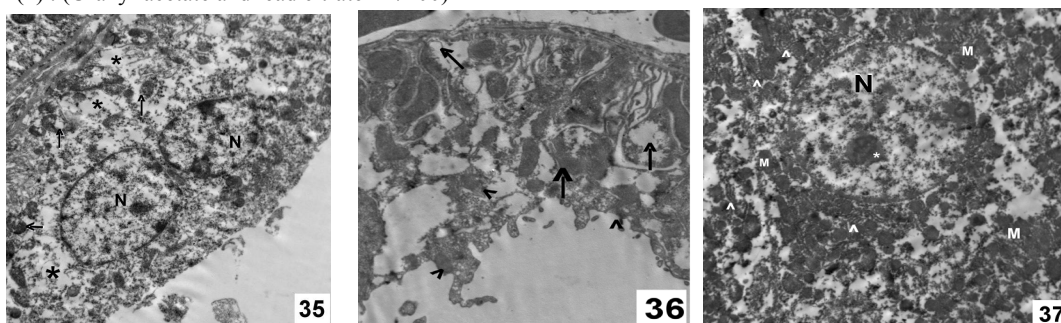


Fig. (35):- An electron micrograph of the distal convoluted tubule cell of rat received no-uric preparation showing nucleus (N) with abundant nuclear sap. The cytoplasm contains damaged mitochondria (arrow) and cytoplasmic spaces (*). (Uranyl acetate and lead citrate X 7200)

Fig. (36):- An electron micrograph of the distal convoluted tubule cell of rat received pure allopurinol preparation showing swollen degenerated mitochondria (arrow) and luminal cytoplasmic debris (arrow heads). (Uranyl acetate and lead citrate X 4800)

Fig. (37):- An electron micrograph of hepatocyte of control albino rat liver. the nucleus (N) with prominent eccentric nucleolus (*) and well defined nuclear membrane. The cytoplasm contains large number of normal mitochondria (M), free ribosomes and rough endoplasmic reticulum (^). (Uranyl acetate and lead citrate X 4800)

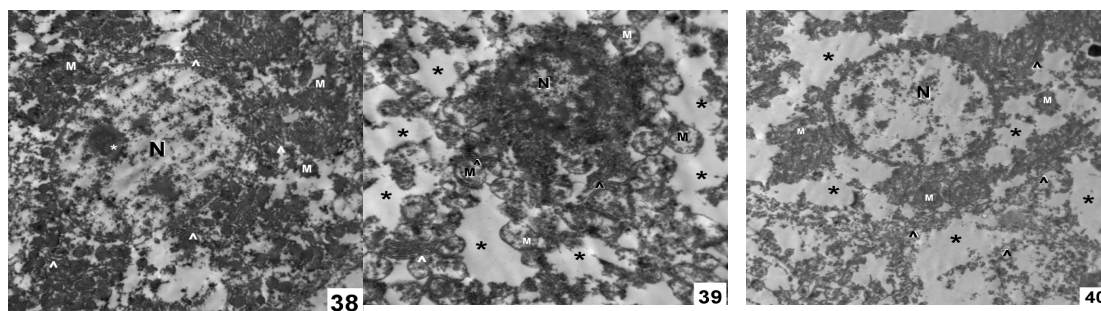


Fig. (38):- An electron micrograph of hepatocyte of albino rat liver receiving sustained release microcapsules preparation of allopurinol. The nucleus (N) with prominent eccentric nucleolus (*) and well defined nuclear membrane. The cytoplasm contains large number of normal mitochondria (M), free ribosomes and rough endoplasmic reticulum (^). (Uranyl acetate and lead citrate X 4800)

Fig. (39):- An electron micrograph of hepatocyte of albino rat liver receiving no-uric preparation of allopurinol. the nucleus (N) is shrunken with clumping of the chromatin on the inner nuclear membrane. The cytoplasm contains little amount of degenerated mitochondria (M), wide cytoplasmic spaces (*) and little rough endoplasmic reticulum (^). (Uranyl acetate and lead citrate X 10000)

Fig. (40):- An electron micrograph of hepatocyte of albino rat liver receiving pure allopurinol. the nucleus (N) is shrunken devoid of nucleolus. The cytoplasm contains little amount of degenerated mitochondria (M), little rough endoplasmic reticulum (^) and wide cytoplasmic spaces (*). (Uranyl acetate and lead citrate X 4800)

4. Discussion

The present study was conducted on adult male albino rats. Males have been chosen in this study to avoid the hormonal changes, which may be faced in females and may affect the results (Hamada, 1979; Messow *et al.*, 1980 and Yabuki *et al.*, 1999).

Liver and kidney have been chosen in this study because they are target organs for drug toxicity (Nakatani *et al.*, 2000 and Saraste and Pulkki, 2000).

The liver is a specialized organ in terms of its metabolic, synthetic and detoxifying function (Nakatani *et al.*, 2000 and Saraste & Pulkki, 2000). Liver and kidney are the primary target for a variety of noxious agents inducing inflammation, necrosis and fibrosis (Meki *et al.*, 2001; Yabuki *et al.*, 2003 and Ishibashi *et al.*, 2006).

Side effects of allopurinol in the present study are more pronounced in the kidney and liver of pure allopurinol treated rats and to a less extent in the kidney and liver of no-uric treated rats. The glomeruli of the rats received no-uric and pure allopurinol show significant reduction in their size on comparing to the control rats and also show significant dilatation of their glomerular space. More over significant reduction in epithelial thickness of proximal convoluted tubules with areas of hemorrhage in between them also recorded. George *et al.* 2006 showed that a steep dose-response relationship exists between allopurinol and its effects on endothelial dysfunction in patients with chronic heart failure. High-dose allopurinol will result in high plasma concentration of the drug and so more side effects. The slowly released microcapsular preparation maintain a suitable level of the drug for a long

period of time so minimize the side effects (El-Gibaly and Abdel-Gaphar, 2005).

The liver in the present study showed areas of hemorrhage between the hepatic cords. These findings are in accordance with that reported by Tam and Carroll (1989), El-Gibaly and Abdel-Gaphar (2005) and Fagugli *et al.* (2008) and Lindh (2009). Tam and Carroll (1989) through autopsy reported fatal allopurinol hepatic toxicity in human in the form of central necrosis. El-Gibaly and Abdel-Gaphar (2005) and Pereira *et al.* (1998) reported that free allopurinol-treated rats showed marked hydropic degeneration of the hepatocytes at the periphery of the hepatic lobules. Besides, the hepatocytes in the center of the lobules underwent necrotic changes.

In this study allopurinol sustained release capsular formula shows the least significant side effects compared with the control group both on the kidney and liver. These findings are similar to that reported on the liver by El-Gibaly and Abdel-Gaphar (2005). They found that the liver of sustained release formula group was more or less normal.

As mentioned before the liver of microcapsule group is more or less normal. These findings considered by El-Gibaly and Abdel-Gaphar (2005) due to the modification in the dissolution rate of allopurinol and also control of the *in vivo* release by microcapsule preparation, so that prolonged absorption properties with a lower allopurinol concentration are maintained in blood over a long time. This may result in increasing the antigout efficiency of allopurinol and minimizing its dangerous effects on liver and other organs.

It is known that the pattern of release of active agent from microparticles depends on the particle size of the core material (Gence *et al.*, 1998). Higher

burst release and release rate constants from this preparation were thus expected due to larger surface area and the decreased diffusion path length and wall thickness of the preparation (El-Gibaly and Abdel-Gaphar, 2005). The spherical matrix model for a heterogenous matrix can best be used to describe the overall release pattern of a dissolved drug from a spherical microcapsule form (Lewis *et al.*, 1998).

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5. References

- Adeyeye CM and Price JC (1994):** Development and evaluation of sustained release ibuprofen-wax microspheres. I. Effect of formulation variables on physical characteristics. *Pharm. Res.* 8: 1377-1383.
- Aldaba-Muruato LR, Moreno MG, Shibayama M, Tsutsumi V and Muriel P(2012):** Protective effects of allopurinol against acute liver damage and cirrhosis induced by carbon tetrachloride: Modulation of NF- κ B, cytokine production and oxidative stress. *Biochimica et Biophysica Acta* 1820: 65–75
- Arabi R, Hashemi SA and Fooladi M (1996):** Microcapsulation of allopurinol by solvent evaporation and controlled release investigation of drugs. *J. Microencapsul.* 13: 527-535.
- Arshady R (1989):** Microspheres and microcapsules: a survey of manufacturing techniques. Part I: suspension crosslinking. *Polym. Eng. Sci.* 29: 1746-1758.
- Bancroft JD and Stevens A (1982):** Theory and practice of histologic technique, 2nd ed. Churchill Livingstone, UK.
- Biagioni E, Busani S, Rinaldi L, Marietta M, Girardis M (2012):** Acute renal failure and liver necrosis associated to allopurinol therapy. *Anaesth Intensive Care.* Jan;40(1):190-1.
- Bodmeier R, Wang J and Bhagwatwar H (1992):** Process and formulation variables in the preparation of wax microparticles by a melt dispersion technique. I. Oil-in-water technique for water-insoluble drugs. *J. Microcapsul.* 9: 89-98.
- Dawson J, Quinn T, Harrow C, Lees KR, Weir CJ, Cleland SJ and Walters MR (2009):** Allopurinol and nitric oxide activity in the cerebral circulation of those with diabetes: a randomized trial, *Diabetes Care*, 32: 135–137.
- Deasy PB (1984):** Microcapsulation and related drug processes. Marcel and Dekker, New York.
- Drury RAB and Willington EA (1980):** "Carleton's Histological Technique". 5th ed., Oxford University, Press New York Toronto.
- El-Gibaly I, (1998):** Microcapsulation of allopurinol using a fully improved non-solvent addition technique a novel binary blend based on polyvinyl chloride: factorial design application. *Pharm. Sci., Assiut Univ.*, 21: 203-228.
- El-Gibaly I, Meki AMA and Abdel-Ghaffar SK (2003):** Novel B melatonin-loaded chitosan microcapsulation: in vitro characterization and antiapoptosis efficacy for aflatoxin B1-induced apoptosis in rat liver. *Int. J. Pharm.* 260: 5-22.
- El-Gibaly I and Abdel-Ghaffar SK (2005):** Effect of hexacosanol on the characteristics novel sustained released allopurinol solid lipospheres (SLS): factorial design application and product evaluation. *Int. J. Pharm.* 294: 33-51.
- Fagugli RM, Gentile G, Ferrara G and Brugnano R (2008):** Acute renal and hepatic failure associated with allopurinol treatment. *Clin Nephrol.* Dec;70(6):523-6.
- Gence L, Demirel MGuler E and Hegazy N (1998):** Microcapsulation of ketorolac tromethamine by means of a coacervation-phase separation technique induced by the addition of non-solvent. *J. Microcapsul.* 15: 45-53.
- George J, Carr E, Davies J, Belch JJ and Struthers A (2006):** High dose allopurinol improves endothelial function by profoundly reducing vascular oxidative stress and not by lowering uric acid. *Circulation*;114:2508-16.
- Glantzounis GK, Tsimoyiannis EC, Kappas AM and Galaris DA (2005):** Uric acid and oxidative stress. *Curr Pharm Des*;11:4145-51.
- Giannola LI, De Caro V and Rizzo MV (1995):** Preparation of white beeswax microspheres loaded with valproic acid and kinetic study of drug release. *Drug Dev. Ind. Pharm.* 21: 793-807.
- Griffith L. D.; Bulger R. E. and Trump B. F. (1973):** Light and Electron Microscopic studies of rat kidney. *Springer link Beta*, 13:321-340.
- Hamada, Y (1979):** Sex difference and fine structure on the epithelium cells of Glomerular capsule in mice. *Exp. Anim. (Tokyo)* 28: 485-490.
- Horiuchi H, Ota M, Nishimura S, Kaneko H, Kasahara Y, Ohta T and Komoriya K (2000):** allopurinol induces renal toxicity by impairing pyrimidine metabolism in mice. *Life Sciences*, Vol. 66, NO.(21):, p 2051-2070
- Ishibashi H, Nakamura M, Komori A, Migita K, Shimoda S (2009):** Liver architecture, cell function, and disease, *Semin. Immunopathol.* 31: 399–409.

- Krishnan E, Pandya BJ, Chung L and Dabbous O (2011):** Hyperuricemia and the risk for subclinical coronary atherosclerosis-data from a prospective observational cohort study. *Arthritis Res Ther.*;13:R66.
- Lewis L, Boni R and Adeyeye CM (1998):** Effect of emulsifier blend on the characteristics of sustained release diclofenac microspheres. *J. Microcapsul.* 15: 283-298.
- Lindh J (2009):** Hepatic adverse effects of allopurinol. *Lakartidningen*, Sep 16-22;106(38):2374-5.
- Lippi G, Montagnana M, Franchini M, Favaloro EJ and Targher G (2008):** The paradoxical relationship between serum uric acid and cardiovascular disease. *Clin Chim Acta*;392:1-7.
- Liu PG, He SQ, Zhang YH and Wu J (2008):** Protective effects of apocynin and allopurinol on ischemia/reperfusion-induced liver injury in mice. *World J Gastroenterol*, May 14; 14(18): 2832-2837.
- Martindale (1999):** In Parfitt, K (Ed), *The Complete Drug Reference*, 32nd ed. The Pharmaceutical Press, London, pp. 390-392: 114-1377.
- Meki AMA, Abdel-Ghaffar SK and Elgibaly I (2001):** Aflatoxin B1 induces Apoptosis in rat liver: Protective effect of melatonin. *Neuroendocrinology Letters*; 22: 417-426.
- Messow C, Gartner K, Hackbarth H, Kangaloo M and Lunebrink L (1980):** Sex differences in kidney morphology and glomerular filtration rate in mice. *Contr. Nephrol.* 19: 51-55.
- Nakatani T, Tawaramato M, Kennedy DO, Kojima A and Mastui-Yuasa I (2000):** Apoptosis induced by chelation of intracellular zinc is associated with depletion of cellular glutathione level in rat hepatocytes. *Chem. Bio. Interact.*: 125 151-163.
- Neogi T, Terkeltaub R, Ellison RC, Hunt S and Zhang Y (2011):** Serum urate is not associated with coronary artery calcification: the NHLBI Family Heart Study. *J Rheumatol*; 38:111-7.
- Pereira S, Almeida J, Silva AO, Quintas M, Candeias O, Freitas F (1998):** Fatal liver necrosis due to allopurinol. *Acta Med Port.* Dec;11(12):1141-4.
- Puddu P, Puddu GM, Cravero E, Vizioli L and Muscari A (2012):** The relationships among hyperuricemia, endothelial dysfunction, and cardiovascular diseases: Molecular mechanisms and clinical implications. *Journal of Cardiology*, 59: 235-242
- Saraste A and Pulkki K (2000):** Morphologic and biochemical hallmark of apoptosis. *Cardvascul. Res.*, 45: 528-537.
- Spiegl P and Abd-El-Fatah S (1977):** Prolonged release microcapsules of allopurinol. *Sci. Pharm.*, 45: 185-190.
- Stocker R and Keaney Jr JF (2004):** Role of oxidative modifications in atherosclerosis. *Physiol Rev.*;84:1381-478.
- Tam S and Carroll W (1989):** Allopurinol hepatotoxicity. *Am. J. Med.* 86: 357-358.
- Tausche AK, Aringer M, Schroeder HE, Bornstein SR, Wunderlich C and Wozel G (2008):** The Janus faces of allopurinol-allopurinol hypersensitivity syndrome. *Am J Med. Mar*;121(3):e3-4.
- Teo WL, Pang SM and Koh HY (2011):** Allopurinol hypersensitivity syndrome with acute generalized exanthematous pustulosis manifestations. *Cutan Ocul Toxicol. Sep*;30(3):243-4.
- Uddin Ms Hawlader MNA and Zhu HJ (2001):** Microcapsulation of ascorbic acid: effect of process variables on product characteristics. *J. Microcapsul.* 18, 199-209.
- Viazzi F, Leoncini G, Ratto E and Pontremoli R (2006):** Serum uric acid as a risk factor for cardiovascular and renal disease: an old controversy revived. *J Clin Hypertens (Greenwich)*;8:510-8.
- Vilivalam VD and Adeyeye CM (1994):** Development and evaluation of controlled-release diclofenac microsphere and tableted microspheres. *J. Microencapsul.* 11, 455-470.
- Woo-Yong Lee, Eun-Ji Koh, Sun-Mee Lee (2012):** A combination of ischemic preconditioning and allopurinol protects against ischemic injury through a nitric oxide-dependent mechanism *Nitric Oxide*, 26 : 1-8.
- Yabuki A, Suzuki S, Matsumoto M and Nishinakagawa H (1999):** Morphological analysis of sex and strain differences in the mouse nephron. *J. Vet. Med. Sci.* 61 (8): 891-896.
- Yabuki A, Matsumoto M, Nishinakagawa H and Suzuki S (2003):** Age-related morphological changes in kidneys of SPF C57BL/6Cr mice maintained under controlled conditions. *J. Vet. Med. Sci.* 65 (8): 845-851.

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Numerical Simulation to Get Flow Pattern in Modified Carotid Artery Bifurcation Model Using PIV

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Abstract: The aim of this paper was to describe the local flow pattern of carotid bifurcation model using instantaneous velocity fields acquired by particle image velocimetry (PIV) and numerical simulation. Solid modified tuning-fork averaged human carotid bifurcation (TF-AHCB) carotid bifurcation glass model was attached to a circuit driven by different static pressure gradient which produced different velocity. The working fluid consisted of glycerin and water mixture with a viscosity of 3.75mPa. s. Hollow glass spheres with a mean size of 10 μ m were used as tracer particles. Instantaneous velocity fields were obtained by means of PIV and shear stresses were calculated according to the velocity parameters. The same parameters were used for numerical simulation to get the velocity fields and wall shear stress distribution. The results showed that both by PIV and numerical simulation, a large flow separation with an anticlockwise rotating vortex formed at the outside wall of internal carotid artery (ICA) inside the model. The location and scope of the vortex changed with the velocity. The higher the velocity was, the smaller the vortex scope was, and the further the location to the bifurcation was. The flow pattern inside the model consists of large flow separation and anticlockwise vortex zones, the center of which locates near the sinus of ICA and are thought to be associated with the genesis of atherosclerosis.

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Keywords: Numerical simulation; particle image velocimetry (PIV); carotid bifurcation; atherosclerosis

1. Introduction

Nowadays, within the in vitro model study, the carotid artery bifurcation model was one of the most generally used in researching atherosclerosis. The Y shaped averaged human carotid bifurcation had been usually used (Ku et al., 1985; Lee and Chiu, 1995; Rindt and Steenhoven, 1996). Later, Ding et al (2001; 2002) proposed a tuning-fork averaged human carotid bifurcation (TF-AHCB) model. Their study confirmed the stronger correlation between the OSI and intimal thickness in the tuning-fork geometry of human carotid bifurcation. On the basis of TF-AHCB model, Yu et al (2007) modified the parameters to make it more similar to the real geometry.

The PIV technique was a new flow measuring technique which could record all of the relevant information in the whole working section. And it was suitable for the study of complicated flow such as vortex flow and turbulent flow. In this research the time-saving technique-PIV was used to measure the flow fields inside the model. At the same time we use the CAD technique to research the flow fields within the model by numerical simulation as the supplement of PIV research.

2. Material and Methods

The diameter and geometry carotid bifurcation model were listed in Figure1. Its geometry has such requests: The ICA, ECA and CCA are in the same section; The internal carotid artery is straight at least with double lengths of the sinus; All of the cross-sections including the sinus were round; The ICA curves from the end of the sinus, and paralleled with ECA; The bifurcation angle was 45°.

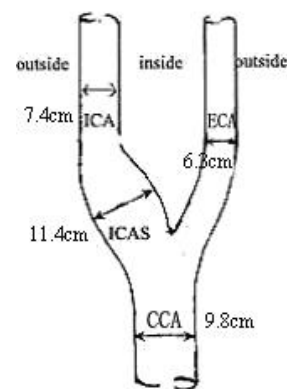


Figure 1. The geometry of the modified TF-AHCB model

The instrument of the circulating was shown in Figure2. The flow velocity was controlled by regulating the water level of the upstream reservoir. The mixture in the downstream reservoir returned into the upstream reservoir with the help of a centrifugal pump. The flow rate was measured by means of an ultrasound flow meter (T206, Transonic Systems, Ithaca, USA).

A solution containing about 35% glycerine (Sigma, USA) and 65% water was used to provide a fluid with a viscosity comparable to blood. The resulting viscosity was measured by means of a capillary viscosimeter (Cavis, Raczek, Wedemark, Germany) and the mixture adapted to yield a viscosity of 3.5mPa.s. Hollow glass spheres with a mean size of 10 μm (Sphericel, Potters Industries, Parsippany, USA) were used as tracer particles and seeded into the fluid. A circulating heating pump was inserted into the fluid reservoir to ensure uniform distribution of the glass spheres at a temperature of 37°C.

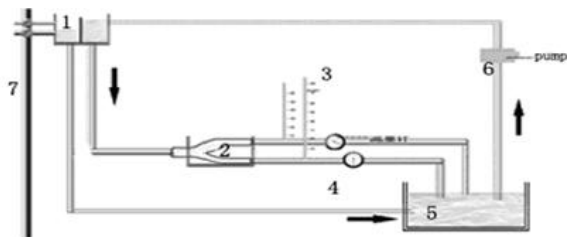


Figure 2. the schematic diagram of the vascular model recirculation system

1.upstream reservoir, 2. carotid bifurcation model, 3. manometer, 4. flow meter 5. downstream reservoir, 6. centrifugal pump, 7. slide pole

The PIV measurements were taken at five different flow rates which were shown in Table1. These five different work conditions were in behalf of the low velocity, mean velocity, peak velocity in the internal carotid artery and two high velocities for control study.

Table 1.The basic hydrodynamic parameters in five work condition

work condition	flow rate (ml/s)	mean velocity (m/s)
1	38.15	0.355
2	60.62	0.559
3	90.16	0.839
4	155.93	1.451
5	259.20	2.412

2.1 Particle image velocimetry

The PIV technique allows the instantaneous capture of an entire flow fields (Yu et al., 2007). A double pulsed Nd:Yag laser (NewWave, GeMini Y120-15,USA) with an energy of 50 mJ at a repetition rate of 15 Hz was used for illumination of a light sheet which was directed into the centerline of the fluid flow. The motion of the seeded particles was recorded twice by means of a CCD-Camera (TSI PowerView™ 4M, 630049-2, USA), which was positioned normal to the laser sheet. The time shift between the image acquisitions was 800 ms. The displacement of the particles between the two recorded images was directly proportional to the local fluid velocity. The images were analyzed using a cross-correlation algorithm yielding the local displacement vector for each interrogation area. In a frame-by-frame analysis the PIV measurements were obtained continuously, 200 frames were captured in each flow rate. The individual recordings were eventually used to reconstruct the flow field.

2.2 Numerical simulation

2.2.1 carotid bifurcation model

Gambit 2.0 software was used to create a geometric model and divide the grid. Altogether obtains non-structure hexahedron grid 51880. The experimental geometry of the model was shown in Figure3. The bifurcation angle is 45°.

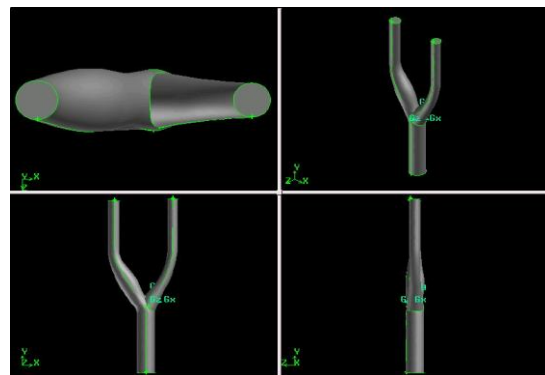


Figure 3. The numerical model of the carotid bifurcation

2.2.2 Controlling equations and calculation method

Suppose blood is isotropic, incompressible Newtonian fluid with constant density and viscosity, and assume that the vessel wall is rigid, impermeable, and the flow is unsteady. Excluding the volume force, heat exchange, and the other physical and chemical factors, the basic equations are:

$$\left\{ \begin{array}{l} \frac{\partial u_j}{\partial x_j} = 0 \\ \rho \frac{\partial u_j u_i}{\partial x_j} = -\frac{\partial P}{\partial x_i} + \mu \frac{\partial}{\partial x_j} \left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i} \right) \end{array} \right.$$

The first one is the continuity equation, and the second is the equation of motion. u_i : flow field velocity, P : fluid pressure, ρ : fluid density, μ :viscosity.

Because of the basic equations are a set of strongly non-linear equations, we can only resort to the numerical methods. Finite Volume Method (FVM) is the main numerical method for solving such problems. FLUENT calculation software is the dedicated CFD software which is based on the finite volume method. Therefore, we choose the FLUENT6.1 software for numerical calculation.

2.2.3 Boundary Conditions

Using the speed entry and pressure exit as boundary condition ; inlet velocity $u_{in}=Q/A$;

using non-slip flow boundary condition, the velocity components is zero. In the internal carotid and external carotid artery, the outlet pressures are zero. Solid wall boundary: the wall function.

2.2.4 Nine section to calculate the velocity

In the ICA, we divide it into nine sections evenly to show the velocity profile more elaborate, and to show the difference in different position within the ICA in different work condition.

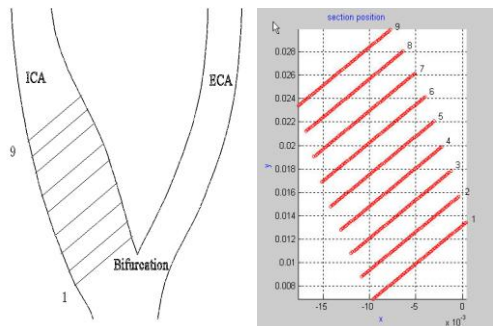


Figure 4. The nine sections for calculating the velocity in ICA.

3. Results

3.1. Velocity distribution in the horizontal section of internal carotid artery

The flow visualization revealed a high-velocity mainstream entering the ICA center, which divided and directed towards the inside wall. In the ICA a large area of flow separation developed near the outside wall. Inside this separation one anticlockwise

flowing vortex developed in work condition 1, 2 and 3. The location and scope of the vortex changed with the velocity. The higher the velocity was, the smaller the vortex scope was, and the farther the location to the bifurcation was. These phenomena were not significant in work condition 4 and 5. In work condition 1, the flow rate in boundary of the vortex was 0.0566 ± 0.0121 m/s; the flow rate in the middle of the flow separation was 0.1896 ± 0.0132 m/s. In work condition 2, the flow rate in boundary of the vortex was 0.0954 ± 0.0271 m/s; the flow rate in the middle of the flow separation was 0.2254 ± 0.0715 m/s. In work condition3, the flow rate in boundary of the vortex was 0.1285 ± 0.0369 m/s; the flow rate in the middle of the flow separation was 0.2507 ± 0.0429 m/s. All the velocities were lower than the main stream velocity. And according to the equation

$\tau = \rho \overline{u'_i v'_j}$, we could know that in the outside wall of ICA where there were the vortex. The shear stress was low compared to the other zones.

3.2 Velocity distribution in ICA by numerical simulation

The numerical simulation also found there was one anticlockwise vortex, from section 1 to section 7 it became larger and larger. But in the same section, the largest vortex existed in workcondition1, 2 and 3. In the controlled high flow rate (work condition 4 and 5), although there was the vortex, its scope was smaller compared with the other work conditions. In the section 1, 2 and 3, the fastest velocity of the anticlockwise vortex was almost zero in work condition 1, 2 and 3; but in work condition 4 and 5, the velocity reached to 1m/s. In section 4, 5 and 6, although the scope of the vortex was lager, the velocity was smaller compared with section1, 2 and 3, that show which was just the core of the vortex. The largest anticlockwise vortex appeared in section 6, and that just the center of the sinus of the internal carotid artery. Between the anticlockwise vortex and mainstream that was where the flow separation was. Its location also changed with the flow rate, when the flow rate increased its location became farther and farther to the outside wall. But in section 8 and 9, this separation disappeared.

From these graphs, we could find that at the border of the anticlockwise vortex, the velocity was less than 0.5m/s in work condition1, 2 and 3. Even in work conditon4 and 5, the velocity was less than 1m/s. And we could conclude the wall shear stress in this zone was low.

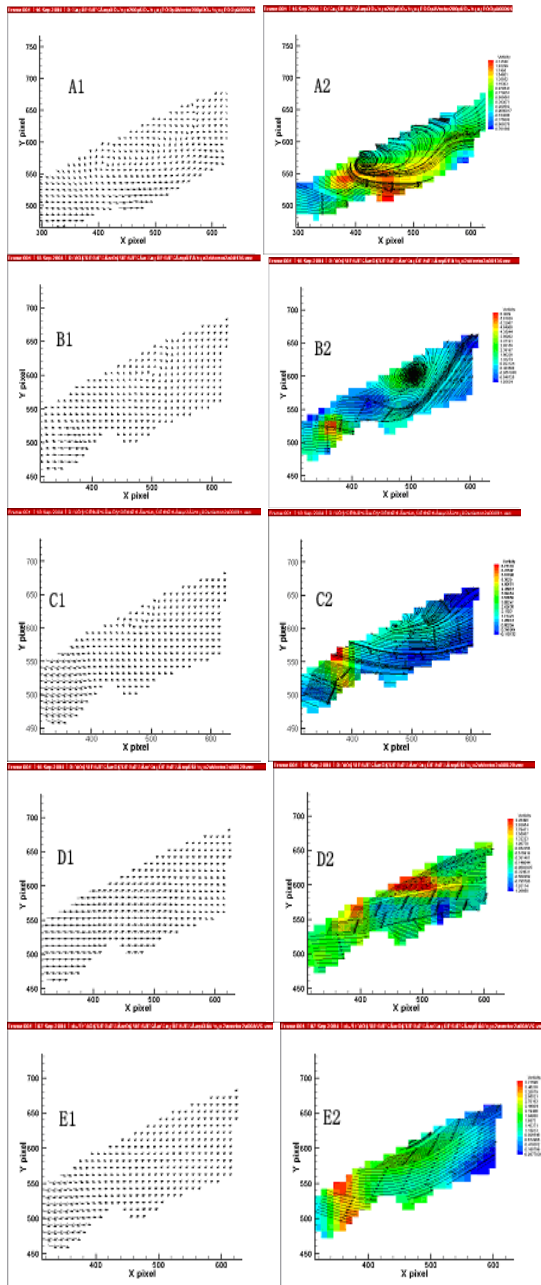


Figure 5. the velocity vectorgram and the vorticity map of horizontal section. (A1,A2)workcondition1;(B1,B2)workcondition2;(C1, C2)workcondition3; A separation was found in ICA and a significant anticlockwise rotating vortex was found near the outside wall of ICA. (D1,D2)workcondition4; (E1,E2)workcondition5. There was no flow separation and vortex.

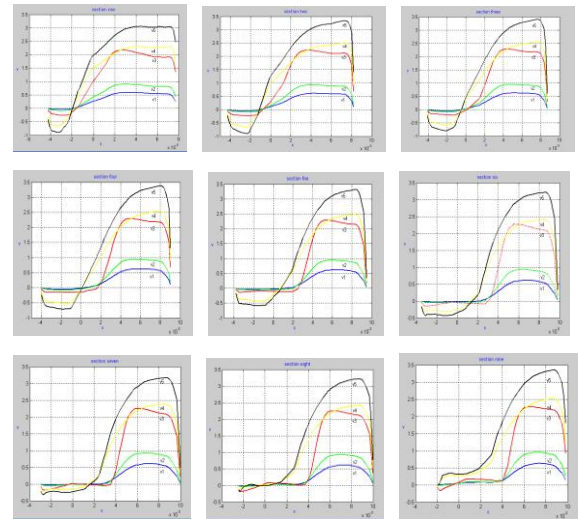


Figure 6. The velocity profile in nine sections under five work conditions. v1-v5: work condition1-workcondition5. From section1 to section6, there were flow separation and anticlockwise vortex. In section6,section7 and section8, there were no flow separation.

4. Discussions

Now, the standard hydrodynamic measuring method was laser doppler anemometry detection. But its defections must be noticed. First, it used one-point measuring technique which was tedious to perform spatial localization. Second, it was hard to provide enough information to describe the flow fields entirely in practical work. Third, it was time-consuming(Baldwin et al.,1994; Barbaro et al.,1998). In 1990s, a new hydrodynamic measuring method-PIV was developed, which based on the association of laser signal and fluid particles. Its merit lied in it could get 2D-velocity of the whole section in one imaging. So it was time-saving and not so tedious. What most important was it made people understand the whole flow fields in detail.Because the panel and area of the PIV image was stable, the PIV technique could implement overall and high-precision describe in small flow fields(Stamhuis and Videler,1995). So, in this research, PIV was used to describe the flow fields inside the model.

Despite the PIV method is more practical and time-saving, but the instrument is very expensive. So we think whether we can choose the other method which can get the similar result with the PIV? The numerical methods are very useful in supporting experimental methods and often enable the determination of flow variables which are difficult to obtain in experiments. So we choose the CFD to do numerical simulation.

The results of PIV demonstrated the flow directions were same with the main stream in CCA and their values are almost equal which proved the flow pattern was stable. In ICA flow separation presented and a vortex flow formed near the lateral wall. The scope and location of the vortex changed with the flow rate. The higher the flow rate was, the smaller the area was and the farther the distance to the bifurcation was. At last, in work condition 4 and 5, the vortex flow disappeared. In carotid sinus, there was always where the core of the vortex was in all of the five conditions.

Also, the numerical simulation we found in section 4, 5 and 6, although the scope of the vortex was larger, the velocity was smaller compared with section 1, 2 and 3, that show which was the core of the vortex, that can be used to explain why the atherosclerosis is prone to form in the sinus of ICA.

But whether in PIV or in numerical simulation, the velocity at the border of the anticlockwise vortex was low, and the wall shear stress must be low. So we decide that in ICA, at the site anticlockwise vortex formed, the wall shear stress was low. And because the atherosclerosis was prone to generate in these zones, we could also think about the relationship between the low shear stress and atherosclerosis.

Clinical observation and animal experiment discovered that early atherosclerotic lesions develop preferentially at bifurcations, branch points, and regions of high curvature in the arterial tree (Suo et al., 2008). This has led to a "geometric risk factor" hypothesis implicating local hemodynamic factors in atherogenesis (Friedman et al., 1983; Koch et al., 2009). Studies have generally implicated low wall shear stress (WSS) in atherogenesis: low shear stress could induce the expression of adhesion molecules ICAM-1 (Tsuboi et al., 1995), VCAM-1 (Varner et al., 1997), E-selectin (Hinds et al., 2001). And low shear stress could stimulate the MCP-1 expression (Shyy et al., 1994), and manipulate the synthesis and secretion of nitrogen monoxide (Dancu et al., 2007; McAllister et al., 2000). Otherwise in such zones, large macromolecules such as LDL deposit on the surface of endothelium, which make it have a long contact period with the endothelial cell (Wang et al., 2003; Deng et al., 1995). Through several pathways the macromolecules aggregated under the endothelium and were swallowed by macrophage cells. This was the early stage mark of atherosclerosis. In the low shear stress areas of the carotid artery, under the influence of low shear stress, many biochemical factors were secreted and stimulated. Also some harmful macromolecules accumulated in these zones, which may lead to or accelerate the atherosclerosis development.

In this study, we used PIV technique and numerical simulation method to measure the flow fields inside the modified model. The results confirmed there were flow separation and vortex flow and low wall shear stress zones in the ICA. This study supports the hypothesis that low shear stress led to the generation of atherosclerosis. And the model we used could supply a reliable experiment platform for future cell biology and molecular biology research.

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References

1. Ku DN, Giddens DP, Zarins CK, et al. Pulsatile flow and atherosclerosis in the human carotid bifurcation. *Arteriosclerosis* 1985; 5(3):293-302.
2. Lee D, Chiu JJ. Intimal thickening under shear stress in a carotid bifurcation—a numerical study. *Journal of Biomechanics* 1995; 29(1):1-11.
3. Rindt CC, Steenhoven AA. Unsteady flow in a rigid 3-D model of the carotid bifurcation. *Journal of Biomechanical Engineering* 1996; 118(1):90-96.
4. Ding ZR, Wang KQ, Lia J, et al. Flow field and oscillatory shear stress in a tuning-fork-shaped model of the average human carotid bifurcation. *Journal of Biomechanics* 2001; 34:1555-1562.
5. Ding ZR, Wang KQ. Tuning-fork-shaped model of the average human carotid bifurcation. *Shanghai Jiao Tong University Journal* 2002; 36(1):97-99.
6. Yu FX, Liao B, Shi YK, et al. Construction of an in vivo carotid artery bifurcation model. *Journal of Sichuan University* 2007; 38(6):1029-1032.
7. Baldwin JT, Deutsch S, Geselowitz DB, et al. LDA measurements of mean velocity and Reynolds stress fields within an artificial heart ventricle. *J Biomech Eng* 1994; 116(2): 190-200.
8. Barbaro V, Grigioni M, Daniele C, et al. Principal stress analysis in LDA measurement of

- the flow field downstream of 19-mm Sorin Bicarbon heart valve. *Technol Health Care*. 1998; 6(4): 259-70
9. Stamhuis E, Videler J. Quantitative flow analysis around aquatic animals using laser sheet particle image velocimetry. *J Exp Biol* 1995;198(Pt 2):283-94
 10. Suo J, Oshinski JN, Giddens DP. Blood flow patterns in the proximal human coronary arteries: relationship to atherosclerotic plaque occurrence. *Mol Cell Biomech* 2008;5(1):9-18
 11. Friedman MH, Deters OJ, Mark FF, et al. Arterial geometry affects hemodynamics. A potential risk factor for atherosclerosis. *Atherosclerosis* 1983; 46:225-231.
 12. Koch S, Nelson D, Rundek T, et al. Race-ethnic variation in carotid bifurcation geometry. *J Stroke Cerebrovasc Dis* 2009 ;18(5):349-53
 13. Tsuboi H, Ando J, Korenaga R, et al. Flow Stimulates ICAM-1 Expression Time and Shear Stress Dependently in Cultured Human Endothelial Cells. *Biochemical and Biophysical Research Communications* 1995;206(3):988-996
 14. Varner SE, Chappell DC, Alexander RW, et al. Endothelial VCAM-1 regulation by steady and oscillatory shear stress. *Atherosclerosis* 1997; 134(1-2):288.
 15. Hinds MT, Park YJ, Jones SA, et al. Local hemodynamics affect monocytic cell adhesion to a three-dimensional flow model coated with E-selectin. *Journal of Biomechanics* 2001; 34(1):95-103.
 16. Shyy YJ, Hsieh HJ, Usami S, et al. Fluid shear stress induces a biphasic response of human monocyte chemotactic protein-1 gene expression in vascular endothelium. *Proc Natl Acad Sci U S A* 1994; 91: 4678–4682
 17. Dancu MB, Berardi DE, Vanden Heuvel JP, et al. Atherogenic endothelial cell eNOS and ET-1 responses to asynchronous hemodynamics are mitigated by conjugated linoleic acid. *Ann Biomed Eng* 2007;35(7):1111-9
 18. McAllister TN, Du T, Frangos JA. Fluid Shear Stress Stimulates Prostaglandin and Nitric Oxide Release in Bone Marrow-Derived Preosteoclast-like Cells. *Biochemical and Biophysical Research Communications* 2000; 270,:643–648.
 19. Wang GX, Deng XY, Guidion R. Concentration polarization of macromolecules in canine carotid arteries and its implication for the localization of atherogenesis. *Journal of Biomechanics* 2003; 36(1):45-51.
 20. Deng XY, Marois Y, How T, et al. Luminal surface concentration of lipoprotein (LDL) and its effect on the wall uptake of cholesterol by canine carotid arteries. *J Vasc Surg* 1995; 21: 135-145.

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Investigating the effect of Organizational Citizenship Behavior on Employees' Empowerment

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Abstract: The Features of today's organizations is dynamic, complexity, ambiguity and tradition aversion. In order to overcome complex, dynamic and uncertain situations, the only way that managers are facing is to empower the organization and employees. Hence, having a capable and efficient manpower that are foundations of scientific wealth and assets, are considered critical to the organizations. The aim of this study is to evaluate the impact of organizational citizenship behavior on employees' empowerment. Research hypotheses examine the impact of organizational citizenship behavior on each dimension of empowerment. The findings show that there is a meaningful relation between OCB and empowerment. On the other hand in order to achieving the strategic goals of organizations, it is necessary to consider the effective factor of attitudinal and behavioral variables of employees and planning in line with the dimensions of empowerment has strong effect in organizational citizenship behaviors.

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Key word: Organization citizenship behavior, empowerment, employees' behavior, IRAN

1- Introduction

In a competitive environment in which organizations must be faster, leaner, provide better service quality, be more efficient, and more profitable, an empowered and proactive service worker is thought to be essential (Bowen and Lawler, 1995).

Under these conditions companies have to design and shape their organization structure, management understanding, company competences and outputs according to new competition conditions in order to compete. The conditions such as customers demand, environmental pressure, quality standards etc. and their partnership, have caused tendency to transform similar characteristic make-up of the companies under the same market conditions (Ataman, 2003)

Rather than using traditional hierarchical structures with clear lines of authority and distinct jobs, many organizations have gone to more autonomous team-oriented organizational environments (LePine et al., 2002).

More than a decade ago, Conger and Kanungo (1988) noted that the practice of empowering subordinates is a

principal component of managerial and organizational. Most of these researchers and many others argue that empowerment need to be supported and nurtured by some prerequisites like incentives, skill and knowledge, and communication and flow of information within an organization climate conducive to employees empowerment in order to attain employees effective performance and job satisfaction(Bitner et al., 1990; Randolph, 1995; Yip, 2000).

Most literature on employees' empowerment provides only conceptual or anecdotal evidence. Therefore, there is a need for more systematic and empirical efforts in investigating the role of empowerment among service employees. Specifically, there is a need for further research to investigate the conditions that affect the empowerment among service employees. One of these conditions is identifying the organization citizenship behavior in organization.

The term "OCB" was first introduced by Bateman and Organ (1983). Organ (1988, p. 4) originally described OCB as "individual behavior that is discretionary, not directly or explicitly recognized by the formal reward system, and that in aggregate promotes the effective functioning of the organization". Organ further described OCB as behavior that contributes indirectly to the organization through the maintenance of the organization's social system.

Much of the scholarly interest in OCBs stems from the widespread belief that OCBs improve the efficiency and effectiveness of organizations (Organ et al., 2006). OCBs include both behaviors that are directed toward specific persons (e.g. interpersonal helping), as well as more impersonal forms of conscientiousness and workplace involvement that contribute to organizational effectiveness (e.g. sportsmanship, organizational loyalty, organizational compliance, individual initiative, civic virtue, and self-development; Organ et al., 2006).

According to Katz and Kahn (1966), innovative and spontaneous behaviors do not necessarily directly contribute to the genotypic function of an organization, but are "vital to organizational survival and effectiveness" and include cooperating with fellow members, protecting the organization (or subsystem), suggesting organizational improvements, self-training for additional organizational responsibility, and creating a favorable climate for the organization in the external environment.

The main goal of this study is to evaluate the impact of organizational citizenship behavior on organizational empowerment.

2- Literature review

2-1- Organization Citizenship Behavior

According to the scholarly researchers Organization Citizenship Behavior is defined as employees's behaviors that go beyond the role requirements, that are not directly or explicitly recognized by the formal reward system, and that facilitate organizational functioning (Organ, 1988).

In the last decade, the researchers have been persuaded by Organ's definition that identified the organizational citizenship as a behavior "that in the aggregate promotes the effective functioning of the organization" (Organ, 1988, P4). This theoretical framework confuses the phenomenal definition through its effects and description and it causes the consolidation of a mainstream focusing only on the OCB's positive effects.

According to Podsakoff et al. (2000), several different forms of OCB have been characterized by a significant theoretical overlap. A big part of these concepts focuses on helping behavior that can be defined as "voluntarily helping others with, or preventing the occurrence of, work-related problems". It is argued by researchers that helping behavior includes concepts such as helping and cooperating with others (Borman and Motowidlo, 1997), interpersonal helping (Graham, 1991), helping co-workers (George and Brief, 1992), altruism (Organ, 1988), interpersonal helping (Graham, 1991) and

sportsmanship (Organ, 1988). Although less frequently, other researchers focalize on concepts such as promoting (George and Brief, 1992; Moorman and Blakely, 1995) and defending the organization (Borman and Motowidlo, 1997).

Many scholars analyze the helping behavior in combination with other concepts that can be considered as specific forms of OCBs: individual initiative (Moorman and Blakely, 1995), civic virtue (Organ, 1988), organizational compliance (Smith et al., 1983), and self-development (Moorman and Blakely, 1995). The focal point of the paper is to analyze behavior involving helping others with work-related problems as a form of citizenship behavior that is recognized by most researchers. Concepts such as organizational loyalty, individual initiative, or organizational compliance are not investigated.

The several attributes on OCBs consequences can be grouped into two issues: the effects on managerial evaluations of employees and the effects on organizational performance (Podsakoff et al., 2000).

Types of organizational citizenship behavior

Graham believes that citizenship behavior shows itself in three different types; include organizational obedience, organizational loyalty and organizational participation that each of them will be briefly described in this article.

Organization obedience: This term describes the behaviors that their necessity and desirability are identified and accepted in reasonable and disciplinary structure. Organizational obedience indicators are behaviors such as respect for organizational rules, doing tasks and responsibilities completely with regard to organizational resources.

Organization loyalty: This loyalty to the organization is different from loyalty to him/her, other individuals and institutional sectors. Moreover, it expresses dedication of employees in the organization and support and defends the interests of the organization.

Organization participation: This word was mean with the active participation of employees in Corporate governance (Meetings, to share their ideas with others and knowledge of current issues).

2-2- Empowerment

According to Bowen and Lawler (1992), empowerment has been described as a means to enable employees to make decisions, and Pastor (1996), as a personal phenomenon where individuals take responsibility for their own actions. The first definition relates to how

management facilitates and implements the empowerment culture, while the second emphasizes the importance of the individual in the truly successful application of empowerment. The term personal empowerment was used in relation to business consultants and it was viewed as a strong self-analytical tool which allows them to understand and address their personal biases, differences of opinions, and experiences with clients in order to be successful in change efforts (Wing, 1996).

Bandora defined empowerment as a creating power of compliance in confronting conditions and counts for it four main factors (Yaha, 2004):

- 1- Emotional support for people that are involved in stressful issues.
- 2- Encouraging and giving feedback to them
- 3- Introduction of successful and effective people
- 4- Gain experience through successful completion of an activity

As Long argued in 1996 the end goal is to develop the performance and potential of the individual as well as that of the organization (Long, 1996). Empowerment could be considered in terms of social exchange theory as a process of enabling (Conger and Kanungo, 1988). Psychological empowerment represents intrinsic motivation and consists of a set of four cognitions (Thomas and Velthouse, 1990): meaningfulness, impact, competence (synonymous with Conger and Kanungo's (1988) concept of self-efficacy), and choice (later renamed by Spreitzer (1995) as self-determination).

3- Methodology

Table 1; Presence or absence of sense of competence among employees

	Category	Frequency of view	View proportion	View proportion	Test proportion	Level of significant
Sense of competence	Group 1	4 \geq	5	0.1	0.6	0.000
	Group 2	4 $<$	84	0.9		
	Total		89	1		

As it is considered in table 1 in order to assess competency feeling among employees, 10% of respondents is lower than 4 and 90% of them are more than 4, the level of significant of is 0.000 and because the rate of significant level of type one error is lower than 0.05 so this hypothesis is confirmed.

4-2- Ranking empowerment dimensions

In order to examine the dimensions empowerment importance, and as the responds are according to likert scale, so the Friedman nonparametric ANOVA is used.

The method of this research is descriptive. The main objective of this study is to describe systematically aspects of empowerment and its relationship with organizational citizenship behavior. So the kind of this research is correlation type. Also in order to evaluate the presence or absence of each dimensions of Empowerment and organizational citizenship behavior we used two tailed test in DAMSAN RAYANE Company.

Statistical population of this research is DAMSAN RAYANE Company employees. In this research the empowerment Dimension are dependent variables and organization citizenship behavior is independent variable. In this research there is need two questionnaires for gathering information that reliability test is used with SPSS software. According to the results that were obtained by SPSS chronbach Alpha for empowerment questionnaire is 0.93 and for OCB is 0.86.

4- Data analysis

4-1- Assessing existence or nonexistence of empowerment dimension

In order to determine empowerment dimension among employees two tailed nonparametric test is used. In this test for each factor the frequency of responds with quantity of lower than 4 (no opinion, disagree, absolutely disagree and high absolutely disagree) in contrast with frequency of responds with quantity of lower than 4 (agree, absolutely agree and high absolutely agree) is compared. Furthermore the hypothesis will be confirmed or rejected with comparing the people number proportion of two groups with quantity of 0.6 (i.e. the respond of 60% of people is more than 4). For instance the table 1 is about existence or nonexistence of competence feeling in employees.

In this analysis we seek to prove the following hypotheses:

Table2; test result

	125.772
Degrees of freedom	4
Level of significant	0.000

The chi-square test statistic in order to prove the following proposition is 125.772 with degrees of freedom equal to 4 and the level of significant is 0. Because the significant level rate is lower than type 1

O is rejected empowerment dimensions have different importance (see table 3).

Table 3; average rank of empowerment dimensions

Empowerment dimensions	Average rank
Sense of competence	3.94
Independence	2.35
Sense of being effective	2.47
Sense of meaningfulness jobs	3.84
Trust between coworkers	2.4

4-3- The main study hypothesis

The main hypothesis of this research is the impact of OCB on empowerment. In order to investigate the

Table 5; Test results

	Sum of square	d.f	Average of square	F	Significant level
Regression	7413.52	1	7413.52	40.144	0.000
Residual	16066.368	87	184.671		
Total	23479.888	88			

The F statistic is 40.144 and the rate of significant level is 0.000. Because in level of 0.05 the rate of significant level is lower than rate of type 1 error, so it is improved that there is a meaningful relation between OCB and empowerment with 95% certainly.

5- Conclusion

The main objective of this study was to investigate the perceived impact of organizational citizenship behavior on organizational empowerment. The results that were obtained in this study approved a significant relationship between citizenship behavior and the empowerment. According to importance role of human resources in achieving the strategic goals of organizations, it is necessary to consider the effective factor of attitudinal and behavioral variables of employees. Planning in line with the dimensions of empowerment has obvious effect in organizational citizenship behaviors.

Achieving to empowerment is not only individual or group effort, rather another macro factors such as

relation between and empowerment as a dependent variable and organizational citizenship behavior as independent variable we used correlation coefficient.

Table 4; correlation coefficient hypothesis test

Adjustment coefficient	determined coefficient	R
0.308	0.316	0.562

As it is considered from Table 4, the correlation coefficient is 0.562 and it shows that OCB and empowerment have strong relationship with each other. Then we investigate that is there a meaningful relation between these variables? In fact we investigate the following hypothesis:

structure, policies, values, reward systems and organizational culture must all together encourage and strengthen individual and group behavior in this regard.

According to this study, the following guidelines are recommended to establish empowerment:

- 1- Increase the range of employees' participation in decision making through the development of skills and abilities of employees.
- 2- Holding enough and adequate classes and workshops in context of organizational citizenship behavior among employees in order to reinforce the spirit of sportsmanship among employees.
- 3- Using OCB factors to evaluate employees' performance.
- 4- Developing and improving connection and information channels in company in order to share knowledge.
- 5- Using brochures, posters and photographs in context of reinforcing organizational citizenship behavior and its factors.
- 6- Interaction between units with other similar units in company in order to share information.
- 7- Make vision, goals and mission of organization clear for employees with organization leaders.

Reference

- Ataman, G. (2003). Örgüt Tasarımında Yeni Tekniklerin Yayılım dinamikleri. *Öneri*, 5(19), 13-19.
- Bateman, T.S. and Organ, D.W. (1983), "Job satisfaction and the good soldier: the relationship between affect and employee 'citizenship'", *Academy of Management Journal*, Vol. 26, pp. 587-95.
- Borman, W.C. and Motowildo, S.J. (1997), "Task performance and contextual performance: the meaning for personnel selection research", *Human Performance*, Vol. 10, pp. 99-109.
- Bowen, D. E. and E. E. Lawler (1995). Organizing for Service: Empowerment or Production Line? In: W.J. Glynn & J.G. Barnes (Eds.), *Understanding services management*, John Wiley & Sons, Chichester, 269-294.
- Bowen, D. E. & E. E. Lawler (1992). The Empowerment of Service Workers: What, Why, How and When?. *Sloan Management review*, 33 (3): 31-39.
- Conger, J. A. and R. N. Kanungo (1988). The empowerment process: Integrating theory and practice. *Academy of Management Review*, 13: 471-482.
- George, J. M., & Brief, A. P. 1992. Feeling good-doing good: A conceptual analysis of the mood at work-organizational spontaneity relationship. *Psychological Bulletin*, 112: 310-329.
- Graham, J. W. 1991. An essay on organizational citizenship behavior. *Employee Responsibilities and Rights Journal*, 4: 249-270
- Organ, D.W. (1988), *Organizational Citizenship Behavior: The Good Soldier Syndrome*, Lexington Books, Lexington, MA.
- Katz, D. and Kahn, R. (1966), *The Social Psychology of Organizations*, Wiley, New York, NY.
- Lepine, J.A., Erez, A. and Johnson, D.E. (2002), "The nature and dimensionality of organizational citizenship behavior: a critical review and meta-analysis", *Journal of Applied Psychology*, Vol. 87 No. 1, pp. 52-65.
- Moorman, R. H., & Blakely, G. L. 1995. Individualism-Collectivism as an individual difference predictor of organizational citizenship behavior. *Journal of Organizational Behavior*, 16: 127-142.
- Organ, D.W., Podsakoff, P.M. and MacKenzie, S.B. (2006), *Organizational Citizenship Behavior: Its Nature, Antecedents, and Consequences*, Sage, Thousand Oaks, CA.
- Podsakoff, P.M., MacKenzie, S., Moorman, R.H. and Fetter, R. (1990), "Transformational leader behaviors and their effects on trust, satisfaction, and organisational citizenship behavior", *The Leadership Quarterly*, Vol. 1 No. 2, pp. 107-42.
- Podsakoff, P.M., MacKenzie, S.B., Paine, J.B. and Bachrach, D.G. (2000), "Organizational citizenship behaviors: a critical review of the theoretical and empirical literature and suggestions for future research", *Journal of Management*, Vol. 26 No. 3, pp. 513-63.
- Smith, C. A., Organ, D. W., & Near, J. P. 1983. Organizational citizenship behavior: Its nature and antecedents. *Journal of Applied Psychology*, 68: 655-663.
- Spreitzer, G.M. (1995), "Psychological empowerment in the workplace: dimensions, measurement, and validation", *Academy of Management Journal*, Vol. 38, pp. 1442-65.
- Thomas, K.W. and Velthouse, B.A. (1990), "Cognitive elements of empowerment: an 'interpretive' model of intrinsic task motivation", *Academy of Management Review*, Vol. 15, pp. 666-81.
- Yahya D, (2004). "Significant conditions in employees empowerment": the case of Jordanian four star hotel, *Jameat-al-yermok*, 332- 367

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Prevalence of oral manifestations in patient with Systemic Lupus Erythematosus (SLE)

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Abstract :: Systemic Lupus Erythematosus (SLE) is an autoimmune disease that characterized by producing lots of antibodies. 5-25 percent of patients have oral lesions, however in some studies reported up to 80 percent. The purpose of this study was to determine the oral manifestations prevalence in patient with SLE. In this study 70 SLE patients attending to Zahedan rheumatology clinic were included. SLE patient's mouths were examined under appropriate light by tongue blades after a rheumatologist confirmation. Regarding questionnaires were filled out. Any lesions in these patients were recorded in the questionnaires after oral medicine specialist confirmation. Then necessary treatments were performed. In this study 70 patients (63 male, 7 female) with the SLE disease were selected, with the age range of 15-70 years. 61.4% of patients had oral lesions. The most common lesions were red lesions (35.08%), white lesions (21.05 %), pigmentations (19.29%), ulcers (10.52%), angular cheilitis (10.52%) and white and red lesions (3.52%). 51.4% of patients had xerostomia. Posterior area of hard palate and lower lip were the most involved sites. There was no significant difference between oral manifestations with age, sex and duration of disease activity ($p > 0.05$). As oral manifestations are one of the first SLE features, it shows the necessity of mouth follow up Physician examination in order to early diagnosis and better treatment of oral lesions in the patients with SLE disease.

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Keywords: Systemic lupus erythematosus, oral lesion, epidemiology

Introduction

Systemic Lupus Erythematosus (SLE) is perfect example of autoimmune disease which is characterized by producing lots of antibodies. 15-17% of lupus cases occur before age of 16, while the highest prevalence of this disease is between ages of 20 to 40. SLE mostly occurs in women but it is more prevalent in blacks(1). Its prevalence is 0.1 percent in the world(2). In 40 to 50 percent of cases, a particular model of Beech butterfly pattern appears in nose and cheeks of patients in which exposure to sunlight may worsen lesions in these areas(3). Blood, liver and kidney failure and heart disease is almost prevalent in this disease too. Although some studies have shown 80 percent of oral lesion's occurrence in SLE patients, oral lesions occur up to 5 to 25 percent in SLE patients(4). SLE causes mouth ulcers or nasopharynx, which usually cause no pain afterwards(5). Lesions generally involve hard and soft palate, buccal mucosa and gingiva. Involvement of lower lip vermilion areas might sometimes occur too.

Other oral problems had been explained before, including xerostomia, stomatodynia, candidiasis, periodontal disease, but direct association of these problems with SLE is not clear yet(3).

DLE is discoid type of lupus erythematosus, which occur in approximately 25% of patients with SLE and could lead to disfigurement of patient, because its lesions have central atrophy and scarring, which could be recognized by an erythematous leading edge, scaling and telangiectasia. These lesions occur in sun-exposed areas of body, scalp, ears, face, back, chest and specific areas of the arms –which are exposed to sun. DLE lesions can cause redness, atrophy and depigmentation of lips. While 25% of patients with SLE have DLE too, only 10% of SLE patients would later develop SLE(1). Dentists should be more careful in treatment of patients with SLE, because on one hand some specific body members would be affected in this disease, which needs to be specifically observed before and also during treatment. On the other hand oral manifestations, which

are one of symptoms of identifying this disease, need to be fully diagnosed too. This is due to the fact that some oral lesions are very similar to lichen planus's one. Moreover, oral ulcers in patients with lupus sometimes impose specific diet. Furthermore, some patients initially visit doctors for oral lesions which subsequently need further consultation in order to be diagnosed correctly. Therefore, in order to achieve this goal, we determined to take an effective step in process of diagnosis and treatment of this disease by examining mouths of patients who visited private clinic of rheumatology in city of Zahedan.

Material and methods

This study is typically cross-sectional study or descriptive study. It was carried out on all patients with lupus erythematosus whether SLE or DLE, who were admitted to private rheumatology clinic in Zahedan city, from beginning of January 1385 (2006) until end of June 1386 (2007). Lupus diagnosis in these patients was based on criteria approved by rheumatology's specialist of American college of Rheumatology (ACR) in 1997. A special form was prepared for patients and then was completed. Personal information of each one of patients with lupus erythematosus whether SLE or DLE was filled out in questionnaire form. Personal information which was recorded included: age, sex, medical history, illness duration, and medications used for treatment. Oral lesions were diagnosed based on clinical features as well as diagnosis of specialists in oral diseases. Oral mucosa's examinations of patients were performed with help of a mirror through appropriate light. In this study, in order to determine prevalence of oral lesions in lupus erythematosus whether SLE or DLE based on classification made in reference books, lesions were classified and reviewed as follows:

Exophytic lesions: any pathological growth beyond natural limits of oral mucosal surfaces would be considered as exophytic lesion.

Non-wear off white lesion: it is a white lesion which would not wear off by scrubbing. It is in shape of exophytic white plaques with irregular shapes or silvery white scars which is formed because of increased production of keratin (hyperkeratosis) or abnormal benign thickening of stratum spinosum (acanthosis), and intercellular and extracellular accumulation of fluid in oral epithelium.

Red lesions: any lesion with red velvet feature which could be inseparable from normal tissue. it is formed because of epithelium atrophy or increasing and scholarozation.

White and red lesions: any lesion in red and white color which could be separable from surrounding normal tissue.

Grooves and fissures: Any gaps or cracks or dents in tissue that had been formed pathologically.

Injury: a lesion with erythematosus context in which epithelium continuity had destroyed completely and lesion had penetrated into connective tissue deeply.

Hard palate includes rugae and posterior palate, soft palate. Lip includes upper lip and lower lip. Tongue includes dorsal surface, side and underside of tongue, right and left buccal mucosa. Depth of vestibule includes upper and lower jaw. Gingiva includes buccal and lingual and bottom of mouth.

Data were analyzed by using statistical software SPSS-15 after extraction of questionnaire forms. Then results were reported as central and dispersion statistical indexes. X^2 tests was used for analyzing data and $p < 0.05$ were considered significant.

Results

In this study, 70 patients, who were referred to rheumatology clinic in city of Zahedan, were examined during winter of 2006 till late spring of 2007. Out of these patients, 7 (10%) of them were men and 63 (90%) of them were women, who were 10 to 70 years old. Their mean age was 32.75. They were divided into three groups as follows: under 20 years, between 20 to 40 years old and over 40 years. Out of 70 patients with SLE, 43 patients (% 61.4) had oral presentations and 27 patients (38.6%) had no oral presentations. There were one or more than one oral presentations in 43 patient of who had oral presentations. In population under study, most prevalent lesions were in group of patients who were between 20 to 40 years old, which was 54%, but statistical tests shown no significant relationship between age and oral lesions ($p=0.3$) (Table 1).

Table 1. frequency distribution of age groups and its relationship with oral presentations in SLE patients who were referred to private rheumatologists in city of Zahedan in 2006 and 2007

age (percent)	Oral presentation		sum (percent)
	have	Have not	
Below 20 years old	2 (40)	3 (60)	5 (100)
Between 20 to 40 years old	35 (64.8)	19 (35.2)	54 (100)
Over 40 years old	6 (54.5)	5 (45.5)	11 (100)
sum	43 (61.4)	27 (38.6)	70 (100)

In field of relationship of sex with oral presentations, out of 43 patients with oral presentations, 6 males and 37 females had oral presentations, that based on χ^2 tests no significant relationship between sex and incidence of oral lesions were observed ($p=0.35$) (table 2).

Table 2: frequency distribution of sex and its relationship with oral presentations in SLE patients who were referred to private rheumatologists in city of Zahedan in 2006 and 2007

Sex	Oral presentations		Sum (percent)
	have	Have not	
Female (percent)	37 (58.7)	26 (41.3)	63 (100)
Male (percent)	6 (85.7)	1 (14.3)	7 (100)
Sum (percent)	43 (61.4)	27 (38.6)	70 (100)

Table 3 shows relationship between oral presentations and time passed since beginning of Lupus disease, which is divided into 3 groups as follows: Time passed since beginning of disease was less than 12 months in first group, 36-12 months in second group and more than 36 months in third group. Results showed no significant association between oral presentations and time passed since beginning of Lupus disease ($p<0.05$). Those patients with xerostomia were examined too. Out of 70 patients with SLE, 36 (51.4%) patients had xerostomia and 34 (48.6%) patients had not xerostomia. The most prevalent lesions regions were reported in posterior hard palate (% 27.9) and lower lips (% 14.2). Other regions were as follows:

1 - soft palate, 2 - right cheek, 3 - left cheek, 4 - buccal gingiva, 5 - lingual gingiva, 6 – side and Sub lingual, 7 - upper lip

Out of 57 patients diagnosed with oral lesions, most diagnosed oral lesions were 20 cases of red lesions (35.08%) and 12 cases of white lesions (21.05%) and 11 cases of pigmentation (19.29%). No exophytic lesions were reported. In white lesions, the highest ones were number of keratosis plaques (hyper keratinization) (50%) (Table 4) and in red lesions, highest ones were erosion (95%, $n = 19$) and other ones were multi formed erythema.

Table 3- frequency distribution of time since beginning of disease and its relationship with oral presentations in SLE patients who were referred to private rheumatologists in city of Zahedan in 2006 and 2007

time since beginning of disease	Oral Presentations		Sum (percent)
	Have (percent)	Have not (percent)	
1-12 months (percent)	18 (58.1)	13 (41.9)	31 (100)
12-36 months (percent)	15 (62.5)	9 (37.5)	24 (100)
Over 36 months (percent)	10 (66.7)	5 (33.3)	15 (100)
Sum (percent)	43 (61.4)	27 (38.6)	70 (100)

Table 4- frequency distribution of white lesions types in SLE patients who were referred to private rheumatologists in city of Zahedan in 2006 and 2007

white lesions frequency	No (percent)
Linea Alba	3 (25)
Hyper keratinization	6 (50)
Lichen Planus	2 (16.7)
Candidiasis	1 (8.3)
Sum	12 (100)

Discussion:

In this study of 70 patients with Lupus Erythematosus admitted to a private clinic Rheumatology in city of Zahedan, who all had SLE, 43 patients (61.4%) had oral lesions in which 15 patients of them had two oral lesion. In total 57 lesions (81.4%) were diagnosed. 61.4% oral lesions in this study were similar to study done by Chavarria in 2005 in which 61 percent oral lesions were reported(6). Moreover, our study is very similar to study of M. Schiodt in 1988 in which 32 patients with Lupus were examined and 75% of patients were reported having oral lesions, that most of lesions were lichen planus and loco planus. Prevalent region of lesions

were in buccal mucosa, gingiva and lower lip vermillion(7).

In study of Johnson Rhdus which was done in 1984, 51 mouths of patient with Lupus were examined and analyzed. In this study, oral lesions in 45% of patients involved irregular exophytic white plaques and silvery white scars and ulcers and hemorrhage. Regions where these lesions occurred were in soft and hard palate and buccal mucosa, respectively. Dispersion of lesions' regions was the same as our study. Although in this study xerostomia were reports 75%-87.5%, in our study xerostomia were lower, i.e. 51.4% (8). Probably, this lower reported number of xerostomia in our study was due to lack of using methods for diagnosing patients with xerostomia, involving specific diagnostic tests of xerostomia, because diagnosis of xerostomia in our study was just based on self-reported statements. Moreover, both types of medications as well as types of patients' diets influenced occurrence of xerostomia. Meanwhile, a number of patients were not aware of their xerostomia and it should be noted that diagnosis of xerostomia was just based on self-reported statements.

The highest prevalence of oral presentations in this study were erosion, hyperkeratosis (keratosis plaques) pigmentation and oral aphthous. These presentations were observed in prevalent order in hard palate, soft palate and lower lip vermillion. Dispersion of lesion's regions is similar to above-mentioned study as well as J.D. Urman study. J.D. Urman studied 182 patients with Lupus in 1978 in which although prevalence of oral lesions were lower than our study (26%), 89% percent of patients had lesions in their hard palate(9). Furthermore, Urman studied 40 patients with Lupus in 1999 in which he reported oral lesions in 40% of patients. Out of this 40%, 45% of lesions were quasi lichen planus. These lesions were mostly occurred in hard palate, mucus buccal, gingival tissue, which was similar to our study in this regard(10).

In contrast with our study, a study was performed by K. Jarallh in which 108 patients with Lupus were studied in a past-oriented way. He reported that oral lesions were 33% which involved erythema and hyperkeratosis in mucus and buccalmucosa(11).

Moreover, number of oral lesions in our study were more than study done by M.A. Nazarinia in Shiraz in 2008 in which prevalence of oral lesions were reported in 28% of patients(12). Furthermore, in a study performed by C.A. Villamin on Philippine patients with Lupus in 2008, oral lesions' prevalence was reported 33%(13).

S.V. Lourenco et al reported oral lesions' prevalence 9% to 45% in patients with Lupus in 2006(14).

Comparing findings of this study about oral lesion' prevalence with other studies showed different and sometimes similar rate of prevalence. In this study, most

of oral lesions' prevalence was related to red lesions, white lesions and pigmentation in which most of these people were not aware of lesions in their mouths. Almost half number of patients complained from xerostomia that could be result of using medications like nerves medications subsequently (or after xerostomia), who had numerous oral cavities lesions(15). But of course relationships of this disease with other lesions such as candidiasis and similar clinical lesions like lichen planus and leukoplanus with Lupus should be identified too.

Meanwhile most of new patients with Lupus had oral presentations and others who had not oral lesions announced that they had no oral lesions before they began to use medications.

Our limitations and constrains in this study was that we were not able to study all patients with Lupus who had been diagnosed both in chronic and new cases. Since impairment in immune system and using medications which weakens immune system, are important factors for occurrence of oral lesions in patients with Lupus(16), and on the other hand most of oral lesions react to treatment with steroidal anti-inflammatory medications, then it might be possible that lack of oral lesions in some patients could be result of using anti-inflammatory and rheumatoid modulators. Therefore, it might be possible that these reported statistics are even lower than actual number of oral lesions.

Other shortcoming of our study was lack of identifying relationship between oral lesions according to severity of disease activity.

Since in a number of studies relationship of oral lesions with incidence of some complications such as lupus nephritis have been reported(17). Investigating relationship between oral lesions and other systematic presentations, specifically skin lesions, could be effective in predicting procedure of this disease(18).

Other shortcoming of our study, that needed invasive measures to be taken, involved non-performance of biopsy on oral lesions and lack of using histological, immunofluorescence, immunohistochemical techniques to determine nature of oral lesions accurately. Because based on some histological studies, these lesions could change criteria, which are just oral ulcers, for diagnosing Lupus oral lesions(19).

Conclusion:

Therefore it is recommended that since mucus skin lesions are oral presentations of prevalent ones, and could also be initial symptoms of occurrence of disease and also representative of underlying systematic situation, then dentists and doctors should be more careful in examining mouths of patients with non-specific complaints, and if they found oral lesions, make sure to make aware patients of importance of these lesions and be persuasive of other symptoms of this

disease. Thereby an effective step is taken in procedure of early diagnosis as well as in-time treatment of Lupus disease which prevents invasive diagnosis measures and also imposed additional costs as well as incorrect treatment measures.

Since Lupus oral lesions could affect initial health and hygiene of mouth and could result in serious periodontal complaints, in-time diagnosis and treatment of this disease is an imperative step for preserving health and hygiene of tooth and mouth. Furthermore, it is recommended that other than paying close attention to oral lesions in Lupus disease, considering other findings in mouth such as anemia and mucosal pallor, atrophic glossitis, candidiasis of periodontal inflammation in disease complications like diabetes, reflux, hyperpigmentation, which may be the first symptom of Addison's disease in these patients is imperative too.

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References

- Greenberg MS, Glick M. *Burket's oral medicine diagnosis and treatment*. 11th ed. Hamilton, Bc Decker 2008: 77-78.
- Harrison TR, Resnick WR. *Harrison's principles of internal medicine*. 16th ed. New York, McGraw Hill 2005: 1962-1963.
- Nevile, Damm, Allen, Buquot. *Oral and maxillo facial pathology*. 20th ed. London, Bc Decker 2002: 688-696.
- Regezi. *Oral pathology*. 4th ed. Philadelphia, Saunders 2003: 58.
- Loann O. Tassiulas: *Kelley's text book of rheumatology*. 8th ed. Philadelphia, Saunders 2009: 1268-1269.
- Chavarria E, Bueno C, Lazaro P and Lecona M. Sub acute cutaneous systemic Lupus erythematosus. Presentation of two clinical Cases. *Actas Dermosifiliogr* 2005; 96(4): 248-51.
- Schioldt M, Halbrg P, et al, A clinical study of 32 patient with oral discoid lupus erythematosus. *Int J Oral Surg* 1978;7(2):85-94.
- Jonsson R, Heyden G, Westberg NG and Njeberg G. oral mucosal lesions in systemic lupus erythematosus a clinical, histopathological and immunopathological study. *J Rheumatol* 1984; 11(1): 38-42.
- Urman JD, Lowenstein MB et al. Oral mucosal Ulceration in systemic Lupus erythematosus. *Arthritis Rheum* 1978;21(1):58.
- Uthman I, Nasr F, Kassak K and Masri AF. Systemic lupus Erythematosus in Lebanon. *lupus* 1999;8(9):713-5.
- Al Jarollah K, Al Awadia et al. systemic Lupus erythematosus in kuwait hospital based study. *Lopus* 1998;7(7):434-8.
- Nazarinia MA, Ghaffarpasand F et al. Systemic lupus erythematosus in the Fars Province of Iran. *Lopus* 2008;17(3):221-7.
- Villamin CA, Navarra SV, Clinical manifestations and clinical syndromes of Filipino patients with systemic lupus erythematosus, *Mod Rheumatol* 2008;18(2):161-4.
- Lourenço SV, de Carvalho FR. Lupus erythematosus: clinical and histopathological study of oral manifestations and immunohistochemical profile of the inflammatory infiltrate. *J Cutan Pathol* 2007;34(7):558-64.
- Little JW, Falace DA, Miller CS and Rhodus NL. *Dental Management of the Medically Compromised Patient*. 6th ed, St. Louis, Mosby 2008; 490-491.
- Meyer U, Kleinheinz J. Oral manifestations in patients with systemic lupus erythematosus, *Mund Kiefer Gesichtschir* 1997;1(2):90-4.
- Sverzut AT, Allais M, Oral manifestation of systemic lupus erythematosus: lupus nephritis-report of a case. *Gen Dent* 2008;56(1):35-41.
- Nico MM, Vilela MA. Oral lesions in lupus erythematosus: correlation with cutaneous lesions. *Eur J Dermatol* 2008;18(4):376-81.
- López-Labady J, Villarroel-Dorrego M. Oral manifestations of systemic and cutaneous lupus erythematosus in a Venezuelan population. *J Oral Pathol Med* 2007;36(9):524-7.

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Prevalence of dementia in Boyerahmad county of Iran

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Abstract: Increasing life expectancy and welfare results in increasing the incidence and prevalence of age related disorders including dementia that causes serious problems for families and patients. Health authorities' awareness of diseases prevalence in a region can help them for better managing it. The aim of this study was evaluation of dementia prevalence in Boyerahmad county of Iran. This study was a cross sectional community based study. Participants were 804 cases, 65 years old and over. 402 people from urban and 402 from rural areas were selected using cluster sampling. Diagnosis of dementia was according to Persian version of Clinical Dementia Rating Scale (CDR). Collected data were analyzed using SPSS software. We used of the frequency tables and percentiles for describes and Chi-square test for inferences. The prevalence of severe dementia in this study was 4.8 percent, moderate dementia was 5.7 percent and mild dementia was 8.7 percent. Increasing age had a significant relationship with the disease, but sex and Location had not relation with dementia prevalence. The prevalence of this disease in Boyer Ahmad was more than most of the world including Europe, Asia and America.

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Keywords: Dementia, Boyerahmad, prevalence, CDR

1-Introduction

Important changes have occurred in the age structure of the population over the last few decades because of a decrease in mortality and birth rates and an increase in life expectancy. As a result, an increase in all illnesses related to aging has been observed. In this context, cognitive disorders are especially significant. The most common causes of dementia are Alzheimer's disease and vascular disease. Both of these are progressive illnesses that lead to functional complications. Many studies conducted within developed countries have established the prevalence and risk factors specific to their population. For instance, studies in North America, the United Kingdom and Europe have reported that dementia affects from 1% to 6% of the population over the age of 65 years and 10% to 20% over the age of 80 years. In Asia, the few studies done in India, China, Sri Lanka, South Korea, and Taiwan suggest that dementia in general, and Alzheimer's disease in particular, is lower than in developed countries. (1-10) 24.3 million people have dementia today, with 4.6 million new cases of dementia every year (one new case every 7 seconds). The number of people affected will double every 20 years to 81.1 million by

2040. Most people with dementia live in developing countries (60% in 2001, rising to 71% by 2040). Rates of increase are not uniform; numbers in developed countries are forecast to increase by 100% between 2001 and 2040, but by more than 300% in India, China, and their south Asian and western Pacific neighbors. (11) In our knowledge there is no community based study of dementia prevalence in Iran to date. Thus this study conducted to evaluate prevalence of dementia in old age people of the Boyerahmad county of Iran.

2-Materia and Methods

The study was cross-sectional, performed from June to September 2010 in Boyerahmad county of Iran. The Boyerahmad Region is situated in southern Iran with a total population of 217,741. 96,786 of this population live in city and the reminder live in rural areas of the territory. Within the population, 4.1% were 65 years or older at the time of the study (2010). The region is notable for the low educational level of the elderly. Only 13.3% of people over 65 years old had education and 0.08% had university education. (12) The subjects were selected with stratified three stage cluster sampling; at first, the population was

stratified into two clusters (rural residents and city residents); secondly, the tongs (the first sampling unit) were relatively sampled according to the number of the bans (a subdivision of tong); thirdly, the bans (the second sampling unit) were chosen from the sampled tongs with equal probability; and finally, six households were selected systematically from the all households in the sampled bans with equal sampling probability. Finally, a total of 804 household was selected. Data was collected using an interviewer administered validated Persian version of Clinical Dementia Rating Scale (CDR). The CDR was developed by Hughes et al. (1982) and revised by Berg (1988). It consists of six items for evaluation of memory, orientation, judgment and problem solving, social life, home life and hobbies, and self-management. It has five Likert-type scale anchoring from functionally normal (score 0), suspicious (score 0.5), mildly disturbed (score 1), moderately disturbed (score 2), and seriously disturbed (score 3). The level of dementia determined according to the total score. Another questionnaire was used to collect Socio-demographic characteristics of the patients including their age, Gender, educational level, number of children, History of chronic diseases, Substance dependence and tests for Sensory impairment. Collection of data was done by health professionals after receiving detailed training about dementia, as well as collection of data, and interviewing. Informed consent was obtained from subjects or their guardian before conducting the study. Collected data was analyzed using the Statistical Package for Social Sciences (SPSS) software version 17. We used of the frequency tables and percentiles for describes and Chi-square test for inferences.

3- Results

This study was performed to evaluate the prevalence of dementia among old population of Boyerahmad County of Iran. Table 1 shows Socio-demographic characteristics of study population. Most of studied subjects were illiterate. Because the number of educated subjects were very low, thus we didn't divided them into subgroups according to level of education. In this region of Iran, the number of children is very high. Therefore 74 percent of subjects had more than 6 children. A large number of populations suffered from hypertension. 40 percent were nicotine dependent. In addition, opium dependence was 4 percent. About half of the subjects were visual and auditory impaired

Table 1. Socio-demographic characteristics of study population of 804 respondents in a community-based epidemiological survey, Boyerahmad County of Iran, June to September 2010

Socio-demographic characteristics	Number	Percent
1- Gender:		
Male	428	53.2
Female	376	46.8
2- Education level:		
Illiterate	713	89
Any education	14	11
3- Age:		
65-75	426	53
76-85	314	39
Over 85	64	8
4- Number of children:		
< 6	217	27
6-10	515	64
> 10	72	9
5- History of chronic diseases:		
Diabetes Mellitus		
Hypertension	61	8
Epilepsy	380	47
Psychiatric disorders	15	2
	106	13
6- Substance dependence:		
Nicotine	322	40
opium	31	4
7- Sensory impairment:		
Visual	375	47
Auditory	270	34

Table 2 shows age-adjusted prevalence of dementia in the studied population. 12.4 percent of the studied population had suspicious dementia, 8.7 percent mild dementia, 5.7 percent moderate dementia and 4.8 percent severe dementia. The difference between three age groups in dementia was statistically significant. Therefore, with rising age the prevalence of dementia was increased. In the group of 65-75 years old group only 8% suffered from dementia. Whereas, this rate was 23.5% and 73% in the 75-85 and over 85 years old groups respectively.

Table 2. Age adjusted prevalence of dementia among 804 respondents, Boyerahmad County of Iran, June to September 2010

Age Diagnosis	65-75	76-85	>85
No dementia	363(85.2%)	177(56.36%)	8(12.5%)
Suspicious dementia	29(6.8%)	62(19.74%)	9(14%)
Mild dementia	22(5.16%)	37(11.78%)	11(17.2%)
Moderate dementia	9(2.1%)	22(7%)	15(23.4%)
Severe dementia	3(0.70%)	15(4.77%)	21(32.8%)
Total	426(100%)	314(100%)	64(100%)

$P < 0.05$ $df = 3$ $\chi^2 = 2.75$

Table 3. Prevalence of dementia among 804 respondents in a community-based epidemiological survey, Boyerahmad County of Iran according to gender, June to September 2010

Dementia	Female	Male	Total
No dementia	261(69.4%)	287(67%)	548(68.6%)
Suspicious dementia	44(11.7%)	57(13.3%)	101(12.6%)
Mild dementia	32(8.5%)	38(8.9%)	70(8.7%)
Moderate dementia	21(5.6%)	25(5.8%)	46(5.7%)
Severe dementia	18(4.8%)	21(4.9%)	39(4.8%)
Total	376(100%)	428(100%)	804(100%)

$X^2=0.75$ $df=3$ $p>0.05$

There was no statistically significant difference between males and females for dementia prevalence. (Table 3)

4-Discussion

Because of increasing the number of old people in recent decades, the health care system burden for caring this population would be growing in the future. The results of present study showed that prevalence of dementia in this region was 19.2%. This is more than its prevalence in other studies performed in Europe, Asia and America. Several factors may participate for this. 89% of the studied subjects were illiterates. Illiteracy is a risk factor for dementia. Also the prevalence of hypertension was 47% in the studied subjects. This factor may also contribute for per development of dementia too. (particularly vascular dementia). There was no statistically significant difference between females and males in the dementia rate. This differs from the results of mentioned studies. An interesting result of this study was the large dimension of family in this region. This can be an index of no development. Also the prevalence of opium and nicotine dependence was high in the studied population.

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References:

1. Evans DA, Funkenstein HH, Albert MS, et al. Prevalence of Alzheimer's disease in a community

population of older persons. *JAMA* 1989; 262:2551–6.

2. Schneider J, Murray J, Banerjee S, et al. EURO CARE: a cross-national study of co resident spouse careers for people with Alzheimer's disease: I—factors associated with career burden. *Int J Geriatric Psychiatry* 1999; 14:651–61.

3. Jagger, Andersen K, Breteler MM, et al. Prognosis with dementia in Europe: a collaborative study of population-based cohorts. *Neurology* 2000; 54:S16–20.

4. Griffiths C, Rooney C. Trends in mortality from Alzheimer's disease, Parkinson's disease and dementia, England and Wales, 1979–2004. *Health Stat Q.* 2006; 30:6–14.

5. Zhang ZX, Zahner GEP, Roman GC, et al. Dementia subtypes in China: prevalence in Beijing, Xian, Shanghai, and Chengdu. *Arch Neurol* 2005; 62:447–53.

6. Shaji S, Bose S, Verghese A. Prevalence of dementia in an urban population in Kerala, India. *Br J Psychiatry* 2005; 186:136–40.

7. Hendrie HC, Ogunniyi A, Hall KS, et al. Incidence of dementia and Alzheimer disease in 2 communities: Yoruba residing in Ibadan, Nigeria, and African Americans residing in Indianapolis, Indiana. *JAMA* 2001; 285:739–47.

8. Liu CK, Lin RT, Chen YF, et al. Prevalence of dementia in an urban area in Taiwan. *J Formos Med Assoc.* 762–8.

9. Shah A, Ellanchenny N, Suh GH. A comparative study of behavioural and psychological symptoms of dementia in patients with Alzheimer's disease and vascular dementia referred to psycho geriatric services in Korea and the U.K. *Int J Geriatric Psychiatry* 2002;17:134–9.

10. Sahin HA, Gurvit IH, Emre M, et al. The attitude of elderly lay people towards the symptoms of dementia. *Int Psychogeriatr* 2006; 18:251–8.

11- Cleusa P Ferri, Martin Prince, Carol Brayne, Henry Brodaty, Laura Fratiglioni, Mary Ganguli, Kathleen Hall, Kazuo Hasegawa, Hugh Hendrie, Yueqin Huang, Anthony Jorm, Colin Mathers, Paulo R Menezes, Elizabeth Rimmer, Marcia Sczufca, and Alzheimer's Disease

International: Global prevalence of dementia: a Delphi consensus study. *Lancet.* 2005 December 17; 366(9503): 2112–2117.

12- Iran Ministry of Interior, Kohgiluyeh & Boyerahmad Governor Generalship. Available at: <http://www.ostan-kb.ir/state-1387-fa.html>

Relationship between task-oriented leadership style and extroverted trait among Physical Education managers

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Abstract: The purpose of this study was to study the relationship between task-oriented leadership style and extroverted trait among Physical Education managers. 50 managers of physical education were randomly selected. Three questionnaires were used in this research: A) A researcher made information questionnaire, including age, experience, degree of education, B) Luthans' leadership style questionnaire, and C) Eysencks' personality inventory questionnaire. Data were analyzed by Pearson coefficient correlation and Chi-square test at $P \leq 0.05$ level. There was a significant but opposite relationship between task-oriented with extraversion trait among physical education managers. There was a significant relationship between task-oriented with physical education managers (age, education degree and experience).

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Key words: Task oriented, extroverted, personality trait

1. Introduction

Leadership and management are the important pillars of every community and organization. Management art is working with others and by others (Abolghasemi, 1981). Management in any organization is an integration factor of fertility and productivity of material resources and manpower available for the purpose of the organization. Human resources are one of the most important factors of economic development, success and survival of organization (Koushki, 2010). Successful and non-successful organization difference are often defined and selected on the basis of leadership quality and managers manner for leadership and organization management and the following individuals that is one of the most important tools for the success of an organization, and was proposed four effective components including leadership characteristics, leadership style, position and nature and following characteristics, and leadership style is a way to help a particular group of people by leaders to perform assigned duties and the group needs provided and defined, and it can be cited the traits of leader which is effective on the performance of leader is personality characteristics (Adibmanesh, 2010). Character is total methods, practices and individual actions toward the environment, and personality has dynamics and evolution, and it is constantly learning; methods and practices reaction of the environment will change during learning (Koushki, 2010). Properties such as age, degree of education, management experience, field and passing characteristics of management training courses are managers' individual traits which has impact on performance of managers. Nowadays, self-scrutiny discussion is important in different

organizations. To obtain more knowledge about the leadership process and related manners can be helpful for managers in order to select appropriate behavior patterns according to personality of each person and managers have to know the realities of life and the world around and act in an appropriate and realistic manner (Ahmadi, 2002). In other words, the managers' method is considered according to manager common leadership styles, management and his personal characteristics.

According to Eysenck, Extrovert personalities more inclined to sociality and possibly Leadership-oriented leadership style (pay much attention to their personal relationships and staff), and vice-versa intraversts tend to individual activities and possibly Task-oriented leadership style (A person who is assigned his attention to the task and work), and understanding each of these features can help him adjust his behavior with a subordinate (Baraheni, 1992). Organization environment requires managers select the appropriate leadership style at any time with the existing conditions and his own personality traits, and use it in order to increase productivity and effectiveness of the organization (Rad, 2002). Results of the personality characteristics of individuals indicates that individuals behavior depends on the character and personality traits (Hooper, 2001; Alkhtani, 2001; Blema & Steinberg, 2005; Seyed Mohammadi, 2005), therefore, the individual personality characteristics is underlying their behavior, and meanwhile effective, creative managers effects department performance due to personality dimensions, so it is assumed there is a positive relationship between two variables (Leadership style and personality characteristics) and the more fit

between personality and job, the more productivity; therefore, the less fit, the less productivity; So choosing the right personality can provide better job for the organization and employees attitudes to their tasks. Currently, management and leadership have been considered as the major issues of physical education and Sport, Since physical education lesson is a part of Education and has a huge share in upbringing and education of the young generation in charge of health, so a comprehensive plan seems essential and avoidless for the qualitative development of education in developing countries including our country, therefore, it is necessary to do extensive research in Education organization managements, particularly in physical education departments, identify leadership styles and personality characteristics of managers, which leadership style is consistent with what kind of personality, so the administrative director of physical education can expand their theoretical views, followers, and the total organization.

2. Material and Methods

55 managers of physical education managers participated in this research. Three questionnaires were used in this research: A) A researcher made information Questionnaire, including age, experience, education level, B) Luthans leadership style questionnaire four-choice format with 35 questions and, C) Eysenck personality inventory questionnaire, including 57 questions, with no true/false options. A group of experts confirmed the validity of the original questionnaires and were approved by using Cronbach's alpha, the internal consistency (validity) of Luthanz leadership style questionnaire was (0.79) and Eysenck personality (0.81), and the optimal estimation was confirmed. Data were analyzed by Pearson correlation coefficient test and to compare Chi-square test was used at $p \leq 0.05$ level.

3. Results

Table 1. Distribution of Task Oriented among managers

Variable (Leadership style)	A	V	St. dev.	Total score
Task-oriented	13.670	5.972	2.443	656
Extroverted	15.491	6.682	2.585	573

Table 2. Relationship between Task-oriented leadership style and Extroversions of Physical Education managers

Variable	Index	Extroverted
Task-oriented	R	-0.287
	Sig	0.048
	N	55

As table 2 shows, there was a negative meaningful relationship between two variables, Task oriented leadership style and Extroverted personality characteristics of Physical Education managers; it means there was an inverse significant relationship between two variables.

Table 3. The relationship between Task oriented leadership style and Individual characteristics of Physical Education managers

Variable	Index	Age	Education	experience
Task-oriented	R	-0.166	-0.109	-0.099
	Sig	0.261	0.463	0.505
	N	55	55	55

As table 3 shows, there between was not a meaningful relationship between Task oriented leadership style and Individual characteristics of managers (age, experience).

4. Discussions

The findings showed there was a significant but opposite relationship between task-oriented style with personality traits of extraversion at level $P=0.05$, which was parallel with Judge and Ebono (2002), and was inconsistency with Ghohari (2010) and Khosrawi (1996), there was a significant relationship between task-oriented with Physical education managers (age, education degree, management experience). Experience of managers can be effective on efficiency and effectiveness of management, but it cannot be a determinant of special leadership style and method for administrators and managers and it seems that Education degree of managers can be effective when it is paired in the fields of management and related sciences, and individuals in other fields with inherent lack of management, experience and training, would have little impact, and success would not be achieved. The factors of leadership styles are related to factors except personality characteristics such as colleagues, organization environment which should be considered more attention. Generally, in this study, it was clear that the research population differed under the different circumstances and due to the personality characteristics of Physical Education managers and using different Physical Education styles for training, this theory would be linked with contingency management theory which knows difference in efficiency and effectiveness of any style with changing circumstances. We therefore suggest that contingency management theory should be introduced to physical education managers further, since there is the risk of leadership styles and management incidence in all ages, management training courses aim to introduce a variety leadership styles and employing them in different situations should be

considered for Physical Education managers due to different personality types.

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References

1. Abolghasemi M, Survey the relationship between personality and management style of Tehran boys guidance school administrators. Master's thesis, Tehran University, 1991.
2. Adibmanesh M. Relationship of 5 big personality factors and leadership style of with educational services manager with the efficiency of schools in Kermanshah. Master's thesis, Teacher Training University in Tehran, 2011.
3. Ahmadi M. Principles of management of Tehran, Dide Avar Publication, 2002.
4. Alkahtani AH, Jarad AI. The impact of Personality and Leadership styles on Learning change capability of Malaysian Managers. *Aus J Busin a Manage Res* 2011; 1, 2.
5. Blema and Steinberg S. Indira Gandhi: The Relationship between Personality Profile and Leadership Style. *Political Psychology*, 2005; 26, 5.
6. Edvin OV, Gunnhild ÅV. The Relationship Between Personality of Leaders and Team Effectiveness. *Scand J Organiz Psych* 2011.
7. Ghohari Moghaddam M. Relationship between personality characteristics and leadership style of project management. Fourth International Conference on Project 7. Management, Tehran, 2010.
8. Hooper H., Potter J. Intelligent leadership creating a passion for change, London random house, 2001.
9. Judge TA, Bono JE, Ilies R, Gerhardt MW. Personality and leadership: A qualitative and quantitative review. *Journal of Applied Psychology*, 2002; 87 (4), 765-780.
10. Khosravi E. Relationship between leadership style and personal characteristics, physical education administrators in higher education. Master's thesis, Tehran University, 1996.
11. Koushki J. Relationship between Personality types and Style Leadership Management Middle managers and staff in Medical Sciences training hospitals of Shiraz University. Shiraz University of Medical Sciences, 2011.
12. Moss SA, Simon N. The relationship between personality and leadership preferences. *Curr res social psych* 2006; 11, 6.
13. Seyed Mohammadi Y. Theory of Personality, 7th Ed., Virayesh Publication, 2005.

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Rheological Properties of Barbari Bread Containing Apple Pomace and Carboxy Methyl Cellulose

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Abstract: Fast staling of traditional bread is one of the reasons for bread wastes. This study was designed to investigate the effect of applied apple fiber and carboxy methyl cellulose on improve the rheological properties and staling of traditional barbari bread. The rheological properties of dough were evaluated using farinograph and extensograph. Bread staling test was applied by sensory evaluation during 1, 2, and 3 days. For this purpose, three different amounts of apple fiber (5%, 8%, and 11%) were dried in a cabinet dryer at 58°C as a powder as well as carboxymethyl cellulose (CMC) at 0.1%, and 0.5% (w/w) were added to the flour. A full factorial design used to arrange treatments. The results of farinograph showed that, the sample containing 11% apple fiber and 0.5% CMC showed higher water absorption capacity, lower degree of softening, and higher quality properties compared to control and also the other samples. The results of extensograph in the sample containing 11% apple fiber and 0.5% CMC indicated lower ratio and high energy for all three time ranges (45, 90, 135 min) as compared with other experimental samples. The results of the panelists indicated that the enriched breads containing 11% apple fiber and 0.5% CMC obtained highest bread score for overall acceptability. The results of this study demonstrated that the combination of high level of apple fiber and CMC in the barbari flat bread significantly retard staling on it and improved its rheological properties.

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1. Introduction

Considering the importance of bread, its quality control and shelf life have been the concern of experts in bread industry. Fast staling of traditional bread (not more than 12-18h) is one of the reasons for bread wastes (Arasteh,1994). In Iran, bread wastes caused by staling are much significant as estimated by 20-25% (Payan,2001). Based on literature breads contained high fiber has longer shelf life than the control sample because fiber may bond to water preventing from moisture loss or may react with starch retarding starch retrogradation. Fibers are cell walls of plants which are not broken down by digestive enzymes. They include cellulose, hemicelluloses, lignin, pectin, gums, and mucilage which may be used to reduce calories and also disease such as high cholesterol, diabetes, and constipation (Mandala et al., 2007). Apple fiber is a byproduct of apples squeeze (sudha et al., 2007). Apples may be used as a good source of dietary fiber (Mckee and Lather., 2000). Fibers derived from fruits and vegetables contain high amount of soluble fiber while fibers originated from grains consisted of in soluble cellulose and hemicellulose. Vegetable fibers show practical properties including water holding capacity, swell capacity, increased viscosity or gelation, ability to bond to biliary acids and cationic exchange capacity which all have significant role in physiological functions (Gallaher and Schneeman., 2001). These are

due to their porous network structure formed by polysaccharide chains which may hold high amount of water through hydrogen bond (Kethireddipalli et al., 2002), or water may be hold in capillary structures of fibers through surface absorption (Lopez et al., 1996). Fibers usually are divided into soluble dietary fibers and insoluble dietary fibers (Gorinstein et al., 2001). Insoluble fibers including: cellulose, lignin and hemicelluloses accelerate digestive contents passing through digestive system so prevent from constipation. Also they may reduce the risk of colon cancer because of increased beneficial bacteria of intestine flora and prevented growth of pathogenic bacteria (Latner and Mckee, 2007). Soluble fibers such as pectin, gums, and some hemicelluloses undergo intestinal bacterial fermentation, affecting metabolism of carbohydrates and lipids (Nawirska and Uklanska., 2008). Practical properties of vegetable fibers depend on the ratio of insoluble dietary fibre (IDF) to soluble dietary fibre (SDF) content, particle size, extraction conditions, and the vegetable source of the fiber. In general, fiber sources with 2:1 IDF/SDF are suitable for nutritional purposes (Jaime et al., 2002). Apples fiber has a balanced IDF/SDF (Gorinstein et al., 2001). One of the most successful methods to keep high quality and long shelf life of bread is the addition of additives such as hydrocolloids (Barcenas and Rosell, 2005). Hydrocolloids may be used as modifiers for bread dough. All characteristics

of hydrocolloids depend on their sources and chemical structures. Viscosity properties of wheat starch are modified to a large extent through addition of hydrocolloids, although chemical structures (Guarda and Rosell., 2004).

CMC often is used to hold moisture, improve texture or mouthfeel, control crystallization of sugar and ice, and control rheological properties of dough, improve volume and consistency of baked products or increase their shelf life (Gimens et al., 2004). Moreover, CMC may absorb more water compared to the other additives such as sugar. This gum is compatible with other additives and modifiers (collar, 1999).

Previous researchers Masoodi and Chauhan (1998) were added apple fiber as a source of dietary fiber at 2, 5, 8 and 11% to wheat flour and they observed that the apple fiber significantly increased water binding capacity. They reported that when the fiber concentrations increased, the volume of dough decreased. In another study Masoodi et al (2002) investigated the application of apple fiber as a dietary fiber on cakes. Dried powdered apple fiber at 5, 10, and 15% with different sizes mixed with wheat flour of the cakes. They observed that increased apple fiber and reduced particle size resulted in increased viscosity. Also specific gravity and pH value of bread dough reduced as a result of increased apple fiber. They also noticed that fiber particle size had significant effect on cake volume as fine particles of fiber made more voluminous cakes compared to coarse particles.

Chen et al (1988) were added apple fiber and cellulose to wheat flour and investigated water holding capacity of different mixtures. They observed that apple fiber is a suitable water binder and increased water holding capacity of bread. Asghar et al (2005) studied the effect of carboxymethyl cellulose and Arabic gums on the frozen dough stability. The results indicated that the qualitative properties of the resulting breads have improved compared to the control bread (Asghar et al., 2005). Mettler and Seibel studied the effect of the addition of carboxymethyl cellulose and guar gums to the bread made of rye and the research results indicated that the qualitative properties of the breads had improvement compared to the control bread (Mettler & Seibel 1995). The aim of this study was to investigate the effect of CMC and apple fiber on rheological properties of Barbari bread dough and staling of bread.

2. Materials and Methods

2.1. Materials

Red variety apple was purchased from a farms located in Damavand. At first, the apples were squeezed, then dried at 58-60°C in a cabinet dryer for 2

days. Dried apple fiber was grinded by Tecator mill and then analyzed. Carboxy methyl cellulose (CMC) was purchased from Danisco (Denmark) and dry active yeast obtained from Fariman (Iran, Mashhad).

2.2. Physicochemical analysis

Flour and apple fiber physicochemical characterizations were: The Moisture content by the AACC method No. 16-44, the ashes content according to AACC No: 01-08, the fat content by AACC No. 10-30, the pH value by AACC No. 02-52, and protein content was determined according to AACC No. 12-46.

The particle size and sugar content were determined by national standard methods No. 103 and No. 4781 respectively.

Soluble and insoluble fiber were measured with fibertech, Acid Detergent Fibre (ADF) and Neutral Detergent Fiber (NDF) were measured using Van Soest method.

The wet gluten and precipitation of flour were determined according to AACC methods No. 11-33 and No. 116 respectively.

The Farinograph test, was conducted using Brabender (Germany) according to the standard method AACC No. 21-54, and dough elasticity was determined as ICC standard methods No. 114.

2.3. Sensory evaluation

The sensory and organoleptic assessment of the traditional Iranian bread was carried out by using 15 trained panelists on overall acceptability and staling of bread by using a hedonic scale. The coded samples in plastic bags were examined by the panel and scored. The highest scores were 6 for the desirable bread with lowest staling and 0 for unacceptable bread with highest staling.

The panelists evaluated and scored overall acceptability of bread samples after 72 hour (h) storage by considering characteristics including: aroma, taste and flavor, upper and lower surfaces properties, form and shape, chew ability.

The sensory evaluations of bread staling of all experimental breads were performed at 24, 48 and 72 h storage in proper packages at room temperature.

2.4. Barbari Bread manufacture

Dough of barbari bread was prepared using direct method. The basic formula for control sample included 100 g of flour, 65 g of water, 2 g of yeast, 1.5 g of sugar, 0.5 g salt and different amounts of apple fiber and CMC as powder on a flour replacement basis. The ingredients of each samples were mixed by mixer (Ziafat, Iran) to make a desirable firmness (15 min), then loaves of dough then loaves of dough were prepared (500g) followed by primary fermentation for

15 min at 30°C and 75-85% relative humidity, the loaves of dough (500g) left for 10-15 min, followed by secondary fermentation in incubator at 30-45°C for 45 min, finally bread was baked at 260°C for 13 min in a industrial oven of tray type.

2.5. Experimental design and statistical analysis

In this study a completely randomized design (CRD) was used to arrange treatments and in order to investigate the effect of different amounts of apple fiber (5%, 8%, and 11%) and carboxymethyl cellulose (0.1% and 0.5% w/w) on rheological properties of Barbari bread dough and staling of bread and compare them with control sample (prepared by basic formula and without apple fiber and CMC).

Therefore as shown in Table 1, ten treatments were designed in triplicates using mechanical methods and five replicates using sensory methods. The data obtained from the measurements were subjected to one-way analysis of variance (ANOVA) to determine the significant differences among the treatments.

All statistical analysis was performed using the Minitab v. 14 statistical package (Minitab Inc., State College, PA, USA).

Table 1. Levels of the independent variable established according to the completely randomized design.

Symbol	Apple fiber (%w/w)	CMC (%w/w)
A (control)	0	0
B1	5	0
B2	8	0
B3	11	0
C1	11	0.5
C2	8	0.5
C3	5	0.5
C4	5	0.1
C5	8	0.1
C6	11	0.1

3. Results and discussion

3.1. Physicochemical analysis

Results of Physicochemical test of apple fiber and wheat flour, chemical properties of wheat flour and apple fiber are shown in Table 2. The results indicated that the wheat flour used was suitable for the production of Barbari bread in terms of the measured parameters including: moisture, ash, protein, wet, gluten, sedimentation unit and pH.

3.2. Farinograph test

The results of farinograph test of different samples are shown in Table 3. Sample C1 which enriched with high level of apple fiber and CMC

showed the highest water absorption capacity as compare with all samples. The control sample showed the lowest water absorption (A).

The result of Table 3 demonstrated that the apple fiber and carboxy methyl cellulose played a significant role to increase of water absorption capacity of bread samples as compare with the control sample.

The average comparison results of dough development factor of samples (Table 3) indicated that there was a significant difference between control sample and the other treatments ($P < 0.05$) as treatment C1 had the highest dough development time and the control had the lowest.

Table 2. Chemical properties of apple pomace and wheat flour

Physicochemical analysis	wheat flour	Apple pomace
Wet (%)	13.7	4.5
Ash (%)	0.7	1.1
Protein (%)	12.4	1.8
Wet Gluten (%)	3.6	---
Falling Number (sec)	612	---
ADF ^a (%)	0.3	13.6
Reducing Sugars (%)	---	41.9
NDF ^b (%)	2.2	19.0
Crude Fiber (%)	0.6	10.5
Sucrose (%)	---	6.2
Sedimentation unit (ml)	28-30	---
Fat (%)	2.6	2.5
pH (%)	6.1	4.6

^aADF: Acid Detergent Fiber

^bNDF: Neutral Detergent Fiber

The result of this research revealed that the increase of the percentages of apple fiber resulted in increased development time of dough.

According the results of Table 3 dough stability time reduced significantly with the addition of apple fiber and CMC to the flour. Thus the control sample exhibited the longest dough stability time and sample C1 showed the shortest stability time.

As shown in Table 3, following the addition of different percentages of apple fiber, softening degree of dough increased significantly at 10 and 12 minutes. Treatment B3 showed the highest softening degree for 10 min and treatments B3, C3 for 12 min.

As shown in Table 3, treatment C1 showed the highest farinograph quality value at 113 and treatment B3 showed the lowest one at 87.

Based on the results of this study dough containing CMC is presented higher farinograph quality than the treatments containing apple pomace alone.

Table 3. Comparison of results Farinography test on Barbari dough containing Apple pomace and Carboxy Methyl Cellulose. Significant difference within column at confidence level of $p < 0.05$.

Treatment	Water absorption%	Dough development time (min)	Dough stability time (min)	Dough softening after 10 minutes (B.U)	Dough softening after 12 minutes (B.U)	Farinograph quality
A	55.20±1.5 ^a	5.50±0.15 ^a	9.00±0.0 ^a	30.50±0.0 ^b	65.0±0.0 ^b	100.0±0.0 ^g
B1	57.55±1.6 ^{ab}	5.77±0.15 ^b	7.55±0.7 ^b	38.50±0.0 ^e	86.0±0.0 ^e	89.0±0.0 ^b
B2	58.52±1.6 ^{ab}	6.77±0.18 ^e	7.07±0.3 ^c	43.0±0.0 ^f	107.0±0.0 ^f	89.0±0.0 ^b
B3	59.60±1.6 ^{ab}	6.60±0.18 ^d	7.10±0.0 ^c	50.0±0.0 ^g	121.50±0.0 ^h	87.0±0.0 ^a
C1	69.35±1.9 ^c	7.22±0.31 ^h	6.80±0.0 ^c	19.0±0.0 ^a	93.50±0.0 ^c	113.0±0.7 ^h
C2	62.35±1.7 ^b	6.75±0.17 ^e	6.50±0.0 ^{cd}	31.0±0.0 ^b	103.50±0.0 ^e	99.0±0.0 ^f
C3	62.50±1.7 ^b	7.10±0.19 ^g	6.05±0.0 ^d	30.0±0.0 ^c	121.50±0.0 ^h	100.50±0.0 ^g
C4	59.85±1.6 ^{ab}	6.85±0.17 ^f	7.50±0.0 ^{bc}	33.50±0.0 ^d	86.50±0.0 ^b	95.0±0.0 ^d
C5	61.20±1.7 ^{ab}	6.60±0.18 ^d	7.70±0.0 ^b	33.50±0.0 ^d	95.50±0.0 ^d	96.0±0.0 ^e
C6	61.15±1.7 ^{ab}	6.40±0.17 ^c	7.38±0.4 ^{bc}	38.0±0.0 ^e	110.0±0.0 ^g	94.0±0.0 ^c

The values reported are mean ± SD.

The results of extensograph tests in Barbari bread dough samples during fermentation at 45, 90 and 135 min were presented in Tables 4, 5, 6.

The results showed that the control samples in the fermentation time of 45, 90 and 135 had the lowest amounts of energy.

As shown in Tables 4, 5, 6 the amount of energy increased following the addition of CMC in experimental samples. Bread samples of C1, C2 and C3 with 0.5% of CMC showed the highest amounts of energy during fermentation times (45, 90 and 135 min).

The average comparison the results of resistance to stretch during all three fermentation times in Barbari bread dough samples demonstrated that treatments were contained apple fiber and CMC exhibited higher amounts of resistance to stretch as compare to control sample.

Therefore treatments B3, C1 and C6 which enriched with 11% apple fiber had the highest levels

and control sample showed the lowest amount of resistance to stretch at all fermentation times.

The results of ability to stretch are shown in Tables 4, 5, 6. According to results, the ability to stretch of sample C1 after control sample was highest during at the fermentation time of 45 min (Table 4). The ability to stretch of sample C1 significantly decreased with increase of fermentation time.

The effect of factors of resistance to stretching and the ability to stretch the dough on the coefficient numerical value is defined as the ratio of resistance to stretching to the ability to stretch.

According to Tables 4, 5, 6 Addition of apple fiber and CMC increased the ratio of Resistance stretch to Ability to stretch, but the results showed that the effect of apple fiber were more effective than CMC as the highest level of this factor during all three fermentation time were belonged to the treatments of B3, C6. As can be seen from the results of Table 7, the highest bread score for overall acceptability was belonged

Table 4. Comparison of results Extensography test on dough containing Apple pomace and Carboxy Methyl Cellulose during fermentation time of 45 min treatment C1 and the lowest was belonged to the control.

Treatment	Energy (cm ²)	Resistance to stretch (B.U)	Ability to stretch (mm)	(Resistance stretch / Ability to stretch)
A	84.0±0.07 ^{ab}	330.25±2.1 ^a	162.50±11.46 ^d	2.05±0.14 ^a
B1	103.50±14.85 ^{bcd}	515.50±36.4 ^{bc}	128.0±9.05 ^{abcd}	4.05±0.28 ^{cd}
B2	91.0±9.90 ^{ab}	511.50±36.2 ^{bc}	117.50±8.20 ^{ab}	4.35±0.29 ^d
B3	84.50±7.70 ^{ab}	602.00±42.6 ^{de}	96.50±6.82 ^a	6.25±0.43 ^e
C1	106.50±0.71 ^{cd}	590.50±41.7 ^{de}	157.0±11.10 ^d	2.50±0.17 ^{ab}

C2	110.5±16.26 ^{ed}	498.00±35.2 ^{bc}	137.00± 9.69 ^{bcd}	3.60±0.25 ^{bcd}
C3	112.0±18.38 ^e	394.50±27.9 ^{ab}	157.50±11.06 ^d	2.90±0.19 ^{abc}
C4	107.0±12.73 ^a	414.50±29.3 ^{ab}	145.50±10.28 ^{cd}	3.20±0.22 ^{abcd}
C5	106.0±11.31 ^{abc}	467.50±33.1 ^{abc}	128.00±9.05 ^{abcd}	4.25±0.29 ^d
C6	101.50±7.78 ^e	664.50±47.0 ^e	106.50±7.52 ^{ab}	6.25±0.43 ^e

The values reported are mean ± SD

Table 5. Comparison of results Extensography test on dough containing Apple pomace and Carboxy Methyl Cellulose during fermentation time of 90 min

Treatment	Energy (cm2)	Resistance to stretch (B.U)	Ability to stretch (mm)	(Resistance stretch / Ability to stretch)
A	64.7±4.57 ^a	283.50±20.0 ^a	139.2±12.85 ^a	2.25±0.15 ^a
B1	104.5±6.68 ^{bcd}	662.0± 46.8 ^{bcd}	108.0±7.64 ^{ab}	5.95±0.41 ^b
B2	99.5±7.03 ^{ab}	764.5±54.1 ^{de}	114.0±8.06 ^a	6.8±0.48 ^b
B3	91.5±6.46 ^{ab}	982.0±69.5 ^e	108.5±7.67 ^c	9.1±0.63 ^c
C1	128.5±9.08 ^{de}	394.5±27.9 ^{ab}	154.5±10.92 ^{bc}	2.55±0.17 ^a
C2	129.0±2.05 ^{cde}	565.0±40.0 ^{bc}	147.5±10.42 ^{abc}	3.50±0.24 ^a
C3	144.0±10.18 ^d	606.0±42.90 ^{bcd}	125.5±17.68 ^{abc}	4.90±0.33 ^b
C4	111.0±7.99 ^{bcd}	494.0±34.90 ^{bc}	120.5±14.85 ^{abc}	4.10±0.28 ^{def}
C5	113.0 ±7.85 ^{bcd}	600.50±42.50 ^{bcd}	122.0±14.14 ^{abc}	5. 0±0.35 ^b
C6	108.0±7.64 ^{bcd}	891.10±63.00 ^e	105.5±7.54 ^a	8.45± 0.66 ^c

The values reported are mean ± SD.

Table 6. Comparison of results Extensography test on dough containing Apple pomace and Carboxy Methyl Cellulose during fermentation time of 135 min

Different letters in each column are indicate statistical difference at 5% leve.

Treatment	Energy (cm2)	Resistance to stretch (B.U)	Ability to stretch (mm)	(Resistance stretch / Ability to stretch)
A	65.5±4.62 ^a	274.0± 19.40 ^{ab}	150.0±10.61 ^{ab}	1.85±0.12 ^a
B1	115.0± 8.13 ^{bc}	687.0± 48.60 ^b	120.5±8.50 ^{ab}	5.7±0.39 ^b
B2	114.0±8.06 ^{bc}	858.5±60.70 ^c	108.0±7.64 ^{ab}	8.35±0.58 ^b
B3	94.0±6.65 ^b	995.5±70.40 ^c	93.0±8. 0 ^{ab}	10.7±0.75 ^b
C1	121.5±8.58 ^{bc}	453.5±31.90 ^a	133.5±9.08 ^{ab}	3.4±0.21 ^c
C2	125.5±9.22 ^c	565.0±40.10 ^b	136.0±9.62 ^{ab}	4.20±0.29 ^{bc}
C3	129.5±9.15 ^c	610.5±43.10 ^b	142.0±10.04 ^{ab}	4.6± 0.32 ^{bc}
C4	97.5±6.89 ^b	478.5±33.80 ^a	130.0±9.48 ^{ab}	3.75±0.25 ^c
C5	110.0±7.78 ^{bc}	641.5±45.30 ^b	117.5±8.66 ^{ab}	5.5±0.38 ^{bc}
C6	118.0±8.34 ^{bc}	937.5±66.30 ^c	95.0±6.72 ^{ab}	9.85±0.69 ^{bc}

The values reported are mean ± SD.

Different letters in each column are indicate statistical difference at 5% leve.

Table7. Mean scores of sensory evaluation treatments when coefficients applied and Sensory evaluation (Bread staling)

Treatment	Overall acceptability of Bread after 72 h storage ^a	Bread staling score ^a		
		24 hours	48 hours	72 hours
A	3.20±0.22 ^a	5.40±0.38 ^a	3.60±0.25 ^a	2.0±0.14 ^a
B1	4.0±0.28 ^{ab}	5.60±0.39 ^a	5.0±0.35 ^{ab}	4.15±0.28 ^b
B2	4.21±0.29 ^{ab}	5.80±0.41 ^a	5.20±0.36 ^b	4.50±0.34 ^b
B3	4.60±0.32 ^b	5.80±0.41 ^a	5.40±0.38 ^b	4.80±0.33 ^b
C1	4.95±0.33 ^b	6.00±0.42 ^a	5.80±0.41 ^b	5.20±0.36 ^b
C2	4.40±0.45 ^{ab}	5.60±0.39 ^a	5.40±0.38 ^b	4.20±0.29 ^b
C3	4.20±0.29 ^{ab}	5.60±0.39 ^a	5.20±0.36 ^b	4.0±0.28 ^b
C4	4.15±0.28 ^{ab}	5.60±0.39 ^a	5.20±0.33 ^{ab}	4.20±0.29 ^b
C5	4.55±0.31 ^b	5.80±0.41 ^a	5.40±0.38 ^b	4.0±0.28 ^a
C6	4.75±0.32 ^b	6.0±0.42 ^a	5.60±0.39 ^b	4.80±0.33 ^b

The values reported are mean ± SD.

Different letters in each column are indicate statistical difference at 5% leve

^a:The highest scores were 6 for the acceptable bread with lowest staling and 0 for unacceptable bread with highest staling

4. Discussions

Increased apple fiber content increases water absorption as a result of network structure of fibers consisted of polysaccharide chains holding high amount of water by hydrogen bonds (kethireddipalli et al., 2002) or water may be held in capillary structures of fibers through surface absorption (lopez et al., 1996). Since apple fiber contains high amount of fibers, these results are predictable. Masoodi and chauhan. (1998) obtained similar results. In addition, water absorption of all samples containing apple fiber with gums is higher than the control sample without fiber. This increase in water absorption may be due to hydrophilic structure of gums and higher content of fiber. Hydroxyl groups of hydrocolloids are bound to water molecules through hydrogen bond and increasing water absorption (Tavakol pour & Ashtari, 2006). There is a direct relationship between apple fiber percentage and dough development time so that addition of fiber to the mixture may reduce water absorption rate and gluten development type and amount of fiber have significant effect on water absorption and expansion of dough. A fiber with

potential to absorb high amount of water may prolong dough development time. Interactions between fibers and gluten of wheat flour may explain different effects of various fibers on dough development time. The obtained results are consistent with the results obtained by sudha et al. (2007). It may be noted that all samples contained gums showed increased dough development time compared to control sample. In general, it may say that applying higher percentages of apple fiber and CMC to Barbari dough may increase dough development time compared to control sample. Arabameri et al. (2004) also found that inclusion of carboxy methyl cellulose in Lavash bread dough prolonged dough development time. The results of dough resistance time of samples are consistent with results obtained by sudha et al. (2007). They reported that, increase the level of apple fiber resulted in reduced dough resistance time.

Addition of CMC to flour containing apple fiber reduced softening degree significantly. Chen et al. (1988) suggested that dough softening was due to

gluten dilution because of increased fiber content or interaction between fiber and gluten.

The extensographic result showed that the type and amount of additives had significant effect on amount of energy. The results showed that the amount of energy significantly increased following the addition of CMC for all three times (45, 90, and 135) of fermentation. This finding was consistent with the result obtained by Rosell et al. (2005) who reported that addition of different amounts of gums may firm dough and increases the amount of energy of the treatments. A strong complex seems formed between flour starch and gluten network strengthened by gums resulting in increased dough stability and energy for dough elasticity. The energy values and ratios of all the extensograms were in line with the baked volume achieved with these flours. The low energy values in conjunction with low ratios (0.6) that indicated soft and weak doughs and the high ratios (7 and above) in conjunction with low energy values that stand for short doughs were confirmed by low baked volumes. High energy values and ratios in the optimum range (about 1.5 to 3.0) in the extensograms indicated a flour of good quality and high baked volumes (Weipert, 2006).

The result of resistance to stretch of this study were consistent with the results obtained by Sudha et al. (2007) who showed that addition of different amounts of apple fiber to cakes may increase resistance to stretch and reduce elasticity of dough.

The results of sensory evaluation proved that sample inoculated with highest level of apple fiber and CMC exhibited the highest overall acceptability and lowest staling after 72 h storage. A possible explanation for this could be related to effective role of apple fiber and CMC to improve the quality of traditional barbari bread.

The result of this research revealed that by applying 11% apple fiber and 5% CMC to traditional barbari bread formulation we successfully achieved a proper formulation for producing barbari bread with higher quality and ability to storage.

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References

1. Anon. 1995 AACC Approved methods of the American Association of Cereal Chemists (9th ed). St. Paul, MN: American Association of Cereal Chemists.
2. Asghar A, Anjum FM, Tariq MW, Hussain S. Effect of carboxy methyl cellulose and gum arabic on the stability of frozen dough for the bakery products. *Turkish Journal of Biology*. 2005; 29(4): 237–241.
3. Arab Ameri M, Azizi M H, Barzegar M. Influence of some hydrocolloids on dough rheological properties and quality of Lavash bread. *Iranian Food Science and Technology*. 2004; 1:55-65.
4. Arasteh N. *Cereal Technology*. Astaneh Qudse Razavi Press. 1994. Iran.
5. Chen H, Rubenthaler GL, Leung HK, Baranowski JD. Chemical, physical and baking properties of apple fiber compared with wheat and oat bran. *Cereal chemistry*. 1988; 65(3): 244-247.
6. Armero E, Collar C. Antistaling additive effects on fresh wheat bread quality. *Food Science and Technology International*. 1996; 2(5) : 323-333.
7. Barcenas M, Rosell CM. Effect of HPMC addition on microstructure, quality and aging of wheat bread. *Food Hydrocolloids*. 2005; 19(6): 1037- 1043.
8. Collar C, Andreu P, Martines jc, Armero E. Optimization of hydrocolloid addition to improve wheat bread dough functionality: response surface methodology study. *Food Hydro colloids*. 1999; 13(6): 469- 475.
9. Chen H, Rubenthaler GL, Leung HK, Branowski JD. Chemical, physical and baking properties of apple fiber compared with wheat and oat bran. *Cereal chemistry*. 1988; 65(3), 244-247.
10. Gorinstein S, Zachwieja Z, Folta M, Barton H, Piotrowicz J, Zemser M, Weisz M, Trakhtenberg S, Martín O. Comparative contents of dietary fiber, total phenolics, and minerals in persimmons and apples. *Journal of agricultural and food chemistry*. 2001; 49(2): 952-7.
11. Gallaher D, Schneeman BO. *dietary Fibre*. In B. Bowman & Russel (Bds), *Present Knowledge in nutrition (& thed., PP. 805)*. Washington, DC. 2001. ILSI.
12. Gimens E, Morau c, kokini j. Effect on xanthan gum and CMC on the Structure and texture of corn flour Pellets expanded by micro wave heating. *Cereal chemistry*. 2004; 81(1) :100-107.
13. Guarda A, Rosell CM, Benedito de Barber C, Galotto M j. Different hydrocolloids as bread improvers an anti staling agents, food hydro colloids .2004; 18(2) : 241-247.
14. Standard method of international for cereal chemistry (ICC).
15. Jaime L, Molla E, Fernandez A, Martin-cabrejas M, Lopez-Andreu F, Esteban R. Structural

- carbohydrates difference and potential source of dietary fibre of onion (*Allium cepa* L.) tissues. *Journal of Agricultural and Food Chemistry*. 2002;50(1):122-128.
16. Kethireddipalli P, Hung YC, Phillips RO. & McWaters, KH. Evaluating the role of cell material and soluble protein in the functionality of cowpea (*Vigna unguiculata*) pastes. *Food Science*. 2002;67(1):53-59.
 17. Lopez G, Ros G, Rincon F, Periago Mj, Martinez MC, Ortuno J. Relationship between physical and hydration properties of soluble and insoluble fibre of artichoke. *Agricultural and Food Chemistry*. 1996;44:2773-2778.
 18. McKee LH, Lather TA. Underutilized sources of dietary fibre. Review. *Plant Foods for Human Nutrition*. 2000;55(4):285-304.
 19. Masoodi FA, Chauhan GS. Use of apple pomace as a source of dietary fibre in bread. *Food Processing and Preservation*. 1998; 22(4): 255-263.
 20. Masoodi FA, Sharma B, Chauhan GS. Use of apple pomace as a source of dietary fibre in cakes. *Plant Foods for Human Nutrition*. 2002; 57(2):1211-128.
 21. Mandala I, Karabela D, Kostaropoulos A. Physical properties of breads containing hydrocolloids stored at low temperature. I. effect of chilling. *Food Hydrocolloid*. 2007;21(8):1397-1406.
 22. Mettler E, Seibel W. Effect of emulsifiers and hydrocolloid on whole wheat Bread quality. *Cereal Chemistry*. 1995;70(4):373-377.
 23. Nawirska A, Uklanska C. Waste products from fruit and vegetable processing as potential sources for food enrichment in dietary fibre. *Acta Scientiarum Polonorum - Technologia Alimentaria*. 2008; 7(2):35-42.
 24. Payan R. Introduction to Cereal Production Technology. Aijh publications. 2008.
 25. Sudha ML, Baskaran AV, Leelavathi K. Apple pomace as a source of dietary fibre and polyphenols and its effects on the rheological characteristics and cake making, food chemistry, 2007; 104(2): 686-692.
 26. Tavakolpour H, Kallbasi - Ashtrari A. Influence of gums on dough properties and flat bread quality of two Persian Wheat varieties, food process engineering. 2006; 30(1): 74 -87.
 27. VanSoest PJ. Use of detergents in the analyses of fibrous feeds. [I. A rapid method for the determination of fiber and lignin. *J. Assn. Offic. Agricultural Chemistry*. 1963; 46(0):829-351.
 28. Weipert, D. (2006); Fundamentals of rheology and spectrometry. In Future of flour a compendium of flour improvement. (L. Popper, W. Schafer and W, Freund eds.) Agrimedia, Bergen, Dunne, Germany. pp.117-146.

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Effect of Weave Structure and Weft Density on the Physical and Mechanical Properties of Micro polyester Woven Fabrics

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Abstract: In this paper, micropolyester woven fabrics with plain, twill and satin weave structures and five different weft densities were produced. Using ANOVA statistical analysis, the effects of weft density and weave structures on the physical and mechanical properties of these fabrics were investigated. The findings of this study revealed that increasing weft density leads to an increase in fabric breaking load, stiffness and crease recovery. On the contrary, the increase in weft density decreased air permeability, and tearing strength. The effect of weft density on fabric breaking elongation and abrasion resistance are similar to each other. Plain weave fabrics were superior to other structures in fabric breaking load, breaking elongation and fabric stiffness. Satin weaves have higher air permeability, whereas twill weaves have higher crease recovery.

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Key words: micro fiber, weave structure, weft density, polyester, physical properties, mechanical properties, woven fabric.

1. Introduction

Polyester fibers poly (ethylene terephthalate) (PET) fibers dominate the world synthetic fibers industry. A polyester fiber is composed of any long-chain synthetic polymer including at least 85 wt % of an ester of a dihydric alcohol (HOROH) and terephthalic acid (p-OOCC6H4COOH) [1, 2].

A very important property of polyester is that its mechanical properties in the wet state and under standard conditions are practically the same. PET fibers have excellent resistance to acids, alkalis and microbial attack. They also have good resistance to light and actinic degradation [3-5].

For comparison, microfibers are half the diameter of a silk fiber, one-third the diameter of cotton fiber, one-quarter the diameter of fine wool fiber and one hundred times finer human hair. In order to be called a microfiber, a fiber must be less than one denier which is the weight in grams of a 9000m length of fiber or yarn. Many microfibers are 0.5 to 0.6 denier [6-8].

Besides having a luxurious body and drape, microfiber fabrics are also lightweight and resilient. They can retain their shape and resist pilling. Compared to other fabrics of similar weight, they are relatively strong and durable. Since fine yarns can be packed tightly together, microfiber fabrics have good wind resistance and water repellency. As the number of filaments in a yarn of given linear density increases, the surface area of all the fibers increases and the spaces between the fibers get smaller. Liquid

water is prevented by surface tension from penetrating the fabric, which will have a degree of water repellency. On the other hand, the spaces between the yarns are porous enough to breathe and wick body moisture away from the body [9-13].

2-Experimental Work

2.1-Materials

Throughout this study, 15 micropolyester woven fabric samples were produced with different weft densities and weave structures. The details of the fabric samples were listed in table 1. Weft yarns were spun from drawn textured polyester yarn (DTY) with count 150 denier and 288 filaments. This means that weft yarns spun from micro polyester fibers with fineness 0.52 denier per filament. Warp yarns were produced from DTY whose fineness 150 denier with 208 filaments, i.e. denier per filament is 0.72. All woven fabric samples were produced on Sulzer weaving machine with the following particulars:

- Warp yarn count: 150 denier /208 filaments.
- Weft yarn count: 150 denier/288 filaments
- Warp density: 110 ends / inch.
- Weft density: 61, 65, 71, 75 and 80 picks / inch
- Fabric Width: 160 cm.
- Number of Harness Frames: 4
- Weave structure: 1/1 plain, 2/2 twill, and 4-satin weaves
- Machine speed: 420 ppm

Weave structures of the woven fabrics in this study were shown in figure 1

2.2-Laboratory Testing

Since the variation in all fabric samples were conducted in weft yarns, all fabric properties were evaluated in the weft direction. Before testing, all micro polyester woven fabrics were conditioned for 24 hours in a standard atmosphere i.e., 20 °C±2 temperature and 65% ±2 Relative humidity. Ten individual readings were taken and averaged for each fabric property. Micro polyester woven fabrics were tested for the following properties: fabric tensile strength, breaking elongation, tearing strength, air permeability, fabric stiffness, crease recovery and abrasion resistance. The standard test methods followed for testing micro polyester woven fabric properties are listed in Table 2.

Table 1: Details of the woven fabric samples

Sample No.	Weave structures	Weft density (ppi)
1	Plain 1/1	61

2	Plain 1/1	65
3	Plain 1/1	71
4	Plain 1/1	75
5	Plain 1/1	80
6	Twill 2/2	61
7	Twill 2/2	65
8	Twill 2/2	71
9	Twill 2/2	75
10	Twill 2/2	80
11	Satin 4	61
12	Satin 4	65
13	Satin 4	71
14	Satin 4	75
15	Satin 4	80

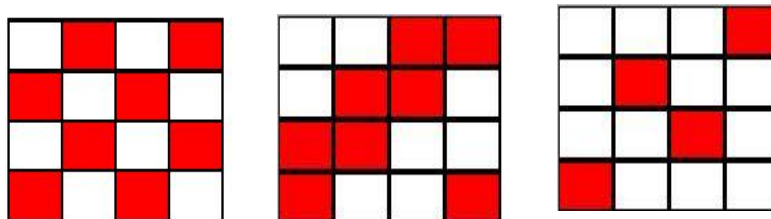


Fig.1- Weave structures of woven fabric samples

Fabric tensile strength and breaking elongation of all fabric samples in weft direction were performed on an Instron 4411 Tester (Instro Inc., U.S.A), which was shown in fig. 2. The tensile testing speed was 100 mm/min. Shirley Air permeability Tester was used to evaluate the air permeability of the fabric samples.

Tearing force of the woven fabric samples was measured using an intensity tearing tester (Elmendorf type), which shown in fig. 3. A Nu-Martindale Abrasion Tester (James H. Heal, UK) was used to evaluate the abrasion behavior of the micro polyester fabrics. The fabrics were abraded under a pressure of 12 kPa (795 ± 7 g). At the end of 1000 rubs, the abrasion cycle was ended. The abrasion resistance of the fabrics was evaluated according to their weight loss (%) after 1000 rubs. For each fabric sample, the abrasion tests were carried out 10 times, and the average weight loss was calculated. The photograph of Martindale abrasion tester was depicted in fig.4.

Fabric stiffness was evaluated using fabric stiffness tester model UASUDA SEIKI Japan, which shown in fig.5. The crease recovery angles of the

fabrics were measured. The tests were performed in weft directions for five replicas for each fabric sample. High crease recovery angle means better crease recovery of the fabric.

Table 2- Standards Test methods of the properties measured in this study

Fabric Property	Standard Test Method
Fabric tensile strength and breaking elongation (strip method)	ISO 13934-1
Air permeability	D737
Fabric tearing strength	D1424
Fabric stiffness	D1388
Fabric abrasion resistance	BS 5690
Crease recovery	AATCC 66-1975



Fig. 2: Instron 4411 Tester



Fig. 3: Elmendorf Type Tearing Tester



Fig. 4: Martindale Abrasion Tester



Fig. 5. Fabric Stiffness Tester

2.3- Statistical Analysis

In this study, five different weft densities were applied to three different weave structures. The results were tested for significant difference using a 3×5 mixed factorial design. The Minitab statistical package was used to execute the statistical analysis. All test results were statistically assessed at significance level, p-value, $0.05 \leq p\text{-value} \leq 0.01$. If the p-value is smaller than or equals 0.05, the effect of weave structure and weft density are considered to be significant.

3- Results and Discussion

3.1- Fabric breaking load

The tensile behavior of woven fabrics is known to be affected by its sett and construction. This influence, when clearly understood, would make engineering of fabrics for tensile properties easier. In this study, tensile properties of micropolyester woven fabrics were characterized by fabric breaking load and elongation.

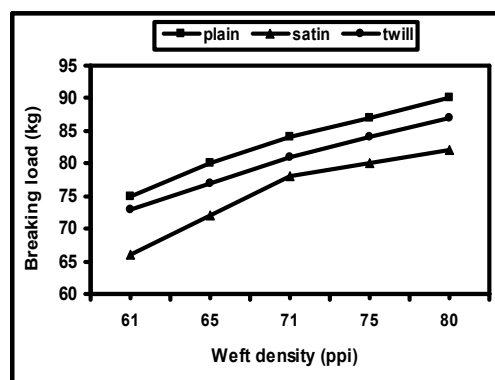


Fig. 6- Variations of fabric breaking load at different levels of weft density and weave structure.

The results of fabric breaking load were depicted in Figure 6. According to the statistical analysis, filling yarn density and weave structure were found to have a significant influence on breaking load of fabrics woven from micropolyester fibers. An increasing trend is detected confirming that as the weft density increases, the breaking load of the fabric samples follow the same trend. It is also shown that weave structure has a profound effect on fabric breaking load. Micropolyester fabrics woven from plain structure showed the highest breaking load followed by fabrics with twill weaves and satin weaves respectively. Generally, increasing weft density from 61 to 80 picks / inch leads to an increase in fabric breaking load by 20%, 24% and 19% for fabrics with weave structures plain, satin and twill respectively. The significant impact of weft density on fabric breaking load may be related to the increase

of yarns which bears the load in fabric structure. Fabric samples with plain structure showed higher breaking load; this is because the higher intersections associated with this structure.

3.2- Fabric breaking elongation

In determining the effect of weft density and weave structure type on breaking extension of fabrics woven from micropolyester fibers, the results were plotted in figure 7. From this figure, it is verified that there is a negative correlation between weft density and breaking elongation. Fabric breaking elongation was increased by the increase in weft density from 61 to 71 picks/ inch, and then decreased with the increase in weft density up to 80 picks /inch.

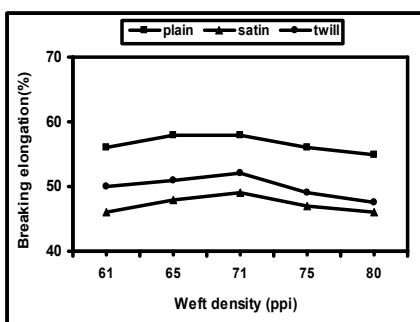


Fig. 7- Variations of fabric breaking elongation at different levels of weft density and weave structure.

It is also apparent that woven micropolyester fabrics with weave structure plain 1/1 are associated with higher breaking elongation followed by twill weave and satin weave respectively. The higher elongation of plain fabrics can be ascribed to the higher intersections between warp yarns and weft yarns in the fabric structure. The lower breaking elongation of satin weave fabrics may be related to the higher float length of the weft yarns in this type of fabrics.

3.3- Fabric air Permeability

The air permeability is very important factor in the performance of some textile materials. Especially, it is taken into consideration for clothing, parachutes sails, vacuum cleaners, fabric for air bags and industrial filter fabrics. The air permeability is mainly dependent upon the fabric's weight and construction (thickness and porosity). Air permeability of micropolyester woven fabrics at different levels of weft densities and weave structures was plotted in figure 8.

From this figure it is seen that when the number of weft yarns per inch increases, the air permeability of the woven fabrics decreases. The higher the values

of filling numbers cause decreases the air permeability of the woven fabrics. As known, increasing number of weft yarns per inch results a tightly woven structure. So, it is thought that the air permeability of the woven fabric is reduced.

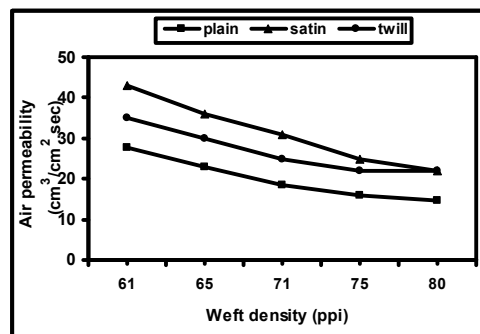


Fig. 8- Variations of fabric air permeability at different levels of weft density and weave structure.

It is also shown that woven fabrics with weave structure plain 1/1 showed lower air permeability compared with other fabric structures. Fabric samples with satin weaves had higher air permeability followed by twill weaves and plain weaves. At higher weft density, the air permeability of woven fabrics with twill and satin weaves are close to each other. The lower values of air permeability of plain weave structures can be attributed to its compactness due to the higher intersections of warp and weft yarns.

3.4- Fabric Stiffness

Stiffness is one of the most widely used parameters to judge bending rigidity and fabric handling. Fabric stiffness and handling is an important decision factor for the end users. The degree of fabric stiffness is related to its properties such as fiber material, yarn and fabric structure. In this work, the effects of weft density and weave structure of micropolyester woven fabrics on fabric stiffness were investigated. The results of fabric stiffness were depicted in figure 9.

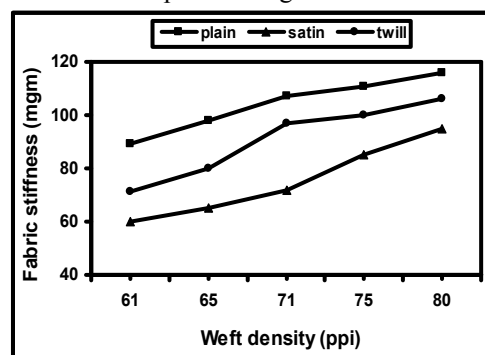


Fig. 9- Variations of fabric stiffness at different levels of weft density and weave structure.

The statistical analysis proved that stiffness of micropolyester woven fabrics has been affected significantly at 0.01 significance level by both weave structure and weft density. Weft density has a profound influence on fabric stiffness. An increasing trend was detected assuring that as the weft density increases fabric stiffness increases. This is because the increase in fabric tightness with the increase in weft density, which in turn increases fabric stiffness. Increasing weft density from 61 to 80 picks / inch leads to an increasing of fabric stiffness by 30%, 58% and 48% for plain, satin and twill weaves respectively.

From this figure it is also shown that the stiffness of micropolyester fabrics woven from plain weaves is higher than those woven from other structures. Associated higher stiffness of plain weaves can be ascribed to the higher tightness which characterizes this type of fabrics.

3.5- Fabric Tear Strength

The values of tearing strength according different levels of weft density and weave structure were plotted in figure 10. The statistical analysis proved that this fabric property has affected significantly with weave structure and weft density. From this figure, it is shown that as the weft density increases fabric tearing strength decreases. Tearing strength of micropolyester woven fabrics decreased by 20%, 9.4% and 17.4% for plain, satin and twill weaves respectively. It is also shown that higher tearing strength was associated with satin weaves followed by twill and plain weaves respectively. The higher tearing strength of satin weaves may be related to the longer flats in this type of fabrics which make yarns to be free under tearing load.

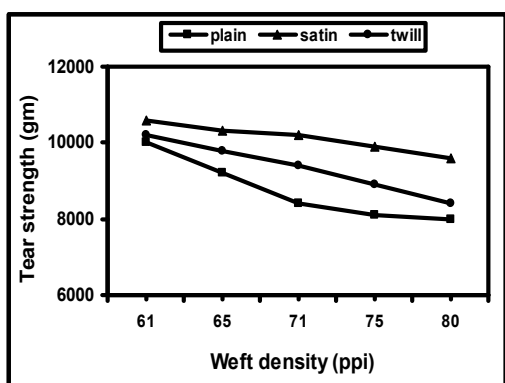


Fig. 10- Variations of fabric tear strength at different levels of weft density and weave structure.

3.6- Fabric Crease Recovery

The crease recovery is one of the fundamental properties of fabrics which affects product performance. Crease recovery refers to the ability of

the fabric to return to its original shape after removing the folding deformations. The crease recovery of fabrics is determined by measuring the crease recovery angle. As the crease recovery angle increases the fabric crease recovery increases.

The values of crease angle of polyester fabrics according to different levels of weft densities and weave structures were depicted in figure 11. From this figure it is seen that both variables have a huge effect on fabric crease recovery.

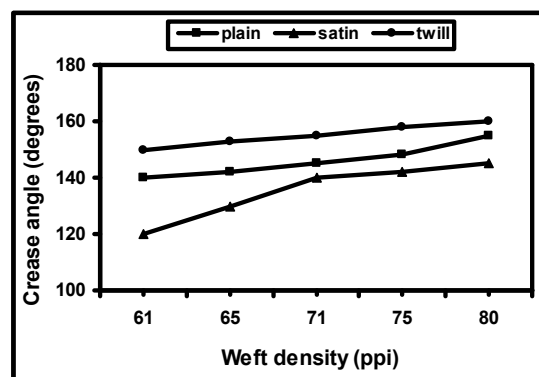


Fig. 11- Variations of fabric tear strength at different levels of weft density and weave structure.

Weft density was found to have a profound effect on crease angle. An increasing trend is detected assuring that as the weft density increases the crease angle increases. Crease angle of micropolyester fabrics increased by 11%, 21% and 7% for plain, satin and twill weaves with the increase in weft density from 61 to 80 picks/inch. It is also shown that twill fabrics exhibited higher crease recovery followed by plain and satin weaves respectively.

3.7- Fabric abrasion resistance

In this study, abrasion resistance of the woven fabric samples was evaluated by the percentage of fabric weight loss. As the weight loss decreases the abrasion resistance of the woven fabrics increases. The weight loss of the woven fabric sample according to weave structure type and weft density was plotted in figure 12. The statistical analysis showed the huge influence of the weft density and weave type on the weigh loss of micro polyester woven fabrics. As seen from this figure, the amount of weight loss increased as the weft density increased from 61 to 71 picks/ inch and decreased as the number of weft yarns in the fabric structure increased to 80 picks / inch.. This is because the fabric tightness will increase with the increase in weft density up to 81 picks / inch. The highest improvement in terms of weight loss was observed on microfiber polyester fabrics with plain structure followed by twill and satin structures respectively.

The higher abrasion resistance associated with plain weaves can be attributed to the higher frictional forces between warp and weft yarns in the fabric cross section.

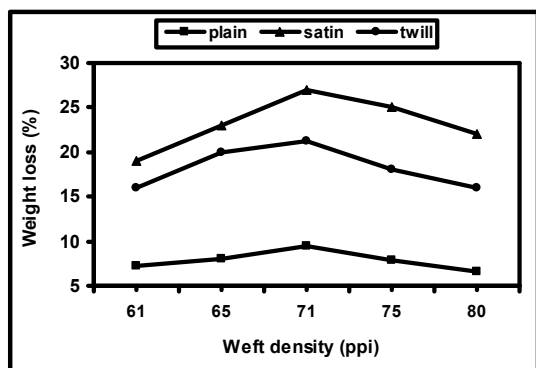


Fig. 12- Variations of fabric weight loss of fabric samples at different levels of weft density and weave structure.

4- Conclusion

Physical and mechanical properties of micropolyester woven fabrics with different weft densities and plain, twill and satin weave structures were investigated. The results of the research can be summarized as follows:

- Fabric breaking load and breaking elongation were significantly affected by weft density and weave structure. Breaking load increases with weft density but breaking elongation increase with the increase of weft density from 61 to 71 picks/inch and then decreased with the increase in weft density. Plain fabrics associated with higher breaking load and elongation followed by twill and satin weaves respectively.
- The effect of weft density on weight loss % of the woven fabrics is similar to its effect on breaking elongation. The order of abrasion resistance of woven fabrics is as follows: plain > twill > satin.
- As the weft density increases fabric air permeability and tearing strength decreases. Satin fabrics have the highest air permeability and tearing strength. Whereas plain fabrics have the lowest air permeability and tearing strength.
- The increase in weft density leads to an increase in crease angle and fabric stiffness. - Plain fabric

showed higher fabric stiffness, while twill fabrics exhibited higher crease recovery.

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5-References

- 1- McIntyre J. E., 2005. Synthetic fibers: nylon, polyester, acrylic, polyolefin, Woodhead Publishing Limited, Boca Raton, FL,
- 2- Grayson M., 1984. Encyclopedia of Textiles, Fibers, and Nonwoven Fabrics, Wiley-Interscience Publication, New York, USA,
- 3- Kroschwitz J. I., 1990. Polymers: fibers and textiles: a compendium, Wiley – Interscience Publication, New York, Wiley,
- 4- Matsuo T., 2008. Fibre materials for advanced technical textiles. Textile Progress; 40:87–121.
- 5- Iroh J O. ,1999. Polymer Data Handbook. New York: Oxford University Press, pp.558–560.
- 6- Joyce A., 2006. Smith, <http://ohioline.osu.edu/hygfact/5000/5546.html>, 05/21/
- 7- Burkinshaw, S. M., 1995. Chemical Principles of Synthetic Fiber Dyeing. 1st edition. Springer,.
- 8- Christmann R., A. Seyve, P. Robe-Berthier, A. Guillaud, ,1994. Chemiefasem/Textilind. 42:912 .
- 9- Lewin M., E. M. Pearce,1998. Handbook of Fiber Chemistry, vol. 2, Marcel Dekker Inc., NY.
- 10- Burkinshaw S. M., 1995. Chemical Principles of Synthetic Fibre Dyeing, Blackie Academic & Professional, London,.
- 11- Baumann J., G. Jerg, 1990. Text. Chem. Col., 22: 12.
- 12- Grayson M., 1984. Encyclopedia of Textiles, Fibers, and Nonwoven Fabrics, Wiley-Interscience Publication, New York, USA,.
- 13- Dieter Groitzsch, 2001. “Ultrafine Micro-fiber Spunlaid Nonwovens”, Nonwovens World, August-September, Vol. 10, Issue(4): , Page – 83.

Infrared, Raman, thermal, kinetic modeling studies of mercury (II) ephedrine complex

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Abstract: The reaction between ephedrine HCl and HgCl₂ in 1:2 molar ratio in methanol was investigated at 70 °C. In normal conditions, the mercury(II) complex formulated as [Hg(eph)₂](Cl)₂.2HCl, was formed by chelating of mercuric chloride and ephedrine hydrochloride without pH adjustment. This complex was characterized by elemental analysis, infrared and Raman spectroscopy. IR spectrum of mercury complex show that ephedrine nucleus has two powerful donating sites –OH and –NH groups, so it is prefer to acts as bidentate ligand. The thermal stability mechanism of this complex was carried out by thermo gravimetric (TG) and differential thermo gravimetric (DTG) analysis which is facilitate to recognized the formation of this complex. The Coats-Redfern and Horowitz-Metzger relations were carried out to calculate the thermodynamic parameters. The bond angles, bond lengths, highest occupied molecular orbital (HOMO), the energy of the lowest unoccupied molecular orbital (LUMO) and energy gap of the studied complex were calculated using HyperChem software program.

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Key words: Ephedrine, Raman spectra, Thermal, Kinetics, Computational chemistry.

1. Introduction

Ephedra (Fig.1) is a Phanerogame-Gymnosperme from the family of Gnetaceen. There are 30 different types of this plant-species known which grow in Asia, Mediterranean countries and America. Specially *Ephedra vulgaris*, *Ephedra equisetina* and *Ephedra sinica* which contain ephedrin with its other isomers. A certain ephedra species has been used in ancient Chinese medicine since ages. Already in 5000 B.C. an ephedra plant was widely used in China under the name Ma-Huang. Ma-Huang has been mentioned as medicine of moderate therapeutic range in the first Chinese pharmacopoe, published under the government of Shen Lung in 1760 B.C. A detailed description of the plant and its pharmacological action is given in the Chinese pharmacopoe of modern times. The pharmacological studies have indicated that ephedrine is a sympathomimetic agonist at both α and β adrenergic receptors, which determine an increase of cardiac rate and contractility, peripheral vasoconstriction, bronchodilatation and central nervous system (CNS) stimulation [1]. Ephedrine is not the only alkaloid used in commercial products, since decongestant preparations usually contain pseudoephedrine. In recent years, the number of dietary supplements containing Ephedra, either as powdered botanical or, more frequently, as a standardized extract, had increased dramatically. Most of these products have been sold for the treatment of obesity or for

increasing performance in body building. Often these dietary supplements also contained caffeine, either synthetic or from botanical extracts, in addition to other ingredients [2]. Weight loss and enhanced performance in body building may be due to the CNS stimulation and thermogenic properties of ephedrine [1]. However, severe contraindications have been given for individuals with hypertension or other cardiovascular diseases, glaucoma, diabetes and hyperthyroidism. Products containing *E. sinica* (or another botanical source of ephedrine) were among the most popular dietary supplements on the market, until their sale was banned by the U.S. Food and Drug Administration (FDA) in April 2004. After the ban of Ephedra products, "Ephedra-free" dietary supplements for weight loss were introduced. However, Ephedra-free is not necessarily danger-free [3]. Citrus aurantium is an ingredient in many of these Ephedra-free dietary supplements. The main active constituent of *C. aurantium* fruit extracts is (–)-synephrine [3], a phenethylamine alkaloid similar in structure to ephedrine. However, dietary supplements often contain *C. aurantium* in combination with concentrates of other herbs that are rich in caffeine and have the same potential to induce arrhythmia, hypertension, heart attacks and strokes as the combination of ephedrine and caffeine [3]. Depending on the oxidation stat of metal, the coordination number and the kind of coordinated ligand, there are many structures, which show

different biological and physico – chemical properties [4, 5]. The literature shows that there is a direct relationship between chemical structure and the antimicrobial properties of chemical compounds [6, 7]. Cui [6], for example, investigated a series of compounds containing NO groups and established that this group is exclusively responsible for the biological activity of some compounds. The author correlated the IR wave number of the valence vibration of the NO group with the antimicrobial activity of the compound. It was suggested that this parameter (the IR wave number) may be a good benchmark for determining the biological properties of compounds containing this group. Previously, the relationship between the chemical structure characterized by spectral parameters and antimicrobial activity was studied [5, 8, 9]. In this work, we prefer to throw a light on an essential compound as ephedrine to evaluate the probability of its interaction with mercury(II) ions upon the spectroscopic and thermal analysis tools. In addition, the bond lengths, bond angles and HOMO-LUMO energy gap were calculated with the employment of semi-empirical molecular orbital calculations. This paper is considered the initial point for the specialists in the medicinal field for condensed investigation.

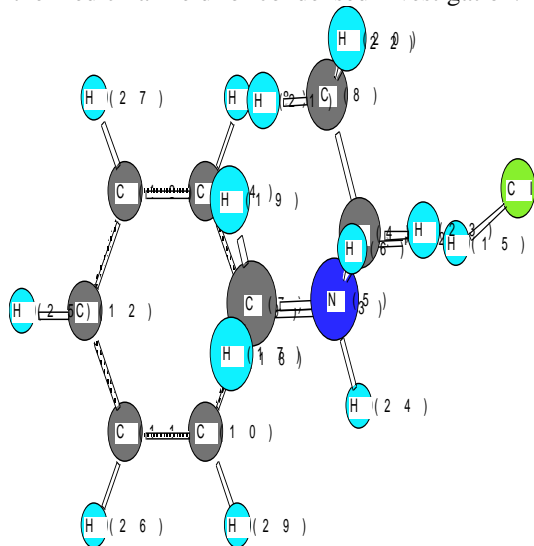


Fig. 1: 3D ephedrine (eph) structure with atom arrangement

2- Experimental

2-1- Reagents

Ephedrine (2-(methylamino)-1-phenylpropan-1-ol hydrochloride) used in this study was obtained from the Egyptian International Pharmaceutical Industrial Company (EIPICO). All other chemicals used in the preparations were of analytical reagent grade, commercially available from different sources (Fluka Co. and Aldrich Co.).

Mercuric(II) chloride received from (Fluka Co.). All solvents are used as it is without further purification.

2-2- Synthesis of ephedrine mercuric (II) complex

The mercuric (II) complex was prepared by molar ratio 1: 2 (1 mmol of HgCl_2 : 2 mmol eph) in methanol solvent. The resulted mixture was heated under reflux for 3 hr. The complex was separated from the reaction mixture and washed with boiling methanol and dried under vacuum over anhydrous CaCl_2 .

2-3- Equipment and measurements

Carbon and Hydrogen content was determined at the Microanalytical Unit of Cairo University. The analysis of metal ions and their conjugated anion (chloride) were carried out according to standard methods [10]. IR spectra were recorded on a FT – IR 4100 Jasco, Japan spectrophotometer with (KBr – discs) in the $\nu = 4000 - 400 \text{ cm}^{-1}$ range, while Raman laser spectra of samples were measured on the Bruker FT-Raman with laser 50 mW at Taif University. The molar conductivities of freshly prepared $1.0 \times 10^{-3} \text{ mol/cm}^3$ DMF solutions were measured for the soluble mercuric complex as well as eph free ligand using Jenway 4010 conductivity meter. TG/DTG measurements are made in an N_2 atmosphere between room temperature and $800 \text{ }^\circ\text{C}$ using SCINCO DSC 1500 STA at Taif University. The initial geometry optimization was performed with HyperChem software (Version 7.5 Hypercube, Inc., Alberta, Canada), for free eph and its Hg(II) complex, the semi-empirical molecular orbital calculations have been employed. Two different methods are used for the calculation of kinetic parameters.

Horowitz and Metzger approximation method [11] derived the relation;

$$\ln[-\ln(1-\alpha)] = \frac{E}{RT_m} \Theta \quad (1)$$

Where α , is the fraction of the sample decomposed at time t and $\Theta = T - T_m$. A plot of

$\ln[-\ln(1-\alpha)]$ against Θ , was found to be linear, from the slope of which the energy of activation E , was calculated and pre-exponential factor Z can be deduced from the relation

$$Z = \frac{E\varphi}{RT_m^2} \exp\left(\frac{E}{RT_m}\right) \quad (2)$$

Where φ is the linear heating rate, the entropy of activation ΔS , was calculated using equation (3).

$$\Delta S = R \ln \left(\frac{Zh}{K_B T_m} \right) \quad (3)$$

Where K_B , the Boltzmann's is constant, h is the Planck's constant and T_m , is the DTG peak temperature.

The order of reaction, n , can be calculated from the relation

$$n = \frac{33.64758 - 182.295\alpha_m + 435.9073\alpha_m^2 - 551.157\alpha_m^3 + 357.3703\alpha_m^4 - 93.4828\alpha_m^5}{4} \quad (4)$$

Where α_m is the fraction of the substance decomposed at T_m .

Coats and Redfern integral method, for first-order reactions, the Coats-Redfern [12] equation may be written in the form

$$\ln \left[\frac{-\ln(1-\alpha)}{T^2} \right] = \ln \left(\frac{ZR}{\phi E} \right) - \frac{E}{RT} \quad (5)$$

A plot of $\ln \left[\frac{-\ln(1-\alpha)}{T^2} \right]$ versus $1/T$ was

found to be linear that upon the slope of Coats-Redfern equation which E , was calculated and Z can be deduced from the intercept. The enthalpy of activation, ΔH , and the Gibbs free energy of activation, ΔG , can be calculated via the equations

$$\Delta H = E - RT_m; \Delta G = \Delta H - T_m \Delta S \quad (6)$$

3- Results and Discussion

The carbon, hydrogen and nitrogen contents of white mercuric(II) ephedrine complex were performed and gave good agreement with calculated data. Yield: 73%; m.p. > 200 °C. calcd. Found; For $C_{20}H_{32}Cl_4HgN_2O_2$ (MW = 674.88 g/mol): calcd.: C, 35.59; H, 4.78; N, 4.15; Cl, 21.01 %. Found: C, 35.21; H, 4.54; N, 3.97; Cl, 20.85%. The molar conductance value of mercuric(II) ephedrine complex in DMF (1.0×10^{-3} mol/cm³) was measured at room temperature and the value is equal 240 ohm⁻¹ cm² mol⁻¹. The comparison between the value of ephedrine free ligand and its mercuric(II) complex led us to concluded that Hg(II) complex has a electrolyte, this meaning that both of chlorine atom exhibited outside the coordination sphere.

A deliberate comparison between the significant band positions in between the ephedrine HCl free ligand with its relative mercuric(II) complex may give enough insight to elucidate the way of bonding of eph ligand towards the Hg(II) ion. Especially, with the absence of powerful technique such as X – ray crystallography. All spectra were carried in the range of 4000–400 cm⁻¹ and the most significant bands are listed in Table 1. The spectrum of free ligand displays a series of significant bands as: 3330, 2972, 1591 and 1395 cm⁻¹ which may assign to $\nu(OH)$, $\nu(NH)$, $\delta(NH)$ and $\delta(OH)$ - in plane bend. The lower appearance shinned on bands of OH and NH groups supports of the presence of intraligand H – bonding (Fig. 2) between the two neighboring groups. Ephedrine ligand bonded towards Hg(II) ion by mode of coordination through its two active (– OH and – NH) sites in neutral state (Fig. 3). This is expected due to the distribution of OH and NH groups, which primates this behavior as appeared from molecular modeling for the minimum internal energy structure (3.385 kcal/mol) by the use of MM⁺ [13] force – field as implemented in hyperchem 7.5. The ν and δ OH in Hg(II) complex are more or less unshifted which may support its interaction after the decomposition of intraligand H – bonding. According to elemental analysis and thermogravimetric studies, the mercuric(II) complex resulted anhydrous not containing water molecules as crystallization. The new bands assigned for $\nu(M-N)$ and $\nu(M-O)$ are easily characterized in the low frequency field and $\nu(M-Cl)$ was detected in the scanning range of Raman spectrum. In Raman spectrum (Fig. 4), the 270 and 172 cm⁻¹ bands are assigned to $\nu(Hg-Cl)$.

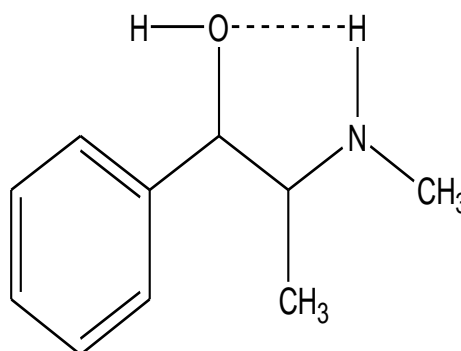


Fig. 2: The modeling structure of ephedrine hydrochloride

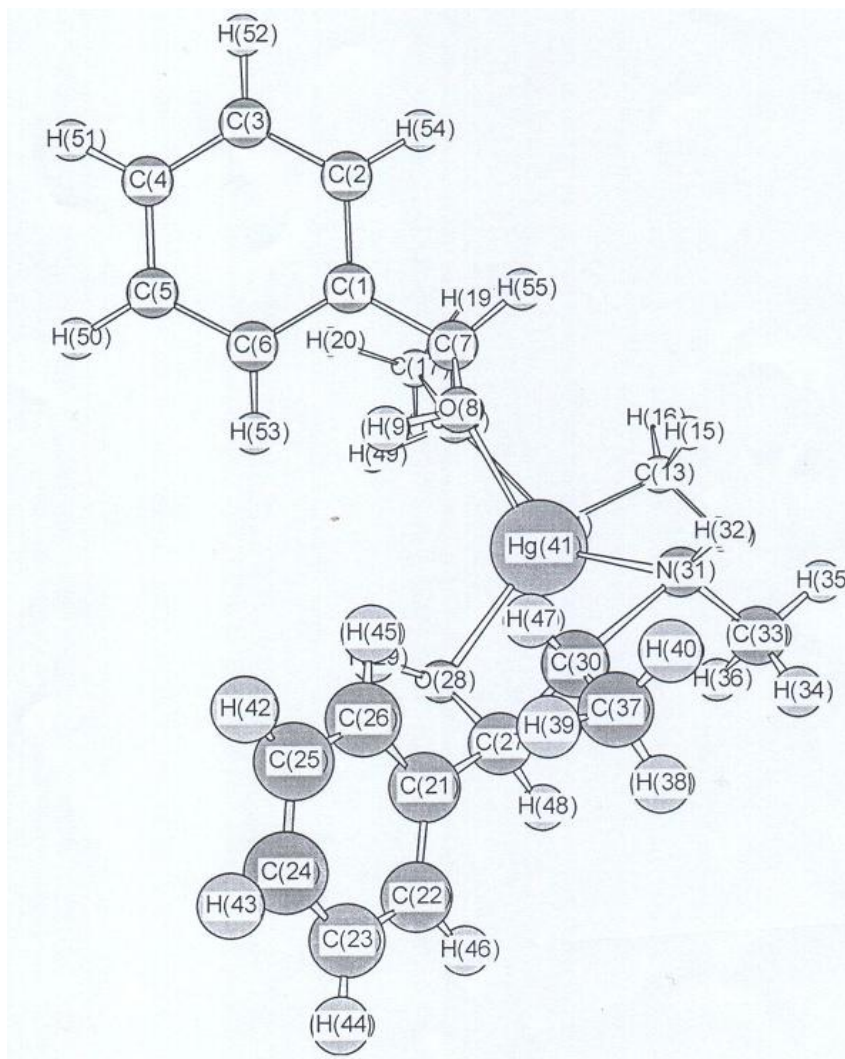


Fig. 3: Suggested structure of [Hg(eph)₂](Cl)₂.2HCl complex

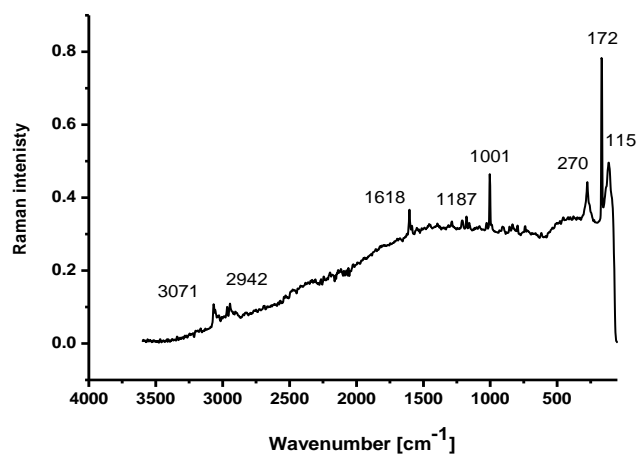


Fig. 4: Raman spectrum of mercuric(II) ephedrine complex

Simultaneous TG/DTG curves of $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex are shown in Fig. 5. The first mass loss (calcd. 59.78%; found 59.50%) between 25–325 °C corresponding to the endothermic peak at 300 °C is due to decomposition of both ephedrine HCl molecules. The second mass losses located in the wide range from 325-to-675 °C (calcd. 40.22%; found 40.50%) with three endothermic of $T_{\text{max}} = 350, 500$ and 600 °C assigned to losses of one chlorine molecule and evaporated of mercury element which agreement with the physical behavior of mercury compounds. The thermal calculations based on the mass loss up to the final temperature are in agreement with the zero final residual. The kinetic parameters (Table 2) such as activation energy (ΔE^*), enthalpy of activation (ΔH^*), entropy of activation

(ΔS^*), free energy change of decomposition (ΔG^*) were evaluated graphically by employing the Coats–Redfern relation [12] and Horowitz and Metzger integral method [11] (Fig. 6) for investigated $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex. The first decomposition step of mercuric (II) complex was discussed which negative entropy has indicated that this complex is formed spontaneously. The negative entropy also indicates a more ordered activated state that may be possible through the chemisorptions of oxygen and other decomposition products. The negative values of the entropies of activation are compensated by the values of the enthalpies of activation, leading to almost the same values for the free energies of activation [14].

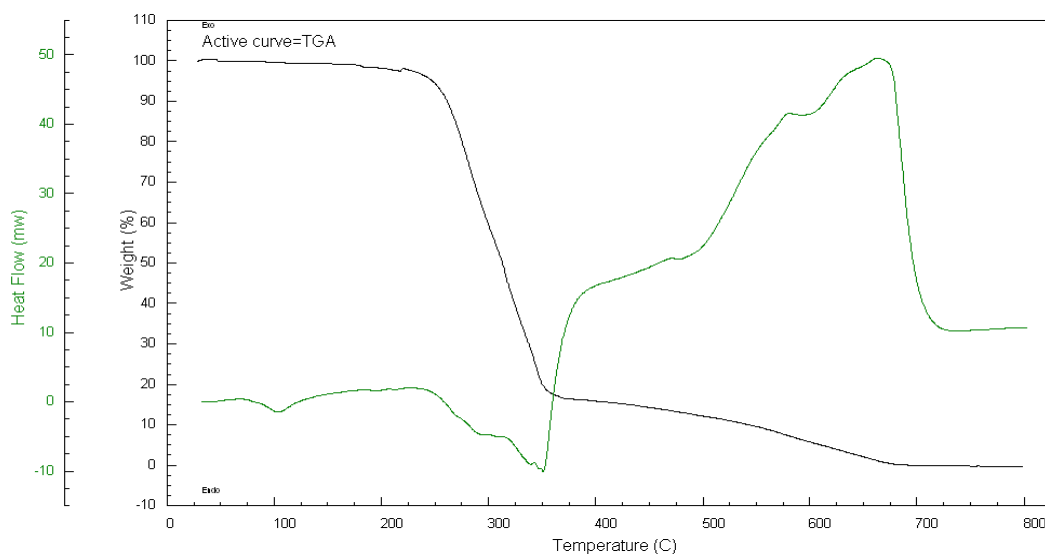


Fig. 5: TG/DTG curves of $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex

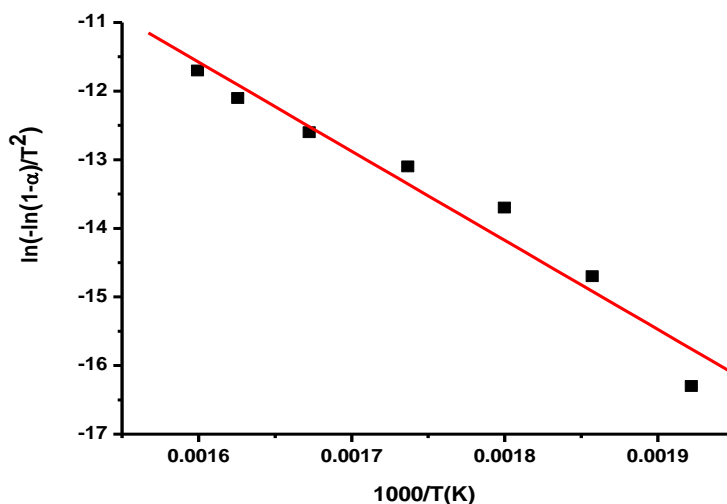


Fig. 6a: Coats–Redfern relation curve of $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex

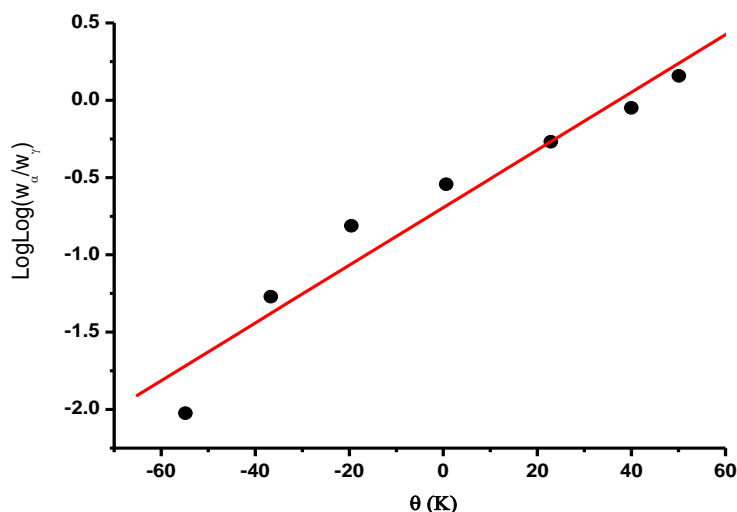
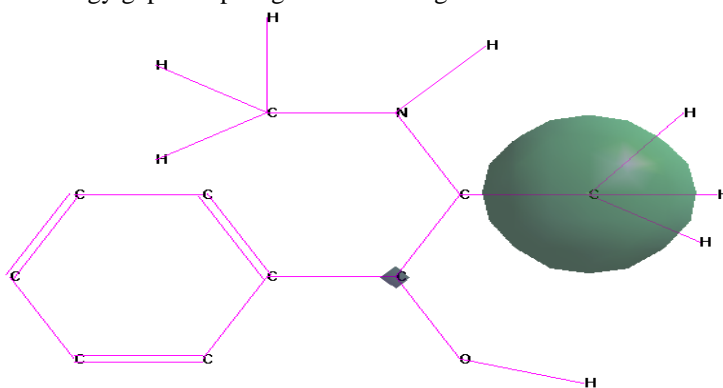


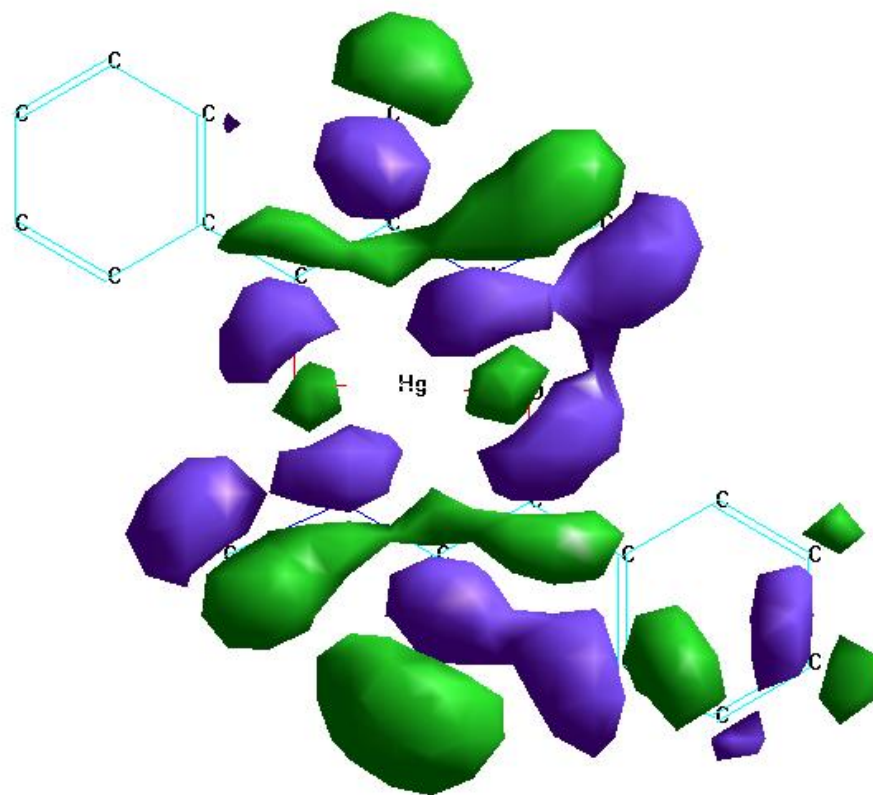
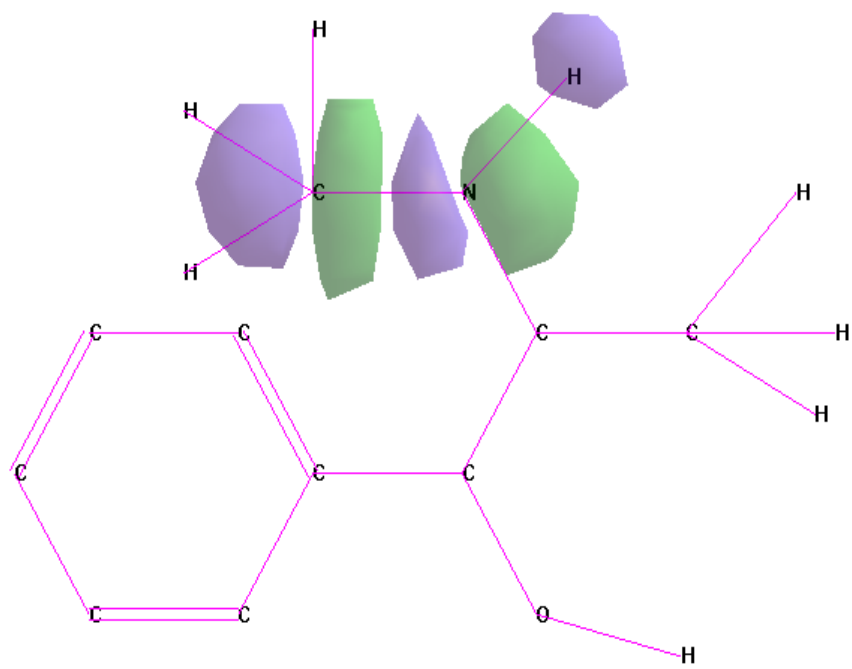
Fig. 6b: Horowitz and Metzger integral curve of $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex

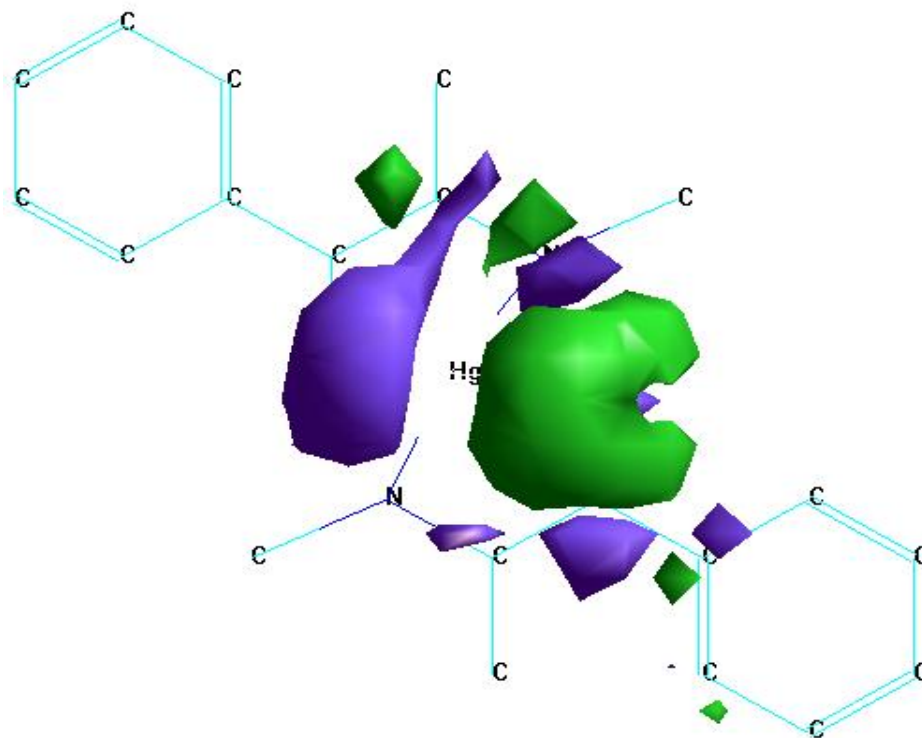
The geometric optimization is one of the theoretical tools help to recognize the place of chelation. The bond lengths and bond angles of the free eph ligand and studied Hg(II) complex were optimized (Tables 3 and 4). These Tables show the significant changes in bond lengths and bond angles for ephedrine free ligand comparable with Hg(II) complex, which supported the place of complexation. Formation of Hg-eph chelation cause displacement in the electron density of N-H and O-H bonds toward Hg(II) ion and makes these bonds weak and decreasing the bond lengths upon complexation state. In case of Hg(II) complex there are two new significant bond lengths exhibited at 2.13 and 2.166 which assigned to O-Hg and N-Hg bonds. Figure 7 refer to the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) for the free ephedrine ligand and its mercuric(II) complex. The energy gaps of eph ligand

and Hg(II) complex are 12.51 and 16.07 eV, respectively, which reflect the chemical activity of the eph molecule. LUMO as an electron acceptor represents the ability to obtain an electron, while HOMO as an electron donor represents the ability to donate an electron. The smaller the LUMO and HOMO energy gaps, the easier it is for the HOMO electrons to be excited. The higher the HOMO energies, the easier it is for HOMO to donate electrons, the lower the LUMO energies, the easier it is for LUMO to accept electrons. A small gap means an unstable structure, unless no vibrational mode of the right symmetry exists for the molecule capable of changing its structure. A large energy gap between the HOMO and the LUMO means a stable molecular structure and interactions can occur, but only with high activation energy. This result proved the stability of Hg(II) complex rather than free ephedrine ligand.



HOMO of eph free ligand = -5.693265 eV





LUMO of eph-Hg(II) complex = 6.658891

Fig. 7: HOMO-LUMO energies for ephedrine ligand and its mercury(II) complex

Table 1: Assignments of the IR essential spectral bands (cm^{-1}) of ephedrine and its $[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$ complex

Compound	ν_{OH}	ν_{NH}	δ_{OH} (out of plane)	$\nu_{\text{C-O}}$	δ_{OH} (in plane)	δ_{NH}	$\nu_{\text{M-Cl}}$	$\nu_{\text{M-N}}$	$\nu_{\text{M-O}}$
Ephedrine (eph)	3330	2972	751	1051	1395	1591	---	---	---
$[\text{Hg}(\text{eph})_2](\text{Cl})_2 \cdot 2\text{HCl}$	3332	3031	745	1048	1455	1593	---	450	519

Table 2: Kinetic parameters using the Coats–Redfern (CR) and Horowitz–Metzger integral operated for the Hg(II) ephedrine complex at first decomposition step

Method	Kinetic Parameters					
	E (Jmol^{-1})	A (S^{-1})	ΔS ($\text{Jmol}^{-1}\text{K}^{-1}$)	ΔH (Jmol^{-1})	ΔG (Jmol^{-1})	r
CR	1.18E+05	5.75E+08	-8.27E+01	1.13E+05	1.61E+05	0.9702
HM	1.08E+05	3.22E+07	-1.07E+02	1.03E+05	1.65E+05	0.9775

Table 3: Bond lengths and angles of ephedrine HCl free ligand

Atoms	Bond length ($^{\circ}\text{A}$)
O(1)-C(3)	1.421
O(1)-H(2)	0.942
C(3)-C(4)	1.514
C(3)-C(9)	1.497

C(3)-H(22)	1.111
C(4)-N(5)	1.453
C(4)-C(8)	1.523
C(4)-H(21)	1.113
N(5)-C(7)	1.453
N(5)-H(6)	1.02
C(7)-H(15)	1.113
C(7)-H(16)	1.113
C(7)-H(17)	1.113

C(8)-H(18)	1.113
C(8)-H(19)	1.113
C(8)-H(20)	1.113
C(9)-C(10)	1.42
C(9)-C(14)	1.42
C(10)-C(11)	1.42
C(10)-H(27)	1.1
C(11)-C(12)	1.42
C(11)-H(24)	1.1
C(12)-C(13)	1.42
C(12)-H(23)	1.1
C(13)-C(14)	1.42
C(13)-H(25)	1.1
C(14)-H(26)	1.1
Atoms	Bond angle (deg)
H(2)-O(1)-C(3)	106.898
O(1)-C(3)-C(4)	107.701
O(1)-C(3)-C(9)	109.5
O(1)-C(3)-H(22)	106.7
C(4)-C(3)-C(9)	109.51
C(4)-C(3)-H(22)	109.391
C(9)-C(3)-H(22)	113.838
C(3)-C(4)-N(5)	108.8
C(3)-C(4)-C(8)	109.509
C(3)-C(4)-H(21)	109.39
N(5)-C(4)-C(8)	108.8
N(5)-C(4)-H(21)	108.8
C(8)-C(4)-H(21)	111.493
C(4)-N(5)-C(7)	107.699
C(4)-N(5)-H(6)	109.47
H(6)-N(5)-C(7)	109.47
N(5)-C(7)-H(15)	108.799
N(5)-C(7)-H(16)	108.8
N(5)-C(7)-H(17)	108.8
H(15)-C(7)-H(16)	109.002
H(15)-C(7)-H(17)	109.002
H(16)-C(7)-H(17)	112.38
C(4)-C(8)-H(18)	110
C(4)-C(8)-H(19)	109.998
C(4)-C(8)-H(20)	109.998
H(18)-C(8)-H(19)	109.002
H(18)-C(8)-H(20)	109.002
H(19)-C(8)-H(20)	108.813
C(3)-C(9)-C(10)	121.399
C(3)-C(9)-C(14)	118.599
C(10)-C(9)-C(14)	120
C(9)-C(10)-C(11)	120
C(9)-C(10)-H(27)	119.998
C(11)-C(10)-H(27)	120
C(10)-C(11)-C(12)	120
C(10)-C(11)-H(24)	119.998
C(12)-C(11)-H(24)	119.998
C(11)-C(12)-C(13)	120.001
C(11)-C(12)-H(23)	119.998
C(13)-C(12)-H(23)	119.998
C(12)-C(13)-C(14)	120
C(12)-C(13)-H(25)	119.998
C(14)-C(13)-H(25)	119.998
C(9)-C(14)-C(13)	120
C(9)-C(14)-H(26)	119.998
C(13)-C(14)-H(26)	119.998

* Red color refer to the place of donation

Table 4: Bond lengths and angles of [Hg(eph)₂](Cl)₂·2HCl complex

Atoms	Bond length (Å)
C(1)-C(2)	1.42
C(1)-C(6)	1.42
C(1)-C(7)	1.497
C(2)-C(3)	1.42
C(2)-H(54)	1.1
C(3)-C(4)	1.42
C(3)-H(52)	1.1
C(4)-C(5)	1.42
C(4)-H(51)	1.1

C(5)-C(6)	1.42
C(5)-H(50)	1.1
C(6)-H(53)	1.1
C(7)-O(8)	1.41
C(7)-C(10)	1.523
C(7)-H(55)	1.113
O(8)-Hg(41)	2.13
O(8)-H(9)	0.992
C(10)-N(11)	1.906
C(10)-C(17)	1.523
C(10)-H(49)	1.113
N(11)-C(13)	1.446
N(11)-Hg(41)	2.166
N(11)-H(12)	1.028
C(13)-H(14)	1.113
C(13)-H(15)	1.113
C(13)-H(16)	1.113
C(17)-H(18)	1.113
C(17)-H(19)	1.113
C(17)-H(20)	1.113
C(21)-C(22)	1.42
C(21)-C(26)	1.42
C(21)-C(27)	1.497
C(22)-C(23)	1.42
C(22)-H(46)	1.1
C(23)-C(24)	1.42
C(23)-H(44)	1.1
C(24)-C(25)	1.42
C(24)-H(43)	1.1
C(25)-C(26)	1.42
C(25)-H(42)	1.1
C(26)-H(45)	1.1
C(27)-O(28)	1.41
C(27)-C(30)	1.523
C(27)-H(48)	1.113
O(28)-Hg(41)	2.13
O(28)-H(29)	0.992
C(30)-N(31)	1.899
C(30)-C(37)	1.523
C(30)-H(47)	1.113
N(31)-C(33)	1.446
N(31)-Hg(41)	2.166
N(31)-H(32)	1.028
C(33)-H(34)	1.113
C(33)-H(35)	1.113
C(33)-H(36)	1.113
C(37)-H(38)	1.113
C(37)-H(39)	1.113
C(37)-H(40)	1.113
Atoms	Bond angle (deg)
C(2)-C(1)-C(6)	119.998
C(2)-C(1)-C(7)	121.4
C(6)-C(1)-C(7)	118.599
C(1)-C(2)-C(3)	120
C(1)-C(2)-H(54)	120
C(3)-C(2)-H(54)	119.998
C(2)-C(3)-C(4)	120
C(2)-C(3)-H(52)	119.998
C(4)-C(3)-H(52)	119.998
C(3)-C(4)-C(5)	119.998
C(3)-C(4)-H(51)	119.998
C(5)-C(4)-H(51)	120
C(4)-C(5)-C(6)	120.001
C(4)-C(5)-H(50)	119.998
C(6)-C(5)-H(50)	119.998
C(1)-C(6)-C(5)	120
C(1)-C(6)-H(53)	119.998
C(5)-C(6)-H(53)	119.998
C(1)-C(7)-O(8)	109.47
C(1)-C(7)-C(10)	109.51
C(1)-C(7)-H(55)	109.388
O(8)-C(7)-C(10)	104.501
O(8)-C(7)-H(55)	109.472
C(10)-C(7)-H(55)	114.34

C(7)-O(8)-Hg(41)	104.501
C(7)-O(8)-H(9)	109.446
H(9)-O(8)-Hg(41)	109.516
C(7)-C(10)-N(11)	130.314
C(7)-C(10)-C(17)	109.51
C(7)-C(10)-H(49)	109.391
N(11)-C(10)-C(17)	109.472
N(11)-C(10)-H(49)	109.472
C(17)-C(10)-H(49)	75.07
C(10)-N(11)-C(13)	109.47
C(10)-N(11)-Hg(41)	76.486
C(10)-N(11)-H(12)	109.586
C(13)-N(11)-Hg(41)	109.47
H(12)-N(11)-C(13)	109.573
H(12)-N(11)-Hg(41)	135.266
N(11)-C(13)-H(14)	109.472
N(11)-C(13)-H(15)	109.47
N(11)-C(13)-H(16)	109.47
H(14)-C(13)-H(15)	109.002
H(14)-C(13)-H(16)	109.002
H(15)-C(13)-H(16)	110.409
C(10)-C(17)-H(18)	110
C(10)-C(17)-H(19)	110
C(10)-C(17)-H(20)	110
H(18)-C(17)-H(19)	109
H(18)-C(17)-H(20)	109.002
H(19)-C(17)-H(20)	108.811
C(22)-C(21)-C(26)	120
C(22)-C(21)-C(27)	120
C(26)-C(21)-C(27)	119.998
C(21)-C(22)-C(23)	120
C(21)-C(22)-H(46)	119.998
C(23)-C(22)-H(46)	119.998
C(22)-C(23)-C(24)	120
C(22)-C(23)-H(44)	119.998
C(24)-C(23)-H(44)	119.998
C(23)-C(24)-C(25)	120
C(23)-C(24)-H(43)	120
C(25)-C(24)-H(43)	119.998
C(24)-C(25)-C(26)	120.001
C(24)-C(25)-H(42)	120.001
C(26)-C(25)-H(42)	119.996
C(21)-C(26)-C(25)	120
C(21)-C(26)-H(45)	119.998
C(25)-C(26)-H(45)	119.998
C(21)-C(27)-O(28)	109.47
C(21)-C(27)-C(30)	109.51
C(21)-C(27)-H(48)	109.391
O(28)-C(27)-C(30)	104.499
O(28)-C(27)-H(48)	109.47
C(30)-C(27)-H(48)	114.34
C(27)-O(28)-Hg(41)	104.501
C(27)-O(28)-H(29)	109.498
H(29)-O(28)-Hg(41)	109.451
C(27)-C(30)-N(31)	130.554
C(27)-C(30)-C(37)	109.51
C(27)-C(30)-H(47)	109.391
N(31)-C(30)-C(37)	109.472
N(31)-C(30)-H(47)	109.47
C(37)-C(30)-H(47)	74.388
C(30)-N(31)-C(33)	109.47
C(30)-N(31)-Hg(41)	75.383
C(30)-N(31)-H(32)	109.363
C(33)-N(31)-Hg(41)	109.472
H(32)-N(31)-C(33)	109.349
H(32)-N(31)-Hg(41)	136.217
N(31)-C(33)-H(34)	109.47
N(31)-C(33)-H(35)	109.47
N(31)-C(33)-H(36)	109.47
H(34)-C(33)-H(35)	109.002
H(34)-C(33)-H(36)	109.002
H(35)-C(33)-H(36)	110.409
C(30)-C(37)-H(38)	109.998
C(30)-C(37)-H(39)	109.998
C(30)-C(37)-H(40)	109.998

H(38)-C(37)-H(39)	109.002
H(38)-C(37)-H(40)	109.002
H(39)-C(37)-H(40)	108.813
O(8)-Hg(41)-N(11)	104.499
O(8)-Hg(41)-O(28)	109.47
O(8)-Hg(41)-N(31)	109.47
N(11)-Hg(41)-O(28)	109.47
N(11)-Hg(41)-N(31)	119.274
O(28)-Hg(41)-N(31)	104.501

* Red color refer to the place of donation

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References

- [1] Schaneberg B.T., S. Crockett, E. Badir and I.A. Khan, (2003). The role of chemical fingerprinting: application to Ephedra, *Phytochemistry* **62**, 911.
- [2] Roman M.C., D. Gray, G. Luo and et al. (2004). Determination of Ephedrine Alkaloids in Botanicals and Dietary Supplements by HPLC-UV: Collaborative Study, *J. AOAC Int.* **87**, 1.
- [3] Pellati F. and S. Benvenuti, (2007). Chromatographic and electrophoretic methods for the analysis of phenethylamine alkaloids in Citrus aurantium, *J. Chromatogr. A* **1161**, 71.
- [4] Lieberman R. L., A. Bino, N. Mirsky, D. A. Summers and R. C. Thompson, (2000). Synthesis, structure and magnetic properties of a chromium(III)nicotinamide complex $[\text{Cr}_3\text{O}(\text{O}_2\text{CCH}_3)_6(\text{na})_3]^+$ (na=nicotinamide), *Inorg. Chim. Acta* **297**, 1.
- [5] koczoń P., J. Piekut, M. Borawska and W. Lewandowski, (2003). Vibrational structure and antimicrobial activity of selected isonicotinate, potassium picolinate and nicotinate, *J. Mol. Struct.* **651**, 651 .
- [6] Cui X., C. L. Joannou, M. N. Hughes and R. Cammack, (1992). The bacteriocidal effects of transition metal complexes containing the NO^+ group on the food -spoilage bacterium *Clostridium sporogenes*, *FEMS Microbiol. Lett.*, **98**, 67 .
- [7] Hueso- Urena F., M. Moreno – carretero, M. Romero – Molina, J. Salas – Peregrin, M. Sanchez – Sanchez, G. Alvarez de Cienfuegos – Lopez and R. Faure, (1993). Transition metal complexes with monodeprotonated isoorotic and 2-thioisoorotic acids: Crystal structure, spectral and magnetic study, and antimicrobial activity, *J. Inorg. Biochem.* **51**, 613.

- [8] Koczoń P., J. Piekut, M. Borawska, R. Świslocka and W. Lewandowski, (2005). The relationship between chemical structure and antimicrobial activity of selected nicotines, p-iodobenzoates, picolinates and isonicotines, *Spectrochim. Acta A* **61**, 1917 .
- [9] Koczoń P., J. Piekut, M. Borawska, R. Świslocka and W. Lewandowski, (2006). Vibrational and microbiological study on alkaline metal picolinates and o-iodobenzoates , *Anal. and Bioanalytical chemistry* **384**, 302.
- [10] Vogel A. I., (1994). *A Text Book of Quantitative Inorganic Analysis*, Longman, London.
- [11] Coats A. W. and J. P. Redfern, (1964). Kinetic Parameters from Thermogravimetric Data 68, *Nature* **201**, 68.
- [12] Horowitz H. H. and G. Metzger, (1963). A New Analysis of Thermogravimetric Traces, *Anal. Chem.* **35**, 1464.
- [13] Allinger N. L., (1977). Conformational analysis. 130. MM2. A hydrocarbon force field utilizing V1 and V2 torsional terms, *J. Am. Chem. Soc.* **99**, 8127.
- [14] Singh B. K., R. K. Sharma and B. S. Garg, (2006). Cobalt(II) complexes of biologically active glutathione: Spectroscopic and molecular modeling, *Spectrochim. Acta A* **63**, 96.

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The relationship between some structural properties of body and aerobic/anaerobic power in members of national female judo team

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Abstract: The aim of this study is to determine the relationship between some structural properties (fat percentage, fat free mass and mass index) of the body in members of national female judo team with aerobic/anaerobic power. For this purpose, 7 judokas with the age of 23.4 ± 1.90 and weight of 67.5 ± 10.87 were selected through a purposed selection and participated in tests of fat percentage, fat free mass and mass index and aerobic/anaerobic in Physical Abilities Measurement Center In national Olympics Academy. Hypothesis of the study were tested using Pearson's correlation coefficient in $P \leq 0.05$ level. The results showed that fat percentage, fat free mass and mass index in female judokas' body have a significant and negative relationship with aerobic and anaerobic power ($P \leq 0.05$). Also results of the anaerobic power show that there is a negative relationship between fat percentage and the absolute average of anaerobic power in female judokas ($P \leq 0.05$), but the relationship between fat free mass and relative average of anaerobic power was not meaningful ($P \leq 0.05$). Also participant's fat percentage and mass index had no meaningful relationship with their relative average of anaerobic power ($P \leq 0.05$), but between relative average of anaerobic power and fat free index there was a positive relationship ($P \leq 0.05$). The results suggest that increasing the muscular mass and decreasing the fat percentage, can improve physiological abilities of female judokas, but this should be considered far more carefully by the coaches in heavy weights, because the negative relationship between muscular mass and aerobic power could limit the athletes.

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Key words: structural properties of body, aerobic power, anaerobic power, female judoka

Introduction

Aerobic and anaerobic powers are amongst the most important physiologic abilities in movement performance, which can lead to victory in competitions. In the way of reaching the optimized level of these abilities which can interact with their competitive needs, athletes may find a pattern of body structure, analysis of which can be useful to organize efforts of those working in the same field. Judo, regarding the nature of its movement skills, needs a special body physique. [1][2]. A judoka needs to maintain his/her inertia and stability, at the same time he/she must keep his pace in movement and reaction and preserve muscular power for the contest[3]. Therefore some specific structural properties alongside with ideal physiologic abilities could be vital in their success. For this reason, researchers claim that it's important to study the relationship between body structure and physiologic abilities from a practical view. For instance, Emerson (2007) suggested that in judo a high percentage of fat in movements which need a massive move has a negative relation with performance and judokas with a higher level of aerobic power show a better performance in activities with greater intensity[4]. Among the physiologic systems of body, experts put more effort on determining the executive capacity of systems like muscular, skeleton, cardiac,

respiratory and nervous systems. This bias is based on the hypothesis that if other systems do their haemostatic job well these 5 systems (muscular, skeleton, cardiac, respiratory and nervous systems) can perform as expected. So, successful execution of movements by muscular system can coordinate other systems and improve the quality of nervous, cardiac and respiratory systems[5,6]. From this aspect, in capacity measuring tests for execution, this idea was always on the table that exterior form or physique affects the optimized performance of a person[7]. For instance, basketball players with more height are more successful than the others if all other factors are the same.[8,9]

Researches in other sport fields suggested that mass index and fat percentage in body have an inverse relationship with aerobic power (Mayhew et al 2007; Benoit LA Marché 2004; Christian 2007)[10]. Also a negative relationship has been reported between fat percentage and anaerobic power (Hang-Mei 2009; Ozkan et al 2009; Vardar et al 2007; Bing-Hang et al 2006)[11]. In judo results of Bing-Hang et al 2006 showed that fat and fat free mass increase as the weight in which judokas are competing increases[12]. Also body weights, muscular mass and total protein all have a positive relationship with anaerobic power in judokas[13]. Despite all these analyses, information about the relationship between structural properties

of the body are limited and in need of more attention[14]. Therefore, regarding the limitation of existing studies, current study aims determining the relationship between some structural properties of the body including fat percentage, fat free mass and mass index of the body and aerobic/anaerobic power in female judokas in national team.[15]

Methodology

Present study is a correlation kind from the aspect of method, from the purpose aspect it's fundamental and from the time view its present looking. Participant were 7 female judokas in national team of I.R.I in 1388, who were competing in -48, -52, -57, -63, -70, -78, +78 divisions according to the international judo federation. Participants were chosen intentionally, so that they agreed on participating after being informed about the goals and procedures of the study. Participants' age range was 21-27 and they were completely healthy according to assessments of the medical federation of I.R.I. also none of the participants were on their menstrual cycle and also none them was on any kind of medicine which could affect the variables of this study.

To perform the current study first all the coordination were made with the judo federation of I.R.I. then in an introduction session, goals, steps, necessity and importance of this study were explained and they were asked to sign a testimonial and fill an individual information questionnaire. After that participants were gathered in the National Olympic Academy's physical abilities' measurement center. The tests for this study were taken in 2 days.

In the first day, first assessments of physique were conducted. They stood on the Physique Analyzer machine and took the handles for two minutes wearing the least cloths they could so that the machine can measure the weight and other physical compositions (fat percentage, mass index of the body and fat free weight of the body). The results of the tests were taken through the printer linked to the machine.

The second assessment took place in the second day which was devoted to the anaerobic power. To measure anaerobic power, the test of anaerobic bi-acid lactic Winget was conducted on the force assessor bicycle (March Monarchy Pelliki, model E894; Winget tests special). Before the test, the machine was adjusted. First participants started a warm up session for 45 seconds in 60-70 RPM. Then they stood by for 5 minutes and then the bicycling pace increased gradually so that they cycled with the maximum speed for 8 second which was accompanied by resistance. And finally absolute anaerobic power indexes were calculated in Watt and recorded by the force assessor bicycle for 8 seconds.

In the second day the maximum treadmill (made in Italy, Techno Gym Company) test was used to measure the aerobic power. First the participants started the standard warm up (7 minutes of stretching and 3-4 minutes of walking on the treadmill). In this test unlike those of Bruce and other tests there was no limitation for stopping the machine. Athlete stood on the machine and the individual information like age, sex and weight were entered. Then the athletes started running fast through the slope right up to the exhaustion point. The tests were being conducted in the presence of a doctor and the coach to stop the athletes from continuing the test in the case of undesired physical or exterior situation (vertigo, change in face color, vomiting or losing balance). After the test, athletes continued running in order to get back to the initial condition. In this test the maximum heart beat was calculated using following formula: $\text{Age} \times 220$ In analysis variables were reported through mean and SD. We made sure that the distribution is normal and then using the Shapiro Wilk test and correlation coefficient of $P \leq 0.05$ the relationship between 2 variables were calculated. All analyses were conducted using the SPSS 16 software.

Findings

Table 1 shows descriptive statistics for this study's variables. According to this table participants have a fat percentage of 21.2 ± 6.22 percent, fat free mass: 52.7 ± 5.67 KG, mass index of the body: 24.0 ± 5.32 KG/M², maximum aerobic Oxygen 46.9 ± 5.32 ML/KG per minute, absolute average anaerobic power 259.7 ± 34.15 Watt, and at last relative average anaerobic power was 3.92 ± 0.72 Watt/KG.

Table1: Descriptive statistics of research variables (7 = N)

Standard deviation	variable	Mean
6.22	fat percentage(%)	21.2
5.67	fat free mass(Kg)	52.7
3.27	mass index of the body(Kg/m ²)	24.01
5.32	maximum aerobic Oxygen (ml/Kg per minute)	46.9
34.15	absolute average anaerobic power(W)	259.7
0.72	relative average anaerobic power(W/Kg)	3.92

The results for the Pearson correlation coefficient in table 2(in next page) shows that fat percentage ($0.39/0 = p$, $574/0 = (6)r$), fat free mass ($0.48/0 = p$, $758/0 = (6)r$) and mass index of the

body ($0.47/0=p$, $0.762/0=r$) have a meaningful relationship with aerobic power in female judokas. Nomination coefficient of latter relationships suggests that fat percentage, fat free mass and mass index of the body respectively are responsible for 32.9%, 61.6% and 58% of variation in the aerobic power. Also there is a meaningful relationship between fat percentage with absolute average anaerobic power ($0.41/0=p$, $0.547/0=r$) and explains 29.1% of its variations, but fat free mass and mass index of the body had no meaningful relationship with absolute average anaerobic power ($0.05/0 < p$). Furthermore, fat percentage and mass index of the body don't have any meaningful relationship with relative average of anaerobic power ($0.05/0 < p$). But fat free mass have a positive and significant relationship with relative average anaerobic power ($0.37/0=p$, $0.687/0=r$) and explains 45.9% of its variation.

Discussion

Current study tried to determine the relationship between some structural properties (fat percentage, fat free mass and mass index) of the body in members of national female judo team with aerobic/anaerobic power. The results of the study for correlating factors to the aerobic power suggested that fat percentage, fat free mass and mass index have a negative relationship with aerobic power. These results are consistent with the prior researches of Mayhew et al 2001, Hosseini 1379, Mogharnasi 1378, Kristin 2007, and Benoit 2004. Also results are consistent with those of MahmoodAbadi 1386 and Mazani 1376 as they found a negative relationship between mass index of the body and aerobic power. The major reason for this consistency can be mechanisms involving in aerobic energy system. It means that athletes should have more aerobic exercises to have a higher level of Oxygen for using, for which body tends to use more of fat sources (Rajabi et al c). So,

we expect people with a higher level of maximum oxygen to have less fat sources and mass index of the body. Although some factors including inheritance, sex and age can affect one's aerobic power, aerobic preparation can be affected by training and Physique. Lots of studies showed that training can improve the aerobic power; meanwhile the improvement through training plans is less than quantity of athletes. Experts believe that the maximum Oxygen used may be improved 5-20% through different methods like long sessions of medium intensity or short sessions of high intensity (Jasem et al 2001)[16]. As a result, female judokas can experience an increase in aerobic power with trainings through which they decrease fat level.

On the other side, researches on the relationship between physique and aerobic power focused on the relationship between fat and maximum oxygen used. People with more fat feel extra weight as a result of extra fat which makes their movements harder and harder. On this basis, Emerson (2007) studied Brazilian male judokas' structural properties and body preparation profile and found out that high percentage of fat has a negative relationship with performance in movements in which a massive move is needed, and judokas with a higher aerobic power have a better performance in high intensity moves. The study conducted on male undergraduates of PE showed that the relationship between their fat percentage and aerobic power is both significant and positive. Also the study on female students both athletes and non-athletes shows that there is a significant negative relationship between aerobic power and fat percentage of all participants. Researchers found that fat is an important factor in aerobic power decrease. Generally, the results of the current study are consistent with all other studies in which a negative relationship between fat percentage and mass index of the body was observed[17].

Table 2: Results of Pearson correlation coefficient to determine the relationship between two variables ($7 = N$)

independent variable	dependent variable	<i>r</i>	<i>p</i>	<i>R</i> ²
Fat percentage	aerobic power	-0.574	0.039*	0.329
fat free mass		-0.758	0.048*	0.616
mass index of the body		-0.762	0.047*	0.58
fat percentage	absolute average anaerobic power	-0.547	0.041*	0.291
fat free mass		0.15	0.748	0.022
mass index of the body		0.354	0.436	0.125
fat percentage	relative average anaerobic power	-0.360	0.428	0.129
fat free mass		0.687	0.037*	0.459
mass index of the body		0.549	0.202	0.301

*The relationship is significant in level $0.05 \geq \alpha$

Also, the inverse relationship between fat free mass and aerobic power could be attributed to fight patterns in different weights; it means that in light weights, judokas have more mobility and conversely heavier weights have less mobility.

Regarding the latter issue, Bing-Hang et al (2006), in a study on elite Chinese judokas, found out that fat percentage increases with the weights in which judokas compete. Similarly in wrestling, Hang-Mei (2009) suggested that heavier weights have more

percentage of fat. Considering these results we expect judokas in heavier weights to have less aerobic power[18].

Results for anaerobic power show that fat percentage has a negative relationship with absolute average anaerobic power; while fat free mass and mass index of the body had no significant relationship with absolute average anaerobic power. Also, fat percentage and mass index of the body in female judokas had no meaningful relationship with relative average anaerobic power; while there was a positive relationship between fat free mass and relative average anaerobic power. These results are consistent with those of Hang-Mei (2009), Ozkan et al (2009), Vardar et al (2007), and Bing Hang et al (2006) as they recognized a positive relationship between fat free mass and relative average anaerobic power.

Although, finding no relationship between mass index of the body and anaerobic power is inconsistent with findings of Mazani (1376) and May-Hew (1989)[19]. This inconsistency can be attributed to physical preparation level of the participants in Mazani's study. His sample was collected from non-athlete people which makes a lot of difference comparing to the sample for present study who are elite national team members. It seems that, the negative relationship between fat percentage and anaerobic power is associated with the resistance force from fat mass in moving performance. As cited before, people with a high percentage of fat face more resistance from fat mass in their moves. Then, considering the nature of anaerobic power -which is the ability of a muscle or a group of muscles to generate a big power with high velocity against a resistance in a period of time- we expect fat percentage to limit anaerobic power. On the other hand, the direct relationship between fat free index and anaerobic power is explained by the muscular mass' role in generating force. Power is one of the most important factors in muscles preparation plan and shows the coordination between speed and strength. In fact, increasing power or speed or both these elements, increases the power and creates a situation in which athletes can do more in less time. On the other side, regarding the fact that training generates an important consistency in phosphogene and anaerobic system's capacity, we expect people in higher levels of competition to improve their muscular efficiency through training. In phosphogene system, the capacity increases with increase in sources of muscular Adenosine Tri Phosphate and phosphocreatine and change in key enzymes. Researchers showed that after a seven month training plan of endurance race including 2 to 3 days training per week, muscular Adenosine Tri Phosphate increases approximately 25%. Also the density of phosphocreatine in muscles showed that the activities of phosphates, miocnase and

creatinekinaz enzymes in 8 weeks of speed training plans has increased 20, 30 36 % respectively. The type of training is one of the most important factors in increasing anaerobic power. To explain this process for judo, one must pay mind involvement level of athletes. According to prior researches anaerobic power has a 70% influence in judo (Wilmore & Castillo 1994)[20]. So, it seems that judokas have more ability to create positive consistency, regarding the nature of their field. This way there is a positive relationship between muscular mass and anaerobic power.

Like other descriptive studies, present study faced some limitations; so future semi-empirical studies can approve our results; especially because analyzing the relationship between body structures and aerobic/anaerobic power in puberty with tendency toward effects of losing weights and changes in structural properties of the body on aerobic/anaerobic power and also effects of changes in structural properties of the body due to the relaxation periods after the competitions, could be so helpful in clarifying the subject of this study.

Generally, results of the present study suggest that aerobic power in female judokas has an inverse relationship with fat percentage, fat free mass and mass index of the body. These findings suggest that more muscular mass and less fat percentage have a positive effect on physiologic abilities of female judokas, but this should be considered more carefully by coaches as the negative relationship between muscular mass and aerobic power can lead to limitation of the movements in heavier weights. Regarding these findings, first we wish to make a piece of advice for the coaches in national judo team in female department to consider aerobic power more carefully as it's an important physiologic factor in heavier weights. Also according to our findings, we advise coaches and athletes to care more for their nutrition plans they conduct before the competition to lose weight in order to prevent assimilation of muscular mass and as a results prevent assimilation of anaerobic power and movement performances.

Reference

1. Sullivan, Michele. G. Weight training Programmed may improve self-image (Clinical rounds) OBGYN News Magazine, 2005: 5-10.
2. M. Mortazavi, J. R. Cameron and A. Niroomand-rad, Adaptive response studies may help choose astronauts for long-term space travel. Adv. Space Res. 31, 1543–1551 (2003).
3. H. I. Roach, G. Mehta, R. O. Oreffo, N. M. Clarke and C. Cooper, Temporal analysis of rat growth plates: cessation of growth with aged despite presence of a

- physic. *J. Histochem. Cytochem.* 51, 373–383(2003).
4. C. M. Brownstein, A. C. Mertens, P. A. Mithy, M. Stovall, J. Qin, G. Heller, L. L. Robison and C. A. Sklar, Factors that affect final height and change in height standard deviation scores in survivors of childhood cancer treated with growth hormone: a report from the childhood cancer survivor study. *J. Clin. Endocrinol. Metab.* 89, 4422–4427 (2004).
 5. J. D. Currey, *Bones Structure and Mechanics*, p. 436. Princeton University Press, Princeton, NJ, 2002.
 6. K. S. Davison, K. Siminoski, J. D. Adachi, D. A. Hanley, D. Goltzman, A. B. Hodsman, R. Josse, S. Kaiser, W. P. Olszynski and J. P. Brown, Bone strength: the whole is greater than the sum of its parts. *Semin. Arthritis Rheum.* 36, 22–31 (2006).
 7. L. W. Townsend, J. L. Shinn and J. W. Wilson, Interplanetary crew exposure estimates for the August 1972 and October 1989 solar particle events. *Radiat. Res.* 126, 108–110 (1991).
 8. S. M. Tommasini, P. Nasser, M. B. Schaffler and K. J. Jepsen, Relationship between bone morphology and bone quality in male tibias: implications for stress fracture risk. *J. Bone Miner. Res.* 20, 1372–1380 (2005).
 9. N. A. Denisova, B. Shukitt-Hale, B. M. Rabin and J. A. Joseph, Brain signaling and behavioral responses induced by exposure to ⁵⁶Fe-particle radiation. *Radiat. Res.* 158, 725–734 (2002).
 10. D. S. Gridley, R. Dutta-Roy, M. L. Andres, G. A. Nelson and M. J. Pecaut, Acute effects of iron-particle radiation on immunity. Part II: Leukocyte activation, cytokines and adhesion. *Radiat. Res.* 165, 78–87 (2006).
 11. S. M. Smith, M. E. Wastney, K. O. O'Brien, B. V. Morukov, I. M. Larina, S. A. Abrams, J. E. Davis-Street, V. Oganov and L. C. Shackelford, Bone markers, calcium metabolism, and calcium kinetics during extended-duration space flight on the Mir space station. *J. Bone Miner. Res.* 20, 208–218 (2005).
 12. Mizoe and K. Tanimoto, Different effects of carbon ion and gamma-irradiation on expression of receptor activator of NF- κ B ligand in MC3T3-E1 osteoblast cells. *Bull. Exp. Biol. Med.* 142, 618–624 (2006).
 13. P. A. Tesch, H. E. Berg, D. Bring, H. J. Evans and A. D. LeBlanc, Effects of 17-day spaceflight on knee extensor muscle function and size. *Eur. J. Appl. Physiol.* 93, 463–468 (2005).
 14. T. Lang, A. LeBlanc, H. Evans, Y. Lu, H. Genant and A. Yu, Cortical and trabecular bone mineral loss from the spine and hip in long duration spaceflight. *J. Bone Miner. Res.* 19, 1006–1012 (2004).
 15. R. T. Turner, What do we know about the effects of spaceflight on bone? *J. Appl. Physiol.* 89, 840–847 (2000).
 16. P. Todd, Space radiation health: a brief primer. *Gravit. Space Biol. Bull.* 16, 1–4 (2003).
 17. P. Guida, M. E. Vazquez and S. Otto, Cytotoxic effects of low- and high-LET radiation on human neuronal progenitor cells: induction of apoptosis and TP53 gene expression. *Radiat. Res.* 164, 545–551 (2005).
 18. M. J. Mitchell and P. M. Logan, Radiation-induced changes in bone. *Radiographics* 18, 1125–1136 (1998).
 19. S. J. Huh, B. Kim, M. K. Kang, J. E. Lee, H. Lim do, W. Park, S. S. Shin and Y. C. Ahn, Pelvic insufficiency fracture after pelvic irradiation in uterine cervix cancer. *Gynecol. Oncol.* 86, 264–268 (2002).
 20. C. Zeitlin, L. Heilbronn and J. Miller, Detailed characterization of the 1087 MeV/nucleon iron-56 beam used for radiobiology at the alternating gradient synchrotron. *Radiat. Res.* 149, 560–569 (1998).
 21. Nayera E Hassan, Sahar A El-Masry, Manal A. Mohsen, Safaa T. Zaki, Eman Elashmawy, Muhammad Al-Tohamy Soliman, Mehreban M. Abd El-moniem "Obesity Degree and Cardiometabolic Risk among School Students", *life science journal*, 2012;9(3):293-301.

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Knowledge and attitude of Women with Special needs towards breast Cancer in Saudi Arabia; A cross sectional study

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Abstract: Background and Objectives: Women with disabilities have lower rates of breast cancer screening than other healthy women and often face barriers to preventive health services. The objective of this study was to assess the knowledge and attitude of early breast cancer detection and identify barriers against this detection among this group of women with special needs. **Methods:** This cross sectional study was conducted at Jeddah deaf and mute club, Saudi Arabia during the period from 2011 to 2012. Forty eight deaf and mute women were enrolled in the study. The distributed questionnaire was filled with the help of a nurse certified in sign language and the distributed questionnaire included demographic data, knowledge about breast cancer and its risk factors, beliefs and practice regarding breast self-examination (BSE) and mammography, in addition to obstacles preventing them from going to screening. **Results:** About two third of the participants have heard about breast cancer, physicians and relatives represented the main source of knowledge. Their knowledge about symptoms of breast cancer and its risk factors was poor. About two thirds of them stated that they do not believe in breast examination and its role in early detection of breast cancer. About 56% of them knew about BSE. The importance of mammogram was not known to 85.4%. The main three barriers that prevented participants from seeking for early detection of breast cancer were ignorance of its important (33.3%), shyness (31.3 %) and far distance from places of free mammography. **Conclusions:** Women with special needs can run the same risk of developing breast cancer like other healthy women. It is recommended that sign language be introduced as part of the health services in all aspect of our health care system.

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Key words: Breast cancer, screening, deaf and mute, disabilities, attitude, knowledge

1. Introduction

In Saudi Arabia, breast cancer ranks first among cancers affecting women¹. It is established that early detection of breast cancer increases survival.²⁻⁴ This is applied for both healthy and disabled persons but in practice, the use of preventive cancer screening services by persons with disabilities and special needs is still not optimal.^{5,6} **Roetzheim and Chirikos** reported that women with disabilities are diagnosed with breast cancer at a later stage and have higher mortality.⁷ They specified disabilities that include persons who experience limitations or barriers related to vision, hearing or mobility.

Many cancer care providers are not well informed about the care needs and issues of people who experience cancer especially those with special needs like the deaf and mute. Not only that but also health care providers are not trained on sign language and most, if not all, health facilities are lacking the translators of this language. These are health and basic human rights of these women with special needs.

The National Society for Human Rights had stated clearly the rights of this needy group. This is based on international law and Saudi Law in which Alshoura council decision numbered (96/66) and dated 18/1/1429 G in addition to the Ministry decision issued in 21/5/1429 G (26/5/2008) and headed by King Abdullah Bin Abdulaziz had agreed on international law for health rights of those with disabilities, and in agreement with Arab contract for special needs to have sign language in media to provide them with the knowledge they need.⁸

Public awareness that early detection of breast cancer improve the outcomes is critical and efforts are directed towards empowering women with these information. Unfortunately women with special needs are facing many problems and lacking such information because information delivery through the language they use and understand (sign language) is not practiced in the medical field.

The objective of this study was to assess the knowledge and attitude of early breast cancer detection

and identify barriers against this detection among this group of women with special needs (deaf and mute) and emphasize the importance of directing our efforts to study the needs of these women.

2. Methods:

This cross-sectional study was conducted at the deaf and mute club in Jeddah, Saudi Arabia during the years 2011 and 2012. The study was approved by the Biomedical Research Ethics Committee at the Faculty of Medicine, King Abdulaziz University. Forty eight deaf and/or mute women had participated in the study. A qualified nurse, trained on sign language at deaf and mute club for 2 weeks and were certified by the director, conducted the translation of the questionnaire to sign language. The participants were consented in sign language.

The questionnaire used in this study included; demographic data, knowledge about breast cancer and its source, beliefs and practice regarding breast self-examination (BSE) and mammography, in addition to obstacles preventing them from going to screening. Data were entered into the computer and analyzed using the Statistical Package for Social Sciences version 15 (SPSS Int. Chicago, IL, USA). The results were presented in the form of number and percentage. Chi-square test was used as a test of significance for quantitative data and significance was considered at *p* value less than 0.05.

3. Results:

The total number of the participants was 48 deaf and mute females. Their mean age was 29.73 ± 8.51 with a range from 15 to 50 years. About 35 (72.9%) were Saudi and about half of the participants (58.3%) were non-working. About 81% of them had preparatory and secondary education. About 20% of them were married and the age of marriage varied from 16 to 29 with mean age of 22.18 ± 4.12 . Fourteen of them had children and more than two thirds had children aged from 20 to 30 years (Table 1).

The results of the study showed that about 32 (66.7%) of the participants have heard about breast cancer. Physicians and relatives represented the main source of their knowledge in (31.3% and 33.3% respectively) (Table 2a).

Their knowledge about Symptoms of breast cancer were poor as pain, change in the nipple and bloody discharge were chosen as presenting symptom by 50%, 31.3% and 20.8% of the participants respectively while only 10.4% mentioned breast mass as a presenting symptom. Regarding the risk factors of the breast cancer, the participants showed also low knowledge as genetic factor, age and late pregnancy were nominated as risk factor by 41.7%, 12.5% and 10.4% of them respectively. Regarding the protecting

factors, 32.6% and 34.8% of the participants nominated absence of stress and healthy lifestyle respectively.

When asked about their beliefs of breast self-examination (BSE), about two thirds of them stated that they do not believe in breast examination and its role in early detection of breast cancer while 20.8% confirmed their belief that holy water Zamzam can prevent cancer. Regarding their feelings when they hear the word "breast cancer" 60.4% stated they feel afraid and 18.8% feel shy and ashamed (Table 3).

It was found that 27 of the participants (56.3%) knew about BSE and 41.7% have learned how to perform it. Nineteen (70.3%) of those who knew about BSE were not sure about the proper time to perform it. More than 90% of them had learned BSE from lectures and campaigns. About 18 (37.5%) of the participants have practiced BSE and 12 (88.8%) found their experience easy. The importance of Mammography was not known to 41 (85.4%) of the studied group and only 10.4% and 4.2% know that it detects tumors and improves survival respectively.

The main three barriers that prevented participants from seeking for early detection of breast cancer were ignorance of its importance (33.3%), shyness (31.3%) and far distance from places of free mammography (16.7%). Unavailability of female physician and refusal of the family were stated by 8 (16.7%) and 5 (10.4%) women respectively (Table 5).

4. Discussion:

Public awareness that breast cancer outcomes are improved through early detection is critical to improving participation in early detection programs. This study has focused on the basic essential knowledge that would affect screening and the practice and common beliefs about cancer among a group of women with special needs (deaf and mute). It was not possible to compare our results to others as such studies that dealt with women with special needs are lacking in Saudi Arabia. To the best of our knowledge this is the first study in Saudi Arabia and in the Arab countries.

Knowledge is power and the key to any successful program is to educate women about cancer nature and importance of early detection. In Saudi Arabia there are several public awareness programs and educational campaigns targeting health women yet different studies showed the knowledge of female regarding breast cancer and its screening still low.⁹⁻¹¹

Table 1: Demographic characters of the studied groups (n=48)

Variables	N	(%)
Age		
Mean ± SD	29.73 ± 8.51	(15-50)
Nationality		
Saudi	35	(72.9)
Non-Saudi	13	(27.1)
Occupation		
Housewife	10	(20.8)
Employee	15	(31.2)
Not working	28	(58.3)
Education		
Primary or less	4	(8.3)
Preparatory/Secondary	39	(81.3)
University	5	(10.4)
Marital Status		
Married	10	(20.8)
Single	33	(68.8)
Divorced	4	(8.3)
Widow	1	(2.1)
Age of Marriage (years)		
Mean ± SD	22.18 ± 4.12	
Range	(16-29)	
Having children		
0	1	(2.1)
One	13	(27.1)
Two	1	(2.1)
Age of First Delivery(years)		
	N	(%)
< 20	2	(14.2)
20-30	10	(71.4)
More than 30	2	(14.2)

Table 2a: Knowledge of the studied group about Breast Cancer and its risk factors

	N	(%)
Did you hear about breast cancer?	32	(66.7)
What are the sources of knowledge?		
Physicians	15	(31.3)
Nurses	1	(2.1)
Support team	-	-
Alternative Media	1	(2.1)
Survivors	1	(2.1)
Relatives	16	(33.3)
Books	1	(2.1)
Internet	6	(12.5)

Table 2b: Knowledge about breast cancer of the studied group

	N	(%)
Early symptoms for seeking medical care		
Change in the size	7	(14.6)
Blood discharge from nipple	10	(20.8)
Change in the nipple or the areola	15	(31.3)
Pain	24	(50)
Mass in the breast	5	(10.4)
Mass in the axilla	4	(8.3)
Risk Factors		
Age	6	(12.5)
Ovarian stimulator	5	(10.4)
No breast feeding	7	(14.6)
Genetic	20	(41.7)
Oral contraceptive	2	(4.2)
Hormonal replacement therapy	6	(12.5)
Late pregnancy	5	(10.4)
Socio-economic	1	(2.1)
Factors to protect from breast cancer		
Healthy diet	9	(19.6)
No use of chemicals & cosmetics	6	(13)
Healthy life style	15	(32.6)
No stress	16	(34.8)

Table 3: Some beliefs regard breast cancer of the studied group

	N	(%)
Examination does not prevent breast cancer	31	(64.6)
Breast cancer is a punishment	1	(2.1)
Zamzam prevent breast cancer	10	(20.8)
Rukia prevent breast cancer	4	(8.3)
No treatment for breast cancer	1	(2.1)
Chemotherapy leads to death	1	(2.1)
How do you feel when you hear about breast cancer		
Pain	2	(4.2)
Disease	1	(2.1)
Death	2	(4.2)
Stigma	-	-
Stress	2	(4.2)
Afraid	29	(60.4)
Shyness	9	(18.8)

Table 4: Perception of the Studied Group about Breast Self-Examination (BSE) (n=48).

	N	(%)
Do you know about BSE?	27	(56.3)
Did you learn how to perform BSE?	20	(41.7)
Who learn you? (n=20)		
Lecture or campaign	18	(90)
Obstetrician	2	(10)
Primary health Care Physician	-	-
Relative	-	-
Do you do practice BSE before?	18	(37.5)
How did you find the experience? (n=18)		
Easy	16	(88.8)
Difficult	2	(11.2)
What is the best time to do BSE? (n=27)		
Before cycle	3	(11.1)
During cycle	1	(3.7)
After cycle	4	(14.8)
I am not sure	19	(70.3)
What is the importance of the mammogram		
Discover tumor	5	(10.4)
Improve survival	2	(4.2)
I do not know	41	(85.4)zzz

Table 5: Obstacles and barriers preventing the studied group from going to early detection of cancer breast

	N	(%)
Shyness	15	(31.3)
Health insurance	2	(4.2)
Cost	1	(2.1)
No female physician	8	(16.7)
I didn't know it is important	16	(33.3)
Refusal of family	5	(10.4)
I do not know where to go	6	(12.5)
Transportation	3	(6.3)
I do not need to search for unknown	4	(8.3)
Free services is away	8	(16.7)
Laziness and looseness	3	(6.3)

For those with special needs the situation is more challenging. Existing health services research has largely ignored this population and the current healthcare system may be unprepared to respond to the special needs of this underserved group. In this study; pain was thought to be one of early symptoms of breast cancer as perceived by about half of the participants and only 10% of them recognized mass in the breast as

a presenting symptom. These findings are reflecting the poor knowledge about breast cancer among this group.

Risk factors also were not clear perceived by the participants to this study. Physicians, internet and Television/radio were reported as best source of information for cancer among healthy women in Saudi Arabia.^{10,12,13} This was not the case of course among these women with special needs as sign language is not used routinely in media in general. In our study physicians and relatives represent the main source of information at about one third of the studied group.

As these women with special needs are not equipped with enough information they have many misconceptions and they believe examination does not prevent breast cancer in about two thirds of the studied group and about one fifth believed that Holy water Zamzam can prevent breast cancer. These false beliefs are consistent with other findings of studies in minority groups like Hispanic and African American populations where the beliefs that traditional therapies (namely natural herbal remedies) are better than standard cancer treatments.¹⁴

Among the studied group about 40% have learned how to perform BSE but about 70 of them were not sure about the proper time. The more serious issue is that about 85% of the participated women did not know what mammogram is and what its value is. These findings could explain those of the previous studies on disabled persons which revealed that people with pre-existing disabilities including people with barriers to hearing may be at greater risk of certain cancers, are often less likely to be screened for cancer, may not receive the most effective treatments and have poorer prognoses and survival rates.⁷ Women with disabilities showed less compliance with breast and cervical screening programs⁽¹⁵⁾.

Existing health services research have largely ignored this population.¹⁶ The current health care system in Saudi Arabia may be unprepared to respond to the special needs of these women particularly in the area of preventive cancer screening.

In conclusion women with special needs can run the same risk of developing breast cancer like other healthy women. Women's health rights are human right and by international law and by Law in Saudi Arabia they have the right to all facilities and services and to empower them with knowledge in their understandable language which is the sign language. We recommend that sign language to be introduced as part of the health services in all aspect of our health care system.

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References:

- 1- Saudi Cancer Registry. (2010): Cancer incidence report, Saudi Arabia-2006. Kingdom of Saudi Arabia: Ministry of Health..
- 2- Armstrong K, Moye E, Williams S, Berlin JA, Reynolds EE. (2007): Screening mammography in women 40 to 49 years of age: a systematic review for the American College of Physicians. *Ann Intern Med.*; 146: 516-526.
- 3- De Koning HJ. (2003): Mammographic screening: evidence from randomized controlled trials. *Ann Oncol.*; 14: 1185-1189.
- 4- Tabar L, Vitak B, Chen HHT, Yen MF, Duffy SW, Smith RA. (2001): Beyond randomized controlled trials; organized mammographic screening substantially reduces breast carcinoma mortality. *Cancer.*; 1724-1731.
- 5- Schopp LH, Sanford TC, Hagglund KJ, Gay JW, Coatney MA. (2002): Removing service barriers for women with physical disabilities; promoting accessibility in the gynecologic care setting. *J Midwifery Women Health.*;47:74-79.
- 6- MMWR. (1998): Use of cervical and breast preventive cancer screening among women with and without functional limitations-United States,1994-1995.MMWR Morb Mortal Wkly Rep.;47:853-856.
- 7- Roetzheim RG, Chirikos TN. (2002): Breast cancer detection and outcomes in a disability beneficiary population. *J Health Care Poor Underserved.*;13: 461-476.
- 8- National Society For Human Rights. Know your Rights. Rights of Disabled, 2008, Kingdom of Saudi Arabia. www.nshrsa.org
- 9- Amin TT, Al Mulhim AR, al Meqihwi A. (2009): Breast cancer knowledge ,risk factors and screening among adult Saudi women in a primary health care setting. *Asian Pac J Cancer Prev.*;10:133-8.[PubMed]
- 10- Jahan S, Al-Saigul AM, Abdelgadir MH. (2006): Breast cancer .Knowledge, attitudes and practices of breast self examination among women in Qassim region of Saudi Arabia. *Saudi Med J.*; 27:1737-41.[PubMed]
- 11- Sait WA, Al-Amoudi SM, Tawtai DA, Abduljabbar HS. (2010):The knowledge of breast cancer among young Saudi females. *Saudi Med J.*;31:1242-4.[PubMed]
- 12- Alam AA. (2006):Knowledge of breast cancer and its risk and protective factors among women in Riyadh. *Ann Saudi Med.*;26:272-7.[PubMed]
- 13- Al-Amoudi SM, Abduljabbar HS. (2012): Men's Knowledge and attitude towards breast cancer in Saudi Arabia. *Saudi Med J.*; 33: 547-550.
- 14- Fernandez ME, Wippold R, Torres-vigil I, Byrd T, Freeberg D, Bains Y, *et al.* (2008): Colorectal cancer screening among Latinos from U.S. cities along the Texas-Mexico border. *Cancer Causes Control*;19: 195-206.
- 15- Ramirez A, Grant D, Papachristou T, *et al.* (2005):Disability and Preventive Cancer Screening: Results from the 2001 California Health Interview Survey. *American Journal of Public Health*; 95 (11):2057-2064.
- 16- Dejong G, Palsbo SE, Beatty PW, Jones GC, Knoll T, Neri MT. (2002): The organization and financing of health services for persons with disabilities. *Milbank Q.*; 80: 261-301.

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Oral S-1/Leucovorin combination in treatment of patient with an advanced large primary hepatocellular carcinoma

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Abstract: Hepatocellular carcinoma (HCC) is a lethal disease and novel treatment strategies will increase survival of the patients. This study aimed to test a combined chemotherapy regimen of S-1/Leucovorin in treatment of a patient who had a large primary hepatocellular carcinoma and was not suitable for hepatectomy or transcatheter arterial chemoembolization (TACE). The treatment course consisted of 50 mg S-1 and 25 mg Leucovorin given orally after meals twice daily for every other week. The outcome suggests that S-1/Leucovorin combination regimen on a biweekly course may provide a novel treatment option for advanced hepatocarcinoma patients.

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Keywords: large primary hepatocellular carcinoma; S-1; Leucovorin; oral chemotherapy

1. Introduction

Hepatocellular carcinoma (HCC) is one of the most common and lethal diseases in the world. HCC most occurs in patients with chronic hepatitis B or C and with cirrhosis, which makes clinical treatment more difficult because the patients have concomitant liver function impairment, poor general health, and are unable to tolerate arterial or intravenous chemotherapy. To date, surgery resection and liver transplantation are the most effective treatments for HCC patients; however, advanced tumor stages and limited sources of liver donors can make these options unfeasible.

Recently, the chemotherapy agent S-1 was successfully applied as an HCC treatment, and studies in different clinical trials (Diasio 1999; Shirasaka et al, 1996) have indicated a good response rate. S-1 is an oral combination regime of tegafur (that is a prodrug of 5-FU, which the liver and other organs convert to 5-FU), gimeracil (that is an inhibitor of the dihydropyrimidine dehydrogenase that degrades 5-FU), and oteracil (that is an inhibitor of the phosphorylation of 5-FU in the gastrointestinal tract, which thereby reduces the toxic gastrointestinal effects of 5-FU) at molar ratios of 1:0.4:1 (Diasio 1999; Shirasaka et al, 1996). This combination was first used for the treatment of advanced or metastatic gastric cancer and colorectal cancer (Koizumi et al, 2008; Ohtsu et al, 2000). In addition, Leucovorin, a folinic acid, was reported to synergistically enhance the effects of 5-FU and other chemotherapy agents due to its ability to suppress the 5-FU inhibitor thymidylate synthase.

In this study, we describe an HCC patient who presented at our clinic with a large primary tumor, but who was not suitable for the standard hepatectomy or transcatheter arterial chemoembolization (TACE)

treatment. Thus, we treated this patient with combination of S-1/Leucovorin. After three months of treatment, the patient had achieved a stable disease status.

2. Case report

A 67-year old male Han patient was admitted to our hospital with complaints of flank and back discomfort and pain for a week" in August of 2010. The patient had a history of hepatitis B infection from 25 years past, but had normal AFP levels upon admission. Physical examinations showed mass on the right - upper quarter of abdomen. Magnetic resonance imaging (MRI) on August 23, 2010 revealed an irregular massive low-signal shadow in the right posterior lobe of the liver. T2W1 focus demonstrated an uneven high-signal shadow of 10.9 × 6.4 cm. Several nodular high-signal shadows were also found in the upper segment of right lobe (Figure 1). Thus, the patient was diagnosed with a large primary hepatocellular carcinoma of the right liver lobe with multiple foci and hepatic cirrhosis.

The patient had Child-Pugh class B liver functions, specifically: TBil, 31.8 μmol/L; DBil, 11.9 μmol/L; IBil, 19.9 μmol/L; ALB, 29.4 g/L; GLB, 41.1 g/L; ALT, 70 U/L; G-GT, 140.0 U/L; HB, 134 g/L; WBC, 4.35 × 10⁹/L; PLT, 46 × 10⁹/L; PT, 15.0 s; APTT, 36.1 s; immunoreactivity-positive HBsAg, but -negative HBsAb, HBeAg, HBeAb, and BcAb; and, HBV-DNA <10³. The multiple lesions of the tumor and the patient's condition made surgical resection not feasible. Therefore, an oral S-1/Leucovorin combination treatment regimen was designed and administrated to the patient starting on August 25, 2010. The treatment course consisted of 50 mg S-1 and 25 mg Leucovorin

after meals twice daily for seven days for every other week.

Liver functions, routine blood and coagulation tests, and MRI were performed every six weeks during this treatment course. The MRI images obtained on November 22, 2010 showed that the tumor in the right posterior lobe of the liver had reduced to 9.6×5.9 cm (Figure 2). During treatment, there was no decrease in neutrophils and platelet count or increase in serum creatinine levels. Clinically, no other adverse effects were observed, such as infection, diarrhea, or stomatitis. To date, the patient retains the Child-Pugh class B liver function and is continuing the combined chemotherapy regimen; however, a recent chest X-ray examination yielded a suspicious finding which may be a potential pulmonary metastasis, despite the intrahepatic tumors appearing otherwise as stable.

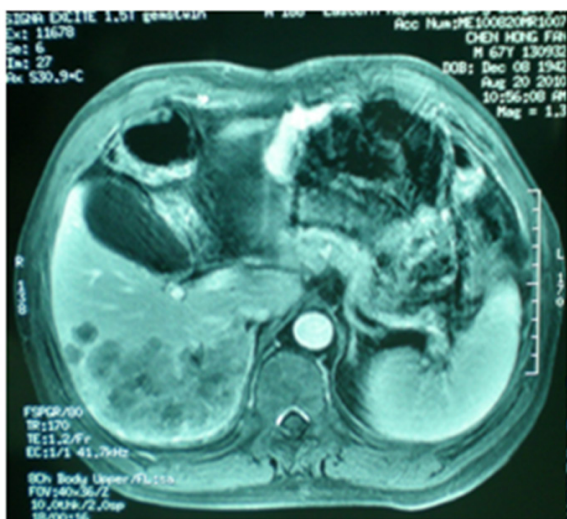


Figure 1. MRI on Aug 23, 2010. The image shows an irregular, massive low-signal shadow in the right posterior lobe of the liver. T2W1 focus demonstrated an uneven high-signal shadow of 10.9×6.4 cm in size. In addition, several nodular high-signal shadows were found in the upper segment of the right lobe.

3. Discussion

CT scan and MRI are the most frequently used tools for HCC diagnosis. If they are used correctly, a biopsy is not needed to confirm HCC diagnosis (Talwalkar and Gores, 2004). Nevertheless, although these cost-efficient diagnostic means are used in clinic, most HCCs are diagnosed in the late stages. This may be because of the preexisting conditions and non-specific symptoms or lab tests that delay suspicion of HCC.

To date, management of HCC patients usually includes surgical resection and liver transplantation. Neoadjuvant or adjuvant systemic chemotherapy has not yet been shown to have any survival benefit,

although 5-FU has been used as the basic drug in treatment of advanced hepatocarcinoma since the 1960s. The underlying mechanism that limits 5-FU efficacy in HCC has been determined. Dihydropyrimidine dehydrogenase (DPD), which is highly expressed in tumor cells, is a rate-limiting enzyme for 5-FU catabolism; in hepatocarcinoma cells, DPD decomposes 5-FU into a toxic metabolite, thereby significantly reducing the 5-Fu concentration and its functional potential. More recently, Leucovorin was found to increase the therapeutic efficacy of 5-FU in HCC patients. This positive effect on 5-FU is due to Leucovorin suppressing the 5-FU inhibitor thymidylate synthase.

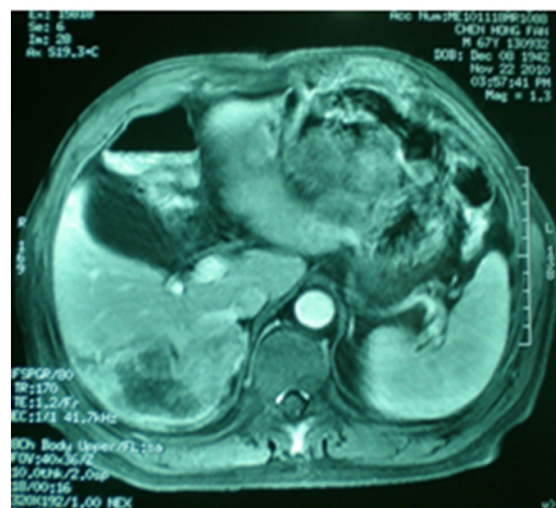


Figure 2. MRI on Nov 22, 2010. The image shows that the tumor in the right posterior lobe of the liver had reduced to 9.6×5.9 cm.

Indeed, S-1/Leucovorin has been used to treat advanced or metastatic gastric cancer and colorectal cancer^[3,4]. However, to the best of our knowledge, no reports in the literature have described S-1/Leucovorin combination therapy for HCC treatment. Several phase II clinical trials of single agent S-1, however, have been conducted for advanced hepatocellular carcinoma, and have indicated a high clinical response rate, longer disease-free survival, and improved overall survival rate. For example, a phase I/II clinical trial in Japan showed that the partial response rate of advanced HCC to S-1 monotherapy reached up to 21.7%, with a progression-free survival and overall survival of 3.7 and 16.6 months, respectively (Furuse et al, 2010). Another phase II clinical trial in Korea reported similar results, in that the partial response rate reached 23.8%,

with time to progression and overall survival of 4 and 14 months, respectively (Kim et al, 2010). These data are impressive and rare in HCC management history, which brings hope for advanced HCC patients.

The S-1/Leucovorin regimen has been widely utilized for head and neck cancer and recurrent colorectal cancer to increase survival of these patients. This particular drug combination was also found to be more tolerable than S-1 monotherapy (Shin et al, 2011; Koizumi et al, 2010). The S-1/Leucovorin biweekly treatment course has showed better efficacy and safety than that of two weeks' administration with two weeks break in treatment of advanced colorectal carcinoma (Shirasaka 2009). We, therefore, copied this regimen treatment course for our patient since he had advanced hepatocarcinoma with liver function impairments.

Our data showed that the patient had a very stable disease with slightly decreased tumor mass in response to treatment. In addition, the neutrophils and platelet count remained stable and there was no increase in serum creatinine levels. Our case report may provide a novel option for treatment of advanced HCC patients in the future.

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References

1. Diasio RB. Clinical implications of dihydropyrimidine dehydrogenase inhibition. *Oncology* 1999;13:17-21.
2. Shirasaka T, Shimamoto Y, Ohshimo H, Yamaguchi M, Kato T, Yonekura K, et al. Development of a novel form of an oral 5-fluorouracil derivative (S-1) directed to the

- potentiation of the tumor selective cytotoxicity of 5-fluorouracil by two biochemical modulators. *Anticancer Drugs* 1996;7:548-557.
3. Koizumi W, Narahara H, Hara T, Takagane A, Akiya T, Takagi M, et al. S-1 plus cisplatin versus S-1 alone for first-line treatment of advanced gastric cancer (SPIRITS trial): a phase III trial. *Lancet Oncol* 2008;9:215-221.
4. Ohtsu A, Baba H, Sakata Y, Mitachi Y, Horikoshi N, Sugimachi K, et al. Phase II study of S-1, a novel oral fluoropyrimidine derivative, in patients with metastatic colorectal carcinoma. S-1 Cooperative Colorectal Carcinoma Study Group. *Br J Cancer* 2000;83:141-145.
5. Talwalkar JA, Gores GJ. Diagnosis and Staging of Hepatocellular Carcinoma. *Gastroenterology* 2004;127:S126-S132.
6. Furuse J, Okusaka T, Kaneko S, Kudo M, Nakachi K, Ueno H, et al. Phase I/II study of the pharmacokinetics, safety and efficacy of S-1 in patients with advanced hepatocellular carcinoma. *Cancer Sci* 2010;101:2606-2611.
7. Kim SJ, Han SW, Oh DY, Yi NJ, Kim YJ, Im SA, et al. Combination chemotherapy with S-1 and platinum in advanced hepatocellular carcinoma. *Anticancer Res* 2010;30:5245-5250.
8. Shin SJ, Jeong JH, Park YS, Lee KH, Shim BY, Kim TW, et al. Phase II trial of S-1 monotherapy in elderly or frail patients with metastatic colorectal cancer. *Invest New Drugs* 2011;29:1073-1080.
9. Koizumi W, Boku N, Yamaguchi K, Miyata Y, Sawaki A, Kato T, et al. Phase II study of S-1 plus leucovorin in patients with metastatic colorectal cancer. *Ann Oncol* 2010;21:766-771.
10. Shirasaka T. Development history and concept of an oral anticancer agent S-1 (TS-1): its clinical usefulness and future vistas. *Jpn J Clin Oncol* 2009;39:2-15.

7/22/2012

The relationship between principal's leadership styles and teacher's organizational trust and commitmentMojgan Mirza¹ and Ma'rof Redzuan²^{1&2}: Department of Social and Development Science, Faculty of Human Ecology, University Putra Malaysia, 43400 Serdang, Selangor, MalaysiaE-mail: Mirza_kla@yahoo.com, marof@putra.upm.edu.my

Abstract: A few researches are tapped by researchers on relationship between principals' leadership styles and teachers' organizational trust and commitment. This paper tried to indicate this relationship in primary schools of the Golestan province - Iran as an educational organization. Pearson's correlation method (n=268 principals and n=513 teachers respondents) indicated that transformational leadership had a significant positive effect and transactional leadership has no significant effect on organizational trust and commitment. Moreover, results indicated a positive relationship between components of the teacher's organizational trust and commitment. Consequently, school principals should be focused on transformational style of leadership and enhancement of the teacher's trust whereby they can develop the organizational commitment qualities.

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Key words: leadership style, trust, commitment, school

1. Introduction

In the past, some researchers have argued that the actual influence of leaders on organizational outcomes is overrated and romanticized as a result of biased attributions about leaders (Meindl & Ehrlich, 1987). Despite these assertions however, it is largely recognized and accepted by practitioners and researchers that leadership is important, and research supports the notion that leaders do contribute to key organizational outcomes (Day & Lord, 1988; Kaiser, Hogan, & Craig, 2008).

In the current structure of public education, the principal is typically the person held accountable for all decisions within a school (Ross & Gray, 2006). The school policies are a result of principal leadership (Wahlstrom & Louis, 2008). Martin and Epitropaki (2001) found that high quality instruction will increase as a result of good leadership. When a principal can help a teacher feel like they can be successful in an activity, then the likelihood of success increases (Ross & Gray, 2004). This concept is called teacher efficacy. A principal is able to enhance teacher efficacy and confidence by listening and understanding the teachers (Printy & Marks, 2006).

Teacher perception of principal leadership influences how the teacher performs in the classroom by affecting a teacher's efficacy, commitment, trust, collaboration, and the overall school culture (Butz, 2010). Leadership will either build trust and confidence or tear them down, but good leadership will builds trust that goes to the subordinates from the leader and from the subordinates to the leader (Stroh, 2007). Hoy and Tschannen-Moran (1999)

define trust as an "individual's or group's willingness to be vulnerable to another party based on the confidence that the latter party is benevolent, reliable, competent, honest and open." Trust can be built between teachers and their principal through principal support (Louis, 2007). When principals support their teachers through difficult times then they find more value in their leader and develop a deeper trust (Deal & Peterson, 1994). Teachers learn to trust their principal through experiences and interaction (Muijs et al., 2006). Principals that have built trust with their employees are able to sustain a safe working environment (Stroh, 2007) where the teachers can focus on teaching instead of their own safety. Schools have also shown to be effective when a culture of trust between teachers and the principal is reflected (Nguni et al., 2006). If a principal is unwilling to interact with his or her teachers then there will be no opportunities to build trust. Principals should be visible and accessible to teachers to build strong trust (Sarros & Sarros, 2007). Trust is built vertically with the leader which can help define what the overall organization stands for, and horizontal trust is built between employees which, in turn, increase organizational involvement (Postmes et al., 2001).

Trust is important in organizational life as well as the human relations (Yilmaz, 2008) and it is a key enabler of cooperative human actions (Mcknight, 1995). Managers play a central role in determining the overall level of trust within organizations (Puusa & Tolvanen, 2006). In addition, the beliefs and actions of managers also directly and indirectly influence trust in organizations (Creed & Miles,

1996). Organizations that have been proven to be effective have cultures of trust between leaders and employees (Nguni et al., 2006). Trust in the organization will reflect the employee's faith in corporate goal attainment and organizational leaders, and the belief that ultimately, organizational actions will prove beneficial for the employee. Schools with a high degree of trust tend to be more focused and goal driven.

Commitment arises from the feel of trust (Kollock, 1994; Yilmaz, 2008). Organizational commitment in the fields of organizational behavior and organizational psychology is, in a general sense, the employee's psychological attachment to the organization. It is employees' attitude towards their organizations. Louis (2007) showed that principal leadership affects teacher commitment. Moreover, effective leadership can motivate subordinates to work harder to complete tasks resulting in high teacher commitment (Postmes, et al., 2001; Chen & Carey, 2009). When teachers and principals can share the development and implementation of goals teachers tend to be more committed to the organization (Youngs & King, 2002). Boxx et al. (1991) theorized that teacher commitment is the result of a leader's ability to manage the organization. Nguni et al., (2006) shared the theory of organizational commitment which is accepting a school's goals and values along with a willingness to give effort for the school and a desire to be affiliated with the school. High organizational commitment can result from a teacher who feels like they belong to the organization and have a strong connection or bond to co-workers and leaders (Martin & Epitropaki, 2001). According to Meyer & Allen (1991)'s theory of commitment, teachers with a strong affective, continuance and normative commitment stay with the organization because they "want to", "has to" and "ought to", respectively.

Since employee behavior and productivity are directly affected by their trust and commitment states, it is imperative to consider employee organizational trust responses to styles of the leaders. Moreover, the leadership style variable, consideration, was also relatively strongly related to organizational commitment (Iok and Crawford, 1999).

Bass (1990)'s theory of behavioral leadership styles has defined beliefs and actions of leaders including the manner and approach of providing organizational direction, implementing organizational plans, and motivating employees in 3 well-known styles; transformational, transactional and Laissez-faire leadership. Transformational leadership behaviors focus on the quality of the relationship with followers, whereas, transactional

leadership behaviors focus on the task to be accomplished by followers (Bass, 1990). According to Abu Daud Silong, (2009), the Bass (1990)'s theory refers to "Full Range Leadership Model".

Koopman (1991) studied how leadership styles affected employees and found those employees who favored their leader's style also favored the organization more. Though there was no direct connect between commitments, it could be argued that this would then affect their levels of commitment to the organization.

Nierhoff et al (1990) found that the "overall management culture and style driven by the top management actions are strongly related to the degree of employee commitment" (p. 344). These correlations bring to light the importance of having strong managers and their roles in the overall organization.

Norazlan Bin Hasbullah (2008), has been carried out the intention of examining the relationship between leadership behavior and organizational commitment in co-operative societies. Experienced employees possessed more stable high commitment regardless of leaders behavior, however new employees commitment are totally dependent on the leader's Nurturant Task plus Participative (NTP) behavior. Overall findings from this study suggest, autocratic and NTP do play important roles in determining the levels of employee's commitment.

Çokluk & Yılmaz (2010) have been focused on the relationship between teachers' organizational commitment and school administrators' leadership behavior. Results indicated that there was a moderate positive relationship between the teachers' perceptions about organizational commitment and supportive leadership behavior of school administrators. There was a moderate negative relationship between organizational commitment and directive leadership behavior of school administrators. Significant relationships were also determined between sub-dimensions of organizational commitment and directive leadership behavior of school administrators

According to Davenport (2010), the existing management and leadership research has demonstrated separately the effects of leadership style on organizational commitment.

2. Methodology

This study employed survey design in form of co-relational cross-sectional research. According to Rungtusanatham, et al. (2003), the current research fell into two categories of survey, descriptive and relational, for more elaboration of the data analysis to provide a richer detail and to obtain the most comprehensive information about this

research topic. The present study was carried out at the primary schools of Golestan province - Iran.

The target population of this study was school principals and their teachers on 2010-2011. The schools were selected by simple random sampling. The necessary Cochran (1977)'s samples were computed ($n=179$ principals, $n=332$ teachers), but for increasing confidence level of sampling 300 principals and 600 teachers considered as real sample size. Based on real sample size and proportional fraction of teachers of the cities within area study, teacher's sample sizes of the cities were computed.

The quantitative data for the study was gathered utilizing; 1) the leadership behaviors (Bass, 1990) to ascertain the well-known styles of leadership, 2) the employee's organizational behavior to assess the organizational trust (Tschannen-Moran & Hoy, 1998; Ferres, 2002, 2003 Organizational Trust Inventory) that is thought to be central to the interpersonal relationships that are characteristic of organizations, and 3) the employee's psychological attachment to the organization as the organizational commitment (Meyer and Allen, 1991).

Pearson's correlation statistical method ($n=268$ principals and $n=513$ teachers respondents) was applied for determination of the strength and direction (nature) of the relationship between independent variables toward dependent variables. The Correlation coefficient only aids in determining the strength and direction (positive or negative) of the relationships; no indication is reflected on the significance of the relationship. Hence, t-test statistical method was used to analysis of interval-ratio data on differences between groups of subjects.

3. Result and discussion

Research used descriptive statistics as a way to examine the mean, standard deviation and other information of data. Descriptive analysis contains three sections including: 1) principal's leadership styles, 2) teacher's organizational trust, and 3) teacher's organizational commitment.

3.1. Descriptive analysis of the principals' leadership styles

Table 1 contains descriptive data for the five transformational (relations-oriented) subscales, three transactional (task-oriented) subscales, and one laissez-faire subscale of principal's leadership styles. The overall scores of data for the transformational and transactional subscales were, in some instances, approximately equal to what Bass & Avolio (1995) consider "ideal" levels for effective leadership. Suggested scores for the most effective leaders include a mean of 3.0 or higher for idealized

influence (attributed), idealized influence (behavior), inspirational motivation, and intellectual stimulation. Mean scores for current research's data for transformational subscales ranged from 2.70 to 2.95. The suggested score for contingent reward is 2.0, only slightly upper than the current sample data mean of 1.66. The score for management-by-exception (active) was 1.48; this was within the suggested range of 1.0 and 2.0. Suggested scores for management-by-exception (passive) and laissez-faire are between 1.0 and 0.0; however, mean scores for the current data had slightly higher ranges of 0.85 and 0.5, respectively.

This pattern of scores for collected data of this research suggests that principals were not exhibiting the "ideal" levels of transformational leadership behaviors. The mean for contingent reward suggests that principals as doing a below average job of clarifying expectations and recognizing accomplishments. This was also the above case for the management-by-exception (active) mean, which implies that principals are taking corrective action in a timely manner. Mean scores for management-by-exception (passive) and laissez-faire suggests that principals have tendency to wait too long before resolving a problem or taking corrective action.

3.2. Descriptive analysis of the teacher's organizational trust

Table 2 contains descriptive data for the total and three subscales of the teacher's organizational trust. A ranking with trust in co-workers ($M=3.44$, $SD=1.6$), trust in supervisor ($M=3.25$, $SD=1.2$) and trust in organization ($M=3.18$, $SD=1.11$) is showed in the table 2.

3.3. Descriptive analysis of the teacher's organizational commitment

In describing the application of their Organizational Commitment Questionnaire (OCQ) scales, Meyer & Allen (1997) do not provide guidance about expected, desired, average, or ideal means for affective, continuance, and normative commitment. Instead, Meyer & Allen (1997) and other researchers (Dunham, Grube, & Castaneda, 1994; Hackett, Bycio, & Hausdorf, 1994; Whitener & Walz, 1993; Lee, 1992; Vardi, Wiener, & Popper, 1989) examined whether there was a positive or negative relationship between the different types of organizational commitment and the outcomes that are being measured, as well as the pattern for those findings. The desired pattern is the highest scores for affective commitment, followed by normative commitment, then continuance commitment. The mean scores for current study's data reflect that

affective commitment score (M=3.18, SD=1.28) were higher than normative commitment (M=3.04, SD=1.09) and continuance commitment (M=2.95,

SD=.94). Table 3 contains information for the three organizational commitment scales.

Table 1: Descriptive statistics for transformational, transactional and laissez-faire leadership's subscales

Subscales	Mean	SD	Kurtosis	Skewness
Transformational Leadership	2.83	.77	-.44	.52
-Idealized Influence (attributed)	2.95	.95	.52	.94
-Idealized Influence (behavior)	2.82	.70	-.66	.33
-Inspirational Motivation	2.70	.69	-.21	.60
-Intellectual stimulation	2.80	.72	-.58	.43
-Individualized consideration	2.85	.80	-1.26	.30
Transactional leadership	1.33	.43	.27	-.26
-Contingent reward	1.66	.74	-.67	.34
-Management-by-exception (active)	1.48	.68	-.16	.41
-Management-by-exception (passive)	.85	.53	.29	-.14
Laissez - Faire	.5	.52	-1.40	.23

Table 2: Descriptive statistics for trust scales

Trust scales	Mean	SD	Kur.	Sk.
co-workers	3.44	1.60	-.26	1.04
supervisor	3.25	1.20	-.33	.77
organization	3.18	1.11	-.35	.69
Total Trust	3.28	1.14	-.84	.76

Table 3: Descriptive statistics for commitment scales

Commit.scales	Mean	SD	Kurt.	Sk.
Affective	3.18	1.28	-.36	.89
Continuance	2.95	.94	-.06	.76
Normative	3.04	1.09	-.24	.87
Total Commitment	3.06	.96	-.31	.90

Table 4: Pearson coefficient between principal's leadership styles and teachers' organizational trust

Subscales Trust Leadership styles	TC	TS	TO	TT
Idealized Influence (attributed)	.672**	.518**	.497**	.657**
Idealized Influence (behavior)	.559**	.447**	.389**	.544**
Inspirational Motivation	.494**	.350**	.336**	.463**
Intellectual stimulation	.563**	.456**	.466**	.574**
Individualized consideration	.599**	.509**	.467**	.610**
• Transformational Leadership	.744**	.589**	.557**	.735**
Contingent reward	-.357**	-.196**	-.291**	-.330**
Management-by-exception (active)	-.351**	-.374**	-.294**	-.390**
Management-by-exception (passive)	-.218**	-.226**	-.243**	-.260**
• Transactional leadership	-.451**	-.382**	-.400**	-.475**
• Laissez - Faire	-.272**	-.205**	-.193**	-.262**

TC=trust in co-worker, TS=trust in supervisor, TO=trust in organization, TT=total trust, **=correlation is significant at $\alpha=.01$ level

3.4. Relationship between principal's leadership styles and teacher's organizational trust

Table 4 shows the results from testing of the relationship between principal's leadership styles and teacher's organizational trust by using the Pearson's statistical method. Results showed a statistically significant relationship between principal's leadership styles and teacher's organizational trust at 99% of the confidence level. This statistical significant relationship is positive-high between teacher's organizational trust and principal's transformational leadership style ($r=.735^{**}$, $p\leq.01$), negative-moderate relationship between teacher's organizational trust and principal's transactional

leadership style ($r= -.475^{**}$, $p\leq.01$), and negative-low relationship between teacher's organizational trust and laissez - faire style ($r= -.262^{**}$, $p\leq.01$).

The result of the analysis indicated that the teachers with high level of the organizational trust are related to the principal's transformational leadership style. Furthermore, principals with laissez-faire leadership style are related to lower level of teacher's organizational trust. In other words, increasing of the teacher's organizational trust is positively influenced by principal's transformational leadership styles. Consequently, finding is supported by Puusa & Tolvanen (2006), managers play a central role in determining the overall level of trust within

organizations. Moreover, the beliefs and actions of managers also directly and indirectly influence trust in organizations (Creed & Miles, 1996). Since teacher's trust states are directly and indirectly affecting on their behavior and productivity, it is imperative to consider teacher's organizational trust responses to styles of the school principals. It is clear that the role of the principals, in relationship between principal's leadership style and teacher's organizational trust, is very important and thus educational organizations endeavor to recruit and nurture transformational leadership qualities among the principals for increased trust among their teachers.

3.5 Relationship between principal's leadership styles and teacher's organizational commitment

Table 5 shows the results from testing of the relationship between principal's leadership styles and teacher's organizational commitment by using Pearson's statistical method. The result illustrated a statistically significant relationship between principal's leadership styles and teacher's organizational commitment at 99% of the confidence level. This significant positive relationship is moderate between principal's transformational style and teacher's affective commitment ($r=.671^{**}$, $p\leq.01$), continuance commitment ($r=.631^{**}$, $p\leq.01$), and normative commitment ($r=.626^{**}$, $p\leq.01$), respectively. In addition, results showed that there was a positive-high relationship between principal's transformational leadership style and teacher's organizational commitment ($r= .741^{**}$, $p=.000$). Moreover, it resulted that there was a negative low

and moderate relationship between teacher's organizational commitment, transactional ($r= -.515^{**}$, $p\leq.01$) and laissez – faire ($r= -.296^{**}$, $p\leq.01$) leadership styles, respectively. Results are supported by Wu (2006), managers have a significant positive relationship with employees' organizational commitment. These research results from the correlation analysis also support the hypothesis that teachers managed under a transformational style of leadership will have a higher organizational commitment. Moreover, findings are supported by Emery (2007), transformational factors are more highly correlated with organizational commitment than transactional factors. The result of Buciuene & Skudiene (2008) and Chiun (2009)'s research indicated that transformational leadership had a significant positive effect and transactional leadership has no significant effect on organizational commitment. In other words, transformational leadership style was positively affected on development of the teacher's organizational commitment. In contrast, transactional leadership might foster reduced commitment because teachers want to avoid principals who appear only when thing go wrong. Moreover, Passive-avoidant leadership had a negative and significant relationship with employees' affective and normative commitment and doesn't have any significant correlation with continuance commitment (Buciuene & Skudiene, 2008). Consequently, transformational style of leadership should appear to have value in leader selection and training programs within the educational service sector.

Table 5: Pearson coefficient between principal's leadership styles and teachers' organizational commitment

Subscales Commitment Leadership styles	AC	CC	NC	TOC
Idealized Influence (attributed)	.591**	.576**	.509**	.643**
Idealized Influence (behavior)	.484**	.494**	.441**	.544**
Inspirational Motivation	.457**	.370**	.423**	.484**
Intellectual stimulation	.509**	.514**	.492**	.581**
Individualized consideration	.562**	.490**	.572**	.627**
• Transformational Leadership	.671**	.631**	.626**	.741**
Contingent reward	-.371**	-.323**	-.294**	-.381**
Management-by-exception (active)	-.341**	-.311**	-.393**	-.402**
Management-by-exception (passive)	-.220**	-.267**	-.246**	-.278**
• Transactional leadership	-.454**	-.436**	-.451**	-.515**
• Laissez - Faire	-.251**	-.251**	-.271**	-.296**

AC=affective commitment, CC=continuance commitment, NC=normative commitment, TOC=total organizational commitment, **=correlation is significant at $\alpha=.01$ level

4. Conclusion

Various past literatures supported the relationship between leadership and commitment where leader's style do have influence on employee's

commitment. Since no similar research has been done in primary schools, this research may contribute to the understanding and improvement of teacher's trust and commitment in educational societies. In this

research population, findings explored that currently principal's exercises initiating structure style in their schools while literature has highlighted that transformational style of leadership is most favorable and influential style of leadership on organizational effectiveness. Moreover, result indicated that transformational factors are more highly correlated with teacher's organizational trust and commitment than transactional factors. It is clear that the role of the principals, in relationship between principal's leadership style and teacher's organizational trust and commitment, is very important and transformational style of leadership should give a specific impression to have value in school principal's selection and training programs within the educational community. Consequently, principals must reward and support their teachers for the work that they do because this perceived support allows for more trust and commitment in the organization.

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5. References

1. Abu Daud Silong, (2009). Leadership theories, Research and Practices, Framing Future Leadership Thinking. Penerbit Universiti Putra Malaysia (UPM). UPM press.
2. Bass, B.M., (1990). Bass and Stogdill's handbook of leadership. New York, Free Press.
3. Bass, B.M., & Avolio, B.J. (1995). MLQ multifactor leadership questionnaire. Scnd Edition, Sampler Set: Technical Report, Leader Form, Rater Form, And Scoring Key for MLQ form 5x-short.
4. Bucuniene, I., Skudiene, V., (2008). Impact of leadership styles on employees' organizational commitment in Lithuanian Manufacturing Companies. South East Eur.J.Econ.Bus., 3(2), 57-66.
5. Butz, R, (2010). The relationship between teacher perceptions of principal leadership style and student achievement during a time of leadership change, PhD dissertation, Walden University
6. Boxx, R., Odom, R., & Dunn, M. (1991). Organizational values and value congruency and their impact on satisfaction commitment, and cohesion: An empirical examination within the public sector. Public Personnel Management, 20(1), 195-205.
7. Chen, S., & Carey, T. (2009). Assessing citizenship behavior in educational contexts, the role of personality, motivation, and culture. Journal of Psychoeducational Assessment, 27(2), 125-137.
8. Chiun Lo MC, Ramaya T., Min H.W., (2009). Leadership styles and organizational commitment: a test on Malaysia manufacturing industry. Afr.J.Mark.Manage., 1(16), 133-139.
9. Cochran, W. G. (1977). Sampling techniques (3rd ed.). New York: John Wiley & Sons.
10. Çokluk & Yılmaz (2010), The Relationship between Leadership Behavior and Organizational Commitment in Turkish Primary Schools, bilig, Number 54: 75-92
11. Creed, W.E., & Miles, R.E., (1996), Trust in organizations: A conceptual framework. In Kramer, R.M., & Tyler, T.R., Trust in organizations: Frontiers of theory and research (pp.16-39). London:sage.
12. Davenport (2010), Leadership style and organizational commitment: the moderating effect of locus of control, ASBBS Annual Conference: Las Vegas, Volume 17 Number 1
13. Deal, T., & Peterson, K., (1994). The Leadership Paradox: Balancing logic and Artistry In Schools. San Fransisco, Ca. Jossey Bass Inc.
14. Ferres, N., Travaglione, A., Connell, J., (2002). Trust: A precursor to the potential mediating effect of transformational leadership? International Journal of Organizational Behavior, 5(8), 242-263.
15. Ferres, N., Travaglione, A., Connell, J., (2003). The Development and Validation of the Workplace Trust Survey (WTS): Combining Qualitative and Quantitative Methodologies. Paper to be Presented at APROS, Mexico 2003, Emotions, Attitudes and Culture Stream, pp.1-22.
16. Hoy, W.K., & Tschannen-Moren, M., (1999). Five faces of trust: An empirical confirmation in urban elementary schools. J. school Leadership, 9: 184-208.
17. Kaiser, R., Hogan, B., & Craig, S., (2008). Leadership and the fate of organizations. American Psychologist, 63(2), 96-110.
18. Koopman, P.L., (1991). "Between control and commitment: Management and change as the art of balancing". Leadership and OD Journal, 12, 3-7.
19. Lok, P., & Crawford, J., (1999). The relationship between commitment an organizational culture, subcultures, leadership styles, job satisfaction in organizational change and development, Leadership and

- Organizational Journal, Vol. 20 No. 7, pp. 365-373.
20. Louis, K.S. (2007). Trust and improvement in schools. *Journal of Educational Change*, 8, 1–24.
 21. Martin, R., & Epitropaki, O. (2001). Role of organizational identification on implicit leadership theories (ILTs), transformational leadership and work attitudes. *Group Processes and Intergroup Relations*, 4(3), 247–262.
 22. McKnight, H., Cummings, L., Chervany, N., (1995). Trust formation in new organizational relationships. University of Minnesota--Curtis L. Carlson School of Management, October, 1995 at the Information & Decision Sciences workshop, University of Minnesota.
 23. Meindl, J. R., & Ehrlich, S. B., (1987). The romance of leadership and the evaluation of organizational performance. *Academy of Management Journal*, 30(1), 91-109.
 24. Meyer, J.P., Allen, J.N., (1991). A Three-component conceptualization of organizational commitment. *Human Resources Management Review*, 1, 61-98.
 25. Meyer, J.P. & Allen, N.J. (1997). *Commitment in the Workplace: Theory, Research, and Application*. Thousand Oaks, CA: Sage Publications.
 26. Muijs, D., Harris, A., Lumby, J., Morrison, M., & Sood, K. (2006). Leadership and leadership development in highly effective further education providers. Is there a relationship? *Journal of Further and Higher Education*, 30(1), 87-106.
 27. Niehoff, B.P., Enz, C.A., & Grover, R.A. (1990), The impact of top-management actions on employee attitudes and perceptions. *Group & Organization Studies*, 15(3), 337-352.
 28. Nguni, S., Slegers, P., & Denessen, E. (2006). Transformational and transactional leadership effects on teachers' job satisfaction, organizational commitment, and organizational citizenship behavior in primary schools: The Tanzanian Case. *School Effectiveness and School Improvement*, 17(2), 145-177.
 29. Norazlan Bin Hasbullah (2008). The relationship between leadership behavior and organizational commitment: A study in the co-operative societies in peninsular Malaysia, Master Dissertation, UM. Malaysia.
 30. Postmes, T., Tanis, M., & de Wit, B. (2001). Communication and commitment in organizations: A social identity approach. *Group Processes & Intergroup Relations*, 4(2), 227-246.
 31. Printy, S., & Marks, H. (2006). Shared leadership for teacher and student learning. *Theory into Practice*, 45(2), 125-132. doi:10.1207/s15430421tip4502-4.
 32. Puusa, A., & Tolvanen, U., (2006). Organizational Identity and Trust. *EJBO Electronic Journal of Business Ethics and Organization Studies*, Vol. 11, No. 2, pp.29-33.
 33. Ross, J., & Gray, P. (2004). Transformational leadership and teacher commitment to organizational values: The mediating effects of collective teacher efficacy. Paper presented at the annual meeting of the American Educational Research Association, San Diego, Ca.
 34. Ross, J., & Gray, P. (2006). School leadership and student achievement: The mediating effects of teacher beliefs. *Canadian Journal of Education*, 29(3), 798-822.
 35. Rungtusanatham, M.J., Choi, T.Y., Hollingsworth, Z.W., Wu & Forza, C., (2003). Survey research in operations management: historical analyses. *Journal of Operations Management*, 21, 475-488.
 36. Sarros, A., & Sarros, J. (2007). The first 100 days: Leadership Challenges of a new CEO. *Educational Management Administration & Leadership*, 35(3), 349-371.
 37. Stroh, L (Ed.). (2007). *Trust Rules How to Tell the Good Guys from the Bad Guys In Work and Life*. Westport, Ct.: Praeger Publishers.
 38. Tschannen-Moran, M. and Hoy, W.K., (1998). Trust in schools: A conceptual and empirical analysis. *J. Educa. Admin.*, 4: 334-352.
 39. Wahlstrom, K., & Louis, K. S. (2008). How teachers experience principal leadership: The roles of professional community, trust, efficacy and shared responsibility. *Educational Administration Quarterly*, 44(4), 458-495.
 40. Yilmaz, K., (2008). The relationship between organizational trust and organizational commitment in Turkish primary school, *Journal of Applied Sciences* 8 (12); 2293-2299.
 41. Youngs, P., & King, M. B. (2002). Principal leadership for professional development to build school capacity. *Educational Administration Quarterly*, 38(5). 337-356.

Syneresis and Texture Stability of Hydrogel Complexes Containing Konjac Flour over Multiple Freeze-thaw Cycles

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Abstract: Hydrogel complexes formed by a 1% mixture of konjac flour and secondary gums (κ -carrageenan or xanthan) at different ratios between 70:30 and 30:70 were investigated for syneresis and texture stability under multiple freeze-thaw cycles. Increasing of freeze-thaw cycles caused the syneresis generated by all konjac/ κ -carrageenan gels significantly increased ($p < 0.05$) while their peak force values decreased ($p < 0.05$). As compared with the gels freshly prepared, significant differences ($p < 0.05$) in syneresis and peak force values were found in all konjac/ κ -carrageenan gels after the first freeze-thaw cycle, in exception of the konjac/ κ -carrageenan (50:50) gel that showed the most stable gel texture until the end of the second cycle. Konjac/xanthan gels ranged from 70:30 to 50:50 demonstrated increasing syneresis but decreasing peak force values with increasing freeze-thaw cycles. Whilst, no syneresis were found ($p > 0.05$) in the gels formed by konjac/xanthan blends at 40:60 and 30:70, which also maintained their gel texture over the fourth freeze-thaw cycle.

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Keywords: Konjac flour, freeze-thaw stability, hydrogel, syneresis, texture characteristic

1. Introduction

In the food production, hydrocolloids or gums have special importance and wide variety of applications. They are contributed to the thickening and stabilizing effects, texture modification, control of moisture and water mobility and improvement of overall product quality (Sae-kang and Suphantharika, 2006; Šubarić et al., 2011). It is therefore to apply in many food products such as bakery, meat, confectionery, jam and jelly. The storage condition and gel stability are considered as key factors affecting food product quality and perception. Frozen food products, which their characteristics are sensitive to the temperature fluctuation, are of considered as a challenge for food manufacturers. Ice crystals within the food matrix which formed during freezing cause physical stress and damage to food; consequently, loss of moisture and changes in textural characteristics often occur upon thawing, resulting in reduction of product quality and consumer acceptance (Williams et al., 2009).

Konjac flour, prepared from the tuber of *Amorphophallus konjac*, is a high molecular weight polysaccharide consisting of mannose and glucose in a ratio of 3:2 with β 1, 4-linkage. It has a strong water-binding ability and forms a gel by deacetylation in mild alkali solution or combining with other secondary gums (e.g. carrageenan, gellan and xanthan) (Thomas, 1997; Takigami, 2000). This unique gelling mechanism could be used to increase

retention or absorption of moisture and other ingredients of which products it is applied. The consistency of konjac hydrogel complexes that provides texture stability will enhance the quality of frozen food products (Chin et al., 2009). In addition, for low-fat meat processing, konjac gel can be used as a fat analogue that is an alternative for animal fat replacement (Akesowan, 2008; Jiménez-Colmenero et al., 2012). The stability of konjac gel would be the informative data required to develop or improve the quality of food products, especially gel-based products when they are stored at specific conditions such as chilled, frozen and freeze-thaw storages.

To better understand the characteristics of konjac hydrogel complexes under multiple freeze-thaw cycles, this work was aimed to investigate the syneresis and texture stability of the gels formed by a 1% mixture of konjac and secondary gums (κ -carrageenan or xanthan) varying from 70:30 to 30:70 under discrete temperature fluctuation. Four freeze-thaw cycles were studied to imitate the product distribution from the processing plant to retail until to consumer.

2. Material and Methods

Materials

Hydrocolloids used were konjac flour (Chengdu Newstar Chengming Bio-Tech Co., Ltd, China), κ -carrageenan (MSC5744, MSC Ltd., USA)

and xanthan gum (KELTROL[®], CP Kelco, San Diego, CA, USA).

Hydrogel complex preparation

Mixed gums (1% w/v) including konjac flour and secondary gum (κ -carrageenan or xanthan) at various proportions from 70:30 to 30:70 were gradually added into distilled water and constantly stirred for 10 min using a magnetic stirrer. The mixture was heated in a water bath at $90 \pm 2^\circ\text{C}$ for 30 min and then each of 10 mL hot mixture was poured into centrifuged tubes for syneresis measurement, while another portion was filled into gel cups (3 cm diameter \times 2.5 cm height) for texture measurement. After cooling down to room temperature ($27 \pm 2^\circ\text{C}$), all test samples were subject to multiple freeze-thaw cycles evaluation. One cycle defines as a freeze-thaw process of 18 h storage at $-18 \pm 2^\circ\text{C}$, followed by 6 h storage at $20 \pm 2^\circ\text{C}$.

Syneresis determination

Syneresis of hydrogel complexes after each freeze-thaw cycle was determined by centrifuging at 3,000 rpm for 20 min. The volume of exuded water was measured by using a laboratory graduated cylinder. Five samples from each treatment were used for determination. Syneresis of the samples was calculated as followed:

$$\text{Syneresis (\%)} = \frac{\text{Total weight of separated liquid (g)}}{\text{Total weight of gel (g)}} \times 100$$

Texture measurement

Hydrogel complexes, selected from each treatment after the end of each freeze-thaw cycle, were removed from the cups. A texture analyser (Model LRX, Lloyd Instruments, Hampshire, UK) with 1000-N load cell, 250 mm/s crosshead speed and a cutting-type test cell were used to determine the gel texture. Five samples from each treatment were used for peak force (N) measurement.

Statistical analysis

Hydrogel complexes of each treatment were prepared in triplicate. Two factors including a mixture of konjac and secondary gum (κ -carrageenan or xanthan) at different proportions and a number of freeze-thaw cycles were studied. Analysis of variance (ANOVA) and the significance of mean difference were analyzed by the Design-Expert[®] Trial version 8.0.2.0 software (State-Ease Inc., Minneapolis, Minnesota, USA). Duncan's new multiple range test was used for mean comparison for a treatment effect (Cochran and Cox, 1992).

3. Results and Discussion

Freeze-thaw stability of the konjac/ κ -carrageenan gel

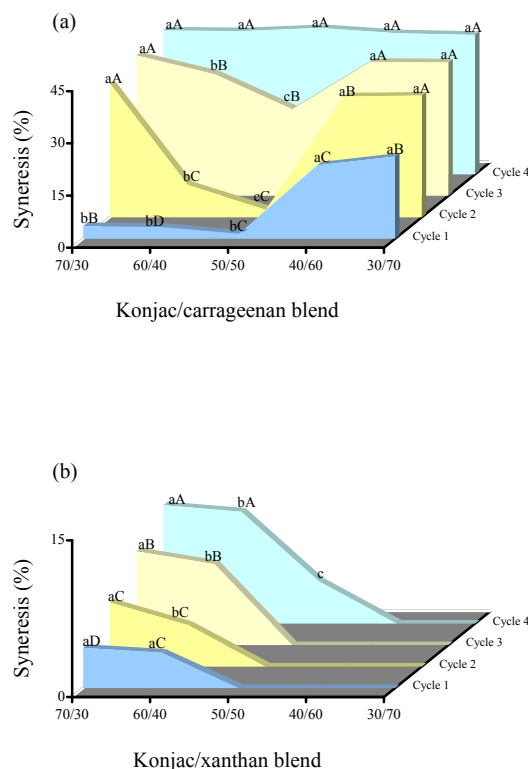


Figure 1. Syneresis of hydrogel complexes under multiple freeze-thaw cycles: (a) konjac/carrageenan blend and (b) konjac/xanthan blend.

The stability of a gel system can be conducted on some critical parameters; syneresis and texture characteristic, which demonstrate the gel texture consistency (Hoover *et al.*, 1997; Williams *et al.*, 2009). Prior to freeze-thaw process, no syneresis was detected on hydrogel complexes investigated, indicating good water-holding capacity of the hydrogels upon formation. The variations of syneresis with various konjac/carrageenan blends and freeze-thaw cycles observed for konjac hydrogel complexes are presented in Figure 1a. It can be seen that the percentage of syneresis continuously increased with an increase of the freeze-thaw cycle, suggesting the inability of mixed gum gels structure to hold water under longer temperature fluctuations. The syneresis of the gels prepared with konjac/ κ -carrageenan blend at 70:30, 40:60 and 30:70 were higher than those at 50:50 and 60:40 after the end of the first up to the third freeze-thaw cycle, meaning that these two mixed gum ratios (50:50 and 60:40)

were optimal for syneresis resistance. It was evident that the various ratios between konjac and κ -carrageenan from 70:30 to 30:70 significantly ($p < 0.05$) influenced on syneresis of the mixed gum gels in different manners depending on the proportion of κ -carrageenan combined in the blend and a number of freeze-thaw cycles. When the κ -carrageenan proportion was higher than that of konjac, the more “excess” proportion of κ -carrageenan chains can form double helix structure and crystalline junction zones alone, causing thermoreversible and brittle gels upon cooling. In general, much syneresis is one of disadvantage characteristics of the κ -carrageenan gel (Whistler and BeMiller, 1993); consequently, partial part of separated water would be come from carrageenan gels. This is the reason why higher proportion of κ -carrageenan than konjac flour in a blend produced a hydrogel with more syneresis. In this work, the lowest syneresis was observed in the 1% konjac/ κ -carrageenan (50:50) gel until the third freeze-thaw cycle was over. Although abundant hydroxyl groups in konjac facilitated the formation of hydrogen bonding with κ -carrageenan and led to good miscibility (Shen et al., 2009), the three-dimensional networks of mixed gums are limited by interactive sites of both polymers. Under this condition, the networks will imbibe water due to the osmotic driving forces of the network chains and also the additional water is assumed to fill the space between the network chains and/or the center of larger pores, macropores or voids. If much more konjac proportion in a blend such as the konjac/ κ -carrageenan blends at 60:40 and 70:30, the excess konjac molecules can undergo self association and hinder the interactions of the gums, resulting in incomplete strong cohesive gels that produced more syneresis. The ability of the hydrogel complexes to hold water is dependent on the conformation of konjac flour and κ -carrageenan in the system, which relates to gel formation via intramolecular and intermolecular hydrogen bonding (Takigami, 2000).

The strong initial water-holding capacity of konjac/ κ -carrageenan gel was occurred after processing because the heating (up to 90°C) involving in the hydrogel formation promoted the chemical interaction between konjac flour and κ -carrageenan. After the first freeze-thaw cycle, apparent syneresis averaging 1.45, 3.41 and 3.65% were detected in the konjac hydrogel complexes formed with κ -carrageenan in ratio of 50:50, 60:40 and 70:30, respectively (Figure 1a). When the freeze-thaw cycle was repeated twice, the formation of ice crystals within the gel texture was occurred again, causing physical stress to the gels and upon thawing

the melting of these ice crystals led to moisture loss. The loss of water after freeze-thaw cycles reflects the instability of the intra- and intermolecular bonding, which may be due to prolong mechanical treatment weakening a gel network of konjac hydrogel complexes formed with κ -carrageenan. The finding implies that the optimum level of konjac addition can improve water holding capacity and reduce the degree of syneresis of κ -carrageenan in a mixed gum gel. However, non-significantly ($p > 0.05$) highest syneresis were determined in all konjac hydrogel complexes with any combinations which kept until completing the fourth cycle.

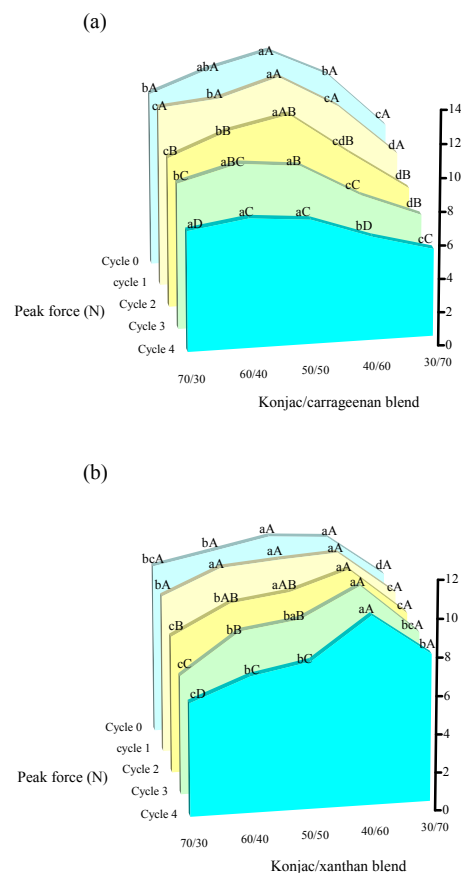


Figure 2. Texture stability of hydrogel complexes under multiple freeze-thaw cycles: (a) konjac/carrageenan blend and (b) konjac/xanthan blend.

The results of texture stability of konjac/ κ -carrageenan gels at different levels from 70:30 to 30:70, represented by the peak force are shown in Figure 2a. After gel preparation or zero freeze-thaw cycle, the lowest peak force was observed in the hydrogel prepared with a konjac/ κ -carrageenan

(30:70) blend; moreover, peak force was increased with decreasing κ -carrageenan proportion from 70 to 50% in the gum combination. The highest peak force values were significantly found ($p < 0.05$) in hydrogel complexes prepared with konjac/ κ -carrageenan blends at 50:50 and 60:40; nevertheless, the gel at 70:30 tended to decrease in peak force. This finding implies a relationship between a konjac/ κ -carrageenan ratio and the gel texture, namely the higher proportion of κ -carrageenan than konjac produced a hydrogel with more brittle texture, which was easier to break down. Whilst, at much more konjac proportion used, the greater influence by high konjac chains might have hindered the interaction between konjac and κ -carrageenan, consequently producing a soft and tender gel with decreasing peak force.

At the end of the first freeze-thaw cycle, all konjac/ κ -carrageenan gels significantly decreased ($p < 0.05$) in peak force values, in exception of the konjac/ κ -carrageenan (50:50) gel which maintained the peak force ($p < 0.05$) until the end of the second cycle. The decrease in peak force with increasing freeze-thaw cycles suggests the inability of the gel system to withstand temperature fluctuation. This is possibly due to water expands when freezing to form ice crystals, consequently gel network in hydrogel complexes are ruptured, resulting in decreasing of gel strength. As the fourth cycle was over, the gel structure would be extremely damaged. Similar result was confirmed by Williams et al. (2009) who showed that the gel strength of curdlan (galactomannan)/ κ -carrageenan was continuously declined after each freeze-thaw cycle and completely destroyed at the end of the fifth freeze-thaw cycle.

Freeze-thaw stability of the konjac/xanthan gel

Unlike the konjac/ κ -carrageenan gel, the use of xanthan as a secondary gum for konjac gel forming resulted in an elastic gel with good syneresis resistance; however, this effect varied with the proportion of xanthan in a mixed gum combination. In case of 1% konjac hydrogel complexes formed with xanthan, konjac/xanthan blend at 70:30 and 60:40 showed significant ($p < 0.05$) increases in syneresis with increasing freeze-thaw process (Figure 1b). The increased syneresis suggests the increment of molecular association between konjac and xanthan, resulting in the release of water from the gel structure. On the contrary, the gels produced by konjac/xanthan blend at 40:60 and 30:70 demonstrated no syneresis (separated water) throughout 4 freeze-thaw cycles, while the syneresis was detected in a konjac/xanthan (50:50) gel after the fourth freeze-thaw cycle. No syneresis means that a

hydrogel complex has strong and stable water-holding capacity, which is important for food application. The result also showed that hydrogel complexes containing a lower proportion of xanthan than konjac demonstrated a higher syneresis. Xanthan gum is an anionic linear hydrocolloid with a (1 \rightarrow 4) linked β -D-glucose backbone and has a large side unit on every other glucose unit at location C-3 (Sworn, 2000; Williams et al., 2009). The highly substituted nature of this gum allows for excellent hydration and hydrogen bonding activity with any polysaccharides (Argin-Soysal et al., 2009). Consequently, each gum concentration contained in a mixed gum blend is responsible for a hydrogel characteristic.

As compared with the result of konjac/ κ -carrageenan gel, the higher syneresis was observed for the konjac/ κ -carrageenan gel than konjac/xanthan gel, could be partly due to the soft texture of the konjac/xanthan gel which provided less resistance to the deformation caused by centrifugation (Sae-kang and Suphantharika, 2006). It is well recognized that the extent of syneresis measured by the centrifugation method is dependent upon rigidity and elasticity as well as extent of phase separation (Yuan and Thompson, 1998). It is therefore a reason why a higher proportion of xanthan incorporated in the konjac hydrogel complexes resulted in the zero syneresis or such strong synergistic effects between konjac and xanthan via some other specific interactions, besides Van der Waals forces (Liang et al., 2011).

The results for texture stability of konjac/xanthan gels shown in Figure 2b reveal that peak force values of hydrogels formed by a combination of konjac and xanthan at 30:70 and 40:60, respectively were consistent over the fourth freeze-thaw cycle. This suggests that these two gels were stable than other treatments. The decreases in peak force values of konjac/xanthan gels at ratio of 50:50, 60:40 and 70:30, respectively were dependent on increasing freeze-thaw cycles. It can be seen that, when a lower proportion of xanthan than konjac was applied, the texture of konjac/xanthan gel at 50:50 and 60:40 were significantly stable after the end of the second freeze-thaw cycle; nevertheless, the konjac/xanthan (70:30) gel tended to lose its gel texture faster than did other mixed gum gels. This was in consonance with the observation recorded for syneresis results in which this gel showed the highest syneresis.

Conclusion:

The variation in the proportion of konjac and secondary gums affected freeze-thaw stability and texture characteristics of hydrogel complexes. The

konjac/carrageenan (50:50) gels was observed for the best stability up to 2 freeze-thaw cycles whereas the gels containing konjac and xanthan ranged from 30:70 to 40:60 showed their stability throughout 4 freeze-thaw cycles. The storage stability of konjac/secondary gum gels as affected by sucrose and sodium chloride under chilling and/or freezing conditions is proposed to the further investigation.

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References

1. Akesowan A. Effect of soy protein isolate on quality of light pork sausages containing konjac flour. *African Journal of Biotechnology* 2008;7:4586-4590.
2. Argin-Soysal S, Kofinas P, Lo YM. Effect of complexation conditions on xanthan-chitosan polyelectrolyte complex gels. *Food Hydrocolloids* 2009;23:202-209.
3. Chin KB, Go MY, Xiong YL. Konjac flour improved textural and water retention properties of transglutaminase-mediated, heat-induced porcine myofibrillar protein gel: Effect of salt level and transglutaminase incubation. *Meat Science* 2009;81:565-572.
4. Cochran WG, Cox GM. *Experimental Design*. 2nd ed. John Wiley and Sons. New York, USA. 1992.
5. Hoover R, Li YX, Hynes G, Senanayake N. Physico-chemical characterization of mung bean starch. *Food Hydrocolloids* 1997;11:401-408.
6. Jiménez-Colmenero F, Cofrades S, Herrero AM, Fernández-Martín F, Rodríguez-Salas L, Ruiz-Capillas C. Konjac gel fat analogue for use in meat products: Comparison with pork fats. *Food Hydrocolloids* 2012;26:63-72.
7. Liang S, Li B, Ding Y, Xu BL, Chen J, Zhu B, Ma MH, Kennedy JF, Knill CJ. Comparative investigation of the molecular interactions in konjac gum/hydrocolloid blends: Concentration addition method (CAM) versus viscosity addition method (VAM). *Carbohydrate Polymers* 2011;83:1062-1067.
8. Sae-kang V, Suphantharika M. Influence of pH and xanthan gum addition on freeze-thaw stability of tapioca starch pastes. *Carbohydrate Polymers* 2006;65:371-380.
9. Shen D, Wan C, Gao S. Molecular weight effects on gelation and rheological properties of konjac glucomannan-xanthan mixtures. *Journal of Polymer Science: Part B: Polymer Physics* 2009;48:313-321.
10. Šubatić D, Babić J, Ačkar D, Piližota V, Kopjar M, Ljubas I, Ivanovska S. Effect of galactomannan hydrocolloids on gelatinization and retrogradation of tapioca and corn starch. *Croatian Journal of Food Science and Technology* 2011;3:26-31.
11. Sworn G. Xanthan gum. In: Phillips GO, Williams PA, eds. *Handbook of hydrocolloids*. CRC Press. New York, USA. 2000:103-115.
12. Takigami S. Konjac mannan. In: Phillips GO, Williams PA, eds. *Handbook of hydrocolloids*. CRC Press. New York, USA. 2000:413-424.
13. Thomas WR. Konjac gum. In: Imeson A, ed. *Thickening and gelling agents for food*, 2nd ed. Chapman & Hall. London, UK. 1997:169-179.
14. Whistler RL, BeMiller JN. *Industrial gums*. 3rd ed. Academic Press. New York, USA. 1993.
15. Williams PD, Sadar LN, Lo YM. Texture stability of hydrogel complex containing curdlan gum over multiple freeze-thaw cycles. *Journal of Food Processing and Preservation* 2009;33:126-139.
16. Yuan RC, Thompson DB. Freeze-thaw stability of three waxy maize starch pastes measured by centrifugation and calorimetry. *Cereal Chemistry* 1998;75:571-573.

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Relationship between Organizational Commitments and Teacher's Personal and Work Characteristics

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Abstract: The development of organizational commitment related to personal and work characteristics of school teacher's is still not well understood and very few studies have explored this concept. Hence, empirical research-evidence is needed to support the proposed link between teachers' commitment and their personal-work characteristics in schools as educational organizations. Participant's teachers (n=513) in this study were asked to provide their demographic information and organizational commitment based on Meyer & Allen's Organizational Commitment Questionnaire. In order to identify the relationship between variables of the study, ANOVA was employed. Result indicated that there is no relationship between age, gender, and educational level of teacher and teacher's affective, continuance, and normative commitment. Whereas, variables such as total number of years of experience in educational institutions, total number of years of teaching experience, total number of years of teaching experience in current school, and teacher involved to decision making have shown significant influence on teacher's affective, continuance and normative commitment. Findings of this research help psychological researchers, school managers and educational organizations to increase their teacher's commitment by focus on work characteristics in order to high productivity and performance.

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Key words: organizational commitment, Teacher, Demographics

1. Introduction

Organizational commitment is widely described in the management and behavioral sciences literature as a key factor in the relationship between individuals and organizations. Committed employees would lead to higher levels of performance and effectiveness at both the individual and organizational level. Therefore, the potential organizational benefits have resulted to focus on the nature of the organizational commitment.

Literature reveals a long list of factors that are associated with the development of organizational commitment. Many authors associate the development of organizational commitment with variables such as the personal characteristics of the employee, organizational characteristics and work characteristics (Mowday 1997; Nijhof et al., 1998). This research try to understand how these various variables fit together and lead to the development of the affective, continuance, and normative dimensions of the Allen and Meyer's (1990) organizational commitment at varying degrees. For example, when teachers are more committed to the school they will work harder for the students and even volunteer for extracurricular activities (Ross & Gray, 2006). Volunteering for activities to support the students and the school is a behavior that shows commitment (Shaw & Reyes, 1992).

Mathieu and Zajac's (1990) have shown a statistically significant positive correlation of .20 ($p < .01$) and .36 ($p < .05$) between age and affective organizational commitment, respectively. In contrast, Hawkins (1998) has been reported non-significant relationship between age and affective commitment ($r = -.004$, $p > .05$). Mathieu & Zajac's (1990) has reported a weak relationship ($r = .089$, $p < .01$) between gender and commitment. Overall, age and gender seem to have an inconsistent and subtle correlation and effects on organizational commitment.

Committed teachers tend to feel like they have a positive bond with the principal as a result of open communication (Postmes et al., 2001). Open communication is a key component to increasing teacher commitment (Postmes et al., 2001). When teachers and principals can share the development and implementation of goals, teachers tend to be more committed to the organization (Youngs & King, 2002). Teachers are more committed to students when they felt like they were successful at increasing their achievement level (Hausman & Goldring, 2001).

Celep (1992) tried to determine the level of organizational commitment of teachers with regard to the commitment to the school, to teaching work, to work group and to the teaching profession. Teacher's commitment to the school was tested with such factors as exerting effort on behalf of the school, and

having proper period in belonging to the school, among others. He indicated a direct relationship between the teacher's organizational commitment and having proper pride to belong to the school and work group.

Relatively, there is still very limited research that supports the argument that those personal and organizational characteristics can affect the level of teacher's organizational commitment within school as an important educational organization. The present study therefore aims to determine the influence of such variables on development of the teacher's organizational commitment in school.

2. Methodology

The sample for this study consisted of teachers of the primary school in Golestan Province, Iran ($n=513$ out of 2459 based on Cochran's formula, 1977). Participant's teachers were asked to provide demographic information and Meyer & Allen's (1997) Organizational Commitment Questionnaire. During the pre-screening process, teacher's demographic information and their response to the organisational commitment were matched. Descriptive statistics procedure is used to show the variation in estimating means, standard deviations, skewness and kurtosis for organizational commitment and its subscales. ANOVA statistical method was used to identify the relationship between demographic variables and teacher's organizational commitment.

3. Results

The sample for this study consisted of teachers ($n=513$; male=241, female=272) of the primary school in Golestan province, Iran. Participant's teachers were asked to provide demographic information. Table 1 presents the demographic information of teachers.

In describing the application of their Organizational Commitment Questionnaire (OCQ) scales, Meyer & Allen (1997) do not provide guidance about expected, desired, average, or ideal means for affective, continuance, and normative commitment. Instead, Meyer & Allen (1997) and other researchers (Dunham, Grube, & Castaneda, 1994; Hackett, Bycio, & Hausdorf, 1994; Whitener & Walz, 1993; Lee, 1992; Vardi, Wiener, & Popper, 1989; Allen & Meyer, 1996) examined whether there was a positive or negative relationship between the different types of organizational commitment and the outcomes that are being measured, as well as the pattern for those findings. The desired pattern is highest scores for affective commitment, followed by normative commitment, then continuance

commitment. The mean scores for current study's data reflect that affective commitment score ($M=3.18$, $SD=1.28$) were higher than normative commitment ($M=3.04$, $SD=1.09$) and continuance commitment ($M=2.95$, $SD=.94$). Table 2 contains information for the three organizational commitment scales.

In order to investigate the relationship between demographic variables and organizational commitment and its subscales, Analysis of Variance (ANOVA) was used to indicate the variance of the organizational commitment of the teachers to the demographic variables. Table 3 to 5 are shown the results of ANOVA statistical analysis. Results indicated that there is no statistical relationship between age, gender, educational level and teacher's affective, continuance and normative commitment. Whereas, work variables such as experience in educational institutions, teaching experience, teaching experience in current school, and teacher's involvement in decision making are significant influence on teacher's affective, continuance and normative commitment.

4. Conclusion

Organizational commitment has been identified as a predictor of behavior within organizations. Organizational commitment has got considerable attention in the last two decades because of its attempt to understand organizational development, productivity and performance. In a school, organizational commitment concept deals with how teachers become committed to their school and how do it effect to the school outcomes. Development of the teacher's organizational commitment depends to factors such as teacher's personal and work characteristics. This research tried to prepare a linkage between these variables. ANOVA statistical method indicated that increasing teacher's experience in educational institutes, increasing teaching experience, and increasing total years of working in a school and more involvement in the decision making, influenced to development of the teacher's organizational commitment. In contrast, findings indicated that teacher's age, gender, and educational level no have significant relationship with teacher's organizational commitment. It is resulted that for developing teacher's commitment should be more focus on work characteristics than personal characteristics.

Overall, results of this research as evidence help researchers, school managers and other educational organizations to increase their follower's organizational commitment in order to high productivity and performance.

Table 1: Summary of samples for teachers by demographic variables

Variables	n	%
<i>Sample</i>	513	
<i>Gender</i>		
Male	241	47
Female	272	53
<i>Age</i>		
25-30	13	2.6
31-35	111	21.6
36-40	145	28.4
41-45	161	31.3
46-50	82	16
<i>Education Level</i>		
Diploma	52	10.1
Bachelor Degree	455	88.8
Master's Degree	6	1.1
<i>Experience in educational institutions(year)</i>		
8-10	118	23.1
11-15	186	36.2
16-20	163	31.7
> 20	46	9
<i>Teaching experience (year)</i>		
5-7	125	24.3
7-10	204	39.9
> 10	184	35.8
<i>Teaching experience in current school (year)</i>		
2-4	209	40.7
5-7	260	49.3
7-10	51	10.1
<i>Involvement in decision making</i>		
Very Low	99	19.4
Some times	387	75.4
Moderate	26	5.2
High	-	-

Table 2: Descriptive statistics for commitment

Commitment scales	Mean	SD	Kur.	Ske.
Affective	3.18	1.28	-.36	.89
Continuance	2.95	.94	-.06	.76
Normative	3.04	1.09	-.24	.87
Commitment	3.06	.96	-.31	.90

Table 3: Results of ANOVA with teacher's demographic variables as independent variables and teacher's affective commitment as dependent variable (n=513)

Demographic Variables	d _f	SS	MS	F	Sig _F
Age	4	13.50	3.30	2.09	.082
Gender	1	5.70	1.60	3.51	.062
Educational Level	3	1.00	.33	.20	.895
Experience in educational institutions	3	29.55	9.85	6.34	.000*
Teaching experience	2	19.07	9.53	6.01	.003*
Teaching experience in current school	2	48.96	24.48	16.61	.000*
Involvement in decision making	2	183.82	91.91	95.29	.000*

Note: $\alpha = .05$ and * = Reject H_0 and statistically significant difference among mean groups with 95% confidence level

Table 4: Results of ANOVA with teacher's demographic variables as independent variables and teacher's continuance commitment as dependent variable (n=513)

Demographic Variables	d _f	SS	MS	F	Sig _F
Age	4	3.17	.794	.891	.470
Gender	1	2.28	2.28	2.58	.109
Educational Level	3	4.00	1.33	1.58	.213
Experience in educational institutions	3	7.77	2.59	2.97	.032*
Teaching experience	2	4.25	2.12	2.41	.049*
Teaching experience in current school	2	6.90	3.45	3.96	.020*
Involvement in decision making	2	93.72	46.86	86.39	.000*

Table 5: Results of ANOVA with teacher's demographic variables as independent variables and teacher's normative commitment as dependent variable (n=513)

Demographic Variables	d _f	SS	MS	F	Sig _F
Age	4	7.03	1.76	1.46	.212
Gender	1	4.91	4.91	4.11	.053
Educational Level	3	2.93	.979	.809	.490
Experience in educational institutions	3	17.23	5.74	4.96	.002*
Teaching experience	2	15.48	7.74	6.68	.001*
Teaching experience in current school	2	20.64	10.32	9.06	.000*
Involvement in decision making	2	115.43	57.71	73.91	.000*

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References

- Allen, N.J., & Meyer, J.P. The measurement and antecedents of affective, continuance and normative commitment to the organization, *Journal of Occupational psychology*, 1990, 63, 1-18.
- Allen, N. J., & Meyer, J. P. Affective, continuance, and normative commitment to the organization: An examination of construct validity. *Journal of Vocational Behavior*, 1996, 49, 252-276.
- Bartlett, J.E., Kotlik, J.W., Higgins, C.C. *Organizational Research: Determining Appropriate Sample Size in Survey Research*, *Information Technology, Learning, and Performance Journal*, 2001, 19 (1), 43-50.
- Celep, C. Teacher's organizational commitment in educational organizations. *National Forum Journals*, 1992, 1-15.
- Cochran, W. G. *Sampling techniques* (3rd ed.). New York: John Wiley & Sons. 1977. 1-428.

- Hawkins, W.D. Predictors of affective organizational commitment among high school principals, PhD dissertation, Faculty of the Virginia Polytechnic Institute and State University. 1998, 1-113.
- Hausman, C., & Goldring, E. Sustaining teacher commitment: the role of professional communities. *Peabody Journal of Education*, 2001, 76 (2), 30-51.
- Krejcie, R.V., Morgan, D.W. Determining sample size for research activities, *Educational and Psychological Measurement*, 1970, 30, 607-610.
- Mathieu, J.E., & Zajac, D.M. A review and meta-analysis of the antecedence, correlates, and consequences of organizational commitment, *Psychological Bulletin*, 1990, 108, 171-194.
- Meyer, J.P. & Allen, N.J. *Commitment in the Workplace: Theory, Research, and Application*. Thousand Oaks, CA: Sage Publications. 1997, 1-151.
- Meyer, J.P, Stanley, D.J., Herscovitch, H., and Topolnyts, L. Affective, Continuance, and Normative Commitment to the Organization: A Meta-analysis of Antecedents, Correlates, and Consequences. *Journal of Vocational Behavior*, 2002, 61, 20-52.
- Mowday, R. T. Reflections on the study and relevance of organizational commitment. *Human Resources Management Review*, 1998, 8 (4), 387- 401.
- Nijhof, W.J., De Jong, M.J., & Beukhof, G. Employee commitment in changing organizations: an exploration. *Journal of European Industrial Training*, 1998, 22(6), 243-248.
- Postmes, T., Tanis, M., & de Wit, B. Communication and commitment in organizations: A social identity approach. *Group Processes & Intergroup Relations*, 2001, 4(2), 227-246.
- Ross, J., & Gray, P. School leadership and student achievement: The mediating effects of teacher beliefs. *Canadian Journal of Education*, 2006, 29(3), 798-822.
- Shaw, J. & Reyes, P. School cultures: Organizational value orientation and commitment. *Journal of Educational Research*, 1992, 85 (5), 295-302.
- Youngs, P., & King, M. B. Principal leadership for professional development to build school capacity. *Educational Administration Quarterly*, 2002, 38(5), 643-670.

The relationship between teacher's organizational trust and organizational commitment in primary schools

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Abstract: Considerable researches have been done on organizational trust and commitment, only a few of them were carried by educational organizations and it is specially untapped by researchers in primary schools. This research aimed to support the proposed link between teacher's organizational trust and commitment in primary schools as educational organizations. This study employed survey design based upon the research question. The study was carried out among 513 teachers in Golestan Province, Iran. Pearson's correlation statistical method indicated a statistically significant and positive-high magnitude relationship between teacher's organizational trust and organizational commitment. Moreover, statistical results indicated a positive moderate-high relationship between components of the teacher's organizational trust and commitment. Consequently, Development of the teacher's commitment is deeply depending on fostering the teacher's organizational trust. Therefore, school principals should be focused on enhancement of the teacher's trust whereby they can develop the organizational commitment qualities.

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Keywords: Commitment, Trust, Teacher, school

1. Introduction

In today's context organizations have to be more organic, flexible, and adaptive because they need dynamic and committed work force to lead the organizations towards the expected direction. Organizational commitment is one of the widely researched areas among researchers, psychologists and human resources management practitioners (Warsi, 2009). Organizational commitment in the fields of organizational behavior and organizational psychology is, in a general sense, the employee's psychological attachment to the organization. It is employees' attitude towards their organizations. Organizational commitment has got considerable attention in the theory and research in the last two decades because of its attempt to understand the intensity and stability of employee dedication to work organizations (Eisenberger, 1990) and linkage with desirable organizational productivity and performance.

There are different classifications about organizational commitment (Katz and Kahn, 1977; Mowday, 1982; Wiener, 1982; O'Reilly and Chatman, 1986; Allen and Myer, 1990, Yilmaz, 2008). The mostly used one among these classifications belongs to Meyer and Allen (1991) as new and multi-dimensional approach. Meyer and Allen's three-component theory of commitment are including; affective, continuance and normative commitment.

According to Meyer (2002) organizational commitment is "the force that binds an individual to

a course of action of relevance to one or more targets". Generally, higher or lower levels of commitment have been shown to be a major driver of employees staying with or leaving an organization (Shaw, 1992). Employees with sense of organizational commitment are less likely to engage in withdrawal behavior and more willing to accept change (Lverson and Buttigeig, 1998). In addition, employees are motivated and dedicated towards meeting and achieving organizational goals (Pfeffer, 1998).

According to Yilmaz (2008) there is a significant relationship between organizational commitment and organizational trust. Trusting in an organization increases the commitment (Yilmaz, 2008). Trust is essential element in constrictive human relationships (Puusa, 2006) and effective relations (Clarke, 2000) and also it is one of the most important themes in human relations and human behaviors (Yilmaz, 2008). Trust has been described as the "social glue" that can hold different kind of organizational structure together (Atkinson & Butcher, 2003) and it is important in organizational life as well as the human relations (Yilmaz, 2008). There are a wide variety of trust definitions, none of which are universally accepted (Bigley & Pearce, 1998). Hoy and Tschannen-Moran (1999)'s multidimensional approach to trust is adopted. Because, it is one of the most frequently used definitions of organizational trust and it captures the key elements of the constructs that are included in the instrument that will be used to measure trust in

schools (Laka-Mathebula, 2004). In this study, we are concerned with trust of teachers as expressed towards their school in three levels as follow; trust the supervisor, trust in co-workers, and trust in the organization. Employees must build trust with both other employees and the leaders they serve for the organization to be successful (Taylor- Dunlop & Lester, 2000).

In organizations where trust is dominant, one can see open and participating atmosphere, responsible employees, productivity and organizational commitment, compromise culture, team work, high job satisfaction and participation in decisions (Buykdere and Solmus, 2006; Yilmaz, 2008). In organizations with lack of trust, employees accuse each other for any mistake, develop defense mechanisms, avoid taking responsibility, feel suspicious and jealous, make gossips, try to stay away from work and disaffirm organizational goals. In addition, there comes out decrease in organizational commitment, professional satisfaction, and performance to unhappy employees and unhappy organization atmosphere (Yilmaz, 2008). Moreover, Complaints become a reason for punishments and discharge. As a result, employees feel themselves stuck in their work (Buykdere and Solmus, 2006; Asunakutlu, 2007, Yilmaz, 2008).

Hence, the study of employee's trust and commitment should be important to educational institutions receiving large amounts of public funds and playing an important role in the development of the skills and knowledge of employees of the future and the community as a whole. In reviewing the literature, there is little agreement as to why it is difficult to develop and sustain trust and commitment in organizational environments and what factors may positively contribute.

When teachers feel like they are helping students be successful, then they are more committed to teaching (Ross & Gray, 2006). High organizational commitment can result from a teacher who feels like they belong to the organization and have a strong connection or bond to co-workers and leaders (Martin & Eitropaki, 2001). Strong organizational commitment will cause the school culture to be strengthened and enhance the overall school atmosphere (Solvason, 2005).

Yilmaz (2008) has been studied to define the relationship between the organizational trust and organizational commitment of primary school teachers. According to the results got from this research, as long as the positive view of primary school teachers on organizational trust and its sub-dimensions increase, it becomes an increase also in organizational commitment levels. Consequently, Pearson's correlation analysis indicated that there

was medium-level, positive and significant relationship between organizational trust and its sub-dimensions and organizational commitment and its sub-dimensions.

Nyhan (2000) explored the possibility of a trust-based organizational model for public sector organizations by addressing trust outcomes as well as trust antecedents using structural equation modeling. Nyhan found that participation, feedback, and empowerment significantly predicted interpersonal trust, and interpersonal trust significantly predicted productivity and organizational commitment. According to Nyhan, these findings support prior research that trust between managers and non-managers can result in increased productivity and organizational commitment.

Cubukcu & Tarakcioglu (2010) have shown that while the factors of organizational trust have positively directed correlation with affective and normative commitment, it has emerged that it a lower level correlation with continuance commitment.

2. Methodology

This study employed survey design in form of co-relational cross-sectional research. The survey method has been chosen because it is regarded as the most appropriate research design to measure the perception of the respondents. Moreover, according to Gall, Borg, & Gall (2006), it was a correlation study designed to analyze the relationship between variables. The present study was carried out at the primary schools of Golestan province - Iran. The target population of this study was school teachers (male, female) on 2010-2011 school calendar. The schools were selected by simple random sampling. The necessary Cochran (1977)'s samples were computed (n= 332 teachers), but for increasing confidence level of sampling about 600 teachers considered as real sample size. Based on real sample size and proportional fraction of teachers of the cities within area study, teacher's sample sizes of the cities were computed. The quantitative data for the study was gathered utilizing; 1) the teacher's organizational behavior to assess the organizational trust (Tschannen-Moran & Hoy, 1998, Ferres, 2002, Organizational Trust Inventory) that is thought to be central to the interpersonal relationships that are characteristic of organizations, and 2) the teacher's psychological attachment to the organization as the organizational commitment (Meyer and Allen, 1991). Pearson's correlation statistical method (n=513 respondents) was applied for determination of the strength and direction (nature) of the relationship between independent variables toward dependent variables. The Correlation coefficient only aids in determining the strength and direction

(positive or negative) of the relationships; no indication is reflected on the significance of the relationship. Hence, t-test statistical method was used to analysis of interval-ratio data on differences between groups of subjects.

3. Results

Two characteristics of the teachers including organizational trust and organizational commitment

were analyzed, descriptively. Table 1 contains descriptive data for the total and three subscales of the teacher's organizational trust. A ranking with trust in co-workers (M=3.44, SD=1.6), trust in supervisor (M=3.25, SD=1.2) and trust in organization (M=3.18, SD=1.11) is showed in the table 1.

Table 1: Descriptive Statistics for Organizational Trust Scales

Trust scales	Mean	SD	Kurtosis	Skewness
Trust in co-workers	3.44	1.60	-.26	1.04
Trust in supervisor	3.25	1.20	-.33	.77
Trust in organization	3.18	1.11	-.35	.69
Total Trust	3.28	1.14	-.84	.76

In describing the application of their Organizational Commitment Questionnaire (OCQ) scales, Meyer & Allen (1997) do not provide guidance about expected, desired, average, or ideal means for affective, continuance, and normative commitment. Instead, Meyer & Allen (1997) and other researchers (Dunham, Grube, & Castaneda, 1994; Hackett, Bycio, & Hausdorf, 1994; Whitener & Walz, 1993; Lee, 1992; Vardi, Wiener, & Popper, 1989; Allen & Meyer, 1997) examined whether there was a positive or negative relationship between the different types of organizational commitment and the

outcomes that are being measured, as well as the pattern for those findings. The desired pattern is highest scores for affective commitment, followed by normative commitment, then continuance commitment. It is supported by findings of this research. The mean scores for current study's data reflect that affective commitment score (M=3.18, SD=1.28) were higher than normative commitment (M=3.04, SD=1.09) and continuance commitment (M=2.95, SD=.94). Table 2 contains information for the three organizational commitment scales.

Table 2: Descriptive statistics for organizational commitment scales

Commitment scales	Mean	SD	Kurtosis	Skewness
Affective commitment	3.18	1.28	-.36	.89
Continuance commitment	2.95	.94	-.06	.76
Normative commitment	3.04	1.09	-.24	.87
Total Organizational Commitment	3.06	.96	-.31	.90

In this section, Pearson Product – Moment Correlation statistical methods were used for testing the research hypotheses and investigating the associated relationship between in-dependent (trust) and depended (commitment) variables.

The result (Table 3) indicated a statistically significant relationship between components of the teacher's organizational trust and organizational commitment at 99% of the confidence level. The statistical significant relationship is positive -high magnitude between teacher's organizational trust, teacher's organizational commitment ($r = .753^{**}$, $p < .01$), and teacher's affective commitment ($r = .717^{**}$, $p < .01$), respectively. In addition, result indicated a positive- moderate magnitude relationship between teacher's organizational trust and teacher's continuance commitment ($r = .634^{**}$, $p < .01$), and normative commitment ($r = .603^{**}$,

$p < .01$). In other word, it can be said that 56.7%, 51.4%, 40.1%, and 36.3% of total variance of organizational commitment, affective commitment, continuance commitment, and normative commitment arise from organizational trust, respectively. Moreover, results indicated a positive with moderate relationship between teacher's organizational commitment and teacher's trust in co-worker ($r = .694^{**}$, $p < .01$), teacher's trust in organization ($r = .657^{**}$, $p < .01$), and teacher's trust in supervisor ($r = .599^{**}$, $p < .000$), respectively. In other word, it can be said that 48.1%, 43.1%, and 35.8% of total variance of organizational commitment arise from trust in co-worker, trust in organization, and trust in supervisor, respectively. Consequently, findings of this research are supported by Yilmaz (2008) and Cubukcu & Tarakcioglu (2010), high level of teacher's trust (in co-worker,

organization, and supervisor) is positively affecting

their organizational commitment.

Table 3: Pearson's correlation coefficient between teacher's organizational trust and organizational commitment

Commitment	TC	TS	TO	TT
Affective commitment	.655**	.581**	.624**	.717**
Continuance Commitment	.578**	.495**	.569**	.634**
Normative commitment	.570**	.475**	.513**	.603**
Total organization commitment	.694**	.599**	.657**	.753**

TC=trust in co-worker, TS=trust in supervisor, TO=trust in organization, TT=total trust, **=correlation is significant at .01 level

4. Conclusions

One of the important subjects affected by organizational trust is organizational commitment (Yilmaz, 2008). Literatures show that the relationship between organizational trust and commitment is untapped by researchers in primary schools. This research aimed to determine the relationship between the primary school teachers' organizational trust and commitment. Employees having high organizational commitment show much more effort in realizing their duties and organizational aims (Yilmaz, 2008). Results indicated that 48.1%, 43.1%, and 35.8% of total variance of organizational commitment arise from trust in co-worker, trust in organization, and trust in supervisor, respectively. Research finding is supported by Yilmaz (2008) and Cubukcu & Tarakcioglu (2010); teacher's trust is positively affecting their organizational commitment. Consequently, human resources managers should remain focused on increasing teachers' organizational trust and commitment for teachers' efficiency and school greater outputs. While a great deal of research has occurred in the area of commitment over the past decade, the new research only suggests that there is a lot more to be done and many very promising avenues to pursue. We hope that our results and comments in this paper can be a catalyst for some of this research.

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References

- Allen, N.J., & Meyer, J.P., (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization, *Journal of Occupational Psychology*, 63: 1-18.
- Bigley, G.A. and J.L. Pierce (1998) 'Straining for shared meaning in organization science: Problems of trust and distrust', *Academy of Management Review*, 23(3), 405-421.
- Clark, C. E. (2000). Differences between public relations and corporate social responsibility: An analysis. *Public Relations Review*, 26 (3), 363-380.
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). New York: John Wiley & Sons.
- Çubukcu, K., Tarakcioglu, S., (2010). The Relation between Organizational Trust and Organizational Commitment: A Study on Teachers of Hotel Management and Tourism Vocational High Schools, *İşletme Araştırmaları Dergisi*, 2(4), 57—78.
- Eisenberger, R., Fasolo, P., & Davis-LaMastro, V. (1990) "Perceived Organizational Support and Employee Diligence, Commitment, and Innovation". *Journal of Applied Psychology*, 75(1), 51-59.
- Ferres, N., Travaglione, A., Connell, J., (2002). Trust: A precursor to the potential mediating effect of transformational leadership? *International Journal of Organizational Behavior*, 5(8), 242-263.
- Gall, M. D., Borg, W. R., & Gall, J. P. (2006). *Educational research: An introduction* (7th ed.). White Plains, NY: Longman. Pages: 672.
- Hoy, W.K., & Tschannen-Moren, M., (1999). Five faces of trust: An empirical confirmation in urban elementary schools. *J. school Leadership*, 9: 184-208.
- Laka-Mathebula, M.R. (2004). Modeling the relationship between organizational commitment, Leadership style, Human resources management practices and organizational trust. PhD dissertation, University of Pretoria etd.
- Lverson RD, Buttigieg DN (1999). Affective, Normative and Continuance Commitment: Can the 'Right Kind' of commitment be managed? *Journal of Management Studies*, 36 (3), 307-333.
- Martin, R., & Epitropaki, O. (2001). Role of organizational identification on implicit leadership theories (ILTs), transformational

- leadership and work attitudes. *Group Processes and Intergroup Relations*, 4(3), 247–262.
13. Meyer, J.P., Allen, J.N., (1991). A Three-component conceptualization of organizational commitment. *Human Resources Management Review*, 1, 61-89.
 14. Meyer, J.P. & Allen, N.J. (1997). *Commitment in the Workplace: Theory, Research, and Application*. Thousand Oaks, CA: SAGE Publications.
 15. Meyer, J.P., Stanley, D.J., Hescovitch, L. & Topolnytsky, L., (2002). Affective, continuance, and normative commitment to the organization: A meta-analysis of antecedents, correlates, and consequences. *Journal of Vocational Behavior*, 61 (1), 20-52.
 16. Nyhan, R. C. (2000). Changing the paradigm: Trust and its role in public sector organizations. *American Review of Public Administration*, 30(1), 87–109.
 17. Pfeffer, J., (1998). *The human equation*. Boston, Harvard Business School Press.
 18. Puusa, A., (2006). Organizational identity and trust, *EJBO Electronic Journal of Business Ethics and Organization Studies*, 11 (2), 29-33.
 19. Ross, J., & Gray, P. (2006). School leadership and student achievement: The mediating effects of teacher beliefs. *Canadian Journal of Education*, 29(3), 798-822.
 20. Shaw, J. & Reyes, P. (1992). School cultures: Organizational value orientation and commitment. *Journal of Educational Research*, 85, 295-302.
 21. Solvason, C., (2005). Investigating specialist school ethos...or do you mean culture? *Educational Studies*, 31(1), 85-94.
 22. Taylor- Dunlop, K., & Lester, P., (2000). The development of an instrument to measure organizational trust. Paper prepared for the annual meeting of the American Educational Research Association, New Orleans, LA, 1-12.
 23. Tschannen-Moran, M. and Hoy, W.K., (1998). Trust in schools: A conceptual and empirical analysis. *Journal of Educational Administration*, 4: 334-352.
 24. Warsi, S., Noor Fatimah, & Sahibzada, S.A., (2009). Study on relationship between organizational commitment and its determination among private sector employees of Pakistan, *International review of Business research paper*, 5(3), 399-410.
 25. Yilmaz, K., (2008). The relationship between organizational trust and organizational commitment in Turkish primary school, *Journal of Applied Sciences* 8 (12); 2293-2299.

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Performance of Circular Opening in Beam Web Connections

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Abstract: Fragile behavior in the area around the connections which is tangent on beam to column and also incidence of brittle cracks and failures in this area, in the event of severe ground shaking, are the main problems and disadvantages that have negative effect on the performance of steel bending frames and would have restrictions effect on the of the frame's plasticity behavior. To solve the problem of bending the frame, two methods have been proposed. In the first method, the connection will be strengthened so that has enough resistance and sufficient strength to prevent cracks and failures to non-elastic deformation of the frame in the inner part of beams be answered. In the second method, instead of strengthen the connection area; the middle part of beam in a certain distance from the terminal connection would weaken intently. So, this weakened section act as a fuse and cause attracting and transmitting place of occurrence of the most transmission of frame shape request to a new far area and also would prevent cracking of the connection and its associated elements. In this paper, we investigated the transformations of frames against lateral force by weakening of the circular hole in a far away area.

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Keywords: Reduced Web Section, Plastic Hinge, Circular Opening, Post Northridge Connections, Perforated Beams

1- Introduction:

Generally, designation in steel structures was based on high plasticity of steel and capability of high transformations and significant energy loss in earthquake by steel. After Northridge earthquake in 1994, initial observations showed the suitability of designation trend in the steel structure, but by doing more accurate tests and also symptoms after the earthquake, engineers found that the steel structures have not shown the necessary flexibility against earthquake. In fact, brittle behavior of welded joints in frame structures caused this event and in many cases, before beams' failure, these beams have experienced fragile failure in weld joints of beams to the columns (Mahin, 1998). The main reason of this behavior is in thermal stresses caused by welding, stress concentration and so on.

Qingshan et al. (2009) showed that openness in beams at a distance far enough from junction would improve seismic behavior of bending frames; On the other hand, this opening does not affect the structural stiffness and the final shift structures increases and finally a large amount of energy from earthquake would loses due to deformation of local shapes in the area. Investigations showed that Failure mechanisms in these beams similar with Vierendeel mechanism were been reduced in place and can avoid from weld brittle failure at the junction. Qingshan et al. (2009) calculated plastic joint's place around the holes in 0.45R distance which showed in following:

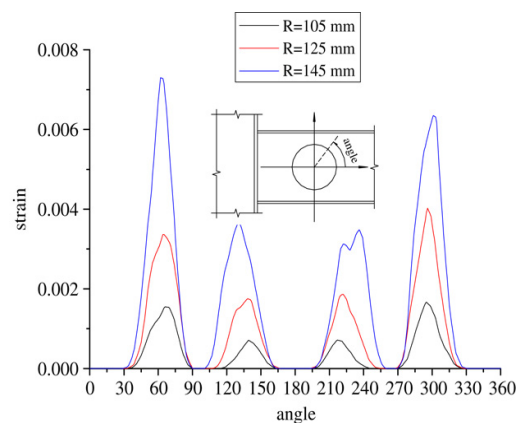


Fig (1-1): distribution of effective plastic strain

Chung et al. (2001) have found that openness in beam would reduce the ultimate beams' loading capacity, but in beams with large openings and a third location opened in the initial and final stone can be used regardless of the loading by studying on two-head beam. Besides, they represent an exponential relation for shear and bending beam reactions with openness by examining the finite element model of a two-head beam.

$$\left(\frac{V_{sd}}{V_{o,Rd}}\right)^{2.5} + \left(\frac{M_{sd}}{M_{o,Rd}}\right)^{2.5} \leq 1$$

Which,

V_{sd} and M_{sd} : Shear and anchor from structure analysis in entry of hole

M_{0Rd} , V_{0Rd} : shear and bending capacity of beam in entry of hole

Liu and Chung (2003) found that all shapes except circle, will form plastic joints in two ends of upper and under T form and also, bearing capacity in different shapes, with constant altitude and longitude, is identical.

Lawson et al. (2006) found that in composite beams which have continuous holes, if the longitude of beam being large enough, effects of second anchors ($P.\Delta$) should be seen in Vierendeel mechanism, so to undergo these effects, they had considered reduction coefficient (K_L).

$$K_L = 1 - \frac{l_{eff}}{25D_t}$$

In abovementioned equation:

L_{eff} = Effective opening length

D_t = depth of upper form T

In this paper, different diameters were considered for circle hole and also different location for this hole was also considered and their effects on the behavior of these joints was evaluated.

2- Stress-strain graphs of elastic state – perfectly plastic

In this paper, steel with yield stress 240 N/mm² were used and elastic state – perfectly plastic were considered based on below figure, If it's need to be manually verified by analyzing the results of the review.

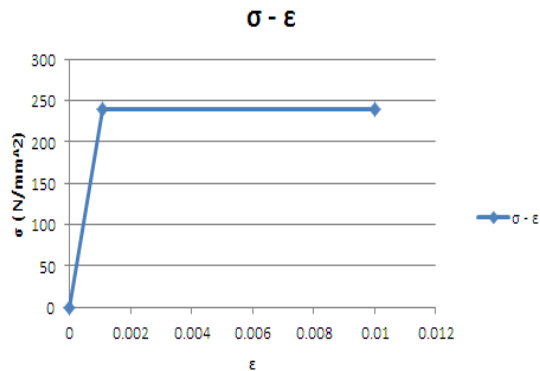


Fig (1-2): Stress-strain graphs of elastic state – perfectly plastic

3- The necessity of using stiffener

According to exist a hole in the beams of open connections (RWS), it's possible to occur local buckling of the beams in place. Thus, on a reduced need for beam, necessity of using stiffener was evaluated. Beam of W36x15 were modeled in three state of without loss of beginning of beam, with loss of beginning of beam and also with a hard life in limit element software. Dimensions of the holes

intended for the hardening of 150x10mm and examples of the model are shown below.

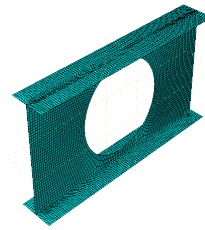


Figure (1-3): beam without loss in its strength

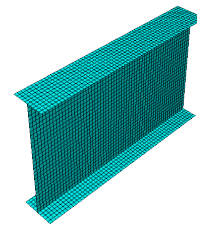


Figure (2-3): beam with loss in its strength without stiffener

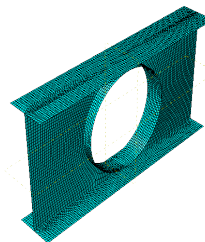


Figure (3-3): beam with loss in its strength without stiffener

After carried on analyzing on three modeled beam of V-Δ and M-θ curves were obtained as follows:

Where:

V: shear force exerted on the end of beam

M: bending moment on the end of beam

Δ: terminal displacement in beam

θ: rotation of the end of beam

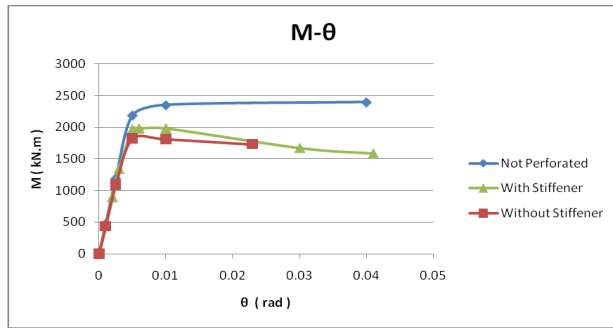


Figure (3-4): M-θ curve on modeled beam

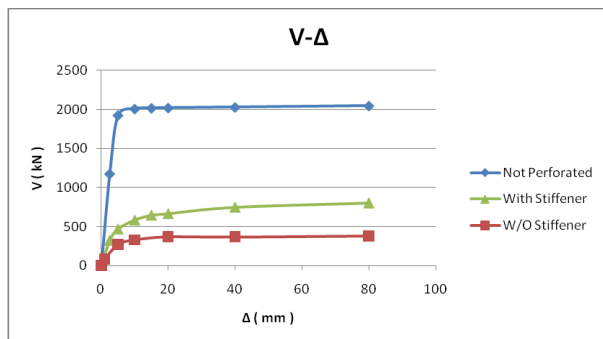


Figure (3-5): V-Δ curve on modeled beam

As is clear from the above graphs, the overall behavior of holed beam would improved and the hole will prevent local buckling, the hardware dimensions must be chosen as beam hole with the original shooting bullets that are not as strong as in the above diagrams.

Curve associated with holed beam stiffeners, the original beams located in the following diagram and the dimensions selected is appropriate for the stiffener.

4 - Modeling stiffeners beams fell with a circular hole

In this study, 5 beams with different holes dimensions according to the following table in addition to no holes beams were investigated.

Table (4-1): Profile of a considered circular hole

Beams names	Full stiffeners	D55%	D60%	D65%	D75%	D85%
Perforated Percentage (%)	0	55	60	65	75	85
Hole diameter (mm)	0	502/9	548/6	594/4	685/8	778

Two abovementioned beams were investigated in two limit condition. In the first case, the center of all holes are placed in 0.6d of considered column and

in second case, the center of all holes are placed in d of considered column. It's noteworthy that since a hole with 0.85 diameters has a radius equal 0.425d, if the center of circle placed in 0.5d, from side of the hole was very close to the end of the connection and realizing that plastic strain around the holes are located or in the connection was not possible, because the center of the column in the first mode is selected equal to 0.6d. in order to realizing the place of holes, before "d" letter of each beam, terms of 1.2 or 2 were used which show 0.6d and d distance from side of column.

5- Review the results of the analysis

All modeled beams were received pure shear force (V) in the end of its position and also received a pure bending moment (M) in the end of its position, and also Shear force diagrams - shift and bending moment - the time for these beams are obtained.

All results from analysis of these beams under pure shear force, shows that these beams have a unique behavior and all plastic strains located around the hole and the desired transformation of the following figures are in this range and so, plasticity of these beams could depreciate energy of earthquake.

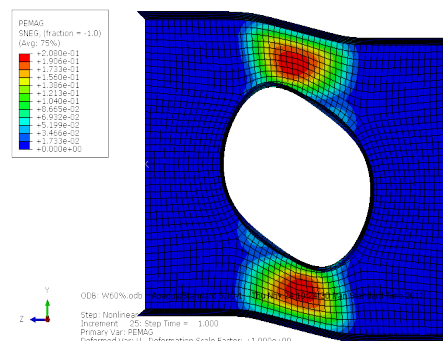


Fig (5-1): Distribution of plastic strains in 1.2d55% beam

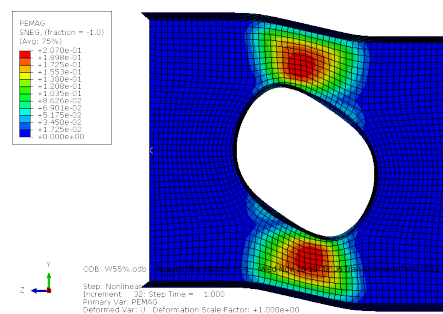


Fig (5-2): Distribution of plastic strains in 1.2d60% beam

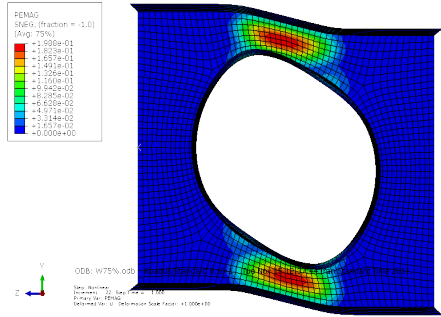


Fig (5-3): Distribution of plastic strains in 1.2d65% beam

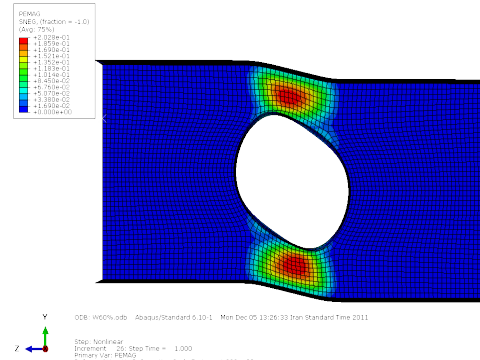


Fig (5-7): Distribution of plastic strains in 2d60% beam

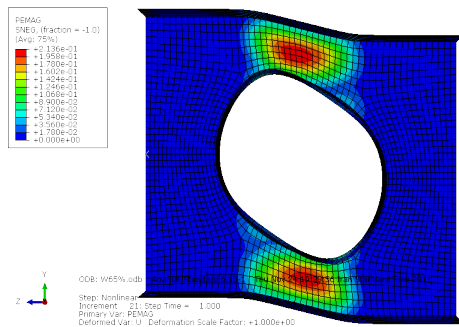


Fig (5-4): Distribution of plastic strains in 1.2d75% beam

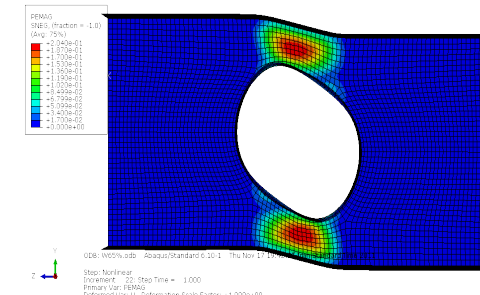


Fig (5-8): Distribution of plastic strains in 2d65% beam

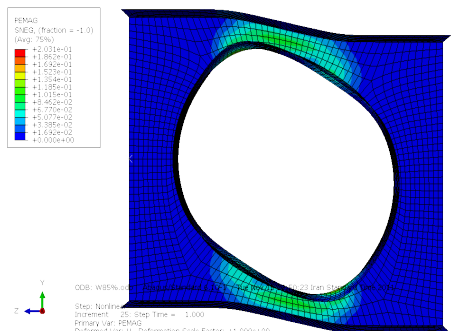


Fig (5-5): Distribution of plastic strains in 1.2d85% beam

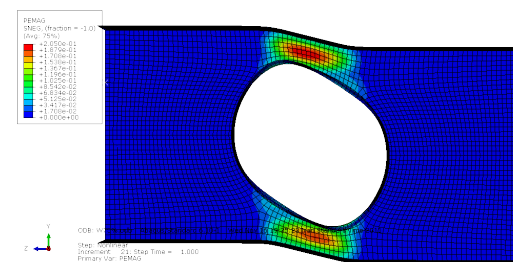


Fig (5-9): Distribution of plastic strains in 2d75% beam

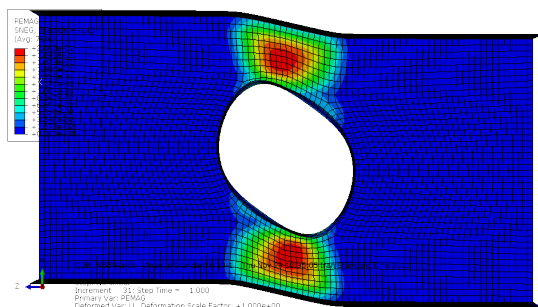


Fig (5-6): Distribution of plastic strains in 2d55% beam

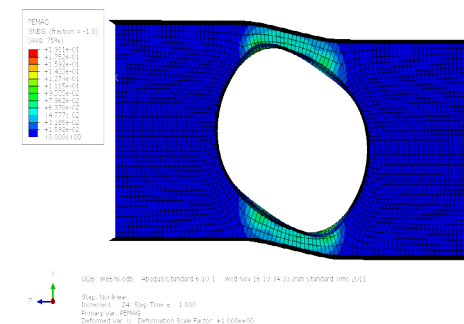


Fig (5-10): Distribution of plastic strains in 2d85% beam

Diagrams of V- Δ which are related to the considered beams were shown in bellow figures. Endpoints of these graphs can be selected based on three criteria. The first criteria is plastic strain reaches

the maximum and make rupture strain of steel investigated in this study, the value of 0.2 is considered, the second criterion, if not more than 20% drop in resistance on the charts this fall, And finally, the third criterion is dominant when add the amount of plastic strain Δ -hole connection and the connection to be plastic.

As its obvious in abovementioned figures, these beams have good plasticity under pure shear force and would intended to meet seismic requirements, but as its obvious in following figures, the beams under pure bending force if they are not appropriate behavior and thus do not meet seismic requirements. This can cause the formation mechanism is not understood Vierendeel in this hole under bending moment. As long as these beams are under pure shear force, because of existing Vierendeel mechanism, it has high plasticity and plastic deformation and strain around the hole hold but in pure bending mode due to lack of mechanism Vierendeel this strain had accumulated in the column and do not meet seismic requirements. After exact investigation on beams in this research, we saw that in %55 and %60 of beams span length was evaluated for both pre-formed plastic strains around the hole are formed at the junction and in other beams, after making the first plastic strains around the hole, further strain can be located at the junction.

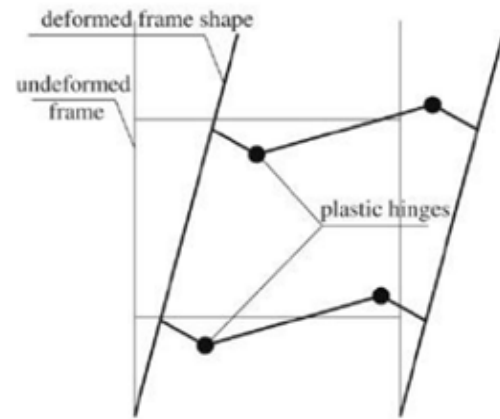


Figure (5-13): The mechanism for the proper behavior of connections RWS

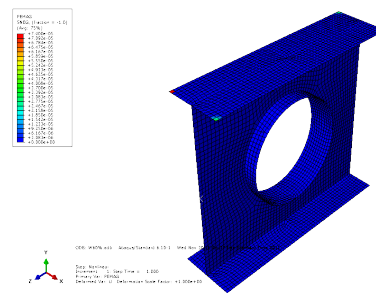


Fig (5-14): Distribution of plastic strains in 1.2d55% beam

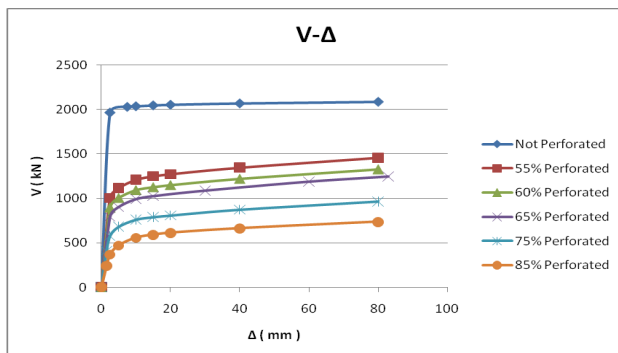


Fig (5-11): V- Δ chart of beams with 1.2d length

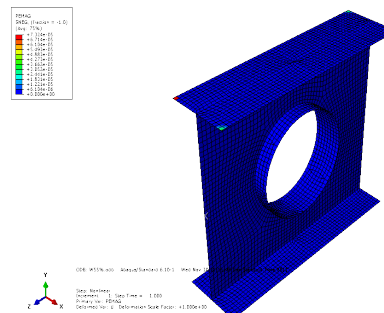


Fig (5-15): Distribution of plastic strains in 1.2d60% beam

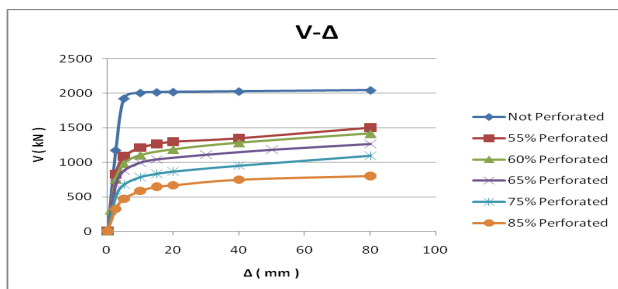


Fig (5-12): V- Δ chart of beams with 2d length

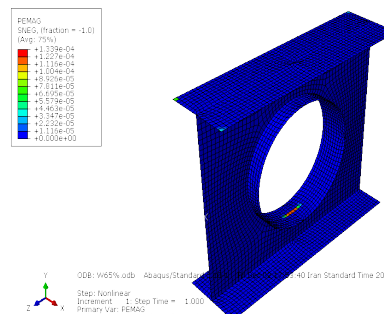


Fig (5-16): Distribution of plastic strains in 1.2d65% beam

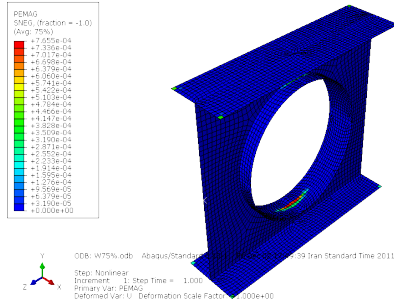


Fig (5-17): Distribution of plastic strains in 1.2d75% beam

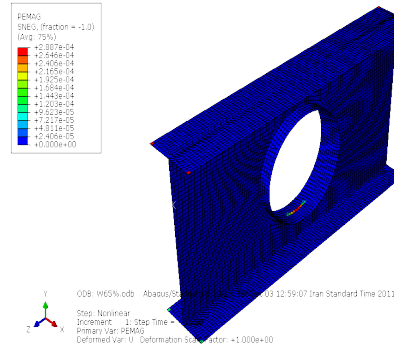


Fig (5-21): Distribution of plastic strains in 2d65% beam

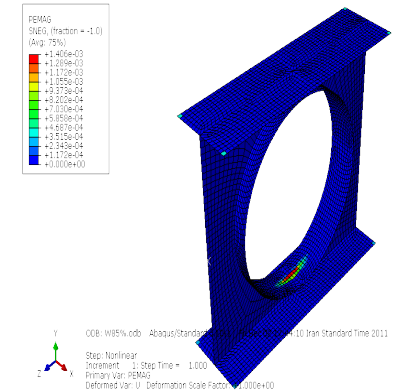


Fig (5-18): Distribution of plastic strains in 1.2d85% beam

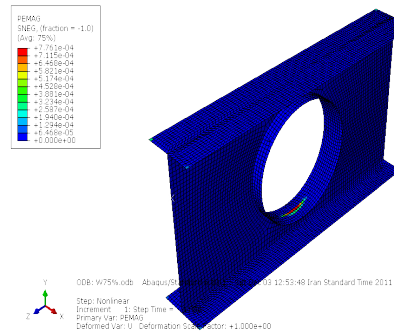


Fig (5-22): Distribution of plastic strains in 2d75% beam

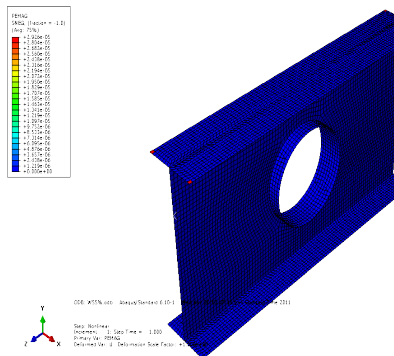


Fig (5-19): Distribution of plastic strains in 2d55% beam

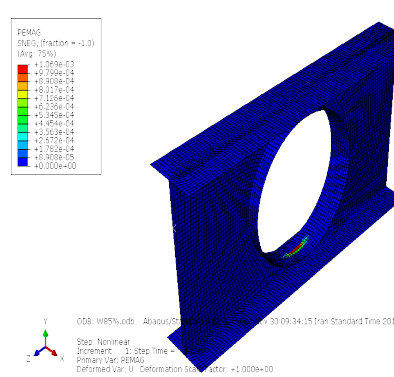


Fig (5-23): Distribution of plastic strains in 2d85% beam

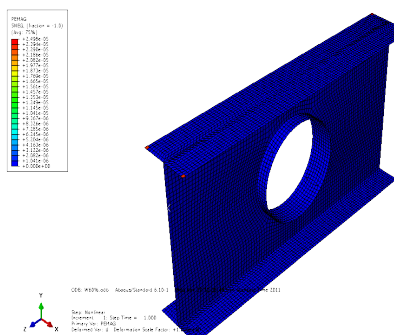


Fig (5-20): Distribution of plastic strains in 2d60% beam

It's note worthy that in 2d %85 beam, because of the relative strain in the software are displayed with different colors, the connection is shown at zero strain. While, if you choose to connect points on the graph in terms of plastic strain analysis of time to draw the figure below, it can be seen in the column and connect this arrow point to the plastic strains occurred and this connection is also not acceptable.

By designing exact charts of M-θ for abovementioned beams, bellow figures would obtain. Based on above figures, we know that %55 and %60 beams do not have appropriate behavior and the maximum allowable strain imposed on the

connection will cause the plastic strain, and for 1.2d and 2d beams are 0.002 and 0.0035 respectively. As it's obvious in following figures, approximately beams figures didn't get out of line graphs of the first plastic strains arise in the connection.

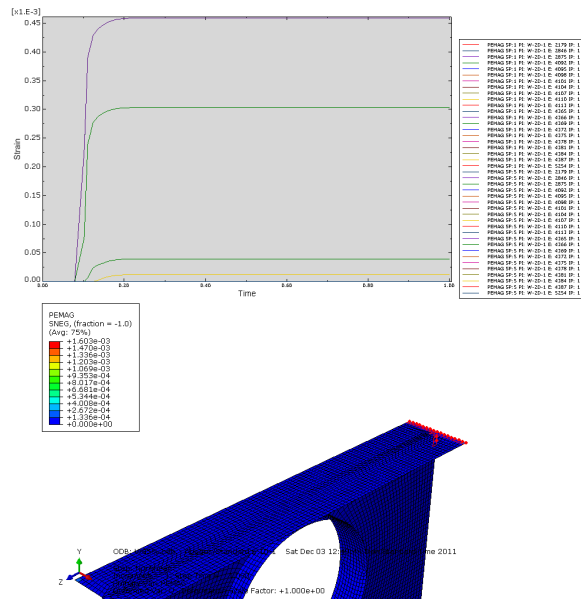


Fig (5-24): Diagram of plastic strain based on time of analysis for determined points.

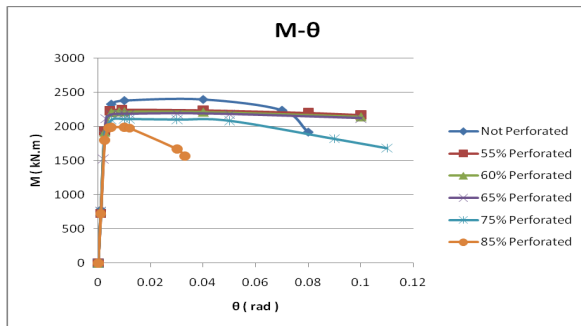


Fig (5-25): M-θ chart of beams with 1.2d length

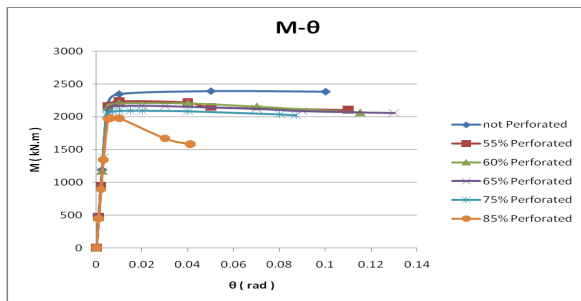


Fig (5-26): M-θ chart of beams with 2d length

6- Conclusion:

In this paper, behavior of connection with open end circle was investigated. By modeling various diameters of holes, the impact of this parameter on connections were studied and also the location of these holes rather than side of the columns were investigated and its impacts was represented.

Effect of stiffeners in this article showed that in the absence of hard at the puncture site due to local buckling phenomenon of cargo, the connection dropped and hard choices with appropriate dimensions can have significant impact in improving the behavior of these connections.

RWS fitting with a circular hole under shear loads have very good behavior and earthquake energy and good will depreciate and plastic strains to come into focus around the hole.

Open end connections were in circle shape the bending moment is not appropriate behavior and the formation mechanism of Vierendeel plastic strains around the hole to move the connection and hypothesis of "weak beam-strong column" would rejected.

Reference:

1. AISC. (2005). "Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications." ANSI/AISC 358-05, Chicago.
2. Chung, K. F., Liu, T. C. H., Ko, A. C. H. (2001). "Investigation on vierendeel mechanism in steel beams with circle web openings." Journal of Constructional Steel Research, 57, 467-490.
3. FEMA. (2000). "Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings." FEMA 350, Washington, D.C.
4. Lawson, R. M., Lim, J., Hicks, S. J., Simms, W. I. (2006). "Design of composite asymmetric cellular beams and beams with large web openings." Journal of Constructional Steel Research, 62, 614-629.
5. Liu, T. C. H., Chung, K. F. (2003). "Steel beams with large web openings of various shapes and sizes: finite element investigation." Journal of Constructional Steel Research, 59, 1159-1176.
6. Mahin, S. A. (1998). "Lessons from damage to steel buildings during the Northridge earthquake." Engineering Structures, 20, 261-270.
7. Qingshan, Y., Bo, L., Na, Y. (2009). "Aseismic behaviors of steel moment resisting frames with opening in beam web." Journal of Constructional Steel Research, 65, 1323-1336.

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Counting of Moving People in the Video using Neural Network System

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Abstract: Automatic counting of people in the crowd using surveillance visual camera is very useful in effective crowd management, security surveillance, and many more applications. In this paper, we have proposed an intelligent framework to automate the process of people counting in the surveillance video. Foreground (moving people) segmentation from the video is done by combination of different foreground estimation techniques. Texture analysis and foreground pixel area for different segmentation techniques are used to extract the useful features. Neural Network is trained on these features and people counting accuracy of more than 96% is achieved on a benchmark video.

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Keywords: People Counting, Video Processing, Foreground segmentation, Texture analysis, Neural networks

1. Introduction

The importance and demand for automated tools to manage and analyze crowd behavior and dynamics grows day by day as the population increases. Some examples are Airports, railway stations, carnivals, concerts and sports events. Extensive use of closed circuit monitoring system is in place in major cities. Moreover, estimation of crowd or number of people attending certain event is also becoming important for government agencies, public opinion making and news channels. Major works started in early 1990s as researchers employed various technologies and techniques to come up with different solutions to problems.

Major research in the field of crowd density estimation has focused on either segmentation of people or head counts, or based on texture analysis or wavelet descriptors. (Velastin et al 1993, 1994) dealt with crowd densities and count. They fixed an area to observe, and then asked people to walk past it normally in different numbers, they had the background image (empty), then they counted the people manually in each image, and got the background subtracted image, and the thin edge images of people. They used the area of pixels in the foreground image and tried to correlate it with the people count. (Zhao et al 2003) proposed Bayesian model based segmentation to segment and count people. (Yoshinaga et al 2010) proposed blob features of moving objects to eliminate background and shadow from the image. For each blob of moving people, numbers of pedestrians are estimated by using neural networks. They have shown that accuracy of 80% can be achieved by this method in the real life scenarios where maximum numbers of

pedestrians are 30 in a single frame. (Xiaohua et al 2005) showed classification accuracy of 95% when crowd density is classified into four classes by using wavelet descriptors. Classification is done by support vector machine. Few researchers have proposed model free people counting in the scene by statistical descriptors (Albiol et al 2009, Brostow and Cipolla 2006). (Ma et al 2008) used texture descriptors called advanced local binary pattern descriptors to estimate crowd density estimation. They have calculated LBP from the blocks of the image and tested on small database of images for automatic surveillance. They divide the image into squares, bottom squares are bigger, upper ones are half the size. The ground truth is manually labeled for each square into classes from low density to high density. They classified the squares using k-means clusters and the distance is computed using their pattern descriptor. Terada et al. proposed a system that calculate the directional movement of the crowd and count the people as they cross some virtual line (Terada et al 1999). (Hashimoto et al 1997) used specialized imaging system using infra-red imaging to count the people in the crowd. (Davies et al 1995) have discussed in detail the concept of crowd monitoring using image processing through visual cameras. (Roqueiro et al 2007) used simple background subtraction from the static images to estimate the crowd density.

Reisman et al (2004) used a forward facing camera mounted on the car to detect crowd of pedestrians. It assumes that a camera in a moving forward car will have outward optic flow. Any moving objects will produce inward optic flow hence they detect the motion. They also use classifiers to

distinguish between human and cars. To estimate the crowd density using image processing, many researchers have used the information of texture, edges or some global or local features [Marana et al 1997, Ma et al 2004, Lin et al 2001]. (Ma et al 2004) argues that the perspective distortions in images for pixel based crowd estimation are either incorrect or not done well, they propose a geometric correction technique, and they argue that the correction depends on y-axis only.

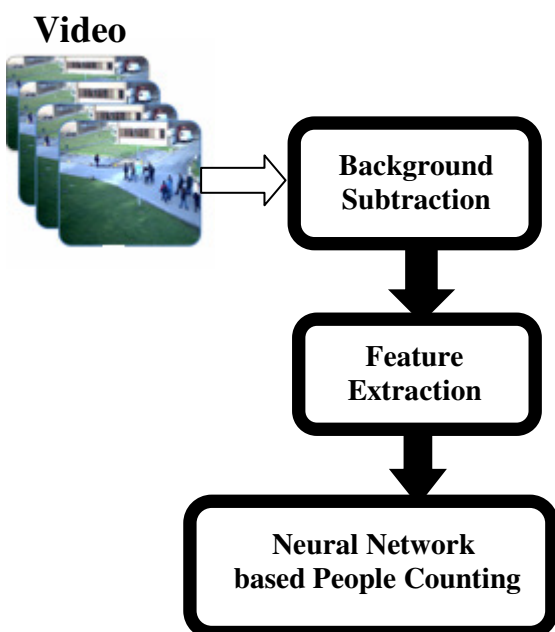


Figure 1: Proposed framework for the counting of people in the video

Another work (Lin et al 2001) trained support vector machines using HAAR transform to identify heads of people after histogram equalization to eliminate illumination changes in a crowd in order to count them and estimate the densities. (Cho et al 1999) and (Huang et al 2002) blended the concept of image processing and neural networks to estimate and count the crowd of people. Crowd levels are detected in (Lo and Velastin 2001) and (Dan and Doug 2005) using classifiers. (Stauffer and Grimson 1999), Aguilera et al 2006) have used mixture of Gaussian model to adaptively extract the foreground containing the pixels in motion. (Yang et al 2003) have used group of image sensors to segment the foreground objects from background scene to count the approximate number of people in the crowd in a particular scene. (Xiaohua et al 2006) have used

wavelets to extract the features from the images for the crowd estimation.

2. Material and Methods

Figure 1 shows the block diagram of the overall people counting framework. In the first step background is modeled from some frames of the video and this background is subtracted from the video to segment the foreground of the video. In the foreground, it is assumed that only people are in motion. In the next step, texture analysis of the foreground frame is done to extract the features. These features are then fed to a trained neural network which output the number of people present in a particular frame. In the next sub-sections, we will discuss each block of figure 1 separately.

A. Background Extraction

Background modeling is an important and fundamental task in many computer vision applications. One very important application is to find moving objects using foreground segmentation. In foreground segmentation, background model is subtracted from each and every frame to find the moving foreground objects in the video. There are many challenges associated with background modeling. Good background model must adapt to the changing conditions such as illumination, shadowing, and other non-stationary objects like rain, leaves and snow. There are many applications of background modeling e.g. traffic monitoring, counting people, object tracking etc. In simple case, previous frame is considered to be the background frame for every frame. This way only the changes can be estimated, which is good for video compression, but not suitable for motion detection applications. Also this algorithm will not give good results for the objects moving very slowly.

Efficient algorithms are based on computing background from multiple frames. There are many algorithms proposed in the literature like Frame Difference method (Gonzalez and Wood 2002), Median Filter (Gonzalez and Wood 2002), Approximate Median (McFarlane et al 1995), Gaussian Mixture model (Stauffer and Grimson 1999), etc.

Background computation is followed by an update to accommodate challenging environment conditions. The video to be processed is loaded and background is computed using median filtering. In this technique, multiple frames are taken into consideration for calculating background. It was noted that for longer videos, if candidate frames are taken at intervals greater than one, the accuracy of both averaging and median filtering increases. This way decent background can be calculated.

$$B_{med}(x, y, t) = median(x, y, t - i) \quad (1)$$

$$i \in \{0, \dots, n-1\}$$

Where $i \in \{0, \dots, n-1\}$ are the frames of the video.

B. Foreground Segmentation

After computing the background frame, we subtract every frame of the video from this background frame. The background frame $B_{med}(x, y)$ calculated in (1) is subtracted from the original frames of the video to get the foreground frames named as $F_{MF}(x, y)$. It gives us the movement that is occurring in the video. Advantage of this approach is that any person that stops moving and was not in the background image is still picked up as an alien to the scene. But the drawback is that if a static person moves which was part of the background frame, its old position and the current position both are counted as pixels where movement has occurred. This artifact causes problem in the counting of the people in the video. Different artifacts caused by lighting condition changes, sensor noise are also picked up as small movements which are not desirable.

To get rid of the noise due to sensor, lighting conditions and shadows, we employed morphology. If we use the erosion on the output of subtraction then it eliminates the small artifacts or false positives due to sensor noise, giving out a cleaner image. A 3×3 erosion operator is applied to $F_{MF}(x, y)$ to get a new foreground frames called $F_{EM}(x, y)$. In this paper, we have proposed combination of techniques to get the best of techniques and improved the results so that better people counting can be achieved. For this purpose foreground segmentation is done with different techniques and texture analysis is done on combination of two techniques namely median filter and erosion operator after median filtering. Similarly $F_{edge}(x, y)$ is calculated based on edge detection through homogeneity and edge cancellation from the frames.

C. Feature Extraction

Once background frame is calculated and foreground is segmented from all frames of the video, different features are extracted from the foreground and their correlation with the ground truth is studied. Following are the description on the features,

Total Area occupied by Foreground (FA): All the frames after foreground segmentation are converted to binary image F_B having pixel values equal to 0 if it is part of background and 1 if it is part of foreground. Total Area occupied by the foreground is calculated as follows,

$$FA = \sum \sum F_F(x, y) \quad (2)$$

It is assumed that higher the value of FA , higher will be the number of people in the frame. This feature set is calculated for three segmentation techniques namely, median filter of difference of frames, Edge detection with edge cancellation and foreground from background using erosion. Moreover, logical AND operation is performed on two images obtained from median filter of difference of frames and foreground from background using erosion methods to combine the good points of both techniques and provide common overlap of the two methods.

$$F_{overlap} = F_{MF}(x, y) \cap F_{EM}(x, y) \quad (3)$$

Where $F_{MF}(x, y)$ the foreground image using medians filter on frame difference and $F_{EM}(x, y)$ is the foreground image using erosion method. FA of the image $F_{overlap}$ is also calculated.

Contrast, Correlation, Energy, Homogeneity: In the next step, gray-level co-occurrence matrix (GLCM) is calculated from the frames $F_{overlap}$ converted into gray scale. GLCM is proposed by Haralick in 1979 (Haralick 1979) and now widely used in the texture analysis of the images. GLCM is the square matrix of size equals to the gray level of the frame. Its entries $p(i, j)$ correspond to the number of times i^{th} gray level occurs near to the j^{th} gray level. Contrast, correlation, Energy and Homogeneity are calculated by the following formula,

$$Contrast = F_{con} = \sum_{i,j} |i - j|^2 p(i, j)$$

$$Correlation = F_{corr} = \sum_{i,j} \frac{(i - \mu_i)(j - \mu_j) p(i, j)}{\sigma_i \sigma_j}$$

$$Energy = F_{en} = \sum_{i,j} p(i, j)^2$$

$$Homogeneity = F_{hom} = \sum_{i,j} \frac{p(i, j)}{1 + |i - j|}$$

$$Entropy = F_{entropy} = -\sum p \times \log_2 p$$

Hence there are total nine features in the feature set F_{set} as described below,

$$\{F_{con}, F_{corr}, F_{en}, F_{hom}, FA_{MF}, F_{entropy}, FA_{EM}, FA_{edge}, FA_{overlap}\}$$

D. Classification

Neural networks (Fausett 1994) are widely used for pattern classification and function approximation. In this paper, we have used back-propagation neural network to perform the people counting based on the

features extracted from the texture analysis done in the previous sub-section. Figure 2 shows a framework to train the neural network. Back-propagation neural network is used with single layer of hidden neurons containing N hidden neurons. Weights of the neural networks are initialized randomly and features are fed to the input layer of the neural network and the output (number of people in the frame) is approximated by the neural network. This estimate of people count is compared with the true number of people in the frame and counting error is calculated which is used for the tuning of the weights of neural network.

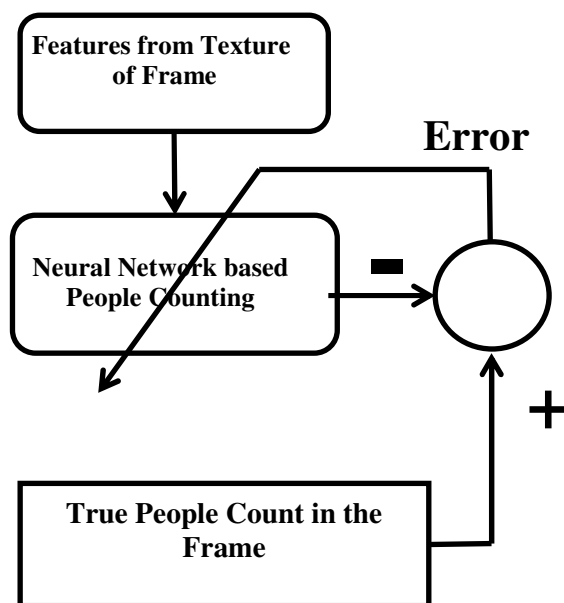


Figure 2: Training of Neural Network based people counting

For the tuning of the weights, Levenberg-Marquardt training algorithm is used. Once the neural network is trained by sufficient number of training patterns, it can be used to count the people in the unknown frames.

E. Video Data for Experimental Results

The experiments were performed on a video of pedestrians. The video had a resolution of 960 and 720 pixels along the horizontal and vertical axes, respectively. We have used 200 frames from this video for training and testing of the algorithm. Manual counting of pedestrians for each frame in both the training- and testing-datasets was performed to establish the ground truth. The manual counting was performed twice to correct the intra-rater variability (i.e., the variability which occurs even when the counting is performed by a single

rater/individual). The video frames contain between 0 and 30 pedestrians.

3. Experimental Results and Discussion

To validate our proposed framework, ground truth of the benchmark video is calculated and stored in the file for 200 frames. In the first step, background frame is calculated through median filter using a fixed number of frames buffered in the memory. This background frame is subtracted from the frames to segment the people moving in the video.

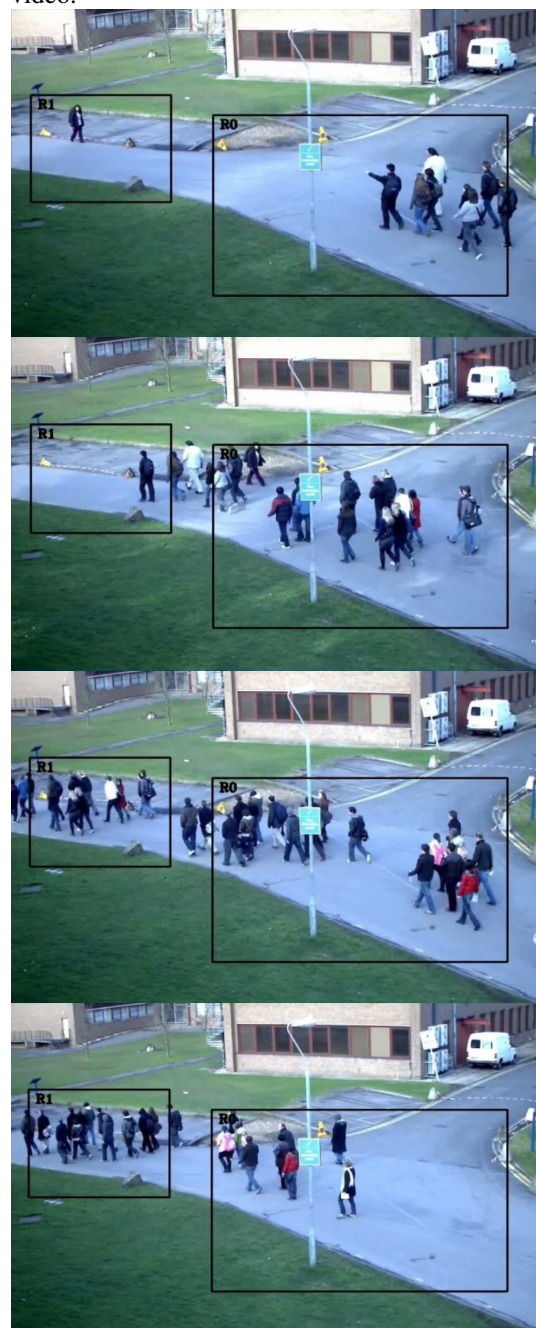


Figure 3: Some representation frames from the video.

Figure 4(a) shows a representative original frame of the video and figure 4(b) shows foreground frame obtained by subtracting the background frame. In this frame moving people are segmented but there are pixels representing the noise in the segmentation process. To remove the noise, erosion process is done to erode the noise from the foreground frame. Figure 4(c) shows foreground frame after erosion.



(a) Frame from Original video



(b) Foreground after median filtering



(c) Foreground using erosion



(d) Overlap image of (b) and (c)



(e) Foreground after Edge Detection using homogeneity with edge cancellation

Figure 4: Foreground extraction from the original video with different techniques

In the erosion process, the noise can be removed but some good pixels may also be removed.

We also applied logical AND operation and overlap frame is calculated using figure 4(b) and 4(c) and shown in figure 4(d). Texture analysis will be done on this overlap frame to extract the texture features like contrast, correlation, entropy etc. Another technique of foreground segmentation is used based on the edge detection using homogeneity and later cancelling these edges. Result is shown in figure 4(e). All of these frames will be used to extract the features in the next stage. As described in section 2(c), total of nine features are calculated from these frames shown in figure 4. To study the sensitivity of these features, every feature is plotted versus the ground truth (True number of people in the frame) in figure 5 (from the top left, feature 1 to feature 9 are plotted row wise).

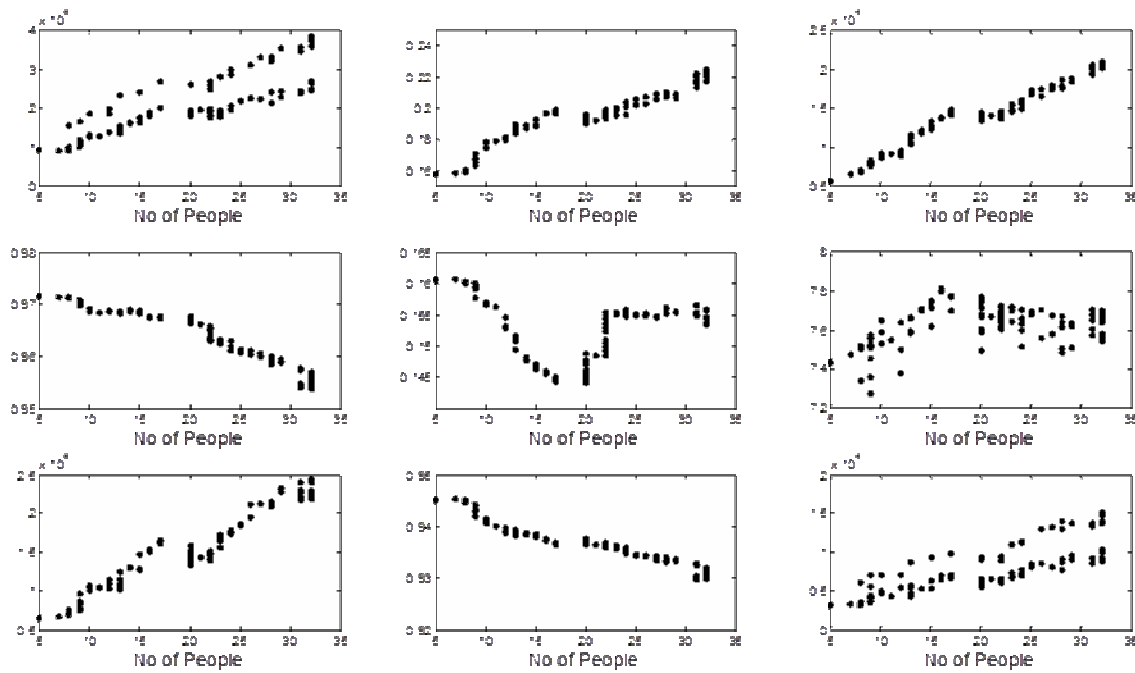


Figure 5: Correlation coefficient of the features with the ground truth (True number of people)

Correlation coefficient is calculated for all nine features with the true number of people in the frames and the values of correlation coefficient are also tabulated in table 1.

Table 1. Correlation coefficient of the features with true number of people in the frame

Feature Number	Correlation Coefficient
FA_{MF}	0.68
F_{con}	0.96
FA_{Edge}	0.99
F_{corr}	-0.93
F_{en}	-0.22
$F_{entropy}$	0.46
FA_{EM}	0.97
F_{hom}	-0.94
$FA_{overlap}$	0.68

It can be observed from the figure 5 and table 1 that some features are having very strong correlation with the number of people present in the frame whereas some features are not having good correlation with the number of people in the frame.

Based on this information, we have selected five features for the training of the neural network whose absolute value of correlation coefficient is more than 0.9. These features are stored in the new feature set F_{set}^{new} .

$$F_{set}^{new} = \{F_{con}, F_{corr}, F_{hom}, FA_{EM}, FA_{edge}\}$$

The new feature set F_{set}^{new} is calculated for all the frames of the video and divided randomly into training and testing set of 100 frames each. To find out the best number of hidden nodes, prediction error (in percentage) is calculated for different number of nodes on the training set as shown below,

$$Error_{Pred} = \frac{|PC_{pred} - PC_{True}|}{PC_{True}} \times 100$$

Where PC_{pred} is the people count predicted by the neural network and PC_{True} is the true people count in the frame.

Mean of the prediction error $Error_{Pred}$ is plotted in figure 6 for different number of hidden neurons starting from 1 to 100 at the step of 5.

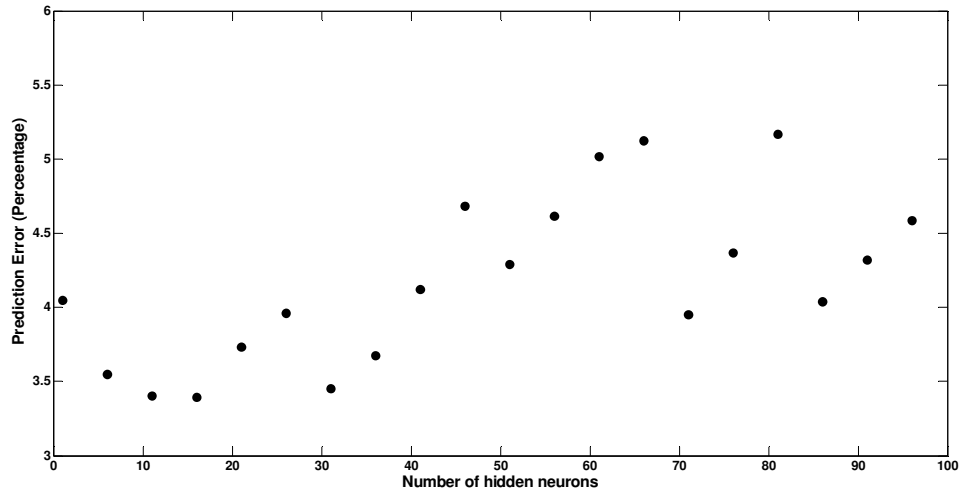


Figure 6: Prediction error in percentage for different number of hidden nodes in the neural network

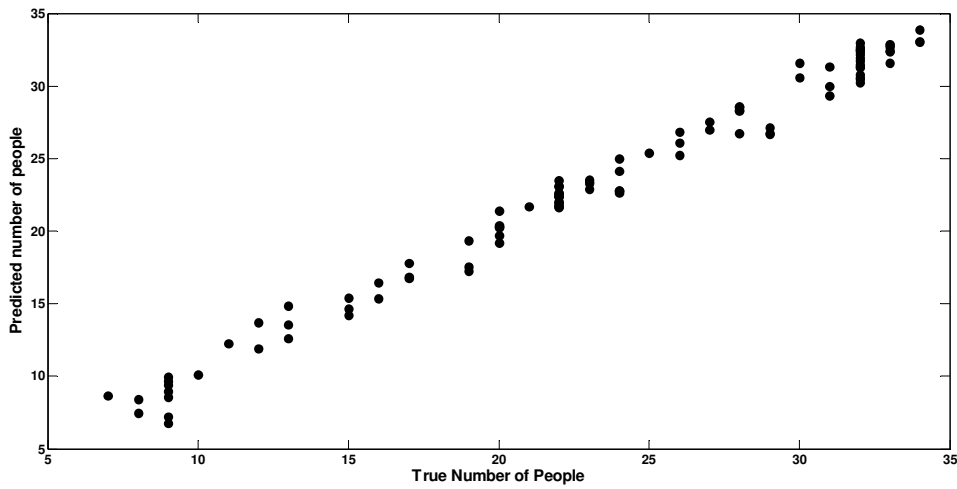


Figure 7: Plot of Predicted number of people and true number of people in the frames

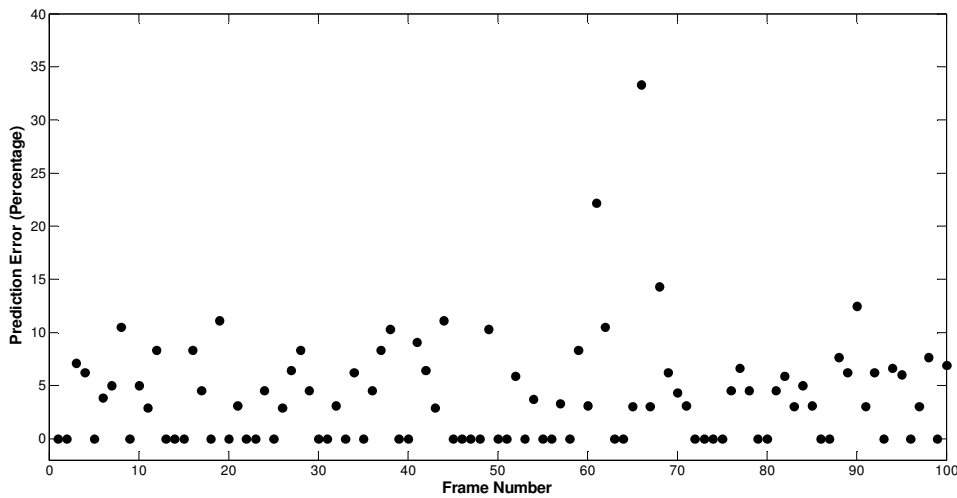


Figure 8: Prediction error in percentage for all testing frames

Thirty independent trials for each number of hidden nodes are done to remove the chance of trapping the learning algorithm of neural network in the local optimum value. From the figure 6, it is clear that optimal number of hidden nodes is 16 for which the prediction error is 3.39%. Hence number of hidden neurons of the neural network is set to be 16 for the testing data.

To test the performance of the neural network, prediction error of people counting in the testing data set is calculated. Whole features data is divided in to training and testing data (100 frames each) 20 times randomly to make the results statistically acceptable. Prediction error of the people counting after 20 runs is found to be $4.03\% \pm 4.10\%$ on the testing data sets. For one testing data, predicted people count by neural network is plotted versus true number of people count in the frame in figure 7. It can be seen from the figure that both data are correlated strongly and a nice linear trend is observed in the figure.

Prediction error (in percentage) of people counting is also plotted in figure 8 and it can be seen from the figure that in most of the frames the error is below 5% counting error. These results shows efficacy of the proposed neural network based people counting from the video automatically. In the future work, we will study the effect of different lighting conditions will be studied for the proposed framework.

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References

1. Velastin SA, J. H. Yin JH, Davies AC, Vicencio-Silva MA, Allsop RE, Penn A. Analysis of crowd movements and densities in built-up environments using image processing. in Proc. IEE Colloquium Image Processing for Transport Applications, Aug. 1993.
2. Velastin SA, J. H. Yin JH, Davies AC, Vicencio-Silva MA, Allsop RE, Penn A. Automated measurement of crowd density and motion using image processing. in Proc. 7th Int. Conf. Road Traffic Monitoring and Control, London, U.K., 1994:127-132.
3. Zhao T, Nevatia R. Bayesian human segmentation in crowded situations. IEEE Conference on Computer Vision and Pattern Recognition, 2003;2:459-466.
4. Yoshinaga S, Shimada A, Taniguchi R. Real-time people counting using blob descriptor. Procedia Social and Behavioral Sciences, 2010;2:143-152.
5. Xiaohua L, Lansun S, Huanqin L. Estimation of crowd density based on wavelet and support vector machines. International Conference on Intelligent Computing, 2005.
6. Albiol A, Silla MJ, Albiol A, Mossi JM. Video analysis using corners motion analysis. In Proc. International Workshop on Performance Evaluation of Tracking and Surveillance (PETS2009), 2009:1-38.
7. Brostow G, Cipolla R. Unsupervised Bayesian detection of independent motion in crowds. In Proc. IEEE Computer Society Conference on Computer Vision & Pattern Recognition (CVPR2006), 2006;1:594-601.
8. Ma W, Huang L, Liu C, Advanced local binary pattern descriptors for crowd estimation. IEEE Pacific Asia Workshop on Computational Intelligence and Industrial application, 2008.
9. Terada K, Yoshida D, Oe S, Yamaguchi J. A method of counting the passing people by using the stereo images. International conference on image processing, 1999.
10. Hashimoto K, Morinaka K, Yoshiike N, Kawaguchi C, Matsueda S. People count system using multi-sensing application. 1997 International conference on solid state sensors and actuators, 1997.
11. Davies AC, Yin JH, Velastin SA. Crowd monitoring using image processing. IEE Electronic and Communications Engineering Journal, 1995;7(1):37-47.
12. Roqueiro D, Petrushin VA. Counting people using video cameras. International Journal of Parallel, Emergent and Distributed Systems (IJPEDS), 2007;22(3):193-209.
13. Reisman P, Mano O, Avidan S, Shashua A. Crowd detection in video sequences, International Symposium on Intelligent Vehicles, 2004:66-71.
14. Marana A, Velastin S, Costa L, Lotufo R. Estimation of crowd density using image processing. Image Processing for Security Applications, IEE Colloquium, 1997;11:1-8.
15. Ma R, Li L, Huang W, Tian Q. On pixel count based crowd density estimation for visual surveillance. 2004 IEEE Conference on

- Cybernetics and Intelligent Systems, 2004;1:170-173.
16. Lin SF, Chen JY, Chao HX. Estimation of number of people in crowded scenes using perspective transformation. *IEEE Transactions on Systems, Man and Cybernetics*, 2001;31(6):645-654.
 17. Cho Y, Chow TWS. A fast neural learning vision system for crowd estimation at underground stations platform. *Neural processing letters*, 1999;10(2):111-120.
 18. Cho Y, Chow TWS, Leung CT. A neural based crowd estimation system by hybrid global learning algorithm. *IEEE Trans on Systems, Man, and Cybernetics, Part B*, 1999;29(4):535-541.
 19. Huang D, Chow TWS, Chau WN. Neural network based system for counting people. *IEEE Trans on Systems, Man, and Cybernetics, Part B*, 2002;1(4):2197-2200.
 20. Lo BPL, Velastin SA. Automatic congestion detection system for underground platforms. In *Proc. Of the Int'l Symposium on Intelligent Multimedia, Video and Speech Processing*, 2001:158-161.
 21. Dan K, Doug G, Hai T. Counting Pedestrian in Crowds using viewpoint invariant training. In *Proc. BMVC*. 2005.
 22. Stauffer C, Grimson WEL. Adaptive background mixture models for real-time tracking. In *CVPR*, 1999;2:2246.
 23. Aguilera J, Thirde D, Kampel M, Borg M, Fernandez G, Ferryman J. Visual Surveillance for Airport Monitoring Applications. In *Proc. of 11th Computer Vision Winter Workshop*, 2006:5-10.
 24. Yang DB, Gonzalez-Banos HH, Guibas LJ. Counting people in crowds with a real-time network of simple image sensors. *Proceedings of Ninth IEEE International Conference on Computer Vision*, 2003;1:122-129.
 25. Xiaohua L, Lansun S, Huanqin L. Estimation of Crowd Density Based on Wavelet and Support Vector Machine. *Transactions of the Institute of Measurement and Control*, 2006;28:299-308.
 26. Gonzalez RC, Woods RE. *Digital image processing*, ISBN:9780201180756, Prentice Hall, 2002.
 27. Stauffer C, Grimson WEL. Adaptive background mixture models for real-time tracking. In *Proc. Computer Vision and Pattern Recognition*, 1999;2:246-252.
 28. McFarlane NJB, Schofield CP. Segmentation and tracking of piglets in images. *Machine Vision and Applications*, 1995;8(3):187-193.
 29. Haralick RM. Statistical and structural approaches to texture, *Proc. Of IEEE*, 1979;67(5):786-804.
 30. Fausett LV. *Fundamentals of Neural Networks: Architectures, Algorithms, and Applications* Prentice-Hall, 1994.

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