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## Life Skills Education for Secondary Education

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**Abstract:** Life skills study is intended to strengthen a pupil's overall development. This involves, for instance, having pupils make an effort to develop spiritual values, physical health and psychological strength. They strengthen their social skills, moral competence and respect for others and themselves. In addition, an effort is made to strengthen their courage, initiative, natural creativity and adaptability to meet the demands and challenges of everyday life. The emphases in life skills underline the fact that the school is the pupils' workplace, where valuable upbringing takes place. Basic responsibility for children's upbringing must, however, always be in the hands of their parents/guardians. As the school assists parents in their role as child-raisers, pupils' education and welfare is thus a joint project of schools and households. This co-operation must be based on mutual respect, mutual trust and joint responsibility. One of the emphases of life skills is to have the school create a positive and secure study environment, characterized by the support and co-operation of everyone in the school, both pupils and staff. A positive school spirit, together with realistic demands and expectations of pupils, facilitates them in achieving the study objectives set. Adolescence is a period of experimenting, experiencing and expanding. Adolescents need help and guidance in decision-making, problem solving, critical thinking, developing interpersonal skills, self-awareness, empathy, coping with stress and managing emotions. The rebelliousness and dislike for parental intrusion usually keeps parents at bay because teenagers do not relish the idea of help and guidance from parents. However, this may not always be so. Beneath frequent violent outbursts, sudden mood swings and related interpersonal problems of an adolescent, there may be a person crying out for professional help. All adolescents need support and guidance. When parents find it difficult to handle signs of trouble, professional help should be sought at the earliest. Extra care is needed while offering help to adolescents problems because it is not easy for teenagers to accept the fact that they need help. Attempts should be made to understand the adolescent, and to safeguard, protect and guide him/her. The Family Life & Life Skills Education Programmed is a good support system for adolescents at the community level. [Armin Mahmoudi & Golsa Moshayedi. **Life Skills Education for Secondary Education.** *Life Sci J* 2012;9(3):1393-1396] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 202

**Key word:** Life Skills, Education, Secondary Education, community level, Education Programmed, violent, self-awareness, spiritual values

### Introduction

Life skills study is intended to strengthen a pupil's overall development. This involves, for instance, having pupils make an effort to develop spiritual values, physical health and psychological strength. They strengthen their social skills, moral competence and respect for others and themselves. In addition, an effort is made to strengthen their courage, initiative, natural creativity and adaptability to meet the demands and challenges of everyday life. The emphases in life skills underline the fact that the school is the pupils' workplace, where valuable upbringing takes place. Basic responsibility for children's upbringing must, however, always be in the hands of their parents/guardians. As the school assists parents in their role as child-raisers, pupils' education and welfare is thus a joint project of schools and households. This co-operation must be based on mutual respect, mutual trust and joint responsibility. One of the emphases of life skills is to have the school create a positive and secure study environment, characterized by the support

and co-operation of everyone in the school, both pupils and staff. A positive school spirit, together with realistic demands and expectations of pupils, facilitates them in achieving the study objectives set. Making life skills a special subject is a response to contemporary demands that pupils be better prepared to face the challenges of life. To do so, they need to work on themselves, respect themselves but know their strong and weak sides. Life skills provide valuable opportunities to strengthen pupils' social development. The aspects dealt with are connected with participating in a democratic society, belonging to a family, having friends and comrades, working with others and placing oneself in another's position. The subject looks at the pupil as a whole, his/her ability to communicate, express opinions and give reasons for them, set objectives, show initiative, find his/her way around in the local environment, avoid dangers and be independent. In addition, creative ability and practical skills need to be developed. Life skills also gives schools the opportunity to take a closer look at issues

which may come up and concern pupils' well-being and feelings.

Adolescence is a period of experimenting, experiencing and expanding. Adolescents need help and guidance indecision-making, problem solving, critical thinking, developing interpersonal skills, self-awareness, empathy, coping with stress and managing emotions. The rebelliousness and dislike for parental intrusion usually keeps parents at bay because teenagers do not relish the idea of help and guidance from parents. However, this may not always be so. Beneath frequent violent outbursts, sudden mood swings and related interpersonal problems of an adolescent, there may be a person crying out for professional help. All adolescents need support and guidance. When parents find it difficult to handle signs of trouble, professional help should be sought at the earliest. Extra care is needed while offering help to adolescents problems because it is not easy for teenagers to accept the fact that they need help. Attempts should be made to understand the adolescent, and to safeguard, protect and guide him/her. The Family Life & Life Skills Education Programmed is a good support system for adolescents at the community level.

#### **Defining Life Skills**

Life skills are abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life. Described in this way, skills that can be said to be life skills are innumerable, and the nature and definition of life skills are likely to differ across cultures and settings. However, analysis of the life skills field suggests that there is a core set of skills that are at the heart of skills-based initiatives for the promotion of the health and well-being of children and adolescents. These are listed below: 1. Decision making 2. Problem solving 3. Creative thinking 4. Critical thinking 5. Effective communication 6. Interpersonal relationship skills 7. Self-awareness 8. Empathy 9. Coping with emotions 10. Coping with stress

**Decision making** helps us to deal constructively with decisions about our lives. This can have consequences for health if young people actively make decisions about their actions in relation to health by assessing the different options, and what effects different decisions may have similar.

**Problem solving** enables us to deal constructively problems in our lives. Significant problems that are left unresolved can cause mental stress and give rise to accompanying physical strain.

**Creative thinking:** Contributes to both decision making and problem solving by enabling us to explore the available alternatives and various consequences of our actions or non-action. It helps us to look beyond

our direct experience, and even if no problem is identified, or no decision is to be made, creative thinking can help us to respond adaptively and with flexibility to the situations of our daily lives.

**Critical thinking:** is an ability to analyze information and experiences in an objective manner. Critical thinking can contribute to health by helping us to recognize and assess the factors that influence attitudes and behavior, such as values, peer pressure, and the media.

**Effective communication:** means that we are able to express ourselves, both verbally and non-verbally, in ways that are appropriate to our cultures and situations. This means being able to express opinions and desires, but also needs and fears. And it may mean being able to ask for advice and help in a time of need.

**Interpersonal relationship skills:** help us to relate in positive ways with the people we interact with. This may mean being able to make and keep friendly relationships, which can be of great importance to our mental and social well-being. It may mean keeping good relations with family members, which are an important source of social support. It may also mean being able to end relationships constructively.

**Self-awareness** includes our recognition of ourselves, of our character, of our strengths and weakness, desires and dislikes. Developing self-awareness can help us to recognize when we are stressed or feel under pressure. It is also often a prerequisite for effective. Communication and interpersonal relations, as well as for developing empathy for others .

**Empathy** is the ability to imagine while is like for another person, even in a situation that we may not be familiar with. Empathy can help us to understand and accept others who may be very different from ourselves, which can improve social interactions, for example, in situations of ethnic or cultural diversity. Empathy can also help to encourage nurturing behavior towards people in need of care and assistance, or tolerance, as is the case with AIDS sufferers, or people with mental disorders, who may be stigmatized and ostracized by the very people they depend upon for support.

#### **Life Skills Education**

For health promotion, life skills education is based on the teaching of generic life skills and includes the practice of skills in relation to major health and social problems. Life skills lessons should be combined with health information, and may also be combined with other approaches, such as programmes designed to effect changes in environmental and social factors which influence the health and development of young

people. The methods used in the teaching of life skills builds upon what is known of how young people learn from their own experiences and from the people around them, from observing how others behave and what consequences arise from behavior. This is described in the Social Learning Theory developed by Bandura (1977). In Social Learning Theory, learning is considered to be an actively involved in a dynamic teaching and learning process. The methods used to facilitate this active involvement include working in small groups and pairs, brain storming, role play, games and debates. A life skills lesson may start with a teacher exploring with the students what their ideas or knowledge are about a particular situation in which a life skill can be used. The children may be asked to discuss the issues raised in more detail in small groups or with a partner. They may then engage in short role play scenarios, or take part in activities that allow them to practice the skills in different situations – actual practice of skills is a vital component of life skills education. Finally, the teacher will assign homework to encourage the children to further discuss and practice the skills with their families and friends. Life skills have already been taught in many schools around the world. Some initiatives are in use in just a few schools, whilst in other countries, life skills programmers have been introduced in a large proportion of schools, and for different age groups. In some countries, there are several important life skills initiatives, originating in different groups in countries, there are several important life skills initiatives, originating in different groups in countries, there are several important life skills initiatives, originating in different groups in countries, there are several important life skills initiatives, originating in different groups in the country, e.g. Non-governmental organizations, education authorities, and religious groups.

#### **Identifying an optimal strategy for life skills education**

The wide range of motives for teaching life skills to children and adolescents include the prevention of drug abuse and teenage pregnancy, the promotion of mental well-being and cooperative learning. For adults, life skills appear in programmers such as communication and empathy skills for medical students and counselors, problem solving and critical thinking for business managers, and coping with emotions and stressors for people with mental health problems.

Given the wide ranging relevance of life skills, an optimal strategy for the introduction of life skills teaching would be to make it available to all children and adolescents in schools. Life skills teaching

promote the learning of abilities that contribute to positive health behavior, positive interpersonal relationships, and mental well-being. Ideally, this learning should occur at a young age, before negative patterns of behavior and interaction have become established.

- The school is an appropriate place for the introduction of life skills education because of:
- The role of schools in the socialization of young people.
- Access to children and adolescents on a large scale
- Economic efficiencies (uses existing infrastructure);
- Experienced teachers already in place;
- High credibility with parents and community members;
- Possibilities for short and long term evaluation

Even in countries where a significant proportion of children do not complete schooling, the introduction of life skills education in schools should be a priority. Life skills education is highly relevant to the daily needs of young people. When it is part of the school curriculum, the indications are that it helps to prevent school drop-out. Furthermore, once experience has been gained in the development and implementation of a life skills programme for schools, this may help with the creation and implementation of programmers for other settings.

#### **Developing life skills programmers**

Designing and implementing a life skills program is only a part of the life skills programmers development process. It is equally important to secure long term support and resources for life skills education, and to engage, from the very beginning, all of the potential agencies that would have a role to play in the process of life skills programmers' development. Implementing life skills programmers will require the introduction of teaching methods that may be new to teachers, and the success of the programmers will depend very much on the availability of in-service training, as well as efforts to include training in participatory learning methods in teacher training colleges.

The introduction of life skills education will require input from the school and education authorities, for teacher training and the development of teaching manuals, as well as for the ongoing support of teaching programmers once they are in place. This investment is worthwhile considering that the potential gains of life skills education are so far reaching. Apart from the impact on child health, there may be other benefits for the school as an institution. For example, evaluative studies of life skills programmers suggest that the methods used can help to improve teacher and pupil

relationships (parsons et al., 1988), and there are indications that life skills lessons are associated with fewer reports of classroom behavior problems. There are also research indications of improved academic performance as a result of teaching life skills (Weissberg et al., 1989). Other positive effects include improved school attendance (Zabin et al., 1986), less bullying, fewer referrals to specialist support services and better relationships between children and their parents. A life skills programmers will have to be proven worthy of the resources allocated to it. Process and outcome evaluation studies should be carried out, and results shared with all the relevant decision makers that could affect the future of the life skills programmers. A programmers that has a component of ongoing assessment of its use and impact offers scope for keeping in touch with changing priorities, and is more likely to be modified and maintained over time.

Well designed, tested and delivered life skills programmers can achieve much in helping children and adolescents become more responsible, healthy and resilient both during childhood and as adolescence.

ii) What is the target group of the life skills program?

If a life skills program is to be developed for the promotion of health and well being, it should ideally be targeted at all children and adolescents, as a positive response to health needs, rather than as an intervention aimed only at those already a risk or who already have health problems.

If the plans are that the life skills program should eventually be implemented wide scale in a country, then the original program is likely to be developed first for the most dominant, majority language and culture in the country. This may mean that minority groups will not be reached, especially if there are no representatives from such groups in the Life Skills Advisory Panel or Development Group. Plans should be made for program adaptation, or life skills program development, for such groups once a program has been implemented and is being maintained. Life skills program can be developed for all ages of children and adolescents in school. Experience gained in countries where life skills program have been developed groups to be targeted are likely to be determined by education policy and the resources available, as well as by the age at which children are most groups, to help select who it is for and for how many year groups. Given the role of life skills in the promotion of positive health behavior, it is worthwhile ensuring that life skills program are available in the pre-adolescent or early adolescent

years, since young people of this age group seem to be most vulnerable to behavior-related health problems.

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## Assessing effective social, cultural and economic factors in applying biotechnologies in garden products of Ilam province

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**Abstract:** Role of technology is obvious and necessary as main element for economic stability and growth and will lead to more effective use of capital, human resources and natural sources. Aim of this research is to assess effective social, cultural and economic factors in applying biotechnologies in garden products of Ilam province in experts and researchers' view. Sample population of this research includes employed experts and researchers in Jihad Keshavarzi institute and the numbers are 150 persons. Value of calculated Cronbach Alpha equals 86% which represents acceptable validity of this questionnaire. Statistical methods which used, includes descriptive and inferential statistics. In descriptive statistics we used frequency, percentage, mean, standard deviation and coefficient of variations. In inferential statistics we used Pearson correlation test. Results of this research show that in their view, variables of increasing performance and number of farmers' reference to experts among different variables contain highest effect on applying biotechnologies. Results of correlation coefficient revealed that there is significant and positive relation between variables of performance increase, farmer's efficiency, status of farmer's ownership, farmer's income, effect of saving on using water and dependent variable (applying technology).

[Amin Alikarami<sup>1</sup> and Amirhossein Pirmoradi<sup>2</sup>. **Assessing effective social, cultural and economic factors in applying biotechnologies in garden products of Ilam province.** *Life Sci J* 2012;9(3):1397-1402] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 203

**Key words:** biotechnology, applying, economic and social-cultural factors

### Introduction:

Considering science and resultant technology was considered by senior managers and decision-making centers of countries in order to reach borders of progress and independency. Solving economic and social-cultural problems and modifying development indexes, optimum usage of capabilities need to apply science in all political, social and economic aspects of nations' life (Kheirandish 2001). Bio-technology indeed includes production, changing products, optimizing plants or animals and making new micro-organisms using organisms of animates or part of that. Bio-technology is one of technologic progresses which passed three historical eras of classical bio-technology, industrial microbiology and modern era (Genetic).

In recent decades and after its quick growth, its great capabilities in the field of different sciences including farming, medicine, ranching, environment, mining and industry, military and ... and creating relatively high products in result of that consideration, attracted experts and statesmen from different countries (Sanati 2002).

We are in the period of the time that poverty and starvation and its consequences, is one of challenges which countries will face it that in spite of proper potential and capacity, they could not use existing capabilities properly. Agriculture part of Iran requires certain consideration and efficient support due to enjoying endogenous and continuous economic growth and key role in creating social justice, preparing food security and proper capacity for creating occupation in

society. One of bio-technologies, is agricultural biotechnology which includes genetic engineering, culturing cellular tissue and molecular markers. It is possible to overcome increasing needs of irregular growing population in century 21 due to potentials and capabilities of agricultural biotechnology to increase food productions and its other capabilities. So, agricultural biotechnology was considered specially. Properly use of agricultural biotechnology can play important role in sustainable development and also preventing social, political, economic threats and environmental pollution. Plant biotechnology can be instrumental for removing problem of food security, seriously (Sharma, 2002).

Many experts including international scientific and development community believes that doubling or tripling world food production, forage, and fibers for supplying food security for 8 billion population in 2030 would not fulfilled without biotechnology. They called next century as governance century and efflorescence of biotechnology and genetic engineering and agent of second green revolution in future (Sanati & Esmail zade 2001).

Anderson and Zehang (2000) said that opportunities which biotechnology prepared for beneficiaries of agriculture are varied and stated that the main ones includes producing agricultural commodities which resist against salinity, drought, pest and diseases, technologies of Sustainable production, on-time and cheap supply of agricultural inputs, increasing quality of productions, extensional services and efficient

technological helps, especial consideration to rural women' needs, improving agricultural and rural infrastructure and etc.

So, obviously developing agricultural researches in order to reach useful technologies can be highly instrumental and secure reaching food security.

Capacities of agriculture part of Iran were not utilized completely and has many shortcoming in spite of enjoying considerable capabilities of sources and production factors including more than 37 million hectares agricultural lands, varied weather and biologic climates and capability for producing broad range of cold and tropical productions, renewable human resources, skilled work forces, utilizers and producers (Qare Yazdi 2005).

Now, in case of using these capabilities, we can declare it as main basis of economic development of country by relying on continuous growing production, desirable efficiency, more investment and Exchange technology compared with other economic parts.

According to potentials and capabilities and potential capabilities of agriculture part of Iran, and at the other hand various barriers in the way of reaching favorite utilization of current capacities including dry and semi-dry climate of Iran, salinity of major part of lands, wastes before and after harvesting, pests and diseases, weeds, drought and other problems, developing agricultural biotechnology can be a milestone to solve that problem (Gould, 2000).

Various problems and barriers, also there are in the way of reaching modern biotechnologies which face applying and utilizing with challenge. So that modern biotechnologies have pros and cons which each of these groups have some reason for their claims. Some considerations about biotechnology includes human and livestock health, environment health, agriculture (Changing nutritional value of plant, creating new weed, decreasing crop varieties and ...), and also social economic, political, moral and finally public considerations (Leisinger, 2000).

The problem is that in spite of proper variation of garden productions and also existence of necessary field and Basis for developing them but efficiency and performance are low in this area which is due to some risks such as bad weather conditions (spring frost and hail), pests and plant diseases (due to using classical methods of Planting and harvesting with indigenous knowledge and local-unmodified figures and also lack of operational use of biotechnology).

According to above subjects, one of mechanisms which can push us forward toward goal is to apply and utilize agricultural biotechnologies that can be represented as favorite and efficient, dynamic and determinant technology in the way of national development and production, decreasing dependency

and reach to self-reliance due to creating significant economic, scientific and environmental conditions. So obviously, in such condition, importance of subject is clear. Different factors involved in applying innovations and these factors and features varies depends on type of society. Accepting and applying ideas, methods and modern technologies by peoples of one social system which indeed need to change human behaviors and visions, is affected by variation in humans' social, cultural, economic and other features and even in conditions and human and material resources in the social system of accepting this modern idea and technology.

Literature study of this research shows that there are many factors involved in applying this innovation and also there are many barriers in the future. Many researchers found main results in this area. Wheeler (2005) in the research as "affective factors for accepting biotechnology" at the northern Australian college found that social-economic factors, level of peoples' literacy, occupational impacts, knowledge and information (knowledge of biotechnology), environmental attitude, individual trends and type of peoples' attitude toward innovation are effective factors in accepting biotechnology. Baker & Burnham (2001) in the research in America found that there is significant relation between amounts of information and peoples' knowledge about biotechnology and also kind of people attitude toward biotechnology and accepting biotechnology. Koivisto & Magnusson in Sweden found that there is significant relation between education level, knowledge of biotechnology, peoples' attitude toward biotechnology, risk-taking and peoples' earnings and accepting biotechnology.

James & Burton (2003) in Australia found that there is significant relation between age, gender, risk-taking and peoples' earnings. Whoh (1980) did research about accepting innovations in Nigeria and found that level of literacy, amounts of contacts with propagator, economic condition and enjoying leadership role and accepting innovation. Igordand & Patric (1987), in the research with the aim of assessing affective structure on accepting agricultural technologies, after assessing individual, economic and social features found that factors such as level of formal and informal education, social participation, performance extent, access to information resource and numbers of contact with propagator have significant relation with accepting agricultural technology.

Arayesh (1998) while assessing effective factors on accepting and lack of continuing innovation of rainy irrigation among farmers of Ilam province concluded that there is significant relation between variables of Farm Experience, size of farming area, economic



factors (including income and access to agricultural inputs) and technical factors and accepting innovation. Musavi(2003) after assessing affective factors on accepting low-input sustainable farming by wheat growers of Sistan Baluchestan found that, there is significant relation between variables of city of residence, performance extent, social features, extent of cooperation with institutes, effect of extensional-educational classes, using connectional channels, extent of sharing farming issues with propagators and service centers, knowledge attitude toward low-input sustainable farming and technical knowledge in the field of wheat cultivation levels and accepting innovation. Pointed histories of this research shows that many factors play role in accepting biotechnology including economic, educational-extensional, cultural and social factors and individual features.

This research seeks to assess economic and social-cultural factors.

#### **Goals:**

Main goal: Assessing effective social, cultural and economic factors in applying biotechnologies in garden products of Ilam province

Specific goals:

- 1-assessing affective economic factors in garden products of Ilam province
- 2- Assessing affective social and cultural factors in garden products of Ilam province
- 3- assessing theoretical basics of research

#### **Methodology (materials):**

This research is applicable in term of aim and descriptive in term of data collection. Correlation method was used among descriptive researches and it is field research in term of audit extent and control degree. Sample population of this study includes experts and researchers of Jahad Keshavarzi institute which involve peoples whom have upper-diploma degree in agriculture courses.

The experts involved those who got bachelor degree in agriculture course and some from humanities related with research subject such as Technology management, sociology and ... which research in research center of Jahad keshavarzi institute of this province and includes 150 humans (so due to low number of sample population, we used census instead of sampling).

Independent variables of this research includes increasing production performance, farmer's efficiency, farmer's earning, extent of his capital, emphasizing on saving in agricultural inputs, exploitation system, extent of cultivation area, status of farmer's ownership, his/her beliefs, traditional values, and his membership in rural forums.

Dependent variable of this research is "accepting biotechnologies in garden products".

Used statistical methods includes inferential and descriptive statistics (Using SPSS software). We used frequency, percentage, mean, SD and coefficient of variation in descriptive statistics and Pearson correlation coefficient in inferential one.

We used Cronbach alpha method for reliability of questionnaire and the mean was calculated as 82% and shows acceptable validity.

#### **Results:**

Individual features of statistical sample are as following :

Most frequency of age group was for 30-39 age level and the mean was 35.8 years. 79.3% were males and 20.7% were females. Most frequency of work experience was for 1-5 years level and the mean equals 11.65 years. 94% lived in urban area and other 6% in village.

Most frequency of education level was for bachelor level with 55.3% and the least for P.H.D with 2.7%. the course of 24.7% of peoples was farming and others studied in ranching and extension courses with 13.3% and 11.3% respectively. Three courses altogether forms 50.3% and 49.7% relates to other courses (Breeding - Soil Science - machinery - Gardening - weeds and ...). in term of class and organizational post, executive experts had 63.3% and propagator and extension expert, manager and official affairs, and researcher had 16.7% , 10.7% and 9.3% respectively.

In term of employment status, 42.7% were Hired, 22% were Contract, and 35.5% were contractual.

Results of this research show that in respondents view, variables of increasing performance and extent of farmer reference to experts had most effect on accepting biotechnology.

Table1 shows prioritizing extent of assessing affective economic factors in accepting effect of biotechnology in garden products.

Table1- prioritizing extent of assessing affective economic factors in accepting effect of biotechnology in respondents view

priority	statement	Range of assessment					mean	SD	C.V	n
		Very low	low	To some extent	high	Very high				
1	Increasing production performance	1.	6.	20.	69.	51.	4/11.	0/837.	20/364.	147.
2	Farmer efficiency	0.	6.	29.	63.	48.	4/05.	0/833.	20/567.	146.
3	Farmer income	2.	11.	17.	61.	58.	4/09.	0/859.	21/002.	149.
4	Farmer reference to experts	3.	14.	49.	69.	15.	3/53.	0/872.	24/702.	150.
5	Farmer capital extent	5.	8.	21.	66.	48.	3/97.	0/996.	25/088.	148.
6	Farmer beliefs	2.	12.	37.	58.	40.	3/82.	0/966.	25/090.	149.
7.	Emphasizing on saving in agricultural inputs	2.	12.	44.	53.	38.	3/76.	0/970.	25/797.	149.
8.	Exploitation system	1.	17.	42.	52.	32.	3/67.	0/974.	26/539.	144.
9.	Extent of cultivation area	2.	16.	44.	48.	37.	3/69.	1/011.	27/398.	147.
10.	Emphasizing on water saving	3.	19.	41.	50.	36.	3/65.	1/046.	28/657.	149.
11.	Farmer ownership status	5.	13.	46.	48.	35.	3/65.	1/046.	28/657.	147.
12.	Farmer traditional values	4.	24.	52.	48.	22.	3/40.	1/010.	29/705.	150.
13.	His/her membership at rural forums	7.	17.	56.	48.	22.	3/41.	1/024.	30/029.	150.

7 questions were asked about strategies for facilitating acceptance from contacts and the results were represented at table 2.

Table2- prioritizing effect extent of strategies for accepting biotechnology

priority	variables	Range of assessment			mean	SD	C.V	n
		low	moderate	high				
1.	Creating best farms and gardens using seeds and plants resulting from biotechnology	7.	29.	112.	4/71.	0/550.	11/672.	148.
2	Giving bank facilities and other agricultural inputs provided that using seeds and plants resulting from biotechnology	8.	29.	110.	4/69.	0/569.	12/132.	147.
3.	Government incentive policies	8.	31.	109.	4/68.	0/572.	12/222.	148.
4.	Giving facilities to graduated students of agriculture and relative courses in the field of biotechnology	7.	41.	100.	4/63.	0/575.	12/419.	148.
5.	Establishing non-governmental cooperation and forums	11.	73.	64.	4/36.	0/617.	14/151.	149.
6.	Using extensional-educational programs	9.	49.	68.	4/53.	0/644.	14/216.	126.
7.	Extending biotechnology research centers	12.	47.	89.	4/52.	0/644.	14/247.	148.

Results of pearson correlation test between dependent and independent variable of research

Results of Pearson correlation test show that there is direct relation between variables of increasing

production performance, farmer efficiency, emphasizing on saving in agricultural inputs,

emphasizing on water saving and status of farmer ownership and dependent variable (acceptance).

Table3 shows results of Pearson correlation test.

Assessed independent variable	Correlation coefficient	Significant level
Increasing production performance	0/270**	0/001
Farmer efficiency	0/218**	0/008
Farmer income	0/137	0/098
Farmer reference to experts	0/112	0/178
Farmer capital extent	0/097	0/241
Farmer beliefs	0/076	0/363
Emphasizing on saving in agricultural inputs	0/192*	0/020
Exploitation system	0/121	0/145
Extent of cultivation area	0/152	0/067
Emphasizing on water saving	0/163*	0/049
Farmer ownership status	0/225**	0/006
Farmer traditional values	0/006	0/945
His/her membership at rural forums	0/063	0/450

#### Suggestions:

According to whole results of this research we can represent these suggestions in order to accept and apply biotechnology:

- 1- Since that production performance and consequently increase in income is one of main basis for accepting biotechnology so it is suggested that actions which lead to increase in income and production be done by authorities.
- 2- Causes for increasing farmer efficiency be prepared from different ways.
- 3- Giving required facilities in order to increase farmers capital which are able to develop their work

- 4- And finally it necessary to analyze economic, farmers social-cultural conditions before extend and impart biotechnologies and it be possible to prepare better conditions for accepting biotechnology.

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**Evaluation of synovial fluid culture in patients with high suspicion for septic arthritis**

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**Abstract:** Septic arthritis is the infection of joints and delay in treatment may lead to irrecoverable injuries such as joint destruction and dissemination of infection to other organs. The aims of this study were to evaluate synovial fluid cultures in patients with high suspicion for septic arthritis, their clinical and laboratory findings and to determine probable causes of true/false negative cultures. In this cross-sectional study, 25 patients with painful and swollen joint and high clinical suspicion for septic arthritis enrolled the study. Sterile synovial fluid aspiration was performed and specimens were evaluated direct smear for gram staining and 3 different cultures using chocolate agar, Mac-Conkey and blood agar for 24 hours. Blood samples were also obtained for culture. Data were analyzed using SPSS software (version 15). Fever, joint pain, swelling, warmth and tenderness were reported by all patients. Ten patients (40%) suffered from chilling and 24 patients (96%) from restricted movement. All synovial fluid gram staining and blood cultures were negative. But synovial blood cultures were positive in 3 patients (12%) showing Klebsiellapneumoniae, Candida albicans and Brucella infections. The results of our study were different from other studies. False negative cultures may be due to fastidious organisms, inadequate laboratory techniques, or prior antibiotic therapy.

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**Key words:** Septic arthritis, culture, Gram Stain

**Introduction:**

Septic arthritis refers to the infection of articular space and is an urgent medical problem, since any delay in diagnosis and cure can lead to irreversible damage to the joint, such as articular destruction and the spread of infection to other parts of the body (1). The prevalence of septic arthritis is about 2-5 per 100,000/year in normal population and 28-38 per 100,000/year in high risk population, like those having rheumatoid arthritis(RA)and also, 40-68 per 100,000/year in those having prosthetic joints (2). The mortality rate of septic arthritis is about 12-18%. Also, about 30-52% of the patients lose their joint activity (3).

Most causes of septic arthritis occur through hematogenous spread. Staphylococcus aureus is the most common cause of non-gonococcal septic arthritis in adults, accounting for about 2/3 of the cases (4). Also, about 80% of cases with septic arthritis in RA patients are due to Staphylococcus aureus. The prognosis of septic arthritis is poor in case of RA, age

above 80 years, presence of prosthetic joints and use of immuno-suppressive drugs (5). Even a mortality rate reaching 50% has been reported in those having RA and concomitant poly-articular septic arthritis (5).

The most common form of septic arthritis is the mono-articular involvement and knee is the most common involved joint. The definite diagnosis is made by directly directly the organism in gram-stained smears of the synovial fluid, positive synovial fluid culture and/or showing the DNA of the micro-organism using polymerase chain reaction (PCR) (6, 7). Currently, diagnosis is often made according to synovial fluid cell count, smear and culture. If the patient has not recently used antibiotics, cultures would be positive in 70-90% of non-gonococcal bacterial arthritis (8). Cultures may show negative results in case of technical problems, fastidious organisms or recent antibiotic use by the patient (9).

PCR has some advantages including high sensitivity and rapidity, especially for fastidious organisms or in case

of antibiotic use. But the main problems are contamination with other organisms which can lead to false positive results and the high price of the technique (10). Also, it has not completely become standardized and is not commonly available.

The aims of this study were to evaluate synovial fluid cultures in patients with high suspicion for septic arthritis, their clinical and laboratory findings and to determine probable causes of true/false negative cultures.

#### Methods:

Twenty five patients with articular pain and swelling and high suspicion for septic arthritis, referring to Imam-Ali hospital of Zahedan, entered the study. The decision for classifying the patient as highly susceptible for septic arthritis was made according to the presence of some clinical symptoms including fever, articular pain, swelling, erythema, tenderness and/or stiffness and some laboratory findings including leukocytosis, elevated erythrocyte sedimentation rate (ESR) and/or elevated C-reactive protein (CRP) and high leukocyte count in synovial fluid with polymorphonuclear (PMN) predominance. In case of hip involvement, orthopedic consultation for articular drainage was also performed.

If the patients were using non-steroidal anti-inflammatory drugs (NSAIDs), methotrexate (MTX) or other cytotoxic medications, the drugs were stopped until the results of smear and culture got ready, but other drugs were continued. After synovial fluid aspiration, empirical antibiotic therapy was started according to common organisms (ceftriaxone 1gr q12 hours and cloxacillin 2gr q6 hours). The decision for continuation or discontinuation of antibiotics and using further treatments were made according to the results of smears and cultures.

Synovial fluid aspiration was performed using sterile material and methods. Using a 10-cc syringe, 10cc of synovial fluid was sent to laboratory for cell count, gram smear, culture, antibiogram and also assessment for crystals. Cultures were performed in 3 different media (chocolate-agar, Mc-Conkey and blood agar; all from Merck Company, Germany) and were kept in an environment with 5-10% carbon dioxide at of 37°C for 48 hours. Also, some amounts of synovial fluids were injected in the blood culture media (Padtan-teb, Iran) and were kept in 37°C. If any turbidity was observed during the coming 3 days, cultures were performed in the chocolate-agar, Mc-Conkey and blood agar again. If no turbidity was observed during the first 3 days, cultures from blood culture media were performed every week for 4 weeks. If a colony was found, smears and other processes were performed as described above. During the protocol, if any colony was found in a culture-plate, smears of the mentioned colonies were assessed using gram stain. In case of gram positive

cocci, catalase test were performed to differentiate between staphylococcus and streptococcus (One drop of oxygenated water was put on a lam and 2-3 colonies of Mc-conkey or chocolate agar media were added and if bubbles were formed, it was assumed as positive catalase result, referring to the presence of staphylococcus). Then coagulase test and cultures in mannitol salt-agar were performed (5-6 colonies were added to 4cc of plasma and were kept in 37°C for 4 hours. This complex was evaluated every 0.5-1 hour and in case of clot formation, the presence of staphylococcus aureus was confirmed.). Also, cultures in media including 1/25000, 1/50,000 and 1/100,000 concentrations of thionin and fuchsin were performed for Brucella and germ-tube test was performed for Candida. In case of Brucella species, biochemical tests including agglutination test was also performed.

#### Results:

Among 25 participants, 6 (24%) were male and 19 (76%) were female. The mean age was  $48.8 \pm 10.8$  years (ranging from 21 to 61 years). Three patients (12%) had diabetes mellitus, 12 (48%) had RA, 4 (16%) had history of renal transplantation, one (4%) had systemic lupus erythematosus (SLE), one (4%) had juvenile rheumatoid arthritis and one patient had both diabetes and RA, simultaneously. Three of the patients (12%) had no underlying disease.

Among those 12 patients with RA, 9 patients used MTX and all were taking prednisolone (7 patients used 7.5mg/day, 3 patients used 10mg/day and 2 patients used 15mg/day).

None of the patients had prosthetic joints or history of intra-articular injection. Three patients (12%) had previous history of joint trauma and 7 patients (28%) had previous history of septic arthritis.

All patients had fever, articular pain, warmth, swelling and tenderness. 40% of patients complained of chills and 96% had joint stiffness. Knee was the most common (92%) site of involvement (60% left knee and 32% right knee) and the remaining 8% had hip involvement. None of the patients had adjacent osteomyelitis in their X-ray evaluations.

The mean white blood cell (WBC) count was  $12,172 \pm 1,851$  /ml. Fifteen patients (60%) had WBC > 11,000/ml. The mean percent of PMNs was  $76.4\% \pm 13.8\%$  and 10 patients (40%) had PMN > 80%.

The mean synovial fluid white cell count was  $49,880 \pm 17,609$  /ml. Ten patients (40%) had synovial fluid cell count > 50,000.

The mean synovial fluid cell count had significant correlation with WBC ( $p < 0.05$ ). Also, the mean synovial fluid cell count showed significant difference among different joints ( $52,666 \pm 15,559$  /ml for the left



knee,  $39,125 \pm 17,041$  /ml for the right knee and  $72,000 \pm 21,174$  /ml for the hip joint) ( $p < 0.05$ ) (figure 1).

The mean ESR level was  $74.8 \pm 31.4$  mm/first hour (ranging from 35 to 125 mm/first hour). The mean ESR levels according to the involved joints are shown in figure 2.

The mean percent of PMN in synovial fluid was  $76.5 \pm 15.8\%$ . Fourteen patients had PMN  $> 80\%$ .

Synovial fluid appeared turbid in 17 patients (72%). The mean white cell counts in turbid and clear fluids were  $53,666 \pm 15,807$  /ml and  $40,142 \pm 19,463$ , respectively ( $p < 0.05$ ) (figure 3).

Blood cultures were negative in all patients, but synovial fluid cultures were positive in 3 patients, including:

- Klebsiellapneumoniae in 45 year old woman with SLE. The patient had no history of cytotoxic or steroid use. She had referred with fever, chills and articular pain and stiffness. WBC count of the patient was 12,000/ml and white cell count in her synovial fluid was 42,000/ml.

- Brucella in a 48 year old woman with RA. She was taking prednisolone (15mg/day) and had positive history for using non-pasteurized milk. She had also previous history of septic arthritis. Her WBC count was 12,300/ml and the synovial fluid white cell count was 48,000/ml. The synovial culture showed the organism in the chocolate-agar environment.

- Candida albicans in a 59 year old woman with diabetes mellitus. She did not have previous history of septic arthritis. Her WBC was 8,000/ml and her synovial fluid cell count was 22,000/ml.

All the 3 mentioned patients had left knee arthritis.

### Discussion:

Although most cases of septic arthritis are due to hematogenous spread of the infection to the articular space, in some cases, bacterial arthritis can be due to bites, trauma, direct inoculation of bacteria during articular surgeries and rarely, due to spreading from adjacent osteomyelitis (11).

Patients with RA are at high risk for bacterial arthritis (12). Intra-articular injection and immuno-suppressive drugs play role in increasing the susceptibility for septic arthritis (13). Therefore, in our study, about 90% of the enrolled patients had risk factors for septic arthritis.

Patients with septic arthritis usually refer with acute pain and swelling of one or more joints (14). Fever is another important finding in patients with septic arthritis (15). According to a meta-analysis performed by Margaretten et al, articular pain (85% sensitivity for predicting septic arthritis), swelling (78% sensitivity) and fever (57% sensitivity) were the only findings in more than 50% of the patients. The less common findings were sweating (27% sensitivity) and stiffness (19% sensitivity) (16). In our study, all the enrolled

participants had fever and articular pain, swelling, warmth and tenderness.

All the enrolled patients had mono-articular involvement and left knee was the most common involved joint. According to other studies, knee involvement has been reported in more than 50% of patients with septic arthritis (11). Deesomchok reported knee involvement as the most common site of involvement (52.5%) during studying 101 patients with non-gonococcal septic arthritis (17).

During our study, the synovial fluid white cell counts of 10 patients were more than 50,000, but none of them had positive blood culture results. The normal synovial fluid is almost without cells. Inflammatory or infected fluids have increased white cell counts, reaching to even 50,000-150,000/ml in bacterial arthritis, mostly consisted of PMNs (18). According to a study performed by McGillicuddy on 49 septic arthritis patients who had positive synovial culture results, 39% of patients had synovial fluid white cell counts less than 50,000/ml (19).

According to the meta-analysis performed by Margaretten, the most important laboratory findings in septic arthritis are synovial fluid cell count and the percentage of PMNs, so that PMN $>90\%$  was significantly correlated with the presence of septic arthritis (16). But according to our study, all the 3 patients with positive synovial culture results had white cell counts less than 50,000. Therefore, lower synovial fluid cell counts cannot rule out the diagnosis of septic arthritis.

During our study, synovial fluids appeared to be turbid in 72% of the cases. Although turbidity can be due to non-cellular materials, it is mostly due to increases in cell counts of synovial fluid (20).

The viscosities of synovial fluids in our study were all decreased. Although purulent synovial fluids can rarely be viscous, the presence of proteolytic enzymes in the synovial fluid usually decreases the viscosity (15).

According to our results, synovial fluid smears could not show any organism in any patient. Previous studies have shown that smears can show the organism in most of the cases with positive culture results. The sensitivity of smears in showing the organism is accounted to be about 29-50% (15). However, the presence of violet crystals and mucin can lead to false positive results due to mimicking cocci organisms in gram staining (20).

According to our results, 12% of patients had positive synovial fluid culture results, including Klebsiellapneumoniae, Brucella and Candida. Although our results are much different from other studies, the important point was the presence of underlying disease in all of them.

According to the study performed by Deesomchok on 101 patients with non-gonococcal septic arthritis, synovial fluid cultures were positive in 72.3% of the

patients. The most common organism were *Staphylococcus aureus* (47.5%), beta-hemolytic *Streptococcus* (28.7%) and gram-negative bacilli (13.9%) (17).

According to a study performed by Von Essen on 47 patients with bacterial arthritis, using blood culture environments for cultivating synovial fluid led to positive results in 21% of patients in whom traditional culture environments could not previously show the organism (21).

*Staphylococcus aureus* and *Streptococcus* have higher tendency than gram-negative bacillus to involve joints. About 80% of cases with septic arthritis in those who have RA are due to *Staphylococcus aureus* (2). But no one of our patients showed *Staphylococcus* infection. This may be due to technical problems or may be due to previous antibiotic consumption by the patients who did not exactly know the drugs they had used, although we asked the patients to bring all the drugs that they had used during the previous 2 weeks.

Synovial fluid cultures are mostly positive in patients with non-gonococcal bacterial arthritis. Negative results can be due to recent antibiotic use or contamination with *Streptococcus* or *Mycoplasma* (20).

During our study, a 59 years old patient with diabetes was found with *Candida* arthritis. Fungal arthritis should be kept in mind when encountering a patient with mono-arthritis in whom immune system is suppressed. In these patients, special culture environments should be used.

Blood culture environments have also been offered for cultivating synovial fluid to help identifying the organism in case of negative results by traditional synovial fluid culture environments (21). False negative results are encountered while cultivating fastidious organisms, laboratory technical problems and prior antibiotic use. During our study, those who had history of recent antibiotic use were excluded from the study. Therefore, the two remaining reasons might have been the main causes of high negative results during our study.

Recently, PCR has been offered as a method for definite diagnosis of septic arthritis. According a study performed on 121 patients with septic arthritis, the sensitivity and specificity of PCR in identifying the organism in synovial fluid were 95% and 97%, respectively. However, this technique is not available world-wide and is very expensive.

#### Conclusion:

According to our results, diagnosing septic arthritis according to clinical symptoms and signs of the patients are probably more reliable than smear and culture results in hospitalized

patients. Also, it seems better to start therapy according to the patient's clinical status.

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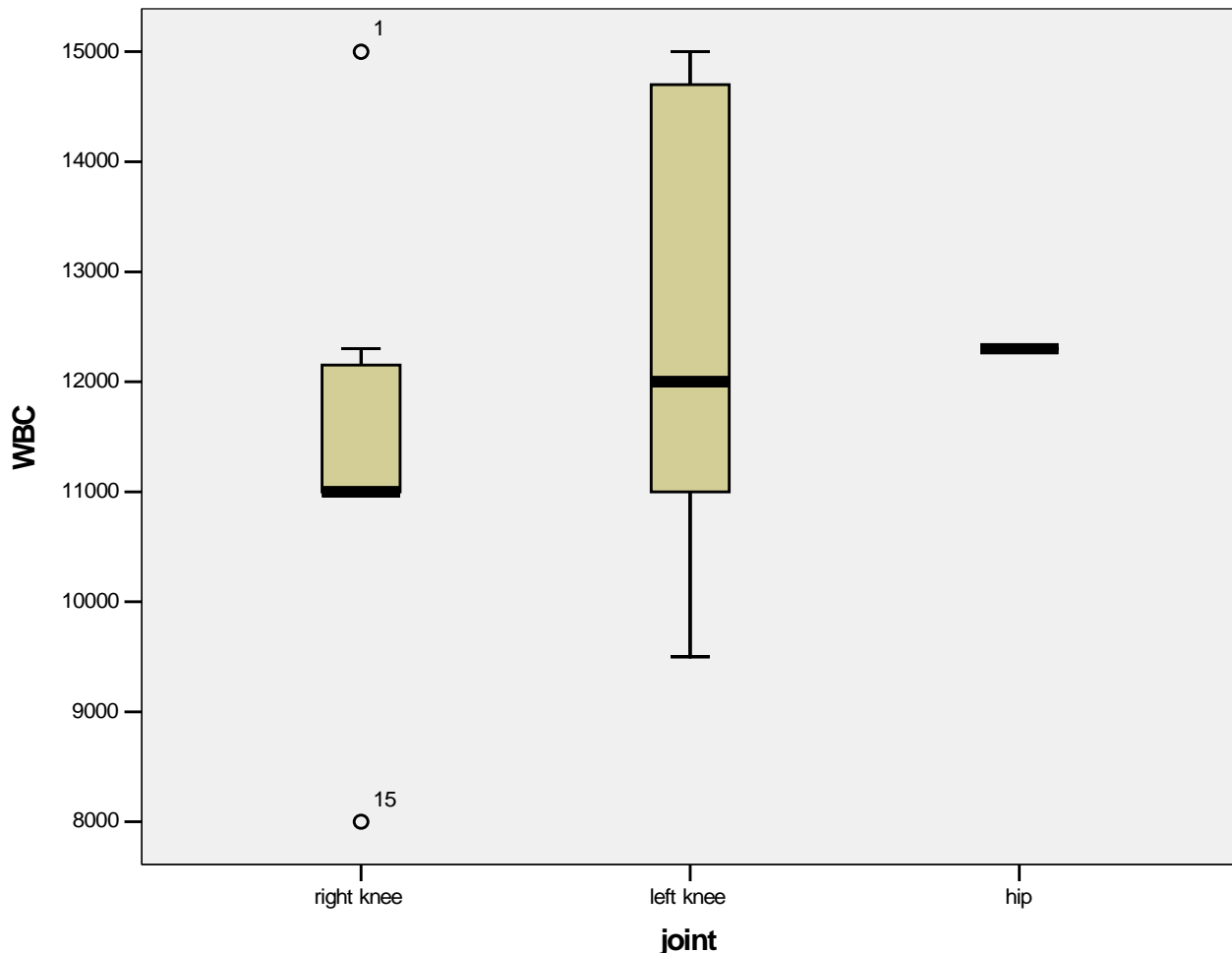
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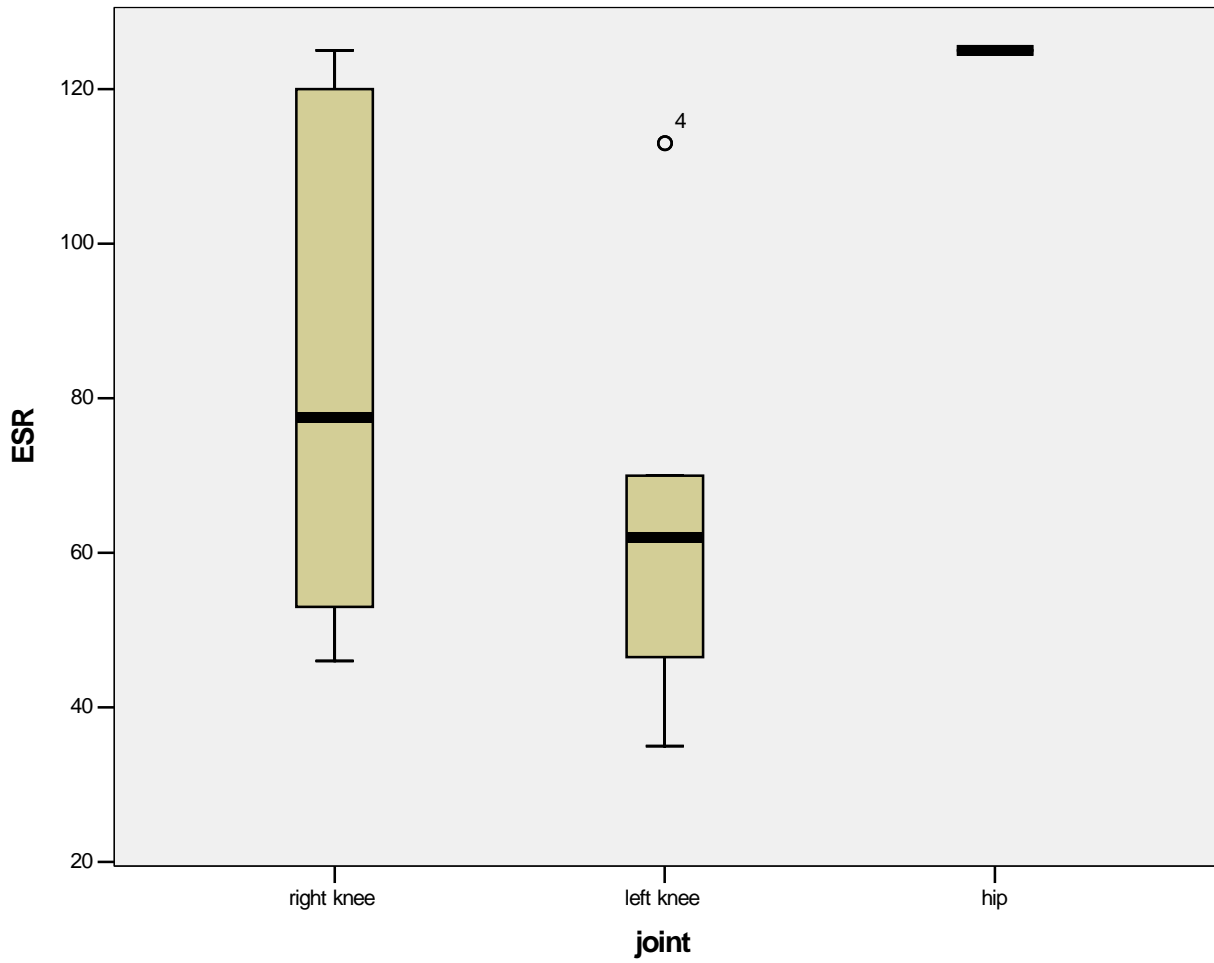
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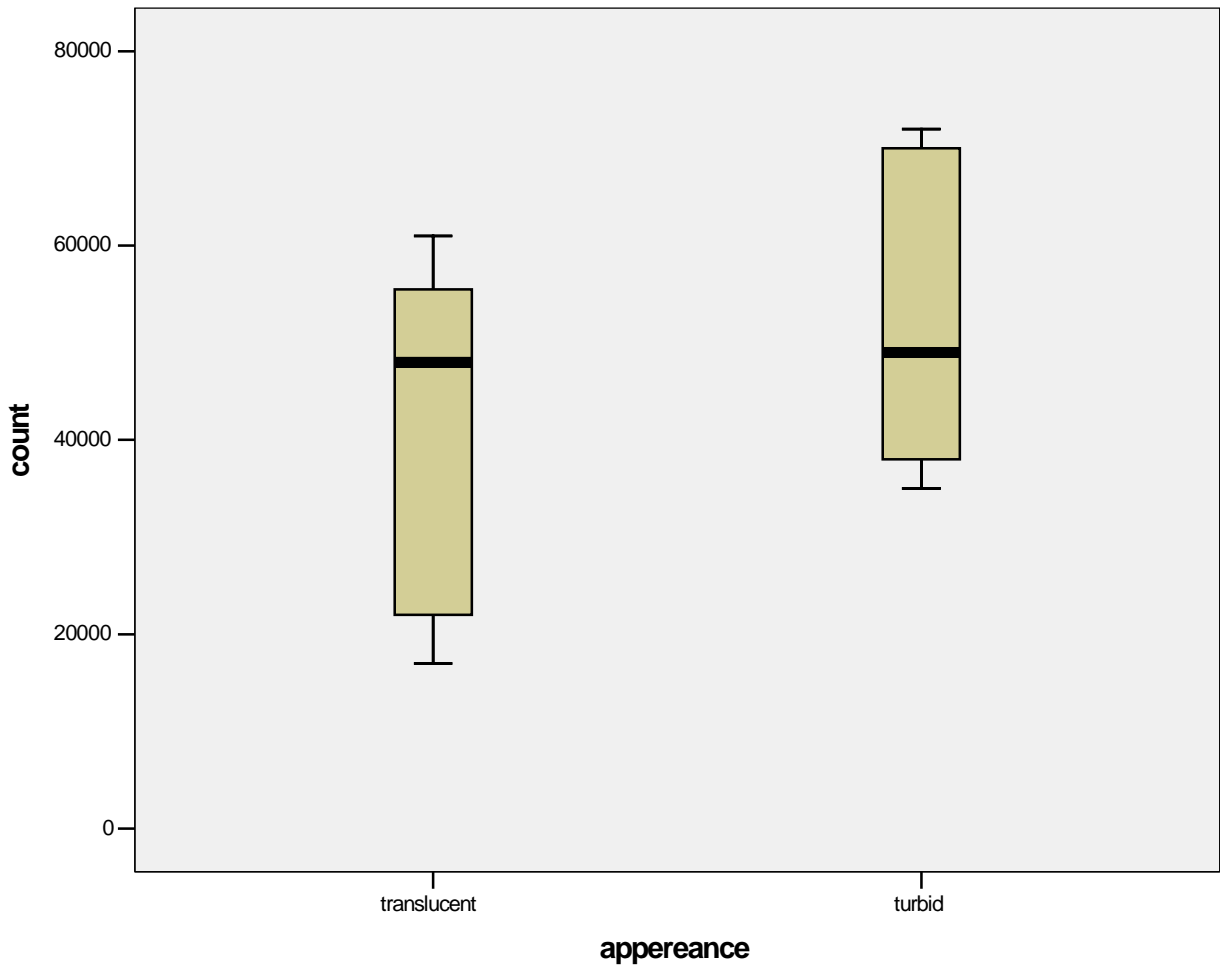
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**Figure 1:** comparing mean WBC counts according to the involved joints



*Figure 2:* comparing mean ESR levels according to the involved joints



*Figure 3:* comparing mean synovial fluid cell counts according to the appearance of the fluid

**ULTRASTRUCTURE OF VITELLOCYTES IN *ELECTROTAENIA MALOPTERURI* (FRITSCH, 1886)  
(CESTODA: PROTEOCEPHALIDAE) A PARASITE OF *MALAPTERURUS ELECTRICUS*  
(SILURIFORMES: MALAPTERURIDAE) FROM EGYPT**

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**ABSTRACT:** This study describes the Ultrastructure of mature Vitellocytes of the Proteocephalidae Cestode *Electrotaenia malopteruri* (Fritsch, 1886) a parasite of the common catfish *Malapterurus electricus* using transmission electron microscopy (TEM). The vitellocyte is characterized by the perinuclear cytoplasm that contains numerous parallel cisternae of granular endoplasmic reticulum (GER), several Golgi complex, its peripheral cytoplasm contains, lipid droplets, shell globule clusters, proposed glycogen like particles. The most characteristic feature of the mature vitellocyte of this Cestode species is the concentric arrangement of shell globule clusters.

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**Keywords:** Proteocephalidae, *Malapterurus electricus*, vitellocytes, Ultra-structure, *Electrotaenia malopteruri*, TEM.

## 1. INTRODUCTION

Cestode class is known to be one of classes that has the highest reproductive capacities of all animal classes, Conn (2000). Several TEM studies have been published on the Ultra structure and differentiation of vitellocytes in Cestodes, Swiderski and Xylander (2000). Vitellocytes in Cestodes have two important functions, i.e. egg shell formation and the nourishment of the early embryo, Swiderski, *et al.*, (1970 a, b); Swiderski and Xylander, (1998 and 2000). So many authors studied the characteristic features of mature vitellocytes in different Cestode groups.

On Amphilinidea, *Amphilina foliacea*, Xylander (1987; 1988) on Gyrocotylidae *Gyrocotyle urna*, Bruňanskà *et al.*, (2005), on Spathebothriidae *Cyathocephalus truncates*, Poddubnaya *et al.*, (2006), on *Didymobothrium rudolphii*, Brunanska *et al.*, (2005), on *Diplocotyle olrikii*, Brunanska *et al.*, (2009), on Caryophyllidea *Atractolytocestus huronensis* Swiderski *et al.*, (2004a), on *Caryophyllaeus laticeps* Swiderski and Mackiewicz (1976), on *Glaediacris catostomi*, Swiderski *et al.*, (2004b), on *Khawia armeniaca*, Swiderski *et al.*, (2009), on *Wenyonia virllis*, Swiderski *et al.*, (2011), on Diphyllidea *Echeneibothrium euterpes*, Swiderski *et al.* (2006a) on *Trypanorhynchea Dollfusiella spinulifera*, McKerr (1985), on *Grillotia erinaceus*, Swiderski *et al.* (2007), on *Paracharistianella trygonis* Swiderski *et al.*, (2006b), on *Progillotia pastinace*, Mokhtar-Maamour and Swiderski (1976), on *Rhinebothriidea Echeneibothrium beaulchampi*, Swiderski and Mokhtar (1974), on

Bothriocephalidea *Bothriocephalus clavibothrium*, Levron *et al.*, (2007), on *Paraechinophallus japonicus*, Koeneva (2001) on *Triaenophorus nodulosus* Bruňanskà (1997), on Proteocephalidea *Proteocephalus exiguous* Swiderski and Subilia (1978), on *Proteocephalus longicollis*, Swiderski (1973); Swiderski *et al.*, (2000) and Li *et al.*, (2003) on Cyclophyllidea *Catenotaenia pusilla*, *Inermicapisifer madagascarinensis*, *Moniezia expansa* and *Mosgovoyia ctenoides*.

The aim of the work is to describe the aspect of Vitellocytes ultrastructure of *Electrotaenia malopteruri* a parasite of *Malapterurus electricus* to compare it with the results of previous reports of vitellocyte structure in other Cestode species.

## 2. MATERIALS AND METHODS:

### 2.1. Materials:

#### 2.1.1. Specimens:

-Mature specimens of *E. malopteruri* were obtained from the intestine of the catfish, *Malapterurus electricus*, River Nile, Egypt.

- Living Cestodes were dissected in a 0.9% NaCl solution and different portion of mature proglottids containing laterally the vitellaria and reproductive system were routinely processed for TEM examination.

### 2.2. Methods:

#### 2.2.1. Specimen preparation:

Specimen were fixed in cold (4°C) 3% glutaraldehyde in a 0.1M sodium cacodylate buffer at PH 7.2, rinsed in a 0.1M sodium cacodylate buffer at PH 7.2, post fixed in cold (4°C) Osmium tetroxide in



the same buffer, dehydrated in an ethanol series, and finally embedded in Epon resin.

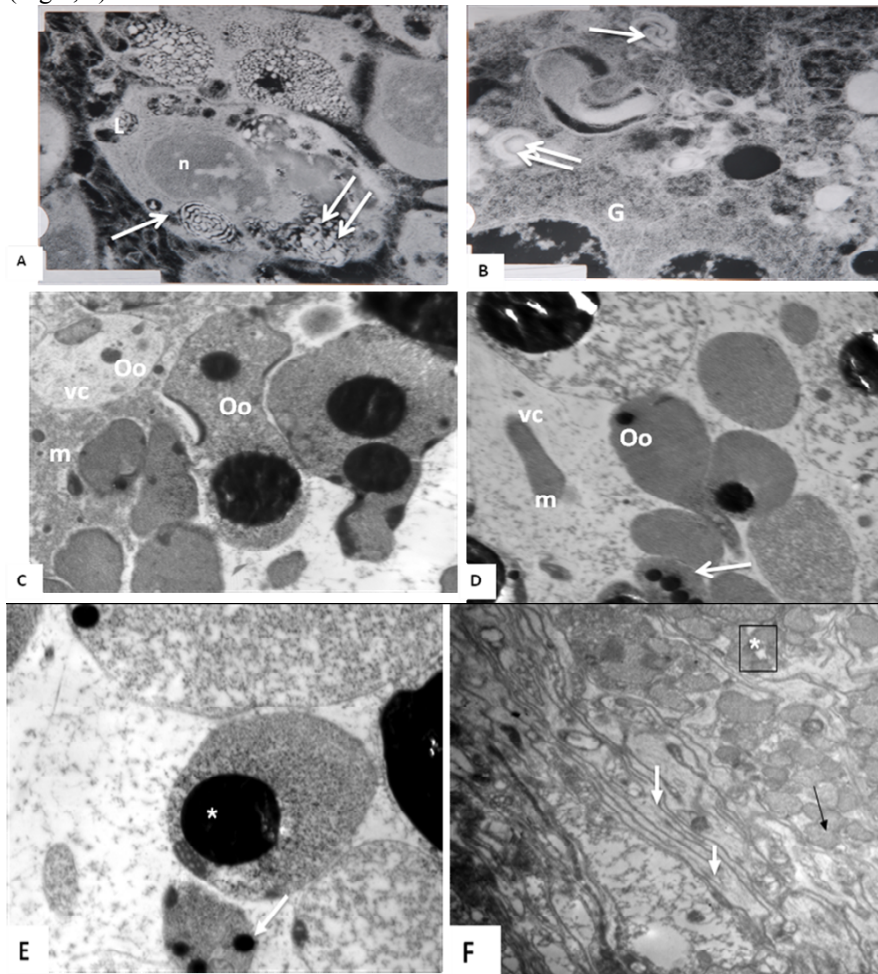
### 2.2.2. Specimen examination

Ultra thin sections were obtained using a Reichert-jung Ultracut E. ultramicrotome, placed on copper grids and double-stained with uranyl acetate and lead citrate. Ultra thin sections were examined using a Joel 1010 Transmission electron microscopy (TEM) operated at 80 KV.

### 3. RESULTS

The vitellaria of *Electrotaenia malopteruri* (Fritsch, 1886) is an extensive system of numerous oval or elongated vitelline follicles enclosed by the parenchyma (Fig.1,A). The characteristic arrangement of concentric distribution of shell globules clusters (Fig.1,A).

Vitellocytes were generally having high Nuclei /cytoplasmic ratio (Fig. 1, A). The nucleus is round and contain large clumps of heterochromatin and the narrow cytoplasm contain large number of lipid droplets, proposed glycogen like droplets, (Fig. 1,B) and concentric rough endoplasmic reticulum (RER). The differentiation of vitellocytes was characterized by the increase of RER. Cisterna which is filled with an electron-dense material (Fig. 1, F), Golgi vesicle gave rise to large membrane-bound inclusions (Fig. 1, F). When completely mature they had a multigranular and were delimited by the smooth membrane. Oocytes are accompanied by the vitellocytes which have shell globules (Fig. 1, D, E), few mitochondria scattered in parenchyma (Fig. 1, C).



**Figure (1):** A-TEM micrograph illustrating the mature vitellocyte with the concentric shell globules (arrows), nucleus (n), Lipid droplets (L), 5000X. B- TEM micrograph illustrating the concentric arrangement of the endoplasmic reticulum (arrow, double arrow), proposed glycogen like-particles (G), Oil droplets, 7500X. C- TEM micrograph illustrating the developing Oocytes (Oo) adjacent to the vitellocyte (vc), note the mitochondria (m), 2500X. D-TEM micrographs illustrating the aggregation of shell globules (arrow), 2500X. E-TEM micrographs illustrating the scattered shell globules (arrows), 3000X. F-TEM micrograph illustrating the characteristic parallel

cisternae of endoplasmic reticulum (white arrows), large membrane bound inclusions of Golgi complex (black arrow), 8000X.

#### 4. DISCUSSION

As summarized by Swiderski and Xylander (2000) in their extensive review, Cestode vitellocytes are very important for egg formation and embryonic development. They play two significant functions:

1-The formation of hard egg shell or a delicate vitelline capsule.

2- Supplying nutritive reserves for the developing embryo.

Both roles are closely connected with the presence of two types of cytoplasmic inclusions in Cestode vitelline cells such as:

\* Egg shell globules, vitelline vesicles or shell globules clusters that taking part in the egg shell or vitelline capsule formation.

\*Glycogen and/ or lipids (Sometimes mixtures of both in different proportion which represent recent various energy sources for the developing embryos).

Lipid droplets were localized only in the vitellocyte cytoplasm in *Paracharistianella trygonis*, Swiderski *et al.*, (2007) and never inside the cell nuclei. This report agreed with the present results. While in Tetraphyllidean *Echeneibothrium beaulchampi* by study of Mokhtar-Maamouri and Swiderski, (1976) and in *Didymobothrium rudolphii* studied by Poddubnaya *et al.*, (2006) it was reported inside the cell nuclei. Other studies on *Diplocotyle olrikii* by Bruňanská *et al.*, (2005) and on Caryophyllidea *Atractolytocestus huronensis* by Bruňanská *et al.*, (2009) their conclusion was that the lamellar heterogenous egg globules are represented in great amount, which was different from our studies that as we noticed that the egg shell globules have a characteristic concentric shape. Report of Swiderski *et al.*, (2004a) on *Caryophyllaeus laticeps* stated that lipid granules were absent in mature vitellocyte. Whereas, Swiderski and Mickiewicz (1976) work on *Glaediacris catostomi* found a great amount of cytoplasmic and nuclear glycogen. Study of Swiderski *et al.*, (2004b) on *Khawia armeniaca* reported the lamellar granules in the cytoplasm of this Caryophyllidean Cestode. Swiderski *et al.* (2009) work on *Wenyonia virllis* found moderate accumulations of cytoplasmic glycogen. In addition, Swiderski *et al.*, (2011) work on Diphyllidea *Echinobothrium euterpes* noticed a large amount of glycogen accumulations around the large, saturated lipid droplets of maturing and mature vitellocytes. Swiderski *et al.*, (2006a) work on *Trypanorhyncha Dollfusiella spinulifera* found very few glycogens in the cytoplasm. Many investigators ; Swiderski and Mokhtar (1974); Mokhtar-Maamour and Swiderski (1976); Swiderski and Subilia (1978); McKerr (1985); Bruňanská M., (1997); Swiderski *et al.*, (2000), Koeneva (2001), Swiderski *et al.*, (2006 b),

Swiderski *et al.*, (2007) and Levron *et al.*, (2007) discussed the ultrastructure of the vitellocytes in the following species: *Grillotia erinaceus*, *Paracharistianella trygonis*, *Echeneibothrium beaulchampi*, *Progillotia pastinace*, *Bothriocephalus clavibothrium*, *Paraechinophallus japonicus*, *Proteocephalus longicollis*, *Inermicapisifer madagascarinensis*, *Triaenophorus nodulosus*, *Catenotaenia pusilla*, *Moniezia expansa*, *Proteocephalus exiguous* and *Mosgovoyia ctenoides* and compared their contents.

The discovery that lipids vary in the vitellocytes of different families raised important questions regarding factors determining lipid types, functional significance and what role they might have in assessing evolutionary relationships at any level. As the nutrient reserves are related to the ecology and life cycle in some species and its accumulation in the vitellocytes may deflect the adaptation to the parasitic way of life in different groups of Cestodes, Swiderski and Xylander (2000).

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Parasitology Research, 74,363-370., Dol: 10.1007/bf00539459.

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**P15INK4B Gene Methylation In Acute Lymphoblastic Leukemia And Its Prognostic Value**

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**Abstract:** P15<sup>INK4B</sup> is a tumor suppressor gene. Inactivation of the p15 occurs due to hyper-methylation of CpG (cytosine phosphodiester bond guanine) islands in their promoters or by deletions in the 9p21 region and is associated with loss of cell cycle control and aberrant proliferation of tumor cells. This study was conducted on 72 newly diagnosed patients with Acute Lymphoblastic Leukemia. A group of 30 apparently normal healthy children and adults of matched age and sex were also included. Methylation specific-polymerase chain reaction for assessment of methylation status of p15 in peripheral blood lymphocytes was done. 26 (36%) of patients showed complete methylation of p15 and 34 (47%) showed partial methylation while 12 (17%) showed unmethylation of p15. In the adults group 30 out of 42 cases died by the end of the follow up period with statistical significant impact of age, immunophenotype and p15 methylation status on OS were found (p= 0.02, 0.04 & 0.0002 respectively). This result indicate that methylation of p15 is a common phenomenon in ALL. We found that the mortality rate was higher among patients with p15 methylation., these findings may highlight the importance for screening for these abnormalities in ALL patients to identify patients with high risk. Prospective knowledge of pretreatment methylation may help determine candidate patients for demethylating therapies.

[Hanaa Mohamed Afifi; Naglaa Mohamed Kholoussi; Abeer Attia Saad; Waheeba Zarouk; Rania El-Bialy Esmail Shaisha and Rasha I Ibrahim. **P15INK4B Gene Methylation In Acute Lymphoblastic Leukemia And Its Prognostic Value.** *Life Sci J* 2012;1414-1420]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 206.

**Key words:** acute lymphoblastic leukemia; P15 methylation; methylation specific-polymerase chain reaction.

**1. Introduction**

Acute lymphoblastic leukemia is an acute sudden onset, rapidly progressing form of leukemia. ALL originates in a single B or T lymphocyte progenitor [1]. Tumor suppressor genes protect cells from undergoing malignant transformation. If these genes, as a result of inherited or acquired mutations, become unable to function, this will lead to neoplastic transformation. Epigenetic events, such as methylation, represent a distinct mechanism of tumor suppressor gene inactivation [2]. Aberrant methylation of tumor suppressor genes is observed frequently in human malignancies [3]. Thus, aberrant methylation serves as an alternative mechanism of gene inactivation in neoplasia [4].

A vast amount of knowledge has been gained about altered methylation patterns in human cancers. Tumor-specific methylation changes in different genes have been identified and documented. The potential clinical application of this information is in cancer diagnosis, prognosis, and therapeutics [5].

The sensitivity and specificity of DNA methylation markers in cancer diagnosis depends on several factors, including the type of cancer and the gene to be studied, the type of body fluid to be used, and the technique involved [6].

P15<sup>INK4B</sup> is a tumor suppressor gene at chromosome 9p21 encodes a cyclin dependent kinase inhibitor. That inhibit activated Cyclin-dependent kinases (CDK) 4/6 complexes which control the cell cycle by phosphorylation and inactivation of Rb, leading to release of transcriptional factors necessary for entry into S-phase ( synthesis phase). Inactivation of the p15 is associated with loss of cell cycle control and aberrant proliferation of tumor cells [7].

Inactivation of p15<sup>INK4B</sup> occurs due to hyper-methylation of CpG (cytosine phosphodiester bond guanine) islands in their promoters or by deletions in the 9p21 region [8].

The aim of the present work is to study the frequency of p15 silencing in childhood and adult ALL patients and to evaluate the prognostic value of p15 methylation in ALL.

**2. Material and Methods**

This study was conducted on 72 newly diagnosed patients with Acute lymphoblastic Leukemia (ALL) (50 B-ALL, 22 T-ALL) attending the Hematology Unit of Ain Shams University Hospitals and National Cancer Center within the period from June 2008 till January 2010 with follow up period not less than 24 months for the surviving patients. They were 30 children and 42 adult.

Approval of the ethical committee of the Ain Shams University Hospitals was obtained. A full explanation of the study was provided to the patients or their parents and an informed written consent was obtained according to the committee policy. A group of 30 apparently normal healthy children and adults of matched age and sex were also analyzed.

Diagnosis of ALL was based on peripheral blood (PB) findings, bone marrow (BM) examination and immunophenotyping studies. Immunophenotyping of PB/ BM samples using EPICS XL coulter flow cytometer to detect the FAB category using acute leukemia panel [9].

All adult patients were treated according to the Hoelzer protocol while pediatric patients were treated according to ALL-BFM 90 protocol [10-11]

Complete remission was defined according to criteria reported by Cheson et al. [12] the bone marrow blast count should be <5% at day 28 and revealing normal maturation of all cellular components (i.e., erythrocytic, granulocytic, and megakaryocytic series). A bone marrow biopsy reveals no clusters or collections of blast cells provided that the neutrophils in the PB should exceed  $1 \times 10^3/\mu\text{l}$  and the platelet count should be more than  $100 \times 10^3/\mu\text{l}$  and. Extramedullary leukemia (eg, central nervous system or soft tissue involvement) must be absent.

#### **Assessment of p15 methylation status by methylation specific-PCR:**

Two mL of fresh venous blood sample were collected in sterile EDTA-treated tubes for assessment of methylation status of p15 in PB lymphocytes by methylation specific-PCR [7]. DNA extraction from whole blood samples was performed using salting out technique. For sodium bisulfite conversion of unmethylated cytosines in DNA The EpiTect Bisulfite Kit comprises a few simple steps: bisulfite-mediated conversion of un-methylated cytosines; binding of the converted single-stranded DNA to the membrane of an EpiTect spin column; washing; desulfonation of membrane-bound DNA; washing of the membrane-bound DNA to remove desulfonation agent; and elution of the pure, converted DNA from the spin column. The eluted DNA is suited for all techniques currently used for the analysis of DNA methylation (Qiagen). The modified DNA was amplified by primer mediated PCR method for amplification.

Primers used (Primer p15-M) 5'-GCGTTCGTATTTGCGGTT-3' (sense)

5'-CGTACAATAACCGAACGACCGA-3' (antisense)

Primer p15-U5'-TGTGATGTGTTTGTATTTGTGGTT-3' (sense)

5'-CCATACAATAACCAACAACAA-3' (antisense).

PCR master mix: Each sample was carried in 2 (200 $\mu\text{L}$ ) PCR tubes one containing the following:

(RNase-free water, L DNTPs (2 $\mu\text{M}$ ), 10x buffer, Mgcl, p15-M(sense), p15-M (antisense), HotStarTaq polymerase and template DNA. PCR protocol for amplification was with the following cycling program 95°C for 15 minutes (initial denaturation step) for 1 cycle. Then, the following was done for 40 cycles: 95°C for 30 seconds (denaturation). 58°C for 1 minute (annealing). 72°C for 1 minutes (extension). Then, 72°C for 10 minutes. Then, holding at 4°C was done.

Agarose gel and polyacrylamide gel electrophoresis are used to separate molecules. Amplified products of controls and patients' samples were run on 3% agarose gel and 8% polyacrylamide gel when needed both were stained with ethidium bromide. A DNA molecular weight marker (consisting of 11 fragments with the following sizes: 72, 118, 194, 234, 271, 281, 310, 603, 872, 1078, and 1353) was also run to identify the site of bands.

Then the gel was removed from the stain and examined on UV transillumination and viewed through protective goggles.

#### **Statistical analysis**

Data were collected, verified, revised and edited on personal computer. The data were analysed statistically using (SPSS) using statistical package version 16.

The following tests were done: Description of quantitative variables as mean $\pm$ SD, median and range and description of qualitative variables as number and percent; Chi-Square test ( $\chi^2$ ) and Fisher exact test: (was performed in table containing value less than 5) was used to compare between p15 methylation and sex, immunophenotype, the presence of liver and spleen enlarged; ANOVA test was done to compare between P15 methylation status as regards Hb concentration PB and BM blast %; Non parameteric test (Kruskal-Wallis test) was used to compare between p15 methylation status as regards age, TLC and platelet count; Overall survival (OS) analysis and disease free survival (DFS) was performed at the univariate level by means of Kaplan-Meier techniques and Log-rank test was used to calculate P value; Variables significantly related to OS were then included in the multivariate Cox proportional hazard regression model. Probability or p value of <0.05 was considered statistically significant. The end-point of the study was OS which was calculated from the date of diagnosis until last follow-up or death.

### **3. Results**

The results of the present study are shown in tables (1-4) and figures (1&2). The study included two main groups: patients group (n=72) including newly diagnosed cases of ALL with follow up period



not less than 24 months for surviving patients. They were 30 children 10 girls and 20 boys, with age range from 18 month to 12 years, and 42 adult 18 females and 24 males, with age range from 18 to 63 years. Additionally, control group (n=30) of normal age and sex matched healthy children and adults. This group comprised 12 children, 8 females and 4 males, with age range from 1 to 12 years and 18 adult 9 female and 9 males, with age range from 19 to 57 years.

In this study the studied patients were divided according to methylation of p15 into three groups unmethylation (group I), partial methylation (group II) and methylation (group III).

#### Comparison between cases and control as regard methylation of p15:

In comparison between cases and control groups as regard methylation of p15 it was found that 20 (66.7%) of the control group showed unmethylation and 10 (33.3%) showed partial methylation while in patients group, 26 (36%) showed complete methylation, 34 (47%) showed partial methylation and 12 (17%) showed unmethylation (**Figure1**). This revealed statistical significant difference ( $X^2=28.655$ ,  $p<0.001$ ).

#### Association between p15 methylation and studied clinical and laboratory data in all patients :

A statistical significant associations between p15 methylation status and the presence of liver enlarged and both PB and BM blast percent were found ( $p<0.001$ ,  $p=0.001$  respectively). While there was statistical insignificant difference between the 3 groups as regard age, gender, total leucocyte count (TLC), mean hemoglobin (Hb) concentration, median platelets count, immunophenotype of ALL and the presence of spleen enlarged ( $p>0.05$ ) (Table 1).

#### Association between p15 methylation and studied clinical and laboratory data in children and adults groups:

In children group, age, presence of hepatomegaly and PB blast percent were significantly related to p15 methylation status ( $p=0.005$ , 0.007 and 0.01 respectively). While, in adults group, statistical significant associations between p15 methylation status and age, gender, median platelet count, both PB & BM blast percent and immunophenotype of ALL were found ( $p= 0.001$ , 0.02, 0.04, 0.001, 0.001 and 0.02 respectively)(Table 2).

#### Impact of p15 methylation status on survival

OS was estimated from the time of diagnosis to the date of death. DFS was estimated from the time of first complete remission to relapse or death. As regards OS in the children group, only 4 out of 30 cases died by the end of the follow up period; one patient died early after the induction therapy and the other 3 cases died after relapse. This small number caused futility of the statistics. On the other hand, in the adults group 30 out of 42 cases died by the end of the follow up period with statistical significant impact of age, immunophenotype and p15 methylation status on OS were found ( $p= 0.02$ , 0.04 & 0.0002 respectively). Nevertheless, univariate analysis showed that P15 methylation status was insignificantly related to DFS in adults group ( $p=0.1$ )( Tables 3,4 and Figure 2)

#### Multivariate regression analysis:

Univariate analysis showed that age, immunophenotype and P15 methylation were significantly related to the risk of mortality in adults group ( $P<0.05$ ). When these factors entered in a multivariate Cox Regression analysis only the P15 methylation status was the only influencing factor (95% Confidence Interval 1.326-4.451;  $P=0.004$ ).

**Table (1):** Association between p15 methylation status and clinical & laboratory data of all patients.

Parameter	Group I	Group II	Group III	P
N(%)	12	34	26	
Med. Age: years	19	11	23	.1
Male	8(18)	18(41)	18(41)	.4
Female	4(14)	16(57)	8(29)	
HM: No	0	12(100)	0	<.001
Yes	12(20)	22(37)	26(43)	
SM: No	4(18)	14(64)	4(18)	.09
Yes	8(16)	20(40)	22(44)	
Med.TLC: $10^3$ /cmm	20	36	50	.1
Hb: gm/dl (mean±SD)	8.1±.8	7.8±.2	8.5±2.7	.3
Med. Plt: $10^3$ /cmm	147.5	60	71	.08
PB blast% (mean±SD)	57.5±24.1	55.6±18.9	74.2±14.9	.001
BM blast % (mean±SD)	77.2±9.9	76.5±12.9	87.7±8.3	.001
B-ALL	6(12)	24(48)	20(40)	.2
T-ALL	6(27)	10(46)	6(27)	

N= number; Med.= median; HM= hepatomegaly; SM: splenomegaly; TLC= total leucocytic count; Hb= hemoglobin; Plt: platelet count; PB= peripheral blood; BM=bone marrow; ALL: acute lymphoblastic leukemia.

**Table (2):** Relation between p15 methylation status and clinical & laboratory data in both children and adults groups.

Parameter N(%)	Children group				Adult Group			
	Group I(4)	Group II(20)	Group III(6)	P	Group I(8)	Group II(14)	Group III(20)	P
Age: years (mean±SD)	11.5 ±0.6	5.9 ±3.6	9 ±1.8	.005	22 ±3.2	44.6 ±13.8	32.3 ±13.1	.001
Male	2(10)	14(70)	4(20)	.7	6(25)	4(17)	14(58)	.02
Female	2(20)	6(60)	2(20)		2(11)	10(56)	6(33)	
HM: No	0	12(100)	0	.007	0	0	0	#
Yes	4(22)	8(44)	6(34)		8(19)	14(33)	20(48)	
SM: No	2(13)	12(74)	2(13)	.5	2(33)	2(33)	2(33)	.5
Yes	2(14)	8(57)	4(29)		6(17)	12(33)	18(50)	
Med. TLC 10 <sup>3</sup> /cmm	42.5	45	52	.8	20	36	45	.1
Hb: gm/dl (mean±SD)	8.2 ±.9	7.8 ±2.5	10.5 ±4.3	.1	8 ±0.8	7.9 ±1.2	8 ±1.7	.9
Med. Plt 10 <sup>3</sup> /cmm	163	85	133	.5	140	29	50	.04
PB blast: % (mean±SD)	82.5 ±2.9	55.5 ±17.2	66.7 ±13.7	.01	45 ±19.2	55.9 ±21.8	76.5 ±14.9	.001
BM blast: % (mean±SD)	89 ±1.2	75.5 ±12	84.3 ±12.8	.06	71.3 ±5.8	78 ±14.5	88.7 ±6.4	.001
B-ALL	4(17)	16(66)	4(17)	.4	2(8)	8(31)	16(61)	.02
T-ALL	0	4(67)	2(33)		6(20)	6(40%)	4(40)	

N= number; Med.= median; HM= hepatomegaly; SM: splenomegaly; TLC= total leucocytic count; Hb= hemoglobin; Plt: platelet count; PB= peripheral blood; BM=bone marrow; ALL: acute lymphoblastic leukemia. # No measures of association are computed. One variable upon which measures of association are computed is a constant.

**Table (3):** Impact of different studied parameter on overall survival in adults groups.

Parameter (N)	Mean for OS		Mortality rate %	95% CI	Log Rank test	P
	Estimate	SE				
Age (years)					5.01	.02
<50 (32)	13.0	2.2	62.5	8.7-17.3		
>50 (10)	5.8	3.0	100	0.0-11.8		
Male (24)	12.4	2.6	66.7	7.4-17.5	.41	.5
Female (18)	9.6	2.6	77.8	4.6-14.6		
TLC(10 <sup>3</sup> /cmm)					0.0	.9
<50 (28)	10.5	2.2	71.4	6.3-14.8		
>50 (14)	12.3	3.4	71.4	5.7-18.9		
B-ALL (26)	7.8	2.0	84.6	3.9-11.7	3.97	.04
T-ALL (16)	16.8	3.2	50	10.6-23.0		
P15					17.1	.0002
Group I (8)	25.8	.5	0	24.6-26.9		
Group II (14)	8.3	2.6	85.7	3.3-13.3		
Group III (20)	6.6	2.2	90	2.2-10.9		

N= number; TLC= total leucocytic count; OS: overall survival; SE: standard error; CI: confidence interval.

**Table (4):** Impact of different studied parameter on DFS in adults groups.

Parameter (N)	Mean for OS		Mortality rate %	95% CI	Log Rank test	P
	Estimate	SE				
Age (years)					2.82	.09
<50 (32)	14.3	2.3	53.1	9.9-18.8		
>50 (10)	4.2	2.7	80	0.0-9.4		
Male (24)	12.5	2.6	62.5	7.4-17.6	.05	.8
Female (18)	11.6	3.1	55.6	5.6-17.5		
TLC(10 <sup>3</sup> /cmm)					.11	.7
<50 (28)	12.1	2.3	60.7	7.5-16.6		
>50 (14)	11.6	3.6	57.1	4.6-18.6		
B-ALL (26)	10.0	2.5	61.5	5.1-14.9	.39	.5
T-ALL (16)	15.5	3.1	56.3	9.5-21.5		
P15					4.09	0.1
Group I (8)	24.1	.9	37.5	22.3-25.9		
Group II (14)	10.7	3.3	57.1	4.2-17.2		
Group III (20)	8.1	2.8	70	2.7-13.5		

N= number; TLC= total leucocytic count; OS: overall survival; SE: standard error; CI: confidence interval.

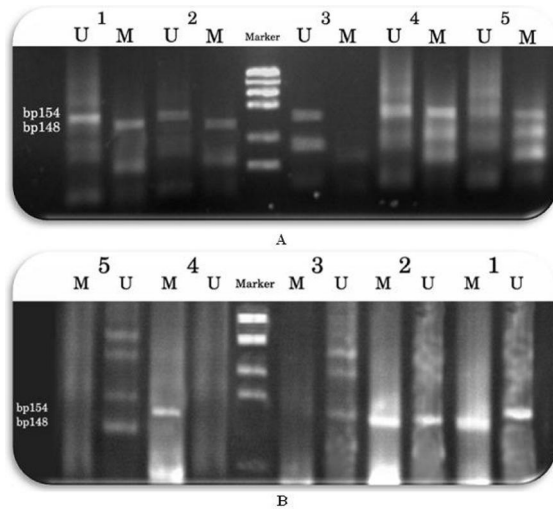


Figure 1. A: Agrose gel: Sample 5: complete methylation as the PCR products showed a specific band at 148 bp with no band at 154 bp (the amplified products only occurred with the methylated primer set); Sample 3: unmethylation as the amplified products only occurred with the unmethylated primer set at 154bp; Samples 1, 2 and 4: partial methylation as the amplified products occurred with the unmethylated and methylation primer set at 154 bp and 148 bp, respectively. B: polyacrylamid gel. Samples (1&2): partial methylation; Samples (3&5): unmethylation; Sample (4): methylation.

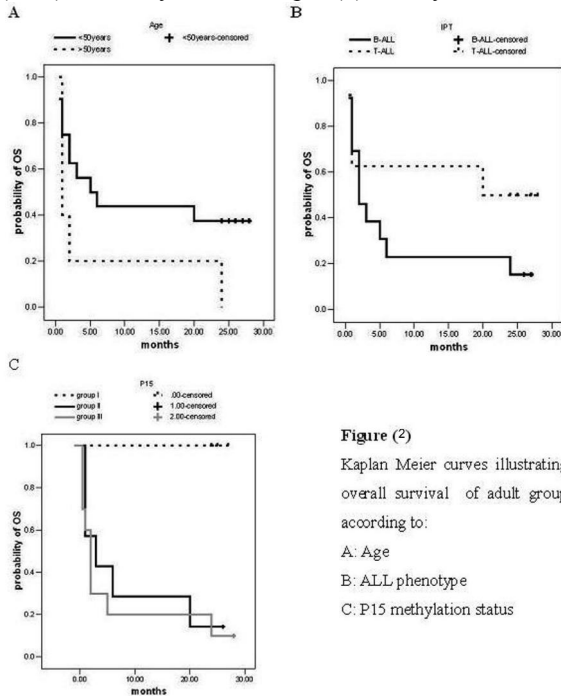


Figure (2)  
Kaplan Meier curves illustrating overall survival of adult group according to:  
A: Age  
B: ALL phenotype  
C: P15 methylation status

#### 4. Discussion

The aim of the present work was to study frequency of p15 silencing in childhood and adult

ALL patients. Moreover, we aimed to evaluate prognostic value of p15 methylation in ALL.

In this study, 72 newly diagnosed children and adult ALL patients were studied for the presence of p15 methylation using methylation specific PCR technique because of its high sensitivity (up to 0.1%) with no false positive results and it is possible to obtain result from small amounts of DNA [13]. Follow up of patients was carried out over a period not less than 24 months for surviving patients.

In this study, we found that 20/30 (66.7%) of the control group had unmethylation of p15 and 10/30 (33.3%) had partial methylation which is nearby to results obtained by Tsellou *et al.* [14] who categorized the control subjects into 2 groups only unmethylation and methylation and detected the methylation in 2/10 (20%). However, Canalli *et al.* [15] and Chen & Wu [7] who studied smaller number of normal healthy subjects did not detect methylation of p15 gene in control groups. This controversy may be due to different methods used for detection of p15 methylation and different numbers of the studied subjects.

Regarding the distribution of p15 methylation in the studied patients, we found that partial methylation was detected in 47% and complete methylation was detected in 36% of the patients. This results were higher than Canalli *et al.* [15] and Jose *et al.* [16] who found that the incidence of p15 methylation was 26% (19/73) and 29% (73/251) respectively). However, Wong *et al.* [17] found that the incidence of p15 methylation was 50% (17/34). This difference may be due to different characteristics and number of the studied patients.

Moreover, in the present study, there was a trend for higher p15 complete methylation distribution among the adult group where 47.6% was completely methylated in adult. While in children 20% only was completely methylated. This is in accordance with Wong *et al.* [17] who studied p15 methylation using methylation specific PCR and reported that p15 methylation in children was 8/21 (38%) and in adults was 9/13 (69.2%). Again Garcia-Manero *et al.* [18] using bisulfate modification and PCR with restriction enzyme found that p15 methylation in children was 4/16 (25%) and in adult was 19/61 (31.1%). This is confirmed by Jose *et al.* [16] who assessed p15 methylation with methylation specific PCR and found statistical significant difference between the methylation profile in adult and children with more frequent p15 methylation in adult ALL than in children ALL. Besides Canalli *et al.* [15] who assessed p15 methylation with bisulfate modification and PCR with restriction enzyme and found statistical

significance when compared between adult and children as regard p15 methylation.

In this study, we observed statistical significant association between p15 methylation status and the presence of liver enlarged and both PB and BM blast percent. While there was statistical insignificant difference between the 3 groups as regard age, gender, TLC, mean Hb concentration, median platelets count, immunophenotype of ALL and the presence of splenomegaly. This is in line with **Wong et al. [17]** who found lack of correlation between p15 methylation and TLC & **Garcia-Manero et al. [18]** who found no correlation between p15 methylation and age, gender, TLC, Hb%, platelet count and type of ALL.

Studying the children group separately we found that the incidence of complete methylation of p15 was more frequent in T ALL patients than B ALL (33% and 17% respectively) although the *p* value did not reach statistical significance. This is in line with **Tsellou et al. [14]** who found that there was a significantly higher proportion of T ALL children patients characterized by p15 INK4B hypermethylation compared with children with B-cell origin ALL.

When the adult group studied separately we found that p15 methylation in B ALL group was 92% (31% were partially methylated and 61% were completely methylated), While methylation of p15 in T ALL group was 80% (40% were partially methylated and 40% were completely methylated). In a study conducted by **Chim et al. [19]**, 56.1% (23/41) of B ALL patients and 62.5% (5/8) of T ALL patients showed p15 methylation. Whereas **Hoshino et al. [20]** found that methylation of p15 in adults with B ALL was 43% (26/70).

In this study univariate analysis showed that p15 methylation were significantly related to the risk of mortality in adults group, the mortality rate was higher in methylated group than in unmethylated group. The same results were obtained by **Jose et al. [16]** and **Roman-Gomez et al. [21]**, who found that the mortality rate and relapse were higher in methylated group than in unmethylated group. While **Chim et al. [19]** who studied 5 years over all survival in adult ALL patients in relation to p15 methylation status found that p15 methylation did not confer any prognostic significance on OS.

In our study univariate analysis showed that age, immunophenotype and P15 methylation were significantly related to the risk of mortality in adults group. When these factors entered in a multivariate Cox Regression analysis the P15 methylation status was the only independent prognostic factor. More to the point **Jose et al. [16]** studied the

methylation status of fifteen genes (including p15) and demonstrated that hypermethylation profile was independent prognostic factor.

In conclusion the results of this study showed that p15 methylation was found in 83% of the studied patients. This result indicate that methylation of p15 is a common phenomenon in ALL.

We found that the mortality rate was higher among patients with p15 methylation where none of the unmethylated patients died by the end of the follow up period. Prospective knowledge of pretreatment methylation may help determine candidate patients for demethylating therapies. Thus, we recommend the following; application of methylation specific PCR (MSP) for detection of DNA methylation because it is specific, sensitive, safe and useful technique, evaluation of the impact of p15 methylation status on patients outcome during diagnosis, remission and relapse for more detection of the effect of methylation on ALL patients, assessment of p15 methylation status in combination with other gene in order to detect distinct subsets of patients with ALL which could be identified based on their methylation characteristics.

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5/2/2012



**Spirometric indices of patients following laparotomic or laparoscopic cholecystectomy: A Comparison Study**

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**Abstract:** Cholecystectomy, due to acute cholecystitis or biliary colic pain, is one of the most common general surgical operations. Pulmonary complications occur in 20-60% of patients who are undergoing abdominal surgery. Lung is the organ most at risk of postoperative complications. The purpose of this study is the comparison of spirometric parameters in patients following laparoscopic or laparotomic cholecystectomy. this descriptive-analytic study done on 60 patients referred to hospital for cholecystectomy. Patients randomly divided into two groups: laparoscopic cholecystectomy (n=30) and laparotomic cholecystectomy (n=30). Spirometric indices were collected before and 24 hours after operations. Data were analyzed using SPSS software. Data considered significant at the level of  $p < 0.05$ . the mean of spirometric indices including FEV1, FVC and PEF25-75% of both groups were decreased after surgery in comparison to amounts before surgery which were significant only in laparoscopic group ( $P < 0.05$ ). Several mechanisms cause reduced pulmonary function after upper abdominal surgery. Reductions in spirometric indices were significantly lower in laparoscopic group and patient's pulmonary function was better after laparoscopic cholecystectomy.

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**Keywords:** cholecystectomy, laparotomy, laparoscopy, pulmonary function

**Introduction:**

Cholecystitis is the inflammation of gallbladder, which commonly occurs due to stone-induced bile duct obstruction (1, 2). Cholecystectomy due to acute cholecystitis or biliary colic pain is one the most common operations done by general surgeons (2, 3). Pulmonary complications rate following abdominal; surgery is 20-60% and pulmonary function tests decrease apparently after upper abdominal surgery (3-7). Laparotomic cholecystectomy leads to inefficiency of pulmonary function, which increases the risk of pneumonia and atelectasis. Laparoscopic cholecystectomy is the method of choice for treatment of symptomatic cholecystitis, in which the patient tolerates less pain and duration of hospital stay, smaller skin incisions and faster recovery in comparison to laparotomic cholecystectomy. On the other hand,

administration of carbon dioxide (CO<sub>2</sub>) gas in laparoscopy may increase the abdominal pressure, which may finally lead to impairment of pulmonary function. So, this method is not recommended in patients with impaired pulmonary function (1). So, as both of the the so-called surgical methods may lead to some extents of pulmonary function impairment, we designed this study to compare spirometric indices of patients following laparotomic or laparoscopic cholecystectomy.

**Material & Methods:**

In our descriptive-analytic study, we studied 60 patients referred to Ali-Ebne-Abitaleb hospital for cholecystectomy during years 2008-2010. Spirometry was done before and 24-hours after surgery and data



were collected. We explained the aim of study for each patient by clarification of benefits and side effects of two surgical methods (laparotomy and laparoscopy) for cholecystectomy. We explained for the patients that the selection of surgical method would be based on randomization. After signing out the written informed consent, surgical operation was done.

Based on randomly selected quaternary block sizes method, patients were randomly divided into two groups: 1. laparoscopy (n=30) and 2. Laparotomy (n=30). Sex and age matching was done for both groups.

Data were analyzed using SPSS software V.17. Student T-test used for determination of relation between two variables. Descriptive data were expressed as mean  $\pm$  SD. The statistical significance level considered as  $P < 0.05$ .

Spirometric indices that were considered in our study including FEV1=Forced expiratory volume in one second, FVC= Forced vital capacity, PEF=Peak expiratory flow rate and FEF25-75%= Forced expiratory flow at 25% to 75%. Spirometry performed by someone who was not aware of its objectives. Standard general anesthesia was done for both groups and then, laparotomy or laparoscopy was done. Laparoscopic cholecystectomy started with an incision beneath the umbilicus, then a trocar inserted into peritoneum cavity and carbone dioxide gas injected in order to increase the abdominal pressure to 14 mmHg.

Then port No.10 and laparoscope camera inserted, and then three 1 cm length incisions created on the right costal margin for insertion of laparoscope trocars. At the end of cholecystectomy, all trocars brought out, CO<sub>2</sub> gas evacuated, and then the abdominal wall incisions were closed. In laparotomy method, cholecystectomy done through a 10-12 cm length abdominal incision under right costal margin (Kocher incision) and then the incision was sutured. 24 hour after surgery, spirometry was done for all patients and data inserted into SPSS software V.17 for further analysis.

We included the patients aged 30 years and older with symptoms of cholecystitis which was approved by sonography and candidated for elective cholecystectomy to our study. Exclusion criteria were: age of 65 years or older and less than 30 years, Body Mass Index (BMI) more than 30, past medical history of cardiopulmonary diseases, abnormal PFT (<75% proportionate to age, sex and weight) and smoking of more than 10 cigarettes per day.

### Results:

From 60 patients' candidate of cholecystectomy, 30 were tolerated laparoscopy and 30 were tolerated laparotomy. The mean change of FEV1 in laparoscopic method was significantly less than laparotomy (0.66 $\pm$ 0.28 versus 1.9 $\pm$ 0.39 respectively) ( $P < 0.05$ )

(Table.1). The mean change of FVC parameter in laparotomy-tolerated patients was significantly more than changes of this parameter in patients tolerated laparoscopy (1.16 $\pm$ 0.11 versus 0.83 $\pm$ 0.2 respectively) ( $P < 0.05$ ) (Table.2).

We also found that the mean change of FEF 25-75% in laparotomy method is significantly more than laparoscopy method (0.75 $\pm$ 0.28 versus 0.39 $\pm$ 0.11 respectively) ( $p < 0.001$ ) (Table.3). About the mean change of PEF, it was significantly higher in patients after laparotomy (1.84 $\pm$ 0.86) in comparison to laparoscopy method (1.28 $\pm$ 0.08) ( $P < 0.001$ ) (Table.4). The mean changes of FEV1/FVC in laparoscopy was 0.06 $\pm$ 0.01 which was significantly less than this amount in laparotomy group (0.1 $\pm$ 0.08) ( $P < 0.001$ ) (Table.5).

### Discussion:

In the study of Sandeep and colleagues in 2007, 60 patients were tolerated cholecystectomy equally divided into two groups: laparoscopy and laparotomy. PFT with spirometer before and after surgery revealed better function of lung in laparoscopy method in comparison to laparotomy (3). In another study, Ravimohan and colleagues in 2005, compared PFT, chest x-ray (CXR) and arterial blood gas (ABG) of 40 patients tolerated laparoscopic cholecystectomy with 15 laparotomic ones. The result of their study recommended that the above-mentioned tests had better values in patients tolerated laparoscopic cholecystectomy (4).

A study in 2006 by Bablekos and colleagues conducted a clinical trial of 28 patients tolerated cholecystectomy, 18 with laparoscopy method and 10 with laparotomy method. Comparison of PFT 24 hours after surgery revealed a decrease in both groups while these changes were apparent only in laparotomy group after 8 days post-surgery (5). In another similar study, Hasukić and colleagues in 2002 conducted a clinical trial with 60 patients candidate of cholecystectomy who were equally divided into two groups of laparoscopy and laparotomy. PFT, CXR and ABG done for both groups and their values comparison revealed a significantly better FEV1 and FVC in patients tolerated laparoscopy (6).

In another clinical trial in 2000, Mimica and colleagues found that PFT and ABG of the patients tolerated laparoscopic cholecystectomy (n=50) were significantly better than patients tolerated laparotomic method (7).

In the clinical trial of Hendolin and colleagues in 2000, 47 patients tolerated cholecystectomy divided into laparoscopy (n=22) and laparotomy (n=25). They found that post-surgical pain and length of hospital stay were significantly less in laparoscopy group in comparison to laparotomy group while patients tolerated laparoscopic cholecystectomy had better pulmonary function after surgery (8). Similarly, Coskun and colleagues in 2000 in a clinical trial on 53 patients found that laparoscopic

cholecystectomy leads to better pulmonary function after surgery in comparison to laparotomic cholecystectomy (9).

Upper abdominal surgery apparently changes the pulmonary function that could be attributed to general anesthesia or the surgical process.

Due to decreasing lung volume, developing a pulmonary shunt and changing of lung mechanics, general anesthesia can lead to changes in respiratory gas exchange. Although, result of recent studies revealed that this effect is temporarily and would be fade during the 24 hours after surgical process. But upper abdominal surgery has more apparent and prolonged effect on pulmonary function which may prolongs even for 10 days after surgery (10).

#### Conclusion:

In this study, the mean changes in FEV<sub>1</sub>-FVC-PEF25-75% of all patients 24 hours post-surgery in both laparoscopy and laparotomy groups were reduced in comparison to the amounts of before surgery. However, the mean changes in all these parameters were significantly lower in laparoscopy group. This is consistent with previous studies.

Several mechanisms can cause pulmonary function to diminish apparently after upper abdominal surgery including surgical incisions and post-operative pain. During the surgical incision of right costal margin for cholecystectomy, abdominal wall muscles are cut. Since the abdominal muscles have an effective role in deep breathing and effective cough, cut off these muscles could be one of the leading causes of changes in pulmonary function tests after surgery. Naturally, the difference in length of surgical incision in laparoscopy method in comparison to laparotomy may lead to a significant better pulmonary function in patients of laparoscopy group. Instead of a large incision, surgeons create only four small incisions for laparoscopy. Therefore, the abdominal wall muscle dysfunction and pain after laparoscopic surgery is the least. Another reason for these changes is diaphragmatic dysfunction. Diaphragmatic dysfunction could be due to pain, increased tonicity of abdominal wall or manipulation of phrenic nerve during cholecystectomy, which is more apparent in laparotomy method.

the mean changes of FEV<sub>1</sub>/FVC ratio decreased in both group but in laparoscopy group, it was significantly less than laparotomy group ( $p < 0.001$ ). FEV<sub>1</sub>/FVC ratio is helpful in differentiation of obstructive from restrictive lung diseases. This ratio is decreased in obstructive lung diseases while is normal or increased in restrictive ones (6, 10).

In our studied population, mean PEF variation decreased compared to before surgery in both groups of patients, but this change in the laparoscopic group was significantly lower ( $p < 0.001$ ). PEF decrease could be

explained by impairment in cough mechanism. Among the laparotomy group patients, this dysfunction is more pronounced due to impaired abdominal muscle dysfunction and larger incisions' induced pain, which could lead to a significant different pulmonary function among laparotomy and laparoscopy groups.

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**Table 1.** Comparison of FEV<sub>1</sub> in laparoscopic versus laparotomic cholecystectomy

Type of surgery	Before surgery (mean±SD)	After surgery (mean±SD)	Mean changes (mean±SD)
Laparoscopy	3.06±0.42	2.30±0.54	<b>0.66±0.28<sup>a</sup></b>
Laparotomy	3.03±0.41	1.13±0.38	<b>1.9±0.39<sup>b</sup></b>

All data are represented mean±SD. <sup>a,b</sup>Data considered significant at the level of p<0.05.

**Table 2.** Comparison of FVC in laparoscopic versus laparotomic cholecystectomy

Type of surgery	Before surgery (mean±SD)	After surgery (mean±SD)	Mean changes (mean±SD)
Laparoscopy	3.52±0.65	2.64±0.60	<b>0.83±0.20<sup>a</sup></b>
Laparotomy	3.73±0.50	2.56±0.52	<b>1.16±0.11<sup>b</sup></b>

All data are represented mean±SD. <sup>a,b</sup>Data considered significant at the level of p<0.05.

**Table 3.** Comparison of FEF<sub>25-75%</sub> in laparoscopic versus laparotomic cholecystectomy

Type of surgery	Before surgery (mean±SD)	After surgery (mean±SD)	Mean changes (mean±SD)
Laparoscopy	1.87±0.56	1.47±0.51	<b>0.39±0.11<sup>a</sup></b>
Laparotomy	1.76±0.30	1.00±0.30	<b>0.75±0.28<sup>b</sup></b>

All data are represented mean±SD. <sup>a,b</sup>Data considered significant at the level of p<0.05.

**Table 4.** Comparison of PEF in laparoscopic versus laparotomic cholecystectomy

Type of surgery	Before surgery (mean±SD)	After surgery (mean±SD)	Mean changes (mean±SD)
Laparoscopy	5.44±01.26	4.15±1.23	<b>1.8±0.08<sup>a</sup></b>
Laparotomy	5.58±0.94	3.74±1.22	<b>1.84±0.86<sup>b</sup></b>

All data are represented mean±SD. <sup>a,b</sup>Data considered significant at the level of p<0.05.

**Table 5.** Comparison of FEV1/FVC ratio in laparoscopic versus laparotomic cholecystectomy

Type of surgery	Before surgery (mean±SD)	After surgery (mean±SD)	Mean changes (mean±SD)
Laparoscopy	0.86±0.01	0.8±0.01	<b>0.06±0.01<sup>a</sup></b>
Laparotomy	0.84±0.03	0.74±0.1	<b>0.1±0.08<sup>b</sup></b>

All data are represented mean±SD. <sup>a,b</sup>Data considered significant at the level of p<0.05.

## The Effect of Positioning on Oxygenation after Coronary Artery Bypass Graft

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**Abstract: Introduction:** Prolonged bed rest is common in critically ill patients, and therapeutic positioning is important to prevent further complications and to improve patient outcomes. **Methods:** This clinical trial study was carried out in Imam Khomeini Hospital, ICU of open heart surgery center, Ahvaz, Iran. Ethical approval for the study was gained from the Ethical Committee of Ahvaz Jundishapur of Medical Sciences (Ethics code: 358). After Informed consent, 60 coronary artery bypass graft patient enrolled in the study. **Result:** Both the PaO<sub>2</sub> and hemoglobin saturation (O<sub>2</sub>Sat) were significantly higher in the left lateral position (PaO<sub>2</sub>=96.4±28.93mmhg, O<sub>2</sub>Sat=95.7±3.32%) than in supine (PaO<sub>2</sub>=84.5±32.1mmhg, O<sub>2</sub>Sat=92.9±5.38%) and right lateral position (PaO<sub>2</sub>=91.7±30.42mmhg, O<sub>2</sub>Sat=94.6±3.93%) and semi sitting position (PaO<sub>2</sub>=83.3±29.23mmhg, O<sub>2</sub>Sat=92.9±5.24%). Repeated measures of ANOVA showed a significant difference in hemoglobin saturation (O<sub>2</sub>Sat) and PaO<sub>2</sub> with posture (p=0.00). PaO<sub>2</sub> and hemoglobin saturation (O<sub>2</sub>Sat) were significantly higher in the left lateral than the other positions. In comparison two by two positions was not found significant difference in hemoglobin saturation (O<sub>2</sub>Sat) for supine and semi sitting (p=0.95). But between other positions were significant difference in hemoglobin saturation (O<sub>2</sub>Sat) (p=0.00). Also in comparison two by two positions in PaO<sub>2</sub> was not found significant difference for supine and semi setting (p=0.7) and supine and right lateral (p=0.057). But between other positions were significant difference in PaO<sub>2</sub> (p<0.05). **Conclusion:** lateral position improves arterial oxygenation in the coronary artery bypass patients, whereas left lateral position was the most effective position in this patients.

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**Key Words:** position, oxygenation, coronary artery bypass graft

### 1. Introduction

Prolonged bed rest is common in critically ill patients, and therapeutic positioning is important to prevent further complications and to improve patient outcomes (7).

Positioning of intensive care patients may be applied to enhance arterial blood oxygenation, promote drainage of respiratory secretions, prevent gastro-esophageal reflux, nosocomial pneumonia and pressure ulcers and/or promote patient comfort (9). Open heart surgery is associated a number of pulmonary or cardiac complications. For example, low in gas exchange, including mainly hypoxia, is one of the commonest problems of patients after open surgery operation in critical care unit (12).

Coronary artery surgery patients are admitted to an intensive care unit (ICU) after surgery. At least the first 12 to 24 hours these patients have to be critically ill and at high risk for complications of immobility like pulmonary complications and pressure ulcers. The current standard of care is to reposition patients every 2 hours. Unfortunately, the majority of critically ill patients do not receive this standard care because a negative influence on the reliability of hemodynamic measurements, and negative effect on oxygenation and on hemodynamic parameter is assumed (7, 11).

Rotation therapy may be effective in altering the distribution of ventilation and perfusion (9, 10). Post studies showed controversial results, In Chan's study (1992) no statistically significant

differences in arterial oxygen were found among supine, right and left lateral position (3).

A beneficial effect of lateral recumbent positions was initially reported in patients suffering from cardiac disease and right lateral position was also recently confirmed to improve hemodynamic in patients suffering from heart failure (19).

In Geogé studies (2002) no differ significantly between supine and lateral position in oxygenation measurements in the immediate postoperative period in single-lung transplant recipients (11).

In Banasik's study, lateral position of post operative cardiac surgery patients appears to cause no detrimental effects on indirect / non invasive blood pressure or heart rate measurements (1).

Lateral decubitus position general discomfort and worses lung function in chronic heart failure (21).

In elderly, mean PaO<sub>2</sub> in sitting position is higher than in supine position (6).

In newest studies report other results, such as: in a study (2007) right lateral posture improves arterial oxygenation in the valvular heart disease patient (21). Also in S. Tongyoo's study (2006) the PaO<sub>2</sub> increased while in the right lateral position in patients whit predominant left pulmonary infiltration (26).either Peter's study indicated lateral position had no beneficial effect on gas exchange in ventilated intensive care patients (21).

Whitman's study (2009) statistically significant differences were found in PaO<sub>2</sub> and Sat O<sub>2</sub> averages in supine and semi sitting positions in postoperative open heart surgery patients (29).

Studies showed (1995 & 88) showed that lateral position (30 °) had negative effect on cardiac index in this position (5, 6).

Considering the different results of oxygenation in various positions, the question is whether different body positions are superior to each for more gas exchange and preventing hypoxia. This study aimed to determine the effect of supine, semi sitting, and right and left lateral positions on oxygenation of hospitalized patients in ICU of open heart surgery center in Ahvaz Imam Khomeini Hospital.

## 2. Methods

This clinical trial study was carried out in Imam Khomeini Hospital, ICU of open heart surgery center, Ahvaz, Iran. Ethical approval for the study was gained from the Ethical Committee of Ahvaz Jundishapur of Medical Sciences (Ethics code: 358).

After Informed consent, 60 coronary artery bypass graft patient enrolled in the study. Inclusion and exclusion criteria were showed in Table 1.

Patient characteristic data include: age, sex, marietal status, level of education and job were collected by interview prior the study.

**Table 1: Inclusion and exclusion criteria**

Inclusion Criteria
<ul style="list-style-type: none"> <li>• <b>Age 40 - 60 year</b></li> <li>• <b>Hemodynamic stability:</b> <ol style="list-style-type: none"> <li>a) <b>Heart Rate :60-130 beat / min</b></li> <li>b) <b>No compromising arrhythmia</b></li> <li>c) <b>No respiratory arrest</b></li> <li>d) <b>Respiratory rate ≥12</b></li> <li>e) <b>Intubated and unconscious patients</b></li> <li>f) <b>Patients undergoing mechanical ventilation</b> <ul style="list-style-type: none"> <li>• <b>Fi O<sub>2</sub>=50%</b></li> <li>• <b>Have intra-arterial line</b></li> <li>• <b>Hemoglobin &gt;10 g/dl</b></li> </ul> </li> </ol> </li> </ul>
Exclusion Criteria
<ul style="list-style-type: none"> <li>• <b>Evidence of chest and spinal trauma</b></li> <li>• <b>Pump time&gt;120 minute</b></li> <li>• <b>Reception of extra liquid</b></li> </ul>

All patients were premeditated with 2cc Sofentanal 15 minute before admitted to ICU. They received oxygen 100% supplementation before procedure. During the intervention, ventilator settings remained constant:

**FiO<sub>2</sub>=50%, F=12, Peep=5, Peressur support=15, Mood= SIMV.**

At first, all patients were lying in supine position and after 30 minute the arterial blood sample baseline were collected via inserted arterial catheter. Then the patients were lying in the different position such as: semi sitting, right and left lateral respectively for 30 minutes and at the end of period, the amount of 1cc a trial blood gas samples were drawn and analyzed immediately (analyzed in premier 3000(American) series machines-Radiometer). Comparison of PaO<sub>2</sub> and hemoglobin saturation (O<sub>2</sub>Sat) values in different positions performed using Bonferroni test.

To determine whether posture brought about significant changes in arterial oxygenation, repeated measures of analysis of variance (*ANOVA*) was used.

## 3. Results

Both the PaO<sub>2</sub> and hemoglobin saturation (O<sub>2</sub>Sat) were significantly higher in the left lateral position(PaO<sub>2</sub>=96.4±28.93mmhg, SaO<sub>2</sub>=95.7±3.32%) than in supine (PaO<sub>2</sub>=84.5±32.1mmhg, O<sub>2</sub>Sat=92.9±5.38%) and right lateral position



( $PaO_2=91.7\pm 30.42$ mmhg,  $O_2Sat=94.6\pm 3.93\%$ ) and semi sitting position ( $PaO_2=83.3\pm 29.23$ mmhg,  $O_2Sat=92.9\pm 5.24\%$ ). Repeated measures of ANOVA showed a significant difference in hemoglobin saturation ( $O_2Sat$ ) and  $PaO_2$  with posture ( $p=0.00$ ).  $PaO_2$  and hemoglobin saturation ( $O_2Sat$ ) were significantly higher in the left lateral than the other positions.

In comparison two by two positions was not found significant difference in hemoglobin saturation ( $O_2Sat$ ) for supine and semi sitting ( $p=0.95$ ). But between other positions were significant difference in hemoglobin saturation ( $O_2Sat$ ) ( $p=0.00$ ). Also in comparison two by two positions in  $PaO_2$  was not found significant difference for supine and semi sitting ( $p=0.7$ ) and supine and right lateral ( $p=0.057$ ). But between other positions were significant difference in  $PaO_2$  ( $p<0.05$ ).

A statistically significant difference on  $PaO_2$  and hemoglobin saturation ( $O_2Sat$ ) was found in different positions.  $PaO_2$  and hemoglobin saturation were significantly higher in the left lateral position: ( $PaO_2=96.4\pm 28.93$ mmhg,  $PaO_2=95.7\pm 3.32\%$ )

Than in supine:

( $PaO_2=84.5\pm 32.1$ mmhg,  $O_2Sat=92.9\pm 5.38\%$ )

And right lateral position:

( $PaO_2=91.7\pm 30.42$ mmhg,  $O_2Sat=94.6\pm 3.93\%$ )

And semi sitting was position:

( $PaO_2=83.3\pm 29.23$ mmhg,  $O_2Sat=92.9\pm 5.24\%$ )

There was significant differences in  $PaO_2$  and hemoglobin saturation ( $O_2Sat$ ) between left and right lateral position ( $P<0/00$ ), semi sitting and right lateral ( $P<0/00$ ), supine and left lateral ( $P<0/00$ ), supine and right lateral ( $P<0/00$ ). no significant differences was found in supine and semi sitting ( $P<0/95$ ).

Patient's characteristics data are shown in Table 2. Both the  $PaO_2$  and hemoglobin saturation ( $O_2Sat$ ) in different positions are shown in Table 3. Both the  $PaO_2$  and hemoglobin saturation ( $O_2Sat$ ) were significantly higher in the left lateral position ( $PaO_2=96.4\pm 28.93$ mmhg,  $PaO_2=95.7\pm 3.32\%$ ) than in supine ( $PaO_2=84.5\pm 32.1$ mmhg,  $O_2Sat=92.9\pm 5.38\%$ ) and right lateral position ( $PaO_2=91.7\pm 30.42$ mmhg,  $O_2Sat=94.6\pm 3.93\%$ ) and semi sitting position ( $PaO_2=83.3\pm 29.23$ mmhg,  $O_2Sat=92.9\pm 5.24\%$ ).

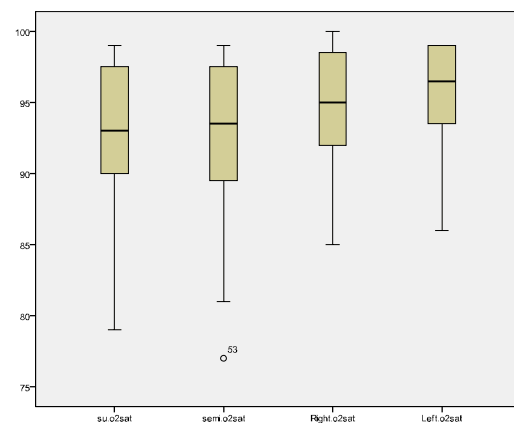
The difference between supine and semi sitting positions was not significant ( $P<0.95$ ).

Repeated measures of ANOVA showed a significant change in hemoglobin saturation ( $O_2Sat$ ) with posture and hemoglobin saturation ( $O_2Sat$ ) were significantly higher in the left lateral than the other positions. In comparison positions two by two

showed that no significant effect was found for supine and semi sitting ( $P<0/95$ ). But between other positions were significant different in hemoglobin saturation ( $O_2Sat$ ).

There was significant difference in  $O_2Sat$  mean between supine position and right lateral position ( $P<0/001$ ), supine position and left lateral position ( $P<0/00$ ), semi sitting position and right lateral position ( $P<0/00$ ), semi sitting position and left lateral position ( $P<0/00$ ) and left lateral position and right lateral position ( $P<0/001$ ).  $PaO_2$  mean was in supine position ( $84.57\pm 32.1$ ), semi sitting position ( $83.357\pm 29.23$ ), right lateral position ( $91.758\pm 30.42$ ), left lateral position ( $96.465\pm 28.93$ ). Repeated measures of ANOVA showed a significant change in  $PaO_2$  in all of the postures and  $PaO_2$  were significantly higher in the left lateral ( $P<0/338$ ) than the other position. There was no significant difference in  $PaO_2$  between supine position whit semi sitting ( $P<0/713$ ) and right lateral position ( $P<0/057$ ).

But the change in  $PaO_2$  was significant between supine position and left lateral position ( $P<0/00$ ) and this amount in left lateral position was higher. In comparison two by two was significant difference in semi sitting position whit right lateral position ( $P<0/00$ ) and semi sitting position whit left lateral position ( $P<0/00$ ) and this amount in lateral position was higher. Also the change in  $PaO_2$  in left and right lateral position was significant and  $PaO_2$  in left lateral position ( $P<0/033$ ) was higher.



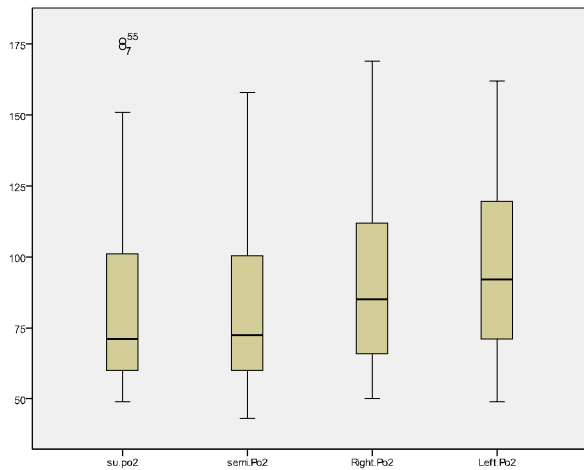
**Fig 1: Comparison between the two conditions in mean  $O_2$  saturation**

#### 4. Discussion

The effect of posture on regional lung function has long interested pulmonary physiologists (12).

Frequent change positions can provide improved ventilation in the lung area and alternating gravitational forces for drainage of mucus from sinus and lung cavities (16).

Gravity causes a vertical gradient in the distribution of pulmonary blood flow such that dependent parts of the lung receive maximal perfusion (12).



**Figure 2: Comparison of PaO<sub>2</sub> in examining both the two conditions**

**Table2. Patient’s characteristics data**

<b>Age (yr)</b>	<b>54.48</b>
<b>Sex (M: F)</b>	<b>20(33.3%)</b>
<b>40(66.7%)</b>	
<b>Education(Elementary, high school , Academic)</b>	<b>39,16,5</b>
<b>Occupation (employee, jobless)</b>	<b>35,25</b>
<b>Marital status ( bachelor, married)</b>	<b>3,57</b>

**Table3: Arterial oxygenation in different positions**

	<b>Supine</b>	<b>semi sitting</b>	<b>right lateral</b>	<b>left lateral</b>
<b>PaO<sub>2</sub></b>	84.5±32.1	83.3±29.23	91.7±30.42	96.4±28.9
<b>O<sub>2</sub>Sat</b>	92.9±5.38	92.9±5.24	94.6±3.93	95.7±3.32
<b>P value</b>	0.00	0.00	0.00	0.00

In the lateral decubitus position , the dependent lung receive greater blood flow than the non-dependent lung (18).In awake spontaneously breathing patients, the dome of the lower diaphragm is pushed higher in to the chest allowing in to contract more efficiently .

Thus, there is no significant ventilation-perfusion are mismatch in this patients are better in the dependent lung.

However, in patients whit cardiomegaly ,the enlarged cardiac chamber may compress lung in the left lateral position in their chest radiographs was

due to other cardiac chamber enlargement .a change posture from supine t left lateral brought about a significant improvement in patients whit severe mitral stenosis whit severe pulmonary arterial hypertension .This possibly due to the posteriori located enlarged left atrium compressing the lung parenchyma, brunch or pulmonary vasculature in the supine position(14).

Study in spontaneously breathing patients whit unilateral lung disease have shown that arterial oxygenation improves whit healthy lung in the dependent position (19, 21).

In patients whit bilateral lung disease arterial oxygenation is best in the right lateral decubitus position. This may be due to the higher anatomic volume of right lung and the minimal compression of lungs by heart in this posture (22).

The mechanism of improvement of oxygenation during positioning may be due to improvement in the ventilation: perfusion mismatch. Gravitational influence causes an increase in blood flow through the well-ventilated non-pathologic dependent lung, whereas there is a decrease in blood flow to the poorly ventilated pathologic lung. This improves the ventilation perfusion mismatch.

There is evidence that dependent lunge in the decubitus position is associated whit a reduction in functional residual capacity when PEEP was no used. PEEP used in the study played a major role in maintaining small airway patency in the dependent lung and preserved alveolar patency (23).

There is evidence to support lateral positioning in patients whit unilateral pulmonary disease, less is known about the effect of lateral positioning on oxygenation in patients whit bilateral pulmonary disease. At 10 to 30 minutes after a lateral position change, cardiac output and heart rate may not be same as in the supine position, but these changes in most mechanically ventilated patients are not clinically significant(8,23,24,25,26).

Early evidence demonstrated that cardiovascular changes can be highly individualized and may be most prominent in patients whit low cardiac output and in patients who are hypothermic and/or receiving vasoactive medications (25).

More recent evidence suggests that lateral positioning of critically ill patients who are hypoxemic or have low cardiac output does not endanger tissue oxygenation (27).

Peter j and co-workers (2006) in study that 33 subjects whit no, unilateral, or bilateral pulmonary infiltrates on chest radiograph participated shown that, lateral positioning had no beneficial effect on gas exchange. However, in ventilated patients who were hemodynamic ally stable. It was well tolerated

and not associated with significant serious adverse events (21).

**Table 4: Comparison of mean differences between the two situations studied and fast criteria in PaO<sub>2</sub>**

Status	Mean differences PaO <sub>2</sub>	Sd	P Value
Couple 1 semi supine, sitting	1.213	25.419	0.713
Couple 2 lying on his back and right lateral	-7.188	28.718	0.057
Couple's 3 lying to the back and left lateral	-11.895	24.250	0.000
Couple 4 semi -sitting, and lying to the right lateral	-8.401	14.575	0.000
Couple 5 semi-sitting and lying to the left lateral	-13.108	20.751	0.000
Couple 6 left and right lateral	-4.706	16.718	0.033

G.D.Puri (2005) in his study showed the effect of different positions (supine, left and right lateral position), on arterial oxygenation in 42 valvular heart disease patients planned for cardiac surgery. In this study right lateral position improves arterial oxygenation in valvular heart disease patients with an enlarged left ventricle (10).

Hardi JA and co-workers (2002) in study tested 46 lung-healthy elderly. They concluded that the significant difference in PaO<sub>2</sub> in sitting and supine positions clearly that the position needs to be considered both when attempting to establish reference values and when evaluating gas exchange in elderly persons (12).

## 5. Conclusion

Lateral position improves arterial oxygenation in the coronary artery bypass patients, whereas left lateral position was the most effective position in these patients.

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## The Effect of Semi Sitting, Supine and Lateral Positions on Results of Arterial Blood Gases and Vital Signs in Patients undergoing Coronary Artery Bypass Graft Surgery

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**Abstract: Introduction:** Imperfect gas exchange, including mainly hypoxia is one of the most common problems of patients after coronary artery bypass surgery in critical care unit. Positioning of intensive care patients may be applied to enhance arterial blood oxygenation, prevent atelectasis and gathering of mucus. Appropriate positioning of the critically ill patient can dramatically improve care unit and outcome. This study aimed to determine the effect of different positions (supine, semi sitting and left and right lateral) on arterial blood gases and vital signs in patients under coronary artery bypass graft surgery. **Method:** In this clinical trial study the effect of four positions on arterial blood gases and vital signs in 60 patients, aged 30-60, after coronary artery bypass graft (CABG), who were receiving mechanical ventilation, and selected via convenience sampling was examined. Arterial blood gas analysis was performed in supine, semi sitting, 30° left and right lateral position after keeping the patients in a given position for 30 minutes. Necessary information's obtained from patients' documents and laboratory results. Data were analyzed by SPSS computer software, version 17 and data were analyzed using repeated measures of ANOVA and bonferroni test. **Results:** statistically significant differences were found in PaO<sub>2</sub> and O<sub>2</sub> Sat averages in different positions (P=0.00). PaO<sub>2</sub> and O<sub>2</sub> Sat values were significantly higher in the left lateral (PaO<sub>2</sub>=96.4 ± 28.93 mmHg, O<sub>2</sub> Sat=95.7 ± 3.32 %) than other positions. But no significant difference was found between BE, HCO<sub>3</sub>, PH, PCO<sub>2</sub> averages (P>0.05). Therefore the averages of BE, HCO<sub>3</sub>, PH, PCO<sub>2</sub> were statistically equal in all positions. Results showed significant differences in averages of respiratory rate, temperature and diastolic blood pressure in four positions (P<0.00). Respiratory rate increased in different positions in turn. However respiratory rate was significantly higher in the left lateral position (14.16 ± 1.75) than other positions. No significant difference was found in heart rate and systolic blood pressure (P>0.05). Therefore the averages of heart rate and systolic blood were equal in all positions. **Conclusion:** Not only change position has not negative effect on patient's vital signs and arterial blood gases, but also applying it improves PaO<sub>2</sub>, O<sub>2</sub> sat and respiratory rate. Lateral position (especially left lateral position) improves oxygenation in this patient after coronary artery bypass graft surgery and there is no contraindication to use it.

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**Key words:** Change position, arterial blood gases, vital signs, coronary artery bypass graft

### 1. Introduction

Imperfect gas exchange, including mainly hypoxia is one of the most common problems of patients after coronary artery bypass surgery in critical care unit (2).

These patients for reasons such as: muscle relaxant drugs, Anesthesia drugs, chest surgery, changes in breathing patterns, pain, fluid retention, increasing the back position for a long time, are always vulnerable to hypoxia and complications from

it, including metabolic acidosis, cerebral edema, pulmonary hypertension, decreased cardiac output, dangerous dysrhythmias, myocardial infarction, tachypnea, increased duration of mechanical ventilation and length of hospitalization (3, 4).

Long periods of bed rest in patients with showing a gradual deterioration in the structure of a body part with a consequent loss of the part's ability to function are common. Another reason for the especially to limit patient movement, different



equipment and pipes connected to a ventilator and monitor. (6).

Prevent complications from immobility, the patient's frequent switching and change positioning is required (7).

Strategy that reduces the side effects are prolonged bed rest, and change the status of clinical nursing care priorities in preventing complications and improving patients has increased (8).

Change in status to prevent bed sores, improve oxygenation, reduce urinary stasis, improve sensory stimulation is effective. Change the status of regional lung ventilation and drainage of mucus from the sinuses and the lung cavities. It also reduces the discomfort caused by immobility; especially back pain is the body. These provide stimulation and exercise therapy may reduce calls in humans (9). Change in status, even during sleep in normal subjects is approximately every 12 minutes, and sensory symptoms in response to rapid changes in body position and movement sense of the term is used to prevent adverse effects (12, 13 and 14).

In reference books, nursing shift patients every 2 hours in patients immobilized with crisis situations, a standard of care nursing. Review doctors sectors in particular shows that 85 percent of their changing status of the patient every 2 hours in specific departments agree are. Nurses should make use of the treatment to prevent complications of immobility.

Several factors such as changes in level of consciousness that will prevent movement (paralysis and sedating s) are resulting from traumatic injuries and surgical complications (open abdominal cavity) causing a long rest patient is in bed (3, 4).

Nursing care and the necessity of these complications placing the patient in good condition to prevent complications and improve patients are aware. In addition, factors such as patient intolerance and hemodynamic instability, as is also (15, 16 and 17). Placing the patient in proper position during surgery is an important part of care.

The purpose of this action was to facilitate the surgical technique and minimize its risks. The appropriate state agencies will be required during the procedure more accessible and respiratory function and blood flow and muscle and skin is protected.

Placing the patient in good condition requires knowledge of anatomical and physiological principles are. Status of the body can create different physiological effects.

Including: change of heart - vascular and respiratory tract is mainly due to the influence of gravity on the distribution of blood flow and pulmonary venous and arterial system occurs. Also changes diaphragm movement due to pressure from

abdominal viscera, including the factors causing respiratory effects in different body positions (19).

## 2. General research

This research framework based on concepts deemed status changes, arterial blood gases, mechanical ventilation, vital signs (blood pressure, pulse, temperature, and breathing), coronary artery bypass and intensive care unit is based.

### 2.1. Study population, sampling and research design

#### A-1 - The type of research

This study is a clinical trial in which the conditions supine, semi sitting and lateral position, arterial blood gas and vital signs results on the side of patients were undergoing coronary artery bypass surgery.

#### A-2 - Community Research Participants

All patients admitted to intensive care, open heart surgery Ahwaz Imam Khomeini Hospital undergoing coronary artery bypass surgery have been constituted.

#### A-3 - Environmental Research

Research environment, open heart surgery intensive care unit of Imam Khomeini Hospital, Ahwaz *Jundishapur* University of Medical Sciences, and Ahwaz is linked to.

#### A-4 - sample

This sampling method was so easy and accessible to patients who were undergoing coronary artery bypass surgery were entered into the study (60 patients) participated in the study.

#### A-5 - Method for calculation of sample size

Sample size using previous studies (40) and using the formula:

$$n = \frac{\left(z_1 - \frac{\alpha}{2} + z_1 - \beta\right)^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

Considering the significance level test,  $\alpha = 0.05$  and the test 90% for detecting at least one standard deviation change in mean variables studied were calculated.

## 2.2. Methods

In this clinical trial study the effect of four positions on arterial blood gases and vital signs in 60 patients, aged 40-60, after coronary artery bypass graft (CABG), who were receiving mechanical ventilation, and selected via convenience sampling



was examined. Arterial blood gas analysis was performed in supine, semi sitting, 30° left and right lateral position after keeping the patients in a given position for 30 minutes. Necessary information's obtained from patients' documents and laboratory results. Data were analyzed by SPSS computer software, version 17 and data were analyzed using repeated measures of ANOVA and Bonferroni test.

After cardiac surgery the patients will be transferred to the ICU. Patients in the first 30 minutes in the supine position (in case of direct head and neck flat on the bed were sick seals Weston and was placed under the head of any means of support) were included.

After this time, an arterial blood sample via arterial catheter that was set in the operating room the patient was taken and vital signs were recorded. For taking arterial blood sample syringe was heparinized after each use blood sample should be analyzed immediately by analyzed with the series 3000 Primer making.

Table (1) was shows that the mean and standard deviation equal to the age of the patients studied  $6.07 \pm 54.48$  respectively.

**Table 1: Mean and SD of the subjects based on age**

SD	mean	No.	Subjects
6.07	54.48	60	

Table (2) shows that 3.33 percent (n = 20) female patients and 66% (40 patients) were male.

**Table 2: Comparison of the frequency distribution of units based on sex**

sex	No.	%
F	20	33.3
M	40	66.7
Total	60	100

**Table 3: Frequency distribution of units based on marital status**

marital status	No.	%
Single	3	5
married	57	95
Total	60	100

### 3. Result

Statistically significant differences were found in PaO<sub>2</sub> and O<sub>2</sub> saturation averages in different positions (P=0.00). PaO<sub>2</sub> and O<sub>2</sub> saturation values were significantly higher in the left lateral (PaO<sub>2</sub>=96.4 ± 28.93 mm. hg, O<sub>2</sub> saturation =95.7 ± 3.32 %) than other positions. But no significant difference was found between BE, HCO<sub>3</sub>, PH, PCO<sub>2</sub> averages (P>0.05). Therefore the averages of BE,

Hco<sub>3</sub>, PH, PCO<sub>2</sub> were statistically equal in all positions. Results showed significant differences in averages of respiratory rate, temperature and diastolic blood pressure in four positions (P<0.00). Respiratory rate increased in different positions in turn. However respiratory rate was significantly higher in the left lateral position ( $14.16 \pm 1.75$ ) than other positions. No significant difference was found in heart rate and systolic blood pressure (P>0.05).

Therefore the averages of heart rate and systolic blood were equal in all positions.

**Table 4: Mean and standard deviation values of arterial blood gases (ABG) in the supine**

ABG	No.	Mean	SD
PH	60	7.36	0.05
PCO <sub>2</sub>	60	40.70	5.64
PaO <sub>2</sub>	60	84.57	32.12
HCO <sub>3</sub>	60	22.87	1.99
BE	60	-2.45	2.29
O <sub>2</sub> saturation	60	92.90	5.38

**Table 5: Mean values of arterial blood gases (ABG) in a semi-sitting criterion**

ABG	No.	Mean	SD
PH	60	7.36	0.05
PCO <sub>2</sub>	60	40.45	5.57
PaO <sub>2</sub>	60	83.35	29.23
HCO <sub>3</sub>	60	22.89	1.88
BE	60	-2.47	2.21
O <sub>2</sub> saturation	60	92.93	5.24

Table (8) shows that the average hard and fast criteria PH supine in the  $7.36 \pm 0.051$ , semi sitting position equal to  $7.36 \pm 0.051$ , on the right lateral position  $7.36 \pm 0.046$  and on the left lateral position was equal to  $7.37 \pm 0.049$ .

For PH status analysis techniques at four positions ((ANOVA)) with repeated measures was used. The error 5% was not significant (P>0.05). The PH value was identical with each other in all situations.

Table (9) shows that the average standard PCO<sub>2</sub> in the supine position with  $40.70 \pm 5.64$ , the semi-sitting position with  $40.45 \pm 5.57$ , on the right lateral position with  $40.29 \pm 4.81$  and in position to the left flank with  $39.85 \pm 4.23$ .

**Table 6: Average values of measure arterial blood gases (ABG) in the right lateral position**

ABG	No.	Mean	SD
PH	60	7.36	0.04
PCO <sub>2</sub>	60	40.29	4.81
PaO <sub>2</sub>	60	91.75	30.42
HCO <sub>3</sub>	60	22.80	2.05
BE	60	-2.53	2.39
O <sub>2</sub> saturation	60	94.63	3.93

**Table 7: Mean arterial blood gas values criteria in the left lateral position**

ABG	No.	Mean	SD
PH	60	7.37	0.049
PCO <sub>2</sub>	60	39.85	4.23
PaO <sub>2</sub>	60	96.46	28.92
HCO <sub>3</sub>	60	23.03	2.14
BE	60	-2.20	2.69
O <sub>2</sub> saturation	60	95.70	3.32

**Table 8: Comparison of criteria PH in different situations**

PH	No.	Mean	Sd	P Value
Supine	60	7.36	0.051	0.371
Semi-sitting	60	7.36	0.051	
Right lateral	60	7.36	0.046	
The left lateral	60	7.37	0.049	

Analysis techniques at four positions ((ANOVA)) with repeated measures used in significant error was 5% (05.0 (P>.

**Table 9: Comparison of standard PCO<sub>2</sub> in different situations**

PCO <sub>2</sub>	No.	Mean	Sd	P Value
Supine	60	40.70	5.64	0.371
Semi-sitting	60	40.45	5.57	
Right lateral	60	40.29	4.81	
left lateral	60	39.85	4.23	

Table (10) shows that the average standard fast PaO<sub>2</sub> in the supine positions (84.57 ± 32.1), semi-sitting (83.357 ± 29.23), lying to the right side (96.465 ± 28) and lying to the left side (. 28 ± 465.96). Results of variance analysis (ANOVA) sided with a 5% error in the duplicate values was significant (P≤0.00). Thus, the PaO<sub>2</sub> in all different situations and the amount of lateral position was more than the other conditions (P<0.338).

**Table 10: Comparison between the various criteria paO<sub>2</sub>**

paO <sub>2</sub>	No.	Mean	Sd	P Value
Supine	60	84.57	32.12	0.00
Semi-sitting	60	83.35	29.23	
Right lateral	60	91.75	30.42	
left lateral	60	96.46	28.92	

Table (11) results barge compared to evaluate differences between mean and standard deviation between different states shows, T statistical methods were used.

The Bonferroni method was used to control Type I error. In this way the possibility of significant levels 0.05 were compared.

Between pairs (1 and 2) there is no significant difference. Both conditions were compared barge that significant differences between conditions supine with a semi-sitting position (713.0> P) and lying to the right side (057.0> P) between supine and back, but there is no left side (00.0> P) is significant, and this value is left lateral position.

Compare pairs of semi-sitting position with the lateral position (00.0> P) and lying to the left side (00.0> P) the difference was significant, and this value was higher in the left lateral positions.

The mean PaO<sub>2</sub> between left and right lateral position was a significant difference and the arterial oxygen pressure in the left lateral position was higher.

#### 4. Discussion

Thus, based on research results, the first hypothesis of the study titled "Effects of the supine position, semi-sitting, and lying to the (right and left lateral) positin on arterial blood gas results in different subjects", the parameters PaO<sub>2</sub> and O<sub>2</sub> saturation can be approved.

The results were also observed in the flank position, PaO<sub>2</sub>, and O<sub>2</sub> saturation levels of the other conditions were reported (especially the left lateral side) after coronary artery bypass surgery causes further improve oxygenation in these patients and are contraindicated in patients with this condition.

G.D.Puri and colleagues (2005) showed impact on regional lung function has long been of interest to physiologists. Shift is causing changes in respiratory gases. Most favorable exchange between carbon dioxide and oxygen in the Alveolus lungs occurs when the ratio of emissions to air in the tissue is normal and circulation areas with the best ventilation are the best. Placing the patient in side lying position due to increase lung perfusion under gravity was, when the patient is asleep to it. Thus, ventilation and perfusion is increased (4).

Gizella I.Bardoczky Studie (2008) evidence of the effectiveness of status changes on the arterial blood gas values. This research to impact on Fio<sub>2</sub> status in patients with chronic lung during lung surgery was performed. 24 patients were selected randomly and were divided into three groups of 8, respectively Fio<sub>2</sub> with the 0.4, 0.6 and 0.1 received by the ventilator and the conditions placed supine and side sleeping were. Pao<sub>2</sub> was observed that the side

sleeping position to supine position was significantly greater ( $p < 0.02$ ) (5).

G.D.Puri and colleagues (2005) A quasi-experimental study of oxygen changes in patients with valvular heart failure with cardiomegaly in the supine and lateral positions, left and right made in India. This study was prepared on 42 patients who Heart surgery was performed. ABG 15 minutes after exposure the patient was performed in each of the three. During the study, 35 percent received the amount of supplemental oxygen (4).

The results suggest that the arterial oxygen saturation and hemoglobin significantly in the right lateral position:

**(PaO<sub>2</sub>=120.6±29.5mmhg,SaO<sub>2</sub>=98.1±1.4%)**

Left lateral:

**(PaO<sub>2</sub>=109.7±32.0,SaO<sub>2</sub>=97.6±1.7% ; mean ±SD;P<0.00)**

This study showed that the right lateral posture can increase and improve arterial oxygenation in patients with heart valve disorders, and seems to be operative in this situation would be useful for patients (4).

In N Markou, (2002) that the impact on respiration and gas exchange in patients with the disease, unilateral lung under mechanical ventilation were done, the number of 15 patients, 8 cases of atelectasis, and 7 cases of pneumonia patients in the study participated. Sedating drugs were found in all patients and unconscious. First patients in the supine and lateral position (10 min each) were placed. Eventually it became clear that the side sleeping position to supine significantly increase PaO<sub>2</sub>/FiO<sub>2</sub> (from 132.5±19.4 mmhg to 162.5±18.9 mmhg) is ( $p < 0.000$ ) (13).

The study results Tongyoo (2006) also confirm the status of arterial blood gas values. This study aimed to influence supine and lateral angle of 60 degrees on the oxygenation of patients with acute respiratory distress syndrome was performed. In this study 18 patients with acute respiratory distress syndrome with a mean age of 52.5 ± 19.6 to 14 male and 4 female, participated. Results showed that the right lateral position to supine can increase PaO<sub>2</sub> (90.3±29 and 84.6±20.4, P=0.23) (18).

## 5. Conclusion

Not only change position has negative effect on patient's vital signs and arterial blood gases, but also applying it improves PaO<sub>2</sub>, O<sub>2</sub> saturation and respiratory rate. Lateral position (especially left lateral position) improves oxygenation in this patient after coronary artery bypass graft surgery and there is no contraindication to use it.

**Table 11: Comparison of mean differences between the two situations studied criteria in Pao<sub>2</sub>**

Status	Mean differences PaO <sub>2</sub>	Sd	P Value
Couple 1 semi supine, sitting	1.213	25.419	0.713
Couple 2 lying on his back and right lateral	-7.188	28.718	0.057
Couple's 3 lying to the back and left lateral	-11.895	24.250	0.000
Couple 4 semi -sitting, and lying to the right	-8.401	14.575	0.000
Couple 5 semi-sitting and lying to the left side	-13.108	20.751	0.000
Couple 6 left and right lateral	-4.706	16.718	0.033

The results of statistical inference with respect to the second hypothesis of the study titled "Effects of the supine position, semi-sitting, and lying to the side (right and left) on different subjects of vital signs", the respiratory rate, temperature and Diastolic blood pressure is confirmed, but the parameters of systolic blood pressure and pulse rate are rejected.

Results showed that the respiratory rate increased and thus the change in the position to the left lateral side to reach the highest levels.

The study results show that changing of positions are not only negative but also the impact on the overall appearance of arterial blood gases are not critical by placing the patient in different positions, and O<sub>2</sub> saturation in the number of PaO<sub>2</sub> breathing has improved, so that lateral position (especially left lateral) after coronary artery bypass surgery which causes further improve of oxygenation in the patients. Moreover there are no contraindications in use of these positions to coronary artery bypass surgery patients.

**Table 12: Comparison of hard and fast criteria for diastolic blood pressure (BP.DAY) in different situations**

Diastolic blood pressure	No.	Mean	Sd	P Value
Supine	60	73.53	14.95	0.012
Semi-sitting	60	78.56	15.89	
Right lateral	60	76.78	13.54	
The left lateral	60	74.06	12.77	

**Table 13: Comparison of the mean difference in diastolic blood pressure in check hard and fast criteria, two to two conditions**

Status	Mean	Sd	P Value
Couple 1 semi supine, sitting	-5.033	12.864	0.004
Couple 2 lying on his back and right lateral	-3.250	15.535	0.110
Couple's 3 lying to the back and left lateral	-0.533	14.042	0.770
Couple 4 semi -sitting, and lying to the right	1.783	13.727	0.318

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## Mother's Satisfaction with the Quality Care Of Maternal & Child Health Services At Maternal and Child Health Centers in Zagazig City, Sharkia Governorate, Egypt

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**Abstract:** The concept of quality is a 'property' or characteristic of medical care. This characteristic can range from one end of the spectrum to the other (e.g. low to high quality care) and can manifest itself through various elements or "attributes". **The aim of the study** was three folds; to assess the quality of care provided by maternal and child health services in MCH centers, to assess the level of mother's' satisfaction with care, and to assess the services' providers of care in the MCH centers in Zagazig city Sharkia governorate. **Design:** A descriptive cross-sectional study design was used in this study. **Settings:** All the MCH centers (4 centers) 4 MCH at Zagazig city were included in the study. The sample consisted of 405 mothers who attended to MCH centers for taken care (Services utilizers) and 150 Health services providers. **Tools:** a standardized checklist was prepared by the researchers to assess the quality of care. Also, service utilizers and providers interview questionnaires were utilized to collect relevant **Results:** A total of 405 mothers were interviewed in the 4 MCH at Zagazig city, out of these, only 53.6%, of mothers were educated up to secondary level where 8.6%, 25.9%, and 11.9% were illiterate, primary and university respectively. Also the results showed that about 77.8 of mothers were house wife and 22.2 were employees. Also, 16% of mothers visit the MCH for their immunization while the other causes were antenatal care was 42.7%, child birth services was 18.7%, ARI was 6.9%, immunization of the child was 6.1%, diarrhea of the child was 7.1% and follow up was 2.2%. and 83.2 of attended mothers feel easy accessibility while only 16.8 feel difficulty in dealing at MCH. The quality score for the structure was 7.8% and for performance was 63.4%. Users rating score about aspects of care in the MCH centers were high score. The health users recommended increasing the drug therapy while 70.6% of them complain from absence of chair for sitting. **CONCLUSION:** There is shortage in the services and dealing with the mothers from the health care providers at MCH also there were shortage in knowledge about quality among the health care providers.

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**Keyword:** quality care, Maternal & Child Health Services, maternal & child health Centers, Mother's Satisfaction.

### 1. Introduction

Quality can be defined as a conformance to requirements (Crosby, 1996). Also, it may be defined as doing the right thing right the first time and improving it every time (Brown, 2007). Quality can be a simple action to achieve desired objectives in the most efficient and effective manner with the emphasis on satisfying the customer or the consumer. It is a health service that is acceptable, accessible, efficient, effective, safe, cost savings and that's continuously evaluated and upgraded (WHO, 2000).

Abdel-Razik *et al.*(2012) identified certain elements of quality, which are accessibility, effectiveness, essential provision of suppliers and equipments, quality of client provider's interaction, equity, acceptability, comprehensiveness of care, and continuity of care and follow up and support to health care providers. Quality of care can be measured at three levels: the policy level; the service delivery level; and the client /outcome level. Outcomes have received special emphasis as a measure of quality. Assessing outcomes has merit both as an indicator of the effectiveness of different interventions and as part of a monitoring system directed to improving quality of care as well as detecting its deterioration (Blumenfeld,

1993). Quality assessment studies usually measure one of three types of outcomes: medical outcomes, costs, and client satisfaction. For the last mentioned, clients are asked to assess not their own health status after receiving care but their satisfaction with the services delivered (Barnett, 1995).

#### Significance of the study

In Egypt, maternal and child health (MCH) services are provided by different types of primary health care (PHC) facilities, including MCH centers and general urban health centers in urban areas as well as combined rural health units, rural health units and integrated rural health units (MOHP, 1999). Maternal and child health care refers to promotive, preventive, curative and rehabilitative health care for women in child bearing period, infants and preschool children (Wallace and Giri, 1990). Assessing quality in health services means, measuring the gap between the qualities of care as perceived by the providers and as perceived by the women users' (Al-Qutob *et al.*, 1996). For instance, quality care to some providers may mean impersonal 'efficient' care, which reduces mortality and morbidity. Less attention is given to women's perception and experience of illness such as daily discomforts which are not identified as major



problems. It is often precisely those daily discomforts which influence her health-seeking behavior. Thus a quality service ought to give special emphasis to women's experiences, expectations, and level of satisfaction with the service, to complement the views of the providers of care (Mawajdeh *et al.*, 1995).

The importance of peoples' perception of quality was demonstrated by (Akin and Hutchinson, 1999) who found that the ill and poor people by-passed free or subsidized services in facilities they perceived to be offering low quality services. The quality and peoples' perception of the quality of services in public facilities, together with the utilization of MCH services, in order to improve the health of mothers and children (Masatu *et al.*, 2001).

#### **Aim of the study is three folds:-**

- 1-To assess the quality of care provided by maternal and child health services in MCH centers.
2. To assess the level of mother's' satisfaction with care and
3. To assess the services' providers of care in the MCH centers in Zagazig city.

#### **Research question**

Are there relationships between Mother's satisfaction and maternal and child health services provided by the MCH centers and its quality of care.

## **2. Subjects and Methods:-**

#### **Research design:**

A descriptive cross-sectional study design was used in this study.

#### **Study Setting:**

All the four MCH centers (Sheba, Abokhalile, Alnahal, and Alsiaden MCH centers.) were included in the study.

#### **Study subjects**

The sample consisted of 405 mothers who attended to MCH for taken care (Services utilizers) and 150 Health services providers. The data was collected through 6 months started at January 2012 and finished at July 2012.

#### **1- Health services providers:**

All the service providers (150) in the studied centers; physicians, dentists, nurses' laboratory technicians and pharmacists were included in the study.

#### **2- Services utilizers:**

From each center maternal (mothers) utilized of the antenatal care, immunization and childbirth services which includes (immunization, diarrhea and acute respiratory infection (ARI) and follow up), clinics were selected after service provision through a systematic random sample technique; every third child's care giver (mother) was interviewed. The total

number of sample was 395 mothers , and then we increased the sample by 3.33% (10 mothers ) to guard against presence of incomplete data. So, the number of sample reached 405 mothers.

#### **Ethical approval**

The agreement for participation of the subjects was taken after full explanation the aim of the study to get their approval for participation in the study. Also, they were assured that the information would be confidential and used only for the research purpose.

#### **Tools of Data Collection:**

1. A standardized observational checklist was prepared by the researchers used to assess the quality of care. The methods used for data collection through the checklist were done by direct observation during work that is the idealistic method. It is used to record the behavior of health services providers, assess the process of the services and to assess the accessibility, availability and quality of the equipments, supplies and materials e.g. drugs.

#### **2- Quality Scale:**

##### **2.1- Service utilizers interview questionnaire:**

It was used to collect data relevant to topic of the study. **Clarification of points related to presentation of users satisfaction:** The type of rating scales selected was the quality scale. Response format of excellent (3), good (2), fair (1) and poor (0) to provide greater variability and lesser skewness of responses. The number of respondent was the figure that was used for calculation of percent. The mean percent score was calculated by multiplying the "excellent" column by 3, the "good" column by 2, the "fair" column by 1 and the "poor" column by 0 and then adding the resulting figures and dividing the sum by total number of respondents. Mothers who responded to any items by don't know were considered missed data. The resulting figure was then divided by 3 and multiplied by 100 to convert the score into percent for meaningful presentation (WHO, 1995).

##### **2.2- Service providers interview questionnaire:**

It was used to collect data relevant to topic of the study. **Quality assessment manual (MOHP, 2000):** It was used to determine the quality index (QI). It comprises of two parts. **The first part** includes the different services components and each component has its criteria, which are the elements of assessment. Each criterion has different standards, which are description of the minimum level of that criterion to be acceptable. The first part comprises of general sections which are shared between the different health programs and services in the facility as structure, general resources and infection control and special sections which are specific for each health service or program provided by the centers as vaccination, ARI program and follow up

programs. **The second part** contains checklist to assess the quality index guided with the first part standards. The checklist contains different general and special sheets with their components and criteria only without the standards.

#### Calculation of the QI:

The data were subjected to scoring system to calculate the QI for each sheet. Each item was evaluated by giving a score; 0= not present, 1= poor, 2= fair and 3= good.

A modified score based on the **MOHP (2000)** score was used; QI: <60= poor quality, QI: 60–74= fair quality and QI: 75–100= good quality.

$$\text{QI for each sheet} = \frac{\text{Total actual number of compliance criteria in that sheet}}{\text{Total required criteria number for the same sheet}} \times 100$$

#### Validity and reliability

The questionnaire was translated into Arabic, and then reviewed by 5 experts (3 experts from community health nursing and 2 experts from obstetrics and Gynecology nursing) who conducted face and content validity of all item. All recommended modifications were performed. Degree of reliability was alpha precision 88% of the study sample.

#### Pilot study

It was carried out for 10 of mothers to and 10 of providers to ascertain the clarity and applicability of the tools, and to assess the respondent's acceptance and understanding the questions. Data were collected by using structured interview questionnaires.

#### Field work

The study was conducted during the period from January to July 2012. Informed consent to participate in the study was obtained from mothers and the providers. Modifications of the tools were done accordingly. Each mother was individually interviewed using the previously mentioned tool. Every one in the sample was assured for confidentiality, asked separately and away from health service providers and motivated to give true answers. Time consumed for each interview ranges from 30 to 45 minutes. The collected data were categorized, tabulated and made ready for use.

#### Statistical analysis

Statistical package for social sciences (SPSS) version 19.0 was used for data analysis. Descriptive statistics; frequency, percent distribution and

arithmetic mean (M) and analytical statistical tests; Yates chi-square ( $\chi^2$ ),  $\chi^2$  and Fischer exact (FE) were used. The significance level for Yates  $\chi^2$ ,  $\chi^2$  and FE were accepted if the P-value  $\leq 0.05$ .

### 3. Results

**Table (1): personal Characteristics of mothers about MCH services** as regard the mother's education; 53.6% were secondary educated, 25.9% primary educated, 11.9% university educated and 8.6% illiterates. Regarding mother's job; 77.8% and 22.2% were housewives, employees respectively. As respect number of visits to the MCH centers, 81.5% and 18.5% of mothers visited the center 1-4 times and  $\geq 5$  times in the last year, respectively. Regarding cause of visit; 20.2%, 50.6%, 29.2% visited for the immunization clinic, the antenatal clinic, and the child birth clinic respectively. So, sick baby clinics were visited more than the well baby clinics (28.4% vs. 8.6%). As regard accessibility to the centers, 83.2% of mothers have no difficulty in accessibility. As regard the usual source of care, 65.4% considered the center is the usual source of care. Regarding time spent in examination; 39.5% of mothers spent 5-9 minutes, 33.3% spent <5 minutes and 27.2% spent >10 minutes.

**Table (2)** demonstrated the quality scores (Qs) percent of structures and performance in ante natal care, immunization, well baby and sick baby clinics in the four MCH centers. Regarding the structural assessment; the mean Qs of the ante natal care, immunization, well baby and sick baby were 66.2%, 75.6%, 72.9% and 68.4%, respectively. As regard the average quality score of the structures of the studied clinics, was reported a fair score (70.8%). As regard the performance assessment, the mean Qs percent of the ante natal, immunization, well baby and sick baby clinics were 59.8%, 73.8%, 63.5% and 56.3%, respectively. As respect the average QS of the studied clinics performance, was reported a fair score (63.4%).

**Table (3)** showed percent distribution of the health care users' rating score about aspects of care provided by the MCH centers. Majority (64.7%) of the mothers had got good care at the center, 18.3% had fair care, 16.3% had an excellent care and 0.7% had poor care. Also, most of mothers were satisfied with different aspects of care, the highest good percent scores were competence of doctors in diagnosis and treatment (48.1%), Politeness of doctors (69.8%), Politeness of nurses (87.8%), child examination by the doctors (65.9%), efficacy of nurses (87.8%), Politeness of laboratory technician (91.6%) and Politeness of pharmacists (93.3%). Further, the present study revealed that good percent scores of doctor's explanation about illness and medication were 69.5% and 48.1%, respectively. On the other hand, the aspect of care, which dissatisfying the users and had the lowest scores was inadequacy of drugs (23.4%).

Availability of laboratory facilities (64.2%), doctors clearing up about medication (68.8%), while the cleanliness; 80.2% and 57.7% were for both the clinic and bath respectively.

**Table (1): personal characteristics of health care users**

Variables	Number (n=405)	Percent
<b>Mother's education:</b>		
Illiterate	35	8.6
Primary	105	25.9
Secondary	217	53.6
University	48	11.9
<b>Mother's job:</b>		
House wife	315	77.8
Employee	90	22.2
Number of visits in the last year:		
1-4	330	81.5
≥5	75	18.5
<b>Cause of visit:</b>		
Immunization of women	65	16
Antenatal care	173	42.7
Child birth services	76	18.7
ARI	28	6.9
Immunization	25	6.1
Diarrhea	29	7.1
Follow up	9	2.2
Difficult accessibility:		
Yes	68	16.8
No	337	83.2
Is the center the usual source of care?		
Yes	265	65.4
No	140	34.6
Waiting time (minutes):		
<15	348	85.9
15-29	52	12.9
30-60	5	1.2
Time spent in examination:		
<5 minutes	135	33.3
5-10 minutes	160	39.5
>10 minutes	110	27.2

**Figure (4)** showed mothers' comments of the health care according to the cause of attending to maternal clinic. Drug adequacy was the most common comment (35.6%), followed by chairs for setting (29.4%). Meanwhile, 24.9% of them with no comments. Regarding the drug adequacy, the highest percents were found among users of immunization clinic (42.7%), users of child birth services clinic (37.3%) and ante natal clinic (31.7%).

**Figure (5)** showed mothers comments of the health care according to the cause of attending to Pediatric clinic. Drug adequacy was the most common

comment (44.0%), followed by chairs for setting (10.2%). Meanwhile, 37.3% of the users had no comments. Regarding the drug adequacy, the highest percents were found among users of sick baby clinic (52.9%), users of immunization clinic (34.3%) and well baby clinic (23.0%).

**Table (6)** showed distribution of the studied health care providers according to their personal and work characteristics. As regard age, the age group 25-34 years was the commonest age group (33.3%) and the least was the age group 45-55 years, 17.3%. Regarding gender, almost all the providers were females (92.7%). As respect the job, the nurses had the highest percent (62.7%) followed by doctors (24.7%), pharmacists (9.3%) and lastly the technicians (3.3%). As regard the work duration, 34.0% of providers worked 5-9 years and 5.3% worked 10-15 years. Regarding training course(s), 72.7% of the providers received training course. As regard duration of the training courses, 37.3% spent one week in the course, 32.0% spent two weeks and 22.0% spent one month. As respect type of the course(s), 49.3% had theoretical and practical courses, 34.6% had theoretical course and 14.7% had a practical course. As regard benefits from the courses, all providers had benefits; 60.7% had complete benefit and 39.3% had partial benefit.

**Table (7)** showed distribution of the studied health care providers according to their knowledge about quality and quality application program in relation to receiving training course. As regard the quality awareness, the majority of providers (71.3%) had no idea about quality in health care and 48.6% of them don't know if there is quality application program in the MCH centers or not. In details, 27.5% of trained providers were aware compared with 31.7% of not trained providers, with no statistical significant difference. Also, 10.1% of trained providers were aware about quality application program in the center compared with 12.2% of not trained providers, no statistical significant difference.

**Figure (8)** showed distribution of the studied health care providers according to their work duration, taking other work duties, presence of work problems and their opinions in the role of the supervisors' visits in improving work performance in the MCH centers in relation to providers' job. As respect work duration, none of the doctors and pharmacists worked in the center ≥10 years compared with 14.1% of the nurses and technicians. Regarding taking other work duties, 52.7% of the providers take other duties. In details, 21.6% of the doctors and pharmacists took other duties compared with 68.7% of the nurses and technicians, with a statistically significant difference. As regard work problems, 58.8% of the doctors and pharmacists are facing work problems compared with 52.5% of the nurses and technicians, with no statistically significant difference. As respect providers' opinion in the role of

supervisors' visits, 66.0% of them said that it has. Also, 43.1% of the doctors and pharmacists said that it have a role in improving work performance compared with 77.8% of the technicians and nurses, with a statistically significant difference.

**Figure (9)** cleared distribution of health care providers' degree of satisfaction, causes of users' satisfaction and dissatisfaction from providers' point of view and providers' recommendations to improve the work in the centers in relation to providers' job. As respect degree of satisfaction, most of the providers (80.7%) were satisfied. In details, 82.4% of the doctors and pharmacists were satisfied compared with 79.8% of the technicians and nurses, with no statistically significant difference. As regard causes of users' satisfaction from providers' point of view, cheap

service and proper care were the commonest causes of satisfaction as reported by 51.3% and 42.0% of providers, respectively. Regarding cheap service, 68.6% of the doctors and pharmacists said that it is the most important cause. While, 52.5% of the nurses and technicians said that proper care was the most common cause. Regarding causes of dissatisfaction, drug deficiency was the commonest cause as reported by 82.4% of the doctors and pharmacists and 71.7% of the nurses and technicians, with statistically insignificant difference. As regard recommendations, adequacy of drugs was the most common recommendation, 49.0% of the doctors and pharmacists recommend that. Also, increasing the resources and equipments was the most common recommendation of the nurses and technicians, 50.5% of them recommend that.

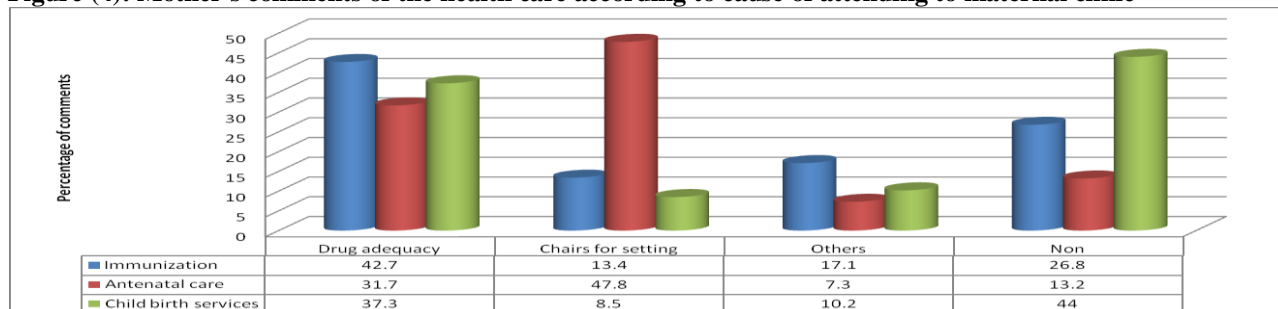
**Table (2): Quality score percent in maternal and child clinics in the 4 MCH centers in Zagazig city.**

Variables	Quality score percent in maternal & pediatric clinics				Average M %
	Antenatal care %	Immunization %	Well baby %	Sick baby %	
<b>Structures:</b>					
Building and infrastructures	70.7	68.7	79.9	75.4	
Furniture and equipments	55.6	81.2	61.3	66.8	
Requirements tools	72.3	76.9	77.6	63.2	
<b>Average mean (X)</b>	66.2	75.6	72.9	68.4	70.8
<b>Performance:</b>					
Health care performance	81.3	93.2	90.8	86.7	
Health education	55.8	87.8	43.3	43.2	
Infection control	28.5	41.4	30.8	26.1	
Records	73.4	72.9	89.0	69.0	
<b>Average mean (M)</b>	59.8	73.8	63.5	56.3	63.4

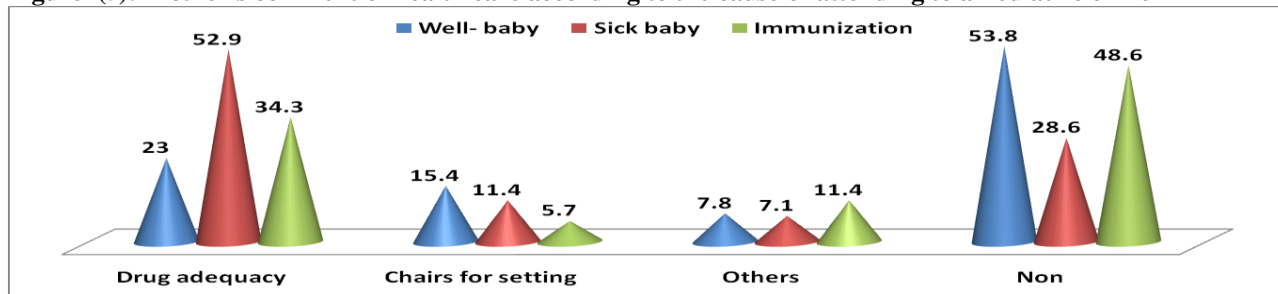
**Table (3): Distribution of the mothers rating score about aspects of care in the MCH centers**

Aspects of care	Mothers No.	Poor		Fair		Good		Excellent	
		No.	%	No.	%	No.	%	No.	%
Politeness of registers	388	2	0.5	69	17.8	276	71.1	41	10.5
Politeness of doctors	374	0	0.0	11	2.9	261	69.8	102	27.3
Child medical examination by doctors	372	0	0.0	25	6.7	245	65.9	102	27.4
Doctors clearing up about illness	367	2	0.5	64	17.4	255	69.5	46	12.5
Doctors clearing up about medications	369	5	1.4	78	21.1	254	68.8	32	8.7
Efficiency of doctors in diagnosis and ,treatment	372	0	0.0	15	4.0	179	48.1	178	47.8
Doctors asking about past history	310	5	1.6	73	23.5	181	58.4	51	16.5
Efficiency of nurses	403	0	0.0	17	4.2	354	87.8	33	8.2
Politeness of nurses	404	3	0.7	26	6.4	245	60.6	130	32.1
Availability of laboratory facilities	215	2	0.9	66	30.7	138	64.2	9	4.2
Politeness of laboratory technicians	215	0	0.0	6	2.8	197	91.6	12	5.6
Convenience of drugs	364	74	20.3	201	55.2	85	23.4	6	1.6
Politeness of pharmacist	345	0	0.0	8	2.3	322	93.3	15	4.3
Pharmacist clearing up about medications	346	3	0.9	10	2.9	323	93.4	10	2.9
Health intervention	203	6	2.9	56	27.6	96	47.3	45	22.2
Work hours	397	0	0.0	66	16.6	316	79.6	15	3.8
Cleanliness of bath	267	18	6.7	93	34.8	154	57.7	2	0.7
Convenience of waiting area	360	61	16.9	159	44.2	137	38.0	3	0.8
Cleanliness of waiting area	403	6	1.5	72	17.9	314	77.9	11	2.7
Cleanliness of clinics	405	0	0.0	54	13.3	325	80.2	26	6.4
Overall rating of services	405	3	0.7	74	18.3	262	64.7	66	16.3

**Figure (4): Mother's comments of the health care according to cause of attending to maternal clinic**



**Figure (5): Mother's comment of health care according to the cause of attending to a Pediatric clinic**



**Table (6): Personal and work characteristics of the studied health care providers in the MCH centers.**

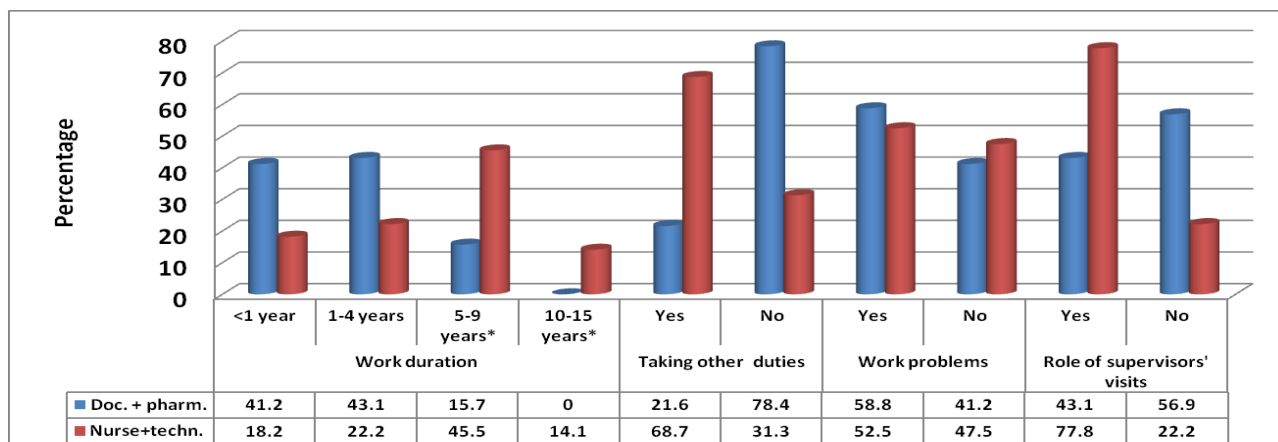
Variables	Number (n=150)	Percent
Age (years):		
<25	40	26.7
25-34	50	33.3
35-44	34	22.7
45-55	26	17.3
Gender:		
Females	139	92.7
Males	11	7.3
Type of work:		
Doctor	37	24.7
Pharmacist	14	9.3
Nurse	94	62.7
Technician	5	3.3
Duration of work (year):		
the<1	44	29.3
1-4	47	31.3
5-9	51	34.0
10-15	8	5.3
Receiving training course(s):		
Yes	109	72.7
No	41	27.3
Duration of training courses (n=69):		
One week	56	37.3
Two weeks	48	32.0
Three weeks	13	8.7
One month	33	22.0
Type of training course(s) (n=69):		
Practical	22	14.7
Theoretical	32	34.6
Both	76	50.7
Benefits of training courses (n=69):		
Complete	91	60.7
Partial	59	39.3



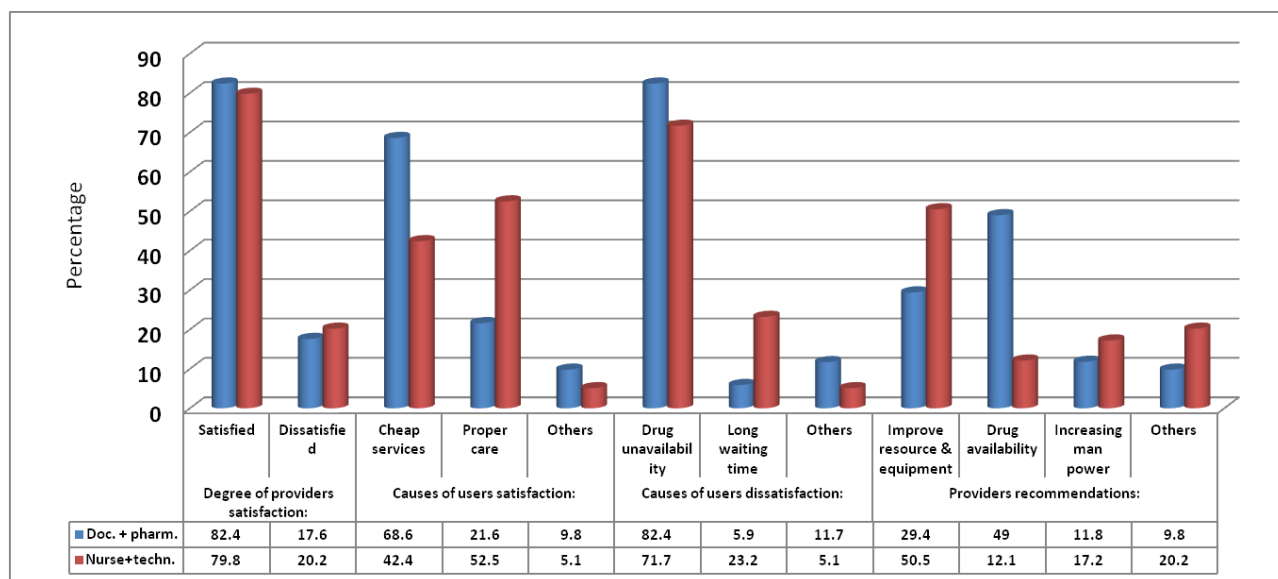
**Table (7): Distribution of health care providers according to their knowledge about quality and quality program application in relation to receiving training course(s).**

Variables	Receiving training course(s)				Total (n=150)		X2	P-Value
	Yes (n= 109)		No (n= 41)		N	%		
	N	%	N	%				
Awareness about quality:								
Yes	30	27.5	13	31.7	43	28.7	0.26	0.613
No	79	72.5	28	68.3	107	71.3		
Awareness about quality application program:								
Yes	11	10.1	5	12.2	16	10.7	1.88	0.391
No	48	44.0	13	31.7	61	40.7		
Don't know	50	45.9	23	56.1	73	48.6		

**Figure (8): Distribution of the studied health care providers according to their work duration, taking other work duties, presence of work problems and their opinions in the role of supervisors' visits in improving work performance in the MCH centers in relation to providers' job.**



**Figure (9): Description of health care providers' degree of satisfaction, causes of users' satisfaction and dissatisfaction from providers' point of view and providers' recommendations to improve the work in the MCH centers in relation to provider's job.**



#### 4. Discussion

The current study aimed to assess the quality of care provided by maternal and child health services in MCH centers, assess the level of mother's satisfaction with MCH care and assess the services' providers of care in the MCH centers in Zagazig city. This study revealed that the small proportions of mothers were illiterate and most of them were medium or higher education. As regards mother's job, the most of mothers were house wives. Regarding time spent in examination; 39.5% of cases spent 5-9 minutes, 33.3% spent <5 minutes and 27.2% spent >10 minutes, and the majority of mothers have waiting time less than 15 minutes. The present results disagreed with Camps (1992) who clarified that 2/3 of the clients were illiterates and 1/4 was medium or higher education, and 79.0% of the clients have no work experience. The high percent of housewife users may be explained; the centers working hours are for the morning shift only, which compatible with this group of users. Mother satisfaction was significantly positive among patients with long-term visits than among those with first-time visits. In the same line with the current results Whittaker (1993) confirmed that a short consultation time did not allow correct diagnosis or management of the condition for which patients presented.

The majority of mothers were satisfied might reflect a low expectation level owing to their lifelong experience of spending a short time with health care providers or that the expectations of patients are directed on a priority basis towards other elements of care (e.g. the provision of medicaments or the provider's politeness). Another study conducted by Taman (2000) who noticed that 76.7% of users regarded the clinic as the primary source of care. Waiting time is a significant predict of patient intent to return for additional clinic care. This was supported with a study by Gurdal *et al.*, 2000 who reported that 21.8%, 52.7% and 25.5% of case spent <5, 5-9 and >10 minutes in examination, respectively. This similar with (Aldana *et al.*, 2001) reported that the expectations of users were far from reality. Thus, the average waiting time clients would be satisfied with was 10.6 +0.3 min. Half the clients considered 8 min the maximum time they could wait in order to be satisfied, whereas only 25% would accept 12 min. Waiting time expectations did not vary significantly among mothers presenting for different services offered by MCH centers. Also Uzochukwu *et al.* (2004) found that the participants requested that efforts should be made to reduce the waiting time, together with increasing the number of staff in the health centers.

The current study revealed that the mean QSs of the ante natal care, immunization, well baby and sick baby were 66.2%, 75.6%, 72.9% and 68.4%,

respectively. As regard the average quality score of the structures of the studied clinics, was reported fair score, 70.8%. On the same line, Hammouda (2000) found that the quality scores of the children clinics' were 49.3%, 61.3%, 55.06% and 61.4%, respectively. Study results were higher than these results. The differences may be explained by the policy of the MOHP that depends on the construction of new centers and get rid of the old as a result of its quality assurance project. Result was similar to Shaker (2005) as he showed that QS percent of structures of the most of the developed MCH facilities in Qalyobia governorate was fair, 66.3%. This result comes in disagreement with Stinson (1991) who addressed the importance of health facility resources as a key component of the quality of health care; the inadequate supply of medical equipment is known to negatively affect the quality of care provided and the utilization of health centers.

Also Morgan and Reynolds (1995) who found that there is no enough chairs and/or desks for doctors and nurses in every pediatric clinic, this interfere with performance of work. Also, there was lack of special beds or place for examination, this make the physician to examine children on desk and this may increase the hazards of infection in addition to difficult for doing examinations. The essential primary equipments and instruments as thermometers, weighing scales and pediatric sphygmometers are not present in adequate numbers.

As regard the performance assessment, the mean QSs percent of the ante natal, immunization, well baby and sick baby clinics were 59.8%, 73.8%, 63.5% and 56.3%, respectively. As respect the average QS of the studied clinics performance was reported a fair score, 63.4%. This also was asserted by Hammouda (2000) who found that the QSs percent of these clinics were 45.0%, 56.9%, 45.1% and 51.0%, respectively. As respect the average QS of the studied clinics performance was reported a fair score were 49.5%. Again, this result was close to Shaker (2005) who reported that the QSs percent were 70.7%.

The present study revealed that the most of the mothers had good care at the center, also, most patients were satisfied with different aspects of care, the highest average mean percent scores were competence of doctors in diagnosis and treatment (81.1%), Politeness of doctors (69.8%), Politeness of nurses (60.6%), child examination by the doctors (65.9%), efficacy of nurses (87.8%). Similar study conducted by Gurdal *et al.* (2000) showed that the lowest average mean percent score was inadequacy of drugs, 44.8%. However, the most prominent complaints of the patient were disorganizing service system and slowness of investigations. On the same line Taman (2000) who showed results less than ours; courtesy of doctors (71.1%), competence of doctors in

diagnosis and treatment (69.9%), courtesy of nurses (57.4%) and child examination by doctors (60.8%). Moreover Aldana *et al.* (2001) found that study highlights the gap between the notion of patient satisfaction as an element representative of quality of care and high quality health care from a professional point of view. Thus, the most powerful predictor for client satisfaction with government health services was the provider's behavior towards the patient, particularly respect and politeness. This aspect was much more important than the provider's technical competence (characterized by elements such as explaining the nature of the problem, physical examination, and giving advice).

Also Zoller *et al.* (2001) reported that the most important indicators of outpatient clinic care quality were getting better, getting service and care when needed and having diagnosis and treatment options explained moreover, This similar with Oermann *et al.* (2006) who found that the teaching activities had a favorable affect on patient satisfaction with received care. Also, individualization of care, orientation of patient, informational effectiveness and safety procedures were important factors affecting patient satisfaction. Lastly, Poole *et al.* (2007) stated that although satisfaction with clinic care was high, the overall and specific, few respondents felt that provision of information about their condition was perceived to be poor, particularly by the elderly.

According to findings of the current study the drug adequacy was the most common recommendation according to cause of attending to maternal clinic, followed by chairs for setting. Meanwhile, 24.9% of the users had no recommendations. Regarding the drug adequacy, the highest percents were found among users of immunization clinic, followed by users of child birth services clinic and ante natal clinic. Our results are in agreement with the findings of Kanji *et al.* (1992) demonstrated that only 12% of clients obtained their prescribed drugs. According to some reports, provision of health care is expected to respond directly to patients' preferences and demands as medical treatment is enhanced by greater patient satisfaction. However, Ahmed *et al.* (1996) showed that about 89% of patients from BI health centers obtained their prescribed drugs. Oermann *et al.* (2006) who found that the aspect of care, which dissatisfying the users and had the lowest average mean percent scores was inadequacy of drugs. These findings contrast with the findings of Msamanga *et al.* (1993) who found that the 80% of patients in public health facilities could not get their prescribed drugs available.

In the present study, the knowledge of health care providers about quality and quality application

program in relation to receiving training course. As regard the quality awareness, the majority of providers had no idea about quality in health care and 48.6% of them don't know if there is quality application program in the MCH centers or not. This may be explained, the quality system not yet introduced in Zagazig city at the time of this study and the providers didn't take any courses about quality in health care in their training courses. The present results agreed with Miller *et al.* (1991) who reported that a relation between the quantity of supervision and the number of served users. Also Rizk (1997) reported that 37.0% of his health care providers taking other work duties.

As regards, degree and causes of users' satisfaction and dissatisfaction from providers' point of view and providers' recommendations to improve the work in the centers. The causes of users' satisfaction from providers' point of view, cheap service and proper care were the commonest causes of satisfaction respectively. Regarding causes of dissatisfaction, drug deficiency was the commonest cause. As regard recommendations, adequacy of drugs was the most common recommendation; also increasing the resources and equipments was the most common recommendation of the nurses and technicians. This result coincided with Fitzpatrick (1991) who stressed that the efficacy of medical treatment is enhanced by greater patient satisfaction. Consequently, patient satisfaction is undoubtedly a useful measure, and to the extent that it is based on patients' accurate assessments, it may provide a direct indicator of quality care. Similar study conducted by Msamanga *et al.* (1993) who reported that the availability of appropriate medication at the first point of contact with the health care system is probably one of the most important components of the quality of primary health care, and therefore a primary determinant of utilization. On the same line Newman *et al.* (1998) found that lack of users' satisfaction with outpatient care was due to long waiting times, lack of physical examinations and failure to receive prescribed medications.

Moreover, Akin and Hutchinson (1999) emphasized that the level of satisfaction with MCH services offered in health centers and perceived quality of care based on availability of prescribed drugs, observed physical condition of the facilities and providers' behaviors were high. This is good as "improved quality of services increases the likelihood of a facility being used". Also Speizer and Bollen (2000) stressed that shortage of health workers was perceived as an indicator of low quality of care. Additionally, Uzochukwu *et al.* (2004) pointed that the most important causes of users' dissatisfaction were the absence of a doctor for all the services, poor staff attitude for all the services, distance for all services

except curative, and lack of drugs for curative services. Very few gave cost and long waiting hours as a reason. Also these results were in accordance with the study done by Awadalla *et al.*(2009) who reported that the most common causes of dissatisfaction were long waiting time and improper environment.

### Conclusions

Quality is rapidly becoming a global issue and of concern to both the providers and the users of health care services. Also, the issue of client satisfaction and dissatisfaction has become a topic of increasing importance in health care. Competence of health team diagnosis and treatment of children and courtesy of doctors and nurses had the highest average mean score among aspects of care in satisfying the users (mothers). Drug adequacy was the most important recommendation of the users. Training courses get benefits to the providers and help them in providing a good quality of health care. Awareness about quality was low among the providers. The main cause of users' dissatisfaction from providers' point of view was drug unavailability. Quality, QA and TQM must become a continuous and integral part of the provision and management of services. The situation should be examined periodically in a formal manner and system supporting activities should be started (e.g. research, guidelines, resources, etc.).

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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  $23.4 \pm 1.90$  and weight of  $67.5 \pm 10.87$  were selected through a purposive 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:  $\text{Age} - 220$  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  $21.2 \pm 6.22$  percent, fat free mass:  $52.7 \pm 5.67$  KG, mass index of the body:  $24.0 \pm 5.32$  KG/M<sup>2</sup>, maximum aerobic Oxygen  $46.9 \pm 5.32$  ML/KG per minute, absolute average anaerobic power  $259.7 \pm 34.15$  Watt, and at last relative average anaerobic power was  $3.92 \pm 0.72$  Watt/KG.

Table 1: 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 <sup>2</sup> )	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 (039/0=p, 574/0- = (6)r), fat free mass (048/0=p, 758/0- = (6) r) and mass index of the body (047/0=p, 762/0- = (6) 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 (041/0=p, 547/0- = (6)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(05/0< p). Furthermore, fat percentage and mass index of the body don't have any meaningful relationship with relative average of anaerobic power (05/0< p). But fat free mass have a positive and significant relationship with relative average anaerobic power (037/0=p, 687/0= (6)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	r	p	R <sup>2</sup>
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 phosphogeneand 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, miocenase 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.

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## Change Patterns of Agronomy and Agricultural Lands by War

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**Abstract:** Environmental pollution is created due to entering contaminants with high concentration in large amount in the environment. War is one of the intense pollution resources of water and soil environment. Widespread use of weapons such as lead particles, explosives, pneumatic bombardment, cannon balls, chemical weapons and chemical, microbial bombs, etc will definitely be followed by environmental destructive effects. Nowadays, damage to the environment is used by the parties involved as a military strategy. Pollution problems created by military activities have plagued a lot of nations. Have been indications of great destructions in relation to the environment. It is a long time that war and its due environmental damages have attracted a lot of attentions. Soil pollution also is one of the most important war environmental effects. Cultivation of crops in a land intensely polluted chemically and the use of waters contaminated with lethal compounds in agricultural farms will cause irrecoverable effects. In most cases, war bombardment and various bullets used during wars contaminate soils in terms of heavy metals. The study done by environmental Organization, Forest Organization and Switzerland National Development Plan (SAEFA) show that the contacts of bombs and bullets widely pollute heavy metals. Lead and copper are the main polluting metals. Due to the movement of most aquatic species and the close relationship between contaminated sediments and waters on the other hand and the lack of distinction between these two, investigation of the effects of trace elements in aquatic ecosystems is very hard. Soil erosion also is the most important process that pollutes aquatic ecosystem by heavy metals. The issue of plants intoxication by trace elements also is emphasized for two reasons. Firstly, in case of outbreak of intoxication in agricultural plants, their function is significantly reduced per surface unit. Secondly, the onset of intoxication in plants of an area and loss of vegetation causes sharp increase in water and wind erosion in those areas. But one of the most important aspects of the issue is penetration of these metals into plants and subsequently the animals feeding on them.

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### 1. Introduction

Environmental pollution is created because contaminants enter into this area with high concentration and in great amounts. War is one of the intense pollution resources of water and soil environment. Widespread use of weapons such as lead particles, explosives, pneumatic bombardment, cannon balls, chemical weapons and chemical, microbial bombs, etc will definitely be followed by environmental destructive effects.

War is a phenomenon resulting from passage of time and man's progress. There are various motivations in relation to war. But the more objectives are, the greater environmental damages will be. Specially, with science development and production of weapons with high power of destruction, combats have taken a new form.

Nowadays, damage to the environment is used by the parties involved as a military strategy. Pollution problems created by military activities have plagued a lot of nations.

In 1980, United Nations Organization declared its anxiety in relation to war effects on the environment and paid great attention to environmental effects of nuclear war. In 1995, in Persian Gulf War and Kosovo war also, tests have been indications of great destructions in relation to the environment.

It is a long time that war and its due environmental damages have attracted a lot of attentions. Soil pollution also is one of the most important war environmental effects. Cultivation of crops in a land intensely polluted chemically and the use of waters contaminated with lethal compounds in agricultural farms will cause irrecoverable effects. In most cases, war bombardment and various bullets used during wars contaminate soils in terms of heavy metals. The study done by environmental Organization, Forest Organization and Switzerland National Development Plan (SAEFA) show that the contacts of bombs and bullets widely pollute heavy metals. Lead and copper are the main polluting metals.

Due to the movement of most aquatic species and the close relationship between contaminated sediments and waters on the other hand and the lack of distinction between these two, investigation of the effects of trace elements in aquatic ecosystems is very hard. Soil erosion also is the most important process that pollutes aquatic ecosystem by heavy metals.

The issue of plants intoxication by trace elements also is emphasized for two reasons. Firstly, in case of outbreak of intoxication in agricultural plants, their function is significantly reduced per surface unit. Secondly, the onset of intoxication in plants of an area and loss of vegetation causes sharp increase in water and wind erosion in those areas. But one of the most important aspects of the issue is penetration of these metals into plants and subsequently the animals feeding on them.

The onset of gastrointestinal complications and numerous cancers in relation to these metals are attributed to foodstuffs. For example, in the case of lead, it is more emphasized on its toxicity effect in men, animals, aquatic organisms and birds; however, this metal rarely causes intoxication in plants. Therefore, it can penetrate into a plant with high concentration without having any dangers to it; but after entering other creatures' bodies, it can be dangerous. Of course currently, there are lots of blind spots in relation to man's knowledge about war. Discontinuation of studying systems, lack of registered information and the existing problems related to sampling have limited studying in this field.

Bombardments, destruction of houses and cities and villages and homelessness of many individuals, have constantly placed people under pressure; but the discomforts and diseases after the war should not be disregarded. Iran and Iraq war is not an exception and has caused a lot of damages to the environment. Unfortunately, after the war and clearing the occupied territories, the lands are used for agriculture, aquaculture and other cases without investigation in terms of soil and water pollution state and the products enter the market and this can result in serious problems.

## **Review of the Resources**

### **1-1 War impacts**

In general, the effects caused by war can be divided into two following groups:

#### **1-1-1 Short-term effects**

The issue can be investigated from different aspects. Among the indirect effects on the environment, it can be referred to military activities such as construction of airports, digging canals and trenches, tanks nests, means of transportation and ... which require broad lands that cause destruction of

lots of plant and animal species. In addition, a lot of countries allocate wide lands for testing their different weapons and all of these greatly damage the ecosystem.

When a heavy bomb is thrown, it produces the temperature of about 300 degrees centigrade which is sufficient alone for destruction of plant and animal community and also for degradation of soil surface levels which require a time period of about thousands of years for their reproduction.

Of course, human aspect of the disaster should not be neglected, that killing defenseless individuals can be identified as the worst effect of bombardments and war.

Over Iran and Iraq war, more than 3 million palm trees were burned and 5000 hectares of fruit gardens were destroyed. A hundred and thirty thousand hectares of natural forests and 73500 hectares of pastures were burnt and became unusable. War has also damaged arable lands. In Khuzestan, Ilam and Kermanshah, about 251000 hectares of lands under irrigated cultivation and 53700 hectares of lands under dry farming were destroyed.

#### **1-1-2 Long-term effects**

Most weapons have chemical complex compounds which can have long-term and highly great effects. Some of these metals have high permeability and some of them even can penetrate hard armors and leave their effects, the most important of which affects the environment. During Iran and Iraq war, Iraqi army widely used chemical weapons which have included 20 long-range rockets carrying chemicals, 284 chemical attacks and 74 chemical artillery attacks which can have great long-term effects. Wars can have lots of dangers, the most important of which affect the environment and which we investigate.

#### **1-1-2-1 Flora and fauna**

In most cases, burning of trees and farms not only disperses different particles in the environment but also destroys plant and animal communities and makes resistant species dominate and this can sometimes cause the change of ecosystem in the region.

Destruction of different plant species by fire in Serbestan war has been broadly reported. As examples, it can be referred to degradation and loss of different plant species in Scadera Lake International Park and also three other international parks.

Ground and aerial bombardments cause destruction of forests and subsequently, we see water flow and erosion.

Meanwhile, animal community also tolerates a lot of damages. Reports emphasize that in Persian Gulf war, 3000 seagulls were lost because of

war, %50 of coral pulses were damaged and hundreds of square fluids of sea grass were influenced.

#### **1-1-2-2 Air pollution**

Fires caused by bombing can enter lots of ash into the environment. Due to breathing, these metals can cause lung diseases and endanger man's health. Of course, this pollution can also affect the areas which are far from war zones. Wind often disperses these particles.

During Persian Gulf War, with targeting oil installation in Kuwait by Iraq, 5-6 oil barrels were burnt in fire every day and this resulted in evaporation of a large amounts of gas pollutions such as carbon dioxide and sulfur dioxide (constructive substances of acid rain) of whose important effects, acid and greasy rainfalls in Iraq and Arabia can be named. Moreover, black snowfall was reported in Kashmir which is 1500 miles away from these regions.

#### **1-1-2-3 war diseases**

War often causes diseases and a variety of disasters which have taken new aspects nowadays with production of chemical and biological weapons. During Serbestan war, women were forbidden from having children because the children might have been incomplete. Those who used fishes and vegetables cultivated in the lands of those regions or had water, experienced discomfort in the abdomen area, nausea and .....

Over Iran and Iraq war also, prevalence of a lot of diseases has been reported. Penetration of the existing metals in weapons into soil, environment and water can have great harmful effects. The onset of ocular infections, digestion system diseases and coetaneous complications caused by war in Khuzestan has been reported. Due to the outbreak of ecological imbalance, the increase of insects carrying diseases and pests has been reported. In addition, respiratory diseases and increase in the number of those suffering from diarrhea and vomiting that can be related to drinking water have been reported in many cases after the war.

#### **1-1-2-4 Water contamination**

As the resource of underground water in many cases is atmospheric precipitation, therefore, it can be easily contaminated with by means of war. Acid and contaminated rains not only themselves can be the resource of underground water, but also through washing contaminated metals used in war ammunition which have been remained in soil have caused contamination of underground water.

As underground water is usually one of the main resources of drinking and irrigation water, the issue requires more studies.

In addition, the problem which was especially in Persian Gulf, Iran and Iraq war was

contamination of Persian Gulf which was the result of oil precipitation caused by bombardment of oil platforms. In Iran and Iraq war, lots of load and oil shipping terminals have been attacked and the oil entering water affected ecosystem in Gulf. Sea herbs, which are the nourishment resource of aquatic organisms, were affected by poisonous and contaminated hydrocarbons resulting from sediments; therefore, animal community of the area was seriously damaged and a large number of fish and shrimps were lost due to this factor.

Of course, the issue becomes more important with passage of time, because the sea currents transport pollution out of Persian Gulf. Therefore, this contamination may enter oceans and be dangerous in long-term.

#### **1-1-2-5 Damage to soil**

As plants are permeable to heavy metals, therefore, considering soil contamination is one of the most important aspects of investigation of the damages caused by war.

By entering the food chain, these metals enter human bodies and other creatures feeding them and cause disturbances in their bodies. Therefore, it is very important to study about the presence of these metals in soil where they have mostly long life. These polluting metals can accumulate in man's body and when exceeding the permitted and standard limit of concentration, they cause a lot of side effects. Yet it requires more studies and researches because of the probability of their transformation into more poisonous materials due to chemical interactions, and carcinogen of some of these compounds.

However, because of the deep motion of these polluting metals in soil, pollution can also endanger underground water. For example, it can be referred to Vietnam War in which America polluted about 3460 square kilometers of lands by distribution of 55 million kilograms chemical and fatal materials in agricultural lands and this pollution entered underground water. This vast use of chemicals for destruction of agricultural fields, forests and water resources is unprecedented.

Currently also every year, a large deal of cultivated products in the regions which were exposed to bombardments in the past, enter the market. These products include summer vegetables, cereals and various green-stuffs.

#### **1-2 Review of previous studies**

As pollution caused by war is of great importance in today's world, lots of studies have been done in this relation.

During Iran and Iraq war, surface soil compaction caused flooding in farmlands and left great effects. On the other hand, change and

conversion of the flow of rivers, cutting off irrigation waters, saturation and becoming a salt marsh have been reported as lands turned into wetlands at the time of destruction of irrigation channels.

Karun River in Khuzestan province is one of the most important regions in terms of economic activities. Due to war, it was contaminated severely. Drowned ships and carcasses of the aircraft which are still seen along Arvand River threaten fishing industry and ecology of the region.

In Persian Gulf War also, 6-8 million barrels of crude oil were spilled in the sea. This oil was created due to sinking of oil tankers or bombardment of oil platforms. Smoke arising from burning of wells also has had great impacts.

Because of burning of these platforms, 40000 tons of sulfur dioxide, 3000 tons of hydrogen sulfide and 500000 tons of carbon monoxide in addition to 50000 tons of Greazy Soot particles were released. From its effects, it can be referred to black rainfall in Himalayas which is 2700 kilometers away, or acid rain in China and also reduction of temperature in Kuwait.

Based on the studies done by Zare-Maivan (1998), lots of people informed about the change of quality of drinking water and also irrigation water in Iran.

In an experiment done in Khuzestan, the lead levels of acid rain fallen in Dezful and Ahvaz were respectively reported 0/24ppm and 0/33ppm in comparison with 0/11ppm and 0/18ppm in Bandar Abbas and Shiraz. The amounts of chlorides, sulfides, iron, sodium and nitrate also have been very high and this issue can affect all aspects of human lives. For example, drinking, irrigation and underground waters are contaminated and it is very dangerous.

Over the studies done by Sedigh et al., regional dispersion of thousands of tons of heavy metals, caused by Persian Gulf War in Iran, has been reported.

The underground water discharged from Zagros is one of the most important drinking and irrigation water supply resources. High levels of acidity and contaminated sediments, which are considered as dangers for people in this area, have been reported in this mountain (including  $\text{SO}_4^{-2}$  and other contaminants).

Main polluting materials such as  $\text{NO}_x$  and  $\text{SO}_4^{-2}$ , smoke particles, organic materials and carbon resulting from burning of wells can be stopped by Zagros Mountain due to the height, but through washing by precipitation enter catchment and groundwater and finally can threaten underground and surface waters.

Throughout World War II also, contamination of the Pacific Ocean has been reported. Burning vessels and explosion of submarines all have helped the pollution of this area. A lot of islands local and migrant birds were annihilated in those areas. Their nests were burnt and their eggs were destroyed and there was extinction danger of many species. Many hunting animals (ferals) also were lost in the islands of this ocean.

In 1995, Al-Ajami reported that during Persian Gulf War, due to destruction and loss of protecting layers of soil, bulk motion of coastal sand in Kuwait was accelerated after the attack of Iraq. It was followed by blocking of irrigation canals, roads and products and fields entries, especially covering of %20 of farm lands.

Mine application, digging tunnels, fogging caused by oil, oil spilling, formation of oil lakes and movement of military vehicles all affect flora and fauna.

During the studies done by Zaman and Al-Sadir Avi, the critical effects of war on plant community in Kuwait became quite clear. A very high level of heavy metals was measured in vegetation. The existence of oil lakes severely threatened animals and birds. In discharging only one oil lake, lots of dead birds, which were trapped in this area, were found.

According to the studies done by Omar Aldosari on deserts in Kuwait, it became clear that these areas are the shelter of more than 374 plant species which made them appropriate places for bird and animal life. These places attract thousands of migratory birds. In these areas, there are more than 300 different bird species, %61 percent of which is native. Extensive movement of vehicles, digging tunnels and channels, explosions and other military activities have greatly damaged this community.

Due to precipitation of oil particles and aerosols on perennial plants, these plants include a high level of heavy metals. The plants should be prevented from grazing domestic and wild animals because they can intensely poison them.

Based on the studies done by Savari and Nabavi on Persian Gulf waters during Iran and Iraq war and also Persian Gulf War, the rate of heavy metals such as lead, cadmium, copper, zinc, nickel and cobalt was higher than standards in sediments in this area. During the war with Iraq, the rate of lead in waters of the northern Persian Gulf which were directly attacked was more than the time of Persian Gulf War. The rate of these metals in this area in comparison with oceans water that was studied by Menari Railey and Chaster is much higher and in some cases 1000 times or more.



On the base of these studies, it was specified that the rate of lead, in the sediments of Khuzestan region to Boushehr and the north of Kharg Island, is high. Other metals like copper and zinc show higher amount especially in Kharg and Bushehr regions. For nickel and cobalt also such a trend can be obviously seen especially in sediments of regions such as Bandar Rig and Kharg Island which are located near Norouz wells.

In addition, in a study done on the rate of heavy metals in Shayegan region, intense contamination of sediments and aquaculture in terms of heavy metals was reported. As the power supplies of Shadegan wetland are Jarrahi River, Karun flooding and also winter outbursts of Bahman Shir River through coastal estuaries; therefore, there is the danger of contamination of this wetland which is one of natural environments for lots of plant species and birds.

The studies by Farrokhian and Imandel confirm the existence of a large amount of metals such as lead, cadmium and zinc in the animal bodies and also water and soil environments. One of the reasons can be attributed to the sediments resulting from Bahman Shir River, and also carrying contaminated sediments from Abadan and Khorramshahr.

### **1-3 War instruments compounds**

#### ***1-3-1 Heavy metals in military compounds***

As it was referred to before, the most important components of ammunitions used in war are heavy metals. As a matter of principle, heavy metals or trace elements refers to metals whose density is more than 5 grams per cubic centimeter? These elements exist in soil in small amounts and include Cd, Ni, Cu, Cr, Co, Pb and .... Of course, given that manganese and iron are among the elements used in blacksmith industry, these elements were also investigated.

#### **1-4 Heavy metals in soil**

This title is often used for some metals (and their ions) with high-density which mainly belong to transition series of periodic table. Some of these are called trace elements or microelements in agriculture.

In many cases, contamination caused by heavy metals in soil is due to external factors such as industrial sources, urban activities or because of the use of sewage contaminated with heavy metals.

The issue under investigation in this research is different from the mentioned cases. In the recent century, contamination caused by wars between nations can be regarded as one of important factors in the increase of these metals in soil.

In terms of these elements, the soil initial content is related to mother stone nature. But factors such as fertilizing the soil, also lixiviation of dietary

cycle inside a plant result in displacement of these elements and sometimes their accumulation in a specific horizon of soil or their disposal in drainage water.

The issue of soil and consequently plant contamination through heavy metals has been constantly considered by man. One of the most important chemical features of soils is their ability to retain and exchange ions on colloidal surfaces. This ability for cation exchange is one of the most important existing differences between soil and other environments of plant roots and it has made soil a suitable place for plants growth. In most cationic discussions, it has been assumed that a borderline exists between exchangeable cations and the product. However, neutrality of electric charge indicates the equality of total of cations and anions.

Distribution of different ions on colloidal surfaces is related to two factors of the minimum energy and the maximum disorder; however, this cation distribution around the soil particles is similar to distribution of gas molecules in the atmosphere. That is, ions are accumulated around colloidal particle which is negatively charged. But this cation arrangement around the particle is due to intense cation attraction by the particle (the minimum energy) and on the other hand, ions affinity to static distribution and scattering (the maximum disorder) and, it forms the ions arrangement around the colloidal particle.

In general, heavy metals in soil can have the following final forms:

- *Creation of mineral deposits such as carbonates and sulfides and also hydroxides*
- *Creation of complicated complexes with higher molecular mass with organic materials of soil*
- *Creation of strong bonds with clay minerals, manganese oxide and hydrated iron*

Overall, a limit has been considered for heavy metals; however, in spite of water and air pollution, which is easily measurable in terms of chemical compounds, given the soil complex system and dynamics, soil contamination cannot be easily measured and a definition for the soil without contamination is hard.

Along with other released elements, microelements also enter soil solution when silicate minerals are analyzed. The fate of these elements is controlled by different factors. These elements may be deposited or remain in soil.

Prediction of each of the above possible states is done through a factor called ionic potential (ion radius/charge (nm)). The elements having ionic potential values more than 95 make oxy-anions in solution including W, Si, Mo (VI) and Cr(VI). The



elements having ionic potential values less than 30 make cations in solution including Cd, Co, Cu, Fe(II), Pb, Ag, Mn(II), Ni and Zn. These elements may be held in compounds sediments of elements with ionic potential in the range of 30 to 95 (the third group). The third group which are the ionic potential between 30-95 include Cr(III), Fe(III), Mn(III), Mn(IV), V(III), Mo(IV) and V(v). As hydrated oxides in many soils, these elements are on soil aggregates in the form of a cover or enter inside soil capillary network. These compounds have a chemical control on other ions activities.

Oxy-hydroxides also serve as a template for other microelements in soil and when they are formed, other micro elements can remain invisible in sedimentary oxides.

Nickel and cobalt are among the elements which are in relation with manganese oxides. Copper and zinc also are in connection with iron oxide and manganese.

These oxides often have high affinity which is increased with the rise of Ph. Microelements are easily superficially absorbed in oxides; however, they may enter the crystal structural lattice. Hydrated oxides can be in the form of solution, but they deposit again in response to the change in reduction potential with soil Ph.

Microelements are often in the form of compounds and rarely are seen in released form. Table 1-1 shows the predicted affinity of elements for making complex with organic and mineral ligands in aerobic soils in acidulous and calcareous state. (Overall from left to right, reduction is reduced)

### 1-5 Factors affecting heavy metals absorption

Numerous factors affect absorbing heavy metals. From among them we can refer to these factors:

- Oxidation and reduction potentials
- Complex formation (selective superficial absorption)
- PH

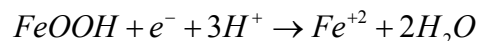
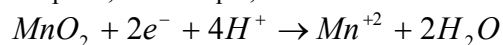
#### 1-5-1 Oxidation and reduction potentials

Saturation conditions and reduction of oxygen in soil make living organisms (such as anaerobic bacteria) use the second electron acceptor such as  $\text{NO}_3^-$ ,  $\text{Fe}^{+3}$  and  $\text{Mn}^{+4}$  and regenerate them; and consequently, oxidation and reduction (Eh) potentials are reduced.

This factor is important because electrochemical and biochemical changes caused by flooding soil directly or indirectly affect solubility and accessibility of microelements in soil. Flooding results in increase in iron, manganese and molybdenum absorption and in many cases develops heavy metals toxicity.

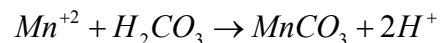
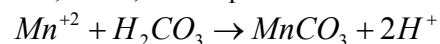
Oxy-hydroxides and also organic oxides of heavy metals are usually accumulated in soils which have adequate ventilation and change into insoluble form. For example, the existence of  $\text{Fe}^{+3}$  and  $\text{Mn}^{+4}$  which is of low solubility in soil is due to oxide conditions. But reduction (anaerobic conditions) makes these elements change into  $\text{Fe}^{+2}$  and  $\text{Mn}^{+2}$  which have no longer sedimentary state and increase concentration of these elements in soil.

One of the observable changes created after reductive conditions is  $\text{O}_2$  consumption and then the use of other electron acceptors which causes  $\text{H}^+$  consumption, for example,



So, this process will increase ph. But in fact,  $\text{CO}_2$  acts as pH buffering agent in these soils and remains constant at about 6 or 7 and this operation is through  $\text{HCO}_3$  and  $\text{H}_2\text{CO}_3$  reactions.

In the absence of  $\text{CO}_2$ , soil Ph. should go higher than 7 and  $\text{H}^+$  consumption continue. But because metal ions (including heavy metals) dissolved by reductive reactions can deposit on carbonates, hydroxides and sulfides and produce protons; therefore, a mechanism opposite proton production; that is, consumption occurs.



#### 1-5-2 Complex formation

Generally, heavy metals absorption is controlled by a mechanism called selective superficial absorption which is in fact inter-spherical complex formation. This absorption is markedly different from other metals absorption and accordingly, chemical reactions, accessibility and their other activities in soil are different. In fact, complexes formation is done through claths which can form strong bonds with heavy metals. The existence of these claths is important due to their effects in increase of metal ion solubility in soil solution. For example, if we consider claths as a reactant with Ca ion, we will also have Mn and Fe cations as microelements:

$$LT = L \sum H_{nL} + \sum CaXL + \sum Fe(III)XL + \sum MnXL$$

The total concentration of clath has been shown by LT, L the amount of free clath,  $\sum H_{nL}$  clathic protonic species,  $\sum MnXL$ ,  $\sum Fe(III)$  and

$\sum CaxL$  are clathric species including  $Ca^{+2}$ ,  $Fe^{+3}$  and  $Mn^{+2}$ . In fact, X represents a specific clath which contains  $H^+$  or  $OH^-$  and  $\sum MXL$  refers to clath-metal species which can exist.

Based on source, claths are divided into 2 organic and nonorganic groups. Organic claths are produced from organic materials analysis. However, these organic materials may also artificially enter the environment (such as adding sewage to the soil).

Nonorganic claths include multivalent ions- Si(IV), C(IV), N(V), S(IV), P(V), B(III), Se(VI), Mo(VI) and As(V)- which are able to produce poorly oxygenated acids in soil. Anionic form of these weak acids in soil-  $SiO_4^{-4}$ ,  $NO_3^-$ ,  $SO_4^{-2}$ ,  $PO_4^{-3}$ ,  $BO_3^{-3}$ ,  $SeO_3^{-2}$ ,  $MoO_4^{-2}$ ,  $AsO_4^{-3}$  and  $CO_3^{-2}$ - can act as clath and form a complex with heavy metals.

Pearson (1993) has divided metals into 3 general groups. On the base of the difference of the type of complex which is produced by microelements in comparison with complexes of other metals, he used the term HSAB (soft and hard acid and base). This principle, which classified metal ions to classes A, B and transitional metals, is based on hard and soft acid and bases theory that was offered by A. Herlands in 1985.

The base of this classification is the affinity of these elements for formation of stable complexes with ligand atoms in periodic table or compound compositions obtained from this table.

Class A ions are called hard acids which have electronic shield with spherical symmetry and are not easily affected by electric field.

Class B is called soft acid. They have electronic shield and are not symmetrical and can be affected by electric fields. Other metals also are placed intermediate between them.

In contrast, ligands also are divided into A and B groups. A ligands have high electro negativity and are oxidized hard. B group ligands have low electro negativity and are easily oxidized. The most stable complexes between metal and ligand A-A and B-B are formed. But other compositions are not so stable.

The term HSAB is experimental but it can give us useful information in the field of reactions of complex formation in soil solution.

Unlike conventional cations, in soil, which are hard acids ( $Mg^{+2}$ ,  $K^+$  and  $Na^+$ ), lots of heavy metals are soft. Therefore, they make a link with ligands more easily. However, the increase in concentration of  $Cl^-$  (a transitional ligand inclined to soft base) can affect different species of heavy metals. Classification of elements to A and B groups and also their ligands are in table 1-2. Soft metal

cations have higher toxicity in relation to transitional cations which themselves have higher toxicity in relation to hard cationic metals. Therefore, considering these elements in soil can prevent the onset of lots of toxicities in plants and also human beings.

#### 1-6 Absorption of heavy metals in plants

Absorption of these elements is often taken place through the root and transmitted to pneumatic organs. The action depends on different factors such as:

- *Total amount of these elements in soil*
- *Proportion of all the elements which have a form absorbable in a plant*
- *Plant ability for carrying metals along root-plant system*

Due to some surveys, Tiffen (1977) mentioned that plants are pseudo acceptors for trace elements or heavy metals; however, this statement was expressed based on apparent indications.

Absorbency of these elements by plant depends on the chemical form and the position of these elements in soil. That part of metals which have been located in solution phase can more easily be absorbed by root but on the contrary, absorption of the parts which form a bond with solid phase of soil (for example, inside crystal network of initial stone) is hard.

However, another effective factor is the charge of absorbing parts of the surface of minute particles such as clay and organic materials. The higher the charge is, the more rigidly it is absorbed.

Moreover, acidity, organic material and drain conditions are factors which affect metals chemical form and thus its absorption by plant.

Due to having cationic exchange ability, the root surface can absorb metals. When heavy metals in soil are more than the standard level, they damage roots or leaves and finally the product; and if used for animal's grazing or man's nourishment, they can be dangerous. For example, the intensity of cadmium and lead may not harm plant but it is very harmful for the feeding man.

However, the damages to microscopic creatures should not be neglected. Rath et al. (1987) reported that microbes are the first community damaged by the presence of heavy metals. Growth reduction and fixation of nitrogen by cyanobacteria can be seen as the result of adding heavy metals to soils.

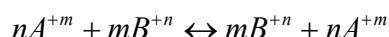
In general, through entering the bodies of these microscopic organisms, these elements affect their metabolism; and in many cases, they produce toxic substances which lead to the loss of organisms.

In case of human and other creatures feeding on contaminated materials also, we see creatures' physiological, physical or psychological disruption; because, after entering a body, the materials cause illness. These elements often enter a body through skin, digestive system and inhalation.

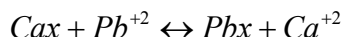
#### 1-6 Absorption of heavy metals in soil

The most important chemical feature of soils is their ability in absorbing and exchanging positively charged ions on colloids surface. Due to the type of research, heavy metals including zinc, cadmium, lead, chromium, nickel, and also manganese and copper have been studied in terms of quantity and their changes in soil.

There are different attitudes about cations absorption on colloids surface and probably the simplest attitude is the law of mass effect which is discussed under the title of The Law of Mass Action in chemistry. For instance, if we consider one of the elements under study, the following equation can be presented for it:



As we see, the equation consists of 2 components. One component is related to a solution phase and the other is a solid phase. Given that the dominant cation in most Khuzestan soils is calcium, the issue of covalent elements exchange, which is easily justified, is raised:



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### Side Effects of Risperidone

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**Abstract: Introduction:** Schizophrenia occurs in all populations and has been considered as a major disease with admixture of positive, negative, cognitive, mood, and motor symptoms. Risperidone is one of the new antipsychotics drug for treatment of schizophrenia. **Materials and methods:** Sampling method was easy sampling based on objective group, by completing the questionnaire. Treating dosage of Risperidone was determined by the psychiatrist in terms of patient's condition. Patients visited 3 times during the research by psychiatrist. **Result:** there are some side effects of risperidone; Parkinsonism is the most of them. Parkinsonism clearly developed in men more than women and clearly increased along with increasing dose of Risperidone, particularly in over 4mgr/day doses. **Conclusion:** we recommended the anticholinergic drug started at first with risperidone.

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**Key word:** risperidone, side effect, schizophrenia

#### Introduction:

Schizophrenia occurs in all populations and has been considered as a major disease entity over the past century; its causes and pathogenesis remain obscure. The incidence varies geographically and temporally. The annual incidence of Schizophrenia averages 10 to 15 per 100,000 and the prevalence in the range of 1.4 to 4.6 per1000. The main age range of risk for schizophrenia is 20 to 35 years (1- 4). It is characterized by an admixture of positive, negative, cognitive, mood, and motor symptoms whose severity varies across patients and through the course of the illness. Schizophrenia tends to be a chronic and relapsing disorder with generally incomplete remissions, variable degrees of functional impairment and social disability. Positive symptoms include delusions, hallucinations and other reality distortions. Negative symptoms involve a blunting or loss of a range of affective and conative functions. These include impairments in affective experience and expression, abulia, alogia, anhedonia, avolition, apathy, and reduced social drive. Disorganization of behavior frequently co-occurs with formal thought disorder. Disorganized thinking and behavior are heritable and, more prominent during acute exacerbations, relatively persistent, and associated with poor outcomes. Impairments in affective experience and expression (negative symptoms) have

long been considered to be cardinal features of schizophrenia and often precede the onset of psychosis by several years. The full-blown catatonic syndrome can occur in the context of stupor or excitement, and is characterized by echolalia, echopraxia, automatic obedience, waxy flexibility, and extreme negativism (5-10). The management of schizophrenic patient presents a dual dilemma for the physician, because schizophrenic patients may appear to be less cooperative than medical patients without concurrent psychiatric illness (11). Antipsychotic drugs are the mainstay of the treatment for schizophrenia. Antipsychotic drugs are typical (traditional) and atypical (novel). One of the atypical antipsychotic drugs is Risperidone, with a unique biochemical profile (12). Side effects of pharmacological treatment in schizophrenia continue to be a major issue in spite of the development of new antipsychotics. Risperidone has some adverse effect : tremor, rigidity, weight gain, extra pyramidal side effect, dysarthria, adverse effect on eye movement, dizziness, ... (13-22). Most of these articles emphasize that the Risperidone has a favorable risk/benefit profile and it is superior to typical antipsychotics and it has less side effect to typical antipsychotics. But we saw more side effect of Risperidone in patient with schizophrenia refer to psychiatry clinic. Therefore we survey side effect of



Risperidone in 50 patients with schizophrenia refer to Shahid Mofetteh psychiatry Clinic in Yasouj, south of Iran.

#### Methods and Materials:

This study is a descriptive study which is conducted as longitudinal form and without any interference; it is provident and field study in terms of time and operation, respectively this research is the prevalence of side effects of Risperidone (an antipsychotic drug, produce in Iran by Sobhan daru co.) in patients with schizophrenia who refer to Shahid Mofatteh Clinic of Yasouj city, south of Iran.

Inclusion criteria: patients with Schizophrenia who were diagnosed by the psychiatrist based on DSM IV-TR criterion, Age 15-60 years, no any history of disease and drug consuming previously.

Exclusion criteria: Patients whose families were disagreed with this plan because of different excuses such as social problems, worrying about divulging family's problems and tribal prejudices were rejected of this plan. Patients who did not cooperate in treatment, announcement and recording side effects. Patients who developed any medical disease during this study.

Studied population includes 50 patients with schizophrenia who referred to Shahid Mofatteh Clinic of Yasouj city, south of Iran. The control group is the same patients. Sampling method was easy sampling based on objective group, by completing the questionnaire. Treating dosage of Risperidone was determined by the psychiatrist in terms of patient's condition between 1-10 mg/day.

The questionnaire included three parts: Demographic data, Information about drug dose and time interval after treatment and Information about drug's possible side effects.

Patients visited 3 times during the research; first visit at the beginning of study, second visit at 14 days after treatment, third visit at 30 days after treatment. Interview, mental status examination and physical exam were done by psychiatrist based on DSM IV-TR criterion and possible side effects of Risperidone were recorded in the questionnaire at every visit.

If the patients experienced side effects in 2-13 days or 15-30 days intervals, they or their families called the psychiatrist for another visit and after interview, mental status examination and physical exam, their possible side effects were recorded in questionnaire.

After collecting information, they were analyzed using SPSS software. Frequency tables, central indices and variation were used to describe information.

It is necessary to mention that this research was carried out by permission of the Vice Chancellor for Research of Yasouj University of Medical Sciences

and the confirmation of Ethical committee of this University and also acquiring the patients' satisfaction and informed consent of them and their family.

#### Results:

The current study was conducted on 50 patients with schizophrenia who referred to Shahid Mofatteh Clinic of Yasouj city (south of Iran), they were treated by Risperidone. This study aimed at analyzing possible side effects of Risperidone on them, so the following results were found:

These 50 patients included 32 men (64%) 18 women (36%). 18 patients were married (36%) and 32 patients were single (64%).

14 patients (28%) were 20-30 years old (the most). The youngest patient had 19 years old and the oldest one was a 60years old. Mean age of statistics community was 38.3 years.

20 patients (40%) were illiterate and were not able to write and read, 20 patients (40%) had education lower than diploma and only 10 patients (20%) had diploma or higher education.

Minimum and maximum applied doses were 2 and 10 mg/day respectively. 16 patients (32%) consumed 4 mg/day Risperidone (most frequency) and others used other doses. The average used dose was 4.8 mg/day.

Side effects (showed in table 1):

Parkinsonism: 4 individuals (8%) complained of Parkinsonism at 5<sup>th</sup> and 7<sup>th</sup> days, its prevalence reached to 27 patients (54%) at 14<sup>th</sup> day, and finally at 30<sup>th</sup> day of study 2 another person complained of Parkinsonism, thus 29 patients (58%) complained of Parkinsonism at the end of this study.

Increase of Appetite: 8 patients (16%) mentioned intense increase of their appetite occasionally and 4 patients (8%) reported intense appetite continuously. Appetite trend was unchanged since 14<sup>th</sup> to 30<sup>th</sup> day and totally 12 people (24%) suffered from this side effect. Occasional increased appetite and continuous increased appetite are discriminated by the interviewer in the questionnaire.

Tremor: 4 patients (8%) complained of fine tremor.

Sexual interest: 4patients (8%) complained of decreased sexual interest at 30<sup>th</sup> day of follow-up.

Agitation: 4 patients (8%) complained of occasional intermediate agitation at 14<sup>th</sup> day of follow-up, one of them was cured at 30<sup>th</sup> day.

Galactorrhea: 1 patient (2%) complained of galactorrhea at 30<sup>th</sup> day of follow-up.

Diarrhea: Only 2 patients (4%) complained of diarrhea was treated without any interference at 10<sup>th</sup> day.

Constipation: Only 2 patients (4%) complained of constipation which was cured at 30<sup>th</sup> day.

Fatigue: Only 2 patients (4%) complained of occasionally fatigue which was cured after 25 days after Risperidone commence.

Dizziness: Only 2 patients (4%) complained of occasionally intermediate dizziness at 30<sup>th</sup> day follow-up, his dizziness has been cured.

There is no complained of any other side effect.

Relation between side effects and drug dosage was shown in table 2, fig 1 and 2: amongst analyzed

side effects of this study, Parkinsonism clearly increased along with increasing dose of Risperidone, particularly in over 4mgr/day doses. There was not found any relation between increased drug dose and development of other side effects. Parkinsonism clearly developed in men more than women. There was not found any relation between patients' sex and development of other side effects (table 3).

**Table1: Distribution of recorded side effects of risperidone during two stage of study**

Side effect	Since start day to 14 <sup>th</sup> day	Since 14 <sup>th</sup> to end of study	Since start to end of study (50 patients=100%)
parkinsonism	27(54%)	2(4%)	29(58%)
Increased appetite	12(24%)	0(0%)	12(24%)
Tremor	4(8%)	2(4%)	6(12%)
Decrease of sexual interest	0(0%)	4(8%)	4(8%)
Agitation	2(4%)	2(4%)	4(8%)
Diarrhea	2(4%)	0(0%)	2(4%)
Fatigue	2(4%)	0(0%)	2(4%)
Dizziness	2(4%)	0(0%)	2(4%)
Galactorrhea	1(2%)	0(0%)	1(2%)
Constipation	1(2%)	0(0%)	1(2%)

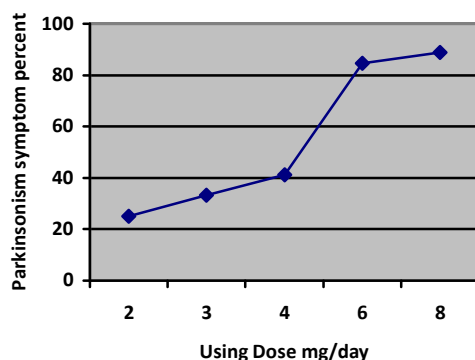
**Table 2: Development of Parkinsonism in terms of received drug dose**

Parkinson/dose	2mgr	3mgr	4mgr	6mgr	8 mgr	All patients
Positive	2 patient	1 patient	7 patients	11patients	8 patients	29patients
Negative	6patients	2 patient	10 patients	2 patient	1 patients	21 patients
All patients	8 patients	3patients	17patients	13 patients	9 patients	50 patients

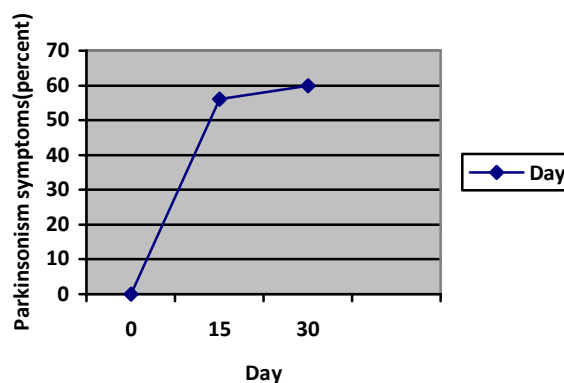
**Table 3: Distribution of Parkinsonism symptoms in patients in term of sex.**

Parkinsonism symptoms	Positive	Negative	Total
Male	22(69%)	10(31%)	32(100%)
Female	7(39%)	11(61%)	18(100%)

$$\chi^2 = 4.22 \quad df= 1 \quad P= 0.04$$



**Fig. 1: relation between time and percent of Parkinsonism**



**Fig2: Parkinsonism symptoms in terms of received drug at time**

**Discussion and conclusion:**

Schizophrenia has been considered as a major disease entity over the past century, occurs in all populations. It is characterized by an admixture of positive, negative, cognitive, mood, and motor symptoms. There are typical and atypical antipsychotics drugs for treatment of schizophrenia. One of the atypical antipsychotic drugs is Risperidone. Most of articles emphasize that the Risperidone has a favorable risk/benefit profile and it is superior to typical antipsychotics and it has less side effect to typical antipsychotics. But we saw some side effect of Risperidone in patient with schizophrenia refer to psychiatry clinic. Therefore the aim of this study is determination of side effect of risperidone.

One side effect of risperidone in our study was Parkinsonism with 58% incidence, approximately the same as report of Knable et al with 42% incidence (21), but opposite to reports of Leucht et al and Yang et al with very slightly extra pyramidal side effect (14 and 18) and Page et al reported no extra pyramidal side effect (20).

Another side effect was increased appetite with 24% incidence, the same as reported of Fell et al and Verma et al (15 and 19).

Another side effect was tremor with 8% incidence but in research by Yen et al tremor was the most side effect (13).

Another side effect was rigidity reported by Yen et al but there is no reported in our study (13).

Another side effect was decrease sexual interest with 8% incidence, but in reported by Brunelleschi et al this side effect was the most (17). The low incidence of decrease libido in our study may be due to social inhibition.

Another side effect was dizziness with 4% incidence, the same as report of Yang J et al (18).

In our study there is galactorrhea, the same as report of Kleinberg et al (22). This is very difficult for unmarried female in the village area in our province.

In our study there is diarrhea and fatigue but no report in other study.

In some reports there is metabolic disorder, adverse effect on eye movement activity (12 and 16), but there is no report in our study (visited by ophthalmologist).

**Conclusion:**

There are some side effects of risperidone with high incidence for example Parkinsonism and it is better anticholinergic drug started at first. When galactorrhea reported by unmarried female, risperidone must discontinue due to social inhibition.

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**Sexual analysis of women weblogs in Iran**Nastaran pashank<sup>1</sup>, Masoud Tarantash<sup>2</sup><sup>1</sup> Faculty of Management, Central Tehran Branch, Islamic Azad University, Tehran, Iran[Nastaran\\_pashank@yahoo.com](mailto:Nastaran_pashank@yahoo.com)<sup>2</sup> Department of Urbanism, Zanjan Branch, Islamic Azad University, Zanjan, Iran[Tarantash@yahoo.com](mailto:Tarantash@yahoo.com)

**Abstract:** Start working with the Internet and its expansion in recent decades, virtual space has provided a good platform for users, they can use this information and also they can produce it by themselves. One of the most important and popular fields for producing contents are weblogs. Blogging in Iran has been welcomed; also women use it frequently in Iran. As soon as blogging started in Iran, when count of Persian blogs became two-digit, the first Iranian woman blogger started to write in virtual space. Now after several years can be said with confidence there's too many women producing large amount of Persian blogs and they have active role in blogging. Due to historical, social, cultural and religious circumstances of Iran and male-dominated culture during several thousand years, it seems Iranian women find suitable space to express their opinions, interests and ideas with the expansion of usage of Internet and Interaction in virtual space and nowadays increasingly has been welcomed by Iranian women. With this interpretation Iranian women use cyberspace for generate their feminine content without any restrictions of physical spaces and prohibitions of male-dominated societies. Due to break these restrictions, more blogs become a personal diary and the personal issues of women, issues that not normally expressed in the physical space. Usually they don't blogging about political, social and economic terms and even some of those who represent the cultural and political issues use male nickname to find position between men's blogs. In any case, weblogs has helped women to express their own issues. The new generations of women have participated in the social sphere more than their previous generations and still seeking to influence more by virtual space. Increasing number of women blogger proves this claim, women have been able to produce their interested content by using unlimited virtual spaces, and they start to communicate with each other by these facilities. This study analyzes women's writing about themselves in their weblogs. Understanding what women do or feel is achieved by examining the form and content of this blogs. Blogging is a way for women to express views, receive and exchange ideas and to express themselves, Due to the presence of male culture conditions and absence of equality between women and men in Iran, this way women blogger have been selected as an alternative for this deficiency. This study examines what Women have written and posted in the blogs they run in the one of biggest website in Iran called Persian blog (Hyperlink: <http://www.persianblog.ir/>). The content of women blogs is qualitatively analyzed to see how the role of women and mother being "acted out", and motherhood being represented.

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**Key words:** women weblogs, Blogging, Cyber Space

**Introduction**

Nowadays, media provide tons of useful and practical information in various fields such as women employment, scientific achievements, child raising issues, healthcare tips and personal hygiene, principals of housekeeping, and assorted issues of married life. (E'ezazi, 1994). In neo-liberal societies, mothers are encouraged to use specialist knowledge about mothers and children as their model of good practice (Chen, 2010). It's suggested, on the one hand, that motherhood is natural and that mothers' knowledge and their skills in childcare emerge easily and instinctually, but on the other, that childrearing is highly skilled and serious, so mothers need to acquaint themselves with formal knowledge and techniques (Phoenix, Woollett & Lloyd, 1991), and comply with physicians' and professionals' expectations or suggestions (Cherry, 1999; Daniels &

Parrott, 1996; Murphy, 2000). Books, magazines, websites in relation to childrearing are easy to find to help mothers care their children, interact with their children, and enact their motherhood. In this, it demonstrates how constructions of knowledge articulate with established power relationships and reify popularly accepted notion about "normal/good mothers" (Phoenix, Woollett & Lloyd, 1991).

Mothers are generally portrayed as the central figure in their children's lives, as carers, socializers, tutors, and providers. They are rarely considered having an existence of their own. Historically, motherhood was the defining characteristic of women, if women were not mothers or potential mothers; they were nothing (Medina & Magnuson, 2009; Roy, 1998). What makes a good mother/motherhood has been socially constructed and has political implications and consequences, yet little



is recognized and written about mothers as active agents (Phoenix, Woollett & Lloyd, 1991). More often, mothers are discussed as caregivers for their children or partners, their experience around motherhood, including their identity as mothers, their feelings towards their children, and their ways of coping with discrepancies between the ideal of motherhood and the real times of their lives is hardly addressed beyond the “private”(family & friends...) sector. Women’s experiences are regarded as trivial and not of much importance, and thus marginalized or excluded in a patriarchal culture. Women’s voices are stigmatized as fussy sister talk, women’s talk, and mommy talk (Hsiao, 2005, 2007; Lopez, 2009).

In the contemporary context of neo-liberalism and postmodernism, Baker (2009) argued that the emphasis on personal agency and decision-making and the declining influence of preordained and institutionalized structures have changed modern femininity vastly around the world. The study found although Australian young mothers feature a supposedly superseded and traditional gender role in their family lives and motherhood, they perform a transformation in the experience of the personal; particularly the construction of individualized biographies of reinvention through motherhood.

Women in modern Iran return to their work as soon as three month after giving birth. Their children are sent to daycare center, nannies, and kindergarten. The ideology of childrearing and mothering has been considerably shifted in accordance with the enhanced women’s self-consciousness in this country. Mothers born in 1980’ confronted the dilemma and conflicts which their mothers had never had. These women grew up in an economically developed, highly competitive society which provides them a platform to make self realization and achievement in all areas, yet demands excellence of their performance in all areas. Women suffer in great role conflicts. Douglas and Michael (2004) also claimed that contemporary mothers fulfill many social roles while striving to meet the expectations to nurture, schedule, taxi, and feed their families. The standards for good mothering seem to be escalating, and the constraints on mothers’ pursuing self actualization seem to be also expanding. The intensive mothering ideology or the new “monism” is regarded to collide with individuated personhood and one’s subjectivity promoted in the postmodern and neo-liberal society. Besides the advocacy of women’s voice heard, experience respected, and dedication verified by feminists, technology seems to provide assistance in the process of mother’s empowerment. The articulation of mothers’ experience in the public sphere had not been valued or even allowed just as women’s other

collective experience had long been excluded from history of mankind. Alice Walker’s (You, 2008) and Adrienne Rich’s (Hsia, 1997) are very few exceptions. Practices associated with motherhood is seen as part of the private or domestic sphere where women belong whilst men inhabit in the social or working context where important and serious mainstream discourses take place(Burr, 2000; Lopez, 2009). Today the public/private boundary might be trespassed by the internet-enabled (virtual) space; such as chat room, forum, blog, etc. With the advent of easy-to-use weblog software, blogs become popular in Iran in recent years, and the number of blogs has been soaring. Along with the rising of the individual self-consciousness, personal style featured blogs become one of the most important site for self expression, presentation, and performance in the age of information (saber, 2007). One of the characteristics that differentiates blogs from other kinds of writing on the web is that they are written with a strong sense of the author’s personality, passion, and point of view, and the most popular content for blogs is the writer’s life and experiences(Lopez, 2009). “Mommy bloggers” are women who blog on issues relating to motherhood and family, and have become an influential section of the blogging community (Neff, 2008). Klein (2009) defined mommy bloggers as a generation of women who are living their parenting years out on the Internet, as a means of spreading the word. When women bloggers wanted a piece of blogosphere; it seems that they wanted was to participate in the public sphere as equals with their male blogging counterparts. Mommy bloggers publicized their mothering experience and so cross the public/ private border set for men and women. Maternal writing in blogs breaks the rule of mother being silent and motherhood being private/domestic. Lopez (2009) then argued that mommy blogging challenges and reinterprets representations of motherhood. The study explored how motherhood is represented in the internet community for mommy bloggers. Namely, the study focused on the content written by ordinary people, not educational elites nor medical professionals who used to get to define “good/normal” mother and “correct” mothering.

#### **Motherhood as Institution**

Motherhood is a historically constructed ideology that provides a gendered model of behavior for women, even those who have not given birth or raised children (Reger, 2001). Having children or being a mother is often constructed as a women’s instinct, “...the day will come when you will want children and everything else you have achieved will pale by comparison” (cited from Tropp, 2006). Marriage and domesticity is said the ultimate goal for

a woman in a patriarchal culture (Burr, 2000; Roy, 1998), and the media often endorsed the belief that bearing children is the single most important element of adult life (Condit, 1996). If women “choose” not to have children, they are responsible for pathological repercussions within their bodies, which in turn might result in great disorder and pathology at the societal level in epidemic of breast cancer (Lantz & Booth, 1998; Yadlon, 1997).

Although many gender norms are implicit, maternity norms are clearly expressed in numerous ways by the dominant culture; good women/mothers are thought to be, by nature, altruistic, nurturing and self sacrificing (Burr, 2000; Cherry, 1999). In fact, women in particular are likely to be labeled deviant if their behavior does not adhere to the dominant gender norms. Deviance is socially constructed, subjecting its objects to social control; those whom labeled deviant are exposed to disapproval or penalty. Burr used “monstrous feminine” to signify the woman who falls outside of all gendered notion of femininity and is interpreted as a potential threat to patriarchal and traditional notion of procreation; they might be too old (Hadfield, 2007; Kelha, 2009), too young (Hadfield, 2007; Wilson & Huntington, 2006), not in a relationship with a man (May, 2004; Valdivia, 1998), not be able to stay home with their children (Avellar & Smock, 2003; Garey, 1995; Guendouzi, 2006), or even not be able to breast feed their children (Bartlett, 2003, 2004; Sutherland, 1999). Guendouzi (2006) wrote that the ideology roots of what currently equates to a good mother are based on the nuclear family and a model of intensive mothering. Hartman has criticized intensive mothering ideology as a major step backward in gender equity, though it continues to be the cultural and political standard by which mothering practices and arrangements are evaluated (cited from Medina & Magnuson, 2009). Mothers, working or not, are considered to be responsible for family care giving and blamable for their children’s incompetence and failure (Kokkonen, 2009). Choi, Henshaw, Baker, and Tree (2005) conducted semi-structured interviews with 24 precipitous and multifarious women in the UK and found that their expectations were very strongly influenced by the myth of motherhood, and conflicts occurred as a result of the discrepancy between the myth and the reality. However, the study found no evidence of resistance to the ideology of motherhood; women were so afraid of being seen to have failed, the only option was the work harder at the performance and this then perpetuates and reinforces the ideology.

#### **Motherhood as Experience**

Early in the second wave of United States feminism, activists such as Simone de Beauvoir and

Firestone identified motherhood as a target for transformation and reevaluation. Until mid 1970’, some feminists, such as Adrienne Rich, argued that denying and rejecting motherhood will obliterate the uniqueness of female experience, and so then reframed motherhood as an essentially positive experience damaged by patriarchal constraints that devalued women’s work (Reger, 2001; Yu, 2006). One of the major categories in the study of motherhood is the experience of mothers. It is disputed that mothering practices have long been based on a white, middle-classed, heterosexual dual-parenting ideology; the diversity of motherhood should have gained more attention. Buzzanell, Naymer, PazTagle, and Liu (2007) explored how diverse (Asian, Hispanic, African American) women perceive and enact their transition into working motherhood in ways that reflect (and are shaped by) their social identities. It was found that their discourse conveys their struggle over and the interplay among mainstream United States as well as their family structures of support. Kielty (2008) also showed interest in the experience of mothers outside of the mainstream. Twenty non-resident mothers in the UK were interviewed to examine their discursive management of their atypical situation and how they positioned themselves in relation to dominant cultural scripts surrounding motherhood. It was argued that these mothers are at risk of isolation as a consequence of social stigma and this may pose barriers to their taking a full and active part in the lives of their children. Other than ethnicity, more facets of mothering practices were discussed. Kelha (2009) examined the experiences of pregnancy, childbirth and postnatal care of middle class women who have become mothers after the age of 35. The study analyzed how these women perceive discourses concerning their age and the medical risks attached to it and their possible strategies of resisting it. May (2004) take a different route into lone motherhood by focusing in identity construction in the life stories of Finnish lone mothers? It was said that the social category of lone motherhood is not one that the lone mothers themselves adopt in their narrative constructions of the self, instead, they attempt to create space for themselves within the normative narratives on motherhood and womanhood, thus refuting the idea that lone motherhood is constitutive of identity. In Iran, different mothering practices were widely investigated. Mothers having children with autism, mothers conceiving with the aid of reproductive technology, mothers with schizophrenia, lesbian mothers, mothers with physical disabilities, divorced lone mothers, and foreign mothers are just to name one or two.

#### **Motherhood as Identity and Subjectivity**

In recent years, identity and difference have been the focus of key debates in cultural studies. Influenced by this trend, mothers' identity and subjectivity also become one of the central issues in the recent studies around motherhood. You (2008) reminded when addressing mothering practices, the difference or diversity is essential as well as similarity. Motherhood constructed in various historical and cultural contexts deserves fair investigation and the subjectivity and personal agency of mothers deserve recognition. Collett (2005) studied the way mothers of young children dress their children, their concerns about when and with whom to manage impression, and the impression these women hope they portray through the physical appearance of their children. Results show that women do use well-dressed and groomed children to enact and confirm identities as "good mothers" and to protect and enhance their own self-concepts during the course of everyday social interaction.

Although previous research has shown that mothers alter work status to live up to intensive mothering expectation, Johnston and Swanson's (2006) study found that mothers also alter their construction of intensive mothering expectations to reconcile these demands with their work status choices. Mothers with different employment decisions differ in their construction of Y.Elvin-Nowak and H.Thomsson's three discursive positions--accessibility, happy mother happy child and separation of work and home. Garey (1995) also examined the way in which employed women with children use the night shift to support a construction of motherhood which closely resembles that of mothers who are not in the labor force. Night shift nurses construct themselves as "stay-at-home moms" by limiting the public visibility of their labor force participation, by involving their children and themselves in symbolically-invested activities, and by positioning themselves in the culturally-appropriate place and time: at home, during the day. All of those strategies work to highlight their visibility as mothers. Infant feeding is one of the central issues regarding the neonatal care. In a capitalistic culture, mothers have not routinely breastfed for several generations. Bartlett (2004) argued that breastfeeding is a cultural practice, rather than something natural, innate, or even gendered. Most of studies see breastfeeding as a personal choice and a personal practice which has varying levels of success or failure. Failure to breastfeed is interpreted as a personal failing of the mother. In fact, feeding becomes a moral minefield to mothers (Bartlett, 2003). The present social context makes breastfeeding extremely difficult for many women. Expert's advice mothers to breast-feed and warn of

the short-medium-and long-term risks associated with formula feeding. Murphy (2000) found most mothers accept the validity of these expert claims and most initiate breastfeeding. However, many abandon breastfeeding before experts recommended and develop strategies to deal with the threat to their identities as good, neo-liberal citizens and mothers. Johnson and Williamson (2009) analyzed, from a feminist poststructuralist perspective, discourses surrounding expressing breast milk instead of breastfeeding the newborns. From interviews with sixteen first time mothers in England, they identified expressing breast milk as a substitution which provides convenience, efficiencies, and independence for women. Mothers actively create the "good maternal body" and use expressing breast milk as a way of aligning subjectivity with cultural ideologies of motherhood. Foucault claimed that we as subjects are perpetually engaged in process whereby we define and produce our own ethical self-understanding. The methods were called technologies of the self, also called care of the self or practices of the self (Capurro, 1996). Technologies of the self are the form of knowledge and strategies that permit individuals to manage one's body, soul, thought, conduct, and way of being, including caring the self, knowing, understanding, and judging the self, examining the self, doubting the self, and expressing the self (Chen, 2004; Foucault, 1988). Care of the self is the starting point to resist against the domination of social structures, yet also the effect of execution of macrological structures of power. Some people celebrate that virtual space created by new technology provides freedom and emancipation for the modern self; some consider the self in the cyberspace is only one of those created in everyday life. However, computer technology and the Internet seem to embody the eccentricity of the modern self and profoundly change the way individuals construct the self. In the age of postmodernism, the self is multiple, eccentric, local, scattered, fragile, and fluid. One has to rely on his very own life stories to find and define his self (Chen, 2004), and to suture the eccentric subject, the society is to identify differences among social groups and display the diversity of meanings rather than pursuing consensus. Kitzmann claimed that in both blogging and the act of writing one's autobiography, an important feature is foregrounding the construction of the modern individual self (cited from Lopez, 2009). In the act of writing from one's own subjectivity about one's own life, one appears to be creating a bounded identity.

Mommy bloggers are those who write about tales of parenting joys and woes and the number of them is increasing. However, in a conference in San Jose, California in 2005, more than 300 women

gather to discuss their place in the blogosphere through BlogHer, an internet community for women bloggers. The mommy bloggers felt attacked and marginalized as if their personal style was somehow less valuable than their colleague's entries on current events or politics. Lopez (2009) argued that the way mommy bloggers are treated is connected to a long history of the struggle for women to define their identity in relation to the title of mother. Although mommy blogs might still contain complaints and what is considered worthless or insignificant dramas, this collection of writing is given new power when they are posted in the Internet for the public to view and discuss. It's not just solitaire or record-keeping, mommy bloggers write their very own stories so that others can recognize their similarities and shared interests. Chan(2008) also analyzed a sample of chat room and forum messages from a user driven Hong Kong-based parenting website called Happy Land, and found that the website has developed beyond its technology-mediated nature into a community of face-to-face friendships and social and emotional support.

#### **Methodology**

The website analyzed in this study is an Iran-based Persian language parenting site called Persianblog (Hyperlink: <http://www.Persianblog.ir>). The site was established in 2002 by three male engineers. By 2010, Persianblog has become the biggest and the most popular website of its kind in Iran. The site provides personal blogging spaces for diaries, albums, guest books, e-mail boxes, and spaces for videos. There are a variety of forums for public discussion of parenting issues which contain millions of posts from participants. From the data offered by the Persianblog, there are 180,000 visits on the front-page of the Persianblog website per day, and 1,800,000 visits on the forums per day, and 3,000,000 total visits on the mommy blogs per day.

Persianblog Families are the spaces for those who have the same interests and/or experiences to interact and share. Members can set up a family and be the head and gather family members (participants). From the long-term observation, the study found three types of families. One is developed by those who have children of same age, such as Family of babies born in July 1995, Family of babies born in September the year of cow, etc. The second type is formed according to where the mommies and babies are located. These mothers usually lived in the same district and shared useful information of resources in that area. They often have family gather events and group shopping (stores or internet). The last type of family is for those who have similar experiences such as Family of children with Tourette syndrome, Family of single moms, Family of mothers who lost

their kids, Family of step-mothers, etc. Besides the participant observation of the website, the researcher also went interview with the chief of the public relation department in Persianblog to obtain detailed information about mommy bloggers, their content of the blogs, and also the forum discussions and Persianblog Families. There were more than half million of registered members in the Persianblog website by January 2010. About one tenth of the members paid for the membership, called VIP members. These members paid NTD.365~1,990(USD11~60) per year to get more spaces and services than the free members. Since Persianblog website is a huge data-base for our study, it's not easy to choose the texts to be analyzed. For the forum posts, the keyword research built in the website was used. On the front page of the website, some of the most discussed topics were listed. The researcher read through the content (topics and full texts) and started to form the keywords to be used later on. The keywords used to find the posts on forums were "childrearing", "mommy talks", "parents-in-law", "new mothers", "breastfeeding", "family", "work", "at-home mothers", "working mothers", and so on. Most of the texts chosen were located in two forums---"Letting it all out" and "Free talks". This is consistent with what interview data shows. Since I can't use keywords to find blog texts, it seems even harder to search for the mommy blogs. In Persianblog, mothers' blogging is displayed in the form of diary. The mommy bloggers who are active in this website were recommended by the PR chief in the interview. The researcher also read through the forum posts obtained by the keywords, and found those mothers who often asked questions and responded. Besides, in the section of Persianblog Families, hundreds of families were scanned to look up those having members over 100 people, and found the heads of those families. With the strategies described above, the study focused on the texts written by mommy bloggers participating in the Persianblog website most vigorously and actively.

#### **Results**

Based on the interview with the chief of the PR department in Persianblog and the internal data provided, most members of Persianblog mommy blog website are aged from thirty-one to forty(69%). Eighty-six percent of them have only one child and seventy-three percent have young children (aged fewer than 4). Members' educational level is relatively high, sixty-nine percent of mothers had gone to university/college. Twenty-seven percent of users are stay-at-home mothers. More than half of them (54%) earn less than 30,000 NT dollars per month, considered fairly low income. Around two thirds of members live in the north of the country.



Since most writing and discussion about motherhood are in the blogs and the forums, the researcher had long been reading the posted articles in both. There are more than forty forums in the Persianblog website yet two of them contain some sixty to seventy percent of discussion, “Free talks” and “Letting it all out”(based on the interview data and participant observation). Topics attracting the most posts are “childrearing”, “stay-at-home mothers’ anguish”, “working mothers’ dilemma”, “living with the parents-in-law” and so on. In analyzing texts in the blogs and forums, it was found that some users were in dual-earner, small nuclear families, yet quite a few lived with their parents-in-law, even sisters or brothers-in-law. This study aims to understand what mothers do and how they feel about mothering, the images of mothers the mommy bloggers portray in their writing in blogs and forums. Frankly, as a reader, I enjoyed reading these research texts, sharing their happiness of childrearing, the joy to be with their kids, to be needed and wanted by their kids, yet also empathized with their agony to be isolated, devaluated, despised, in childrearing and housekeeping, and the torture and dilemma between work and family. Mommy bloggers keep all kinds of records, everything and every aspect about their kids’ lives; height, weight, the shots gotten, how much of and when the milk or food was taken, when and how and even how much their babies pee or poo and sleep, how good or bad a kind (or brand) of baby product is for their kids, how friendly or not a place (restaurants, super markets, hospitals, pediatrician clinics, parks, kindergartens...) is to their kids. What their kids are going to eat, drink, watch and learn, mothers try to evaluate and get involved. During pregnancy, mothers also write about their body and emotion changes and the sentimental connection with their babies. Mothers also like to share their family lives, having gone where with whom doing what, getting what from whom and giving what to whom, and how they feel about all these. By reading these mothers’ unexciting, everyday details which are so natural, real, mundane, even trivial, yet so unique, peculiar and individual, one seems to witness these mothers’ little happiness and misfortune in their lives, and seems to be able to understand and imagine their lives through the stories and anecdotes in their blogs. The language used in mommy blogs and forums is extremely informal and usually narrative. Some of the content is full of humor and levity to entertain the audience, yet still show the abundance of sentiments. The readers of such blogs feel very close to the author partly because of the resonance. They would laugh and cry along as if they are listening to a friend.

Scholars had criticized the Mother War rhetoric; work status and mothering are culturally

constructed as rigid binaries (Johnston & Swanson, 2004; Medina & Magnuson, 2009; Stephens, 2004). However, the cultural Mother War rhetoric had seemed to be internalized in most mothers’ thinking. The study has gained a few discourses or discursive positions surrounding motherhood produced by participants in Persianblog website. Mothers often identified with these two categories of mothers, yet the discourses were not so exclusively created by each category.

### **1. Sacrifice and Persistence**

Once a woman got married, it seems so “normal” to scarify herself. Some mothers had to move far away, some quit their jobs for childbearing and childrearing. The work status and living status might be tremendously changed for some mothers, yet never fathers. Although some mothers did get help, it was so taken for granted for women to raise their kids without a handful help from men. One respondent even confessed that as long as her husband doesn’t have an affair or hit her, she’s going to tolerate the marriage. Some mothers said that it is out of a woman’s free will to get married, to have children and to breastfeed; she has to endure whatever has come along. Mothers often advice one another not to “think too much”, to loosen up a bit, or to see things from a different perspective. Studies found that each additional child is associated with a negative effect on women’s wages, and the motherhood wage penalty has not diminished over time (Avellar & Smock, 2003). Quite a few mothers in our study quitted their jobs, lost jobs or shifted to lower paid jobs. Becoming a stay-at-home mother was considered a sacrifice. Mothers often claimed that they are forced to give up their jobs since nobody in the family will take care of their kids or her family doesn’t allow or can’t afford a nanny. Most mothers, especially the participants in forums, were not happy even suffering yet tried hard to be a “good” mother.

### **2. Reflection, Self-Doubting and Self-Blaming**

It’s common to see the reflective rhetoric in mommy blogs and forums. Mothers tend to question themselves; whether they are not capable enough or haven’t tried hard enough. Both at-home mothers and working mothers are struggling and living in anxiety. Mothers felt great conflicts between work and family, feeling guilty for not being able to personally take care of their kids. Those “holiday mothers” seem to suffer the most. They claimed that their kids don’t want them and are not close to them, and this makes them ineligible mothers. The working mothers on the net seem to have an ideal, perfect mother prototype, and so often blame themselves for not being good enough.

### **3. Childrearing is Mom’s Business?**



Stay-at-home mothers or not, mothers seem to carry this thought, agree or not. In many mommy blogs, details in children's growth and what they achieved are often elaborately and carefully recorded. This seems to bring such joy and sense of accomplishment to the bloggers, Mothers enjoy being needed and desired by their children. Almost all mothers show their intolerance that they are not the most (if not only) important character in their children's lives. These seem to confirm the age-old myth: family care giving is primarily the responsibility of women. Some mommy bloggers, mostly at-home mothers, cry out against the myth, yet the situation was not much changed. Only when mothers are so exhausted that they are getting sick, their husbands would offer "help" in childrearing and/or housekeeping. Work-family conflicts are generally more stressful for women because men and women differ in their understanding of what constitute their respective parental roles. Regardless of their relative contribution to family income, men tend to think of their parental role as income provider and women perceive theirs as care provider, even when care is partially or wholly substituted. Chan (2008) indicated that Hong Kong mothers still regarded their care giver role to be integral to their identity as parents. This might also be applied to the mothers in Iran. Though in the mommy blogs and forums, protests about doing most of housekeeping and looking after children, the labor distribution or gender role ideology in family has changed very slowly in Iran. At-home mothers complained a great deal about getting little or no help from their husbands, while working mothers felt their husbands would not share housework and childrearing in the holidays, especially those living with their parents-in-law. Ironically, those who claimed "gotten help" from their husbands in housekeeping and child caring show such gratitude and often feel lucky to have "good" husbands. If taking care of applause and working mothers who want their weekends off bring about such blame?

#### **4. Accessibility, Happiness, and Separate Spheres**

Current western models of motherhood are a product of both hegemonic institutional discourses and the discourses expressed by who omen themselves in their everyday interaction. It is suggested that accessibility, happiness, and separate spheres emerged as the most dominant discursive positions open to women when discussing motherhood. The first position suggests that the well-being of the child is dependent on continual access to the mother. The second position suggests that happiness of the mother will promote happiness in the child. The third position asserts separate spheres for employment and motherhood (Guendouzi, 2006).

This model of motherhood suggests women need to be happy and fulfilled to promote well-being in their children. At the same time, however, women need to be accessible and to engage in intensive mothering practices. This model sets up a dialectical tension between two positions that may be in opposition to each other: being there for your children (accessible) and achieving your own individual needs (separate spheres). The first two discursive positions emerged more than the third one in this study. It's commonly agreed that mothers are optimal for their kids, other family members/relatives are second, and the paid nannies are usually the last choice. If financially allowed, women should take care of their own kids. Mommy bloggers and participants are reluctant to let their relatives; especially their mothers-in-law take care of their kids and don't trust nannies. They often complain and criticize the ways others care for their kids. Mothers insisting working and sending their kids away without acceptable reasons are questioned and contradicted. However, working mothers in this study develop anti-discourses against the accessibility in dominant discourses of motherhood. First of all, working mothers argued that by working and making money, they can provide the kids better lives materially and non-materially which staying home with kids might not afford.

Some mother takes themselves as examples, saying that their own mothers were working when they were growing up, yet they don't feel inappropriate or sentimentally not close to their mothers. Some mothers even admitted that they were not very nurturing, and the professional nannies (nannies obtain a license after taking courses and passing tests and exams) might take better care of their kids. Working mothers also expressed their dislike for the famous saying "Children grow up only once". They argued that they accompany and take care of their kids after work and during holidays, and do not totally miss out the process of their children's growth. Happy mother, happy baby" discourse was recognized by mothers on the net. It was often seen that respondents reminded the mommy bloggers and forum posters to love themselves, to loosen up a little, to give them a break and not to push them too hard. Mothers are advised to understand themselves before they make decision; to work or to stay home. If they feel sacrificial for their family and kids, they might be happy at the end.

#### **5. Busy & Lazy Husbands need to be Trained and Educated**

Husbands written in mommy blogs and forums in Iran were often portrayed as incompetent and indifferent, playing only a minor role in parenting and domestic affairs generally. For a man in Iran, women in the family do all the housework; before he got married, his mom and sisters do it, after

married; his wife should do the job. Some husbands even thought that it was shameful to take out the garbage if the couple lives with his parents. Quite a few husbands are called by the mommy bloggers “his majesty” since they never do anything around the house. Some fathers were terribly busy in their work. They are often on business trip, or working till midnight. The working mothers, on the contrary, have to rush home to get the kids, and feed them, supervise them, bath them, check their homework, send them to bed, prepare their lunch tomorrow, and finally do their unfinished work from their jobs. More and more husbands work in Iran and only come home once a week or a month, or even longer. This type of family gained popularity these recent years since the commercial trade between Iran and Iran became frequent. This trend seems to take men out of their parenting roles even more and leave women heavier burden of caring their children. Opposite to most mothers’ expectations in Iran, great deals of married men believe that they don’t have to do the housework as long as they bring back the bacon. Those happier mothers (especially at-home mothers) are those whose husbands are more willingly to share the housework (including care for children). Respondent mothers repeatedly emphasized that “all” men need to be educated and trained to fit their parenting roles and mothers are to teach them how to do the housework and make them share the painstaking jobs that moms have been doing.

#### **6. Autonomy of Mothering Practices**

Some mothers in this study were found to be deprived of the autonomy of their mothering practices. Mothers living with their parents-in-law, at-home mothers, and new mothers suffer the most and complain a great deal about being interfered in the ways of caring their babies (kids) by their relatives, mostly mothers-in-law. Mothers show such aversion even hatred toward their mothers-in-law when criticized on the ways they raise their kids. Mothers were portrayed as lack of modern knowledge of childcare, self-righteous, nagging, picky, and always boasting of their mothering experiences and belittling their daughters-in-law’s. In Iranian culture, it seems common for women in the family to fight for babies (kids). There are far more complicated relationships among mothers-in-law, daughters-in-law, sisters-in-law, and other in-laws in oriental cultures which often have a strong kinship. In many mommy blogs, the interactions with these relatives are often described. It seems that mothers-in-law always interfere in mothers’ childcare and try to them advices that are not welcomed.

#### **7. Be Financially Independent**

Whenever mothers asked about whether to quit their jobs to take care of kids in their blogs or forums,

they obtained many advices not to do so. Mothers said if you don’t have a job, you don’t have money, status and dignity, and no one in the family would listen to what you say. At-home moms were considered disadvantaged. Since the ones who bring back the bacon in the family (usually husbands) often shows superiority to them. At-home mothers often felt not being appreciated for her sacrifice and hard working. They found themselves with no self-esteem, no sense of accomplishment, and no money, nowhere to go and no way out of their misery.

#### **8. I’m a Stay-at-Home Mother and I’m Very Busy!**

Just as Julie Stephens (2004) had written, “The mother in this contemporary phase of capitalism is caught in a constant process of anxiety-ridden self-improvement. Like other social relationships. Motherhood cannot be seen in isolation from the new capitalism. In a highly competitive job market requiring people to reinvent themselves according to performance-driven principles, the identity of the new capitalist mother is intricately bound up with a logic that is central to current economic arrangements and work practices.” At-home mothers seem also aware of this logic, many protested heatedly that people often think they are idle and have a lot of free time. Some claimed that they run their family and marriage just like running business and staying-at-home is also a “job”, only without salary. At-home mothers carefully and specifically listed what they have done for the kids, their husbands, and other family members, and all kinds of errands, chores, and domestic affairs. Their lives were portrayed busy and stressing. They complained about not getting any recess, not even a sick leave. Many mothers on the net, regardless working or staying home, seem to agree the notion that being an at-home mother is harder than being a working mother. Working mothers often admitted that they have had enough after a few days of staying with their kids during some consecutive holidays and felt happy and relieved to send the kids away. At-home mothers talked about the joy of seeing their kids grow and being there for them, witnessing every step of their children’s development and not missing out any “first time” of their kids. Yet the hard work of taking care of children is never recognized by a patriarchal culture. In Iran, it’s typical to think that at-home mothers don’t need to go to work, “just” stay home and take care of the kids, how hard could that be? In mommy blogs and forms, many at-home moms spilled out their personal stories full of anger, frustration, laments, regrets, self-pity, and almost every one of them was tragic and heart-broken to the readers. The responds these posts attained are pretty much the same---get a job, mom! This gives an

impression that working is one (if not only) way out of misery for at-home mothers.

### 9. Mean Parents-in-Law, Loving Original Parents

Although the stay-at-home mothers complained more about their parents-in-law, working mothers also felt the family they are married to do not treat them well. Parents-in-law (especially mothers-in-law) were portrayed selfish and not being fair. They only love their own kids and treat the daughters-in-law as outsiders. Iranian women get married and move to live with their husbands, parents-in-law, sisters-in-law, brothers-in-law and their wives (or/and kids). Although the type of the nuclear family gains popularity at present time, quite a few bloggers still live with their in-laws. These mothers complained about having to do most of the work around the house and their husbands, and sisters-in-law practically have to do nothing. If the working mothers ask their husbands to share the housework, their mothers-in-law would interfere and stop them. Most mothers felt unfairly treated in the family they were married to and their contributions often were not regarded important and appreciated. On the contrary, mothers felt their own parents really love them and stand by them. Original families care about them and give them advices not to quit their jobs for their own good. In-laws might ask mothers to quit their jobs to take care of the kids or they might push mothers out to work and make money for the family. Either way, mothers felt being exploited, and never are for their own good.

### 10. Hostile Labor System for Mothers

As some of beliefs of Iran's traditional society in respect to women can point negative attitudes of some organizations and financial and social institutions, negative reactions of society, and social insecurity towards women (Saber, 2002). Working mothers felt the operation of the work force is harmful to their mothering practices. Very few mothers can get off their work at five pm on time, and some have to go to work real early. Mothers were terribly busy in sending their kids to the nannies, day care centers, schools, and picking them up from those places and always worry about being late. Laws violations were often seen in the labor market. Some mothers got fired once pregnant or badly treated. Some were forced to quit their jobs for unfriendliness and discrimination toward motherhood. It seems that the price of motherhood for Iranian women is still high; the "motherhood penalty" is obvious in the mommy blogs and forums.

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## Treatment of Intraoperative Sinus Tachycardia with Neostigmine Methylsulfate

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**Abstract: Background:** Neostigmine is an anticholinesterase drug. Sometimes during operation, patient heart rate increased without known causes. **Materials and Methods:** We used intravenous neostigmine for control of sinus tachycardia during surgery. In this research 100 patients with class I, II ASA were selected within a period of time (29 months) for intraoperative treatment of sinus tachycardia. **Results:** The maximum effect of neostigmine in reducing heart rate were in 15 minutes after its injection with 29.3% and 29.4% reducing in heart rate of the patients with 1-12 y/o and 12-65 y/o respectively. **Conclusion:** The results of this study indicate intravenous injection of neostigmine in doses .0.01mg/kg can be useful in reducing intraoperative unknown sinus tachycardia in patients with different ranges of age.

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**KeyWords:** Neostigmine, Sinus tachycardia, Intraoperative

### 1-Introduction:

Neostigmine is classified as a cholinergic agent or parasympathomimetic agent (1). Its effects are similar to those of acetylcholine and acts by stimulating the parasympathetic nervous system (2). Cholinergic actions include slowing of the heart rate; increased gastrointestinal secretions and motility; increased secretions and contractility of bronchial smooth muscle; increased contractions of the urinary bladder with relaxation of muscle sphincter; increased force of skeletal muscle contraction; sweating; miosis (pupil constriction) and reduction of intraocular pressure; decrease in blood pressure(3,4). Neostigmine is used in the symptomatic control of Myasthenia Gravis and may be used postoperatively to treat or prevent urinary retention or distention (5,6). During the administration of anesthetic drugs Neostigmine may be given intraoperatively or post-surgically to reverse the effects of nondepolarizing neuromuscular blocking agents such as atracurium (7). Sometimes during operation under general anesthesia, patient heart rate suddenly increased without any known causes like pain, hypotension, hypoxia and acidosis. We used of intravenous neostigmine for intraoperative control of this kind of unknown sinus tachycardia.

### 2-Materials and Methods:

In this research 100 patients that taken general anesthesia for different kind of surgery were

selected within a period of 29 months. The inclusive criteria for the study were patients with class I and II (ASA), age between 1-65 years old and sinus tachycardia with unknown etiology. The exclusive criteria were patients with asthma, upper and lower respiratory tract infections and tachyarrhythmia.

During surgery under general anesthesia if heart rate of the patients increased and the causes of sinus tachycardia such as pain, hypovolemia, hypotension, hypoxia, hypercarbia, acidosis and light anesthesia were rolled out then intravenous neostigmine in doses 0.01mg/kg were injected slowly. Atropine was available at hand when injection of neostigmine was done. Patient's monitorings were ECG, pulse oxymeter, noninvasive blood pressure (NIBP) and esophageal or precordial estroscope.

### 3-Results:

The table-1 represents changes of heart rate in the different times of operation and different ages and sex (male, female) after injection of neostigmine. In patients with age between 1-12 y/o the maximum effect of neostigmine in reducing heart rate were in 15 minutes after its injection with 29.3% reducing in heart rate of the patients. In the patients with age between 12-65 y/o the maximum effect of neostigmine in reducing heart rate were 15 minutes after injection with 29.4% reducing in heart rate.



Table-1: Changes in heart rate in the different time of operations at different ages and sex

TIME(min)	Male Female n=100 1-65 y/o	Male Female n=30 1-12 y/o	Male n=14 1-12 y/o	Female n=16 12-65 y/o	Male Female N=70 12-65y/o	Female N=45 12-65y/o	Male N=25 12-65y/o
zero	139.3	147	144.9	147.9	136	137.6	133.2
1	137.7	145.6	143.2	147.8	134.4	136.1	131.4
2	131.1	139.1	136.7	139.7	128.6	130.3	125.7
3	124.2	123.1	121.2	124.8	124.8	126.4	124.7
4	119.9	121.4	120.7	122.1	119.3	121.7	115.2
5	114.2	118.3	115.1	121.2	112.5	114.8	108.5
7	107.6	113.2	110.6	115.6	105.2	108.1	100.2
10	99.5	104.2	100	108	97.6	100.1	93.1
15	98.4	104	99.9	107.7	96	99.2	90.5
20	98.6	104.2	100.1	107.7	96.2	99.3	90.7
25	98.6	104.3	100.1	108.1	96.2	99.4	90.6
30	99	104.6	100.2	108.5	96.6	99.7	91.1

#### 4-Discussion:

The results of this study indicate intravenous injection of neostigmine in doses .0.01mg/kg can be useful in reducing intraoperative sinus tachycardia in patients with different ranges of age but its maximum effect is in male with age 1-12 years old. In this research in two patients following injection of neostigmine side effects occurred. One patient suffering wheezing and increase in secretions of lungs that had a history of upper respiratory tract infection and in another patient bradycardia developed in which it was treated with atropine.

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## Threshold of Pain Perception to Intraoral Anesthetic Injections among Egyptian Children

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**Abstract:** A total of 126 healthy Egyptian children of both sexes aged 5-6 years old; without any history of previous intraoral injection; were included in the present study. They had at least one carious primary tooth. The study design was a double blind; where subjects were randomly allocated into two equal groups. The aim of this clinical investigation was to determine the efficacy of some adjunctives as counterstimulation and distraction in minimizing of pain perception during administration of local anesthetics in pediatric dental patients. Selected sites for maxillary and mandibular infiltration anesthesia; were performed; and the children responses were quantified using the sound, eye and motor (SEM) scale. Administration of anterior maxillary infiltration produced the maximum pain; while that of posterior maxillary infiltration and inferior alveolar nerve block were accompanied by minimum pain (2 and 3, respectively). There was no significant gender-specific difference in pain perception among children. Moreover, the adjunctive methods combined with local administration of anesthesia; namely; counterstimulation and distraction, showed non-significant differences in pain perception. It seems that pediatric pain perception and reaction may be an anatomical location-dependent in nature.

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Key words: Pain threshold, Local anesthesia, SEM scale, Counterstimulation, Distraction.

### 1. Introduction

There is no exaggeration to mention that, individuals who are hurt while receiving dental care as children are more likely to avoid dental care as adults. Painful management has been shown to be important in the creation of dental fear. Hence, effective pain control is critical in dentistry; with especial interest in pediatric dental practice<sup>(1-3)</sup>.

First and foremost, we cannot deny that; the provision of many dental treatments depends upon achieving excellent local anesthesia. Pain-free procedures are of obvious benefit to the patient. It also helps the operator as treatment can be performed in a calm, unhurried and convenient fashion<sup>(4,5)</sup>. On the contrary, failed local anesthesia; therefore can have effects at both ends of the syringe<sup>(6,7)</sup>.

Furtherly, as intraoral anesthesia is commonly used in conventional dentistry but, paradoxically, its administration produces pain and anxiety that may cause subsequent unfavorable behavior<sup>(8,9)</sup>.

Therefore, a number of methods have been suggested to reduce the pain induced by infiltration of local anesthetic agents<sup>(10,11)</sup>. However, the efficiency of those complementary methods in reducing the pain reaction was a matter of debate, and the site-specific pain reaction to an anesthetic injection has not been studied so far.

The aim of the present study was to evaluate the pediatric reaction to the pain induced by intraoral anesthetic injections of some areas of upper and

lower jaws and to determine the efficacy of some adjunctives as counterstimulation and distraction in minimizing of pain perception during administration of local anesthetics in pediatric dental patients; among a restricted sample of Egyptian children.

### 2. Subjects and Methods

A total of 126 children (65 males and 61 females) aged 5-6 years (mean age 5.4 years); were included in the present randomized clinical trial. The subjects attended from kindergarten and primary schools in the district nearby Nasr city. They presented to the out-patient clinic of Pedodontics Department, Faculty of Dental Medicine, Al-Azhar University; for the treatment of carious primary teeth. The participating children were in complete physical and mental health without any confounding medical history. The required inclusion criteria for participation in such clinical trials were considered<sup>(12,13)</sup>. The study procedures as well as probable risks and discomforts were explained to the parents or legal guardians of the patients. Moreover, a written consent was obtained from all participants. The double blind technique was chosen as the study design. Only cooperative children were included in the study procedure; according to the Frankl scale<sup>(14)</sup>. The 126 children were then randomly allocated into two equal experimental groups (n = 63); by randomized selection of the numbers. All injections were performed by a single pediatric dentist. Topical

anesthesia was achieved with Benzocaine gel 20%; applied over the dried mucosa for 1 minute using a cotton applicator. During the injections, one group received counterstimulation method and the other group received the distraction method<sup>(15, 16)</sup>. Counterstimulation involved the use of the thumb to create vibration with slight pressure on the soft tissue adjacent to the injection site<sup>(16)</sup>. The distraction technique involved asking the subject to raise the right and left legs in turn using voice control technique<sup>(15)</sup>. Assessment of children's behavior during injections was performed by another dentist; according to the sound, eye and motor (SEM) scale<sup>(16, 17)</sup>. The scale scores were calculated by summing the three "Grade" values. For further reliability of SEM data, a third assistant shared the SEM evaluation along with the second dentist. All quantitative data of SEM scores are presented as the median. Statistical analysis of data was performed using the non-parametric test (Kruskal-Wallis). Individual differences between groups was also used (Mann-Whitney U-test). Moreover, intra-examiner agreement of data was evaluated via kappa statistics. In the present study  $P < 0.05$  was considered to indicate statistical significance.

### 3. Results

No adverse event was observed during the study course. The intra-examiner agreement of data for SEM scale was excellent ( $r = 0.87$ ). All the children completed their participation in the present study without any disturbances in their attitude and behavior. They were completely interested to share in such investigation. Figure (I) illustrated the median SEM scores for the intraoral anesthetic injections. The maxillary posterior local infiltration and inferior alveolar nerve block showed the least painful reaction (2 and 3 respectively). While the maxillary anterior local infiltration showed highest painful reaction with SEM scale (7). Maxillary injections scored an increased values than those of mandibular injections (4.5 for maxilla;  $n = 59$ ) versus 4 for mandible ( $n = 67$ ). The difference in values was statistically significant ( $P < 0.05$ ). Analysis of SEM scores between both equal groups showed a non-significant difference of pain perception between male and female children ( $P < 0.05$ ); a finding which denoted that, pain is not a gender dependent (a data not presented). Injection techniques in both groups showed an almost slight difference of SEM score values; for which there were no statistically significant differences in SEM scores between the members of each group (Fig.II).

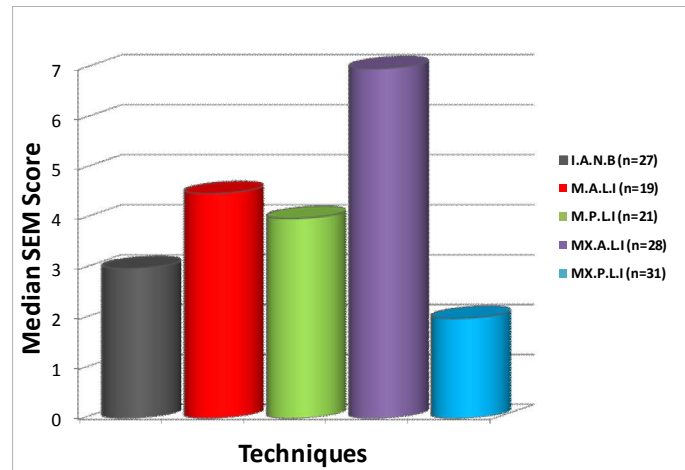


Fig. I: Median SEM score for the intraoral injection techniques

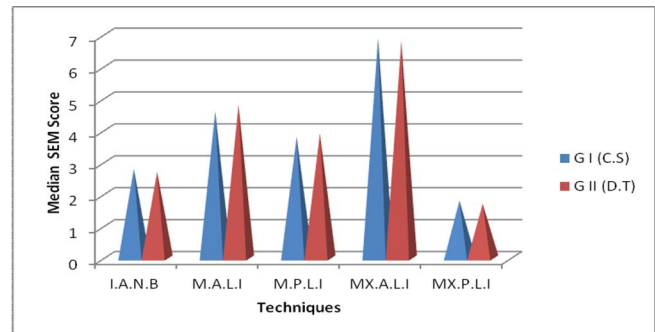


Fig. II: Scale of group to group comparison of injection techniques

#### Key:

Inferior Alveolar Nerve Block = I.A.N.B

C.S = Counterstimulation

Mandibular Anterior Local Infiltration = M.A.L.I

D.T = Distraction

Mandibular Posterior Local Infiltration = M.P.L.I

Maxillary Anterior Local Infiltration = MX.A.L.I

Maxillary Posterior Local Infiltration = MX.P.L.I

### 4. Discussion

As a matter of fact, anxiety is one of the major issues in delivering dental treatment to children, and the injection is the most anxiety-provoking procedure for both children and adults<sup>(18, 19)</sup>. Moreover, the dentist also finds the administration of local anesthetic solution to children as anxiety-provoking task<sup>(20)</sup>. Furtherly, pain is defined as an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of

such damage. Clinical pain is characterized by the presence of discomfort and abnormal sensitivity in the general context of patient symptomatology. In addition to the aforementioned facts, administration of local anesthetic via an intraoral injection is associated with acute pain symptoms as a result of the soft tissue injury caused by the needle stick<sup>(8-10)</sup>.

The design of the present study was conducted in a double-blind manner; in which one investigator carried out the local anesthetic injection while another investigator carried out the evaluation. This technique rendered the obtained criteria and values within the actual records; as it became far away from any preferable tendencies evoked by the investigator.

All children completed the present study interestingly and without complaints of duration of visits. There were no encountered reports of adverse effects to be considered as potential side effects due to local injection per se and/or the anesthetic solution.

The effectiveness of some methods in reducing anxiety and pain inherent in dental procedures; namely; intraoral anesthetic injections; were not yet well documented. Among those methods which were used in the present study; are distraction and counterstimulation. Distraction is a tactic designed to divert a patient's attention away from their current behavior to focus their interest in something else. Counterstimulation is defined as a gentle vibration or stroking of the mucosa. Both methods were encountered by several investigators; where they considered them as adjunctive methods for injection pain relief in a contemporary pediatric dental practice setting<sup>(15, 16, 19)</sup>. Moreover, others claimed that, there are only empirical comments regarding the efficacy of such methods<sup>(19-21)</sup>. The present study clarified also that, no gender, or ethnic characteristics were considered; and only those children in need of dental treatment under local anesthesia and met the inclusion criteria were selected.

Certainly pain is difficult if not impossible to quantify. Moreover, pain assessment is more difficult in children, since they usually have not developed the cognitive skills necessary for self-expression<sup>(9, 10, 13)</sup>. Hence, in the present study, sound eye-motor scale was used as the observational scale<sup>(14, 16)</sup>. Its use is justified since none of the existing observational scales are feasible for measuring pain in a dental situation. In the present study, convincing reliability with SEM scale was almost seen. Sounds and movements accompanied one another and rarely were desperate responses were seen. Moreover, children response to painful situations may not only be dependent on the pain experienced during the procedure but may also be influenced by many other factors; a finding which rendered the application of this scale to be almost difficult<sup>(18)</sup>. This could add to

the previous statement that, pain is a personal psychological experience and an observer can play no legitimate part in its direct measurement<sup>(4, 6)</sup>. Furtherly, no prior instructions were avoid bias due to anticipated pain in the present study.

The present study revealed a maximum pain perception scores in the anterior segment of the maxilla, followed in descending order by the anterior segment of mandible, posterior segment of mandible and the posterior segment of maxilla. These findings are almost in accordance to those of other investigators; who stated also that maxillary injections of the anesthetic agent induced an apparent pain as compared to mandibular injections; whenever the injection site<sup>(17, 21)</sup>. The difference in pain perception among various sites of oral cavity could be attributed to the nature of tissue per se. Probably, the firmly attached tissue in the palatal and anterior regions of the maxilla and the pressure induced by injections, could explain the levels of pain feeling.

The present study showed that, inferior alveolar nerve block was accompanied by a more or less reasonable reaction; as compared to that of mandibular infiltration. This finding is in agreement with the results of other investigators<sup>(19, 21)</sup>.

It could be concluded that, the anatomical location of intraoral injection rather than the injection technique determines the severity of pain perception and its subsequent reaction. It could be recommended also that, the use of both distraction and counterstimulation might be helpful and effective in reducing pain perception and reaction in pediatric dental patients.

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## An integrated FAHP-FMOMILP model for multi-product Multi-period lot sizing with Supplier selection in quantity discount environments

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**Abstract:** Supplier selection is a multi-criteria decision making problem which includes both qualitative and quantitative factors. Supplier selection includes three main decisions: ordering one or several product? Which suppliers and how much of each supplier? Which time? In this research an integrated approach of Fuzzy analytic hierarchy process and Fuzzy multi-objective mixed integer linear programming for multi-product Multi-period lot sizing with supplier selection in quantity discount environments is proposed. In the first step, the suppliers were evaluated by qualitative and quantitative criteria and using fuzzy analytic hierarchy process technique. In the next stage, the suppliers were selected and order quantity from each one was determined; fuzzy multi-objective mixed integer linear programming was applied for this purpose.

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**Keywords:** Supplier selection, Fuzzy analytic hierarchy process (FAHP), fuzzy preference programming (FPP), fuzzy multi-objective mixed integer linear programming (FMOMILP), Multi-product Multi-period lot-sizing, quantity discount

### 1- Introduction

In production industries, cost of raw materials exceeds 70% of product manufacturing expenses, and at least 50% of qualitative pitfalls of the products originate from the purchased raw materials (Burton, 1988). Organizations must pursue strategies to achieve higher quality, reduced costs and shorter lead times to maintain a competitive position in the global market. Based on new strategies for purchasing and manufacturing, suppliers play a key role in achieving corporate competition. Hence, selecting the right suppliers is a vital component of these strategies (Amid et al., 2009).

There are essentially two types of supplier selection problems: single-source and multi-source (Ustun & Demirtas, 2008a, 2008b). In single-source case, all suppliers are able to supply all demands of customers. This ability of suppliers in commodity provision is not solely limited to their capability in supplying the amount of material for the customer but incorporates all criteria which convince the customer to purchase from a certain supplier. In this state, the only important decision is identification of the best supplier. Suppliers' evaluation models can be deployed for this purpose. Multi-attribute decision-making models account for majority of options proposed in such cases. Several suppliers shall be used for providing the materials in the case that none of suppliers is capable of providing all general demands of the customer due to limitations in capacity, quality, price, and other significant reasons or when the strategy of company's provision sector is

to avoid reliance on a single source to prevent from material deficiency and maintain competition among the suppliers. Two problems are encountered in this case: selection of suppliers and determination of order quantity from each supplier (Ghodsypour & O'Brien, 1998).

The models introduced for selection of suppliers are divided into two general categories: mathematical programming models and ranking models. Ranking models can be used in situations when the decision to select the supplier is not complicated. Yet with further complexity of decision-making conditions, ranking models will not yield favorable responses due to addition of problem constraints and especially for the case of multi-source selection in which the decision needs to be made on simultaneous selection of suppliers and determination of their optimal order quantity. Mathematical programming models must be used to solve such problems. For the same reason, most of papers presented during the recent years in the field of supplier selection have used a mathematical programming model. (Chen, 2009; Hammami et al., 2009; Choi & Chang, 2006; Cakravastia et al., 2002; Amid et al., 2006, 2009; Wu et al., 2010; Liao & Rittscher, 2007; Basnet & Leung, 2005).

Failure to incorporate the qualitative criteria is among the major problems of mathematical models which impair their efficiency while through reviewing the models proposed for selection of suppliers this fact is revealed that most criteria used in selection are qualitative. To overcome this

drawback, Ghodsypour & O'Brien (1998) proposed a two-stage integrated model. Initially, suppliers were evaluated and ranked by means of a multi-criteria model; for this purpose, they applied Analytic Hierarchy Process (AHP) technique to evaluate the tangible and intangible criteria. In the second stage, the obtained ranks were input in a mathematical programming model as coefficient of objective function where total value of purchasing (TVP) function is maximized. They utilized a linear programming model in the second stage for choosing suppliers and determining their order quantity. As such, AHP alleviates the defect mentioned in mathematical programming which pertains to its inability to consider the qualitative criteria affecting the selection. Accordingly, the results of mathematical modeling will be more reliable. Since then, use of integrated models increased due to enhancement of decision-making quality and their high level of reliability. The following research works can be implied as examples: Kokangul & Susuz, 2009; Lee et al., 2009; Wu et al., 2009; Ustun & Demirtas, 2008a, 2008b; Lin, 2009

Contained in the various evaluation methods proposed in the available literature, price, delivery performance, and quality are the most common criteria (Wang & Yang, 2009). Hence, most of programming models were based on these criteria; these criteria are generally taken as objectives of model otherwise are regarded as constraints. Purchase costs are among the most important criteria considered as objective function in most researches. For this reason, many researchers take into account the discount conditions in their studies. Chaudhry et al. (1993) were the pioneers of considering discount conditions in their mathematical programming model. Many researchers were conducted afterwards in this scope; some instances include: Sadrian & Yoon, 1994; Rosenthal et al., 1995; Xu et al., 2000; Tempelmeier, 2002; Xia & Wu, 2007; Crama et al., 2004; Choi & Chang, 2006; Ganeshan et al., 1999; Chang, 2006; Amid et al., 2009; Wang & Yang, 2009.

In the current research, a two-stage integrated model is proposed for selecting the suppliers and determining their optimal order quantity. This model applies to general state of decision-making about selection of suppliers i.e. multi-products, multi-suppliers, and multi-periods. In the first stage, the suppliers are evaluated by means of some qualitative and quantitative criteria. In this stage, suppliers are evaluated for different products separately and the calculated weights of these evaluations enter as the overall priorities for suppliers into the second stage where order quantity are selected and allocated. FAHP technique is used in the present study to

evaluate the suppliers. In the second stage, the superior suppliers are selected by a mathematical programming model and optimal order quantity of each one is determined. A FMOMILP model is used in this stage for decision optimization; this model consists of six objective functions including: cost reduction, increase of total value of purchasing, reduction of products' defect, improvement of on-time delivery, reduction of lead-time, and enhancement of guarantee level. These objective functions are the most important quantitative criteria affecting selection of suppliers, which can be converted into objective functions because of having quantitative values.

## 2. Fuzzy Analytic Hierarchy Process

### 2.1. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a theory of measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales (Saaty, 2008). AHP is a multi-attribute decision-making technique which is based on human brain's analysis for intricate and fuzzy problems. This method was primarily introduced by Thomas. L. Saaty in 1971 (Saaty, 1980).

The procedures of AHP to solve a complex problem involve six essential steps (Lee 2009):

1. Define the unstructured problem and state clearly the objectives and outcomes;
2. Decompose the problem into a hierarchical structure with decision elements;
3. Employ pairwise comparisons among decision elements and form comparison matrices;
4. Use the value method to estimate the relative weights of the decision elements;
5. Check the consistency property of matrices to ensure that the judgments of decision makers are consistent;
6. Aggregate the relative weights of decision elements to obtain an overall rating for the alternatives.

### 2.2. Fuzzy set theory and triangular fuzzy number

Fuzzy set theory (FST) was introduced by Zadeh (1965) and is a class of objects with a continuum of grades of membership (Zadeh, 1965). A fuzzy set  $A$  in  $X$  is characterized by membership function  $f_A(x)$  which associates with each point in  $X$  a real number in the interval  $[0,1]$ , with the value of  $f_A(x)$  at  $x$  representing the "grade of membership" of  $x$  in  $A$  (Zadeh, 1965).

A triangular fuzzy number (TFN)  $\tilde{A}$  is defined by three real numbers  $l \leq m \leq u$ , and characterized by a linear piecewise continuous membership function  $\mu_{\tilde{A}}(x)$  of the type (Mikhailov & Tsvetnikov, 2004):

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-l}{m-l} & l \leq x \leq m \\ \frac{u-x}{u-m} & m \leq x \leq u \\ 0 & \text{Otherwise} \end{cases} \quad (1)$$

The fuzzy number  $\tilde{A}$  can be expressed as a triple  $(l, m, u)$ , where  $m$  is the most possible value of the fuzzy number; and  $l$  and  $u$  are the lower and the upper bounds, respectively (Mikhailov, 2003).

### 2.3. Fuzzy preference programming method

In many cases the preference model of the human decision-maker is uncertain and fuzzy and it is relatively difficult to provide crisp numerical values of the comparison ratios. The decision-maker may be uncertain about his level of preference due to incomplete information or knowledge, inherent complexity and uncertainty within the decision environment, lack of an appropriate measure or scale. A natural way to cope with uncertain judgments is to express the comparison ratios as fuzzy sets or fuzzy numbers, which incorporate the vagueness of the human thinking (Mikhailov, 2003).

Van Laarhoven and Pedrycz (1983) were the first persons who used fuzzy concept in pairwise comparisons in their research works. Evaluation of fuzzy priorities in pairwise comparison matrix is most important stage in solving FAHP models. They benefited from fuzzy logarithmic least squares method for this purpose. Many other FAHP methods were subsequently proposed by researchers, including: Geometric mean method (Buckley, 1985), interval arithmetic (Cheng & Mon, 1994), extend analysis method (Chang 1996), Fuzzy least squares method (Xu et al., 2000), Fuzzy preference programming (Mikhailov, 2003).

Fuzzy preference programming method is used in the current paper due to its numerous merits compared to alternative techniques. The most important of these advantages is the measurement of consistency indexes for the fuzzy pairwise comparison matrixes. It is not possible to determine the consistency ratios of fuzzy pairwise comparison matrixes in other AHP methods without conducting an additional study (Dagdeviren & Yüksel, 2010) and as opposed to other approaches it does not require constructing fuzzy comparison matrices and derives the priority vector from the incomplete judgment set (Cakir & Canbolat, 2008)

Suppose the pairwise comparisons matrix  $F = \{\tilde{a}_{ij}\}$  for  $n$  elements which contained  $m \leq n(n-1)/2$  judgments about fuzzy pairwise comparison where  $i = 1, 2, \dots, n-1, j = 2, 3, \dots, n, j > i$  and

$a_{ij} = (l_{ij}, m_{ij}, u_{ij})$  are triangular fuzzy numbers. In this state, the non-linear program proposed by Mikhailov & Tsvetnov (2004) is written in the form of equation (2) for obtaining the relative weights of pairwise comparison matrix.

$$\begin{aligned} & \text{Maximize } \lambda \\ & \text{Subject to} \\ & (m_{ij} - l_{ij})\lambda w_j - w_i + l_{ij} w_j \leq 0, \\ & (u_{ij} - m_{ij})\lambda w_j + w_i - u_{ij} w_j \leq 0, \\ & \sum_{k=1}^n w_k = 1, w_k > 0, k = 1, 2, \dots, n. \\ & i = 1, 2, \dots, n-1, j = 2, 3, \dots, n, j > i. \end{aligned} \quad (2)$$

The optimal value  $\lambda^*$  can be used for measuring the consistency of the initial set of fuzzy judgments. The optimal value  $\lambda^*$ , if it is positive, indicates that all solution ratios completely satisfy the fuzzy judgments, i.e.  $l_{ij} \leq (w_i/w_j)^* \leq u_{ij}$ , which means that the initial set of fuzzy judgements is rather consistent. A negative value of  $\lambda^*$  shows that the solutions ratios approximately satisfy all double-side inequalities  $l_{ij} \leq w_i/w_j \leq u_{ij}$ , i.e. the fuzzy judgements are strongly inconsistent (Mikhailov & Tsvetnov, 2004).

### 3. Benefits, opportunities, costs and risks

In decision-making, there are often criteria that are opposite in direction to other criteria as in benefits (B) versus costs (C), and in opportunities (O) versus risks (R), and sometimes need to be distinguished by using negative numbers (Saaty 2003b). For the same reason, Saaty (2004) proposed a model with criteria B, O, C, and R criteria for determining the priorities of variables. An advantage of BOCR is the merging ability in different decision-making problems including AHP. B, O, C, and R are involved in a hierarchy as major priorities after objective and each of them consists of criteria and sub-criteria.

The important point in hierarchical structures with BOCR merits is the fact that if significance degrees of B, O, C and R are not equal, they cannot be mutually compared with the objective in order to achieve the weights. To obtain weight of each priority, a series of control criteria are defined with respect to the objective. So, the relative weights of these priorities can be derived through pairwise comparisons between control criteria compared to objective and BCOR merits compared to control criteria (Lee, 2009).

In order to calculate weights of alternatives, the weights obtained for each alternative with respect to priorities are merged with the weights obtained for each of criteria with respect to objective. Saaty (2003a) proposed five techniques for combining these values. If  $W_j$  is final weight of each alternative.  $B_j$ ,

$O_j$ ,  $C_j$ , and  $R_j$  respectively represent combined results of  $j$ th alternative with merits B, O, C, and R;  $b$ ,  $o$ ,  $c$ , and  $r$  also respectively represent normalized weights of B, O, C, and R merits with respect to the objective. These five methods will be in the form of equation (3) (Lee, 2009):

1. Additive  

$$W_j = bB_j + oO_j + c\left[\frac{1}{C_j}\right]_{Normalized} + r\left[\frac{1}{R_j}\right]_{Normalized}$$
2. Probabilistic additive  

$$W_j = bB_j + oO_j + c(1 - C_j) + r(1 - R_j)$$
3. Subtractive  

$$W_j = bB_j - oO_j + cC_j - rR_j$$
4. Multiplicative priority powers  

$$W_j = B_j^b O_j^o \left[\frac{1}{C_j}\right]_{Normalized}^c \left[\frac{1}{R_j}\right]_{Normalized}^r$$
5. Multiplicative  

$$W_j = B_j O_j / C_j R_j$$

**4. max-min method**

A general multi-objective model for the supplier selection problem can be stated as follows (Weber and Current, 1993; Amid et al., 2011):

$$\begin{aligned} &Min \ Z_1, Z_2, \dots, Z_k \\ &Max \ Z_{k+1}, Z_{k+2}, \dots, Z_p \end{aligned} \tag{4}$$

Subject to  
 $x \in X_d, \ X_d = \{x / g_s(x) \leq b_s, \ s = 1, 2, \dots, m\}$   
 in which the  $Z_1, Z_2, \dots, Z_k$  are the negative objectives or criteria for minimization like cost, late delivery, etc. and  $Z_{k+1}, Z_{k+2}, \dots, Z_p$  are the positive objectives or criteria for maximization such as quality, on-time delivery, after sale service and so on.  $X_d$  is the set of feasible solutions that satisfy the set of system and policy constraints.

Zimmermann (1978) first used the max-min operator of Bellman and Zadeh (1970) to solve fuzzy multi-objective linear programming problems.

Values of objective function  $Z_j, j = 1, 2, \dots, q$  change linearly in the interval  $Z_j^{min}$  to  $Z_j^{max}$ . Therefore, he held the opinion that these functions can be presumed as fuzzy numbers of linear membership functions (Fig.1).

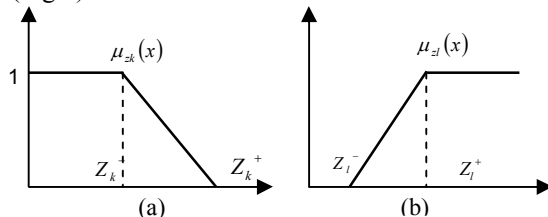


Fig. 1: Membership function: (a) minimum & (b) maximum objective

Linear membership function of each minimization function ( $Z_k$ ) and maximization function ( $Z_l$ ) are obtained as expressed in equations (5) and (6) using their minimal and maximal values.

$$\mu_{z_k}(x) = \begin{cases} 1 & \text{for } Z_k \leq Z_k^- \\ f_{z_k} = (Z_k^+ - Z_k(x)) / (Z_k^+ - Z_k^-) & \text{for } Z_k^- \leq Z_k(x) \leq Z_k^+ \\ 0 & \text{for } Z_k \geq Z_k^+ \end{cases} \quad (k = 1, 2, \dots, p) \tag{5}$$

$$\mu_{z_l}(x) = \begin{cases} 0 & \text{for } Z_l \leq Z_l^- \\ f_{z_l} = (Z_l(x) - Z_l^-) / (Z_l^+ - Z_l^-) & \text{for } Z_l^- \leq Z_l(x) \leq Z_l^+ \\ 1 & \text{for } Z_l \geq Z_l^+ \end{cases} \quad (l = p+1, p+2, \dots, q) \tag{6}$$

Where:  $Z_k^+$  and  $Z_k^-$  are respectively maximum and minimum values of minimization function  $Z_k$ , and also  $Z_l^+$  and  $Z_l^-$  respectively represent maximum and minimum values of maximization function  $Z_l$ . These values are obtained by solving each of objective functions separately and in two maximization and minimization states.

Max-min model was proposed by Zimmerman (1978, 1993) for solving MOLP problems as shown by equation (7):

$$\begin{aligned} &Max \ \lambda \\ &Subject \ to \\ &\lambda \leq f_{z_j}(x), \ j = 1, \dots, q \text{ (for all objective functions)} \\ &g_r(x) \leq b_r, \ r = 1, \dots, m \\ &x_i \geq 0, \ i = 1, \dots, n, \ \lambda \in [0, 1] \end{aligned} \tag{7}$$

**5. Integrated FAHP-FMOMILP model for supplier selection and order lot-sizing**

The proposed algorithm is illustrated in Fig. 2. This algorithm consists of two major stages: evaluation stage and order allocation stage.

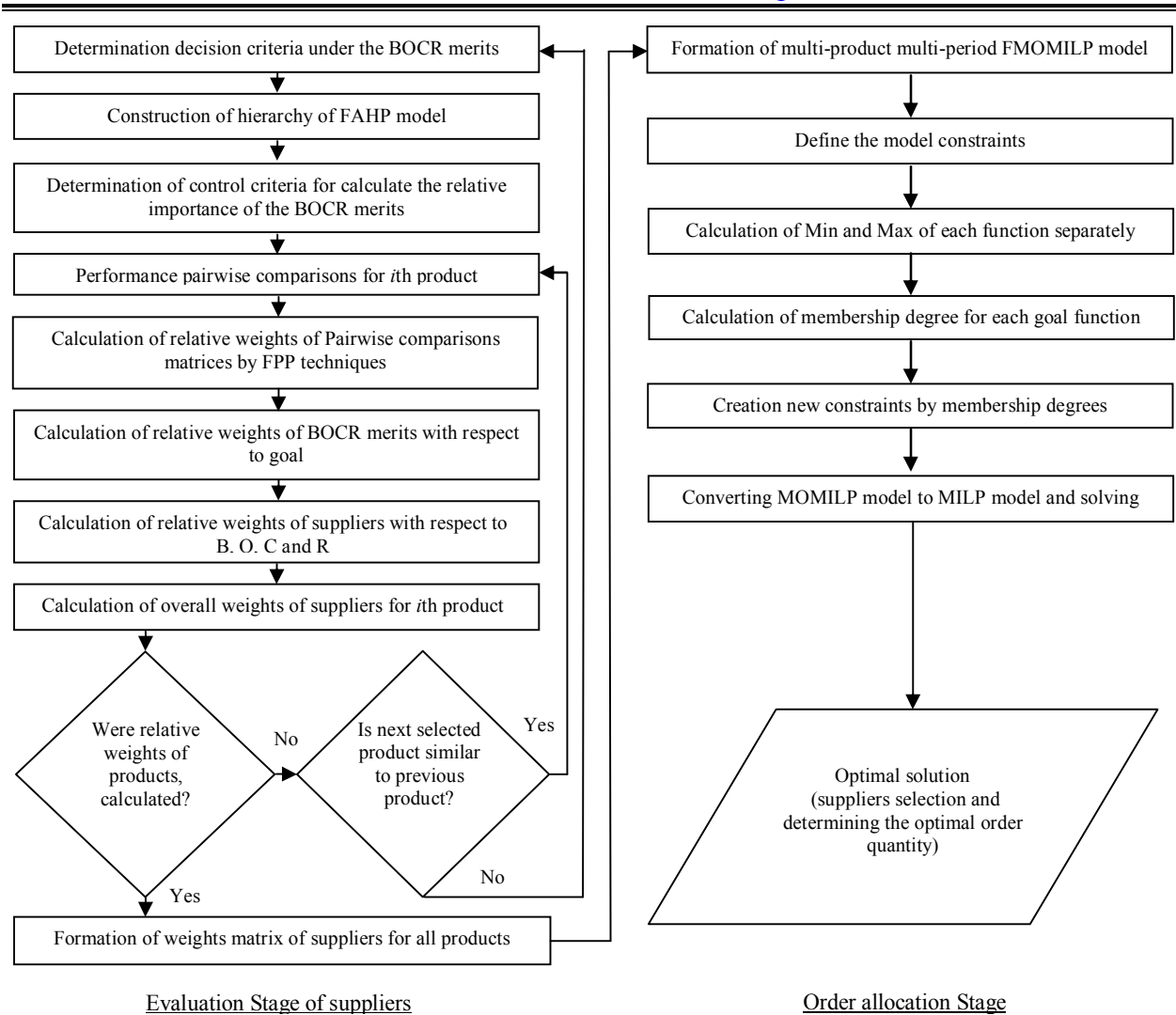
**5.1. Evaluation Stage**

In the evaluation stage, the suppliers are evaluated and weighted through FAHP technique and the obtained weights enter the allocation stage as coefficients of TVP objective function. In the following section, this stage is analyzed in four main steps:

**Determination of decision-making criteria, control criteria, and construction of AHP model:**

Determination of criteria is one of the most important parts of decision-making process. The criteria indicate level of attaining the objectives and strategies of organization. Taking into account the kind of respective product in this stage, evaluation criteria are primarily determined according to BOCR merits.

Following determination of criteria, hierarchical structure is constructed. The important point in hierarchical structures with BOCR merits is the fact that if significance degrees of B, O, C and R are not equal, they cannot be mutually compared with the objective in order to achieve the weights. To obtain



**Fig 2: The algorithms of the Evaluation and allocation Stages**

weight of each priority, a series of control criteria are defined with respect to the objective. So, the relative weights of these priorities can be derived through pairwise comparisons between control criteria compared to objective and BCOR merits compared to control criteria (Lee, 2009).

**Performing Pairwise Comparisons and Calculation of Relative Weights:**

In this step, elements of each hierarchy level are compared with the corresponding element in the upper level in pairs.

For benefits (B) and opportunities (O), the question is to ask what gives the most benefit or presents the greatest opportunity to influence fulfillment of the sub-criterion (detailed criterion). For costs (C) and risks (R), the question is to ask what incurs the most cost or faces the greatest risk (Lee, 2009).

In the respective calculations, the corresponding values of linguistic variables are introduced by

triangular fuzzy numbers in the pairwise comparison matrices as demonstrated in table 1 (Lee, 2009; Cakir & Canbolat, 2008). FPP method is used in this step to calculate relative weights of pairwise comparison matrices.

Table 1. Membership function of the Linguistic variable

Linguistic variable	Membership function
Equally important	(1,1,2)
Moderately important	(2,3,4)
More important	(4,5,6)
Strongly important	(6,7,8)
Extremely important	(8,9,9)
Preferences between the above intervals	(x-1,x,x+1) for x= 2,4,6,8

**Calculation of Relative Weights B, O, C, and R with respect to objective, and suppliers with respect to B, O, C, and R:**

Relative weight of each alternative with respect to each of B, O, C, and R merits are obtained via sum of multiplication of relative weights of sub-criteria of the same priority by relative weight of that alternative



with respect to these sub-criteria; these values are respectively designated  $B_i$ ,  $O_i$ ,  $C_j$ , and  $R_j$ . Relative weights of B, O, C and R with respect to objective are also determined through sum of multiplication of relative weight of each merits by relative weight of each control criteria. These values are respectively represented by  $b$ ,  $o$ ,  $c$ , and  $r$ .

#### Calculation of final weights of suppliers and creation of weight matrix:

In this step, the relative weights obtained for B, O, C, and R merits with respect to objective are combined with the relative weights of suppliers with respect to B, O, C, and R merits using a method proposed by Saaty in section 3 so as to derive the total weight of suppliers. Saaty (2003b) has investigated advantages of each of these methods in his research.

Now, it is necessary to realize that whether weights of suppliers have been obtained for all products or not. If the answer is "yes" the procedure is directed to the second stage of algorithm otherwise weights of suppliers shall be calculated for all products. There is another fundamental question here: is the selected product similar to the former one in terms of performance features and selection criteria? If not, the first stage of the proposed algorithm should be executed for evaluating the suppliers. The main reason lies in the fact that control criteria and sub-criteria affecting the selection will vary if the features of a product change. Therefore, a new hierarchy with decision-related criteria shall be defined to precisely acquire the preferences of suppliers. Conversely, if the answer to the question is "yes", there will be no need to define a new hierarchy and algorithm procedures will be repeated after its fourth stage. These comparisons are only performed for suppliers and control criteria. The reason is the fact that sub-criteria and control criteria have not changed in the previous stage.

Algorithm of evaluation stage is iterated as many times as the number of products until weights of all suppliers are achieved for all products. In the last stage, the weights obtained in a  $I \times J$  matrix are categorized and denoted by  $W_{ij}$ . Accordingly, result of evaluation stage of  $W_{ij}$  weight matrix will be indicative of score of "j" supplier for the "i" product. It must be vitally noted that if the  $j$ th supplier cannot supply the  $i$ th product, then  $W_{ij}$  will equal zero. The calculated weight matrices are introduced as input to the allocation stage to enter the decision-making space as coefficients of objective function of TVP.

#### 5.2. Order allocation Stage

In this stage, the suppliers are selected via six objective functions and optimal order quantity for each

of suppliers will be determined. Steps of allocation stage are as below:

#### Creation of multi-product multi-period FMOMILP model in quantity discount environments:

The notations used in MOMILP model are as follows:

##### - Notations

##### Indices:

"i": Index of products

"j": Index of suppliers

"t": index of time periods

"k": index of price level

##### Parameters:

I: number of products

J: Number of suppliers

T: Number of time periods

$n_{ijt}$ : Number of price levels of  $j$ th supplier for  $i$ th product and  $t$ th period

$D_{it}$ : Demand of  $i$ th product in the  $t$ th period

$C_{ijt}$ : Capacity of  $j$ th supplier for  $i$ th product in  $t$ th period

$P_{ijk}$ : Purchase price of the  $i$ th product from the  $j$ th supplier in  $k$ th price level and for  $t$ th period

$S_{ijk}$ : The  $k$ th price level of  $j$ th supplier for  $i$ th product in  $t$ th period ( $0 = S_{ij0} < S_{ij1} < \dots < S_{ijm(ij)t} = C_{ijt}$ )

$O_{jt}$ : ordering cost for the  $j$ th supplier in  $t$ th period

$H_{it}$ : Holding cost of  $i$ th product in  $t$ th period

$W_{ij}$ : Overall weight of  $j$ th supplier for  $i$ th product

$q_{ijt}$ : Defect rate of  $i$ th product by  $j$ th supplier in  $t$ th period

$t_{ijt}$ : On-time delivery rate of  $i$ th product by the  $j$ th supplier in  $t$ th period

$Lt_{ijt}$ : Lead time for a unit of  $i$ th product by  $j$ th supplier in  $t$ th period

$g_{ijt}$ : Guarantee provided for a unit of  $i$ th product by  $j$ th supplier in  $t$ th period

##### Decision variables:

$X_{ijk}$ : Value of  $i$ th product ordered to  $j$ th supplier in  $k$ th price level for  $t$ th period

$Y_{ijk}$ : It value is 1, if  $i$ th product is ordered to  $j$ th supplier in  $k$ th price level for  $t$ th period, and equals 0 otherwise.

##### Intermediate Variable:

$I_{it}$ : Inventory of  $i$ th product at the end of  $t$ th period (Inventory of  $i$ th product transferred from  $t$ th to  $(t+1)$ th period) is assumed:  $I_{i0} = 0$  and  $I_{iT} = 0$ .

##### - Objective Functions

**Total Cost:** The expenses related to supply of product includes three items: purchase cost, ordering

cost, and holding cost. Sum of these three costs equals total cost which shall be minimized.

$$\min f_1(X,Y) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T P_{ijkt} X_{ijkt} + \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T O_{ijt} Y_{ijkt} + \sum_{i=1}^I \sum_{t=1}^T h_{it} I_{it} \quad (8)$$

**TVP:** The weights measured in suppliers' evaluation stage are transferred to this stage as input data so that Sum of multiplication of order quantities to suppliers and their weights will yield the total purchase amount defined via equation (9):

$$\max f_2(X) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T W_{ij} X_{ijkt} \quad (9)$$

**Total defect rate:** Sum of multiplication of defect rate of purchase unit and total purchase amount signifies total defect rate of purchase as defined through equation (10):

$$\min f_3(x) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T q_{ijt} X_{ijkt} \quad (10)$$

**Total on-time delivery rate:** Sum of multiplication of on-time delivery rate of purchase unit and total purchase amount gives the total on-time delivery rate of purchase as expressed by equation (11):

$$\max f_4(x) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T t_{ijt} X_{ijkt} \quad (11)$$

**Total lead time:** Sum of multiplication of lead times of unit ordered product and total purchase amount yields the total lead time of purchase as defined by equation (12):

$$\min f_5(x) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T Lt_{ijt} X_{ijkt} \quad (12)$$

**Total guarantee:** Sum of multiplication of guarantee of unit purchased products and total purchase amount gives the total guarantee as expressed by equation (13).

$$\max f_6(x) = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^{n_{ij}} \sum_{t=1}^T g_{ijt} X_{ijkt} \quad (13)$$

**- Model constraints**

The constraints of the problem are formulated as follows:

**Capacity constraints:**

$$\sum_{k=1}^{n_{ij}} X_{ijkt} \leq C_{ijt} Y_{ijkt} \quad i=1,2,\dots,I \quad j=1,2,\dots,J \quad t=1,2,\dots,T \quad (14)$$

**Demand constraint:**

$$I_{i(t-1)} + \sum_{j=1}^J \sum_{k=1}^{n_{ij}} X_{ijkt} \geq D_{it} \quad i=1,2,\dots,I \quad t=1,2,\dots,T \quad (15)$$

**Material balance equations:**

$$I_{it} = \sum_{j=1}^J \sum_{k=1}^{n_{ij}} X_{ijkt} - D_{it} + I_{i(t-1)} \quad i=1,2,\dots,I \quad t=1,2,\dots,T \quad (16)$$

**Discount intervals constraints:**

$$S_{ij(k-1)t} Y_{ijkt} \leq X_{ijkt} \leq S_{ijkt} Y_{ijkt} \quad i=1,\dots,I \quad j=1,\dots,J \quad t=1,\dots,T \quad k=1,\dots,n_{ij} \quad (17)$$

$$\sum_{k=1}^{n_{ij}} Y_{ijkt} \leq 1 \quad k=1,2,\dots,n_{ij} \quad (18)$$

**Inventory constraints:**

$$I_{iT} = 0 \quad i=1,2,\dots,I \quad (19)$$

**Non negativity and binary constraints:**

$$X_{ijkt} \geq 0$$

$$I_{it} \geq 0 \quad (20)$$

$$Y_{ijkt} = 0 \text{ or } 1 \text{ Integer}$$

Set of (14) constraints guarantees sum of orders from a supplier shall be less than its capacity. In one period of time, demand is supplied from two quantity; its order quantity and the inventory remaining from the previous period, which according to (15), sum of two values shall be always greater than or equal to the required demand value. Sum of order quantity of *i*th product in *t*th period and the quantity of inventory remaining from previous period is always equal to demand quantity of that product and the quantity transferred to the next period. This constraint is considered in (16). It is noteworthy that due to comprehensiveness of constraint of material balance equations (16) compared to demand constraints (15), there is no need to demand constraints for performing the model and their presence is mainly for more profound comprehension of model constraints. Set of constraints of (17) will guarantee that order quantity in each price level is in its discount domain. Constraint (18) is taken into account to select the supplier only in one discount level. Constraint (19) is imposed to have zero for inventory of each product at the end of programming period.

**Using max-min technique for solving FMOMILP model**

The last general stage of the proposed model comprises model solution and determination of superior suppliers. Max-min technique in the current paper for solving the model so that suitable suppliers are selected and their optimal order quantity were determined.

**6- Case Study**

To have a better insight of the model, a numerical example is presented in this part. The information used in this example has been prepared from purchase sector of a steel industry company which has three suppliers and two required products of steel bar kind. Purchase programming is done for all three periods.

**6-1- Evaluation Stage**

**Determination of decision-making criteria, control criteria, and construction of AHP model**

This proposed model consists of 11 criteria and five control criteria used in Lee's research (2009). Their hierarchical structures are shown in figures 3 and 4.

**Performing the pairwise comparisons and calculation of relative weights**

In this stage, elements of each hierarchy level are compared in pairs with respect to the element in the

upper level and pairwise comparison matrices are formed. By applying FPP technique for each of matrices and with the aid of LINGO 80 software, weight values of each hierarchy element are summarized in table 2 and 3.

**Calculation of B, O, C, and R relative weights with respect to objective and suppliers with respect to B, O, C, and R**

To calculate relative weight of each of B, O, C, and R merits with respect to objective, sum of multiplication of relative weight of each priority and relative weight of each control criteria, which yield the values of b, o, c, and r as shown in table 2.

To calculate relative weight of each supplier with respect to each of B, O, C, and R merits, sum of multiplication of relative weight of sub-criteria of the same priority and relative weight of that supplier with respect to this sub-criterion. The respective values of  $B_i, O_i, C_i,$  and  $R_i$  are included in table 3.

**Calculation of final weight of suppliers and creation of weights matrices:**

To obtain the final weight of suppliers, b, o, c, and r values obtained for merits B, O, C, and R are combined with values of  $R_j, C_j, O_j, B_j$  obtained for three suppliers by probabilistic additive method and the results are normalized. As such, final weights of suppliers are obtained for a product. The same

procedures are repeated to have the weights of suppliers for all other products. Accordingly, total weights matrices of suppliers are obtained for two ordered products in the form of following matrices:

$$W_{ij} = \begin{bmatrix} 0.307 & 0.301 & 0.392 \\ 0.217 & 0.287 & 0.496 \end{bmatrix}$$

**6-2- Order allocation Stage**

**Creation of multi-product multi-period FMOMILP in quantity discount environments:**

The needed values for formulating the model are expressed in tables (4) to (7). Values of purchasing cost of product unit from three suppliers are shown in table (4) for different price levels, which are assumed constant for all periods. Purchasing cost unit is expressed in dollars for one ton of product. Values of  $h_{it}$  and  $O_{jt}$  are expressed dollar for each ton and  $D_{it}$  values are expressed in tons as included in table (5). The values of  $C_{ijt}, q_{ijt}, Lt_{ijt}, g_{ijt}$  in table (6) are taken constant for all periods. Units of  $C_{ijt}, q_{ijt}, Lt_{ijt}, g_{ijt}$  values are respectively expressed in tons, quantity in product unit, days, and months.  $t_{ijt}$  values are shown for three periods in table (7) expressed in percents. Having applied parameter values in functions (8) through (13) and constraints (14) through (20), FMOMILP model is formulated.

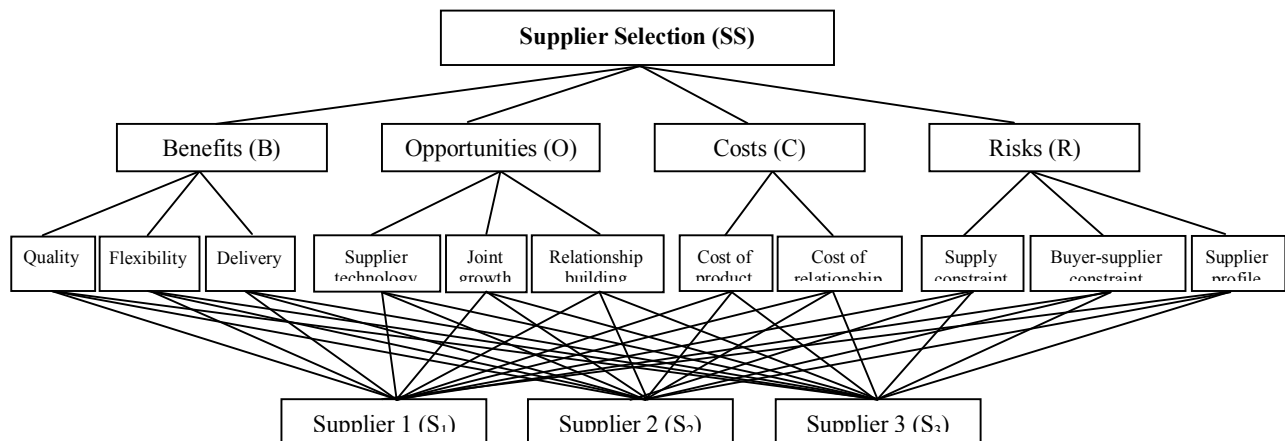


Fig.3. BOCR hierarchy

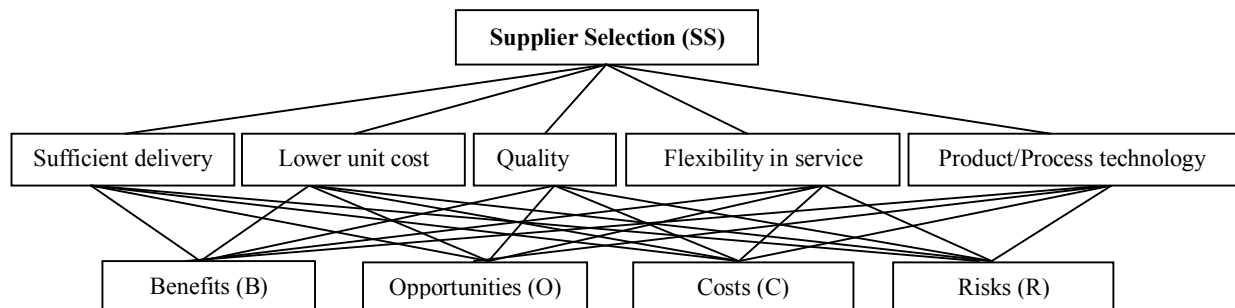


Fig.4. control hierarchy

Table 2. Priorities of merits

Merits	Sufficient delivery (0.128)	Lower unit cost (0.217)	Quality (0.276)	Flexibility in service (0.218)	Product/Process technology (0.161)	Normalized Weights (b, o, c, r)
B	0.335	0.385	0.531	0.641	0.047	0.420
O	0.106	0.301	0.348	0.079	0.508	0.274
C	0.473	0.097	0.094	0.226	0.106	0.174
R	0.086	0.217	0.027	0.054	0.339	0.132

Table 3. Priorities of alternatives under four merits

Merits	Benefits				Opportunities			
	Quality (0.379)	Flexibility (0.208)	Delivery (0.413)	Normalized Weights (B <sub>j</sub> )	Supplier technology (0.463)	Joint growth (0.128)	Relationship building (0.409)	Normalized Weights (O <sub>j</sub> )
S1	0.508	0.313	0.114	0.305	S1 0.508	0.313	0.114	0.322
S2	0.137	0.068	0.294	0.187	S2 0.137	0.068	0.294	0.192
S3	0.355	0.619	0.592	0.508	S3 0.355	0.619	0.592	0.486
Merits	Costs			Risks				
	Cost of product (0.694)	Cost of relationship (0.306)	Normalized Weights (C <sub>j</sub> )	Supply constraint (0.561)	Buyer-supplier constraint (0.083)	Supplier profile (0.356)	Normalized Weights (R <sub>j</sub> )	
S1	0.508	0.313	0.448	S1 0.438	0.313	0.114	0.312	
S2	0.137	0.068	0.116	S2 0.152	0.068	0.294	0.196	
S3	0.355	0.619	0.436	S3 0.41	0.619	0.592	0.492	

Table 4. Suppliers quantity discount

	Product 1					Product 2				
	P <sub>1i1t</sub>	S <sub>1i1t</sub>	P <sub>1i2t</sub>	S <sub>1i2t</sub>	P <sub>1i3t</sub>	P <sub>2i1t</sub>	S <sub>2i1t</sub>	P <sub>2i2t</sub>	S <sub>2i2t</sub>	P <sub>2i3t</sub>
S <sub>1</sub>	330	80	315	230	305	440	120	410	260	390
S <sub>2</sub>	375	110	340	-	-	390	85	370	240	340
S <sub>3</sub>	315	90	305	250	295	435	120	415	-	-

Table 5. Supplier's quantitative information (D<sub>it</sub>, h<sub>it</sub>, O<sub>it</sub>)

	D <sub>it</sub>			h <sub>it</sub>			O <sub>it</sub>		
	t=1	t=2	t=3	t=1	t=2	t=3	t=1	t=2	t=3
Product 1	540	570	480	25	30	35	S1 3600	3500	3400
Product 2	630	740	450	40	43	45	S2 4000	3100	3900
							S3 3400	3400	3200

Table 6. Supplier's quantitative information (C<sub>ijt</sub>, q<sub>ijt</sub>, Lt<sub>ijt</sub>, g<sub>ijt</sub>)

	C <sub>ijt</sub>			q <sub>ijt</sub>			Lt <sub>ijt</sub>			g <sub>ijt</sub>		
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>
Product 1	360	370	420	0.0035	0.0040	0.0020	6	7	4	18	20	24
Product 2	440	420	360	0.0035	0.0020	0.0040	8	5	7	15	20	18

Table 7. Supplier's quantitative information (t<sub>ijt</sub>)

	Period 1			Period 2			Period 3		
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>
Product 1	0.97	0.95	0.99	0.95	0.96	0.98	0.96	0.94	0.99
Product 2	0.96	0.99	0.93	0.96	0.98	0.94	0.95	0.99	0.95



Table 8. Supplier selected, optimal order quantity and Inventory of product

	$Y_{iikt}$			$X_{iikt}$			$h_{it}$		
	t=1	t=2	t=3	t=1	t=2	t=3	t=1	t=2	t=3
Product 1	$Y_{1131}=1$ $Y_{1331}=1$	$Y_{1332}=1$	$Y_{1333}=1$	$X_{1131}=330$ $X_{1331}=420$	$X_{1332}=420$	$X_{1333}=420$	$I_{11}=210$	$I_{12}=60$	$I_{13}=0$
Product 2	$Y_{2231}=1$ $Y_{2321}=1$	$Y_{2232}=1$ $Y_{2322}=1$	$Y_{2233}=1$ $Y_{2323}=1$	$X_{2231}=420$ $X_{2321}=210$	$X_{2232}=420$ $X_{2322}=320$	$X_{2233}=242.8$ $X_{2323}=207.2$	$I_{21}=0$	$I_{22}=0$	$I_{23}=0$

### Using max-min technique for solving FMOMILP model:

To solve model through this model, maximal and minimal values of each objective function are initially obtained disregarding other objective functions and by imposing all constraints. LINDO 6.1 software is used for this purpose.

Subsequently, membership degrees of objective functions are obtained according to (5) and (6). These membership degrees are fixed greater than or equal to  $\lambda$  variable and new constraint is imposed equal to number of objective functions. Through adding these constraints to the former constraints and conversion of objective function to  $\text{Max } Z=\lambda$ , multi-objective linear programming model is transformed into a single-objective linear programming model; optimal answers are gained as shown in table (8) through solving this model by means of LINDO 6.1 software.

### 7. Conclusions

In the current research, an integrated two-stage model was proposed for selection of suppliers in general purchase state i.e. multi-products, multi-suppliers, multi- periods and in quantity discount environments. In the first stage, the suppliers were evaluated and selected in the second stage using a mathematical programming model. One of problems of the mathematical models is the fact that qualitative criteria are not brought under consideration. TO overcome problem, a two-stage approach was taken where suppliers were first evaluated in the first stage by means of qualitative and quantitative criteria affecting the decision-making. From another aspect, one of most important features of mathematical models is presence of variables by obtaining which optimal answers can be achieved. Set of the variables in the proposed model consists of three different groups of variables: variable "Y" which determines the superior supplier for products and different periods; variable "X" which is representative of order quantity of each product to supplier in programming periods, and variable "I" which denotes the inventory of each product at the end of each period. Through solving this model and obtaining these variables, superior suppliers are identified and optimal order quantity for each one is also determined.

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## Characterization of the antioxidant properties of citrus mutants induced by Gamma-rays

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**Abstract:** The antioxidant potential of the methanolic extracts obtained from fruits and leaves of gamma irradiated citrus was evaluated using 1,1-diphenyl-2-picrylhydrazyl (DPPH), superoxide anion, hydrogen peroxide and nitric oxide inhibition assays. Results showed that antioxidant activity of citrus was modulated by gamma irradiation. The DPPH, superoxide and hydrogen peroxide scavenging activities were significant higher ( $p < 0.05$ ) for the pulp, leaf and peel extracts of citrus mutants, with IC<sub>50</sub> value ranges of 1.02–1.10, 2.59–2.84, 0.82–0.91 mg/mL, respectively, but lower nitric oxide scavenging activities for the peel and pulp extracts of citrus mutants, as compared with the corresponding values of citrus wild-type.

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**Keywords:** gamma irradiation; citrus mutants; antioxidant activity

### 1. Introduction

Citrus is one of the most abundant and widely consumed crops globally because of their great economic and health value. Producer continuously seek varieties with morphological appearance, i.e. size, color and shape, taste characteristics, improved nutritional value, shelf life and other quality features to meet the consumers' expectations and concepts related to fruit traits and to promote international trade. However, it has been known that citrus is among the most difficult plants to improve through traditional breeding approaches.

Inducing mutations by gamma ray has been effectively used to improve more desirable and economically useful traits with several species of citrus. Irradiation of gamma rays on budstick can produce higher frequencies of mutation, leading to the creation of new variants compared to the control. Nowadays, the number of cultivars derived from mutation induction increases constantly (Bermejo et al., 2011; Chaudhuri, 2002; Deng, 2005; Ling et al., 2008; Raza et al., 2003). Although many of the effects of gamma irradiation on seedlessness, pollen germination, fruit quality and growth of citrus have received considerable attention, little experimental study that takes into account the antioxidant activity of citrus mutants obtained by gamma irradiation. Our objective was, therefore, to evaluate the potential antioxidant activities of these citrus mutants by employing the 1,1-diphenyl-2-picrylhydrazyl (DPPH), superoxide, hydrogen peroxide and nitric oxide

scavenging assays. Leaves and different fruit parts (peel and pulp) were chosen in an attempt to make systematic comparisons among their potent bioactivities and to identify the part with high antioxidant activity for further studies.

### 2. Material and Methods

#### 2.1. Irradiation and sample preparation

Budsticks obtained from one year-old citrus (*Citrus unshiu* Marc. cv. Miyagawa) were exposed to cobalt (<sup>60</sup>Co) source with the dose of 120 Gy at the Institute for Nuclear Science and Technology, Jeju National University. The budsticks were then refrigerated until the following day when buds were grafted onto one year old sour orange (*C. aurantium* L.) seedling in the greenhouse and then selected mutant plants were moved to an open field. Initially, the leaf type, early and late fruit developments, thorn formation, size of petal leaves, adaptability to environmental conditions, fruit yield, and other plant characteristics were recorded. All cultivars shared the same environmental, cultural and soil conditions, thus the differences among cultivars were not influenced by climatic factors or crop technique. Representative samples studied in this paper were harvested in 2010. Based on preliminary observations of fruit characteristics, mutation had stable targeted fruit quality traits, with three mutants (Mut) selected for antioxidant analysis (Oh and Kim, 2011), test subjects were divided into four groups: (i) citrus wild-type derived from non-irradiated shoots

(WT); (ii) citrus mutants with comparatively high sugar/acid ratio (Mut I); (iii) citrus mutants with red color (Mut II); (iv) citrus mutants with rough shape (Mut III). The fruit peel and pulp, and leaves of citrus were dissected, lyophilized and then ground into a fine powder using a blender. Portions (25 g) of the powered 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  $\mu\text{m}$  membrane filter (Waters, Milford, MA, US), which were stored at 4 °C until further use.

## 2.2. 1,1-Diphenyl-2-picrylhydrazyl (DPPH) and superoxide radical scavenging assays

DPPH radical and superoxide scavenging activities of citrus WT and Mut methanolic extracts were determined as described in our recently published paper (Kim and Kim, 2011). A dose response curve was plotted to determine the  $\text{IC}_{50}$  values.  $\text{IC}_{50}$  is defined as the concentration sufficient to obtain 50 % of a maximum scavenging capacity. All tests were performed in triplicate.

## 2.3. Hydrogen peroxide scavenging assay

The hydrogen peroxide scavenging of the methanolic extracts was measured by using the method of (Senevirathne et al, 2010). Each experiment was performed at least in triplicate.

## 2.4. Nitric oxide radical scavenging assay

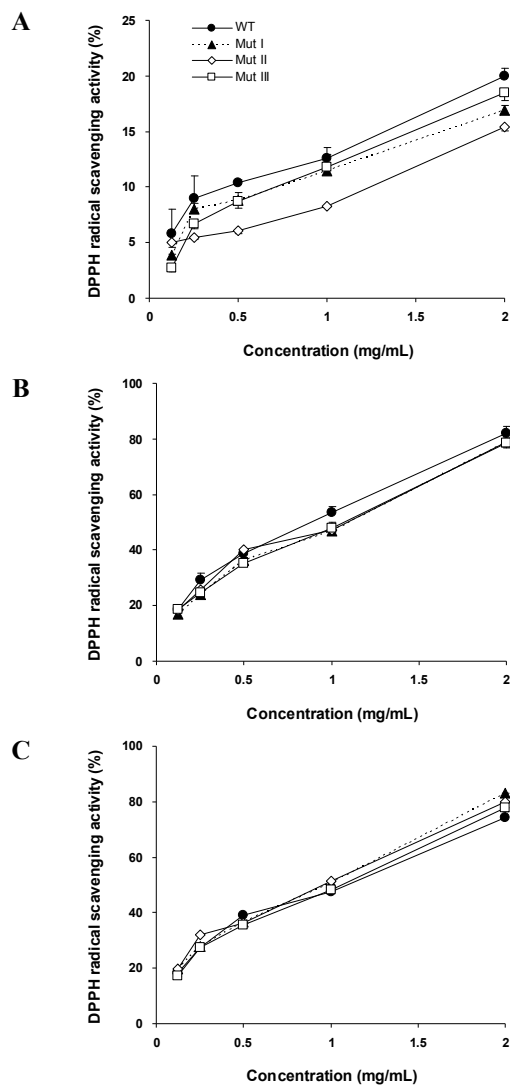
Nitric oxide scavenging activity was evaluated following the method of Green et al (1982) with slight modifications. The reaction mixture (100  $\mu\text{L}$ ) containing 10 mM sodium nitroprusside in phosphate-buffered saline (pH 7.0), with or without methanolic extracts at concentrations of 0.125, 0.25, 0.5, 1 and 2 mg/mL, was incubated at 25 °C for 3 h. Following incubation, reaction mixture was mixed with an equal amount of Greiss reagent (1% sulfanilamide and 0.1% *N*-1-naphthylethylene diamine dihydrochloride in 2.5% polyphosphoric acid), which was allowed to stand for 5 min, then absorbance of assay mixture was determined at 540 nm. Three replicates were made for each test sample to calculate  $\text{IC}_{50}$  values.

## 2.5. Statistical analysis

All values are expressed as the means  $\pm$  standard deviation. Treatment effects were analyzed by one-way analysis of variance followed by a Duncan's multiple range tests using SPSS software (ver. 12.1, SPSS Inc., Chicago, IL, US). Differences were considered statistically significant at  $p < 0.05$ .

## 3. Results and Discussion

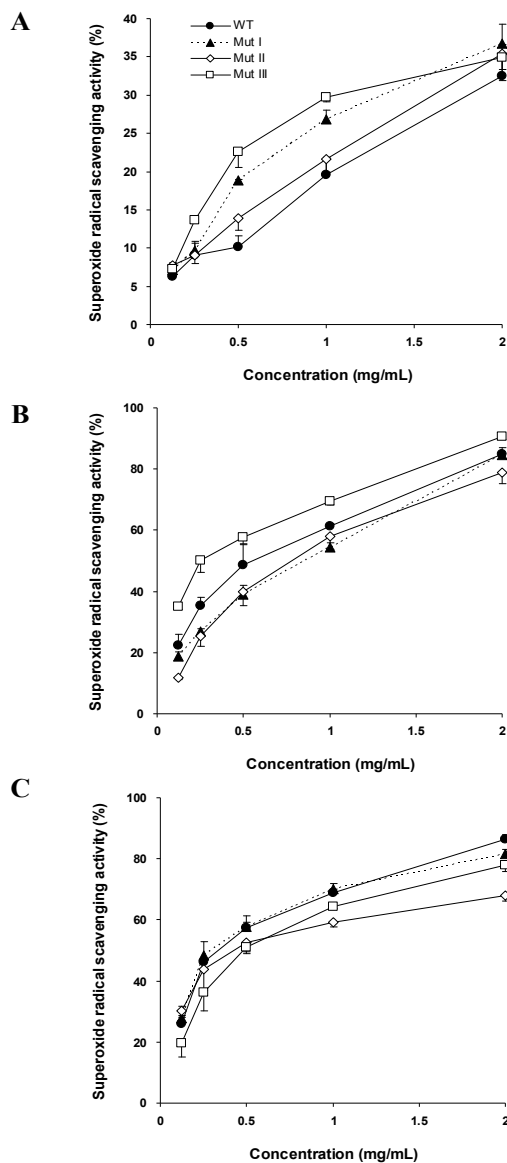
The prevention of the chain initiation step by scavenging various reactive species such as free radicals is considered to be an important antioxidant mode of action (Dastmalchi et al, 2007).



**Fig. 1.** Scavenging DPPH radical effects of leaf (A), peel (B) and pulp (C) extracts of citrus derived from non-irradiated and irradiated shoots. Data represent the mean  $\pm$  standard deviation of three determinations.

Scavenging activity for free radicals of DPPH has been widely used to evaluate the antioxidant activity of natural products from plant sources (Huang et al, 2005; Zhu et al, 2004). The decrease in absorbance of the DPPH radical due to its reduction by different antioxidants is illustrated. Absorbance decreases as a result of a color change from purple to yellow as the radical is scavenged by

antioxidants through donation of hydrogen to form the stable DPPH free radical.



**Fig. 2.** Scavenging superoxide radical effects of leaves (A), peel (B) and pulp (C) extracts of citrus derived from non-irradiated and irradiated shoots. Data represent the mean  $\pm$  standard deviation of three determinations.

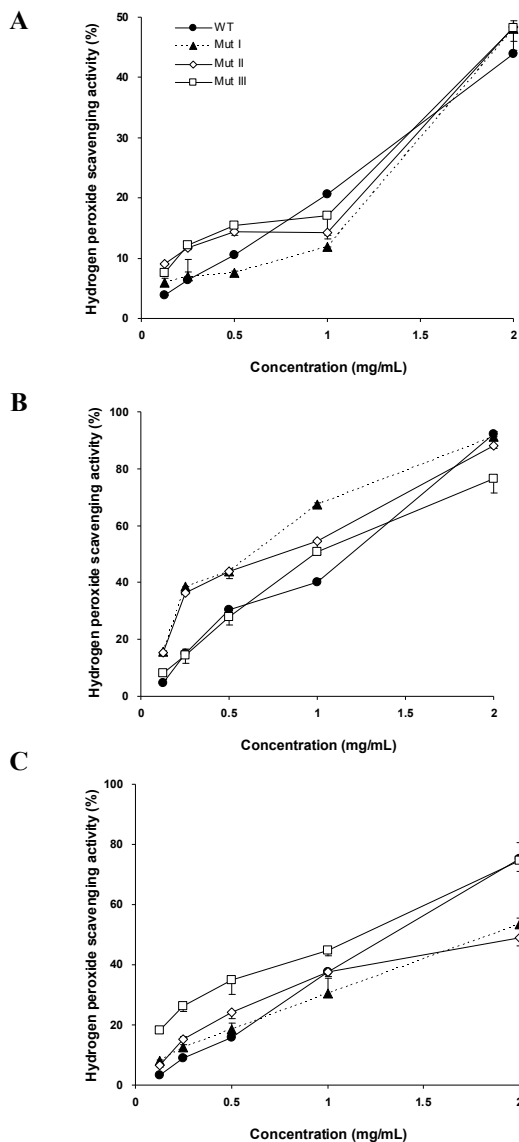
Methanolic extracts of citrus WT and Mut plants were prepared for investigation of their antioxidant activities. As the data shown in Figure 1, scavenging effects of three parts of citrus extracts on DPPH radicals sharply increased from 0.125 to 2 mg/mL and were 15–20%, 79–82% and 74–83% for

leaf, peel and pulp at 2 mg/mL, respectively. The top three most potent scavenging DPPH radical activity was observed in the pulp extracts of all Mut groups (1.02, 1.03 and 1.10 mg/mL  $IC_{50}$  for Mut I, II and III, respectively), which possess significantly higher activity on scavenging DPPH radicals than that of citrus WT (1.13 mg/mL  $IC_{50}$ ) ( $p < 0.05$ ) (Table 1). However, citrus leaf and peel extracts of Mut groups showed lower  $IC_{50}$  value than that of WT group extracts (Figure 1 and Table 1).

Superoxide anion is one of the most representative free radicals. In biochemical systems, superoxide radical can be converted into hydrogen peroxide by the action of superoxide dismutase and the hydrogen peroxide can subsequently generate extremely reactive hydroxyl radicals in the presence of certain transition metal ions or by UV photolysis (Halliwell and Gutteridge, 1999). In the present study, the superoxide anion scavenging activities of citrus WT and Mut plants were investigated and compared by using a NBT reduction method. With regard to scavenging effects of methanolic extracts on superoxide radicals, citrus peel and pulp more effective than leaves; the scavenging effects of citrus peel and pulp extracts increased from 12–35% and 20–30% at 0.125 mg/mL to from 79–90% and 68–87% at 2 mg/mL, respectively, much better than that of leaf extracts (Figure 1 and Table 1). The citrus leaf extracts of all Mut groups (2.59–2.84 mg/mL  $IC_{50}$ ) and peel extracts of Mut III (0.63 mg/mL  $IC_{50}$ ) had relatively higher potential scavenging effects on superoxide as compared with the corresponding extracts of WT (3.15 and 0.86 mg/mL  $IC_{50}$ , respectively) ( $p < 0.05$ ) (Table 1). However,  $IC_{50}$  values of peel extracts of Mut I and II, and pulp extract of Mut II and III in superoxide scavenging activities were above those of WT extracts, indicating they had relatively little scavenging properties (Table 1). No statistically significant differences were observed between the other Mut and the WT samples (Table 1).

Although hydrogen peroxide itself is not very reactive, it can sometimes cause cytotoxicity by giving rise to hydroxyl radicals in the cell. The results of hydrogen peroxide inhibition by the methanolic extracts of citrus WT and Mut plants are summarized in Figure 3 and Table 1. The  $IC_{50}$  values of peel and pulp extracts were 0.82–1.18 and 1.17–1.83 mg/mL, respectively, which were lower than that of leaf extracts (2.21–2.31 mg/mL) (Table 1). Obviously, the hydrogen peroxide scavenging activities were concentration-dependent for all parts of citrus extracts and showed significantly higher in peel extracts of Mut I and II, and in pulp extracts of Mut III than those of WT group extracts, while lower in the extracts of Mut III peels, and Mut II and III

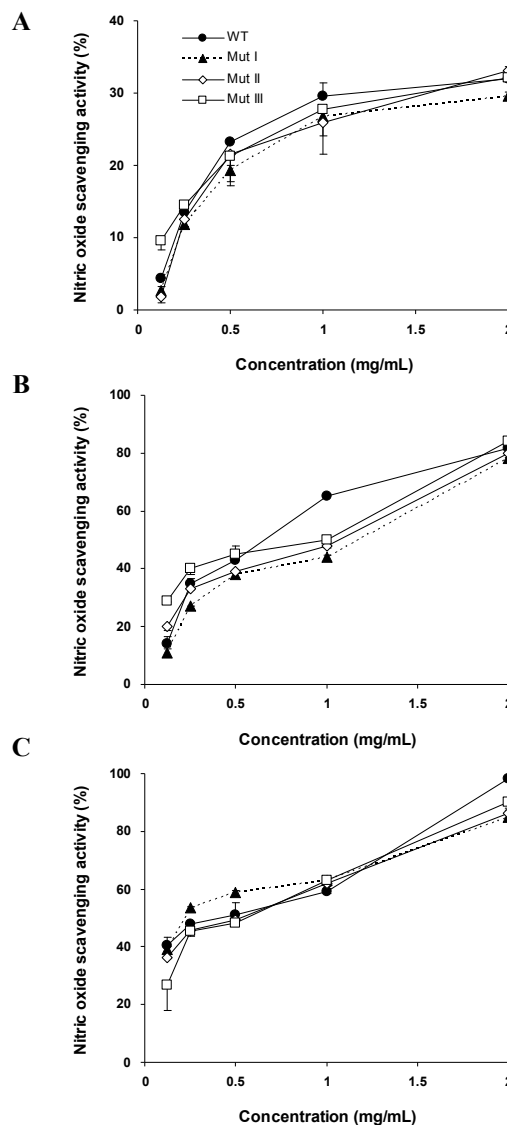
pulps (Figure 3 and Table 1). Data represent the mean  $\pm$  standard deviation of three determinations.



**Fig. 3.** Scavenging hydrogen peroxide effects of leaves (A), peel (B) and pulp (C) extracts of citrus derived from non-irradiated and irradiated shoots.

Nitric oxide is an essential bioregulatory molecule required for several physiological processes. The elevation of the nitric oxide results in inflammation, cancer and other pathological conditions. The nitric oxide scavenging abilities of the methanolic extracts of citrus WT and Mut plants are presented in Figure 4 and their  $IC_{50}$  in Table 1. The same trend was observed for the level of nitric oxide scavenging effects in tested citrus; three parts of citrus extracts scavenged nitric oxide in

a dose-dependent manner, and citrus peel and pulp extracts had higher nitric oxide scavenging ability than citrus leaf extracts. However, these extracts of all Mut groups showed no better scavenging effects on nitric oxide compared with the corresponding extracts of WT (Table 1). Moreover, the capacities of scavenging effects on nitric oxide in the extracts of Mut I and II peels, and Mut II and III pulps were lower (higher  $IC_{50}$  values) than those of WT extracts (Table 1).



**Fig. 4.** Scavenging nitric oxide radical effects of leaves (A), peel (B) and pulp (C) extracts of citrus derived from non-irradiated and irradiated shoots. Data represent the mean  $\pm$  standard deviation of three determinations.



**Table 1.** IC<sub>50</sub> value in antioxidant capacities of leaves, peel and pulp extracts of citrus derived from non-irradiated and irradiated shoots

Group	IC <sub>50</sub> value (mg/mL)*			
	DPPH radical	Superoxide radical	Hydrogen peroxide	Nitric oxide radical
Leaves				
WT	5.52 ± 0.358 <sup>a</sup>	3.15 ± 0.450	2.31 ± 0.041	2.82 ± 0.160
Mut I	6.46 ± 0.333 <sup>b</sup>	2.59 ± 0.194	2.31 ± 0.063	3.08 ± 0.057
Mut II	7.41 ± 0.253 <sup>c</sup>	2.84 ± 0.239	2.27 ± 0.180	2.83 ± 0.374
Mut III	5.61 ± 0.261 <sup>a</sup>	2.64 ± 0.121	2.21 ± 0.107	3.00 ± 0.338
Peel				
WT	1.00 ± 0.050 <sup>a</sup>	0.86 ± 0.054 <sup>a</sup>	1.09 ± 0.013 <sup>a</sup>	0.92 ± 0.032 <sup>a</sup>
Mut I	1.11 ± 0.051 <sup>b</sup>	0.98 ± 0.017 <sup>b</sup>	0.82 ± 0.005 <sup>b</sup>	1.11 ± 0.012 <sup>b</sup>
Mut II	1.08 ± 0.027 <sup>b</sup>	1.03 ± 0.025 <sup>b</sup>	0.91 ± 0.032 <sup>c</sup>	1.02 ± 0.013 <sup>c</sup>
Mut III	1.10 ± 0.011 <sup>b</sup>	0.63 ± 0.026 <sup>c</sup>	1.18 ± 0.058 <sup>d</sup>	0.90 ± 0.018 <sup>a</sup>
Pulp				
WT	1.13 ± 0.027 <sup>a</sup>	0.72 ± 0.001 <sup>a</sup>	1.35 ± 0.068 <sup>a</sup>	0.66 ± 0.031 <sup>a</sup>
Mut I	1.02 ± 0.004 <sup>b</sup>	0.72 ± 0.056 <sup>a</sup>	1.82 ± 0.137 <sup>b</sup>	0.65 ± 0.013 <sup>a</sup>
Mut II	1.03 ± 0.007 <sup>b</sup>	0.95 ± 0.080 <sup>b</sup>	1.83 ± 0.072 <sup>b</sup>	0.75 ± 0.014 <sup>b</sup>
Mut III	1.10 ± 0.004 <sup>c</sup>	0.89 ± 0.067 <sup>b</sup>	1.17 ± 0.066 <sup>c</sup>	0.76 ± 0.062 <sup>b</sup>

\*IC<sub>50</sub>, the concentration of citrus methanolic extracts that inhibited 50% of radicals. IC<sub>50</sub> was obtained by interpolation from linear regression analysis. Each values is expressed as mean ± standard deviation ( $n = 3$ ).

<sup>a-d</sup> Values with different superscripts in a column are significantly different ( $p < 0.05$ )

Reactive oxygen species such as superoxide, hydrogen peroxide and nitric oxide radicals, are very unstable and play an important role in oxidative stress related to the pathogenesis of various diseases through the direct reaction with other substances (Halliwell and Gutteridge, 1999; Finkel and Holbrook, 2000). Antioxidant properties of the various extracts from many plants are of great interest in both academia and the food industry, since their possible use as natural additives emerged from a growing tendency to replace synthetic antioxidant by natural ones. Previously, we observed great variations in the phenolic contents of citrus fruits and leaves obtained by gamma irradiation and some authors have shown the important role played by phenolics in the antioxidant capacity of citrus (Proteggente et al, 2003; Gorinstein et al, 2004; Anagnostopoulou et al, 2006). Considering above results obtained, it may anticipated that gamma irradiation modulates antioxidant activity achieved by the scavenging of DPPH, superoxide, hydrogen peroxide and nitric oxide, possibly because of the correlation between antioxidant activity and the contents of phenolics. A further research is recommended to verify the mechanism of antioxidative action of citrus extracts induced by gamma irradiation.

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## Survey Simple Correlation, Yield and Yield Components of (*Cucurbita Pepo Var. Styrica*) Influenced by Treatments Different Bio –Fertilizer

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**Abstract:** In order to evaluate correlation, yield and yield components of (*Cucurbita pepo var. Styrica*) influenced by treatments different bio fertilizer, Experimental crop year 2010 at the Research Farm of Agriculture and Natural Resources Research Center of West Azarbaijan Randomized complete block design with 13 fertilizer treatments in 4 replications was performed, Analysis of variance showed the data The significant difference between treatments was observed in 1% probability level the highest percentage of 61% and oil yield 2634 (kg / ha) of 13 fertilizer treatments, Obtained. The highest amount of protein yield related to the treatment 13 as well as the lowest amount percentage and protein yield related to the treatment 4 (control) is. Highest percentage and lowest values of protein yield, respectively, 1976 (kg / ha) and 375 (kg / ha) is allocated to. According to this survey results yield of fertilizer treatment 13 (30 tons of Livestock Manure per ha, phosphate barvare(2) one hundred grams per ha+ Nitroxin fertilizer 1 liter per ha+Thiobacillus fertilizer 1.5 kg per ha) is recommended for increase yield quality and quantity of cucurbita. also results of simple correlation analysis between the traits studied in the cucurbita due to applied different biological fertilizer treatments showed The strong correlation between grain yield and oil yield and protein yield is very high so that with increasing amounts of oil and protein, grain yield is increased and also high correlation between oil yield and protein yield was significant means with increasing protein yield also amounts of oil increased as well as between protein yield and harvest index and number of branches high and significant correlation exists so that by increasing the number of branches and harvest index, protein yield increases.

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**Keywords:** cucurbita, correlation, bio fertilizers, oil yield, protein and seed

### Introduction

Cucurbita is an annual and herbaceous plant. This plant is native to tropical and subtropical regions and from the America has spread to other parts of the world (25, 36). For optimum plant growth, nutrients must be available in sufficient and balanced quantities (10). Farming regions that emphasize heavy chemical application are led to adverse environmental, gricultural and health consequences Shehata and El-khawas, (29). Seeds of these plant are rich source of protein, oil and valuable active ingredients such as fatty acids, Phytosterols and Vitamin E. and from the active ingredients of that, drugs such as Peponen, Prostaliquid and gronfing for trait of prostate swelling and irritation urine is made(11). the amount of oil in seed is about 40 to 60 percent and most important fatty acid constituent the oil of this plant is linoleic acid 45 to 50 (19). One of the major problems of the cucurbita manufacturing is that low yield due to the weakness in manufacturing fruit of this plant given that this subjects the first fruit and its growth. In the cucurbits family plants as a strong physiological target for photosynthetic material acts, so the formation of next fruit limited and therefore makes it difficult for them to grow. In

addition excessive growth of fruit in this plant causes to prevent the seeds formation in that or greatly reduce that (Robinson, 1993; Rylsky 1974). in the numerous references to the positive effect of organic fertilizers on the composition and extension of microbial communities, Fauna and flora of soil, and exacerbation of metabolic processes within the soil, root and plant foliage is emphasized (47 & 44,39). biological fertilizers exclusively are not applicable to organic fertilizers derived from livestock manure, plant additions and etc., but also production, obtained from the activity of microorganisms which are in the connection with nitrogen fixation and bioavailability of phosphorus and other nutrients, that are active in the soil, also includes (51,46). One of the possible options to reduce the use of chemical fertilizers could be use of bio and organic fertilizers. Biofertilizers are products containing living cells of different types of microorganisms which when, applied to seed, plant surface or soil, colonize the rhizosphere or the interior of the plant and promotes growth by converting nutritionally important elements (nitrogen, hosphorus) from unavailable to available form through biological process such as nitrogen fixation and solubilization of rock phosphate (27). Beneficial

microorganisms in biofertilizers accelerate and improve plant growth and protect plants from pests and diseases (13). To increase the availability of phosphorus and nitrogen for plants, large amounts of fertilizers are used on a regular basis soon after application of a large proportion of phosphorus fertilizer is rapidly immobilized and becomes unavailable to plants (37) and also, 25% of the applied nitrogen fertilizer is lost from the soil plant system through leaching, volatilization and denitrification (28). Symbiotic nitrogen fixer and phosphate solubilizing microorganisms play an important role in supplementing nitrogen and phosphorus to the plant, allowing a sustainable use of nitrogen and phosphate fertilizers (35). The fixed phosphorus in the soil can be solubilized by phosphate solubilizing bacteria (PSB), which have the capacity to convert inorganic unavailable phosphorus form to soluble forms  $HPO_4^{2-}$  and  $H_2PO_4^-$  through the process of organic acid production, chelation and ion exchange reactions and make them available to plants. Therefore, the use of PSB in agricultural practice would not only offset the high cost of manufacturing phosphate fertilizers but would also mobilize insoluble phosphorus in the fertilizers and soils to which they are applied (9, 6, and 11). Biological nitrogen fixation is one way of converting elemental nitrogen into plant usable form (21). Nitrogen-fixing bacteria (NFB) that function transform inert atmospheric  $N_2$  to organic compounds (8, 13). The ability of these bacteria to contribute to yields in crops is only partly a result of biological  $N_2$ -fixation. The mechanisms involved have a significant plant-growth promotion potential. In these relationships the bacteria receive non-specific photosynthetic carbon from the plant and, in turn, provide the plant with fixed nitrogen, hormones, signal molecules, vitamins, iron, etc (24, 17). Previous studies showed that the combination of biofertilizers with organic or chemical fertilizers further enhanced the biomass and grain yield of crops (4, 1). Soils of arid and semi-arid regions have low organic carbon content and need organic amendments to improve their properties and consequently their productivity and natural fertility. Addition of organic matter, from different sources, improved physical and chemical properties of soil and consequently affects the growth and development of plant roots and shoots (12, 9). Although, information on the effect of animal manure and the other organic fertilizers on crop yield are available, farmers in the Iran rely on chemical fertilizers to maintain crop yield, and pay little attention to maintaining soil organic matter in soils in Iran (30). Some manure-bound nutrients are gradually released from the organic component of the manure. The release rates of these organic nutrients

can conceivably be affected by the chemical nature of the manure and SOM that forms from the manure (20). The use of animal waste in maintaining soil organic matter is a popular practice in all parts of the world. It is not only a safe and effective way of recovery for lost plant nutrients like nitrogen and phosphorus but also improves the physical and chemical attributes of the soil (3). Municipal solid waste can be composted to reduce the volume of waste and disease-causing organisms and to convert it in an organic-rich, soil-like product, through aerobic or anaerobic fermentation (16). The addition of municipal solid waste compost to agricultural soils has beneficial effects on crop development and yields by improving soil physical and biological properties (14). Positive effects of organic fertilizers on growth of pumpkin were reported in several studies (36,2) Economic and environmental problems caused by the indiscriminate use of chemical fertilizers and due to the inherent capabilities as well as very interesting and diverse creatures terri-colous and especially microorganisms that caused one of the most important and useful fields of research in scientific studies, efforts to produce biological fertilizer (bio) is (5). The use of biological fertilizers in agricultural ecosystems with the purpose of eliminating or substantially reducing the use of chemical inputs, one of the main elements of sustainable agriculture is important in (31). Bashan and partners (8) showed that the use of *Azotobacter* causes to increase nitrogen content in grains. consumption of chemical fertilizers is one of the main objectives of sustainable production in agricultural ecosystems is, in this regard, this study had a survey on the effect of various biological fertilizers on morphological characteristics and yield of cucurbita plant was done.

#### Material and methods

This experiment in 1387 in Research Center for Agriculture and Natural Resources of West Azarbaijan with latitude 37 degrees 53 minutes North and longitude 45 degrees 10 minutes east and with a height of 1325 meters above sea level is carried out. The average annual precipitation of 236.7 mm and mean annual temperature is about 13.1 ° C is. Coldest and warmest months of the year to January and July respectively are. To determine soil characteristics, from zero to 30 cm depth were sampled and determined that the clay loam soil texture and pH equal to 7.9 is. Hydrometer method for determining soil texture and pH meter devices was used to determine the pH (Table 2- 1).

For preparing the soil of farm in autumn, moldboard plow land with deep plowing and in spring with favorable conditions, secondary tillage for the final seed bed preparation, was done by a cultivator. Research in a randomized complete block

design with 13 fertilizer treatments (Table 2) in four replications was done. Each plot consisted of five rows refer to distances of 100 cm from each other was. cucurbita seeds as univalve were planted 40 cm apart, 4 seed was planted in each hole and after emergence, plants were thinned and remained a strong plant. planting Wet planting (irrigation before planting) was done on 7 May. Rotted livestock manure before planting, were given to treatments intended, results achieved from livestock manure nutrients are presented in Table 3. Seeds after inoculation with bio-fertilizers were planted at a depth of 4 cm. any kind of poison not used on the farm. Operations against weeds were done two times, by hand and by mechanical method. Farm irrigation during the growing season due to weather conditions and phenological stages of plant at the appropriate time depending on the crop water requirement three times in 4 leaf stage, flowering and 100 percent of fruit set) was performed. Were harvested in late September and the main stem length traits, sub stem number, 1000 seeds weight, humid fruit yield, biological yield, seed yield, harvest index, oil and protein percentage and yield were measured. Statistical calculations were performed using MSTATC, SPSS-19 and Minitab software. Charts and statistical tables took place as Excel and Word software. Average under-study traits were compared using LSD test at 1% probability level.

According to the chart of scotter plot, seed yield kg per ha and protein yield regression line shows that the highest yield obtained from combination of treatment 13, that the most

appropriate treatment combination. also treatment compounds 7,8 and 12 also are devoted the medium to high yield. And lowest yield amount is allocated to control treatment.

Results from this study showed that biological fertilizers combined with livestock manure treatments 7, 8, 9, 10, 11, 12 and 13 the best results in terms of oil and protein content and yield, main stem length, number of lateral branches, yield biological, seed and harvest index showed in cucurbita plant (Table 3-2). Rotten livestock manure thoroughly supply the needed food of plants, also has a very important role in improving soil physical and is very effective in enhancing soil fertility, livestock manures have a main role in increasing soil humus and fertility of soil, use of this fertilizers improving gas exchange in soil, maintain water and nutrients in the soil, lightening the heavy soils and enhance the adhesion properties sandy soils and an increase of yield is efficient. yield increase in livestock manure treatments, perhaps due to increased activity of microorganisms, and release of some CO<sub>2</sub> in plants and in result that causes to photosynthesis of plant (31) were observed significantly enhancement in vegetative traits such as plant height, stem diameter and diameter, biological yield, oil percentage in seed and grain yield of sunflower in the result of application of bio fertilizers. They knew the reason for this increase in relation to improving soil structure which increasing soil water holding capacity, with proper ventilation and drainage and causes to root growth and nutrient uptake (Somasundaram etc, 32).

Table 1 Analysis of Some Physical and Chemical Characteristics of Soil, Experiment Place

Characteristic	Saturation S.P	Electrical conductivity	pH	Neutral Materials T.N.V	Organic matter	Phosphorus absorption	Potassium absorption	Sand	Silt	Clay	Soil texture
Unit	%	Ds.m <sup>-1</sup>	-	%	%	ppm	ppm	%	%	%	-
Amount	56	0.117	7.91	29.8	1.5	16.4	222	13	46	41	loam Clay

Table 2 Fertilizer Treatments and Amount of Used Per Unit Area

Number	Treatment	Amount of Fertilizer per unit area
1	Phosphate Barvar 2 +Phosphorus fertilizer	Phosphate barvar 2 (100 gr/ha) +Phosphorus Fertilizer (60 kg/ ha)
2	Nitroxin	Nitroxin Fertilizer (Azotobacter) (1 liter/ha)
3	Thiobacillus	Thiobacillus Fertilizer(1.5 kg / ha)
4	Control	Non-use biological and chemical Fertilizers
5	NPK	Phosphorus Fertilizer(120 kg/ha)+ Potassium Fertilizer ( 100 kg/ha) + Nitrogen Fertilizer(60 kg/ha)
6	Livestock Manure	Livestock Manure (30 ton/ha)
7	Livestock Manure+Phosphate Barvar 2	Livestock Manure (30 ton/ha)+ Phosphate Barvar 2 (100gr/ha)
8	Livestock Manure+Nitroxin	Livestock Manure (30 ton/ha)+ Nitroxin Fertilizer (Azotobacter) (1 liter/ha)
9	Livestock Manure+ Thiobacillus	Livestock Manure (30 ton/ha)+ Thiobacillus Fertilizer(1.5 kg/ha)
10	Livestock Manure+ Nitroxin+Phosphate Barvar 2	Livestock Manure (30 ton/ha)+ Phosphate Barvar 2 (100gr/ha)+ Nitroxin Fertilizer (Azotobacter) (1 liter/ha)
11	Livestock Manure + Thiobacillus+Phosphate Barvar 2	Livestock Manure (30 ton/ha)+ Phosphate Barvar 2 (100gr/ha)+ Thiobacillus Fertilizer(1.5 kg/ha)
12	Livestock Manure + Nitroxin+ Thiobacillus	Livestock Manure (30 ton/ha)+ Nitroxin Fertilizer (Azotobacter) (1 liter/ha) + Thiobacillus Fertilizer (1.5 kg/ha)
13	Livestock Manure+ Thiobacillus+Nitroxin+Phosphate Barvar 2	Livestock Manure (30 ton/ha)+ Phosphate Barvar 2 (100gr/ha) + Nitroxin Fertilizer (Azotobacter) (1 liter/ha) + Thiobacillus Fertilizer (1.5 kg/ha)



Table 3 The Results Analysis Of Variance Of Fertilizer Treatments On Yield And Yield Components Of Cucurbita.

S.O.V	Mean of square						
	df	Seed Yield kg/ha	% Oil	Oil Yield kg/ha	% protein	Protein Yield Kg/ha	Length main Stem(m)
Replication	3	7474,218**	0,019 ns	2044,808**	0,00001 ns	1344,840**	0,0006 ns
Treatment	12	17086,4,648**	163,264**	100072,660**	242,410 ns	144740,282**	3,116**
Error	36	1066,640	0,047	387,706	0,001	264,662	0,003
% CV	-	1,42	0,01	1,30	0,01	1,37	1,06

ns, non-significant \*\*, significant in 1% probability level.

Table 3 Continued.

S.O.V	Mean of square				
	df	Biological Yield (ha)	HI	Count lateral branch	Length Lateral Stem(m)
Replication	3	0,00001 ns	0,0002**	0,00001 ns	0,0001 ns
Treatment	12	20213243,264 ns	13,776**	2,410 ns	2,418**
Error	36	0,001	0,000	0,001	0,002
% CV	-	0,0001	1,46	0,01	1,40

ns, non-significant \*\*, significant in 1% probability level.

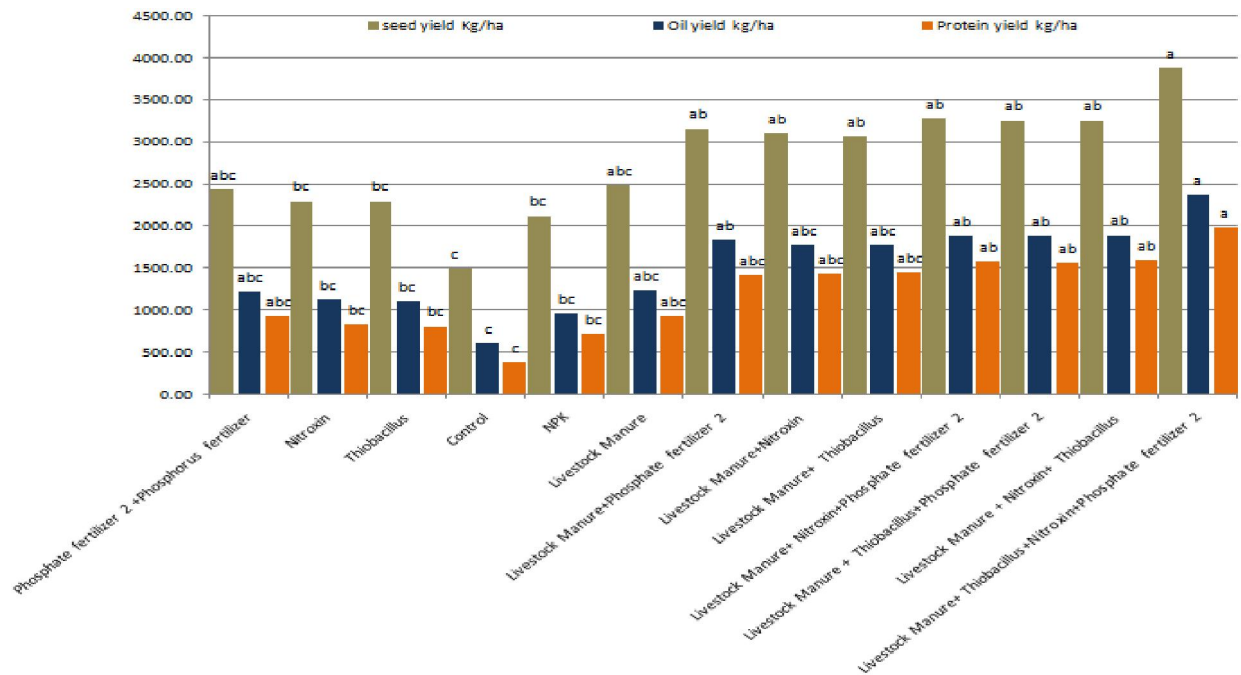


Figure 1 Effect of different fertilizer treatments on yield, seed protein of ucurbita  
Dissimilar letters is Indicate significant differences at 1% probability level

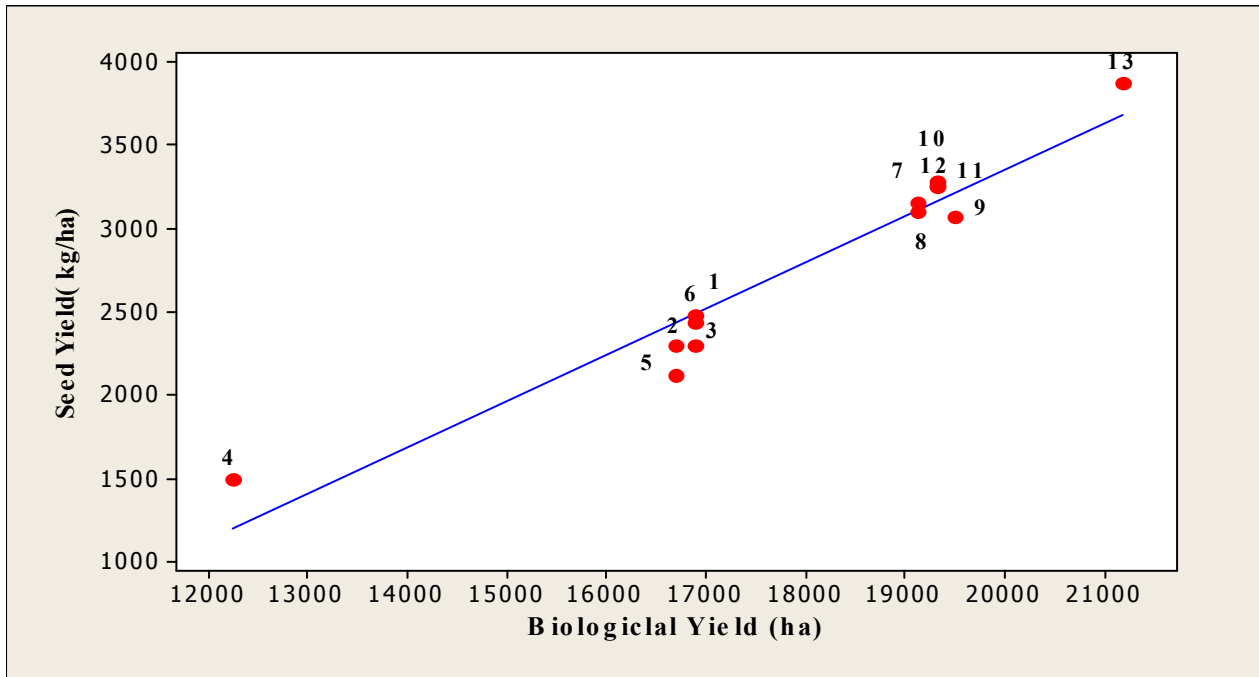


Figure 2 the scatter plot chart, linear regression of grain yield and biological yield under the effect of applied different fertilizer Treatments

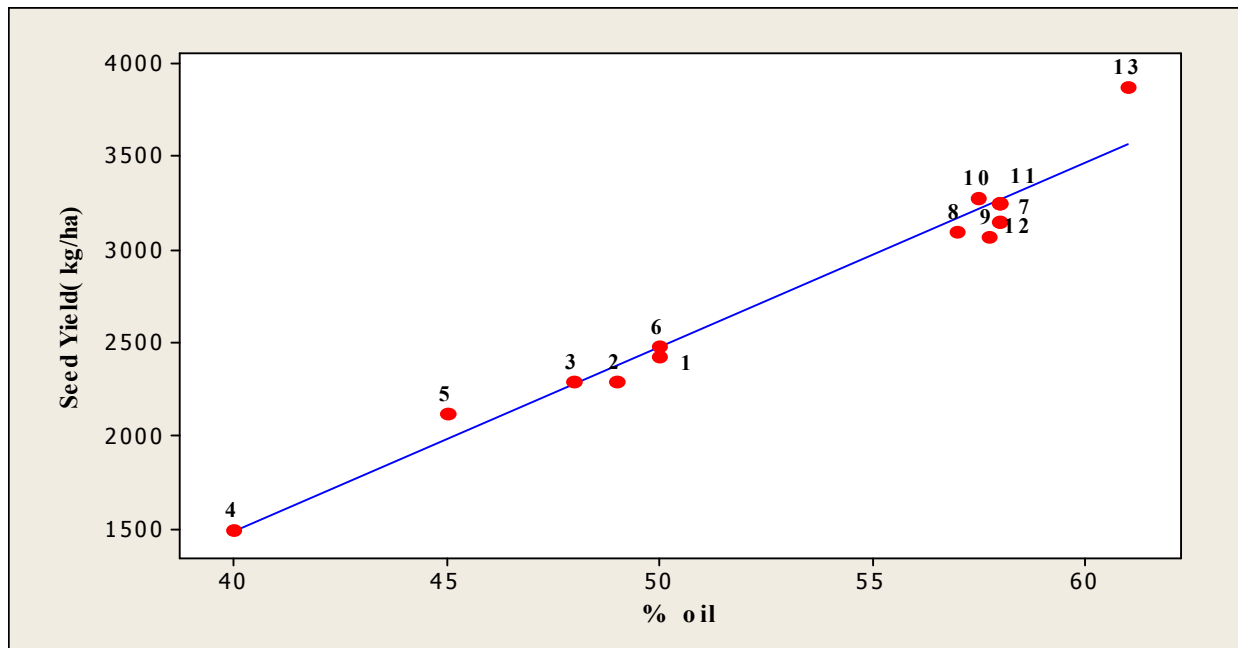


Figure 3 chart of scatter plot, linear regression of seed yield and oil percent under effect of different fertilizer treatments.

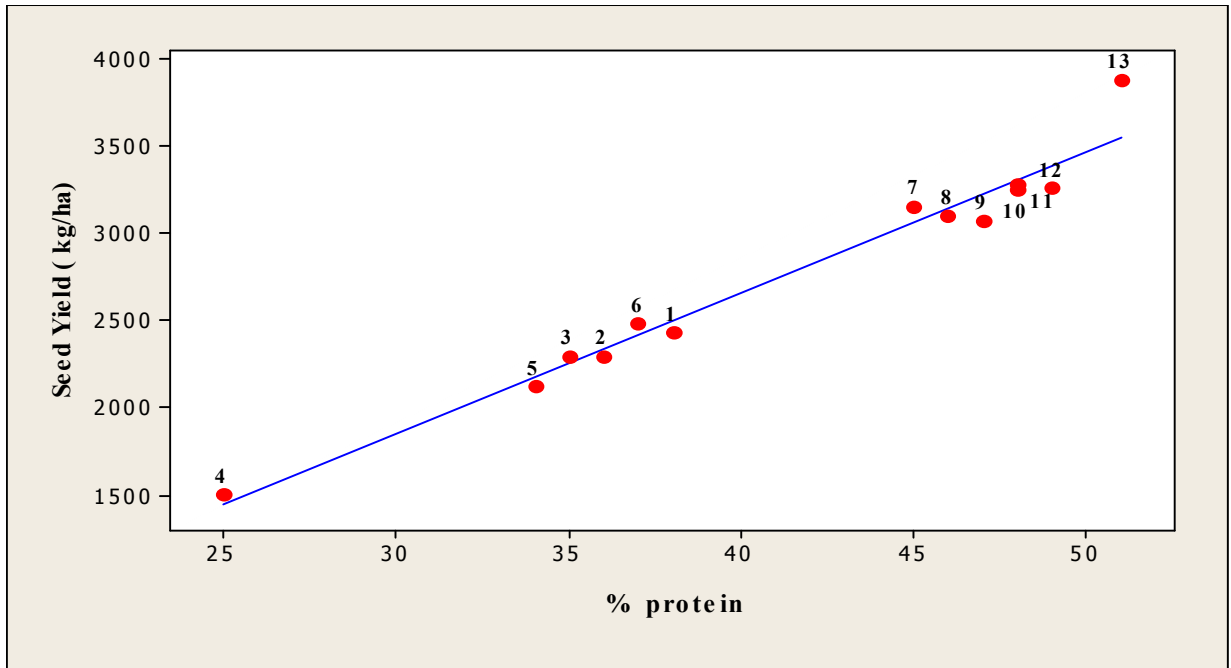


Figure 4 chart of scatter plot, linear regression of seed yield and protein percent under effect of different fertilizer treatments.

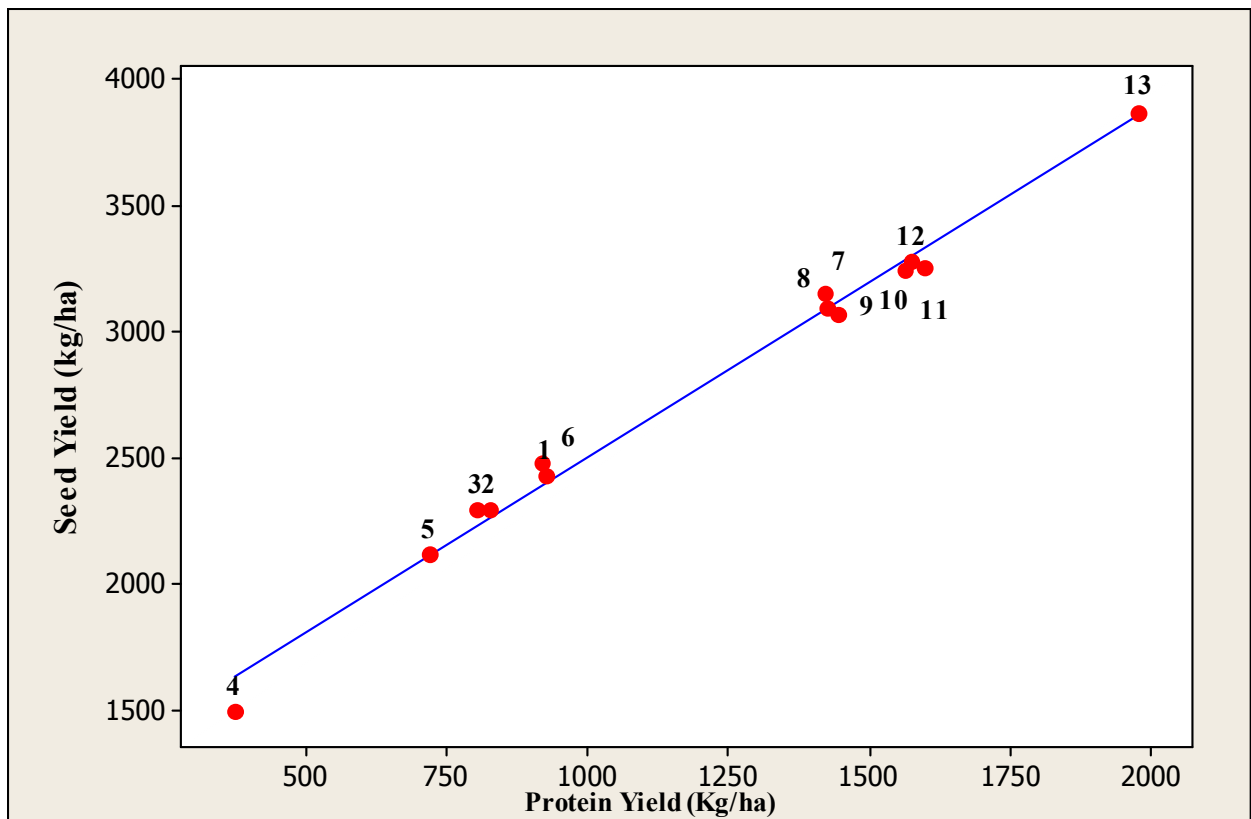


Figure 5 chart of scatter plot, linear regression of seed yield and protein yield under effect of different fertilizer treatments.

Table 4: Mean comparisons for measured traits

Treatment	Mean comparisons													
	Seed Yield kg/ha		% Oil		Oil Yield kg/ha		Protein Yield Kg/ha		Length main Stem(m)		Length Lateral Stem(m)		HI	
1	2434	abc	20.00	abc	1217	abc	924/9	abc	7.00	abc	7.77	ab	14/42	abc
2	2297	bc	19.00	abc	1120	bc	826/9	bc	7.80	bc	7.00	ab	13/37	bc
3	2297	bc	18.00	abc	1102	bc	803/9	bc	7.00	bc	7.47	ab	13/31	bc
4	1500	c	18.00	c	700/0	c	370/0	c	1/20	c	1/00	b	12/27	c
5	2119	bc	18.00	bc	903/7	bc	720/0	bc	7.00	bc	7.47	ab	12/30	bc
6	2482	abc	20.00	abc	1241	abc	918/4	abc	7.20	abc	7.70	ab	14/30	abc
7	2104	ab	18.00	ab	1829	ab	1419	abc	7.02	ab	7.30	a	16/49	abc
8	2099	ab	17.00	ab	1777	abc	1427	abc	7.00	ab	7.47	a	16/24	abc
9	2070	ab	17.00	ab	1773	abc	1443	abc	7.00	ab	7.47	a	16/24	abc
10	2279	ab	17.00	ab	1887	ab	1504	ab	7.00	ab	7.00	a	16/48	ab
11	2202	ab	18.00	ab	1887	ab	1561	ab	7.00	ab	7.00	a	16/48	ab
12	2207	ab	18.00	ab	1889	ab	1597	ab	7.00	ab	7.00	a	16/48	ab
13	2370	a	19.00	a	2234	a	1977	a	8.00	a	8.00	a	18/29	a

Table 5: Simple linear correlation between the studied traits cucurbita, in applied different treatments of bio-fertilizers

	Seed Yield (kg/ha)	% Oil	Oil Yield kg/ha	% protein	Protein Yield (Kg/ha)	Length main tem(m)	Count lateral branch	Length Lateral stem(m)	Biological Yield (ha)	HI
Seed Yield( kg/ha)	1									
% Oil	-.982**	1								
Oil Yield kg/ha	-.948**	-.988**	1							
% protein	-.982**	-.988**	-.974**	1						
Protein Yield(Kg/ha)	-.948**	-.977**	-.948**	-.982**	1					
Length main tem(m)	-.974**	-.944**	-.972**	-.944**	-.988**	1				
Count lateral branch	-.988**	-.977**	-.984**	-.972**	-.982**	-.978**	1			
Length Lateral stem(m)	-.978**	-.970**	-.982**	-.978**	-.981**	-.971**	-.984**	1		
Biological Yield( ha)	-.970**	-.980**	-.981**	-.977**	-.947**	-.974**	-.971**	-.991**	1	
HI	-.988**	-.974**	-.987**	-.970**	-.984**	-.977**	-.987**	-.973**	-.980**	1

Increase in crop yield under the application of bio-fertilizers have been reported. the positive impact of bio fertilizers on growth and plant yield, not only because it provides essential elements in providing, Elements influencing of plant growth, like auxin, amino acids and vitamins that are By analyzing plant growth is stimulated (23) Yazdani and etc reported that the use of different types of chemical and bio fertilizers in the soil on oil percent, cilimarin and cilibin in seed of maritighal had a significant effect, so that the treatment (Silybum marianum) manure compost had the highest percentage of oil compared to other treatments, and then fertilizer treatments of Azotobacter and mix of Azotobacter and compost, had the highest percentage of oil, also chemical fertilizer treatment had the lowest percentage of cilibin. Kennedy and etc (19) and use of Nitrazhin bio fertilizer caused to increase of 28% seed yield in comparison to control treatment, although between this treatment and mix of Nitrazhin and PSB, there was no statistically

significant disorders. The results of three-years research of Murkovic and etc was done in 1996 on 100 lines of cucurbita with the aim of achieving the varieties with high oil yield and high linoleic acid showed that the seed oil content and percentage of linoleic acid sequence is variable from 21%. They also -56/5-39/5/67 and from 4 reported in a delay in harvesting and And the use of bio fertilizers the fruit and reducing the temperature, in stage of fruit maturity linoleic fatty acid amount of seed oil increases. Tajbakhsh and etc (34) in their report stated that if nitrogen usage at flowering time was in a suitable amount it can increase storage compounds and seed oils. recommendations of fertilizer treatment for medicinal plants should be done with considering to all effective conditions, because it a Fertilizer treatment may lead to increase of product whereas causes to reduce the amount of active ingredients of medicinal plants or the cause to change the material components. (Active ingredient that is not useful) (5) And (48 in all

these systems, bio fertilizers) biologic (as a natural alternative to chemical fertilizers, and undeniably positive role in the sustainable management (32,27) in this, has the soil and ultimately the whole system stability direction, the status of soil from organic matter and therefore the existing biodiversity. Biological fertilizers containing microorganisms which are capable of nutrients from unusable to usable form to convert and this conversion is done in a biological process. Biological fertilizers production cost is low and do not create pollution in the ecosystem, the consumption of these fertilizers not only increased yield but also decreased the use amount of chemical fertilizers, in research of Iranipour and etc (17, 38) on the impact of biological fertilizers on plants similar results achieved. the most common bio fertilizers, containing micro-organisms can point to Molecular nitrogen stabilizer bacteria (Diazotrophs) such as Azotobacters phosphate solubilizing microorganisms as phosphate barvar 2+(8), given that the consequences of leaching nitrogen and contamination of water resources and fixation of phosphorus and calcium compounds accumulate in alkaline soils and lime with aluminum and iron in acidic soils can have a profound impact in achieving the purpose of sustainable agriculture and have increased yield (33). Matsi and etc (21) showed that use of livestock manure can increase High consumption elements nitrogen, phosphorus and potassium accessibility. these results with the results of the research of the other researchers is consistent on other plants (34). However, use of livestock manure has a very important role in soil improving and compaction, in addition, adding livestock manure to soil leading to improve soil structure, fertility and increasing soil organic matter (22).

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## Computer Games and Its Effect on Attribution of Learned Helplessness Students

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**Abstract:** Games are increasingly being used as educational tools. Many cognitive skills of a child may be observed during computer game play and in part because they are presumed to enhance student motivation. Motivation is important in learning contexts because it can lead students to make greater effort, seek greater challenges, set higher goals, and has higher achievement. We look at student motivation in games from the viewpoint of attribution theory, which predicts more learning by students who make attributions along certain dimensions, and thus may provide a way of examining this claim in more detail. The goal of this research was to study to determine the effect of Instruction based on Computer games on reducing learned helplessness among the female students, who were studying in Mashhad in 2010-2011 academic years. Selection was random sampling. In this research, the subjects were 40 students of fourth and fifth grade of elementary school female students who were identified as learned helplessness by children's attribution-style questionnaire (CASQ). The experimental and controlled groups were selected randomly. Experimental group was affected by dependent variables for 10 sessions, each session 45 minutes. The method of instruction was based on computer games and research design was experimental. Then posttest was taken from both groups. Covariance analyses and t test were used to analyze the research results. The results showed that there was a significant difference between experimental and control groups ( $p \leq 0.05$ ). The practical purpose of this study is to make use of the research findings in education and counseling.

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**Key words:** computer games, learned helplessness, attribution, motivation

### 1. Introduction

Learned helplessness is formally defined as a disruption in motivation, affect, and learning following exposure to non-contingent (uncontrollable) outcomes. There are three crucial elements to its definition: contingency, cognition, and behavior. Contingency refers to the objective relationship between actions and outcomes; for helplessness to occur there must be no relationship between a person's actions and the outcome he or she experiences. Cognition refers to how individuals perceive the contingency, explain it, and extrapolate from this understanding. The perception of uncontrollability (non contingency) may be accurate or inaccurate, but once it occurs individuals attempt to explain it. From this explanation they make extrapolations about the future and, when learned helplessness occurs, they expect that their behavior will not influence future outcomes. Behavior refers to the observable effects of being exposed to uncontrollable outcomes. Most often it involves a sense of giving up— weaker attempts to control the situation or even failure to try to do so at all—a behavior incompatible with new learning. The response is also accompanied by negative emotions such as anxiety and sadness.

A theoretical framework that is useful for understanding motivation in a learning context is achievement attribution theory (Weiner, 1972). Based on the assumption that humans are rational decision makers who seek to understand the causes of their own behavior, attribution theory describes the explanations that people make for events in their life. In particular, achievement attribution looks at how people explain their performance at tasks. Achievement attributions are described along three causal dimensions that have been shown to be critical factors in the attribution process. Locus of control refers to whether the cause to which events are attributed is internal (e.g., high ability) or external (e.g., a difficult test) to the student. Stability refers to how constant the perceived cause is over time; for example, some students might consider ability to be stable over time, while others believe it can change. The third dimension, controllability, refers to the belief that the perceived cause can be or not (Weiner, 1986). These attributions are important because they tend to lead to behavioral changes that affect learning. Students who attribute their success to internal and controllable causes like amount of effort put forth, and attribute failure to unstable causes like an exceptionally difficult test or lack of effort, tend to

have better learning outcomes. Those who attribute success to external causes like luck and attribute failure to stable internal causes like lack of ability tend to have lower learning outcomes; these attributions may be termed 'maladaptive', particularly when they are inaccurate. These attributions also seem to be causal; a number of studies have shown that we can retrain students to make successful attributions, or those that lead to more learning (e.g., Perry, Hechter, Menec, & Weinberg, 1993). Therefore, if improving attributions helps learning, understanding people's attributions in games.

Good video games are in form of stages, which show continuous relation development between game and players and decrease failure experience, players can resume the game from where the failed. Therefore students do not fear to be defeated and encourage taking risk, discovering and trying unknowns. As a matter of fact, in playing failure is good, but students in schools rarely face with risky atmosphere (Gee, 2003). Some researchers who studied all aspects of pedagogical computer games, instead of introducing them threatening, they called them new culture which have to be welcomed with open arm and use them in a proper way (Gunter, 1999). Turning to the issue that computer and computer games, nowadays, are part of a new generation who are developing and progressing, and most of Iran's problems and critical issues in Educational systems are due to failing in use of psychological findings in treatment and training, especially for those students who feel helpless and are experiencing depression and pessimism emphasize on most catastrophic reason for failure, the importance and necessity present this study as a new method or educational complementary and stress the importance and necessity of this research.

### 1.1. Review of the Related Literature

Nowadays, computer software is example of powerful cognitive tools and they are also called "cognitive technologies", "mind technologies" and "mind tools" (Santrock, 2008). Computer games not only encompass special symbolism system, but also realize this in terms of goal-directed activity and with immediate result. One of the main reasons that make these computer games so popular is goal-directing activity, and maybe it is a good reason for their capabilities of using and motivating cognitive skills (Gunter, 1999).

Computer games are not only considered as important cultural artifacts, but also have a significant cognitive value. By introducing games to the class, the first thing that we expect to happen is the increase in motivation (Squire, 2005). Computer games can teach experiments, problem solving, cognitive skills such as memory, visuospatial, motor, frustration tolerance and

meta-cognition and other high levels of skills. The basic research on proper computer games revealed that these kinds of games lead to internal motivation, entertainment, controlling, challenging, and curiosity (Malone, 1981, Cordova & Lepper, 1996, as cited in Squire, 2005) and develop children thinking skills (Chang & Chen, 2009). Also it is assumed that playing in class increase player's willingness for developing new skills, accepting new roles and having a better understanding of the world from proficient point of view (Gee, 2007 & Squire, 2007).

According to Prensky (2001, cited in Reinders, 2001) games share: 1) rules 2) goals and objectives 3) outcome and feedback 4) conflict, competition, challenge, and opposition 5) interaction 6) the representation of a story

Students in educational places can develop their previous abilities through new tools and acquiring new skills. Computers and computer games, because of their interactive nature, cause mastery simultaneously. Playing such games is a powerful tool for increasing and developing of students' self-confidence that is socially disorder (Linch, 1983, as cited in Gunter, 1999).

Owsten (2007) in a study categorized playing computer games as an education activity that can create motivation and interaction in students in useful activities subject matters. The results indicated that playing computer games could help student to improve their ability in maintaining the content, comparing data presented and using opportunity and acquiring skill. Gee (2006) stated that video and computer games involve in a new art form. These games include a set of joys, learning and cognition development and life expansion that we expect them from art. The games create the approximate area of development in which child always act beyond his/her age, daily behavior, and it seems that child look like more than s/he is (Vygotsky, 1967, 1993, as cited in Gerdler, 2001). Playing create approximate development area and include both cognitive and socio-emotional development. Learning is the ultimate goal of playing (Verenikina et al, 2003). This finding indicated that computer-based video game playing not only can improve participants' fact differentiation/recall processes, but also promotes problem-solving skills by recognizing multiple solutions for problems. The broad categories of computer games are basically action, adventure/quest, fighting, puzzle, role-play, simulations, sports and strategy games. Based on one of the findings, when children find a solution for a problem through computer and two-player adventurous games comparing to one-player games, they showed more progression. Two-player games not only increase the general performance but also decrease the normal arguments between the players in such games.

Computer games provide a sense of controllability (Potter, 1998, quoted Qutaiba, 2011, p 1). Lack of control over a situation, will reduce the motivation of response to achieve targets and sense of lack of control over a situation create a negative cognition, which prevents the learning of a given relationship between a particular and specific power and the lack of control is responsible for emotional disorders. On the other hand computer games increases the sense of skills acquisition against the chance and provides them a different meaning of failure from what they experience in the school. The result of this assumption is consistent with results of researches, which has been used in a number of play therapy institutes and centers. Computer games have successfully used for a number of varieties of treatments of cognitive, emotional and motivational impairment. Gardner (1992 quoted Gunter, 1999) claimed that of positive effects of video games is player achievement to an improved self-esteem feeling that occurs following the skills of self-motivation in the game.

Gee (2008) has shown that computer games result in promotion of emotion and cognition leading to decline in frustration. Griffiths (2002) knows dominance and target-orientation of computer games as the main cause of overcoming frustration.

Computer games provide positive excitement (Potter, 1998, quoted Qutaiba, 2011). Griffiths (2002) stated that computer games due to fast and instantaneous feedback and in the experimental conditions have caused an increase in the internal control and positive documents. He has claimed that computer games in pilot study, due to the fast and instantaneous feedback has caused a decline in negative documents. Educational computer games, which are used in order to facilitate social and interpersonal skills learning lead to improvements in attribution and thus reduce the frustration through role playing and working in groups (Ogan et al 2008).

With regard to above-mentioned and assuming that most of Iran's society' educational and behavioral treatment system are due to failing in use of psychological findings in treatment and training, especially for those students who feel helpless and are experiencing depression and pessimism and as a result show weak academic performance, this method is known as a new and complementary method of education.

The purpose of the present study was the investigation into the influence of Computer games and its effect on attribution of learned helplessness students. The practical purpose of this study is to make use of the research findings in teaching in educational centers and consoling clinic for those children who are experiencing helplessness and educational problems of

these students can be solved by taking the advantages of such methods and cause academic performance improvement.

This research also studied about

-- *Does training based on computer games reduce learned helplessness?*

- *Does training based on computer games increase positive attribution of events?*

- *Does training based on computer games reduce negative attribution of events?*

Based on research questions, other hypotheses are as follows:

- a. **Hypothesis 1:** the rate of learned helplessness among female students having been trained based on computer games method are less than those that have not been exposed to this method.
- b. **Hypothesis 2:** the rate of attribution of positive events in female students having been trained based on computer games is more than those who have not been exposed to this method.
- c. **Hypothesis 3:** the rate of attribution of negative events in female students having been trained based on computer games is more than those who have not been exposed to this method.

### 3. Method

#### 3.1. Subjects:

Subjects in this study were 40 students of fourth and fifth grade of elementary school female students who were identified as learned helplessness by children's attribution-style questionnaire (CASQ), among the 6416 female students, who were studying in governmental schools of Mashhad in 2010-2011 academic years.

In this study phallic cluster sampling was used. That is from 7<sup>th</sup> district of education in Mashhad, one district and from desired district two elementary schools were selected randomly. Then of these schools two fourth grades and two fifth grades were selected and the numbers of students were 110. Children's attribution-style test was taken, 40 students whose marks were the lowest in questionnaire were selected who were known as the learned helplessness students.

Two classes were selected as experimental group and two classes were selected as controlled group randomly. Each group has 20 students. As the desired population includes two age groups of 10 and 11, the portion of students in each age group in sample is as equal as the portion of the students in population. In this way, that 50% of the sample are from fourth grade and 50% from fifth grade. And this portion is as the same as the portion in our research population.



Control variables were:

- 1) *Age: All the subjects were selected between 10-11 year old students.*
- 2) *Gender: The subjects were females.*

### 3.2. Measurement tool

The instruments were paper-pencil questionnaires, children's attribution-style questionnaire (CASQ). Measurement tool for this research is children's attribution-style questionnaire (CASQ). This questionnaire was designed by Peterson and Seligman for children between 8 and 13 and contains two positive (pleasant events) and negative (unpleasant events) situations. Each situation has 3 attribution aspects (internal, stable and general). This test was standardized by Heybatollahi (1984) according to Iranian culture with 36, two-choice questions. This questionnaire includes 36 two-choice questions (positive and negative situation, each contains 18 questions) and of 18 questions related to each situation, each of 3 aspects (internal, stable and general) contains 6 questions.

### 3.3. Procedure

The questionnaire (children's attribution-style questionnaire) was given to subjects, simultaneously 110 answer sheets were collected and scored. Among the samples; there were 50 percent from fourth grade and 50 percent from fifth grade.

The total came to 40 students. 10 fourth grade students and 10 students of fifth grade were as experimental group. Students got familiar with how computers work and play. None of software intended for research had been used by the students in the past. Software was selected in the field of role-playing, exciting puzzles and educational (Arcade Software, Sara and Dara). All the selected software related to Islamic-Iranian culture and was appropriate for age of 10 to 11.

110 sessions (twice a week) for each experimental group (experimental group consisted of two groups of four people and was one of two groups of 6). It is learned at the beginning of the game rule. Then, playing with each other about it, to pay the assessment and judgment.

### 3.4. Data analysis

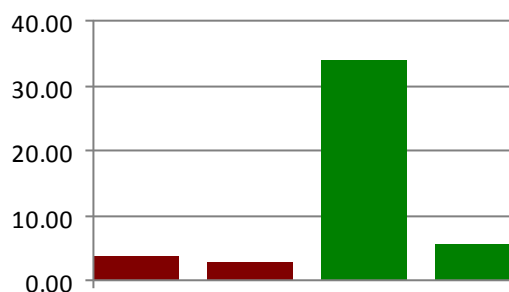
#### Methods and tools of data analysis

Analysis of covariance was used in order to analyze the data obtained from this project. Based on this method, the mean of posttest was compared after the adjustment of pretest scores. This means that first, before implementing any researches, differences that may exist between the two groups are neutral, and then the mean of pretest scores of both groups (after adjustment) are calculated and compared.

Significant differences between the two groups reflect the effect of independent variables (training based on computer games) on the dependent variable (learned helplessness).

#### Evaluation of research hypotheses

**Hypothesis 1:** the rate of learned helplessness among female students having been trained based on computer games method are less than those that have not been



exposed to this method. Based on values of the total mean of positive and negative positions and values of the test statistic in the following table we can infer that there was not a significant different between a pre-test scores in both control and experimental groups.

**Fig 1: The average reduction in negative situations and increase in positive positions**

**Table 1: The average amount of learned helplessness**

	group	average	Standard deviation
pretest	experimental	3.600	3.202
	control	2.800	2.118
Post test	experimental	33.99	1.997
	control	5.450	3.967

**Table 2: Summary of covariance analysis of comparing the mean of posttest scores of the positive and negative situation after adjusting pretest scores in experimental and control group**

Source	F	Sig.	Partial Eta Squared	Observed Powerb
Rate of increase in positive and decrease in negative situations	738.75	0.000	0.582	1.000

Given the value of pre-test and post test in both groups we can conclude that the null hypothesis, or the hypothesis in which " there is no significance between the rate of learned helplessness among female students having been trained based on computer games method and those that have not been exposed to this method" is rejected at the significance level of 5%



and 95% confidence in which the rate of learned helplessness among female students having been trained based on computer games method are less than those that have not been exposed to this method. Based on the findings in significant it was  $F$  (  $p \leq 0.05$  ).

Therefore, there are significant differences between the mean of posttest scores of attribution style in both experimental and control groups after adjusting pretest scores. In other words, training based on computer games reduce the amount of learned helplessness. Based on this 58% of individual differences in experimental and control groups related to the impact of computer-based training game.

**FHypothesis 2:** The rate if positive events attributions of schoolgirls having been trained based on computer games method are less than those that have not been exposed to this method.

Based on values of the mean of positive and negative positions and values of the test statistic we can infer that there was not a significant different between a pre-test scores in both control and experimental groups. And in other words we can accept that both experimental and control groups were similar in terms of negative and positive situations. But after training the experimental group we witness a significant difference between control and experimental groups.

Given the value of pre-test and posttest in both groups we can conclude that the null hypothesis, or the hypothesis in which " The rate of positive events attributions of schoolgirls having been trained based on computer games method are more than those that have not been exposed to this method" is rejected at the significance level of 5% and 95% confidence in which The rate of positive events attributions of schoolgirls having been trained based on computer games method are more than those that have not been exposed to this method. Based on the findings  $F$  (  $p \leq 0.05$  ) was significant. Therefore, there are significant differences between the mean of posttest scores of attribution style in both experimental and control groups after adjusting pretest scores. In other words, computer game-based training increases the amount of positive events. Based on this 1 to 83% of individual differences in experimental and control groups related to the impact of computer-based training game.

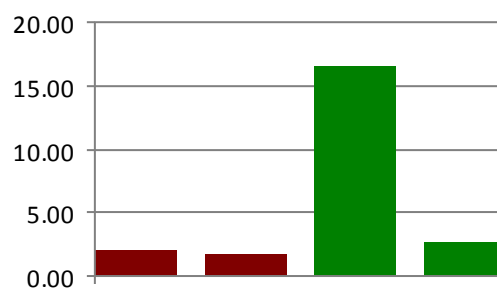
**Hypothesis3:** The rate of negative events attributions of schoolgirls having been trained based on computer games method are less than those that have not been exposed to this method.

Based on values of the mean of negative positions and values of the test statistic we can infer that there was not a significant different between a pre-test scores in both control and experimental groups. And in other words we can accept that both

experimental and control groups were similar in terms of negative situations. But after training the experimental group we witness a significant difference between control and experimental groups.

**Table 3: The average score of positive events increase**

	group	average	Standard deviation
Pre-test	experimen tal	2.05	2.305
	control	1.7	1.559
posttest	experimen tal	16.6	1.314
	control	2.7	2.13



**ig 2: The average score of positive situations increase**

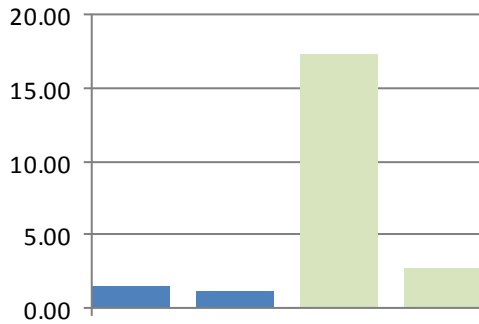
**Table 4: Summary of covariance analysis of comparing the mean scores of posttest positive events after adjustment Pretest scores in experimental and control group**

Source	F	Sig.	Partial Eta Squared	Observed Power <sup>b</sup>
Increasing positive events	1325.31	0.000	0.834	1.000

*P-value=0.00*

Training based on computer games decrease total attribution of negative events. Given the value of pre-test and posttest in both groups we can conclude that the null hypothesis, or the hypothesis in which " The rate of negative events attributions of schoolgirls having been trained based on computer games method are more than those that have not been exposed to this method" is rejected at the significance level of 5% and 95% confidence in which the rate of negative events attributions of schoolgirls having been trained based on computer games method are less than those that have not been exposed to this method. Based on the findings  $F$  (  $p \leq 0.05$  ) was significant. Therefore, there are

significant differences between the mean of posttest scores of attribution of negative events in both experimental and control groups after adjusting pretest scores. In other words, training based on computer games decreases the rate of negative events. Based on this 61% of individual differences in experimental and control groups related to the impact of training based on computer games.



**Fig 3. the average score of negative situations reduction**

**Table 5: The average score of negative events reduction**

	group	M	S
Pre-test	experimental	1.550	1.276
	control	1.100	1.252
Post test	experimental	17.300	1.129
	control	2.2750	2.447

**3. Results and Discussion**

In this study, a hypothesis was taken into account to investigate the effect of training based on computer games, learned helplessness decreasing. Analysis of covariance was applied to test this hypothesis. Research results indicate that the computer game based learning, can put children into a challenging situation to develop those specific cognitive skills and make them learned and entertained. On the other hand in the case of the pessimists, who are involved helplessness feeling and have a false belief and cognition, teacher or counselor or facilitator try to correct them, and change their attributions from lack of talent and ability to lack of efforts and in this regard provide them with more self-image, self esteem and efforts, and prevent them from repeated failure and its consequences which will ultimately lead to helplessness and depression. When students are trained based on computer games they have a true feeling of control and empowerment. They feel that they will dominate on what they do. On the other hand "role-playing" software show us how people act powerfully and with high motivation to discover or create a new identity or role. Good game allows people to build their

new world and at the same time more deeply learning is obtained. Increasing positive events and decreasing negative events from fiction role-playing games are example of the effects of computer games.

**Table6: Summary of covariance analysis of comparing the mean scores of posttest negative events after adjustment Pretest scores in experimental and control group**

Source	F	Sig.	Partial Eta Squared	Observed Powerb
Decreasing negative events	1258.11	0.000	0.610	1.000

*Significant factors in this study can be factors such as:*

**1.** Being recent and a new type of training and its motivation aspect, which, unfortunately, most schools act poorly or even negatively in driving motivation. Emotions are a key source of motivation for directing the idea, learning and problem solving. Computer games work perfectly as a form of entertainment training in connecting emotion and problem solving. Our feelings in evaluating the information and actions can help us to receive feedback when we perform in the world and explain how to assess or evaluate the concept. Feeling of helplessness, pessimism and extreme frustration, anger and fear can overwhelm our thinking and undermines learning, which is called emotional filters.

**2.** staging in computer games have been set from easy to hard.

**3.** The experience of failure for students is not the same as other tasks, the value of failure in computer games have been decrease and the key role of failure allows students to test different assumptions.

**4.** Collective and cooperative involvement, since competing in computer games are seen as a social relationship there is a close connection between competition and cooperation while it is not so in school.

**5.** Role-playing and simulated programs, in this role-playing students experience a feeling of choice, strong feeling of possessing, and also they are able to produce and not only consume and that leads to a deep and optimistic learning.

**6.** When computer games were approved as a tool, teacher using revers engineering organizes the subject matters in form of game, which totally includes concepts such as tool intermediation and the concept of approximate area of growth and activity. Fortunately, we can reform children’s inappropriate behavior through different pedagogical and therapeutic ways, which results in removing frustration.

Learned helplessness in people results from their inappropriate and incongruous style of definition and since this style has rooted in one’s cognition and

beliefs we can modify them using methods based on activity theory namely computer games. The acceptance of main hypothesis of this research indicates the effectiveness of this method in modifying definition style and hence reducing helplessness.

Good computer games reduce the experience of failure because the player can resume from where he failed. Therefore, players never scare of failing and are encouraged to take risk, discover and test unknown things.

This hypothesis that "The rate of positive events attributions of schoolgirls having been trained based on computer games method are more than those that have not been exposed to this method has been proved and it shows that by modifying person's inappropriate beliefs and attributions we are able to develop an ability inside him by which he can make a connection between successes and happy events with ability. Student who connects his success to some external factors such as chance and so on, doubts about his abilities and it might do a damage on his self-esteem and lead to helplessness which then cause frustration. The more a student enjoys from internal attribution of positive events, the less s/he has problems with mental health, self-esteem and educational performance and is safe with haplessness and frustration. When a student thinks that his success comes from factors, which are stable and permanent, next times s/he will try more and except more for success. In Seligman and colleagues (1999) view, the reaction of optimistic children to happy events of life differs from those pessimists. Children who believe that happy events have permanent factors are more positivistic and optimistic than those who believe these events have contemporary factors. Optimistic children, for defining happy events for themselves refer to permanent factors. They point to abilities and features, which are always with them, such as hardworking, being loved or loved one.

In "Alavi Detective" (one of the game plays that was considered ) game they stated the happy events of successfully finding the lost items as "I found the evidence because I searched the room carefully."

This hypothesis that the rate of negative events attributions of schoolgirls having been trained based on computer games method are less than those that have not been exposed to this method has been proved. The acceptance of this hypothesis indicates that we can teach students to believe that they should relate their failure and unhappy events to external factors such as chance, level of difficulty of the task and do not relate them to internal factors such as ability, talent and so on. In Seligman and colleagues (1999) view, that whom people put the blame on affects their self-esteem. Children who got used to blame themselves when they fail, have low self-esteem and feel guilty

and embarrassment. Children, who put the blame on other people and situations when an unhappy event comes up, have a better opinion about themselves. Yet, that does not mean to teach children to consider others as guilty when things are against them, the main point here is that teach them how to see correctly in a way that they hold themselves responsible whenever things go wrong and try to modify their behavior and when they are not responsible for what comes up appreciate themselves.

Members consult and cooperate with each other. Holding themselves responsible for whatever goes wrong develops absolute thinking, black and white, and playing cooperative games reduces this feeling. That whom people put the blame on affects their self-esteem. Children who got used to blame themselves when they fail, have low self-esteem and feel guilty and embarrassment; in fact when a problem occurs children should be asked to be realistic. In other words, neither should they reprimand themselves and feel guilty, nor should they relate all mistakes to others. Students can be taught to relate unpleasant events to unstable and temporary factors not to stable and permanent ones. That is, they should not relate their cause of failure to stable factors such as lack of ability or/and lack of talent, but by relating this failure to unstable factors such as less effort or inappropriate conditions, try to compensate their failure.

Seligman and colleagues (1999) view, Children who are at greater risk for depression, believe that the causes of unpleasant events that comes to them, are constant, and accordingly, had argued that the since the cause is permanent, the adverse events are always repeated. Conversely, the children who are faced with the regression with the flexibility and are resistant to depression, believe that the causes of adverse events, are temporary.

Pessimistic child relates adverse events to the deficiencies in his character attributes, while an optimistic child believes that temporary and changeable mood state and other states, are the cause of these events. Therefore, children should learn to use words like "sometimes" and "recently" instead of words "always" and "never" when they face failures, banishment and difficult things.

Students can be taught in case of failure or creation of unpleasant events, only allocate the cause to same case and avoid generalizing it to other conditions. The child must be believed that the cause of adverse events were due to specific rather than general causes, expectations of failure or bad experiences will decrease in the future and if relates threatening events to the general causes then his expectation from the possible unpleasant experiences will increase in future.

Computer games can teach experiment, problem solving, trans-cognition and other high-level

skills. Through games, children are aware of their thinking and beliefs and are taking steps to control them. "Role-playing" software is involved how to discover or create a new identity or role that is motivated and has the power to act on and people recreate themselves in their new world and at the same time in-depth learning is obtained.

#### Practical and research suggestions:

Suggestions which will be practiced in future researches are as follows:

Due to the limitations that existed in this study some suggestions are proposed to be dealt with in future research. The proposals include:

1. Investigating the effect of computer games training on reducing or eliminating the problems such as aggression, hyperactivity, mild fears and phobia, anxiety, social anxiety, and Autism.
2. The investigation of the effect of training method based on computer games in mental therapy and pain management in children and adolescents treated with chemotherapy.
3. Holding training classes for parents to familiar with teaching methods based on computer games. In role-playing games of false belief and understanding of children will modify and change their attributes from lack of talent and ability to efforts, and in this case provide them with the self-image, self esteem and more efforts. Source of internal control about people's beliefs the role of environmental events impact on their lives. And parents and those who are in charge of education should be the internal model (effort) and in their speech and behavior, depict this attribute style.

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## Prioritization of Development Projects of Qazvin Municipality

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**Abstract:** This article is based on an MA thesis which has been supervised by the author. The purpose of this study is to gain information about the projects and the utilization of the plans of Qazvin Municipality with regard to the budget constraints through the application of decision making techniques of mathematic model of AHP. The purpose of this study is to utilize a proper method of decision making for the prioritization of the projects through exploration of effective qualitative and quantitative factors and assessment of their weight values in pairs and putting them in a matrix. Of course, this purpose is a means to the final end of the satisfaction of the customers (in municipal system the citizens). The purpose of this research is to signify the significant projects and utilize developmental plans of Qazvin Municipality; therefore, AHP has been used as a decision making technique. In this study, first the entire numbers of municipal developmental plans were recognized which included 313 plans within 82 developmental programs. Therefore, based on expert opinions and the significance of the plans, 36 criteria were put in the priority and then reduced to 25 factors through questionnaires. Finally, these factors were weighed and those with scores lower than 7 were excluded and just 13 factors were left to be analyzed. The application of the weights given to the projects and factors by a group of experts (an experienced team of 24 experts) and then collection of a series of questionnaires distributed among the public as well as the criteria which were compared in matrices and then the application of the average mean of the weight of each project concerning each one of the factors were calculated. Finally, the most appropriate project was selected through the calculation of the total priority of each project concerning all factors.

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**Key Words:** AHP (Analytic Hierarchical Process), Development Responsibilities, Service Responsibilities, Administrative Responsibilities.

### Review of Literature:

#### Background:

This method was first introduced by Professor Thomas Al Saaty (the Professor of Pitsburg University) in his book by the same title which was published in 1980.

This method has been applicable in regard with several issues and so far many articles have been published on the issue, one of the best ones of which has been published by Vargas and Harker in 1987.

In Iran, for the first time, this issue was seriously discussed in 1992 in one of the scientific conferences of Research Center of Iranian National Industries.

Because of the broad application of AHP technique and its dependence on scientific methods, Professor Saaty was invited by Industrial Management Organization in 1999 to lecture on AHP in this organization.

#### Concept of AHP

AHP is a method which relies on the mathematic knowledge which generally includes all the thoughts related to a problem. AHP is a demonstrable and comprehensible method without the complexities of other methods of decision making. This method is an analytic procedure which

enables us to measure intangible aspects and overcome the constraints of decision making. AHP is an appropriate method for a better decision making and helps us make decisions about complex issues which have no structure. Analytic Hierarchical Process also tries to combine qualitative and quantitative criteria for those decision makings in which several factors and principles are involved. This method is able to determine the priority of options involved in decision making so that the decision maker or the group of decision makers would be able to determine the best options through the definition of the goal and options involved.

#### The Advantages of AHP

- Being simple and applicable;
- Compiling and systematizing the very mental process of decision making and as a result, facilitating a proper and accurate judgment;
- Flexibility with regard to different problems and in various grounds;
- Creating appropriate environment and conditions for the improvement of the definitions through discussion in a decision making group (combining, analysis and adjusting the contradictions among them);



- The possibility of analyzing the sensitivity of the results and reexamination with low costs;
- Doing the numerical calculations and specifying the priority of the options and alternatives based on numerical values (a method for measuring qualitative values in the form of figures);
- The access of the manager to the data related to the evaluation standards and determining the percentage of the confidence in the data and information obtained by the decision maker (by a fixed rate or comprehensiveness) and the weight of each of the criteria as a side advantage of the method.

### Method of Application of AHP

The principle of application of AHP is based on a completely natural rationale, the rationale all of us have undoubtedly practiced several times. The main problem is broken into comparable components to the extent possible (these components include the determining qualitative and quantitative factors in decision making). These components are classified based on their degree of significance and then chosen through well-known mathematical methods and based on the highest estimated score.

### The Applications of AHP

This method has too many usages in various problems including the supervisions of programmer, selection of location, prioritization of factors of decision making. The following achievements can be mentioned for AHP:

1. It is a scientific way for quantitative discussions about several kinds of quantitative and scientific connections in a complex network.
2. It is a powerful instrument for the completion of other (progressive and regressive) planning methods which is reflected in the opinions of the personnel and manager for its reciprocal effects.
3. It is a complementary method for other research methods in operations such as estimation of cost and profit and minimum risk for selection of projects.
4. It's an instrument for warning and directing the progressive function of a dynamic set of goals of an organization.

It should be noted that this method is generally established on a natural and instinctive thought in which scores are given to several significant and qualitative factors involved in decision making and the highest score would be our choice. For this reason, this method seems to be easily perceived and its application in many

problems, even our daily issues, seems possible and effective.

### Designing a Hierarchy

The first step in AHP is to provide a graphic presentation of the problem in which the objective, criteria and the alternatives are illustrated. Diagram 1 illustrates the hierarchy of selection of a car. The first level in the hierarchy includes the aim which is selection of the best car and in the second level, four criteria are presented which include price, fuel consumption, comfort and model and in the final level the car options (A, B, C) are illustrated.

### Estimating the weight

In AHP, the components of each level are compared with their counterpart components in the higher level in pairs and their weight is calculated; such weights are called relative weight. Then, through combining the relative weights, the final weight which is called the absolute weight, is determined for each option.

First, the cars are separately compared regarding price, fuel consumption, comfort and model, and the weight of each is specified regarding the goal determined. All comparisons in Analytic Hierarchical Process are made in pairs, for example if we are going to compare the cars with regard to their comfort, first we compare car A with car B and after that car A with car C and then car B with car C.

In such comparisons, the decision makers would use verbal judgments, so that if component (i) is compared with component (j) then the decision maker would say that the significance of (i) compared to (j) would be one of the following states:

- Extremely preferred or extremely significant or extremely desired;
- Very strong preference, significance or desirability;
- Strong preference, significance or desirability;
- Moderately preferred or moderately significant or moderately desired;
- Equal preference, significance or desirability.

These judgments are transformed into quantitative amounts from 1 to 9 by Saaty which are presented in the table (1):

It should be noted that in comparison of pairs, the preference of each element to itself equals one, so all the components located on the diagonal of the matrix equals one. Moreover, this should be noted that if the preference of A to B equals 2, the preference of B to A would be  $\frac{1}{2}$ . Therefore, pair comparison matrix can be completed as follows:

When pair comparison matrix is provided, we can estimate the weight for each option; in other

words, based on the pair comparisons presented in pair comparison matrix we are going to come to the weight of each car with regard to its comfort.

For the estimation of weight of each option of pair comparison matrix (relative weight) several methods have been suggested the most significant of which include:

- Method of minimum ordinary squares;
- Method of minimum Logarithm squares;
- Method of specific vector;
- Approximate methods.

Here one of the approximate methods (arithmetical average which is a relatively simple method) is explained. This method includes three following steps:

**First step:** The values of each column are added up.

**Second step:** Each component in the pair comparison matrix is divided to the total of its column so that the pair comparison matrix would be normalized.

**Third step:** The average mean of the components of each row of the normalized matrix is estimated. These average values are the estimation of the weights considered.

In order to clarify on the issue, the estimation steps of this algorithm for tables (pair comparison matrix of three cars concerning their comfort) are demonstrated below:

**First Step:** Adding up the values of each column

**Second Step:** Division of each component of matrix to the total of its column (Note: Sum of the values of the columns in a normalized matrix equals 1.

**Third Step:** Estimation of the average of the components of each column

Hence, we observe that regarding comfort, car A (with the preference of 593%) is the best car. Car B (with the preference of 341%) is the second best and car C (with the preference of 66%) is the last one.

Preference vector which illustrates the relative preference of cars A, B, and C with regard to the criterion of comfort can be shown as follows: (0.593, 0.341, 0.066)

#### **Estimation of Other Relative Weights:**

In the previous section, the weight of each car regarding its comfort was estimated. Now, we should estimate the weight of cars concerning other criteria (price, fuel consumption and model) and the weight of the criteria with regard to the goal. In order to estimate these weights, first the decision maker should compare the cars in pairs with regard to each one of the criteria and then prepare the pair matrix. These pair comparisons are illustrated in tables (3-7) to (3-9).

Through the application of arithmetic average method, the weights of the cars are estimated

concerning each criterion. The results of these estimations are demonstrated in table (9).

As can be observed car C has the best price (with the weight of 557%) and the most suitable consumption (with the weight of 639%) but with regard to the model car B (with the weight of 655%) is better than two other cars.

After the estimation of the weight of the cars regarding all criteria, the weight of the criteria should also be signified. In other words, the share of each one of the criteria in determination of the best car should be determined. For this purpose we need to compare the criteria in pairs. The pair preference of these criteria is asked from the decision maker and then pair comparison matrix is provided which is illustrated in table (10).

The weights of the criteria are estimated by arithmetic average method which are demonstrated below:

Price	0.398
Consumption	0.085
Comfort	0.218
Model	0.299

As can be observed, the criterion of price possesses the largest weight.

#### **Estimation of the Final Weight of the Cars**

Now that the weight of the criteria is estimated with regard to the objective and the weight of the cars is estimated with regard to the criteria, it's the time for the way of combining these weights to be explained for the estimation of the final weight.

Since the weight of the criteria reflects their significance in determination of the objective and the weight of each option with regard to the criterion indicates the share of that option in the related criterion, one can easily say that the final weight of each option is obtained from the product of weight of each criterion and weight of the related option of that criterion. Table (2-11) briefly illustrates the weight of the car with regard to the criteria.

Then, regarding the relative weights estimated, the final weight for each alternative would be obtained in the following way.

Final weight of car A =  $0.398 \times 0.123 + 0.085 \times 0.087 + 0.218 \times 0.593 + 0.299 \times 0.265 = 0.265$

Final weight of car B =  $0.398 \times 0.230 + 0.085 \times 0.274 + 0.218 \times 0.341 + 0.299 \times 0.655 = 0.421$

Final weight of car C =  $0.398 \times 0.557 + 0.085 \times 0.639 + 0.218 \times 0.066 + 0.299 \times 0.080 = 0.314$

Therefore the preference of the cars would be as follows: As can be observed, car B is the best choice.

#### **Case Study:**

##### **Statement of the Problem**

Municipality as a public and independent NGO has a wide range of responsibilities which are classified under three main groups of development

responsibilities, service responsibilities and administrative responsibilities. Development responsibilities of Municipality are carried out through the administration of development projects in the form of 8 plans. These plans include:

1. Urban development planning;
2. Directing and discharging the surface waters of the city;
3. Improvement of urban traffic;
4. Establishment of other protective installations in the cities;
5. Improvement of urban environment;
6. Construction of tourist, cultural and sport areas and establishments;
7. Construction of revenue making establishments;
8. Construction of other urban facilities and establishments.

As can be inferred from the titles of the plans there are many qualitative and quantitative factors within the organization or outside it that affect the significance of the plans. The municipal budget is limited and the significance of each of the factors is different. Therefore, the director as a decision maker should use a powerful scientific technique to decide which project should be preferred.

#### **Significance and Justification of the study:**

One of the most significant responsibilities of the directors is to make decisions. The more the responsibilities and powers of the directors is the more significant the act of making decisions would be. Since an appropriate and timely decision can have a significant effect on the organization, the necessity of the existence of a powerful technique that would be able to help the directors in this regard is quite noticeable. In short, we can say that in those cases that the decision making includes several qualitative and quantitative criteria and variables of different weight values the prioritization of municipal development projects have the same characteristic; therefore, the application of AHP technique which is a hierarchical analysis of decision making becomes quite significant, since in this technique, after knowing significant and essential factors, it is tried to establish a rational balance among different effective criteria and to signify their effects on one another by pair comparison and prior to making the final decision.

#### **Purposes of the Study:**

Since the Municipal Office is a public and independent institution and supplies its revenues from the citizens, then it is obliged to be responsible for the needs of the public. Some of these duties are fulfilled through the accomplishment of development projects.

The Municipal Office can not accomplish all projects at the same time, so it has to prioritize the projects in

order to have the optimum selection and utilize its limited resources in the best possible way.

The purpose of this study is to utilize a proper method of decision making for the prioritization of the projects through exploration of effective qualitative and quantitative factors and assessment of their weight values in pairs and putting them in a matrix. Of course, this purpose is a means to the final end of the satisfaction of the customers (in municipal system the citizens).

#### **Research Questions:**

A- Main Question:

How are the municipal development projects of Qazvin prioritized?

B- Subordinate questions:

1. What are the effective criteria in prioritization of municipal development projects of Qazvin?
2. What value each criterion may have in prioritization of municipal development projects of Qazvin?

**Statistical Community:** Projects of Qazvin Municipal Office.

#### **Data Analysis**

##### **Introduction**

One of the major work processes of any human being is to make decisions. During the process of decision making people are willing to optimize their goal based on the best determined choices and criteria. In this part, the decision is to be made about the projects of Qazvin Municipal Office. First, the completed forms are distributed in order to collect data based on the opinions of experts and directors. Then, through classification of the opinions presented in the questionnaires, the factors affecting the projects of Municipal Office were signified based on the highest scores acquired (higher than 7).

Then, through utilizing pair comparison method the projects are compared with regard to the effective factors. After providing the matrices and normalized matrix, the score of each project is determined with regard to all factors. Finally, the priority of the proposed projects is determined based on the analysis of compatibility rate of the comparisons. All municipal development projects within 8 development plans of the year 2003 were analyzed through several sessions of determining the repetitions of all criteria and indices, the 313 projects were distinguished and recorded.

These criteria were classified under 5 dimensions including:

1. Social criteria;
2. Municipal techno-developmental;
3. Environmental;
4. Economical;
5. Safety and health.

The total number of 313 projects were reduced to 26 and then to 25 criteria in the following specialized sessions and after more analyses. Projects were given scores from (1) to (9) and then submitted to the development and municipal experts in municipal and provincial headquarters who are experience in the administration of the projects.

The projects accomplished are demonstrated below in order. General indices of municipal developmental plans have designed 36 projects based on the opinions of the experts which are demonstrated below.

These factors were reduced to 25 criteria based on the opinions of the experts.

Table 1- These scores are presented by a group of experts and then they have been evaluated. As a result, the average means of the scores for each option have been listed in table 14 based on 22 factors.

In order to determine the score of the most significant factor affecting the selection of the appropriate project, those factors which have an average score higher than 7 are selected and the others are eliminated. The real factors which affect the selection of the appropriate project among those factors with scores higher than 7 include the following 11 factors.

Security and safety and welfare of the users;  
Improvement of urban traffic;  
Infrastructural aspects of the plan;  
Possession of the land;  
Improvement of urban sight;  
Being economical and providing revenue making resources or reducing the costs;  
Cost of administration of the project based on the budget;  
Documentation of the plan;  
Geographical and ecological conditions;  
Coordination with other plans;  
Recreational criteria and Chances for public to spend spare times;  
Absorption of national and provincial credits;  
Period of the plan.

#### **Selection of the Proposed Project to Create Utilization Affairs**

In this part, the evaluated projects are selected. First, the projects are named and then in the prioritization stage and in pair comparison tables, numbers are used. So, in order to give them preferences, the following projects are selected based on 10 factors which have been considered appropriate.

1. Administration of comprehensive program of privacy;
2. Garbage recycling;
3. Improvement of city entrances;
4. Directing and discharging the surface waters;

5. Improvement of urban traffic and transportation;
6. Establishment of Baragin Park;
7. Reestablishment and improvement of traditional gardens in Qazvin;
8. Establishment of western, eastern and central terminals ;
9. Administration of Green Belt in Qazvin;
10. Securing Navvab and Baragin Rivers within the urban limits.

#### **Application of AHP**

Now that the projects are selected for prioritization of effective factors in evaluation of the projects, the projects are evaluated by AHP method which is a multi-stage method.

#### **Structure of the Tree of Decision Making**

The first step in Analytic Hierarchical Process is to provide a graphics illustration of the problem.

The tree of decision making is the graphic presentation of decision making strategy. In this structure, first the objective of decision making is written and then, the effective factors in making decision are written vertically and in order of their significance in separate levels of decision making tree (In this study, the factors affecting decision making are placed at the same level). In the bottom level of the tree (level 3) the options involved in decision making (proposed projects) are written. The column can be described in the following way:

Level 1: The objective of decision making is to utilize qualitative and quantitative factors and determining the priority of the appropriate project for utilization.

Level 2: The effective factors in determination of the appropriate project are those 13 factors which had been selected in the previous part.

Level 3: The proposed projects are those 10 projects selected in the previous chapters. The graphic structure is presented below.

Based on the AHP method and analysis of the data, the final result is reported according to table 17 As can be observed, the project of improving urban transportation and traffic obtains the first preference.

#### **Conclusion:**

When a group of experts finished the job of data collection especially on weighing the projects and calculation operations, the results of the research are presented to the directors and researchers. It should be mentioned that decision making techniques do not affect the decision making; however, they provide us with a systematic method so that we would be able to come to the best answer with our own priorities.

The calculations made about the prioritization of the projects by the method of AHP and base on 13 factors and 10 options (projects) indicate that the

proposed projects which have been evaluated are prioritized in the following order:

1. First priority: Improvement of urban transportation and traffic scoring 0.118;
2. Second priority: Improvement of the city entrances scoring 0.115;
3. Third priority: Administration of Qazvin's Green Belt scoring 0.1032
4. Forth Priority: Establishing Barajin Park scoring 0.1029;
5. Fifth priority: Establishment of Eastern, Western and central terminals scoring 0.1025
6. Sixth priority: Implementation of the comprehensive plan of privacy scoring 0.1014;
7. Seventh priority: Controlling and discharging the surface waters scoring 0.100;
8. Eighth priority: Recycling the garbage scoring 0.0864;
9. Ninth priority: Making Navvab and Barajin Rivers secure within the urban district scoring 0.086;
10. Tenth priority: Reconstruction and improvement of traditional gardens of Qazvin scoring 0.083.

Table (1) the value of the preferences for pair comparisons

Degree of significance	Definition	Description
1	Equally preferred	Both activities play an equal role in achieving the desired destination
2	Moderately preferred	The experience and the judgment support one of the activities to some degree
5	Strongly preferred	The experience and the judgment strongly support one of the activities
7	Very strongly preferred	One of the activities is focused much more than other activities and its prevalence is evident in practice
9	Extremely preferred	Evident preference of one activity over another; the highest possible order is verified
2,4,6,8	For the states where the degree of significance is between the above-mentioned values	The preferences within the above-mentioned intervals

Table 2. Comparison matrix for 3 cars regarding their comfort.

	Car A	Car B	Car C
Car A	1	2	8
Car B	1/2	1	6
Car C	1/8	1/6	1

Table 3: The results of first step of the algorithm (adding up of the columns)

	Car A	Car B	Car C
Car A	1	2	8
Car B	1/2	1	6
Car C	1/8	1/6	1
Sum of each column	13/8	19/6	15

Table 4: The results of second step of the algorithm (normalizing the columns)

	Car A	Car B	Car C
Car A	8/13	12/19	8/15
Car B	4/13	6/19	6/15
Car C	1/13	1/19	1/15

Table 5: Estimation of the average mean of the components of each row

	Car A	Car B	Car C	The average of the row
Car A	0.615	0.631	0.533	0.593
Car B	0.308	0.316	0.316	0.341
Car C	0.077	0.053	0.053	0.066
Sum	1.000	1.000	1.000	1.000

Table 6: Pair comparison matrix for three cars regarding their price

	Car A	Car B	Car C
Car A	1	1/3	1/4
Car B	3	1	1/2
Car C	4	2	1

Table 7: Pair comparison matrix for three cars regarding their consumption

	Car A	Car B	Car C
Car A	1	1/4	1/6
Car B	4	1	1/3
Car C	6	3	1



Table 8: Pair comparison matrix for three cars regarding their model

	Car A	Car B	Car C
Car A	1	4	4
Car B	3	1	7
Car C	1/4	1/7	1

Table 9: Weight of cars for the criteria of price, consumption and model

	Price	Consumption	Model
Car A	0.123	0.087	0.265
Car B	0.320	0.274	0.655
Car C	0.557	0.639	0.080

Table 10: Pair comparison matrix of the criteria

	Price	Consumption	Comfort	Model
Price	1	3	2	2
Consumption	1/3	1	1/4	1/4
Comfort	1/2	4	1	1/2
Model	1/2	4	2	1

Table 11: The weight of the cars concerning the criteria

	Price	Consumption	Comfort	Model
Car A	0.123	0.087	0.593	0.256
Car B	0.320	0.274	0.341	0.655
Car C	0.557	0.639	0.066	0.080

Table 12: Final Preference of the cars

Final weight	Car	Preference
0/431	B	1
0/314	C	2
0/265	A	3

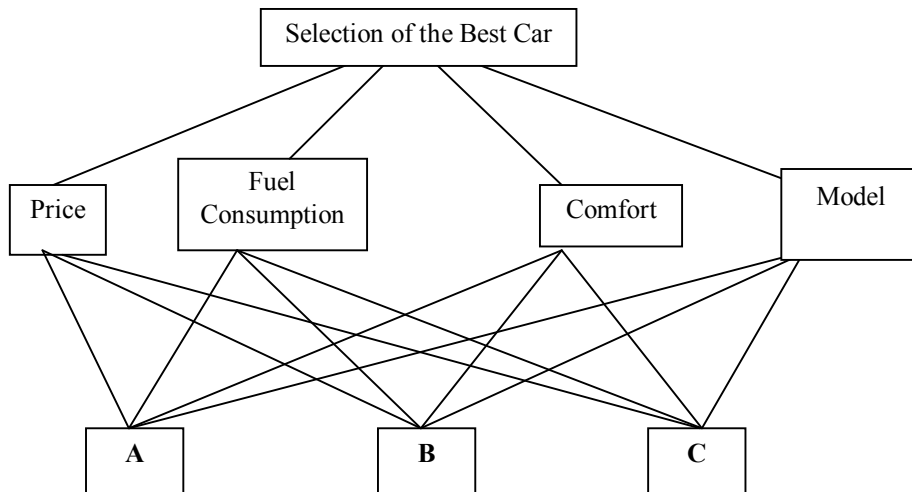


Fig 1: hierarchy of selection of a car

Table 13: 36 Developmental plans based on the opinions

Row	Developmental plans	Row	Developmental plans
1	Providing revenue making resources	19	Municipal and architectural criterion
2	Cost of the plan	20	Public recreation
3	Public need for the plan	21	Ecological conditions of the plan
4	Geographical conditions	22	Infrastructural aspects
5	Chances for public to spend spare times	23	Absorption of capital from the private sector
6	The rate of added value of the plan	24	Being attentive to the public health
7	Social criterion	25	Possession of the land used for the plan
8	Cultural criterion	26	Tourist attraction
9	Historical criterion	27	Promotion of public knowledge
10	Population of users	28	Reducing public roughness

11	Natural criterion	29	Improvement of urban sight
12	Environmental criterion	30	Public security
13	Economical criterion	31	Service utilization of the plan
14	Administration period	32	Improvement of urban traffic
15	Economical plan	33	Public participation in the plan
16	Public welfare	34	Credit for the plan
17	Absorption of national and provincial credits	35	Coordination with other plans
18	Employment	36	Documentation of the plan

Table 14. average means of the scores for each option

Row	Factor	Scores out of 9
1	Cost of administration of the plan	7.29
2	Providing revenue making resources	7.79
3	Absorption of national and provincial credits	7.16
4	Geographical conditions and area	7.63
5	Ecological conditions	7.29
6	Infrastructural aspects of the plan	8
7	Possession of the land	7.95
8	Improvement of urban sight	7.83
9	Improvement of urban traffic	8.04
10	Coordination with other plans	7.29
11	Documentation of the plan	7.75
12	Recreational criteria	7.20
13	Chances for public to spend spare times	7
14	Population of users	7.75
15	Promotion of public knowledge	7.04
16	Public welfare	7.62
17	Public health and security	8.16
18	Being economical	7.29
19	Period of the plan	7.08

Table 15. Final result

Rank	Final score	Description
6	0.1014	Implementation of comprehensive plan of privacy
8	0.0864	Recycling
2	0.1155	Organization of the entrances of the city
7	0.1002	Controlling and discharging the surface water
1	0.1182	Improving the urban transportation and traffic
4	0.1029	Establishment of Barajin Park
10	0.0836	Reconstruction and improvement of traditional gardens of Qazvin
5	0.1025	Establishment of east, west and central terminals
3	0.1032	Implementation of Qazvin green belt
9	0.0860	Making Barajin and Navvab rivers secure within the urban restrict

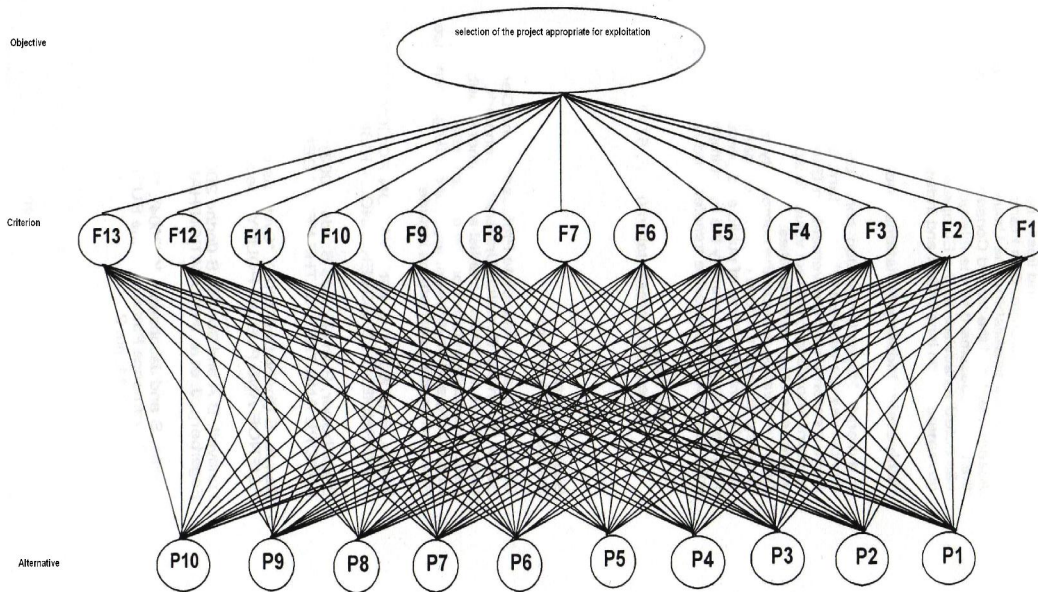


Fig 2: Structure of the Tree of Decision Making

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## Determination of efficacy of physical examination in the diagnosis diaphragmatic injuries due to stab wound to lower thoracic area confirmed with thoracoscopy

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**Abstract:** Diaphragmatic injury is probable in penetrating trauma to the thorax below nipple line and patients should be evaluated to rule it out. Chest XRay, Ultrasonography, CT scan, Pneumoperitoneum and abdominal paracentesis are usually limited in diagnosing diaphragmatic injury and many cases may be missed with these diagnostic modalities. Thoracoscopy is known as an accurate method for diagnosis of diaphragmatic injury. The purpose of this study is to introduce thoracoscopy as a procedure for diagnosis of diaphragmatic injury in stab wounds to the lower thoracic area and to evaluate the efficacy of physical examination with finger through the wound in comparison with thoracoscopy in the diagnosis of these injuries. Hemodynamically stable patients with stab wound to the lower thoracic area were studied. First patients were examined with finger through the wound and then the accuracy of digital exploration in the diagnosis of diaphragmatic injury was evaluated with thoracoscopy. 42 patients (15 to 30 years) were studied. 30 patients (71.4%) had stab wound to left side. 28 patients (66.7%) had stab wound to anterior chest. Results of physical examination were positive in 7 (16.7%), negative in 32 (79.2%) and inconclusive in 3 (7.1%) patients. All patients with diaphragmatic injury confirmed with thoracoscopy were also diagnosed with digital exploration; and all negative cases in physical examination had intact diaphragm in thoracoscopy. Putting inconclusive cases aside, sensitivity, specificity, positive and negative predictive value of digital exploration in the diagnosis of diaphragmatic injuries due to stab wound to lower thoracic area were 100%. Digital exploration through the wound is an accurate, simple and inexpensive procedure for the diagnosis of diaphragmatic injury in stab wounds to the lower thoracic area that without need to general anesthesia or additional incisions allows early diagnosis of diaphragmatic lesions. In cases that the exam is inconclusive, the procedure can be performed using general anesthesia or thoracoscopy may be considered as an alternative diagnostic method.

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**Keywords:** Thoracoabdominal penetrating trauma, Diaphragmatic injury, Digital exploration, Thoracoscopy, Stab wound

### Introduction:

The majority of diaphragm damages are caused by penetrating injuries (1-5, 30). During exhalation, the right and left diaphragms lift up to fifth rib and fifth intercostal space on the chest, respectively (6-10, 15). In penetrating injuries of the chest below the nipple, the possibility for diaphragm damage is close to 30-42% (11-17, 37). Patients with penetrating injuries below the nipple and upper costal edge of the chest should be examined to reject diaphragm injury (18-22, 30). This is

important, as damage to the diaphragm may be along with the injuries of abdominal viscera. Moreover, herniation of abdominal viscera may cause life-threatening heart and pulmonary instabilities (23-27, 37). Stomach injury along with diaphragmatic injury may cause empyema (24, 28). There is also a risk of damage to the spleen and liver along with diaphragm injury. Delay in the diagnosis of diaphragmatic injury can cause gradual herniation of intra-abdominal

and incarcerated viscera and finally their strangulation (23-24,29).

There are various comments on how to deal with penetrating chest injuries below the nipple. Shelds believes that if only stab wounds with symptoms are investigated, some diaphragm ruptures will remain undiagnosed. Pneumoperitoneum and abdominal paracentesis generally do not help in early diagnosis of these injuries. Sonography and CT scan are of limited value. In cases where the Chest X-Ray (CXR) is suspected, and these tests are not able to diagnose the trauma, thoracoscopy/laparoscopy will definitively confirm or deny the diaphragm injuries (31-34, 28). The results of Murray et al. showed that among 45 patients with diaphragmatic injury, 31% did not suffer from abdominal tenderness and 40% had normal Chest X-Ray (17). Jackson believes that all patients with penetrating damage below the left intercostal space should be examined by thoracoscopy (12). Sabiston declared that in the case of upper costal edge penetrating trauma below the nipple, patients with epigastrium stab wound should be examined by Peritoneal lavage. The Patients with Hemothorax or Pneumothorax should be examined by thoracoscopy. Patients with normal CXR and external wounds in thoracoabdominal regions should be examined by laparoscopy (30). Schwartz believes that in the lower chest stab wounds, following the local anesthetic, the finger must be entered into the thoracic space and the diaphragm must be touched. If the hole not touched by the finger, but there is a risk of damage to the diaphragm, diagnostic peritoneal lavage (DPL) should be performed. If the red cell count is between 1,000 and 10,000 per cubic millimeter, then thoracoscopy should be performed (26). Fehenmo believes that in the case of penetrating wounds of the lower chest, the diaphragm should be touched by the finger, especially if the chest tube is inserted (34). Morales stated that the finger diagnosis is a simple method with high accuracy which allows early diagnosis of diaphragm rupture. This method has high sensitivity and negative predictive value (16).

The objective of the present study is to introduce the thoracoscopy as the golden standard method for the diagnosis of diaphragmatic injuries for penetrating injuries below the nipple in Khatam-Al-Anbia Hospital of Zadehan. Attempts were done to compare the clinical values of finger and thoracoscopy examinations. All patients with a stab wound in the lower chest were examined by thoracoscopy following finger examination. By comparing the results of these two diagnosis methods, the sensitivity and specificity of clinical examination with the finger for diagnosis of diaphragm injury were determined.

Morales examined the patient with left side abdominal stab wound by finger through the wound and then compared the obtained results with thoracoscopy and

laparotomy. 6 patients (7.3%) could not be examined with the finger. These include four patients due to the ribs or cartilage overlap and 2 patients due to unwillingness for cooperation. The diaphragm damage was diagnosed by thoracoscopy in 2 patients. According to Morales, the sensitivity of finger examination, specificity, positive and negative predictive values were equal to 96%, 83.3%, 91% and 93.7%, respectively (16).

estrepo and Conostudied 33 patients. They found the sensitivity and specificity of 100% and 93.9%, respectively for finger examination (16).

Nelhas studied 55 patients with penetrating stab wounds in left side lower chest. He reported the sensitivity, specificity and accuracy of thoracoscopy of 100%, 90% and 94%, respectively for diagnosis of diaphragmatic injury (18).

Uribe has examined 28 patients with penetrating trauma of thoracoabdominal region. His results showed that the sensitivity and specificity of thoracoscopy for diagnosis of diaphragmatic injury is equal to 100% (35). Spann and LazdunskiLang studied 26 and 14 patients, respectively. Their results also showed that sensitivity and specificity of thoracoscopy for diagnosis of diaphragmatic injury is equal to 100% (35).

#### Methods :

The sampling method is the simple available successive sampling method. The statistical population is patients with stab wounds in lower chest who have referred to Khatam-Al-Anbia Hospital of Zahedan during the period of study. Patients should be hemodynamically stable or become stable after chest tube insertion. Patients who have simultaneously traumatic limbs are included in the population. Also, patients with penetrating trauma in both sides of the chest who were stabilized with the insertion of bilateral chest tubes were also included.

Patients with penetrating bullet trauma, unstable patients and patients with abdominal trauma were excluded from the study population. The decision was taken for inserting chest tube in emergency ward or the surgery room considering the patient stability and the respiratory distress.

After preparation of the wound and following the anesthetic injection, the wound was examined by the researcher with the index finger. The examination results along with patient demographic information including age, gender, side, injured intercostal space, and its anteriority and posteriority were recorded in the checklist.

#### Results:

42 patients with a stab wound in lower part of the chest with stable vital signs were studied. The age of patients was ranging from 15 to 30 years old with the average



age of 22.4 years old. All patients were male (100%). 30 patients (71.4%) suffered a left side stab wound and 12 patients (28.6%) suffered from a rightside stab wound. The fifth to ninth intercostal spaces suffered from trauma where the seventh space had the highest frequency (Table 1).

Table 1 - Distribution of involved intercostal space in patients with stab wound in lower chest

Intercostal Space	Number	Percent (%)
5	8	19.1
6	9	21.4
7	13	30.9
8	7	16.7
9	5	11.9
Total	42	100

38 patients (66.7%) suffered a stab wound anterior to the posterior Axillaryline and 14 patients (233%) suffered a posterior stab wound. All patients were examined by thoracoscopy in the first 24 hours after trauma. In 6 patients (14.3%), general anesthesia was used for thoracoscopy. Local anesthesia was performed for 1 patient due to numerous stab wounds and for 4 patients due to patients' noncompliance and lack of good vision of diaphragm. One patient firstly was put under general anesthesia due to possibility of diaphragm rupture. In none of the cases, the saturation of arterial blood with single lung ventilation by patients or under general anesthesia exceeds less than 90%, and there was no need to terminate the operation did prematurely.

None of the patients had any previous history of heart-pulmonary disease or thoracoscopy surgery.

The results of clinical examination were positive, negative and inconclusive in 7 (16.7%), 32 (76.2%) and 3 (7.1%) patients, respectively. The inconclusive cases were due to the ribs overlap and the lack of precise touch of the diaphragm.

The results of thoracoscopy were positive and negative in 7 (16.7%) 35 (83.3%) patients, respectively. There was no inconclusive case. In total, 16.7% of patients with stab wound in lower chest suffered from diaphragm rupture.

All patients in whom diaphragmatic rupture was confirmed by thoracoscopy, were also have been diagnosed by clinical examination with finger. All of the negative cases in terms of health examination had also normal diaphragm in thoracoscopy. The 3 inconclusive cases showed no evidence symptoms of diaphragm rupture in thoracoscopy clinical examination.

The incidence of diaphragm rupture in left-side and right-side stab wounds was equal to 6 of 30 (20%) and 1 of 12 (8.3%), respectively. The observed difference was not statistically significant (P = 0.84).

The incidence of diaphragm rupture in the anterior and posterior stab wounds was equal to 5 of 28 (17.9%) and 2 of 14 (14.3%), respectively. The observed difference was not statistically significant (P = 0.174). With excluding 3 inconclusive cases, the sensitivity, specificity and positive and negative predictive values of 100% are calculated for the examination with finger for diagnosis of diaphragm rupture caused by the lower chest stab wound:

Diaphragm Rupture Diagnosed by Thoracoscopy

	Positive	Negative	Total
Positive	7	0	7
Negative	0	32	32
Total	7	32	

Diaphragm Rupture Diagnosed by  
Clinical Examination with Finger

$$\begin{aligned}
 &= \frac{32}{32 + 0} = \% 100 \text{ Specificity} = \frac{7}{7 + 0} = \% 100 \text{ Sensitivity} \\
 &= \frac{32}{32 + 0} = \% 100 \text{ Negative Predictive Value} = \frac{7}{7 + 0} = \% 100 \text{ Positive Predictive Value}
 \end{aligned}$$

**Discussion:**

In this study, the mean age of patients was 22.4 years old which is comparable to the literature review conducted by the Shah. The third decade was known as the most common ages in various studies. In this study, all patients were male, while the ratio of men to women was 4 to 1 in Shah's study. Diaphragm trauma in men is much more than women. This difference is due to inclusion of blunt trauma cases in Shah's review, while only stab wounds were investigated in the present study. The social and cultural issues are also involved in the observed difference (27).

71.4% of patients suffered a left side stab wound which is consistent with the results of Dudley. Basically, the most attackers are right-handed, and there is a close relationship between this region and the target, i.e. the heart, therefore most thoracoabdominal injuries occur on the left side (9).

Also, the incidence of diaphragm rupture in left side and right side stab wounds was equal to 20% and 80%, respectively. Although there is no statistically significant difference due to patient noncompliance in emergency ward (16).

In the present study, 16.7% of patients suffered from diaphragm rupture which is comparable with other studies that have reported the incidence of diaphragm rupture in the range of 7% to 32% (13, 17, 34 and 36). The sensitivity and specificity of 100% was obtained for examination with finger for diagnosis of diaphragm rupture caused by the lower chest stab wound. Morales has reported the sensitivity and specificity of 96% and 83.3%, respectively. The sensitivity of 100% and the specificity of 93.9 have been reported by Restrepo and Vano. There were only 2 false negative cases in Morales's study which were inconclusive by clinical examination with finger.

**Conclusion:**

It seems that the number of such cases can be reduced by intercostal anesthesia and most careful clinical examination with finger and thereby specificity can be increased. According to Morales, it can be said that the examination with finger is a simple and low cost method with high sensitivity and negative predictive value. It allows the early diagnosis of diaphragm rupture without the need for general anesthesia or an additional incision. In cases where the examination is inconclusive, the examination under general anesthesia or thoracoscopy can be considered as an alternative diagnostic method (16).

**Acknowledgment:**

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significant difference between the values, but they are in good agreement with studies which reported the most incidence of penetrating trauma on left side (34). The incidence of diaphragm rupture in the anterior and posterior stab wounds was equal to 17.9% and 14.3%, respectively. Although there is also no statistically significant difference between values, but they are in good agreement with studies which have reported the most incidence of the diaphragm rupture in anterior stab wound (34).

The clinical examination with finger was inconclusive for 7.1% of patients due to ribs overlap and lack of precise touch of the diaphragm. The results of Morales also showed that 7.3% of patients examined by clinical examination with finger were inconclusive due to ribs overlap (4.9%) and patient noncompliance (2.4%). There were no such cases in the present study because the examination with finger was performed in the operating room following the intercostal anesthesia or general anesthesia in the cases where there was no possibility for clinical examination. Sciences for their leading suggestions on this manuscript.

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## Identification of key parameters on Soil Water Characteristic Curve

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**Abstract:** In environmental geotechnics, transport phenomena in unsaturated soils significantly depends on the degree of saturation, because many substances are dissolved in pore water and get distributed in soil by advection with the convective flow of pore water or diffusion in the pore water itself, although there is no convective flow. By reducing the amount of pore water, this transportation path becomes less effective. Therefore, identification of key parameters which affect the soil water characteristic curve (SWCC) is an important issue in unsaturated soil mechanics for analyses of any geo-environmental problems. Although broad studies have been done on unsaturated soil behavior, but there is still no unified model which can be able to simulate soil water characteristic curve, accurately. During past decades, several mathematical functions have been proposed to model the SWCC and because of various key parameters which affect the SWCC, the proposed models are not so comprehensive. Therefore, the curves obtained from conventional tests often cannot be directly applied in practice, and the mathematical expressions from one condition cannot be used to simulate another situation. The effects of initial void ratio, initial water content, stress condition and high suction were studied in this work revealing that water content and stress state are more important than the other factors, but their influences tend to decrease when suction increases.

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**Key words:** Soil-water characteristic curve (SWCC), unsaturated soil, void ratio, water content, loading history.

### 1. Introduction

The soil-water characteristic curve (SWCC) is described as the relationship between the degree of saturation,  $S_r$ , (or the volumetric water content,  $\theta$ ) and the matric suction,  $S (= u_a - u_w)$  where  $u_a$  and  $u_w$  are pore air and pore water pressure, respectively. SWCC usually obtained by drying or wetting a soil sample under constant stress while monitoring the changes of water content in the soil. The curve is also called the soil moisture characteristic curve or the soil water retention curve.

The soil-water characteristic curve can usually give an indication of the hydraulic properties of the soil, and is a fundamental property in soil physics and soil mechanics. The soil-water characteristic curve is widely used to predict hydraulic conductivity, soil water storage, field capacity and soil aggregate stability in agricultural engineering (Brady, 1999). It is also one of the most fundamental geotechnical properties of soils and is used in estimating the shear strength, stress-strain relationships and permeability of unsaturated soils (Mualem, 1976; Fredlund *et al.*, 1994; Assouline, 2001; Fredlund *et al.*, 1996; Wheeler, 1996). In fact, this curve presents the basic characteristics of a partially saturated soil.

Many experimental tests had been done to obtain the SWCC for different types of soil under

different conditions. Due to the limitations of time and of accurately measuring suction, a wide range of suction tests have not been performed and the various factors affecting the SWCC have not received great attention. This paper concentrates on key parameters on the SWCC as reported in published data and provides some useful conclusions for practical purposes. Figure.1 presents a typical SWCC curve during drying path, which usually consists of three zones: capillary saturation zone, desaturation and residual saturation zones. When the suction value exceeds the air-entry value (AEV), the degree of saturation decreases rapidly at relatively low suction values and then reduces more gradually when the suction becomes high.

Recently, many hydro mechanical constitutive models have been developed for partially saturated soils. Because of the complicated microstructure of partially saturated soil and its importance on unsaturated soil behavior, the SWCC should preferably be used to model the soil behavior accurately. But there are many influences on the SWCC, and without further studies on whether the soil water characteristic curve from conventional tests can be used or not, the resulting large errors may lead to misunderstanding and wrong engineering solutions.

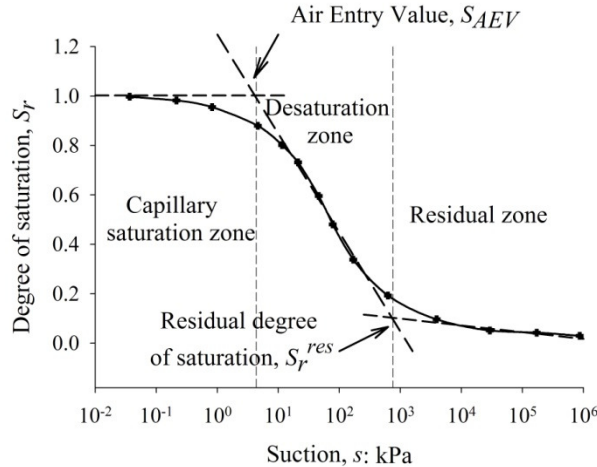


Figure.1. Typical SWCC showing the regions of desaturation (Vanapalli *et al.*, 1999)

**2. Key parameters influencing the SWCC**

The pressure plate test was commonly used to measure suction indirectly using the axis translation technique, which is not able to apply significant stress level. Hence, it cannot be used to study the effect of overload stress (i.e. the loading history of specimens). Therefore, SWCC curve generated by pressure plate apparatus should be considered very carefully. Other factors such as soil structure (and aggregation), initial water content, void ratio, type of soil, mineralogy, and compaction method also have significant effects on SWCC. Among these factors, stress history and initial water content often have the greatest effect on soil structure, which potentially control the nature of the soil-water characteristic curve.

**2.1. Effect of initial void ratio**

Tarantino (2009) studied the effect of initial void ratio on the SWCC. The material properties are listed in Table 1.

Table.1. Summary of the soil property

$G_s$	$w_p$	$w_l$	$I_p$
2.67	29.6%	43%	13.4

Each specimen was set in the modified oedometer apparatus for unsaturated soil, and suction was applied by the pressure plate method. Air entry value of the soil is the matric suction value from which air starts to enter into the soil, which is also referred to as bubbling pressure (Brooks and Corey, 1977), from which the maximum pore size in a soil specimen can be measured or estimated. The AEV (denoted as  $S_{AEV}$ ) shows the magnitude of the capillary saturation zone for a given soil (Figure.1). Figure.2a shows the relation between AVE and void ratio.

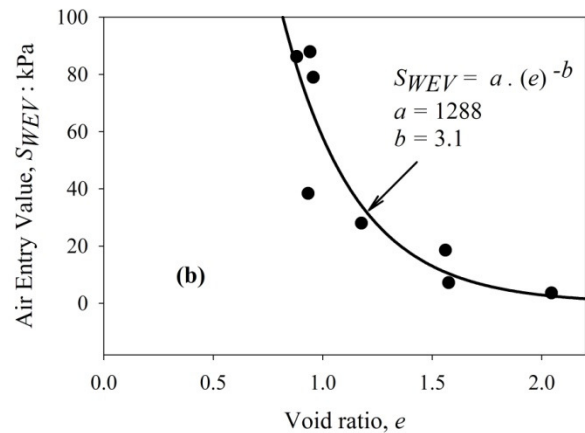
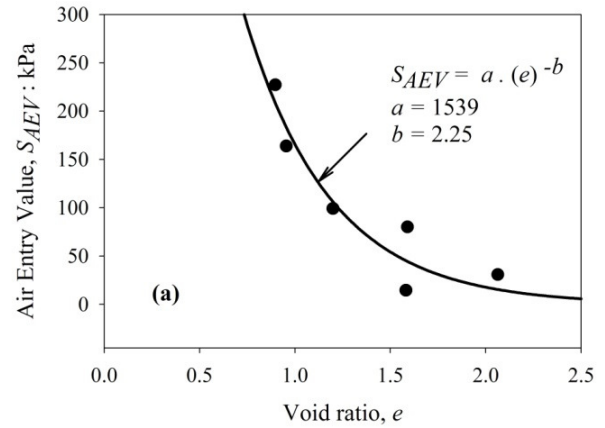


Figure.2. Relationship between void ratio and air-entry value (a); water-entry value (b) (Tarantino, 2009)

As shown in this Figure, The larger amount of AEV should be in inverse proportion to the void ratio of the soil. Similar to the AEV when a soil is wetted up the fully saturation state, matric suction reduces to a certain value called WEV (water-entry value). The relationship between WEV (denoted as  $S_{WEV}$ ) and degree of saturation is shown in Figure.2b.

Figure.3. presents the variation of the residual degree of saturation ( $S_r^{res}$ ), which is the degree of saturation at the start of the residual saturation zone followed by AEV. It can be seen from Figures.2 and 3 that the smaller value of initial void ratio (i.e. the denser the soil) leads to the higher the air-entry value, and the higher the residual degree of saturation. The air-entry value and the residual degree of saturation ( $S_r^{res}$ ) can be expressed together by void ratio ( $e$ ) using empirical relationships.



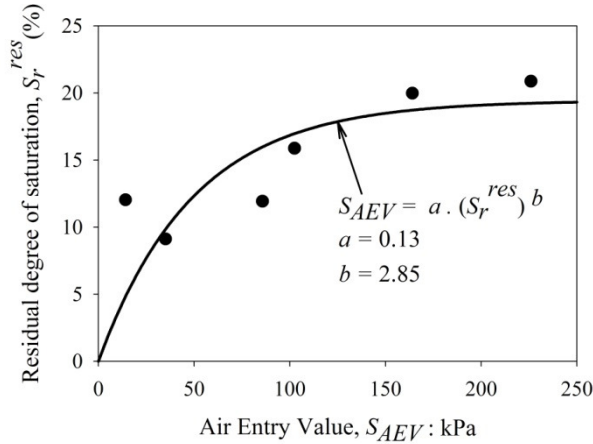


Figure.3. Relationship between AEV and residual degree of saturation (Tarantino, 2009)

The AEV is an important parameter for partially saturated soils since the degree of saturation starts to decrease dramatically when the suction exceeds the AEV. As shown in Figure.2a, according to different values of initial void ratio, there is a wide range of AEVs values, so the denser soil gives, the higher AEV, which implies that for soils with small void ratio, trivial changes in degree of saturation, can be assumed at low suctions, i.e. the soil can be treated as fully saturated. This might be a helpful observation when soils from different depth are being dealt with.

**2.2. Effect of initial water content**

Figure.4. illustrates the effect of initial water content on the SWCC obtained by Vanapalli *et al.* (1999). The samples were of sandy-clay-till obtained from Indian Head, Canada, which is classified as clay with low liquid limit. The liquid limit, plastic limit and grading properties are listed in Table 2.

Table.2. Summary of the soil property

Soil type	Sand	Silt	Clay	w <sub>l</sub>	w <sub>p</sub>
Compacted till	28%	42%	30%	35.5%	16.8%

The AASHTO standard compacted maximum density is 1.80 g/cm<sup>3</sup> at optimum water content of 16.3%. The specific density of the soil solids is 2.73. All samples were compacted and prepared with the required initial water content and density, and then placed between filter paper and porous stones in consolidation rings, then were loaded to 3.5 kPa in a conventional oedometer. The initial water content has considerable influence on the shape of SWCC curves. The higher initial water content, gives the steeper SWCC. The air-entry value also increases with initial water content. The resistance to desaturation is relatively low in the dry of optimum specimens in

comparison to optimum and wet specimens. Therefore, the effect of desaturation is more obvious in specimens with high initial water content, especially at low suction. SWCCs with different initial water content tend to converge at high suction values.

**2.3. Effect of stress state**

In the field, due to different loading history, soil normally experiences a certain stress, which is recognized to have some influences on SWCC (Fredlund and Rahardjo, 1993). Vanapalli *et al.* (1996; 1998; 1999) studied the influence of total stress state on the SWCC of a compacted fine-grained soil indirectly. Since the conventional pressure plate apparatus does not allow any external loading, an equivalent pressure is applied to study the effect of loading history on SWCC. Equivalent pressure can be explained by Figure.5. A saturated specimen was placed in an oedometer, under constant volume conditions and loaded to 200 kPa (point A in Figure.5). Then it was allowed to swell under a nominal pressure (3.5 kPa) (point B). When the specimen had experienced maximum pre-stress pressure (200 kPa), it had a void ratio corresponding to 100 kPa on the initial compression branch after swelling under the applied pressure of 3.5 kPa (point C). The equivalent pressure for this specimen is equal to 100 kPa.

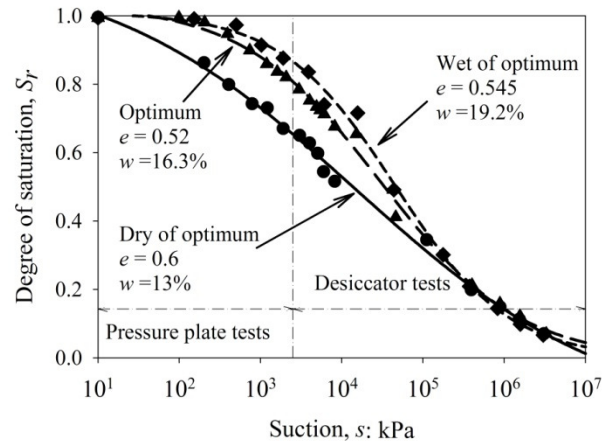


Figure.4. SWCCs for specimens compacted at different initial water contents (Vanapalli *et al.*, 1999)

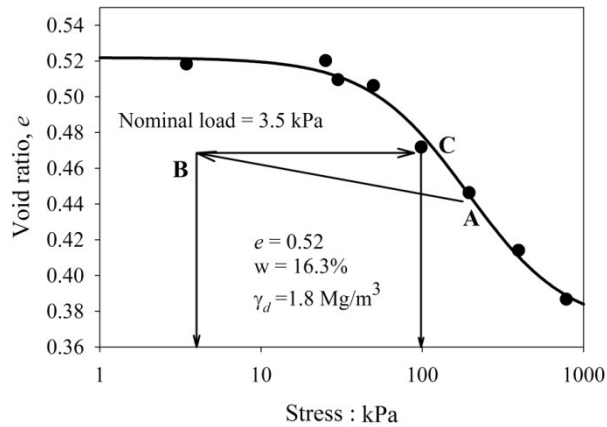


Figure.5. Void ratio vs applied stress for an initial void ratio of 0.52 (Vanapalli *et al.*, 1999)

The SWCCs developed for the specimens compacted dry of optimum and with equivalent pressures of 25, 35, 80 and 200 kPa are shown in Figure.6. It can be seen, the air-entry value of specimens increases with increasing equivalent pressure. In general, beyond the air-entry value, specimens subjected to higher equivalent pressures have higher degrees of saturation at any given suction.

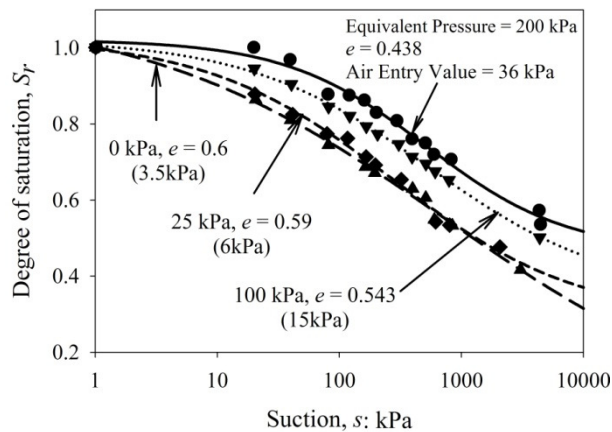


Figure.6. SWCC for specimens compacted dry of optimum water content (Vanapalli *et al.*, 1999)

To explain this phenomenon, Vanapalli *et al.* (1999) suggested that when investigating the structure of partially saturated soils, there are two kinds of structure to be considered: macrostructure and microstructure. Soil microstructure is described as the elementary particle associations within soil, whereas the arrangement of soil aggregates is referred to as the macrostructure (Mitchell, 1976).

Macro-structure controls soil-water characteristic behavior of compacted specimens with initial water

contents in the dry side of optimum moisture, particularly at low suction values. The air-entry value and the residual state of saturation increase with the equivalent pressure for specimens with dry of optimum initial water content conditions. Microstructure seems to govern the soil-water characteristic behavior of specimens compacted wet of optimum and resists the desaturation (drying). This interpretation has to be confirmed by the inspection of soil structure at different water contents.

Ng and Pang (2000) investigated the influence of stress state on the SWCC of an “undisturbed” or natural, completely decomposed volcanic soil. A conventional volumetric pressure plate extractor and a modified one were used together. Three undisturbed or natural specimens were directly cut from the block into oedometer rings. The net normal stress levels considered in the modified volumetric pressure plate extractor were 40 and 80 kPa, which were appropriate for many relatively shallow slope failures in Hong Kong. Samples were first loaded to 40 and 80 kPa applied net normal stress, respectively, in oedometers with free drainage for 24 h for pre-consolidation purpose. Then they were removed and placed in the modified volumetric pressure plate extractor to subject the SWCCs to a predetermined stress. The required stress applied to each specimen was maintained throughout the tests. The measured SWCCs from their research are shown in Figure.7.

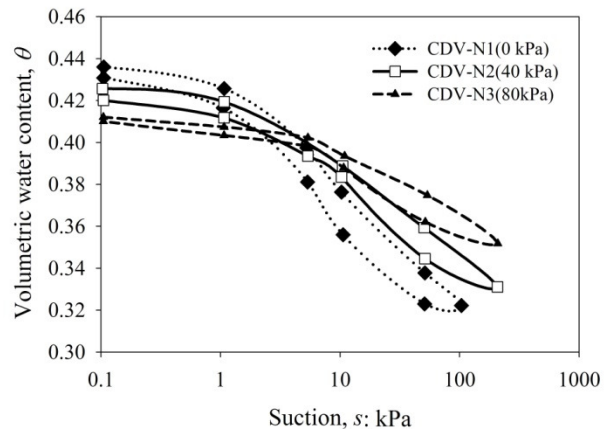


Figure.7. Effects of stress state on SWCC (Ng and Pang, 2000)

The results indicated that as matric suction increases, the volumetric water content of all specimens decreases but at different rates. The higher applied load, leads to the lower rate of reduction in volumetric water content. The point where the volumetric water content starts to decrease significantly indicates the air-entry value.

Figure.7 shows a general tendency that soil specimens subjected to higher stresses possess higher air-entry values, which is related to the presence of a smaller average pore sizes distribution in soil specimens under higher applied load. Stress history or applied stress seems not to affect significantly the shape of SWCC, although the AEV increases and the rate of change of the degree of saturation decreases with the increasing net total stress.

**2.4. Effect of high suction values**

It has been shown that different initial values of void ratio, water content and stress state will influence the SWCC, especially at low suctions. In this section the effects at high suction values are investigated.

Regardless of the initial conditions of water content (i.e. dry of optimum, optimum and wet of optimum) and stress history, the soil-water characteristic behavior appears to be similar at high suctions (i.e. 20000–300000 kPa), as shown in Figure.8. In other words, as Vanapalli *et al.* (1999) explained, the inner forces between soil aggregates are very strong in resisting desaturation behavior at the high suction values. Apparently, water films at these suctions are so thin that all the water is within the range of influence of osmotic and adsorptive fields. Therefore, soil structure (and aggregation) seems to have negligible influence on the soil-water characteristic behavior in this high suction range. From this, it can be concluded that when suction is very high, the effect of initial water content and stress history can be ignored.

**3. Conclusion**

The SWCC is an important soil function in unsaturated soil mechanics. When combined with constitutive models, different factors corresponding to field situations should be considered. In this paper some of these key parameters are discussed in the context of how they affect the SWCC. Among these factors stress state and initial water content have the greatest influence. However, at high suction values the effect of these factors tends to diminish. More tests are needed to understand the general features of the SWCC, especially to provide data about soil structure, microstructure and macrostructure. It is not practicable and necessary to test samples under every condition. For this reason a basic series of tests for each type of soil should be performed to establish the main effects and the influence they have on the SWCC of the soil.

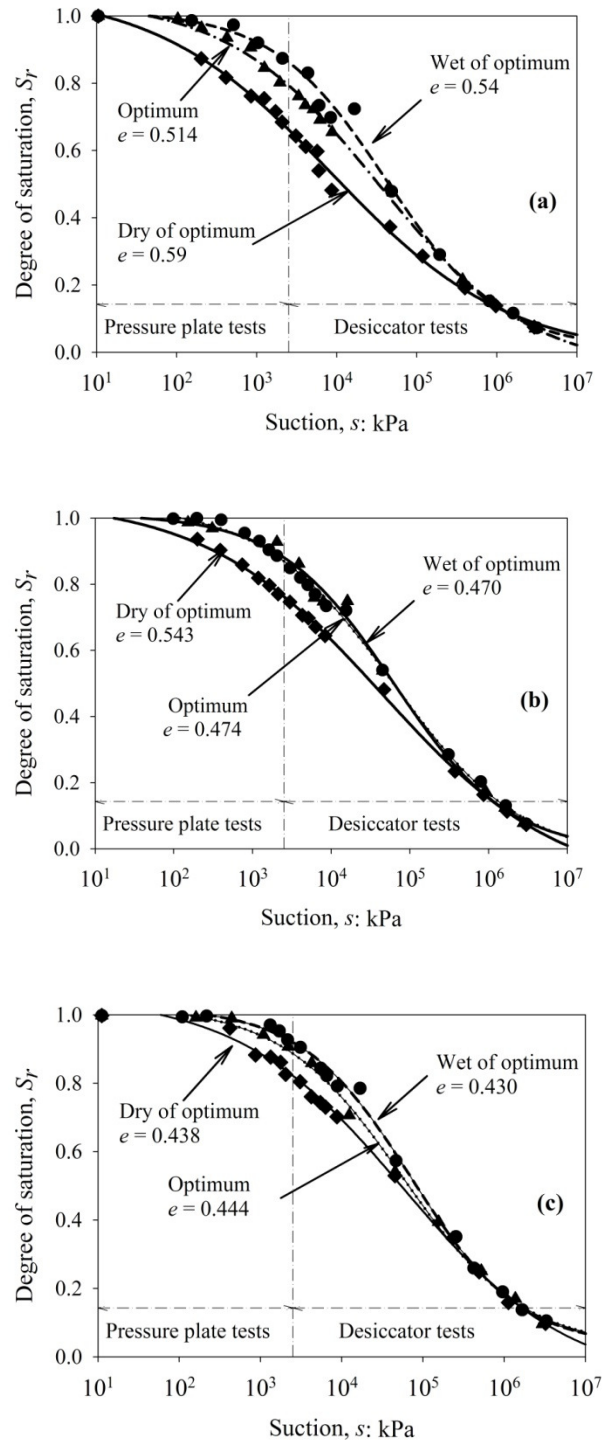


Figure.8. SWCC under different equivalent pressures (a) 25 kPa; (b) 100 kPa; (c) 200 kPa (Vanapalli *et al.*, 1999)

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9/23/2012

## Evaluation of the use of Self-reinforced Absorbable versus Metallic Plates and Screws in the Fractures of Symphysis and Parasymphysis Area

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**Abstract:**The aim of the present study was to evaluate the clinical and paraclinical results of the use of self-reinforced absorbable mini-plates and screws in the reduction of fractures of mandibular symphysis and compare them with the results of using routine non-absorbable titanium mini-plates and screws. Absorbable plates do not need a second surgical procedure to remove. Therefore, there is less cost for the patient and no need for the patient to be put under anesthesia, given its complications. In addition, there will be no interferences with radiographic techniques. Twenty patients with fractures of the mandibular symphysis or parasymphysis areas, who had referred to were randomly divide into two groups. Group 1 and 2 subjects underwent treatment with non-absorbable metallic mini-plates and absorbable mini-plates and screws, respectively. All the patients underwent general anesthesia. After injection of a local anesthetic agent with 1:100,000 epinephrine, a vestibular incision was used to access the fractured bone, which was reduced using the prepared mini-plates and screws. All the patients underwent intermaxillary fixation (IMF) for three weeks and evaluated at 1-, 3- and 8-week post-operative intervals. Data was analyzed with chi-squared test and independent samples t-test using SPSS statistical software. The patients were evaluated in relation to infection, pain, presence of manifest exudate, fever, occlusion and limitations in mouth opening and mobility of the fractured fragments. At the end of 6-week and 8-month post-operative intervals the patients underwent panoramic radiography. No significant differences were observed in any of the above-mentioned variables between the two groups ( $P>0.05$ ).Based on the results of the present study, it can be concluded that absorbable systems are good and efficacious alternatives for non-absorbable titanium systems and can be used without complications in the reduction of fractures of mandibular symphysis and parasymphysis areas; however, absorbable systems cannot completely replace non-absorbable systems at present.

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**Key words:** Clinical and paraclinical results, absorbable mini-plates and screws, self-reinforced, metallic mini-plates and screws, fracture of symphysis and parasymphysis.

### Introduction

Patients with fractures of facial bones due to various accidents frequently refer to maxillofacial surgery departments (1). One of the most common fractures of facial bones is fracture of the mandible, with a frequency of 49-60% (2). Techniques to reduce such fractures include closed and open reduction techniques; in the open reduction technique the most common procedure is the use of metallic mini-plates (2). Michelet and Colleque (1960) introduced the use of metallic mini-plates in the reduction of mandibular fractures. Although metallic mini-plates have many advantages, they have some disadvantages and limitations in some cases, including interference of

metallic plates with CT scan, MRI and radiographic techniques (1). Use of metallic mini-plates can lead to major changes in the maxillofacial skeleton in children during growth periods or during surgeries of maxillofacial traumas (1). Another disadvantage of metallic mini-plates is that they are palpable on the skin (3). Areas of resorption have been reported beneath metallic mini-plates, resulting in disturbances in bone structure (3). In edentulous patients metallic mini-plates can disturb the process of manufacture and use of dentures (3). Osteoporosis, bone atrophy or re-fracture and patient pain and discomfort due to hypersensitivity to heat might be some other disadvantages of metallic mini-plates (3). In addition, metallic mini-plates can result in tissue damage if they are left in place for a long



time (3); therefore, a second surgery is necessary to remove them (1). In recent years, use of absorbable mini-plates has been considered as a solution to eliminate the above-mentioned disadvantages and avoid a second surgical procedure to remove the plates, given the complications mentioned above, including general anesthesia and costs of hospitalization (3). For more than three decades a lot of research has been carried out on absorbable mini-plates and screws. Ideally, materials which are used for reduction of fractures or for osteotomy procedures should not be toxic, carcinogenic or allergenic. Conversely, these materials should be biocompatible and should induce the least local reactions in human tissues; they should not have any systemic reactions and should be sufficiently stable to maintain fracture site or osteotomy integrity without any detrimental effects on bone healing and regeneration (4). Recently, absorbable mini-plates have been introduced, which lose their strength over time and gradually transfer stress to the underlying bone, preventing osteoporosis and bone atrophy (3). The advantages of absorbable mini-plates include predictability of absorption time, easy adaptation of the plate, easy insertion, flexibility and complete fixation. There are few research studies on quantitative evaluations of the use of absorbable mini-plates and screws for the reduction of mandibular fractures (4). A pilot study has evaluated the use of absorbable mini-plates and screws for reduction of fractures of anterior mandible, indicating that they are safe to reduce anterior fractures of the mandible (5). No studies to date have compared self-reinforced absorbable mini-plates and screws with the routine use of metallic mini-plates for the reduction of mandibular fractures.

### Materials and Methods

Twenty patients with single fractures of mandibular symphysis and parasymphysis areas, who had referred to the Department of Oral and Maxillofacial Surgery at Imam Hospital, were randomly divided into two groups. Patients in group 1 underwent reduction of fractures with non-absorbable titanium mini-plates and screws manufactured by Mondeal; patients in group 2 underwent reduction of fractures with absorbable mini-plates and screws manufactured by Inion. The time interval between trauma and hospitalization was 4–9 days. None of the patients had any systemic conditions or problems, including diabetes, use of alcohol or steroid therapy. All the patients underwent routine laboratory tests, including CBC (RBC, WBC, Hb, Hct platelet count), on the day of surgery. All the patients received 1 gram of intravenous cefazolin and 8 mg of intravenous dexamethasone 1 hour before surgery. The patients were put under general anesthesia and all the procedures, before, during and after the surgical

operation, were the same for all the patients. Maxillary and mandibular arch bars were placed and the patients temporarily underwent intermaxillary fixation (IMF). Subsequently the patients received 4 mL of local anesthetic agent with 1:100,000 epinephrine. Ten minutes after injection of the local anesthetic agent a vestibular incision was made with the use of cautery and a scalpel blade at the fracture site. The fractured fragments were reduced after a full-thickness flap was elevated. A proper occlusion was established and the mini-plates and screw were placed, followed by fixation. The incision was sutured and the duration of surgery, from the incisions to the end of the last suture, was recorded with the use of a chronometer. All the patients were administered intravenous cefazolin every 6 hours for 48 hours and 8 mg of intravenous dexamethasone every 8 hours for 24 hours post-operatively. The patients were discharged after 48 hours and were visited regularly during the first week. Intermaxillary fixation was removed after 3 weeks and the patients underwent physiotherapy, elastic therapy and a soft diet. The patients were evaluated at 1-, 3- and 8-week and 3- and 6-month post-operative intervals for pain, infection and fracture repair. Visual analog scale (VAS) was used to measure pain at 12- and 48-hour and 1-week post-operative intervals. The patients were evaluated after the first week for rubor, fever and manifest exudate and the signs were recorded in the relevant form. The patients underwent a clinical and radiographic examination after 8 weeks. During the clinical examination, occlusion, mobility of the fractured site, pain, pain during function and inadequate stability during function were evaluated and the results were recorded. Chi-squared test was used for data analysis with SPSS.

### Results

Males and females comprised 35% and 65% of the 20 patients under study, with a mean age of  $33.5 \pm 1.5$  years. In group 1 (metallic mini-plates and screws) 60% of the patients had mandibular symphysis fractures and 40% had mandibular parasymphysis fractures. In group 2 (absorbable mini-plates and screws) 70% of the patients had mandibular symphysis fractures and 30% had mandibular parasymphysis fractures. The time interval between the fractures and hospitalization was 4–9 days in both groups.

The duration of surgeries in group 2 was significantly longer than that in group 1, with means of 33 and 45 minutes in groups 1 and 2, respectively ( $P=0.005$ ).

Evaluation of the patients during the first post-operative week and at the end of the first week did not reveal any significant differences in rubor and inflammation, fever and manifest exudate between the two groups ( $P>0.05$ ) (Table 1).

**Table 1. Comparison of clinical evaluations of the patients in the two groups during the first week and at the end of the first week post-operatively**

Variable		None-absorbable	Absorbable	P
Pain	No pain	60%	40%	0.328
	Mild pain	40%	60%	
Rubor		20%	0	0.237
Fever		20%	0	0.237
Manifest exudate		20%	0	0.470

Evaluation of patients at the end of the third post-operative week did not reveal statistically significant differences in pain, rubor and inflammation, fever and occlusion between the two groups ( $P>0.05$ ) (Table 2).

**Table 2. Comparison of clinical evaluations of the patients between the two groups at the end of the third post-operative week**

Variable	None-absorbable	Absorbable	P
Pain	20%	0	0.237
Rubor	0	0	-
Fever	10%	0	0.5
Occlusion	10%	0	0.5

Evaluation of the patients at 6- and 8-week post-operative intervals did not reveal any significant differences in pain severity, occlusion, limitations in mouth opening, pain during function, mobility at the fractured segments at fracture site and presence of exudates between the two groups ( $P>0.05$ ). In this context, at the end of 8th week post-operatively there were no pain, no problems in occlusion, no limitations in mouth opening, no pain during function, no mobility of fractured segments at fracture site and no exudate in the two groups.

### Discussion

The results of the present study did not show any significant differences in pain severity at 12- and 48-hour and 1-week post-operative intervals between the two groups. In a study carried out by Laughlin et al (2007) post-operative pain of the patients was evaluated in the same manner. In that study, pain in patients treated with absorbable mini-plates and screws disappeared at the end of second post-operative week (6). In some studies, patients treated with non-absorbable mini-plates and screws have reported severe

pain and in 3.6% of the cases the mini-plate have been removed as a result (3,4). Severe pain in such cases might be attributed to resorption of bone beneath the plate and pressure on tooth roots subsequent to this phenomenon. Lack of adequate expertise on behalf of the surgeon might result in improper placement of the mini-plate, resulting in damage to tooth roots and pain. On the whole, incidence of post-operative pain in the present study is almost similar to the results of other studies. Although the severity of post-operative pain was similar in both groups, the need for a second surgery with non-absorbable mini-plates and screws and the resultant pain makes it logical to use absorbable mini-plates and screws.

Infection was evaluated in the present study by examining the patients for rubor, inflammation, fever and manifest exudates at the surgery site. In this context, 2% of patients treated with non-absorbable mini-plates and screws had rubor at surgery site up to the end of the third post-operative week; however, none of the patients in group 2 exhibited any signs and symptoms of infection. The results of the present study are consistent with the results of studies carried out by Laughlin, Yerit, Yelikontiola and Kim (5,6,8,9). The incidence of post-operative infection in patients treated with non-absorbable mini-plates and screws has been 10.3 24.6% in various studies (9 12); the incidence of infection in the present study was less than those reported previously. The differences might be attributed to differences in population sizes, expertise of the surgeon and surgical team, follow-up period, criteria used to diagnose infection, a history of background medical conditions, use of medications and alcohol, type and severity of fractures involved and the type of the absorbable material used (13 16).

In the present study clinical and radiologic criteria, occlusion, mobility of the area involved, atrophy or resorption of bone, sclerosis, presence of pain or an increase in pain severity and stability during function at the end of follow-up (the 8th week) were used to evaluate fractures. Success rate was 100% in both groups during the follow-up period. In a study carried out by Laughlin success rates were 100% and 96.1% with the use of absorbable and non-absorbable mini-plates, respectively (6). In a study carried out by Yelikontiola success rate was 90% with absorbable mini-plates (5). Kim reported a success rate of 100% with absorbable mini-plates (8). In the present study the duration of surgery was significantly longer in the group treated with absorbable mini-plates compared to the group treated with non-absorbable mini-plates. Lopez-CedrumCambranos reported that the duration of surgery with absorbable mini-plates and screws is significantly longer than that with non-absorbable mini-plates (10). Tiainen and Serlo reported the same results (11,12).

Various factors might be involved in lengthening the duration of surgery with the use of absorbable mini-plates and screws, including extra steps during placement of absorbable mini-plates and screws, the need to heat the plate and the screws, the need for temporary drainage and finally the need for precise adjustment of the holes necessary for screw placement (11). On the other hand, since the use of absorbable mini-plates and screws is a relatively new technique in many surgical centers, including ours, the surgeons do not have sufficient expertise in using this technique, leading to a significant increase in the duration of the procedure (17,18). It appears an increase in the experience and expertise of surgeons, resolution of technical and educational problems and the use of newer reinforced mini-plates and screws might be useful in decreasing the duration of the surgical procedure. Considering what discussed it can be concluded that only the differences in the duration of the surgical procedure cannot be considered a reason for not recommending the use of absorbable mini-plates and screws (6).

### Conclusion

On the whole, the results of the present study showed that absorbable mini-plates and screws are good and efficacious alternatives for non-absorbable mini-plates and screws in reduction and fixation of fractures of the mandibular symphysis and parasymphysis areas given the success rate and satisfaction with the results and they can be used without any problems and worries. However, their routine use in all the maxillary and mandibular fractures requires more long-term studies with greater population sizes. Nevertheless, satisfaction of patients with the absorbable system in the reduction of the fractures in the present study is an incentive for us to use these plates in future again.

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10/03/2012

## Biochemical and Genetical Evaluation of Pomegranate Impact on Diabetes Mellitus Induced by Alloxan in Female Rats

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**Abstract:** Various food industries explored the possibility of developing a nutritional supplement rich in natural antioxidants from pomegranates. This study has focused on the ability of pomegranate peel and juice to study the antioxidant status. Thirty two rats were allocated in 4 groups as follows: Group1; control group without any treatment; Group2: diabetic animals injected with alloxan; Group 3: diabetic peel group animals injected with alloxan and then feed on peel pomegranate; Group4: diabetic juice group animals injected with alloxan and then gavage with pomegranate juice. After 4 weeks of treatment biochemical analysis were measured such as glucose, insulin, alpha-amylase, lipid profile (cholesterol, triglyceride HDL, LDL and total lipids), total protein, homocysteine, total antioxidant capacity and liver enzymes (AST&ALT). In addition, pancreas and liver tissues were separated for genetic analysis in which pancreatic tissues were used for RAPD-PCR analysis and liver tissues for DNA fragmentation assay. Results showed significant increase in glucose and alpha amylase levels in diabetic group, while insulin decreased. Peel and juice of pomegranate ameliorates this effect and decreased glucose, alpha amylase while insulin level increased. Cholesterol, triglycerides, LDL and total lipids increased while HDL decreased in diabetic group. Peel and juice of pomegranate prevented these changes. The more pronounced effect appeared in group III treated with peel pomegranate. Total protein was not affected by alloxan or pomegranate. Homocysteine was significantly increased while total antioxidant capacity decreased in diabetic group. After treatment by pomegranate peel and juice, these parameters become near to the control values. AST and ALT were significantly increased in diabetic group. But after treatment with peel and juice, AST and ALT levels decreased and become near to the control level especially ALT value. Furthermore, rate of DNA fragmentation and DNA band polymorphism increased significantly in diabetic group. While after treatment by peel and juice rate of DNA band polymorphism and DNA fragmentation were decreased significantly. Pomegranate peel and juice showed significant reduction in LDL oxidative susceptibility and an increase in total antioxidant status. Pomegranate is able to reduce the progression in atherosclerosis. The antioxidant content in foods decreased the oxidative stress related diseases. [Hala F. Osman, Mariam G. Eshak, Emad Mohamed El-Sherbiny, Mohamed M. Bayoumi, **Biochemical and Genetical Evaluation of Pomegranate Impact on Diabetes Mellitus Induced by Alloxan in Female Rats.** *Life Sci J* 2012;9(3):1543-1553] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 225.

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### 1. Introduction

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Hyperglycaemia is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems (Rahimi *et al.*, 2005). Insulin stimulates muscle and fat cells to remove glucose from the blood and stimulates the liver to metabolize glucose, causing the blood sugar level to decrease to normal levels.

The burden of diabetes is increasing globally, particularly in developing countries. The causes are a complex, but are in large part due to rapid increases in overweight, obesity and physical inactivity (WHO, 2011).

A WHO fact sheet stated that, 346 million people worldwide have diabetes. In 2004, an

estimated 3.4 million people died from consequences of high blood sugar. More than 80% of diabetes deaths occur in low- and middle-income countries. WHO demonstrated that diabetes death will double between 2005 and 2030. The total number of persons with diagnosed and undiagnosed diabetes in Egypt will increase from 3.80 million in 2000 to 8.80 million by the year 2025 (Herman *et al.*, 1997).

Pomegranate is a small tree, belonging to the Punicaceae family. Pomegranate juice has become increasingly popular because of the attribution to important biological actions (Gil *et al.*, 2000 and Schubert *et al.*, 2002) including cardiovascular protection (Aviram *et al.*, 2002). Pomegranate juice has recently been demonstrated to improve lipid profiles in type II diabetic patients with hyperlipidemia (Esmailzadeh *et al.*, 2004).



Pomegranate has been known to possess considerable pharmacological properties because pomegranate peel is a rich source of antioxidants, especially polyphenols, such as ellagic acid, quercetin, anthocyanidins, punicalagin and many plant polyphenols (Guo *et al.*, 2007). It has been shown to act as anti-microbial, anti-viral, anti-cancer, potent anti-oxidant, anti-mutagenic (Aqil and Ahmad, 2007 and Lansky and Newman, 2007), antitumour (Afaq *et al.*, 2005), anti-diarrhoeal (Mathabe *et al.*, 2006), antifungal (Vasconcelos *et al.*, 2006) and anti-ulcer effects (Gharzouli *et al.*, 1999). Pomegranate has been used in the preparation of tinctures, juice, cosmetics and therapeutic formulae (Kim *et al.*, 2002). The pomegranate juice consumption has also been shown to be effective for coronary heart disease (Fuhrman *et al.*, 2005) and chronic obstructive pulmonary disease (Cerdeira *et al.*, 2006). The presence of anti-oxidants has been reported from pomegranate in juice, peel, pulp and seed fractions (Li *et al.*, 2006).

For many years, scientists have been searching for clues in our genetic makeup that may explain why some people are more likely to get diabetes than others. "The Genetic Landscape of Diabetes" introduces some of the genes that have been suggested to play a role in the development of diabetes (Negi *et al.*, 2003).

Several extracts/constituents of *Punica granatum* have been found to prevent low-density lipoprotein oxidation and hence are anti-atherogenic (Wang *et al.*, 2004). Modulating the expression of oxidation-sensitive genes *in vitro* and in hypercholesterolemic mice (De Nigris *et al.*, 2005), as well as inhibiting the nuclear factor  $\kappa\beta$ , which is activated by reactive oxygen species (ROS) (Afaq *et al.*, 2005). Moreover, Guo *et al.* (2007) demonstrated *in vitro*, a powerful DNA damage prevention ability of *Punica granatum*.

Genetic toxicology tests are assays designed to detect direct or indirect genetic damage induced by chemical compounds. Fixation of DNA damage can result in gene mutations, loss of heterozygosity, chromosome loss or gain, and chromosome aberrations. These events may play an important role in many malignancies. Thus, identifying genotoxic/mutagenic effects is important for the risk/benefit assessment of substances, in particular those which are part of the dietary habits of any populations (Doppalapudi *et al.*, 2007).

Flowers of pomegranate have been used as an anti-diabetic medicine in Unani medicine and as a supplement in the diet therapy in many countries. The flowers can significantly lower the blood glucose level of type 2 diabetes animals with different possible mechanisms including enhancement of

mRNA expression, improvement of insulin receptor sensitivity, increment of peripheral glucose utilization, etc. Therefore, evaluation the protective role of several extracts from several parts of the pomegranate such as peel and fruit juice were studied in this work against alloxan induced diabetic female rats.

## 2. Materials and Methods

### Animals:

Thirty-two female adult albino rats (*Rattus rattus*) weighting 270-290 g, were purchased from the animal house of National Research Center in Dokki, Egypt, and acclimated to the laboratory conditions for 2 weeks prior to the initiation of the experiment. Rats were maintained on a stock diet and tap water that were allowed *ad libitum*.

### Chemical Treatments:

Alloxan was purchased from El-Gomhoriya Chemicals Company in Egypt and dissolved in saline for intraperitoneal injection as a single dose of 120 mg/kg body weight.

### Fruit Preparation:

Pomegranate (*Punica granatum*) fruits were supplied from Agriculture Research Center, Giza, Egypt. It was made sure that it had no previous treatment with any pesticides. Peel was separated from seeds, washed by tap water, dried in sunlight then grinded to make powder (250 mg/kg b.w.). Seeds were mixed in an automatic mixer and filtered to obtain fresh juice (5ml/Kg b.w.).

### Design of the Experiment:

Animals were divided into four groups as follows: GI-Control group: Normal control animals without any treatment, GII- Diabetic group: animals intraperitoneally injected with a single dose of 120 mg/kg b.w. of alloxan, GIII- Diabetic Peel group: animals intraperitoneally injected with a single dose of 120 mg/kg b.w. of alloxan then were fed on pomegranate peel powder (250 mg/kg b.w.) with the diet daily for 4 weeks, GIV- Diabetic Juice group: animals intraperitoneally injected with a single dose of 120 mg/kg b.w. of alloxan, then were gavage with pomegranate juice (5ml/Kg b.w.) daily each animal received for 4 weeks. Blood glucose level was measured 72 hours post-injection using one-touch glucometer, to confirm diabetes.

### Biochemical Analysis:

At the end of the experiment, blood samples were withdrawn by cardiac puncture after anaesthetization of rats by ether. The blood was collected in the dried test tubes and then centrifuged at 3000 r.p.m. for 10 min. The collected sera were used for determination of glucose level according to Trinder (1969), insulin hormone level was evaluated by the solid phase radioimmunoassay (RIA) using  $^{125}\text{I}$

according to Sapin *et al.*, (1998). Alpha-amylase activity was measured according to the method described by Caraway (1959). Serum total cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL) were determined according to Stein (1987) and triglycerides were evaluated according to Young (1990). Total lipids determination was carried out according to the method of Knight (1972). Total protein evaluated by Biuret reagent Tietz (1992). Homocystiene was estimated by the method of Vester and Rasmussen (1991). Total antioxidant capacity was determined by colorimetric method described by Koracevic (2001). AST and ALT were determined according to the method of Reitman and Frankel (1957). The pancreas and liver tissues were separated for genetic analysis.

#### Molecular analysis:

The genomic DNA was isolated using phenol/chloroform extraction and ethanol precipitation method with minor modifications (Sambrook *et al.*, 1989). The purity of the DNA preparation was determined by examining the ratio of absorbency at 260 to 280 nm (Aquadro *et al.*, 1992).

#### I-RAPD-PCR analysis:

To generate RAPD profiles from rats DNA, oligodecamers (10-mer random primers) A and C kits from the Operon Technologies were used. DNA amplification reactions were performed under conditions reported by Williams *et al.* (1990) and Plotsky *et al.* (1995). PCR amplification was conducted in 25  $\mu$ l reaction volume containing 100 ng genomic DNA, 100  $\mu$ M dNTPs, 40 nM primer (Operon, Alameda, CA, USA), 2.5 units of Taq DNA polymerase and 5  $\mu$ l promega 10X Taq DNA polymerase buffer. The reactions were carried out in Thermocycler (Perkin-Elmer 9700) programmed with a first denaturation of 5 min at 94°C, followed by 45 cycles of 1 min at 94°C, 1 min at 36°C and 2 min at 72°C and finally, one cycle at 72°C for 5 min. The PCR product was analyzed by electrophoresing 15  $\mu$ l of the amplified mixture on agarose gel. The Gel-Pro Analyzer (Media Cybernetics) was used to document ethidium bromide DNA gels.

#### II-DNA fragmentation analysis:

Liver tissues of female rats were used to determine the quantitative profile of the DNA fragmentation using Diphenylamine reaction procedure. Briefly, liver samples were collected immediately after sacrificing the animals. The tissues were lysed in 0.5 ml of lysis buffer containing, 10 mM tris-HCl (pH 8),

1 mM EDTA, 0.2% triton X-100, centrifuged at 10 000 r.p.m. (Eppendorf) for 20 min at 4°C. The pellets were resuspended in 0.5 ml of lysis buffer. To the pellets (P) and the supernatants (S), 0.5 ml of 25% trichloroacetic acid (TCA) was added and incubated at 4°C for 24 hrs. The samples were centrifuged for 20 min at 10 000 r.p.m. (Eppendorf) at 4°C and the pellets were suspended in 80 ml of 5% TCA, followed by incubation at 83°C for 20 min. Subsequently, to each sample 160 ml of DPA solution [150 mg DPA in 10 ml glacial acetic acid, 150 ml of sulfuric acid and 50 ml acetaldehyde (16 mg:ml)] was added and incubated at room temperature for 24 hrs. The proportion of fragmented DNA was calculated from absorbance reading at 600 nm using the formula:

$$\% \text{ DNA fragmentation} = \frac{\text{OD(s)}}{\text{OD(s)} + \text{OD(P)}} \times 100$$

#### Statistical Analysis

All data were statistically analyzed as a one-way analysis of variance using the General Linear Model, SAS software (SAS Institute, 2004). Weight data were reported as least square means (LSM)  $\pm$  standard errors (SEM). Duncen, multiple range test was used to separate the means when significant differences exist. Statistical significance was set at 5% probability.

### 3. Results

As shown in table (1) Glucose level was significantly increased ( $P \leq 0.05$ ) in diabetic group. After peel or juice administration, glucose level was significantly decreased ( $P \leq 0.05$ ) compared to diabetic rats. The pronounced decrease in glucose level was appeared in group III compared to control group. While insulin level decreased significantly ( $P \leq 0.05$ ) in group II compared to control. pomegranate administration increased the level of insulin significantly ( $P \leq 0.05$ ) in groups (III&IV) compared to diabetic group.

Table (1) obviously showed that the level of alpha amylase in group II was increased significantly ( $P \leq 0.05$ ) compared to control. The activity of alpha amylase in group III and IV administered peel or juice of pomegranate was decreased compared to diabetic group and became around of control level. From the data represented in the table, an inhibition in alpha amylase activity was noticed in group IV more than that in group III.

**Table (1): Serum Glucose, insulin and  $\alpha$ -amylase in control rats (Gr.I), diabetic rats (Gr. II), diabetic rats treated with pomegranate peel (Gr. III) and diabetic rats treated with pomegranate juice (Gr. IV).**

Parameters	Groups (each group contain 8 rats)			
	Gr.I Control	Gr.II Diabetic	Gr.III Diabetic+ Peel	Gr.IV Diabetic+juice
<b>Glucose (mg/dl)</b> Mean $\pm$ S.E.	94.52 $\pm$ 4.83 <sup>d</sup>	227.80 $\pm$ 7.72 <sup>a</sup>	114.18 $\pm$ 1.44 <sup>c</sup>	164.38 $\pm$ 6.65 <sup>b</sup>
<b>Insulin (mIU/ml)</b> Mean $\pm$ S.E.	4.46 $\pm$ 0.28 <sup>a</sup>	2.10 $\pm$ 0.19 <sup>c</sup>	3.96 $\pm$ 0.28 <sup>ab</sup>	3.54 $\pm$ 0.26 <sup>b</sup>
<b><math>\alpha</math>-Amylase (U/L)</b> Mean $\pm$ S.E.	637 $\pm$ 15.40 <sup>a</sup>	678.75 $\pm$ 15.68 <sup>a</sup>	550.62 $\pm$ 15.89 <sup>b</sup>	496.25 $\pm$ 13.08 <sup>c</sup>

Data are represented as Mean  $\pm$  SE.

Means in the same raw followed by different superscripts are significantly different ( $P \leq 0.05$ ).

**Table (2): Serum cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol and total lipids in control rats (Gr.I), diabetic rats (Gr. II), diabetic rats treated with pomegranate peel (Gr. III) and diabetic rats treated with pomegranate juice (Gr. IV).**

Parameters	Groups (each group contain 8 rats)			
	Gr.I Control	Gr.II Diabetic	Gr.III Diabetic+Peel	Gr.IV Diabetic+ juice
<b>Cholesterol (mg/dl)</b> Mean $\pm$ S.E.	99.03 $\pm$ 2.38 <sup>c</sup>	162.43 $\pm$ 9.03 <sup>a</sup>	135.94 $\pm$ 6.59 <sup>b</sup>	138.03 $\pm$ 6.61 <sup>b</sup>
<b>Triglycerides (mg/dl)</b> Mean $\pm$ S.E.	108.63 $\pm$ 5.50 <sup>b</sup>	141.42 $\pm$ 5.19 <sup>a</sup>	110.78 $\pm$ 6.49 <sup>b</sup>	112.75 $\pm$ 6.52 <sup>b</sup>
<b>HDL-cholesterol (mg/dl)</b> Mean $\pm$ S.E.	46.25 $\pm$ 2.49 <sup>a</sup>	29.68 $\pm$ 1.12 <sup>c</sup>	36.45 $\pm$ 1.86 <sup>b</sup>	31.62 $\pm$ 1.10 <sup>bc</sup>
<b>LDL-cholesterol (mg/dl)</b> Mean $\pm$ S.E.	30.45 $\pm$ 1.74 <sup>c</sup>	106.58 $\pm$ 5.89 <sup>a</sup>	78.71 $\pm$ 3.31 <sup>b</sup>	85.96 $\pm$ 4.42 <sup>b</sup>
<b>Total lipids (mg/dl)</b> Mean $\pm$ S.E.	406.25 $\pm$ 5.97 <sup>c</sup>	573.12 $\pm$ 16.78 <sup>a</sup>	464.5 $\pm$ 12.22 <sup>b</sup>	474.25 $\pm$ 13.01 <sup>b</sup>

Data are represented as Mean  $\pm$  SE.

Means in the same raw followed by different superscripts are significantly different ( $P \leq 0.05$ ).

As shown in table (2) Cholesterol and triglycerides levels increased significantly ( $P \leq 0.05$ ) in diabetic groups. Cholesterol level decreased significantly ( $P \leq 0.05$ ) in groups (III&IV) treated with pomegranate peel and juice comparing to group (II), but still increased and not became near the value of control. While triglycerides levels decreased significantly ( $P \leq 0.05$ ) in groups (III&IV) compared to diabetic group and levels approached that of the control group.

HDL-cholesterol level was significantly decreased ( $P \leq 0.05$ ) in comparison of all groups to control. HDL -cholesterol was remarkably higher in group III ( $P \leq 0.05$ ) compared to diabetic group. In

group IV, HDL-cholesterol was not significantly changed. Whereas LDL-cholesterol level increased significantly ( $P \leq 0.05$ ) in comparison the groups with control. After pomegranate peel and juice administration, LDL-cholesterol levels were decreased in groups III & IV ( $P \leq 0.05$ ) compared to diabetic group.

Total lipids were increased significantly ( $P \leq 0.05$ ) in diabetic group compared to control. Administration of pomegranate peel and juice decreased these effects. The level of total lipids in groups III & IV decreased significantly ( $P \leq 0.05$ ) than the diabetic group, but it was still higher than the control.

**Table (3): Serum total protein, homocystiene and total anti-oxidant capacity (TAC) in control rats (Gr.I), diabetic rats (Gr. II), diabetic rats treated with pomegranate peel (Gr. III) and diabetic rats treated with pomegranate juice (Gr. IV).**

Parameters	Groups (each group contain 8 rats)			
	Gr.I Control	Gr.II Diabetic	Gr.III Diabetic+Peel	Gr.IV Diabetic+Juice
<b>Total protein (g/dl)</b> Mean ± S.E.	6.57± 0.28 <sup>a</sup>	6.80± 0.32 <sup>a</sup>	7.15± 0.45 <sup>a</sup>	6.67± 0.15 <sup>a</sup>
<b>Homocystiene (µmol/L)</b> Mean ± S.E.	9.83± 0.32 <sup>c</sup>	14.68± 0.54 <sup>a</sup>	10.49± 0.43 <sup>c</sup>	11.92± 0.53 <sup>b</sup>
<b>TAC (µmol/L)</b> Mean ± S.E.	1.18 ± 0.05 <sup>a</sup>	0.74 ± 0.03 <sup>c</sup>	0.99± 0.05 <sup>b</sup>	0.96 ± 0.04 <sup>b</sup>

Data are represented as Mean ± SE.

Means in the same raw followed by different superscripts are significantly different ( $P \leq 0.05$ ).

As shown in table (3) Total protein was not significantly affected ( $P > 0.05$ ) by any of the treatments. Homocystiene level showed significant increase ( $P \leq 0.05$ ) in diabetic rats group compared to control. Whereas pomegranate peel administration decreased the level of homocysteine significantly ( $P \leq 0.05$ ), as well as juice administration decreased homocysteine level significantly ( $P \leq 0.05$ ) compared to diabetic group. The pronounced effect of

pomegranate peel administration was much higher than that of juice.

Total antioxidant capacity (TAC) was significantly decreased ( $P \leq 0.05$ ) in group II compared to control and improved significantly increase in groups III & IV ( $P \leq 0.05$ ). A powerful effect of pomegranate was observed in both groups III and IV ( $P \leq 0.05$ ) compared to diabetic one. However the TAC levels of both these groups did not return to the control level.

**Table (4): Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in control rats (Gr.I), diabetic rats (Gr. II), diabetic rats treated with pomegranate peel (Gr. III) and diabetic rats treated with pomegranate juice (Gr. IV).**

Parameters	Groups (each group contain 8 rats)			
	Gr.I Control	Gr.II Diabetic	Gr.III Diabetic+Peel	Gr.IV Diaetic+juice
<b>ALT (U/I)</b> Mean ± S.E.	71.25± 2.54 <sup>c</sup>	135.62± 3.66 <sup>a</sup>	79.75± 2.58 <sup>c</sup>	90.00± 3.41 <sup>b</sup>
<b>AST (U/I)</b> Mean ± S.E.	245.12± 4.72 <sup>c</sup>	388.5± 12.93 <sup>a</sup>	281.87± 8.84 <sup>b</sup>	282.50± 8.78 <sup>b</sup>

Data are represented as Mean ± SE.

Means in the same raw followed by different superscripts are significantly different ( $P \leq 0.05$ ).

As shown in table (4) ALT and AST revealed significant increase ( $P \leq 0.05$ ) in diabetic groups compared to control. Administration of pomegranate peel and juice showed significant decrease ( $P \leq 0.05$ ) in ALT & AST activities compared to diabetic group. ALT activity in group (III) became near to that of control value.

#### I -RAPD fingerprinting assay

The molecular genetic variability among the treated rats genomes and their controls were evaluated using 2 random primer kits (A and C).

Only four of these primers (10-mer random primers, Table 5) gave positive and detectable bands (Figure1).

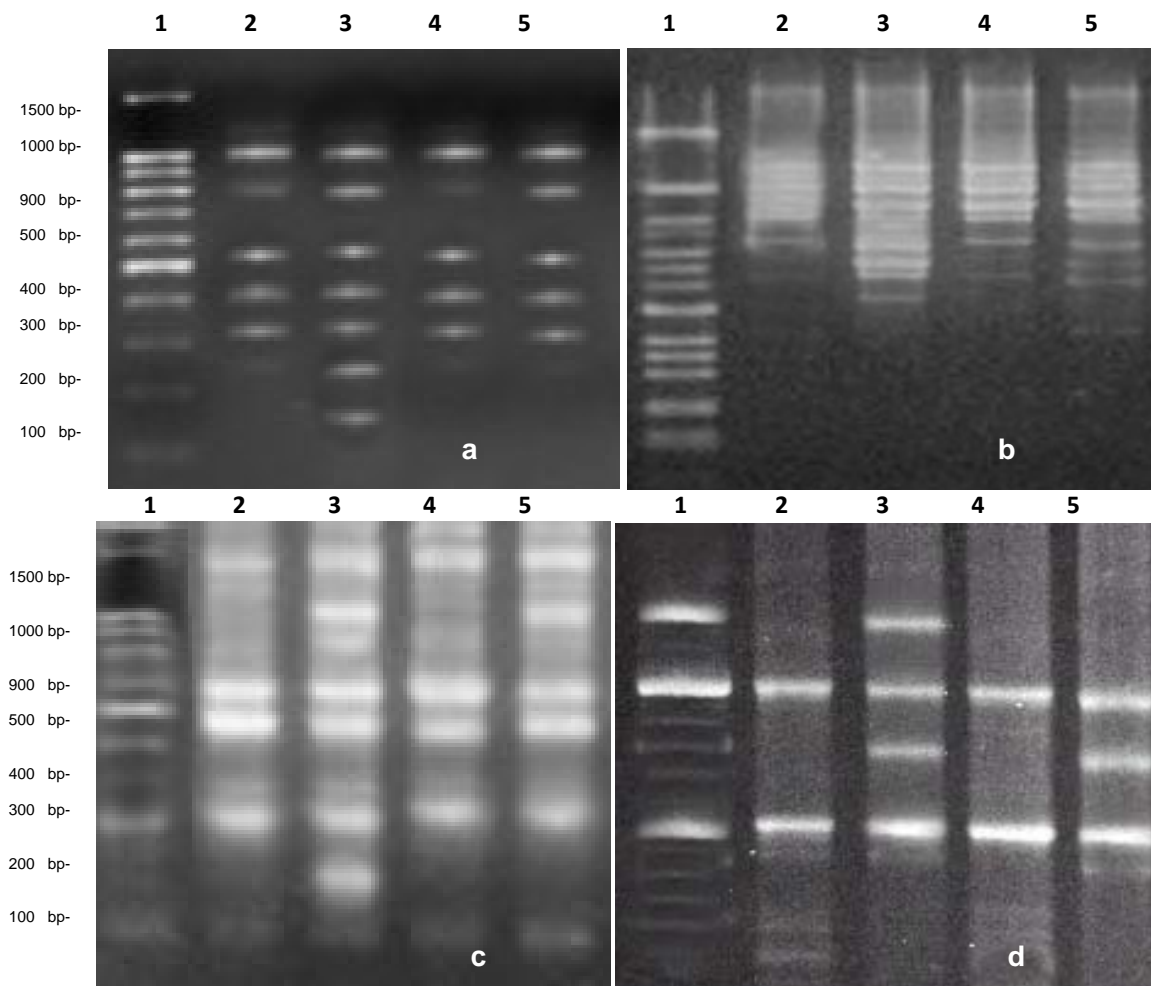
These primers provided a total of 218 different bands with an average of 20.2±0.9 bands per primer (Table 5). Nearly the same results were obtained when the PCR assay was performed for each sample within each group (5 animals).

Untreated control group did not reveal damage on the DNA compared with other groups. Where, most of the bands (270 bands, 87%) resulted from all primers (A02, A03, A05 and C03) were

monomorphic for the control and alloxan treated animals (Figure 1).

However, most of the DNA of the samples treated with alloxan revealed polymorphic bands including the appearance of new bands or the loss of

some of the bands, which did not appear in the DNA samples of control rats (Figure 1). These new bands could be considered as “genus diagnostic” markers which are attributed to the alloxan treatment.



**Figure 1:** Comparison of RAPD fingerprinting profiles of different female rat genomic DNA treated with alloxan and pomegranate extracts (peel and juice). a) Represents PCR products with primer A02; b) represents PCR products with primer A03; c) represents PCR products with primer A05; and d) represents PCR products with primer C03. The DNA marker was in lanes 1. Lane 2 represents PCR products of untreated control samples; lane 3 represents rats treated with alloxan; lane 4 represents rat treated with alloxan plus pomegranate peel and lane 5 represents rats treated with alloxan plus pomegranate juice.

**Table (5): Sequence of primers employed.**

Primer	Sequence
A02	5'-TGCCGAGCTG-3'
A03	5'-AGTCAGCCAC-3'
A05	5'-AGGGGTCTTG-3'
C03	5'-GGGGTCTTT-3'

On the other hand, treatment with pomegranate peel after alloxan was able to inhibit the damage caused by alloxan treatment. Moreover,

treatment with pomegranate juice did slightly inhibit the DNA damage attributed to alloxan treatment. However, the effect of pomegranate juice in



decreasing the DNA damage was less than that of the pomegranate peel (Figure 1).

## II-DNA fragmentation

The evaluation of the protective effect of pomegranate extracts (peel and juice) against alloxan induced diabetic in female rats was investigated by quantitative DNA fragmentation analysis. The DNA damage was examined in liver tissues collected from

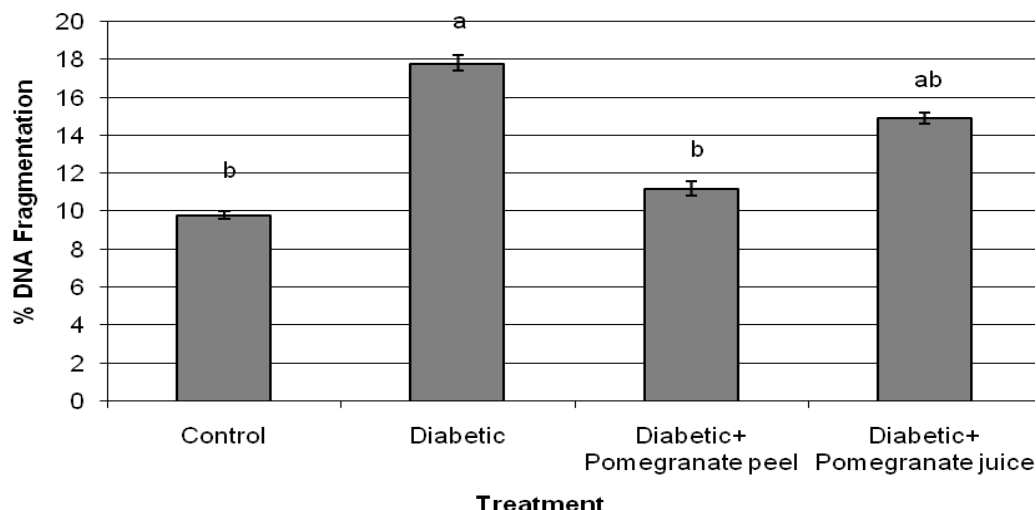
diabetic rats using diphenylamine reaction procedure (Figure 2 and Table 6). The results revealed that DNA damage in untreated control rats was lower than all other treated groups. However, rate of DNA fragmentation in female rats treated with alloxan induced diabetic was significantly higher than control rats (Figure 2 & Table 6).

**Table (6): Rate of DNA fragmentation in liver tissues of female rat treated with alloxan and pomegranate extracts (peel and juice).**

Groups	Rate of DNA fragmentation
I) Control	9.8±0.2 <sup>b</sup>
II) Diabetic	17.8±0.4 <sup>a</sup>
III) Diabetic+ Pomegranate peel	11.2±0.4 <sup>b</sup>
IV) Diabetic+ Pomegranate juice	14.9±0.3 <sup>ab</sup>

Data are represented as Mean ± SE.

Means in the same row followed by different superscripts are significantly different ( $P \leq 0.05$ ).



**Figure 2.** DNA fragmentation in liver tissues of female rats treated with alloxan and pomegranate extracts (peel and juice) analyzed by diphenylamine reaction procedure. Results are expressed as mean ± SEM of data from at least five samples,  $P < 0.05$ . CP: Cyclophosphamide; QD quantum dots; Co: cobalt

As shown in fig. (2) and table (6) treatment of alloxan-treated female rats with pomegranate peel decreased significantly the rate of DNA fragmentation compared with alloxan-treated female rats. Furthermore, treatment of alloxan-treated female rats with pomegranate juice slightly decreased the rate of DNA fragmentation compared with alloxan-treated female rats; however, this reduction was not significantly different.

## 4. Dissection

*Punica granatum* is widely used plant that has high nutritional value. This study assessed the effect of pomegranate peel and juice consumption on

rats treated with alloxan-induced diabetes mellitus. The obtained results are in accordance with data of Jafri *et al.* (2000) who found that oral administration of aqueous ethanolic of flowers of *punica granatum* led to significant blood glucose lowering effect in normal, glucose-fed hyperglycaemic and alloxan-induced diabetic rats. In the study of Prashanth *et al.* (2001) the ethanolic extracts of *punica granatum* was tested for their effect on alpha-amylase activity. It was found to exhibit interesting alpha-amylase inhibitory activity. Also Enas and Khalil, (2004) found that the diabetic rats treated with aqueous peel of pomegranate for 4 weeks displayed significantly lowered blood glucose level and augmentation in

insulin level. The action of alloxan is due to that alloxan induced free radical damage. *Punica granatum* peel possesses strong antioxidant property (Chidamabara *et al.*, 2004) and can act as free radical scavenger and protect cells from damage. Also it may increase insulin receptors. Thus, pomegranate can reduce blood glucose through regeneration of the cells. Parmar and Kar, (2007) found that peel of *Punica granatum* normalized all the adverse changes induced by alloxan. The dose of alloxan increased serum level of glucose and alpha amylase and decrease insulin level. Subsequent phytochemical analysis indicated that the high content of total polyphenols in the peel might be related to the antioxidant and antiperoxidative effects of the test peel. Also Joanne *et al.* (2011) found the same results for peel of *Punica granatum* in glucose, insulin and alpha-amylase.

The results of the current study are in agreement with that of Esmailzadeh *et al.* (2004), who found significant reductions were recorded in total cholesterol, LDL-cholesterol, whereas no change in HDL-cholesterol was noticed. It is concluded that concentrated pomegranate juice consumption may modify the risk factors in hyperlipidemic patients and its inclusion. Esmailzadeh *et al.* (2006) reported the same effect, whereas triglycerides were not changed in diabetic persons treated with concentrated pomegranate juice. Pomegranate juice was able to reduce the progression of atherosclerosis (De-Nigris *et al.*, 2005).

Moreover, a study of Bagri *et al.* (2009) found that the administration of pomegranate (Pg) aqueous extract at doses of 250 mg/kg and 500 mg/kg for 21 days resulted in a significant reduction in fasting blood glucose, cholesterol, triglycerides and LDL-cholesterol in compression with a diabetic group induced by streptozotocin. The results suggest that Pg could be used, as a dietary supplement, in the treatment of chronic diseases characterized by atherogenous lipoprotein profile, aggravated antioxidant status and impaired glucose metabolism and also in their prevention.

Also Mirimiran *et al.* (2010) reported that pomegranate seed oil (PSO) v. placebo adjusted the lipid profile for base line values. Serum cholesterol, LDL-cholesterol and glucose concentrations variables remained unchanged. It was concluded that administration of PSO for 4 weeks in hyperlipidaemic subjects had favorable effects on lipid profiles. Fenercioglu *et al.* (2010) indicated that the polyphenol antioxidant supplement containing pomegranate extract has important antagonizing effect on oxidative stress and lipid peroxidation in patients with type 2 diabetes mellitus and might be beneficial in preventing cardiovascular

complications. They showed a decrease in LDL and an increase in HDL.

On the other hand Changrani *et al.* (2006) reported that the concentration of total protein decreased significantly in case of diabetes. While Duman *et al.*, 2009 found that the incorporation of pomegranate extract rich in polyphenols did not influence the total protein.

Jacobs *et al.* (1998) found that an elevation in the concentration of total homocysteine is known to be an independent risk factor for the development of vascular disease. Alterations in homocysteine metabolism have also been observed in diabetic patients. Patients with two types of diabetes who have signs of renal dysfunction tend to exhibit elevated total homocysteine levels. Elias and Eng, 2004 recorded that plasma homocysteine levels have been elevated in patients with diabetes. The plasma concentration of homocysteine in patients with diabetes is further confounded by the use of medication used to treat the disease and by the development of renal impairment. While Gursu, 2001 found that Homocysteine level experimentally induced insulin-dependent diabetes mellitus is decreased. The insulin increases activities of enzymes transsulfuration and remethylation.

Our results are in agreement with Osama *et al.* (2010) who investigated the antioxidant effect of *Punica granatum* peel methanolic extract against oxidative damage in streptozotocin-induced diabetic rats. The results revealed that using the peel extract for 4 weeks significantly enhanced the activities of antioxidant enzymes in liver and kidney tissues and elevated the total serum of antioxidant capacity. Kaur *et al.* (2006) found that pretreatment with pomegranate flower extract afforded up to 60% protection against hepatic lipid peroxidation. They found an inhibition in the modulation of liver markers (AST and ALT). These results indicated that pomegranate flowers possess potent antioxidant and hepatoprotective properties. Toklu, *et al.* (2007) studied the effect of chronic administration of pomegranate peel extract on liver fibrosis induced by bile duct ligation. They showed that the elevated AST and ALT were significantly decreased after treatment. Thus chronic pomegranate peel extract treatment, with its antioxidant and antifibrotic properties may be of potential therapeutic value in protecting the liver from fibrosis and oxidative injury.

The concept that environmental chemical exposure could induce DNA damage has led to the introduction of requirements for testing mutagenic properties of new and/or frequently consumed substances, especially food. However, it has been documented, in the literature, that antioxidant intake can reduce cancer risk and may also mitigate the

effects of oxidative DNA damage (Watters *et al.*, 2007). In the current work evaluation the protective effect of the pomegranate peel and juice against alloxan induced diabetic was studied. The results revealed that pomegranate peel was more potent to inhibit the DNA fragmentation and DNA damage than pomegranate juice. These results are in accordance with the findings of Guo *et al.* (2007), which demonstrated *in vitro* that besides scavenging free radicals and reactive oxygen species (ROS), *Punica granatum* also prevents DNA damage. Therefore, our results confirm and extend our knowledge on the ability of *Punica granatum* to protect DNA in rats.

In recent years, attention has been focused on the antioxidant properties elicited by plants or food against ROS, lipid peroxidation, protein damage, and DNA strand breaking. Several plants can positively modulate biological systems against damaging effects produced by active oxygen species by several means, including free radical scavengers and enzymes such as superoxide dismutase (SOD) and catalase (CAT) (Srinivasan *et al.*, 2007).

The antioxidant activities of *Punica granatum* are associated with different bioactive components, mainly polyphenols, ellagitannins, condensed tannins, and anthocyanins (Noda *et al.*, 2002; Negi *et al.*, 2003 and Li *et al.*, 2006). In this regard, Watters *et al.* (2007) showed that polyphenols present in pomegranate protect neonatal mouse brain against hypoxic-ischemic injury. Moreover, Kaur *et al.* (2006) demonstrated that *Punica granatum* extract afforded up to 60% protection against hepatic lipid peroxidation due to the maintenance of the glutathione levels and activities of CAT, glutathione peroxidase, glutathione reductase, and glutathione-S-transferase.

Although the biochemical mechanisms underlying Pomegranate peel and Pomegranate juice activities are not yet clear, our results demonstrated that *Punica granatum* has an *in vivo* preventive effect against DNA fragmentation and/or damage due to alloxan, probably due to its free radical scavenging capability.

Conclusion: This study demonstrates that *Punica granatum* has a preventive effect against alloxan induced biochemical alterations and DNA fragmentation and damage in female rats. We suggest that the antioxidant content in *Punica granatum* extracts which decreased the oxidative stress related diseases may be due to its free radical scavenging capability. A little attention has been paid to pomegranate health promoting values.

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