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# Choosing the Best Anti-Virus in the World by Application of TOPSIS Method

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**Abstract:** Decision making problem is the process of finding the best option from all of the feasible alternatives. Due to the fact that, the collected data for choosing an anti-virus isn't concrete and substantial the way users demand including the risk attitude for a decision maker which is somehow unknown, and considering the increase in the complexity and the variety of decision making problems, the methods of decision making become more varied and will have more capability of problem solving. We present a new TOPSIS method for normalizing the collected data and ranking the alternatives, a multi-attribute decision making (MADM) technique for ranking and selection of a number of externally determined alternatives through distance measures. A Technique for Order Preference by Similarity to Ideal Solution method is a multiple criteria method to identify solution from finite set of points and by eliminating the units of criterion functions and determining a solution with the shortest distance to the ideal solution and the greatest distance from the negative-ideal one. For this research some of these criteria considered are "Detection and Missed Samples", "False Positive/Alarm", "Scanning Speed", "Encoding and transcoding" and so on.
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**Keywords:** MCDM, TOPSIS Method, Antivirus, Criteria of Anti-Viruses

## 1. Introduction

The Anti-Virus (Post and Kagan, 1998) secures the computers by observing and reviewing files contents (Post and Kievit, 1991). If it observes viruses prevents them from entering into your computer and/or executing, by giving you a warning and asking you for command of deletion and taking your precautionary measures. But one of the foremost concerns for those, who work with computer, is to select and install a safe and secure anti-virus for protection of their computers. Computer viruses are developed every day and to prevent them to ruin the existing files seems to be inevitable. Therefore, the applications of anti-viruses are growing more than ever. However, if you observe the anti-viruses market, you will be certainly shocked by seeing a large numbers of anti-viruses brands, consequently this may cause the problem for selecting a suitable anti-viruses. The fact is every one considers certain criteria to select safe anti-virus. Therefore, we should notice this important point that there is no perfect anti-virus and that we should always keep checking and testing the installed security software on our systems.

Computer viruses have been extensively studied by many authors (Cohen, 1990). In 1984, Fredrick B. Cohen (Cohen, 1987) purposed term Computer Virus. Computer viruses are those programs, which are spread like biologic viruses and execute unexpected measures when they enter into computers. Despite the fact that all viruses are not dangerous, most of them have been written with the aim of destruction of certain types of files, application programs and/or operating systems. Like all other programs, viruses are benefited from system sources such as memory and hard disk space, CPU power and other sources. They can do dangerous actions, for instance, they may damage the computer systems erasing data, stealing information or modifying the normal operation (Jose et al., 2008). Also, a virus may provide license of access to the device via network or without identification.

The functions of existing anti-virus are not the same. Such anti-virus covers the files and/or its memory in order to review the existing certain virus signatures, which may contaminate the system. Anti-viruses are seeking for the virus signatures based on certain signs, definitions and/or identified of viruses. The computer viruses programmer always writes new computer viruses and updates their former written ones. Therefore, it always requires updating the information bank including definitions and computer virus signatures relating to the given software. After installation of the anti-virus on your computer, you may do scan and review the system in order to identify the existing virus at certain time intervals or period (Naie et al., 2011).

Performance of anti-viruses is also reviewed based on criteria and by using TOPSIS method where these criteria are main parameters for comparison and evaluation of anti-viruses against types of viruses and internet worms as well as spywares and malwares.

Multiple criteria decision making (MCDM) is the tool most frequently used to deal with conflict management (Fu et al., 2007; Shi et al., 2005). Practical problems are often characterized by several non-commensurable and conflicting (competing) criteria, and there may be no solution satisfying all criteria simultaneously. Therefore, the solution is a set of non-inferior solutions, or a compromise solution according to the decision makers' preference. A compromise solution for a problem with conflict criteria can allow the decision makers to reach a final decision. The foundation for compromise solutions was established by Yu (1973) and Zeleny (1982), and other distance-based techniques have also been developed (Chen and Hwang, 1992).The compromise solution is a feasible solution closest to the ideal/aspired level and a compromise means an agreement established by mutual concessions.

The TOPSIS (technique for order performance by similarity to ideal solution) was first developed by Hwang & Yoon (1981). According to this technique, the best alternative would be the one that is nearest to the positive-ideal solution and farthest from the negative ideal solution (Ertugrul & Karakasoglu, 2007). The positive- ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Wang & Elhag, 2006). In short, the positive-ideal solution is composed of all best values attainable from the criteria, whereas the negative ideal solution consists of all worst values attainable from the criteria (Wang, 2007). Interested readers can check the contents of Shih et al. (2007) for more details of TOPSIS and There have been lots of studies in the literature using TOPSIS for the solution of MCDM problems. (Chen, 2000; Chu, 2002; Chu & Lin, 2002; Lai, Liu, & Hwang, 1994; Wang et al., 2005).

In this article, we have tried to select the best anti-viruses from 20 globally introduced anti-viruses by using TOPSIS method. The existing lists comprise names of anti-viruses in alphabetic order (On-Demand Comparative; 2011, Performance Test, 2011).

The used test-set contain about 200 thousands recent/prevalent malware sample from last months and consists of: (On-Demand Comparative, 2011).

Similarly, this review has been conducted on a computer with the following specifications (On-Demand Comparative, 2011).

- WINDOWS : Windows XP service pack 3
- CPU : Intel Core 2 Duo E8300/2.83 GHz
- RAM : 2 GB Ram
- HARD DISK : SATA II

Table 1: 20 globally introduced anti-virus software

| Anti-Virus | Version |
|---|---|
| Avast! Free Antivirus 6.0 | 6.0.1203 |
| AVG Anti-Virus 2012 | 10.0.1392 |
| AVIRA Free Antivirus 2012 | 10.2.0.700 |
| Bitdefender Antivirus Plus 2012 | 15.0.27.319 |
| eScan Anti-Virus 11 | 11.0.1139.998 |
| ESET NOD32 Antivirus 5 | 5.0.90.0 |
| F-Secure Anti-Virus 2012 | 10.51.106 |
| G DATA Antivirus 2012 | 22.0.2.32 |
| K7 Antivirus Plus 11.1 | 11.1.0050 |
| Kaspersky Anti-Virus 2012 | 12.0.0.374 |
| McAfee Antivirus Plus 2012 | 15.0.291 |
| Microsoft Security Essentials 2.1 | 2.1.1116.0 |
| Panda Cloud Antivirus Free 1.5.1 | 1.5.1 |
| PC Tools Spyware Doctor with Antivirus 2012 | 8.0.0.655 |
| Qihoo 360 Antivirus 2.0 | 2.0.1.1332 |
| Sophos Endpoint Security 9.7 | 9.7.4 |
| Symantec Norton Antivirus 2012 | 19.1.0.21 |
| Trend Micro Titanium Antivirus Plus 2012 | 2012 |
| TrustPort Antivirus 2012 | 10.0.0.4796 |
| Webroot Secure Anywhere Antivirus 2012 | 7.0.11.25 |

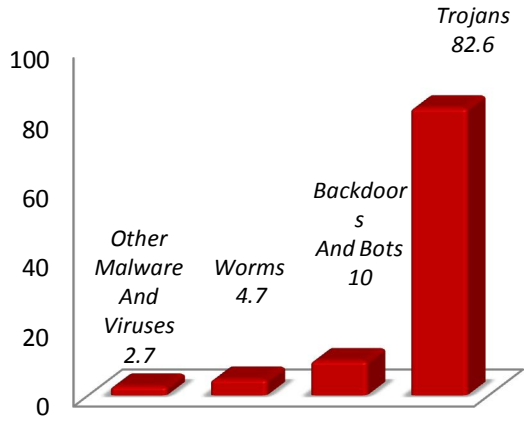


Figure 1. Diagram of computer destructive codes and anti-viruses

## 2. Method

Decision-making problem is the process of finding the best option from all of the feasible alternatives. In almost all such problems the multiplicity of criteria for judging the alternatives is pervasive. That is, for many such problems, the decision maker wants to solve a multiple criteria decision making (MCDM) problem. Multiple criteria decision making may be considered as a complex and

dynamic process including one managerial level and one engineering level (Duckstein & Opricovic , 1980). The managerial level defines the goals, and chooses the final ‘‘optimal’’ alternative. The multi-criteria nature of decisions is emphasized at this managerial level, at which public officials called ‘‘decision makers’’ have the power to accept or reject the solution proposed by the engineering level. These decision makers, who provide the preference structure, are ‘‘off line’’ from the optimization procedure done at the engineering level. A MCDM problem can be concisely expressed in matrix format as

| | $C_1$ | $C_2$ | ... | $C_n$ |
|---|---|---|---|---|
| $A_1$ | $x_{11}$ | $x_{12}$ | ... | $x_{1n}$ |
| $A_2$ | $x_{21}$ | $x_{22}$ | ... | $x_{2n}$ |
| $A_m$ | $x_{m1}$ | $x_{m2}$ | ... | $x_{mn}$ |

$$W = [w_1 ; w_2 ; \ldots ; w_n]$$

Where A1,A2, . . . ,Am are possible alternatives among which decision makers have to choose, C1,C2, . . . ,Cn are criteria with which alternative performance are measured, xij is the rating of alternative Ai with respect to criterion Cj, wj is the weight of criterion Cj. The main steps of multiple criteria decision making are the following:

**(a)** Establishing system evaluation criteria that relate system capabilities to goals.

**(b)** Developing alternative systems for attaining the goals (generating alternatives).

**(c)** Evaluating alternatives in terms of criteria (the values of the criterion functions).

**(d)** Applying a normative multi-criteria analysis method.

**(e)** Accepting one alternative as ‘‘optimal’’ (preferred).

**(f)** If the final solution is not accepted, gather new information and go into the next iteration of multi-criteria optimization.

Steps (a) and (e) are performed at the upper level, where decision makers have the central role, and the other steps are mostly engineering tasks. For step (d), a decision maker should express his/her preferences in terms of the relative importance of criteria, and one approach is to introduce criteria weights. This weights in MCDM do not have a clear economic significance, but their use provides the opportunity to model the actual aspects of decision making (the preference structure). In classical MCDM methods, the ratings and the weights of the criteria are known precisely (Fishburn et al.,1992). A survey of the methods has been presented Hwang and Yoon (1981). Technique for order performance by similarity to ideal solution (TOPSIS) (Lai et al., 1994), one of known classical MCDM method, was first developed by Hwang and Yoon (1981).

TOPSIS method is a technique for order preference by similarity to ideal solution that maximizes the benefit criteria/attributes and minimizes the cost criteria/attributes, whereas the negative ideal solution maximizes the cost criteria/attributes and minimizes the benefit criteria/attributes. The best alternative is the one, which is closest to the ideal solution and farthest from the negative ideal solution. Suppose a MCDM problem has n alternatives, A1,A2, . . . ,An, and m decision criteria/attributes, C1,C2, . . . ,Cm. Each alternative is evaluated with respect to the m criteria/attributes. Each value assigned to each alternative with respect to each criterion form a decision matrix denoted by X = (Xij)n×m as below :

$$\mathbf{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \cdots & \vdots & \cdots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \cdots & \vdots & \cdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nj} & \cdots & x_{nm} \end{bmatrix}. \quad (1)$$

Let $W = (w_1, w_2, \ldots, w_m)$ be the relative weight vector about the criteria, satisfying $\sum_{j=1}^{m} w_j = 1$ . Then the procedure of TOPSIS can be expressed in a series of steps:

Step 1. Calculate the normalized decision matrix. Some normalized methods for TOPSIS are summarized by Shih et al (2007).For simplify, a vector normalization method is introduced whose normalized value $n_{ij}$ is calculated as:

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{n} x_{kj}^2}} \quad i = 1,2,\ldots,n \quad j = 1,2,\ldots,m \quad (2)$$

Step 2. Calculate the weighted normalized decision matrix $V = (v_{ij})_{n\times m}$ :

$$v_{ij} = w_j n_{ij} \quad i = 1,2,\ldots,n \quad j = 1,2,\ldots,m \quad (3)$$

Where $w_j$ is the relative weight of the $j$th criterion/attribute, and $\sum_{j=1}^{m} w_j = 1$.

Step 3. Determine the positive ideal $A^+$ and negative ideal solution $A^-$as below

$$A^+ = \{ v_1^+ , v_2^+ , \ldots , v_m^+ \} = \{(max_i\, v_{ij} \mid j \in \Omega_b) , (min_i\, v_{ij} \mid j \in \Omega_c)\} \quad (4)$$

$$A^- = \{ v_1^- , v_2^- , \ldots , v_m^- \} = \{(min_i\, v_{ij} \mid j \in \Omega_b) , (max_i\, v_{ij} \mid j \in \Omega_c)\} \quad (5)$$

Where $\Omega_b$ is associated with benefit criteria, and $\Omega_c$ is associated with cost criteria.

Step 4. Calculate the separation measures, using the m-dimensional Euclidean distance. The separation of each alternative from the ideal solution ($A^+$) and the

negative ideal solution ($A^-$) are given as below, respectively:

$$D_i^+ = \sqrt{\sum_{j=1}^{m}\left(v_{ij} - v_j^+\right)^2} \quad i = 1,2,\ldots,n \qquad (6)$$

$$D_i^- = \sqrt{\sum_{j=1}^{m}\left(v_{ij} - v_j^-\right)^2} \quad i = 1,2,\ldots,n \qquad (7)$$

Step 5. Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative $A_i$ with respect to $A^+$ is defined as:

$$RC_i = \frac{D_i^+}{D_i^+ + D_i^-} \qquad i = 1,2,\ldots,n \qquad (8)$$

Step 6. Rank the alternatives according to the relative closeness to the ideal solution. The smaller the value $RC_i$, the less distance the alternative $A_i$ to the ideal solution. The best alternative is the one with the greatest relative closeness to the ideal solution.

## 3. Data Analysis

Performing data analysis can include various criteria. We have chosen these eight criteria, including, detection and missed samples, fast positive alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, installing and uninstalling applications, launching application. These eight are the most important ones (On-Demand Comparative; 2011, Performance Test, 2011).

### 3.1. Detection and Missed Samples

The following diagram shows anti-viruses situation in detection and cleaning of computer viruses. The used percentages in this diagram indicate number of undetected viruses among total employed destructive codes in this comprehensive evaluation. Thus, the lower level for each anti-virus shows the stronger performance of it (On-Demand Comparative, 2011).

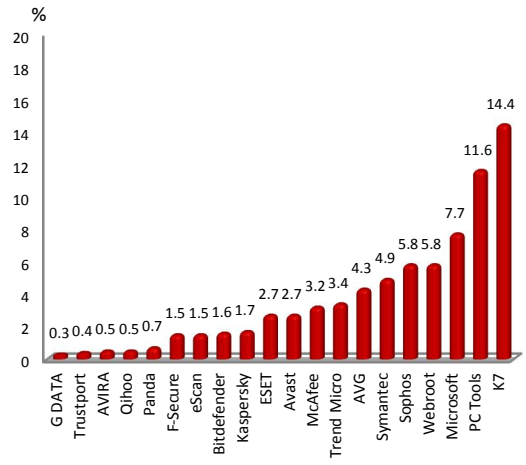


Figure 2. Diagram of number of undetected anti-viruses among all employed destructive codes in this assessment

### 3.2. False Positive/Alarm

In order to better evaluate the quality of the detection capabilities of anti-virus products (distinguish good files from malicious files), we provide also a false alarm test. False alarms can sometimes cause as much trouble as a real infection. Please consider the false alarm rate when looking at the detection rates, as a product, which is prone to cause false alarms, achieves higher scores easier (all discovered false alarms were reported/send to the respective Anti-Virus vendors and have been fixed). Number of false alarms found in our set of clean files (lower is better). The graph above shows the number of false alarms found in our set of clean files bye the tested anti-virus products. The graph below shows the number of false alarms found in our set of clean files by the tested Anti-Virus products (On-Demand Comparative. 2011).

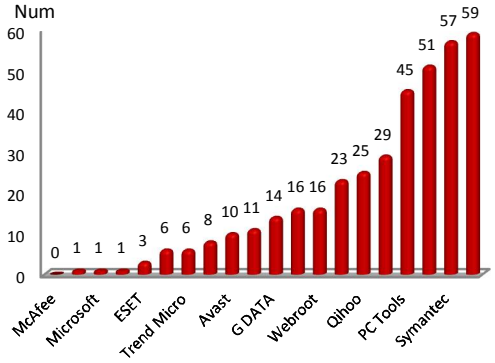


**Figure 3.** Diagram of codes error identification and safe files by anti-viruses

### 3.3. Scanning Speed

Anti-Viruses products have different scanning speeds due to various reasons. It has to be taken in account of how reliable the detection rate of an Anti-Virus is; if the Anti-Virus product uses code emulation, if it is able to detect difficult polymorphic viruses, if is does a deep heuristic scan analysis and active rootkit scan, how deep and thorough the unpacking and unarchiving support is, additional security scan, if it really scans all file types (or uses e.g. white lists in the cloud), etc.Most products have technologies to decrease scan times on subsequent scans by skipping previously scanned files. As we want to know the scan speed (when files are really scanned for malware) and not the skipping files sped, those technologies are not taken info account here, In our opinion some products should inform the users more clearly about the performance-optimized scans and then let the users decide if they prefer a short performance-optimized scan (which does not re-check all files, with the potential risk of overlooking infected files!) or a full-security scan.

The following graph shows the throughput rate in MB/Sec (higher is faster) of the various Anti-Virus products when scanning (on-demand) with highest setting our whole set of clean files (used for the false alarm testing). The scanning throughput rate will vary based on the set of clean files, the setting and the hardware used (On-Demand Comparative, 2011).

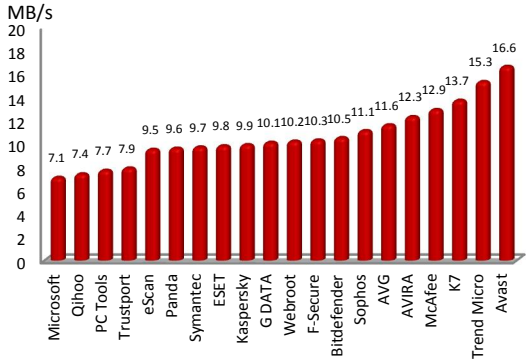


Figure 4. Diagram of anti-virus performance speed in detection and removal destructive codes

### 3.4. File Copying

Some Anti-Virus Products do not scan all kind of files by design/default (e.g. based on their file extensions), or use fingerprinting technologies, which may skip already scanned files in order to increase the speed. We copied a set of different file types which are wide-spread at home and office workstations from one physical hard disk to another physical hard disk (Performance Test, 2011).

Table 2. File coping speed from one physical hard disk to another physical hard disk

| Anti-Virus | Score | Value |
|---|---|---|
| Avast | Very Fast | 9 |
| AVG | Very Fast | 9 |
| AVIRA | Very Fast | 9 |
| Bitdefender | Very Fast | 9 |
| eScan | Very Fast | 9 |
| ESET | Very Fast | 9 |
| F-Secure | Very Fast | 9 |
| G DATA | Very Fast | 9 |
| K7 | Very Fast | 9 |
| Kaspersky | Very Fast | 9 |
| McAfee | Mediocre | 5 |
| Microsoft | Very Fast | 9 |
| Panda | Very Fast | 9 |
| PC Tools | Fast | 7 |
| Qihoo | Very Fast | 9 |
| Sophos | Very Fast | 9 |
| Symantec | Very Fast | 9 |
| Trend Micro | Fast | 7 |
| Trustport | Fast | 7 |
| Webroot | Very Fast | 9 |

### 3.5 Archiving and Unarchiving

Archives are commonly used for file storage, and the impact of Anti-Virus software on the time taken to create new archives or to unarchive files from existing archives may be to interest for most users. We archived a set of different file types which are widespread at home and office workstations from one physical hard disk to another physical hard disk and unzipped them after this again on a third physical hard disk. The results already consider the fingerprinting/optimization technologies of the Anti-Virus product, as most users usually make archives of files they have on their disk (Performance Test, 2011).

Table 3. Archiving and unarchiving speed a set of different file types which are widespread

| Anti-Virus | Score | Value |
|---|---|---|
| Avast | Very Fast | 9 |
| AVG | Very Fast | 9 |
| AVIRA | Very Fast | 9 |
| Bitdefender | Fast | 7 |
| eScan | Very Fast | 9 |
| ESET | Very Fast | 9 |
| F-Secure | Very Fast | 9 |
| G DATA | Fast | 7 |
| K7 | Very Fast | 9 |
| Kaspersky | Very Fast | 9 |
| McAfee | Very Fast | 9 |
| Microsoft | Very Fast | 9 |
| Panda | Very Fast | 9 |
| PC Tools | Slow | 3 |
| Qihoo | Fast | 7 |
| Sophos | Very Fast | 9 |
| Symantec | Very Fast | 9 |
| Trend Micro | Fast | 7 |
| Trustport | Mediocre | 5 |
| Webroot | Very Fast | 9 |

### 3.6. Encoding and Transcoding

Music files are often stored and converted on home systems, and converting such files takes system resources. Due that, many home users may be interested to know if their Anti-Virus product imposes a slowdown while converting multimedia files from one format to another. We encoded and transcoded some multimedia files with FFmpeg, and for the iPod conversion we used HnadBrakeCLI. The impact during FFmpeg and iPod converting was almost the same (Performance Test, 2011).

Table 4. Encoding and transcoding speed some multimedia files with FFmpeg and HnadBrakeCLI

| Anti-Virus | Score | Value |
|---|---|---|
| Avast | Very Fast | 9 |
| AVG | Very Fast | 9 |
| AVIRA | Very Fast | 9 |
| Bitdefender | Fast | 7 |

| | | |
|---|---|---|
| eScan | Fast | 7 |
| ESET | Very Fast | 9 |
| F-Secure | Very Fast | 9 |
| G DATA | Mediocre | 5 |
| K7 | Very Fast | 9 |
| Kaspersky | Very Fast | 9 |
| McAfee | Fast | 7 |
| Microsoft | Very Fast | 9 |
| Panda | Very Fast | 9 |
| PC Tools | Fast | 7 |
| Qihoo | Mediocre | 5 |
| Sophos | Very Fast | 9 |
| Symantec | Very Fast | 9 |
| Trend Micro | Fast | 7 |
| Trustport | Fast | 7 |
| Webroot | Very Fast | 9 |

### 3.7. Installing and Uninstalling Application

We installed several programs (Like Visual C++, .Net Framework, etc.) with MSI installers, and then uninstalled them and measured how long it took. We did not consider fingerprinting, because usually an application is only installed once (Performance Test, 2011).

Table 5. Anti-viruses speed in terms of affecting on installation and deletion of software

| Anti-Virus | Score | Value |
|---|---|---|
| Avast | Very Fast | 9 |
| AVG | Very Fast | 9 |
| AVIRA | Very Fast | 9 |
| Bitdefender | Fast | 7 |
| eScan | Fast | 7 |
| ESET | Very Fast | 9 |
| F-Secure | Very Fast | 9 |
| G DATA | Very Fast | 9 |
| K7 | Very Fast | 9 |
| Kaspersky | Very Fast | 9 |
| McAfee | Very Fast | 9 |
| Microsoft | Very Fast | 9 |
| Panda | Very Fast | 9 |
| PC Tools | Very Fast | 9 |
| Qihoo | Fast | 7 |
| Sophos | Very Fast | 9 |
| Symantec | Very Fast | 9 |
| Trend Micro | Very Fast | 9 |
| Trustport | Fast | 7 |
| Webroot | Very Fast | 9 |

### 3.8. Launching Application

Office document files are very common. We opened some large document files in Microsoft office and close it. Before each opening, the workstation was rebooted. The time taken for the viewer or edit application to open and a document to be displayed was measured. Although we list the result for the first opening and the subsequent openings, we consider the subsequent opening more important, as normally this operation is done several times by users, and optimization features of the Anti-Virus products take place, minimizing their impact on the system (Performance Test, 2010).

Table 6. Launching Application speed some multimedia files with FFmpeg and HnadBrakeCLI

| Anti-Virus | Score | Value |
|---|---|---|
| Avast | Very Fast | 9 |
| AVG | Very Fast | 9 |
| AVIRA | Very Fast | 9 |
| Bitdefender | Very Fast | 9 |
| eScan | Very Fast | 9 |
| ESET | Very Fast | 9 |
| F-Secure | Very Fast | 9 |
| G DATA | Very Fast | 9 |
| K7 | Very Fast | 9 |
| Kaspersky | Very Fast | 9 |
| McAfee | Very Fast | 9 |
| Microsoft | Very Fast | 9 |
| Panda | Very Fast | 9 |
| PC Tools | Very Fast | 9 |
| Qihoo | Fast | 7 |
| Sophos | Very Fast | 9 |
| Symantec | Very Fast | 9 |
| Trend Micro | Very Fast | 9 |
| Trustport | Fast | 7 |
| Webroot | Very Fast | 9 |

## 4. Research Findings

results of test have been collected based on detection and missed samples, false positive/Alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, install/uninstall application and launching application.

Table 7. Results of tests based on the studied criteria

| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 2.7 | 10 | 16.6 | 9 | 9 | 9 | 9 | 9 |
| A2 | 4.3 | 57 | 11.6 | 9 | 9 | 9 | 9 | 9 |
| A3 | 0.5 | 11 | 12.3 | 9 | 9 | 9 | 9 | 9 |
| A4 | 1.6 | 8 | 10.5 | 9 | 7 | 7 | 7 | 9 |
| A5 | 1.5 | 29 | 9.5 | 9 | 9 | 7 | 7 | 9 |
| A6 | 2.7 | 3 | 9.8 | 9 | 9 | 9 | 9 | 9 |
| A7 | 1.5 | 6 | 10.3 | 9 | 9 | 9 | 9 | 9 |
| A8 | 0.3 | 14 | 10.1 | 9 | 7 | 5 | 9 | 9 |
| A9 | 14.4 | 23 | 13.7 | 9 | 9 | 9 | 9 | 9 |
| A10 | 1.7 | 1 | 9.9 | 9 | 9 | 9 | 9 | 9 |
| A11 | 3.2 | 0 | 12.9 | 5 | 9 | 7 | 9 | 9 |
| A12 | 7.7 | 1 | 7.1 | 9 | 9 | 9 | 9 | 9 |
| A13 | 0.7 | 1 | 9.6 | 9 | 9 | 9 | 9 | 9 |
| A14 | 11.6 | 45 | 7.7 | 7 | 3 | 7 | 9 | 9 |
| A15 | 0.5 | 25 | 7.4 | 9 | 7 | 5 | 7 | 7 |
| A16 | 5.8 | 16 | 11.1 | 9 | 9 | 9 | 9 | 9 |
| A17 | 4.9 | 57 | 9.7 | 9 | 9 | 9 | 9 | 9 |
| A18 | 3.4 | 6 | 15.3 | 7 | 7 | 7 | 9 | 9 |
| A19 | 0.4 | 59 | 7.9 | 7 | 5 | 7 | 7 | 7 |
| A20 | 5.8 | 16 | 10.2 | 9 | 9 | 9 | 9 | 9 |

This decision making problem has 20 options and 8 criteria and the result of options assessment for detection and missed samples, false positive/Alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, install/uninstall application and launching application as well as result of scale-less matrix with respect to formula $X_{ij}$ are as follows and The scale for decision-making matrix norm method is used:

$$n_{ij} = \frac{X_{ij}}{\sqrt{\sum_{k=1}^{n} X_{kj}^2}}$$

Significance coefficients of these criteria by means of eigenvector are respectively as followings:

$W$ = [0.215, 0.215, 0.215, 0.071, 0.071, 0.071, 0.071, 0.071]

Calculate the weighted normalized decision matrix : $v_{ij} = w_j n_{ij}$ $i = 1,2,\ldots,20$ $j = 1,2,\ldots,8$

Determine the positive ideal solution $A^+$ and negative ideal solution $A^-$ as below**:**

For value C1 positive ideal $A^+$ = {0.0027} and negative ideal $A^-$ = {0.1309}

For value C2 positive ideal $A^+$ = {0.0000} and negative ideal $A^-$ = {0.1033}

For value C3 positive ideal $A^+$ = {0.0729} and negative ideal $A^-$ = {0.0311}

For value C4 positive ideal $A^+$ = {0.0166} and negative ideal $A^-$ = {0.0092}

For value C5 positive ideal $A^+$ = {0.0172} and negative ideal $A^-$ = {0.0057}

For value C6 positive ideal $A^+$ = {0.0176} and negative ideal $A^-$ = {0.0097}

For value C7 positive ideal $A^+$ = {0.0165} and negative ideal $A^-$ = {0.0128}

For value C8 positive ideal $A^+$ = {0.0161} and negative ideal $A^-$ = {0.0125}

$$\begin{pmatrix}
0.1142 & 0.0814 & 0.3393 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.1819 & 0.4642 & 0.2371 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0211 & 0.0895 & 0.2514 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0676 & 0.0651 & 0.2146 & 0.2348 & 0.1895 & 0.1929 & 0.1812 & 0.2281 \\
0.0634 & 0.2361 & 0.1942 & 0.2348 & 0.2436 & 0.1929 & 0.1812 & 0.2281 \\
0.1142 & 0.0244 & 0.2003 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0634 & 0.0488 & 0.2105 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0126 & 0.1140 & 0.2064 & 0.2348 & 0.1895 & 0.1378 & 0.2330 & 0.2281 \\
0.6092 & 0.1873 & 0.2800 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0719 & 0.0081 & 0.2023 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.1353 & 0 & 0.2637 & 0.1304 & 0.2436 & 0.1929 & 0.2330 & 0.2281 \\
0.3258 & 0.0081 & 0.1451 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.0296 & 0.0081 & 0.1962 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.4908 & 0.3664 & 0.1574 & 0.1826 & 0.0812 & 0.1929 & 0.2330 & 0.2281 \\
0.0211 & 0.2036 & 0.1512 & 0.2348 & 0.1895 & 0.1378 & 0.1812 & 0.1774 \\
0.2454 & 0.1303 & 0.2269 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.2073 & 0.4642 & 0.1983 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281 \\
0.1438 & 0.0488 & 0.3127 & 0.1826 & 0.1895 & 0.1929 & 0.2330 & 0.2281 \\
0.0169 & 0.4805 & 0.1615 & 0.1826 & 0.1353 & 0.1929 & 0.1812 & 0.1774 \\
0.2454 & 0.1303 & 0.2085 & 0.2348 & 0.2436 & 0.2480 & 0.2330 & 0.2281
\end{pmatrix}$$

The separation of each alternative from the positive ideal solution ($A^+$) and the negative ideal solution ($A^-$) are given as below:

$$D_i^+ = \sqrt{\sum_{j=1}^{m} \left(v_{ij} - v_j^+\right)^2}$$

$$D_i^- = \sqrt{\sum_{j=1}^{m} \left(v_{ij} - v_j^-\right)^2}$$

Table 8. Results of $D_i^+$ and $D_i^-$

| $D_i^+$ | Score | $D_i^-$ | Score |
|---|---|---|---|
| $D_1^+$ | 0.0298 | $D_1^-$ | 0.1439 |
| $D_2^+$ | 0.1093 | $D_2^-$ | 0.0954 |
| $D_3^+$ | 0.0272 | $D_3^-$ | 0.1544 |
| $D_4^+$ | 0.034 | $D_4^-$ | 0.1479 |
| $D_5^+$ | 0.0612 | $D_5^-$ | 0.1298 |
| $D_6^+$ | 0.0388 | $D_6^-$ | 0.1461 |
| $D_7^+$ | 0.0324 | $D_7^-$ | 0.1511 |
| $D_8^+$ | 0.0387 | $D_8^-$ | 0.1515 |
| $D_9^+$ | 0.1372 | $D_9^-$ | 0.0714 |
| $D_{10}^+$ | 0.0331 | $D_{10}^-$ | 0.1552 |
| $D_{11}^+$ | 0.0341 | $D_{11}^-$ | 0.1478 |
| $D_{12}^+$ | 0.0812 | $D_{12}^-$ | 0.1196 |
| $D_{13}^+$ | 0.0314 | $D_{13}^-$ | 0.162 |
| $D_{14}^+$ | 0.1376 | $D_{14}^-$ | 0.0362 |
| $D_{15}^+$ | 0.0605 | $D_{15}^-$ | 0.1401 |
| $D_{61}^+$ | 0.0641 | $D_{61}^-$ | 0.1112 |
| $D_{17}^+$ | 0.1132 | $D_{17}^-$ | 0.0888 |
| $D_{18}^+$ | 0.0335 | $D_{18}^-$ | 0.1415 |
| $D_{19}^+$ | 0.1107 | $D_{19}^-$ | 0.1275 |
| $D_{20}^+$ | 0.0657 | $D_{20}^-$ | 0.1106 |

Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative $A_i$ with respect to $A^+$ is defined as:

$$RC_i = \frac{D_i^+}{D_i^+ + D_i^-}$$

**Table** 8. Results of $RC_i$

| $RC_i$ | *Score* |
|---|---|
| $RC_1$ | 0.8280 |
| $RC_2$ | 0.4661 |
| $RC_3$ | 0.8499 |
| $RC_4$ | 0.8128 |
| $RC_5$ | 0.6794 |
| $RC_6$ | 0.7900 |
| $RC_7$ | 0.8231 |
| $RC_8$ | 0.7963 |
| $RC_9$ | 0.3423 |
| $RC_{10}$ | 0.8242 |
| $RC_{11}$ | 0.8125 |
| $RC_{12}$ | 0.5954 |
| $RC_{13}$ | 0.8375 |
| $RC_{14}$ | 0.2084 |
| $RC_{15}$ | 0.6984 |
| $RC_{16}$ | 0.6343 |
| $RC_{17}$ | 0.4396 |
| $RC_{18}$ | 0.8085 |
| $RC_{19}$ | 0.5352 |
| $RC_{20}$ | 0.6273 |

## 5. Conclusion

The smaller the value of $RC_i$ , the nearer it is close to the ideal solution. Therefore, A3 is the best alternative, and A14 is the worst alternative. In this assessment, option A14 i.e. PC Tools Spyware Doctor with Antivirus 2012 is the worst antivirus and As a result, Option A3 i.e. AVIRA Free Antivirus 2012 will be the best option. This Model according to the mentioned conditions is able to do the ranking repeatedly by updating number of antivirus and their criteria**.**

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09/04/2012

# Evaluation the rule of NSAIDs in the creation and worsening of the upper gastrointestinal bleeding

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**Abstract:** Upper gastrointestinal bleeding (UGIB) is a life threatening problem worldwide. It is mentioned that using various drugs such as non steroidal anti inflammatory drugs (NSAIDs), antiplatelets and anticoagulants has higher bleeding risk in these patients. The aim of current study is to evaluate the role of NSAIDs, antiplatelets and anticoagulants in severity of UGIB. Eighty patients (52.5% male and 47.5% female with mean age of 52.90±20.35 years) with the history of NSAIDs use admitted with the diagnosis of UGIB in 2010 in gastroenterology Ward, Imam Reza hospital were studied. Patients' demographic findings, history of antiplatelets and anticoagulants use, endoscopic findings and patients' outcome were recorded. The most common referral cause was hematemesis (62.5%) and blood in gastric wash was observed in 22.5%. among patients, 67.5% used only one and 32.5% used multiple NSAIDs. Antiplatelets and anticoagulants were used along with NSAIDs in 35% and 30%, respectively. Ulcer was the commonest finding in endoscopy (77.5%). In 47.5% of cases, transfusion was needed and 17.5% had surgery. Hematemesis (p=0.003), hematochezia (p=0.03) and surgery (p=0.001) in patients with multiple NSAIDs use and blood and coffee-ground (p=0.001), unstable hemodynamic (p=0.02) and need for transfusion in patients with one NSAIDs use was significantly higher. Unstable hemodynamic was the only significantly difference between patients with use of only NSAIDs and NSAIDs and antiplatelets and/or anticoagulants (p=0.01). Patients with NSAIDs use would have severe symptoms if UGIB happens, especially in case of multiple NSAIDs use, there is the probability of uncontrollable bleeding and need for more aggressive treatments. Antiplatelets and anticoagulants use with NSAIDs increase the risk of severe clinical symptoms in UGIB.

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**Keywords:** Bleeding; Upper gastrointestinal tract; NSAIDs, antiplatelet agents, anticoagulation agent

## 1. Introduction

Upper gastrointestinal bleeding (UGIB) is an obvious and potential life threatening problem in all over the world. Despite advances in diagnosis and treatment, the mortality rate has remained steady (1). Upper gastrointestinal bleeding is about 4 times more common in comparison with bleeding in lower gastrointestinal. Upper gastrointestinal bleeding is one of the common disease and with the prevalence about 102 to 150 hospitalized person in year courses disability and heavy costs for treatment (2, 3).

Upper gastrointestinal bleeding may be due to different cases: Information from Saudi Arabia, Kuwait, Jordan, Greece and Iran, named two major causes of UGIB, peptic ulcer and esophageal varices. And use of NSAIDs and chronic infection with Helicobacter pylori were two major predisposing factors (4-8). Increasing life expectancy in developing countries leads to increased incidence of joint disorders which is along with increases in prescription of NSAID medicines (9). Although NSAIDs are effective, but using these medicines is along with several unpleasant reactions in different organs. Gastrointestinal complications are the most common type of these reactions and are along with dyspepsia, heartburn and gastric discomfort with the more severe events such as peptic ulcer with bleeding and perforation threatening complications (10, 11). Using these medicines increases the risk of bleeding and gastrointestinal complications compared to normal individuals (12, 13). It has been observed that using anti-coagulant and anti-platelet medicines was along with increases in the rate of UGIB. Gastrointestinal system is the most common place which patients have gastrointestinal bleeding because of taking edible anticoagulants (14). The number of UGIB patients who refer while taking warfarin, due to the increasing indications of anticoagulant medicines use, is increasing (15). Patients with artificial heart valves, attack or chronic atrial fibrillation, recurrent DVT, coagulation diseases and vascular diseases usually use anticoagulants for long term and they are at high risk of bleeding. Despite progresses in controlling gastrointestinal bleeding in these patients, extensive bleeding usually occurs in 20% of these patients (15-19). Considering contents, it is obvious that different factors put patients at the risk of gastrointestinal bleeding. This study is to evaluate the rule of anti-clotting, anti-platelet medicines and NSAIDs in causing and aggravation of upper gastrointestinal bleeding.

## 2. Materials and Methods

Study type is descriptive – sectional. In this of study, 80 patients diagnosed with upper gastrointestinal bleeding who were hospitalized in digestive section of Iran hospitals, were studied.

- *Inclusion criteria to study were as follows:*

1) Bleeding should only be of upper gastrointestinal.
2) Age should be over 14 years.
3) Patients with upper endoscopy and diagnosis of UGIB.
- *Exclusion criteria from the study were as follows:*
1) bleeding from the respiratory system (hemoptysis)
2) bleeding from the nasopharynx
3) lower gastrointestinal system's bleeding
4) gastrointestinal bleeding from unknown origin
5) upper gastrointestinal cancer
During the study, all patients' information, who were hospitalized with the diagnosis of upper gastrointestinal bleeding was evaluated using the clinical files of patients.
- *Variables which were studied are as follow:*
• Age, sex, main reason for referring, NGT status, Haemodynamic, The history of taking NSAID, anticoagulants or antiplatelets, Endoscopy diagnosis, The rate of blood transfusion, Duration of hospitalization, Type of operation, the existence or non-occurrence of death
- *Ethical considerations:*
All patients' information were obtained from clinical files. All patients' information was strictly confidential and we will not mention about it anywhere. All diagnostic and therapeutic procedures were in the course of the disease and no additional costs were imposed to the patients.

**3. Statistical analysis**
All data were analyzed using statistical software SPSS16. Descriptive statistics methods (frequencies, percentages) were used for statistical evaluation. For comparing qualitative results the statistical test (Chi Square) was used. Less than 0.05 P value was considered significant in this study.

**4. Results**
200 patients with upper gastrointestinal bleeding with a history of using NSAIDs we examined.

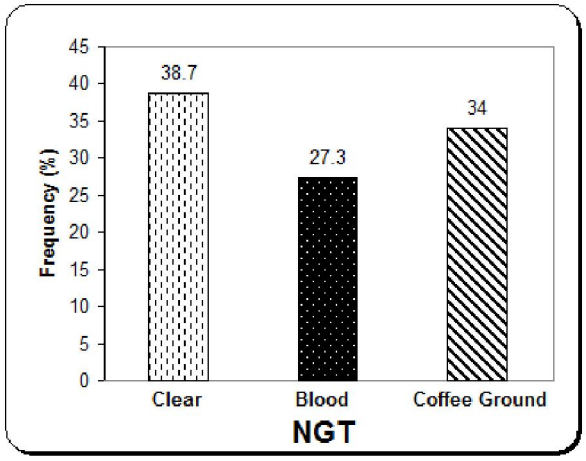


Figure 1. Status of NGT in patients. Results expressed as Frequency.

- *Demographic findings:*
Mean age of patients was 44.67 ± 13.21 years old with a median of 45 years. It is observed that most male patients with UGIB are slightly larger.
- *Reason for referring:*
In 125 cases (62.5%) Hematemesis, in 70 cases (35%) Melena, and in 60 cases (30%) was Hematochezia. In some cases, patients simultaneously had two complaints.
- *Status of NGT:*
Figure 1 shows NGT Status of the patients. As it can be seen, clear blood was founded only in 38.7 % of patients. Blood is mostly clear or sufficient ground.
- *Haemodynamic status:*
Figure 2 shows the haemodynamic status of patients. As it can be seen half of the patients had haemodynamic instability that in two cases (3.2%) patients were in shock.

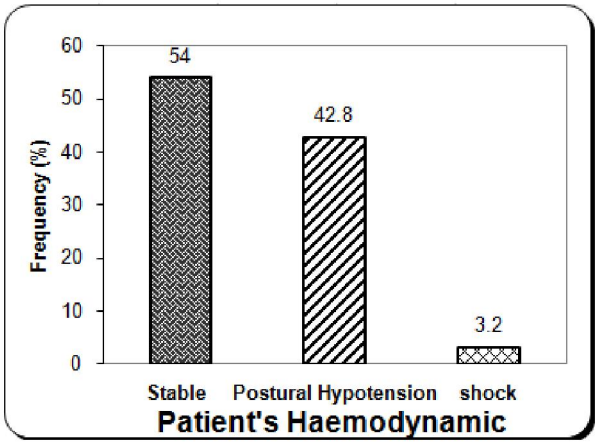


Figure 2. haemodynamic status of patients. Results expressed as Frequency.

As seen in the figure, Most patients at the time of entry into the department in terms of hemodynamic were stable or had conditional hypotension.
- *Medical history:*
In 135 cases (67.5%) patients were using on NSAIDs medicines and in 65 cases (32.5%) patients were using two or more NSAIDs medicines. Anti-platelet medicines in 70 cases (35%) and anticoagulation medicines in 60 cases (30%) of patients were simultaneously taking with NSAIDs.
- *Endoscopic findings:*
In 165 cases (82/5%) of patients Ulcer was identified that in 65 cases (32.5%) it was gastric ulcer, in 40 cases (20%) it was duodenal ulcer and in 50 cases (25%) it was esophageal oesophagitis = erosions.
In 45 cases (22.5%) erosive lesions in the stomach (gastritis erosive) existed. In 40 cases (20%) other findings were led to bleeding. Also in 20 cases (10%) it was esophageal varices and in 5 cases (2.5%) it was Mallory–Weiss. Different findings were observed simultaneously in some patients.
- *Blood transfusion:*

In 95 cases (47.5%) blood transfusions was required.

Mean received blood levels was 3.22 ± 0.31 units with the median of 2 units. The lowest and highest received blood were respectively 1 and 9 units. In 20 cases (10%), FFP was received that the average receive of FFP was 4.82 ± 3.65 units with the median of 2 units.

- *Average duration of hospitalization:*

Average duration of hospitalization was 7 ±3.34 with the median of 5 days. Minimum and maximum duration of hospitalization was respectively 2 and 15 days.

- *Surgery:*

In 35 cases (17.5%) of patients surgery was required because there was extensive bleeding.

- *Mortality:*

In this study 6 cases (3%), mortality was observed. Different findings among the consumption of one or more NSAIDs were compared.

Figure 3 shows the frequency of Hematemesis among two groups. As it can be seen in patients who were taking a few NSAIDs simultaneously, Hematemesis rate is markedly higher (p=0.003). Melena was in 55 cases (27.5%) who were taking one NSAIDs and 23 cases (11.5%) who were taking several types of NSAIDs. The difference between two groups was not statistically significant (p=0.23). Hematochezia was also seen in 27 cases (13.5%) of patients who were taking one type of NSAIDs and in 36 cases (18%) of patients who were taking several types of NSAIDs. Hematochezia is markedly more in patients who are taking several types of NSAIDs. (p=0.037).

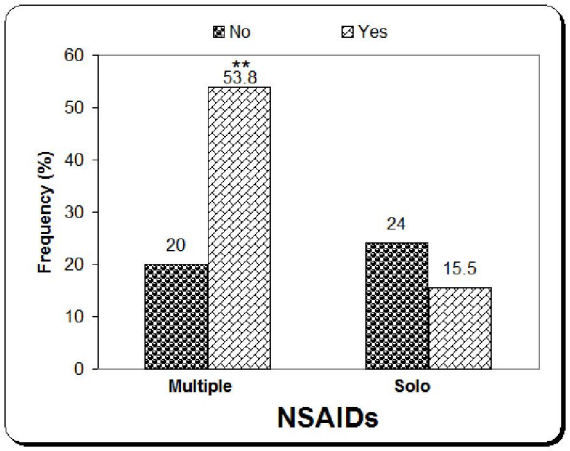


Figure 3. Frequency of Hematemesis among two groups. Hematemesis statistics is greater in the patients who are taking more than one type of NSAIDs. Results expressed as Frequency. **p<0.01

Figure 4 shows the results of NGT in two groups. As it can be seen clear and Grande adequate bleeding in NSAIDs user cases is more (p=0.001). From the standpoint of Haemodynamic in groups who were using one or several types of NSAIDs, stable condition , respectively was found in 35 cases (38.4%) and 16 cases (61.5%), orthostatic hypotension respectively was found in 75 cases (55.6%) and 20 cases (30.8%) and shock was found in 5 cases (14.3%). There were significant differences between two groups (p=0.02). In the group who were taking one type of NSAIDs, peptic ulcer in 14 cases (29.2%) and duodenum in 35 cases (29.2%) and esophageal erosions in 50 cases (41.7%) was found. What were mentioned above, in the group who were taking several types of NSAIDs, were respectively 30 cases (85.7%), 5 cases (14/3%) and 0. It is observed, in patients who were taking several types of NSAIDs, gastric ulcer was markedly more common (p=0/001). Erosive lesions was in 20 cases (14.8%) of patients who were taking one type of NSAIDs and 25 cases (38.5%) of patients who were taking several type of NSAIDs. The difference between two groups was not significant in this case (p=0.027).

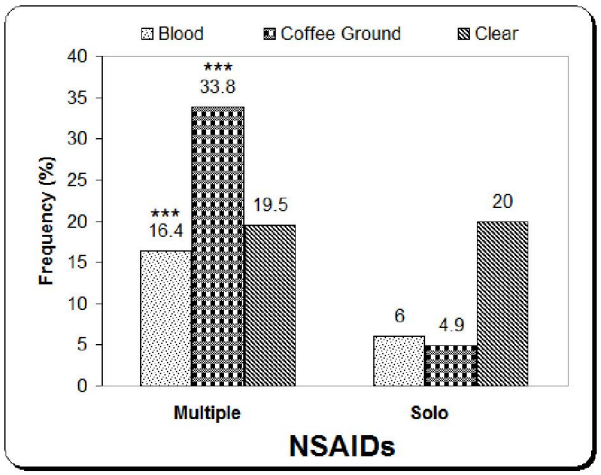


Figure 4. Results of NGT in two groups. Results expressed as Frequency. ***p<0.001.

Figure 5 shows the need for blood in two groups of patients who were taking one or several type of NSAIDs. Significantly, Patients who were taking on type of NSAIDs need to receive more blood. (p=0.005). Require for Transfusion is more in patients who were taking several types of NSAIDs.

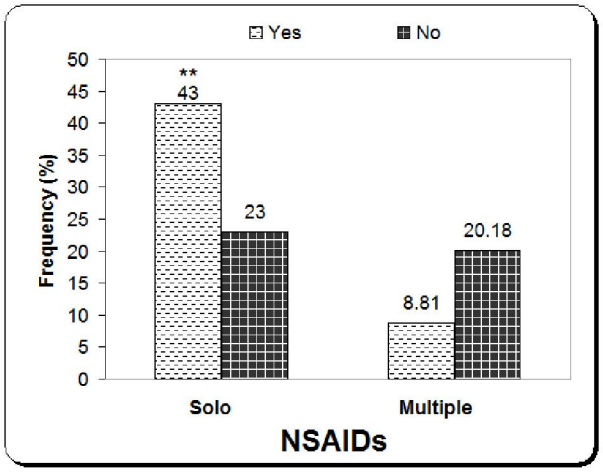


Figure 5. The need for blood Transfusion in two groups of patients who were taking one or several type of NSAIDs. Results expressed as Frequency. **p<0.01

Figure 6 shows the rate of need for surgery in patients who were taking one or several types of NSAIDs.

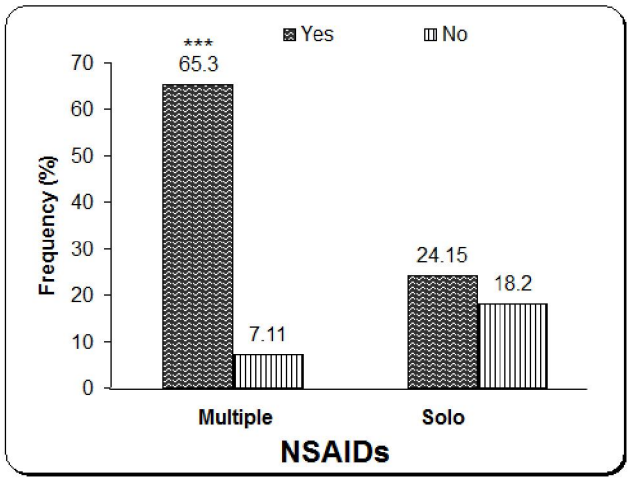


Figure 6. Rate of need for surgery in patients who were taking one or several types of NSAIDs

As it can be seen in the diagram, the need for surgery in patients who were taking several type of NSAIDs, was significantly more because of the lack of bleeding control and patients inadequate haemodynamic status (p=0.002). Hospitalization duration, for patients who were taking one type of NSAIDs was 5.23±2.89 and for patients who were taking several types of NSAIDs was 6.21±4.19. It can be seen that patients who were taking several types of NSAIDs had longer hospital stay due to the severity of symptoms, however the difference between two groups is not statistically significant (p=0.22).

In 110 cases (55%), patients were taking only NSAIDs medicine category (first group) and in 90 cases (45%) patients were taking NSAIDs with anticoagulants or anti-platelet medicines (second group). Results between these two groups were also compared. 50 cases (55.6%) of patients in first group and 75 cases (68.2%) of patients in second group had Hematemesis. There was no significant difference between the two groups in this case. (p=0.34). Need for surgery in patients who were taking several types of NSAIDs is more. Melena in first and second group respectively was in 35 cases (38.9%) and 35 cases (31.8%) patients. There was no significant difference between the two groups (p=0.65). Hematochezia in first and second group respectively was in 35 cases (38.9%) and 25 cases (22.7%). In this case also, there was no significant difference between the two groups (p=0.27).

In NGT findings, in the first group, bright blood was in 9 cases (11.7%), coffee ground was in 23 cases (42.4%), and clear blood without any specific findings was in 37 cases (39.1%) of patients. What were mentioned above, in the second group were respectively, 30 cases (27.3%), 35 cases (31.8%) and 45 cases (40.9%). It can be seen that active bleeding in patients who take several medicines is more, however there is no significant difference in this case (p=0.39). Stable haemodynamic status in first and second group was respectively in 30 cases (33.3%) and 70 cases (63.6%) of patients, orthostatic hypotension, was respectively in 55 cases (61.1%) and 45 cases (36.4%) of patients and shock respectively was in 5 cases (5.6%) and 0 cases. Markedly, the rate of unstable haemodynamic was higher in the cases who used only NSAIDs (p=0.01).

The need for blood transfusions in first group was in 40 cases (44.4%) and in second group was in 55 cases (50%) of patients. It can be seen that the rate of need for blood transfusions in the group who is treated with several groups of medicines is higher. However, the difference between groups was not significant (p=0.65). Surgery was needed in the first and second group respectively in 10 cases (11.1%) and 25 cases (22.7%) of patients. It can be seen that in this case, the need of surgery, for the group who is treated whit several groups of medicines is more. Although this difference was not statistically significant (p=0.24). The mean hospital stay in first group was 6.41 ±1.72 and in the second group was 4.11 ±1.29.

The difference between the two groups was not statistically significant (p=0.43). Between patients with and without anti-platelet consumption, need for blood respectively was in 14 cases (50%) and 24 cases (46.2%). There was no significant difference in this case (p=0.54). Surgery in cases with and without anti-platelet consumption respectively was needed in 20 cases (28.6%) and 15 cases (11.5%). There was also no significant difference in this case (p=0.06). The need for blood products in patients who with and without anticoagulation consumption respectively was found in 35 (58.3%) and 60 (42.9%) cases of patients. There was no statistically significant difference between the two groups (p=0.41). The need for surgery in patients who with and without anticoagulation consumption respectively was found in 5 (8.3%) and 30 (21.4%) cases of patients. There was no statistically significant difference between the two groups (p=0.2). Due to low mortality (10 cases, 10%) evaluating the rule of NSAIDs, statistically was not possible. It is hoped in future joint this issue should be discussed.

## 5. Discussion

Upper gastrointestinal bleeding (UGIB) is an obvious potentially life threatening problem all over the world. Despite advances in diagnosis and treatment, the mortality rate has remained steady (1). Anticoagulation treatment creates problems in managing the gastrointestinal bleeding. The most important site with obvious bleeding in patients who received edible anticoagulation therapy is the gastrointestinal system (14). One-fourth to one –third population over 65 years, use anticoagulant medicines. In clinical trials these medicines were along with increased risk of UGIB. It is surprising that, very little is known about the epidemiology poisoning effect of these medicines and bleeding. Except for low dose aspirin, there is very rare information about risks along with non salicylates medicines and its interaction with other danger factors. In contrast, prevention of UGIB in patients who use anti-

platelet medicines is only evaluated for high risk patients, like patients who have a history of UGIB (29, 30). While the information is not available in other groups which are at risk. It has been clearly shown that Aspirin and NSAIDs increase the risk of upper gastrointestinal bleeding (20). In fact, because the upper gastrointestinal bleeding is common, it seems that it's the most important and serious complication, about using this class of medicines (21). Use of these medicines increases the bleeding risk and gastrointestinal complication, 3 to 5 time more than common individuals (12, 13). Anti platelet therapy is effective in reducing the incidence of cerebral vascular accidents, myocardial infarction and death because of cardiovascular reasons in patients with symptomatic Atrothrombotic diseases (31). As described previously, the simultaneous use of NSAIDs and anticoagulation medicines is along with increases risk of UGIB (32). In patients treated with anti platelet, use of NSAIDs should be avoided when it is possible. In few patients who really need to use these group of medicines, concurrent use of PPl can reduce the risk of UGIB. In the current study we investigated the upper gastrointestinal bleeding cases, in patients with the history of taking NSAIDs. It was observed that major bleeding was accrued in the consumption of one type of NSAIDs. And in cases which used one type of unstable haemodynamic NSAIDs, need for blood transfusion was more. However the lack of proper endoscopic control and surgery was more while using several types of NSAIDs. In this study, patients were 58.7% male, 41.3% female with the mean age 44.67 ±13.21 years old. In Marco and his colleagues study male to female ratio also was higher and the mean age was 71.5 ± 13.8 years old (28). In the present study, the most common reason to refer was Hematemesis and bright blood was observed in 27.3% cases of stomach washing. The most common findings were about ulcer endoscopic (77.5%), particularly peptic ulcer. In 47.5 % of patients blood transfusions was required and 17.5% had surgery. In Elghuel's study also peptic ulcer (37.1%) was the most common causes of UGIB (26), however, unlike the present study; duodenal ulcer was the most common type. Several factors increase the risk of gastrointestinal complications of using NSAIDs such as aspirin. These factors include the history of gastric ulcer or Gastrointestinal complications, older age, congestive heart disease and the treatment simultaneously with anticoagulants or corticosteroids (22, 23). Among these factors, the history of gastrointestinal bleeding with high risk for recurrent bleeding is there for NSAIDs users (22, 24). Concurrent use of NSAIDs and anticoagulant medicines was along with increased risk of UGIB (32). Ibanez and colleagues estimated the risk of UGIB which is related to anti-platelet medicines and the risk score for UGIB occurrence for Aspirin was 4, for Clopidogrel was 2.3, for Amvl Dypyryd was 0.9, for Ticlopidine was 3.1 and for Flvsal was 1.6. Concurrent use of proton pump inhibitors reduced all of the risks. Anti-platelet medicines were responsible for 14.5% of UGIBs (33).García Rodríguez and Jick also observed during one study that the risk of bleeding in patients treated with NSAIDs, who concurrently used anticoagulants or corticosteroids, is more (25). In Thomopoulos and colleagues study, major of patients who used NSAIDs and anticoagulants simultaneously (74.3%), had peptic ulcer as the cause of bleeding (38). In the present study anti-platelet medicines in 35% and anticoagulant medicines in 30% were used simultaneously with NSAIDs. In Marco and his colleagues' study, of the causes of bleeding in patients treated with NSAIDs in 16.7%, it was because of using other medicines simultaneously (28). But in Laszlo and colleagues study there was no difference between users and non users in the clinical presentation, location of bleeding or frequency of symptoms. 40% in each group did not have any symptoms before the onset of bleeding. Blood receive rate in patients who received NSAIDs was slightly higher. There was no difference in terms of frequency of surgical intervention (27). In this study, also the only significant difference between two groups was in taking NSAIDs alone or in combination with anticoagulants and / or unstable homodynamic anti-platelet which was more in first group. However, in present study, despite observed aggravation of bleeding and its complications, there was no significant statistically difference between anticoagulant consumers and non consumers and anti-platelet consumers and non consumers in term of need for blood and surgery. (Probably it was due to low number of patients or because medical center is referral). In the present study it was observed that Hematemesis, Hematochezia and surgery were markedly more in patients who used several types of NSAIDs and bright bleeding, coffee ground, unstable homodynamic and need for blood were markedly more in patients who used one type of NSAIDs.

## 6. Conclusion

Patients who took NSAIDs had more severe symptoms of bleeding and particularly in patients who took several types of NSAIDs simultaneously, the possibility of uncontrollable bleeding and need for more invasive treatment measures were more. Using Anti-platelet and anticoagulation simultaneously with NSAIDs did not increase the risk of severe symptoms.

## 7. Suggestions

The results of this study demonstrated that, patients who are taking NSAIDs are in a high risk of complications and problems of gastrointestinal bleeding. Particularly in cases who are taking several types of NSAIDs simultaneously. It is recommended to inhibit patients, taking NSAIDs medicines as possible, particularly several types of NSAIDs simultaneously and it should be prescribed only for cases with indication. It was also observed that patients who were taking Anti-platelet and/or anticoagulation had some difference with patients who didn't take it but the difference was not statistically significant. However to confirm the findings, it is recommended to do another study with larger sample size and considering the control group included patients with

UGIB, without taking NSAIDs and anti-platelet and anticoagulant for better and more accurate results.

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# Synthesis and novel chemical reaction for a new class of 3-(1', 2'-dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline series "*C*-nucleosides" as antiviral agents

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**Abstract:** Numerous acyclic-*C*-nucleosides showed efficacy antiviral activities. In this work we prepared and checked the anti-hepatitis B activity of two new class of pyrazolo [3, 4-b] quinoxaline-*C*-nucleosides typically 3-(1', 2'-dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline and 3-(1`, 2`, 3`-trihydroxyprop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline. The later prepared using one-pot reaction between *O*-phenylenediamine, aldo or keto hexoses or pentoses, and phenyl hydrazine hydrochloride, it prepared using two other methods to prove the mechanism of the one-pot reaction. 3-(1', 2'-dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline reacted with thionyl chloride, to produce novel class of mono halogenated sulfite dimer using Y. Fakhreldin reaction. The novel reaction can conclude as follow (1`, 2` dihydroxyeth-1`-yl) -*C*-nucleosides react with thionyl chloride to produce {1' Deoxy, 2' Chloro eth-1'-yl) -*C*-nucleoside} {(1"deoxy, 2"-hydroxy eth-1"-yl) -*C*-nucleoside} 1', 1" Sulfite. Some of the *C*-nucleosides synthesized, showed promising Anti-hepatitis B activity.
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**Keywords:** phenylpyrazolo [3, 4-b] quinoxaline, Fakhreldin, c-nucleosides.

## 1. Introduction

*C*-Nucleoside is a group of *C*-glycosylated hetero cycles in which the anomeric carbon attached to the hetero cycle by a carbon-carbon bond. This linkage is more durable towards hydrolytic and enzymatic reagents than the carbon-nitrogen bond of *N*-nucleosides, which makes *C*-nucleosides powerful tools for biochemical investigations and antimitotic or antiviral research[1]. Few members of this class of naturally occurring compounds such as showdomycin, formycin, and oxazinomycin possess diverse biological properties that are in several instances, of medical significance. The frequently fundamental biological properties of these substances have made them attractive targets for chemical synthesis, but as yet this has proved to be a more formidable task than the preparation of *N*-nucleosides. [2, 3]

## 2. Results and discussion

In this work 3(D-erythro-1`, 2`, 3`-trihydroxyprop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline **2**$_{a\ c}$ prepared using the following three methods:

- Method 1: Condensing D- Gulose, or D-mannose, or D-Glucose [4, 5], or D-altrose or D-fructose, *O*-phenylenediamine, and phenyl hydrazine hydrochloride.
- Method 2: Dehydrative cyclization of D-glucosazone with *O*-phenylenediamine.
- Method 3: Action of phenyl hydrazine hydrochloride on 2 (1`, 2`, 3`, 4` tetrahydroxybut-1`-yl) quinoxaline **1**.

Preparing **2**$_{a\ c}$ using method 1 and 2 prove that the configuration of the hydroxide group at C1'-3' of either the aldoses or ketoses does not affect the pyrazolo[3, 4-b]quinoxaline ring formation, and Osazone can be the intermediate compound in the one-pot reaction. Preparing **2**$_{a\ c}$ using method 3 proves the cyclization. The course of the reaction based on the founding from preparing **2**$_{a\ c}$ using methods 1, 2, and 3demonstrate in scheme (1). D-galactose condensed with *O*-phenylenediamine, and phenyl hydrazine hydrochloride in one-pot reaction to form 3-(D-threo 1`, 2`, 3`-trihydroxyprop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline **3**$_{a\ c}$.

One-pot reaction between D-xylose or D ribose or D-arabinose, *O*-phenylenediamine, and phenyl hydrazine hydrochloride afforded 3-(D- 1`, 2` dihydroxyeth-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline **4**$_{a\ c}$. Synthesis of 3-(L-1`, 2`-dihydroxyeth-1`-yl) pyrazolo [3, 4-b]quinoxaline accomplished by the one-pot reaction between L-arabinose with *O*-phenylenediamine and phenyl hydrazine hydrochloride.

4, 5-Dimethyl-*O*-phenylenediamine reacted with sugar and phenyl hydrazine hydrochloride in one-pot reaction to produce the corresponding 6, 7-

dimethyl pyrazolo [3, 4-b] quinoxaline-*C*-nucleosides **2**$_{b\ c}$, **3**$_{b\ c}$, **4**$_{b\ c}$ and **5**$_{b\ c}$. To facilitate interpretation of the spectral data, the synthesized compounds **2**$_{b\ c}$, **3**$_{b\ c}$, **4**$_{b\ c}$ and **5**$_{b\ c}$ acetylated using acetic anhydride in pyridine to give the corresponding crystalline acetyl derivatives **2**$_{b\ d}$, **3**$_{b\ d}$, **4**$_{b\ d}$, and **5**$_{b\ d}$.

**Y. Fakhreldin Reaction:** Yasser Elmoghazy Fakhreldin et al. discovered that (1`, 2` dihydroxyeth-1`-yl) -*C*-nucleosides react with thionyl chloride to produce {1' Deoxy, 2' Chloro eth-1'-yl) -*C*-nucleoside} {(1"deoxy, 2"-hydroxy eth-1"-yl) -*C*-nucleoside} 1', 1" Sulfite.

Compound **4**$_{a\ c}$ treated with thionyl chloride to produce {3-(1' Deoxy, 2' Chloro eth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline} {3 (1"deoxy, 2"-hydroxy eth-1"-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline} 1', 1" Sulfite **6**. $^1$H NMR spectrum of **6** showed duplication of the pyrazolo [3, 4-b] quinoxaline moiety. Compound **6** mass spectra showed the molecular ion peak at m/z = 676 and the elemental analysis indicated its formula $C_{34}$ $H_{25}$ $N_8$ $O_4$ Cl S. Compound **6** treated with morpholine as a nucleophile and resulted in the cleavage of the molecule into the compounds **4**$_{ac}$ and **7**. The $^1$HNMR spectra of **7** showed the appearance of morpholine protons. Compound **7** mass spectra showed the molecular ion peak at m/z = 375 and the elemental analysis indicated its formula $C_{21}H_{21}N_5O_2$.

**Anti-hepatitis B virus activity of the prepared compounds**

The hepato plasma cell line Hep. G2-2. 2.15 were used to evaluate the antiviral effect of the tested compounds against HBV[7]. The cells were incubated in growth medium (RPMI-1640, 10% heat-inactivated fetal calf serum (FCS) and antibiotic) at 37°C, 5% $CO_2$ with and without tested compound. Quantitation of HBV-DNA performed using a semi-quantitative PCR followed by DIG PCR ELISA[8]. The cytotoxic effect of the compounds assessed by culturing the hep. G2-2. 2.15 cells in the presence of compounds as for the antiviral assay; the viability of the cell were analyzed using a MTT-assay. Compound **3**$_{a\ c}$ showed moderate inhibition of viral replication and slight cytotoxic effect. Compounds **2**$_{a\ c}$ and **4**$_{a\ c}$ showed almost no effect on viral replication, while compounds **5**$_{a\ c}$, **2**$_{b\ c}$, **3**$_{b\ c}$, **4**$_{b\ c}$, **2**$_{b\ d}$ and **5**$_{b\ c}$ were highly toxic. Compounds **2**$_{a\ d}$, **3**$_{a\ d}$, **4**$_{a\ d}$, **5**$_{a\ d}$, and **5**$_{b\ d}$ were moderately cytotoxic. It observed that the presence of the 6, 7-dimethyl groups in the 1-phenylpyrazolo [3, 4-b] quinoxaline moiety afforded a highly cytotoxic effect.

## 3. Experimental

Melting points are uncorrected and were taken on Electro thermal 9100 apparatus. IR spectra were recorded on Carl Zeise spectrophotometer model "UR 10" using KBr. $^1$HNMR determined on Jeol 270 MHz using tetramethylsilane as an internal standard. Mass spectrum (MS) were recorded on Finigan SSQ 7000 mass spectrometer. Microanalysis performed by the Central Service Laboratory at University of Cairo.

*General methods for synthesis of 1-phenylpyrazolo [3, 4-b] quinoxaline-C-nucleosides*

*Method 1:* Add *O*-phenylenediamine (0.01 mol), phenylhydrazine hydrochloride (0.05mol), 3 ml glacial acetic acid and 0.5 g of sodium acetate to sugar solution (0.01 mol in 100 ml water). Heat the reaction mixture at 100 °C for 6-8 hours, and then cool to 20 °C. Wash the produce precipitate with water and 30% ethanol and recrystallize it from ethanol.

*Method 2:* Add *O*-phenylenediamine (0.01 mol), phenyl hydrazine hydrochloride (0.02 mol), 1 ml glacial acetic acid, and 0.1 g of sodium acetate to a solution of osazone (0.01mol in 60 ml water). Heat the reaction mixture at 100 °C for 4-6 hours, and then cool to 20°C. Wash the precipitate with water and 30% ethanol recrystallize it from ethanol.

*Method 3:* Add phenyl hydrazine hydrochloride (0.03 mol), 2 ml glacial acetic acid and 0.1 g sodium acetate to a solution of 2 (D-ribo1`,2`,3`,4` tetrahydroxytetr-1`-yl) quinoxaline (0.01mol in 60 ml water). Heat the reaction mixture at 100°C for 5 hours then cool to 20°C. Wash the produce precipitate with water and 30% ethanol recrystallize it from ethanol.

*3-(D-erythro 1`, 2`, 3`trihydroxy prop-1`-yl)-1-phenyl pyrazolo [3, 4-b] quinoxaline* **2**$_{a\ c}$

2$_{a\ c}$ prepared using D- Gulose, D-mannose, D-Glucose, D-altrose or D-fructose in method 1 and using glucosazone in method 2. It also prepared using and 2 (D-ribo1`, 2`, 3`, 4` tetrahydroxy tetr-1`-yl) quinoxaline[6] in method 3. Products from methods 1, 2, and 3 compared using melting point, mixed melting and IR fingerprinting at 900-1300 cm$^{-1}$. Method 1, 2, and 3 products showed same melting point, mixed melting and IR fingerprinting at 900-1300 cm$^{-1}$; yield in average was 66%. Product recrystallized from ethanol, m.p. 218-220°C. Anal. Calc. for: $C_{18}H_{16}N_4O_3$: C, 64.29; H, 4.76; N, 16.67. Found: C, 64.28; H, 4.77; N, 16.60. IR: broad band at 3460 cm$^{-1}$ (OH), 1598 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 3.57-

3.76 (m, 2H, 3'-H), 4.3-4.5 (m, 1H, 2'-H), 4.71-5.31 (m, 3H, 3 OH), 5.85 (d, 1H, *J* = 4.8 Hz, 1'-H), 7.2-8.3 (m, 9H, Ar-H). Mass: m/z (M+ 336, 4%).

*3-(D-threo 1`, 2`, 3`-trihydroxyprop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **3**$_{a\ c}$

Using D-Galactose and method 1: Product recrystallized from ethanol and yield was 64%; m.p. 198-200°C. Anal. Calc. for $C_{18}H_{16}N_4O_3$: C, 64.29; H, 4.76; N, 16.67. Found: C, 64.26; H, 4.80; N, 16.62. IR: broad band at 3340 cm$^{-1}$ (OH), 1596 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 3.55-3.74 (m, 2H, 3'-H), 4.23-4.51 (m, 1H, 2'-H), 4.71-5.3 (m, 3H, 3OH), 5.86 (d, 1H, *J*=6 Hz, 1'-H), 7.21-8.32 (m, 9H, Ar-H). Mass: m/z (M+ 336, 6%).

*3-(D-1', 2'-dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **4**$_{a\ c}$

Using D-arabinose, D-xylose or D-ribose and method 1, product recrystallized from ethanol and yield was 61%; m.p 212-214°C. Anal. Calc. for $C_{17}H_{14}N_4O_2$: C, 66.67; H, 4.57; N, 18.30. Found: C, 66.61; H, 4.53; N, 18.25. IR: broad band at 3450 cm$^{-1}$ (OH), 1596 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 4.05-4.30 (m, 2H, 2'-H), 4.93 (t, 1H, *J* = 6.2 Hz, OH), 5.26 (q, 1H, *J* = 5.6 Hz, OH), 5.86 (d. 1H, *J* = 5.0 Hz, 1'-H), 7.39-8.43 (m, 9H, Ar-H). Mass: m/z (M+ 306, 7%).

*3-(L-1', 2'-Dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b]quinoxaline* **5**$_{a\ c}$

Using L-arabinose and method 1, product recrystallize from ethanol; yield was 60%; m.p. 216-218°C. Anal. Calc. for $C_{17}H_{14}N_4O_2$: C, 66.67; H, 4.57; N, 18.30. Found: C, 66.60; H, 4.52; N, 18.23.IR: broad band at 3440 cm$^{-1}$ (OH), 1597 cm$^{-1}$ (C=N); $^1$H NMR (DMSO-d6): δ 4.01-4.22 (m, 2H, 2'-H), 4.94 (t, 1H, *J* = 6 Hz. OH), 5.29 (q, 1H, *J*=5.8 Hz, OH), 5.87 (d, 1H, *J* = 4.6 Hz, 1'-H), 7.35-8.43 (m, 9H, Ar-H). Mass: m/z (M+ 306, 5%).

Synthesis of 3-(sugar)-6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline analogues; using 4, 5-dimethyl-*O*-phenylenediamine instead of *O*-phenylenediamine with different hexoses and pentoses in method 1.

*3-(D-erythro-1`, 2`, 3` trihydroxyprop-1`-yl)-6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **2**$_{b\ c}$

Using D-mannose and method 1; recrystallize product from ethanol; yield 72%; m.p 200-202°C. Anal. Calc. for $C_{20}H_{20}N_4O_3$: C, 65.93; H, 5.49; N, 15.38. Found: C, 65.85; H, 5.48; N, 15.32. IR: broad band at 3390 cm$^{-1}$ (OH), 1598 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 2.40 (s, 3H, $CH_3$), 2.52 (s, 3H, $CH_3$), 3.82-3.92 (m, 2H, 3'-H), 4.44 (q, 1H, *J* = 5.5 Hz, 2'-H), 4.56-4.75 (m, 2H, 2OH), 5.03-5.12 (m, 1H, OH), 5.84 (d, 1H, *J* = 4.8 Hz, 1'-H), 7.33-8.48 (m, 7H, Ar-H). Mass: m/z (M+ 364, 6%).

*3-(D-threo-1`, 2`, 3` trihydroxyprop-1`-yl) 6, 7-Dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **3**$_{b\ c}$

Using D- galactose and method 1; recrystallize product from ethanol; yield 73%; m.p 189-191°C. Anal. Calc. for $C_{20}H_{20}N_4O_3$: C, 65.93; H, 5.49; N, 15.38. Found: C, 65.81; H, 5.41; N, 15.29. IR: broad band at 3400 cm$^{-1}$ (OH), 1595 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 2.39 (s, 3H, $CH_3$), 2.40 (s, 3H, $CH_3$), 3.61-3.70 (m, 2 H, 3'-H), 4.38 (q, 1H, *J* = 5.3 Hz, 2'-H), 4.68 (t, 1H, *J* = 5.6 Hz, OH), 4.89 (d, *J* = 5.6 Hz, OH), 5.21 (t, 1H, *J*=5.6 Hz, OH), 5.48 (d, 1 H, *J*=6.2 Hz, 1'-H), 7.30-8.42 (m, 7 H, Ar-H). Mass: m/z (M+ 364, 4%).

*3-(D-1, 2 dihydroxyeth-1'-yl)-6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **4**$_{b\ c}$

Using D-Arabinose, recrystallize from ethanol, yellow needles; yield 69%; m.p. 184-186°C. Anal. Calc. for $C_{19}H_{18}N_4O_2$: C, 68.26; H, 5.39; N, 16.77. Found: C, 68.15; H, 5.33; N. 16.72. IR: broad band at 3390 cm$^{-1}$ (OH), 1593 cm$^{-1}$ (C=N). $^1$H NMR (DMSO-d6): δ 2.28 (s, 6H, 2$CH_3$), 4.09-4.20 (dd, 2 H, 2'-H), 5.01(t, 1H, *J*= 5.8 Hz, OH), 5.26 (q, 1H, *J* = 5.9 Hz, OH), 5.81 (d, 1 H, *J* = 5.2 Hz, 1'-H), 7.27-8.35 (m, 7H, Ar-H). Mass: m/z (M+ 334, 3%).

*3-(L-1, 2 dihydroxyeth-1'-yl)-6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **5**$_{b\ c}$

Using L-arabinose and method 1; recrystallize Product from ethanol; yield 68%; m.p. 216-218°C. Anal. Calc. for $C_{19}H_{18}N_4O_2$: C, 68.26; H, 5.39; N, 16.77. Found: C, 68.12; H, 5.28; N, 16.71. IR: broad band at 3402 (OH), 1597 cm$^{-1}$ (C=N); $^1$H NMR (DMSO-d6): δ 2.49 (s, 6 H, 2$CH_3$), 4.03-4.18 (m, 2H, 2'-H), 4.93 (t, 1H, *J* = 6 Hz, OH), 5.24 (q, 1H, *J* = 5.2 Hz, OH), 5.80 (d, 1H, *J* = 4.6 Hz, 1'-H), 7.23-8.41 (m, 7 H, Ar-H). Mass: m/z (M+ 334, 4%).

*Acetylation of 1-pheny pyrazolo [3, 4-b] quinoxaline-C-nucleosides*

*General method*

Add acetic anhydride (3 ml) to a solution of 1-phenyl pyrazolo [3, 4-b] quinoxaline-*C*-nucleoside (0.3 m mol) in 3 ml of pyridine. The reaction mixture stirred for 30 hrs at room temperature, and then poured onto crushed ice. The precipitate so formed filtered off and washed successfully with water, then recrystallized from the proper solvent.

*3-(D-erythro 1`, 2`, 3` tri O acetyl prop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **2**$_{a\ d}$

Compound **2**$_{a\ c}$ acetylated; recrystallized from 50% ethanol; yield 80%; m.p. 116-118°C.

Anal. Calc. for $C_{24}H_{22}N_4O_6$: C, 62.34; H, 4.76; N, 12.12. Found C, 62.31; H, 4.71; N, 12.07. IR: 1743 (C=O), 1597 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.05 (s, 3H, $COCH_3$), 2.09 (s, 3H, $COCH_3$), 2.77 (s, 3H, $COCH_3$), 4.6 (m, 2H, 3'-H), 6.12 (q, 1H, *J* = 3.24 Hz, 2'-H), 6.82 (d, 1H, *J* = 5.7 Hz, 1'-H), 7.30-8.51 (m, 9H, Ar-H). Mass: m/z (M+ 462, 7%).

*3-(D-threo 1`, 2`, 3` tri O acetyl prop-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **$3_{a\ d}$**

Compound $3_{a\ c}$ acetylated; recrystallized from 50% ethanol, yield 81%; m.p. 100-102°C. Anal. Calc. for $C_{24}H_{22}N_4O_6$: C, 62.34; H, 4.76; N, 12.12. Found: C, 62.32: H, 4.73; N, 12.07. IR: 1748 $cm^{-1}$ (C=O), 1597$cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.08 (s, 3H, $COCH_3$), 2.10 (s, 3H, $COCH_3$), 2.26 (s. 3H, $COCH_3$), 4.39- 4.51 (m, 2H, 3'-H), 6.14 (q, 1H, *J* = 4.26 Hz, 2'-H), 6.9 (d. 1 H, *J* = 6.1 Hz, 1'-H), 7.30-8.51 (m, 9H, Ar-H). Mass: m/z (M+ 462, 4%).

*3-(D- 1`, 2` di O acetyl eth-1`-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **$4_{a\ d}$**

Compound **$4_{a\ c}$** acetylated; recrystallized from 50% ethanol; yield 84%; m.p 118-120°C. Anal. Calc. for $C_{21}H_{18}N_4O_4$: C, 64.61; H, 4.62; N. 14.36. Found: C, 64.54; H, 4.54; N, 14.24. IR: 1738 $cm^{-1}$ (C=O), 1598 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.09 (s, 3H, $COCH_3$), 2.26 (s, 3H, $COCH_3$), 4.95 (d, 2H, *J* = 5.8 Hz, 2'-H), 6.83 (t, 1H, *J* = 5.8 Hz, 1'-H), 7.26-8.46 (m, 9H, Ar-H). Mass: m/z (M+ 390, 3%).

*3-(L-1`, 2` Di O acetyl eth-1`-yl) -1-phenylpyrazolo-[3, 4-b]quinoxaline* **$5_{a\ d}$**

Compound **$5_{a\ c}$** acetylated, recrystallized from 50% ethanol; yield 83%; m.p. 128-130°C. Anal. Calc. for $C_{21}H_{18}N_4O_4$: C, 64.61; H, 4.62; N, 14.36. Found: C, 64.52; H, 4.56; N, 14.22. IR: 1743 $cm^{-1}$ (C=O), 1569 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.08 (s, 3H, $COCH_3$). 2.25 (s, 3H, $COCH_3$), 4.95 (d, 2H, *J* = 5.8 Hz, 2'-H), 6.83 (t-1H, *J* = 5.7 Hz, 1'-H), 7.26-8.46 (m, 9H. Ar-H). Mass: m/z (M+ 390, 4%).

*3-(D-erythro 1`, 2`, 3` tri O acetyl prop-1`-yl) 6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **$2_{b\ d}$.** Compound **$2_{b\ c}$** acetylated, recrystallized from isopropyl alcohol; yield 85%; m.p. 140-142 °C. Anal. Calc. for $C_{26}H_{26}N_4O_6$: C, 63.67; H, 5.31; N, 11.43. Found: C, 63.48; H. 5.21; N, 11.22. IR: 1731 $cm^{-1}$ (C=O), 1597 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.01 (s, 3H, $COCH_3$), 2.04 (s, 3H, $COCH_3$), 2.23 (s, 3H, $COCH_3$), 2.54 (s, 6H, $2CH_3$), 4.49-4.66 (2dd, 2H, 3'-H), 6.10 (q, 1H, *J* = 3.1 Hz, 2'-H), 6.77 (d, 1H, *J* = 5.4 Hz, 1'-H), 7.26-8.46 (m, 7H, Ar-H). Mass: m/z (M+ 490, 4%).

*3-(D-threo 1`, 2`, 3` tri O acetyl prop-1`-yl) 6, 7-dimethyl-1-phenylpyrazolo [3, 4 b] quinoxaline* **$3_{b\ d}$**

Compound **$3_{b\ c}$** acetylated, recrystallized from isopropyl alcohol; yield 84%; m.p. 138-140 °C. Anal. Calc. for $C_{26}H_{26}N_4O_6$: C, 63.67; H, 5.31; N, 11.43. Found: C, 63.65; H, 5.28; N, 11.31. IR: $cm^{-1}$ 1748 (C=O), 1601 $cm^{-1}$ (C=N); $^1H$ NMR ($CDCl_3$): δ 2.04 (s, 6H, 2 $COCH_3$), 2.06 (s, 3H, $COCH_3$). 2.55 (s, 6H, $2CH_3$); 4.22-4.52 (2dd, 2H, 3'-H), 6.11 (q, 1H, *J* = 4.2 Hz, 2'-H), 6.85 (d, 1H, J = 6.4 Hz, 1'-H), 7.26-8.45(m, 7H, Ar-H). Mass: m/z (M+ 490, 7%).

*3-(D-1`, 2` di O acetyl eth-1`-yl) 6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **$4_{b\ d}$**

Compound **$4_{b\ c}$** acetylated, recrystallized from isopropyl alcohol; yield 80%; m.p. 93-95°C. Anal. Calc. for $C_{23}H_{22}N_4O_4$: C, 66.03; H, 5.26; N, 13.40. Found: C, 65.91; H, 5.17; N, 13.25. IR: 17.47 $cm^{-1}$ (C=O), 1597 $cm^{-1}$ (C=N): $^1H$ NMR ($CDCl_3$): δ 2.08 (s, 3H, $COCH_3$), 2.24 (s, 3H, $COCH_3$), 2.53 (s, 6H, $2CH_3$), 4.93(d, 2H, *J* = 6 Hz. 2'-H), 6.81 (t, 1H, *J* = 5.7 Hz, 1'-H), 7.26-8.45(m,7H, Ar-H). Mass: m/z (M+ 418, 5%).

*3-(L-1`, 2` di O acetyl eth-1`-yl) 6, 7-dimethyl-1-phenylpyrazolo [3, 4-b] quinoxaline* **$5_{b\ d}$**

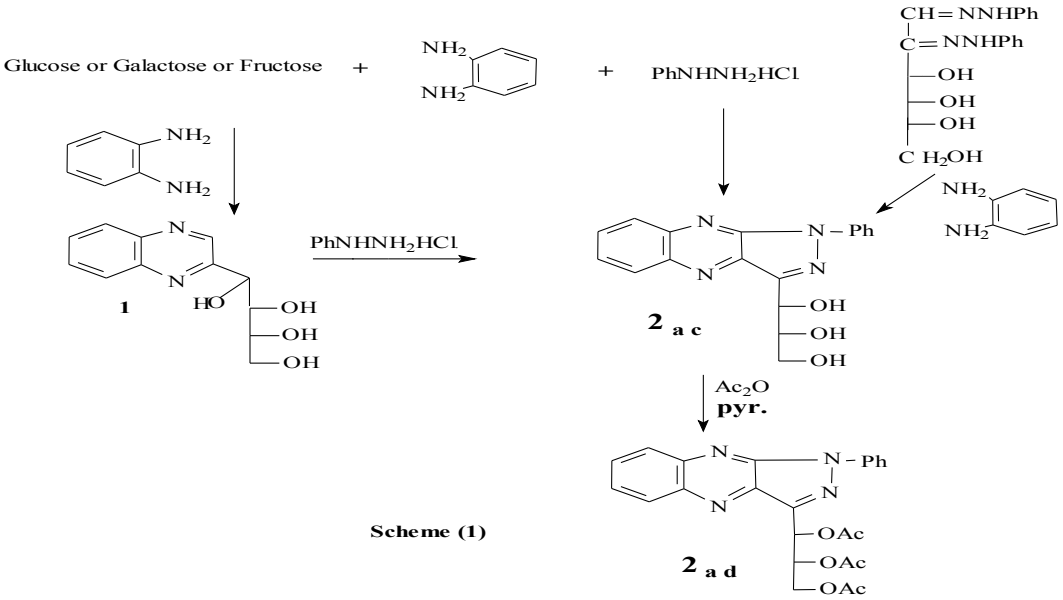
Compound $5_{b\ c}$ acetylated, recrystallized from isopropyl alcohol; yield 80%; m.p. 93-95 °C. Anal. Calc. for $C_{23}H_{22}N_4O_4$: C, 66.03; H, 5.26; N, 13.40. Found: C, 65.90; H, 5.15; N, 13.31. IR: $cm^{-1}$ 1747 (C=O), 1599 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.08 (s, 3H, $COCH_3$); 2.44 (s, 3H, $COCH_3$), 2.50 (s, 6H, $2CH_3$), 4.94(d, 2H, *J* = 5.8H, 2'-H), 6.81(t, 1H, *J* = 5.9 Hz, 1'-H), 7.26-8.44(m, 7H, Ar-H). Mass: m/z (M+ 418, 6%).

*{3-(1' Deoxy, 2' Chloro eth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline} {3 (1''deoxy, 2''-hydroxy eth-1''-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline} 1', 1'' Sulfite* **6.**

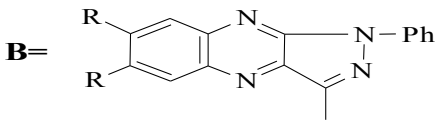
Compound **$4_{a\ c}$** (1 m mol) in 3 ml of acetonitrile and 0.1 ml of thionyl chloride cooled to 0°C and stirred for ½ hour. The produced material washed several times with diethyl ether, then dried to give **6** in 70% yield; m.p. 148-150 °C. Anal. Calc. for $C_{34}H_{25}N_8Cl\ S\ O_4$: C, 60.36; H, 3.70; N, 16.57; CI, 5.18; S, 4.73. Found: C, 60.28; H, 3.64; N, 16.43; Cl, 5.12; S, 4.70. IR: broad band at 3422 $cm^{-1}$ (OH), 1599 $cm^{-1}$ (C=N), 1207 $cm^{-1}$ (S=O); $^1H$ NMR ($CDCl_3$): δ 5.00-5.03 (m, 4H, 2'-H, 2''-H), 5.85(t, 1H, *J* = 9.4 Hz. OH), 6.22 (t, 1H, *J*= 8.1 Hz, 1'-H), 6. 67 (t, 1H, *J* = 5.9 Hz, 1''-H), 7.26-8.46(m. 18H, Ar-H). Mass: m/z (M+ 676, 8%).

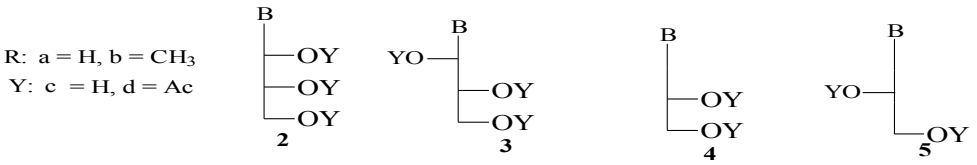
*3-(D-1'-hydroxy-2'- N-morpholino eth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline* **7**

Compound **6** (1 m mol) treated with excess morpholine and left overnight at room temperature under stirring. The product separated on column (4 x 60 cm) of silica gel with1:2 ether: pet. ether as an eluent, to give compounds $\mathbf{4}_{a\,c}$ and **7.** Compound **7** isolated in 31% yield; m.p. 90-92 °C. Anal. Calc. for $C_{21}H_{21}N_5O_2$: C, 67.20; H, 5.60: N, 18.67. Found: C, 67.12; H, 5.54; N, 18.54. IR: broad band at 3320 $cm^{-1}$ (OH), 1585 $cm^{-1}$ (C=N). $^1H$ NMR ($CDCl_3$): δ 2.59-2.72 (m, 4H, morpholino-H), 2.86-2.95 (m, 4H, morpholino-H), 3.73-3.83(m, 2H, 2'-H), 4.06- 4.10(m, 1H, OH), 4.55(t, 1H, *J* = 8.3 Hz, 1'-H), 7.26-8.48(m, 9H, Ar-H). Mass: m/z (M+ 375, 5%).

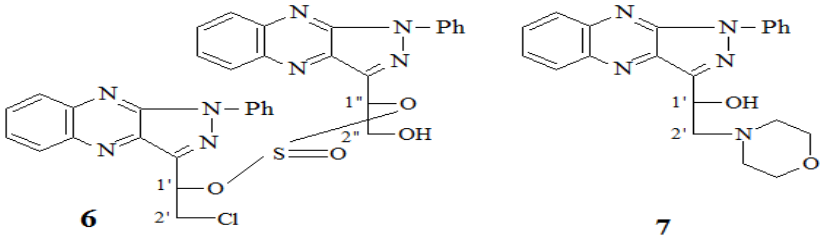



**Scheme (1)**




**Scheme(2)**




**Scheme (3)**

| Compound # | % cytotoxicity | % Inhibition |
|---|---|---|
| $2_{a\,c}$ | 12.0 | 0.0 |
| $2_{b\,c}$ | 52.0 | 37.0 |
| $3_{a\,c}$ | 5.1 | 35.0 |
| $3_{b\,c}$ | 89.4 | 24.0 |
| $4_{a\,c}$ | 23.8 | 0.0 |
| $4_{b\,c}$ | 94.0 | **11.0** |
| $5_{a\,c}$ | 52.0 | 3.0 |
| $5_{b\,c}$ | 94.0 | **54.0** |
| $2_{a\,d}$ | 30.9 | 44.0 |
| $2_{b\,d}$ | 97.2 | 0.0 |
| $3_{a\,d}$ | 26.6 | 22.0 |
| $3_{b\,d}$ | 93.0 | 40.0 |
| $4_{a\,d}$ | 34.7 | 44 |
| $4_{b\,d}$ | 66.5 | 25.0 |
| $5_{a\,d}$ | 29.0 | 18.0 |
| $5_{b\,d}$ | 24.0 | 33.0 |
| 7 | 7.5 | 10.0 |

Concentration =100 μ *M*.

**4. Conclusion**

New class of 3-(1', 2'-dihydroxyeth-1'-yl)-1-phenylpyrazolo [3, 4-b] quinoxaline and 3-(1`, 2`, 3`trihydroxy prop-1`-yl)-1-phenyl pyrazolo [3, 4-b] quinoxaline series "C-nucleosides" prepared and checked for antiviral activity. Presented a new chemical reaction called "Y. Fakhreldin reaction": (1`, 2` dihydroxyeth-1`-yl) compounds, react with thionyl chloride, to produce {1' Deoxy, 2' Chloro eth-1'-yl) compound} {(1"deoxy, 2"-hydroxy eth-1"-yl) compound} 1', 1" Sulfite.

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# The Effect of Competition on Relation of Corporate Governance Parameters and Cash Holding Level

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**Abstract:** In companies with weak supervision mechanisms, managers have incentives and opportunities in order to use company resources for their own benefits paid by stake holders. In this situation due to its high liquidity, company's cash, faces a high risk of misuse and views being imposed by managers such as expansionism, providing compensations and welfare benefits and other resource wasting activities. The main objective of this research is to focus on the level of competitiveness in product markets, as an indicator of corporate governance and examining its effect on cash holding policies by public corporate managers. The research period is 5 consecutive years from 2006 to 2010 and the research statistical sample is consists 102 of companies enlisted in Tehran stock exchange. In the main hypotheses of the current research, it is asserted that comparing with other companies, there is a weak relationship between corporate governance mechanisms and cash holding level in companies with high competitive power in product market. Results show that claims are only objective about of board independency and expected results of institutional ownership mechanisms and the size of board was not verified. In general, it seems that the competition in product market has had a great effect in consolidation of monitoring and controlling role of board and specifically it has prevented the company from cash excess.
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**Key words**: Competition in Product Markets, Corporate Governance, Cash Holding

## 1. Introduction

Product Market Competition (PMC) is considered as one of the mechanisms of corporate governance. In fact, managers of corporations acting in more competitive environments are less likely to spend corporate cash to reach their self-benefiting objectives. It is argued that holding cash reserves in corporations is goal-oriented and based on the management's objectives. In this regard, corporations need cash to finance new projects, pay stakeholders in cash, to fulfill their commitments, etc. Therefore, it appears that cash balance is a basis and criterion for cash reserves holding policies, since the balance has been reserved according to the will and intention of the management to be used for their intended spending. With respect to the evidences which exist on the relationship between the mechanisms of corporate governance and cash holdings policies, it is expected that corporations with high levels of corporate governance mechanisms hold less cash reserves. In addition, it seems that competition factor in product market can be a suitable and powerful alternative for corporate governance mechanisms to encounter cash flow related agency problems. Jensen (1986) was the first one to analyze this problem within the framework of his well-known theory. He considered the costs resulted from surplus cash balance as the costs invested for the projects with a negative net present value. To Jensen, managers of firms with high excess cash and slow growth try to meet their short-term interests through improper investment of cash flows [12].

Evidence shows that governance mechanisms potentially provoke some changes in cash-holding policies. In the present research, the features of the relationship between PMC and corporate governance will be quantified effectively using some criteria which are simple yet suitable for the Iranian capital market. Development of theoretical foundations of measurement and quantification of managerial forecasts is one of the research rationales.

Cash management of a corporation depends on the demand for cash. Cash management aims to maximize the wealth of stakeholders through limiting cash levels in the corporation. Cash should be held at a level that allows for a balance between cash holdings cost and the cost of insufficient cash. In addition, cash management affects the value of a corporation, because cash investment levels require increase of other costs, which are under the influence of level of net working capital. Both the increase and decrease of net working capital require a balance of

free cash flow in the future and, in turn, changes in corporation valuation. [12]

The competitive pressures of product market force corporations to minimize production cost and improve productivity. If a corporation fails to adjust its operational activities on this basis, it will be excluded from the competitive market. Therefore, PMC can be considered as one of the mechanisms of corporate governance. In fact, managers of corporations acting in more competitive environments are less likely to spend corporate cash to reach their self-benefiting objectives. It is argued that holding cash reserves in corporations is goal-oriented and based on the management's objectives. In this regard, corporations need cash to finance new projects, pay stakeholders in cash, fulfill their commitments, etc. Therefore, it appears that cash balance is a basis and criterion for cash reserves policies, since the balance has been reserved according to the will and intention of a manager to use for their intended spending. With respect to the evidences which exist on the relationship between the mechanisms of corporate governance and cash holdings policies, it is expected that corporations with high levels of corporate governance mechanisms hold less cash reserves. In addition, it seems that competition factor in product market can be a suitable and powerful alternative for corporate governance mechanisms to encounter cash flow related agency problems. On the other hand, it seems that the level of optimum investment and corporation's operational efficiency is a function of the cash management in the corporation. This research focuses on the effect and level of competition as an index of corporate governance, and the study of its effect on cash holdings policies made by corporate managers of stock companies as part of the information which plays a key role in illustrating corporation's vision for investors. It also discusses the effect of different features of these forecasts on cash holdings policy of the companies listed in Tehran Stock Exchange. The main question of the research is that whether the relationship between the mechanisms of corporate governance and the level of cash holdings in corporations with a high competitive power in product market is weaker as compared with that of other corporations.

## 2. Literature Review

Opler et al. (1999) studied the factors influencing the cash balance of corporations in the United States for the period 1971–1994 and realized that the corporations with higher growth opportunities and cash flows with higher risk hold more cash than total non-cash assets [11]. Ozkan (2004) studied a sample of English corporations during 1984–1999 and showed particularly that there is a significant relationship between the level of corporate ownership by management and the amount of cash holdings of a corporation. He also showed that, generally, growth opportunities, cash flows, liquid assets, financial leverage, and bank liabilities are important factors in determining a corporation's cash holdings [8]. Lee (2009) stated that if the board of directors plays the role of corporate governance, it is forecasted that corporations with stronger managerial structures (higher percentage of unaffiliated (outside) members in the board, etc.) will have lower cash holdings after controlling other factors. The analyses were started with a test of the relationship among cash holdings, the structure of the board of directors, and managerial ownership structure. After controlling other determinants of cash holdings, it was concluded that corporations with more share of non-executive managers in the board of directors, separate general manager and chief of the board positions, and smaller the board of directors have less cash holdings [9].

Harford et al. (2008) proved that corporations with more domestic ownership and more percentage of institutional ownership have more cash holdings, whereas corporations with higher quality of corporate governance and larger and more independent the board of directors have less cash holdings. Izadinia and Rasaeian (2010) studied the relationship of some of the mechanisms of corporate governance, including the percentage of unaffiliated members of the board of directors and Q-Tobin to the percentage of institutional investors, and the level of cash holdings as independent variables and as the criterion of corporation value, and the dependant variable in Tehran Stock Exchange. The results of the research indicate that there is a positive and significant relationship between ownership percentage of institutional investors and the value of the companies listed in Tehran Stock Exchange; however, there is no significant relationship between the percentage of unaffiliated members of the board of directors and the value of the companies listed in Tehran Stock Exchange. The level of cash holdings has also a positive and significant relationship with value of the companies listed in Tehran Stock Exchange [2].

PMC, as an external mechanism, may lead to a change in the behavior of stock companies with respect to determining the policies of current assets management. Whereas, conducting research on this variable is an issue which has not been discussed much in earlier studies, especially in Iran. One of the requirements of the present research is applying some

criteria to measure competition in the product market of the sample corporations to promote theoretical foundation of the issue. In addition, studying PMC as a factor of corporate governance through explaining its effects on cash holdings is another requirement of the research. This research uses the framework presented by Alchian (1950), Stigler (1958), Fama and Jensen (1993), and Hart (1983) to evaluate how the differences in the characteristics of forecasting management benefit affect the corporations' capital cost. The framework of Alimo (2010) is based on the principle that there is a significant relationship between corporate governance and the level of cash holdings of corporations acting in competitive environments. These researchers point out that extra cash leaves adverse effect on the efficiency of corporations.

## 3. Research Hypotheses

**Primary Hypothesis**: The relationship between the features of corporate governance and the level of cash holdings in highly competitive corporations in product market is weaker as compared with that of other corporations.

**Secondary hypothesis (1)**: The relationship between the percentage of institutional ownership and the level of cash holdings in highly competitive corporations in product market is weaker as compared with that of other corporations.

**Secondary hypothesis (2)**: The relationship between the size of the board of directors and the level of cash holdings in highly competitive corporations in product market is weaker as compared with that of other companies.

**Secondary hypothesis (3)**: The relationship between the independence of the board of directors and the level of cash holdings in highly competitive corporations in product market is weaker as compared with that of other corporations.

## 4. Research Method

### 4.1. Dependent Variable

Dependent variable of the present research is the cash balance of the sample corporations which reflects the policies of the managers of these corporations regarding the required cash reserves for the intended activities. In this research, cash balance is defined as cash and deposits in banks which are extracted from the audited balance sheet of the sample corporations.

### 4.2. Independent Variables

The independent variables of the present research include corporate governance criteria and PMC. Earlier studies has considered a group of factors as the mechanisms of corporate governance, which are mainly based on the policies of the company's governing body and are considered as the governance internal mechanisms. Based on this and following Ditmar et al. (2003), two major and common factors of corporate governance are considered as follows:

#### 4.2.1. Control and Ownership Factors (Percentage of Institutional Ownership)

With this respect, the percentage of the share of institutional stakeholders in each corporation is studied. To measure this variable, the number of shares of institutional stakeholders is divided into the total shares issued by the corporation. Institutional stakeholders are institutes such as insurance companies, banks or investing corporations which are able to own a major part of a stock company due to having major financial resources and to gain governance power due to having high levels of voting right. Therefore, an institutional stakeholder is considered as the largest stakeholder of each company. The governance of this group of stakeholders is realized not only through the power they exercise in decision-making in assemblies and electing the board of directors, but also through taking a monitoring role, as the institutional nature provides them with special monitoring tools which enables them to put a manager under pressure to achieve their objectives.

#### 4.2.2. Corporate Governance Factor (Size and Independence of the board of directors)

Here, the size and independence of the board of directors are considered. In stock companies, the board of directors is elected by stakeholders to manage the corporation. The strategies of the board and their governance procedures play a major role in the success or failure of enterprises. The number of board members is considered to estimate its size. In addition, to standardize this variable and to include it in a regression model, following is employed:

$$Bsize = Ln(1 + BoardNumber)$$

The nature and role of each member of the board of directors are considered to quantify the independence of the board of directors. On this basis, the ratio of the number of unaffiliated members of the board to the affiliated members is considered as a criterion for its independence. The more the ratio is, the more the independence of the board of directors would be, because the unaffiliated members have a monitoring role over the rest of members [5].

PMC is the second factor of the independent variables:

Due to increasingly complex business environment, growth in the number of producers of a certain product, expansion of corporate advertising

policies, gaining success in business environment requires application of special competitive procedures by managers. The pressures caused by PMC potentially influence the decisions of stock companies' managers and they are required to react against such pressures, as these reactions determine their survival or exclusion from the field of competition. In the present research, PMC is considered as an external corporate governance mechanism and the criterion of Price Cost Margin is used to measure it. This criterion is calculated by Lerner index, which was used by Aghion et al. (2005) as follows:

$$PCM = \frac{Sales - TotalCost}{Sales}$$

Where Sales is "sales price" and TotalCost is "the total cost of goods or services" (Alimo, 2010).

For this purpose, the virtual variable of D-PCM is defined and the mean of PMC of all the sample corporations is used to divide them into highly and less competitive companies.

Hypotheses Testing Method: To test hypotheses, regression models are used in which cash balance is a function of corporate governance mechanism and control variables. These models are derived from the studies of Opler et al. (1999) and Alimo (2010) and are as follows:

**4.3. Research Models**

Model No (1) is used as follows to test the first hypothesis:

**Model (1):**

Cash i,t=β0+ β1 INST i,t+ β2D-INST +β3PCM i,t+ β4D-PCM i,t+ β5 D-PCM*PCM i, + β6D-PCM* INST i,t+ β7 D-PCM* D- INST i,t + β8Size i,t+β9Lev i,t+ β10CF i,t +β11 NWC i,t+ € i,

In above regression model, coefficients β1 and β2 show the relationship between institutional ownership and the level of cash holdings, coefficients β3 and β4 show the relationship between PMC and the level of cash holdings, and coefficients β6 and β7 show the relationship between institutional ownership and the level of cash holdings in highly competitive corporations in PMC.

**Model (2):**

Cash i,t=β0+ β1 Bsize i,t+ β2D- Bsize +β3PCM i,t+ β4D-PCM i,t+ β5 D-PCM*PCM i,t + β6D-PCM* Bsize i,t+ β7 D-PCM* D- Bsize i,t + β8Size i,t +β9Lev i,t+ β10CF i,t+β11 NWC i,t+ € i,t

In above regression model, coefficients β1 and β2 show the relationship between size of the board of directors and the level of cash holdings, coefficients β3 and β4 show the relationship between PMC and the level of cash holdings, and coefficients β6 and β7 show the relationship between size of the board of directors and the level of cash holdings in highly competitive corporations in product market. Coefficients β8 and β12 show the relationship between control variables and the level of cash holdings.

**Model (3):**

Cash i,t=β0+ β1 OUTDIR i,t+ β2D- OUTDIR +β3PCM i,t+ β4D-PCM i,t + β5 D-PCM*PCM i,t + β6D-PCM*OUTDIR i,t+ β7 D-PCM*D-OUTDIR i,t + β8Size i,t +β9Lev i,t+ β10CF i,t+β11 NWC i,t+ € i,t

In above regression model, coefficients β1 and β2 show the relationship between independence of the board of directors and the level of cash holdings, coefficients β3 and β4 show the relationship between PMC and the level of cash holdings, and coefficients β6 and β7 show the relationship between independence of the board of directors and the level of cash holdings in highly competitive corporations in product market.

**In the above models:**

**Cash:** cash balance divided by all assets (cash is ready money and deposits in banks divided by assets book value. These figures are obtained from the audited balance sheets of sample corporations).

**INST:** INST is the percentage of institutional ownership (number of shares belonging to the largest stakeholder divided by the total number of distributed shares of the corporation. Information on ownership and governance variables of corporations is obtained from the notes accompanied by financial statements and minutes of the board of directors, which are available for different years and for each corporation at Stock Exchange Organization website.)

**D-INST:** D-INST is a virtual variable. If the percentage of institutional ownership of a corporation is higher than the mean of total institutional ownership percentage of sample corporations, the value of virtual variable will be one, otherwise, it will be zero.

**Bsize:** The size of the board of directors (the number of members of the board of directors)

**D-Bsize:** D-Bsize is a virtual variable. If the number of members of the board of directors of a corporation is higher than the mean of the number of the board of directors of the entire sample corporations, D-Bsize value will be one, otherwise, it will be zero.

**OUTDIR:** OUTDIR is the criteria of independence of the board of directors (i.e. the ratio of the unaffiliated members of the board of directors to the affiliated members)

**D-DUTDIR:** D-DUTDIR is a virtual variable. If the general manager of a corporation is also a member of the board of directors of the corporation, the value of

D-DUTDIR will be one, otherwise, it will be zero. (Violation of independence of the board of directors)
**PCM:** PCM is the criterion for PMC (calculated by the method mentioned in 2-11)
**D-PCM:** D-PCM is a virtual variable. If the competition level of a corporation is higher than the mean of total competition of sample corporations, D-PCM value will be one, otherwise, it will be zero.
**Size:** The size of a corporation as a control variable (Normal logarithm of total book value of all assets)
**Lev:** It is the financial leverage of a corporation as a control variable (The ratio of total book value of debts to total book value of assets)
**CF:** Net cash flows of the corporation (extracted from cash flows statement) divided by all assets as control variable
**NWC:** The ratio of working capital to total assets as a control variable (working capital is calculated from the difference between current assets and current liabilities.)

To make decisions on acceptance or rejection of the main hypothesis in the present research, the test model for secondary hypotheses is fitted and decisions are made based on the obtained results.

**4.4. Sample Selection**

Data were collected through desk research and the required data for the test of research hypotheses have been extracted from the annual financial statements and explanatory notes of the companies listed in Tehran Stock Exchange Organization, and through informative software of Stock Exchange Organization, including Tadbir Pardaz and Rahavard Novin software, and Stock Exchange Organization websites, especially WWW.RDIS.IR and circulars of the Central Bank. In the present study, the classified and audited financial data of manufacturing companies listed in Tehran Stock Exchange were used to test the hypotheses of the research. The systematic elimination sampling method was used to select the suitable sample. This method was used to standardize the sample with respect to the whole population and to make it possible to generalize the obtained results about the statistical population. The inclusion criteria for selecting the sample are as follows:

1) The corporation should not be of the investment and financial intermediation corporations.
2) The corporation's fiscal year should be ended on 20 Mars.
3) The corporation should not have a change in the fiscal year during research period.
4) Trading symbol of the corporation should not be transferred to the stock exchange unofficial board.

By applying the conditions and considerations in systematic elimination sampling, 102 corporations were selected from the statistical population to conduct the tests. The research was conducted on the data of five consecutive years from 2006 to 2010; therefore, the final volume of the sample is 510 (5*102) firm- year. Judgment about the test result is made based on the error level that is calculated. In the present research, acceptance or rejection of the hypotheses was judged according to the significance level. If the calculation error is less than 5%, the null hypothesis is rejected and the alternative hypothesis is kept as the sound hypothesis and in case it is bigger than 5%, the null hypothesis is not rejected.

**5. Research Findings**

In the first secondary hypothesis of the research, it is forecasted that the relationship between the percentage of institutional ownership and cash holdings level in highly competitive corporations in product market is weaker than that in other corporations. To test this hypothesis, a regression model was used in which the cash balance was a function of the percentage of institutional ownership. In addition, a virtual variable was used in hypotheses testing model to separate highly competitive corporations from other corporations. The results obtained from the tests include the results of the statistical analysis, summary of the regression model, and the analysis of the independent variables coefficients. Table 1 shows the results obtained from the statistical analysis for the summary of the test model of the research's first secondary hypothesis.

Table 1: The results of the statistical analysis for regression model of the first secondary hypothesis test

| $R^2$ | Durbin-Watson Statistic | F Statistic | Significance Level of F |
|---|---|---|---|
| 0.167 | 1.649 | 4.319 | 0.000 |

Table 2: The results of the statistical analysis for the coefficients of the first secondary hypothesis test

$Cash_{i,t}=\beta_0+\beta_1 INST_{i,t}+\beta_2 D\text{-}INST+\beta_3 PCM_{i,t}+\beta_4 D\text{-}PCM_{i,t}+\beta_5 D\text{-}PCM*PCM_{i,t}+\beta_6 D\text{-}PCM*INST_{i,t}+\beta_7 D\text{-}PCM*D\text{-}INST_{i,t}+\beta_8 Size_{i,t}+\beta_9 Lev_{i,t}+\beta_{10} CF_{i,t}+\beta_{11} NWC_{i,t}+\epsilon_{i,t}$

| Variable | Factor Magnitude (Standardized β) | t Statistic | Significance Level (P-value) | Collinearity Tests | |
|---|---|---|---|---|---|
| | | | | Tolerance | Variance Inflation Factor |
| INST | 0.03 | 0.296 | .0767 | 0.784 | 1.429 |
| D-INST | -.0056 | -0.549 | 0.583 | 0.778 | 1.615 |
| PCM | 0.202 | 2.017 | 0.044 | 0.883 | 1.278 |
| DPCM | 0.034 | 0.138 | 0.89 | 0.83 | 1.475 |
| D-PCM*PCM | 0.489 | 3.381 | 0.001 | 0.887 | 1.235 |
| D-PCM* INST | 0.239 | 0.805 | 0.421 | 0.821 | 1.277 |
| D-PCM* D- INST | -0.053 | -0.444 | 0.657 | 0.829 | 1.236 |
| Lev | -0.008 | -0.099 | 0.921 | 0.815 | 1.171 |
| Size | 0.043 | 0.935 | 0.35 | 0.881 | 1.135 |
| NWC | 0.238 | 3.459 | 0.001 | 0.888 | 1.578 |
| CF | 0.003 | 2.047 | 0.031 | 0.974 | 1.027 |

The results of the statistical analysis show that the coefficient of determination of regression model is 0.167 and this model could explain 16.7 percent of the changes of dependant variable through changes of independent variables. Durbin statistic is between 1.5 and 2.5; therefore, there is no autocorrelation among the errors of regression models. According to the results, the significance level of statistic F is less than the level of test error[1] ($\alpha$ =0.05). Consequently, the estimated model is statistically significant and the relationships between the research variables are linear. Table 2 shows the results of the statistical analysis for the independent variables coefficients of the first secondary hypothesis test.

The results of the collinearity tests show that there is not a strong collinearity between the variables of the fitted regression model because the statistics of the tests for collinearity are close to 1 for all the variables. The results show that the coefficient obtained for INST variable, which reflects the relationship between institutional ownership and cash balance, is not significant, so there is no significant relationship between the pertinent variables. The coefficient estimated for PCM variable is 0.202 at the significance level of 0.044. This finding indicates that there is a direct and significant relationship between PMC and the level of cash holdings, whereas the coefficient of PCM*DPCM, which shows this relationship for highly competitive corporations, is 0.489. This finding shows that the highly competitive corporations in product market might hold cash at a high level to confront market's competitive pressures. The results related to the control variables indicate that there is a significant relationship between working capital and net cash flows and cash balance. No significant results are seen for the rest of control variables. Generally, as the coefficients obtained for the variable of institutional ownership percentage and its variables interacting with competition intensity are not significant, the first secondary hypothesis cannot be accepted and it is rejected at the confidence level of 95 percent. Table 3 shows the results obtained from the statistical analysis for the summary of the test model of the second Secondary hypothesis.

[1] All of statistical tests are performed with confidence level of 95%

Table 3: The results of the statistical analysis for the regression model of the second secondary hypothesis test

| $R^2$ | Durbin-Watson Statistic | F Statistic | Significance Level of F |
|---|---|---|---|
| 0.174 | 1.642 | 4.703 | 0.000 |

The results of the statistical analysis show that the coefficient of determination of the regression model is 0.174. This model could explain 17.4 percent of the changes of the dependent variable by the changes of the independent variables. Durbin statistic was between 1.5 and 2.5; therefore, there is no correlation between the errors of its regression models. The significance level of statistic F is less than the error level of the test; therefore, the estimated model is not statistically significant and the relationship between the research variables is linear.

Table 4: The results of the statistical analysis for the coefficients of the test model of the second secondary hypothesis

$Cash_{i,t}=\beta_0+\beta_1 Bsize_{i,t}+\beta_2 D\text{-}Bsize+\beta_3 PCM_{i,t}+\beta_4 D\text{-}PCM_{i,t}+\beta_5 D\text{-}PCM*PCM_{i,t}+\beta_6 D\text{-}PCM*Bsize_{i,t}+\beta_7 D\text{-}PCM*D\text{-}Bsize_{i,t}+\beta_8 Size_{i,t}+\beta_9 Lev_{i,t}+\beta_{10} CF_{i,t}+\beta_{11} NWC_{i,t}+\epsilon_{i,t}$

| Variable | Standardized β | t- Statistic | Significance Level (P-value) | Collinearity Tests | |
|---|---|---|---|---|---|
| | | | | Tolerance | Variance Inflation Factor |
| Bsize | 0.061 | 2.482 | 0.013 | 0.615 | 1.677 |
| D- Bsize | 0.107 | 0.917 | 0.36 | 0.633 | 1.535 |
| PCM | 0.207 | 2.07 | 0.039 | 0.782 | 1.687 |
| DPCM | 0.625 | 1.664 | 0.097 | 0.613 | 1.573 |
| D-PCM*PCM | 0.403 | 2.725 | 0.007 | 0.683 | 1.554 |
| D-PCM* Bsize | -0.483 | -2.234 | 0.018 | 0.712 | 1.804 |
| D-PCM* D- INST | 0.003 | 0.064 | 0.949 | 0.716 | 1.396 |
| Lev | 0.009 | 0.121 | .904 | 0.813 | 1.197 |
| Size | 0.032 | 0.696 | 0.487 | 0.87 | 1.15 |
| NWC | 0.257 | 3.753 | 0.000 | 0.688 | 1.579 |
| CF | 0.0015 | 2.332 | 0.014 | 0.948 | 1.054 |

The results of the statistical analysis for the independent variables show that the coefficients obtained for Bsize variable, which reflects the relationship between the size of the board of directors and cash balance, is 0.061 at a significance level of 0.013. This finding indicates that there is a direct and significant relationship between cash balance and the number of members of the board of directors. The coefficient estimated for PCM variable is also positive and significant which shows that the relationship between PMC and cash holdings level is direct. In addition, the value of PCM*DPCM variable is higher than the vlaue of PCM variable coefficient which shows that in corporations with higher competition, the effect of competitive pressures on cash holdings policies have been more stong. The coefficient obtained for D-PCM* Bsize, which shows the relationship between the size of the board of directors and cash holdings in the corporations with a high competitive power, is -0.483 at a significance level of 0.018. This finding specifically shows the difference of highly competitive corporations. It also indicates that by including D-PCM variable and separating these corporations in the model, the direction between the size of the board of directors and cash holdings become reversed. In other words, in highly competitive corporations in product market, with the increase of members of the board of directors, the level of cash holdings decreases. At the same time, there has been a direct relationship in the whole sample.

Regardless of the direction and type of the relationship, the results show that in highly competitive corporations, the relationship between the size of the board of directors and the level of cash holdings was more stronger as compared with the other corporations. According to the above results, the second secondary hypothesis of the research is rejected at the confidence level of 95%. In total, as the coefficient obtained for the variable of the board of directors in highly competitive corporations is not smaller than the coefficient of this variable in other corporation, the claim made in the second secondary hypothesis cannot be accepted. The third secondary hypothesis concentrates on the relationship between the independence of the board of directors and level of cash holdings in highly competitive corporations in product market as compared with other corporations. Table 5 shows the results obtained from the statistical analysis for the summary of this model.

Table 5: The results of the the statistical analysis for the regression model of the third secondary hypothesis test

| $R^2$ | Durbin-Watson Statistic | F Statistic | Significance Level of F |
|---|---|---|---|
| 0.174 | 1.634 | 4.679 | 0.000 |

Coefficient of determination of the regression model is 0.174 and this model could explain 17.4 percent of the changes of the dependent variable by the changes of the independent variables. Durbin statistic is between 1.5 and 2.5; therefore, there is no correlation between the errors of its regression models. The significance level of statistic F is lower than the level of test error and consequently the estimated model is not statistically significant and the relationship between the research variables is linear.

Table 6: The results of the statistical analysis for the coefficients of the third secondary hypothesis test model

$$Cash_{i,t}=\beta_0+\beta_1 OUTDIR_{i,t}+\beta_2 D\text{-}OUTDIR+\beta_3 PCM_{i,t}+\beta_4 D\text{-}PCM_{i,t}+\beta_5 D\text{-}PCM*PCM_{i,t}+\beta_6 D\text{-}PCM*OUTDIR_{i,t}+\beta_7 D\text{-}PCM*D\text{-}OUTDIR_{i,t}+\beta_8 Size_{i,t}+\beta_9 Lev_{i,t}+\beta_{10} CF_{i,t}+\beta_{11} NWC_{i,t}+\epsilon_{i,t}$$

| Variable | Standardized β | t Statistic | Significance Level (P-value) | Collinearity Tests | |
|---|---|---|---|---|---|
| | | | | Tolerance | Variance Inflation Factor |
| OUTDIR | 0.103 | 1.994 | 0.043 | 0.556 | 1.797 |
| D- OUTDIR | -0.005 | -0.103 | 0.918 | 0.766 | 1.306 |
| PCM | 0.197 | 1.976 | 0.049 | 0.884 | 1.448 |
| DPCM | 0.236 | 1.927 | 0.055 | 0.721 | 1.258 |
| D-PCM*PCM | 0.548 | 3.917 | 0.002 | 0.887 | 1.432 |
| D-PCM* OUTDIR | 0.02 | 0.216 | 0.829 | 0.509 | 1.776 |
| D-PCM* D- OUTDIR | 0.042 | 0.874 | 0.383 | 0.77 | 1.299 |
| Lev | -0.004 | -0.048 | 0.926 | 0.71 | 1.222 |
| Size | 0.044 | 0.96 | 0.338 | 0.879 | 1.138 |
| NWC | 0.244 | 3.573 | 0.000 | 0.891 | 1.259 |
| OUTDIR | 0.103 | 1.994 | 0.043 | 0.556 | 1.797 |

The results of the statistical analysis for the independent variables show that the coefficients obtained for OUTDIR variable, which reflects the relationship between the independence of the board of directors and cash balance is 0.103 at the significance level of 0.043. This finding indicates that there is a direct and significant relationship between the cash balance and independence of the board of directors in the sample corporations. The results show that the forecast made in the third secondary hypothesis – the relationship between the independence of the board of directors with the level of cash holdings in highly competitive corporations in product market is weaker than other corporations - can be true and from this perspective, the third secondary hypothesis is accepted at the confidence level of 95 percent.

**6. Discussion and conclusion**

The overall objective of the research was to discuss the relationship between PMC and corporate governance and cash holdings policies in the corporations listed in Tehran Stock Exchange. In the present research, the percentage of institutional ownership, size of the board of directors and independence of the board of directors were considered as the features of cash holdings policies and for each of which a hypothesis was proposed. The research hypotheses were tested using regression models. Based on the results, it was proved that the power to compete in product market does not play an effective role in the governance system of the sample corporations. In addition, it was proved that the relationship between the percentage of institutional ownership and level of cash holdings in highly competitive corporations in product market is stronger than that in other corporations. This finding is inconsistent with the theoretical foundations of the research, as a significant relationship was expected between institutional ownership and the level of cash holdings and it was expected that the competition level of product market would affect this relationship. Theoretical foundation pertaining to the monitoring role of institutional stakeholders is based on the principle that this group of stakeholders find the required motivation to supervise and assume respective costs due to their long-term perspective on their investments. Such a theoretical foundation might not be realized for the institutional stakeholders of the statistical population corporations

of the study and their incentive to invest on corporations' stock might not be long-term interests. If so, active monitoring hypothesis will not be applicable. Consequently, institutional stakeholders would not play their governance role with respect to explaining cash holdings policies as stated in the theoretical foundation of the present research. In the second perspective, it was claimed that the relationship between the size of the board of directors and level of cash holdings in highly competitive corporations in product market is weaker than the other corporations. This relationship indicates that in highly competitive corporations, the level of cash holdings decreases with an increase in the number of the members of the board of directors. In this regard, Lee (2009) and Alimo (2010) realized that PMC had a significant effect on reinforcing the monitoring and controlling role of the board of directors; particularly, it has prevented cash accumulation in corporations. It seems that in highly competitive corporations, there is no significant relationship between the independence of the board of directors and level of cash holdings, whereas this relationship is direct and significant for all the sample corporations. In this concern, Harford et al. (2008) and Lee (2009) found a reversed relationship between the independence of the board of directors and level of cash holdings. It is likely that, similar to institutional stakeholders, unaffiliated members of the board of directors do not particularly exercise their authorities to control managers' policies with respect to cash holdings and/or they are not sufficiently aware of the effect of cash balance on the overall performance and efficiency of the corporation. Such an approach reduces the power of other governance mechanisms through increasing the number of members of the board of directors and especially through increasing the number of unaffiliated members, because, relying on the unaffiliated members of the board of directors to play their role favorably, investors and creditors may use their monitoring tools less frequently.

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# Analysis of emotional intelligence (EQ) and study the relationship between students' demography traits and emotional intelligence (Case study: students of Tabriz Islamic Azad University)

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**Abstract:** This research aims to analyze emotional intelligence and study the relationship between demography traits like age, family income and studies level of the male and female students of Tabriz Islamic Azad University (Iran) and EQ.This research is survey according to the method and it is analytical and applied according to the goals. The statistical population involves the students of Tabriz Islamic Azad University (Iran).The research sample consists of 400 students (187 male and 213 female) selected by simple random method. The data were collected by interview, observation and author made questionnaire. The validity of the questionnaire was confirmed as content validity and the reliability was achieved 0.89 by Cronbach alpha test. Pearson correlation coefficient, Levene test and samples mean comparison test were employed. The results showed that there is a relationship between age and emotional intelligence among male students and there is no significant relationship between age and emotional intelligence among female students. There is a relationship between emotional intelligence and male students' family income, but there is no relationship between emotional intelligence and female students' family income and there is no relationship between emotional intelligence and studies level among male and female students.
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**Keywords:** emotional intelligence, demographic traits, self assertiveness, emotion control, Tabriz Islamic Azad University.

## 1. Introduction

In the traditional society, the human being met his needs by hunting and agriculture and the craftsmen followed defined customs and norms and a few people thought about shifting the conditions. The ability of meeting needs depended on the physical power and value added of the working force was spent on construction of the palaces. After industrial revolution, the working styles were progressed and physical work was accompanied by thinking. Creativity and innovation were empowered and gradually some individuals sought for new subjects to satisfy their curiosity. These individuals had risk taking trait. In the industrial society, energy and matter, movement and power were considered and steam machine and complex machineries were innovated and business and working styles were developed by enhancement of investment.

In recent super industrial and information era, the rate of the changes is so high that it is called speed and revolution era. In this period, physical working is replaced by qualitative human force by power of creativity, innovation and thinking. In such atmosphere by domination of thinking, those societies could develop that utilize human forces as resource of ideas and thought and main factor of production in optimal way. By ever increasing of entrepreneurs, emotional intelligence plays an important role in efficacy of development. Emotional intelligence impacts significantly on personal and organizational success and covers personal and organizational performance, physical health and customer satisfaction (Joseph Winoman 2010, Shat, Maluf, Torstinoson Beholaro Rock, 2007). The results of studies show that emotional intelligence is effective and learnable.

Emotional intelligence is more important than cognitive and technical intelligence. It seems that the success of the people depends on intelligence, rational reasoning, and occupational skills in the work place. The results of studies in 1990 showed that there is an emotional brain, the location that emotion is dominated there and this part is separated from rational part but they are connected to each other where power of reasoning and emotions is used together. According to the structure of the brain, at first, information enters to emotional center and then to reasoning center. The scientists discovered that human being needs emotion and feeling in order to gain energy and being creative.

### Theoretical principles Intelligence

Intelligence is the oldest concept in psychology. Although different challenges have been offered in scientific texts, but there is no census about

this subject matter. There are two groups of psychologists: the first group believes that intelligence is talent and the second group suggests that there are different kinds of intelligence. Abstractness of intelligence concept causes to challenges in definition of intelligence, indeed, there is no objective and physical foundation for it and it is a process that individuals' behaviors and responses are inferred accordingly (Ganji, 2007:24).

David Vekseler has defined intelligence as general ability for rational thinking, purposeful activity and compatibility with environment. In his opinion, intelligence is ability consisting of dependent elements and rational thinking and purposeful behaviors is sign of being intelligent and in this case, the person could be compatible with environment(Basics of general psychology :14).

Cattel defines intelligence as talent for cognition and learning and employment of the cultural elements in order to solve daily problems and conform to environment (ibid:24).

**Emotion**

Emotion is defined in Oxford dictionary as: any excitement and disturbance in mind, feeling and every powerful subjective or excited state. Emotion consists of four elements: 1-expressive or motor element 2-combinatory element 3-coordinating element 4-processing element. Expressive or motor element involves facial expressions, body movement and tone of voice; combinatory element consists of identification and consciousness recognition of emotions and feelings; processing element involves ability of identification of emotions in others by processing facial expressions and physical movements, tone and speed of voice and this ability is developed since infancy and child hood period (Akbar Zadeh, 2004).

**Theories of emotion**

There are different viewpoints about emotion: 1-James Lange: before nineteenth century, William James suggested that emotion is result of overt behavioral reactions to events not emotions cause to behavioral reactions. In other words, emotion is effect of behavioral reactions not cause of them. Since this theory was proposed by Lange, the Danish physiologist, so it was called James Lange theory. According to this theory, the main factor in emotion is feedback of some physical conversions in respond to threatening and unpleasant situations. This theory was proposed like fastening cart in front of the horse "we are scared since we run away", "we are mad since we beat others"(Hassan Zadeh, 2007).

Emotion is direct reaction of organism to stimulus. In other words, emotional stimulus causes to activation of muscle and behavioral responses that feedback of the organism responses is considered emotional experience (Khoda Panahi, 2003:62)

2- Parkinson (1995) suggests four factors by analysis of different components of emotion: evaluation of situation, stimulated, facial expressions, and readiness for action. In respond to the question of combination of these factors in comprehension of emotion, Parkinson addresses to the role of these factors in emotional experience. Emotional experience affects mostly on evaluation of situations and this experience is being affected by: 1-level of stimulation 2-facial expressions 3- readiness for action. It can be referred to theories of Cannon Philip Bard, Stanley Schachter, Singer and Magda Arnold (cognitive –evaluation theory), Richard Solomon, Lazarus (cognitive-motivational-relational theory) and Weiner theory (attributive theory).

**Cognitive intelligence and emotional intelligence**

The scientists believe that human brain involves cognitive and non cognitive intelligence that they are different but they interacted with each other continuously. Human brain consists of right and left hemispheres. Emotional brain or first brain is located in right hemisphere and this part is activated firstly, then second brain or left hemisphere is activated. Second brain is called logical brain and it contains information about reasoning, accurate behavioral principles and cultural rules. This theory is like that we behave innately and then offer reasons for our conduct. It can be claimed that ninety percent of our conducts is emotional and ten percent is rational. Golman (1995) believes that the human being has two active brains: one thinks and the other feels and in most of the times they are coordinated in extraordinary way. When emotional brain is superior to logical brain, it causes to imbalance (Eskandari Azad, 2011:28). In Sorundic opinion, intelligence behavior consists of special abilities. He refers to three kinds of intelligence that they are different in different people: 1-abstract intelligence deals with thinking and inputs, comprehension of the relationship among elements and phenomena. Understanding theories and mathematics depends on this intelligence; 2-mechanical intelligence: it relates to communicative characteristics and effective employment of tools and activities. The individuals by scientific skills posse high emotional intelligence; 3-social intelligence refers to personal capabilities in establishing social relations (ibid).

**Emotional intelligence (EQ)**

There are different definitions about emotional intelligence. This term was employed widely since publishing Golman's book in 1995. In interview by John O'Neil in 1996, he defines emotional intelligence as intelligence involving identification of self emotions and utilization of them

for better decision making in life. It is ability of controlling moods and mental situations and impulses that motivates the person in failure and disappointing conditions. Weisinger (2000) defines emotional intelligence as employing feeling and emotions in controlling of behavior, thoughts and effective communication with colleagues, supervisors and customers, management of time and planning for promotion. Mayer and Salovey define emotional intelligence as ability to evaluation, expression and coordination of feeling and its effective usage. In any definitions, emotional intelligence involves ability to comprehension of feeling, access and production of emotions in manner that aids in thinking and understanding the meaning of emotions leading to progress in feeling and thinking (AkbarZadeh,2004:52).

**Models of EQ**

The theoretical models of emotional intelligence are considered from ability and combinatory view points. Emotional intelligence is result of mind ability. In combinatory viewpoint, emotional intelligence is combination of mind ability and traits like optimism and satisfaction. Generally speaking, models of Mayer and Salovey model, Golman model, Bar –Ann model, Deluxe and Haggis model are main models in EQ.

Mayer and Salovey model (EQ capabilities model): These researchers suggested that individuals behave differently in processing emotive information for identification and recognition. According to this model, EQ involves experimental intelligence (ability to feeling, responding and correct utilization of emotive information) and strategic intelligence (ability to comprehension and managements of emotion).These scopes are divided into their subsets:

1-feeling and showing emotion
2-facilitation of thinking by emotion
3-perception
4-coordination and control of emotion

1-Emotional intelligence begins with expression of feeling .Emotive feeling involves registration, attention and conceptualization of emotive message by facial expression, tone of voice and cultural products. The individuals are different in expression their feelings. Those who evaluate their feelings rapidly could respond to environment and others.

2- Facilitation of thinking by emotion addresses to the effect of emotion on cognitive system and it is used for problem solving, reasoning, decision making and creativity. Cognition could be damaged by emotion and it causes to prioritization in cognitive system.

3- Perception of emotion: the principle capability is called naming of emotions with words. The person who percepts emotions he could comprehend personal relationships. The individuals with high EQ could understand unfamiliar emotive words used for expression of feelings.

4- Coordination and control of emotion means connecting with emotions based on its application in defined situations. The optimal level of control of emotions is balancing them. Effort to confinement of emotion leads to suppression. The individuals use different techniques for controlling their moods in order to control their emotions. The active control involves calming down, control of stress, cognitive effort and exercises.

**2. Methodology**

**Literature Review**

Several researches have been done in emotional intelligence scope. Seyed Mohammad Bager Mohseniyan studied EQ, mental health and family performance among children of handicapped fathers and normal students in order to investigate the relationship among the grade of father's handicapping, mental health, EQ and family performance. The statistical sample consisted of 99 high school students that 37 students were children of war handicapped fathers, 32 students were normal and 30 students were children of handicapped fathers. The students with fathers handicapped in war were selected by random cluster method from Shahed high schools and two other groups were selected by purposeful method. The data were analyzed by descriptive statistics, ANOVA, Pearson correlation coefficient and Spearman correlation coefficient. The results showed that there is a significant difference among three groups in mental health and subscales of physical pains, obsessive compulsive, anxiety, interpersonal sensitivity, aggression and psychosis.

The results showed there is no significant difference in the studied groups in EQ and subscales of self respect, empathy, interpersonal relations, mental pressure coping and happiness. There is also a significant difference in family performance and communication, emotional responsiveness and role. In general, mental health and EQ of children of war handicapped fathers were low and also family performance of children of handicapped fathers was high. There is a positive and significant relationship among EQ, family performance and mental health. In families of the war handicapped, father's emotional solitude is related to reduction of communication and family relationship and shifting family members' communicative patterns. These changes reduce children emotional intelligence especially mental health and increase anxiety and aggression.

Ismail Kavousi, Fatemeh Tohidi and Zhila Sarlak investigated the relationship between EQ and time management in MS students of Qazvin Medical

University. The results showed that there is a positive correlation between EQ and time management, EQ and time management components (Kavousi,Tohidi and Sarlak, 2002:4). Professor Hinis Kang chi Hissin PiTai and Pifan Chung investigated the relationship in leadership, emotional intelligence, commitment and occupational performance among Tai 186 salespersons. The results showed that commitment was intermediary between leadership style and occupational performance. The salespersons' emotional intelligence was intermediary between leadership and occupational performance. A research was conducted by Agaei and Jalalvand (2003) on the relationship between EQ and demographic traits by attitude toward marriage among 55 girls and 57 boys. The results showed that there is no significant relationship between EQ and attitude toward marriage. Hassan Zadeh and Saadati studied the relationship between emotional intelligence and demographic traits among 140 school managers of different grades in region one in Sari. The results showed that emotional intelligence of the managers of different levels (primary, guidance and high school) is not different. There is no difference between principals' emotional intelligence and managerial experiences and emotional intelligence is higher in women than men. The emotional intelligence is higher in specialist managers. There is no difference in managers' emotional intelligence, studies level and age.

Research conceptual model

| | |
|---|---|
| age | Intelligence |
| Type of university | |
| Level of studies | |
| gender | |

This research is descriptive and survey according to data collection and it is applied based on the goal. The data were collected by: 1-library method and 2-level observation. Validity is questionnaire efficiency for measuring the traits (Sharifi, 2002). The validity of the research was specified high by studying viewpoints of the experts and professors and correction of some questions.

The reliability of the research shows capability of the questionnaire in preserving reliability in time in spite of uncontrollable conditions of test and respondents and insignificant changes. This measure indicates tools fitness in achieving reliable results (Sakaran, 2005:227).In this research, the reliability was achieved 0.86 by Cronbach alpha and the data were analyzed by SPSS software.

**The statistical population and sample and sampling method**

The statistical population involves all real and assumed members that the results are generalized to this population (Delavar,2001:120). The statistical population of this research involves students of Tabriz Islamic Azad University. The sample consists of set of signs selected from one part, a group or a society so that it indicates quality and characteristics of that society shown by *n* (Khaki,2004:250). In this research 400 individuals were selected as sample.

**Materials**

Questionnaire is a common tool and direct method for collection of the data. A questionnaire consists of statements that the respondent responses according to these statements (Zohreh Sarmad and et al, 2006: 141). Check and answer provides direct communication with the interviewee and it leads to deep evaluation of perceptions, attitudes, interests and desires of the subjects (ibid: 149). The data were collected by check and answer method and questionnaire.

**Analysis of Data**

**Descriptive statistics**: in this method, the results of small group are generalized to the society (Hafezniya, 2001:242).

According to the table it is seen that number of students is 400 that %46.8 is male and %53.5 is female.

According to the table2, family income of %21.4 of the male students is lower than 400 thousands, % 47.1 is upper than 400 to 700 thousands, %27.3 is higher than 700 to one million, %2.1 is higher than one million to 1500 million, %1.1 is higher than 1500 to 2500 in one month. It can be said that %16.4 of the female students is lower than 400 thousands, % 43.2 is upper than 400 to 700 thousands, %65.2 is higher than 700 to one million, %2.3 is higher than one million to 1500 million, %0.5 is higher than 1500 to 2500 in month.

**Table 1.** frequency distribution of the respondents based on gender

| serial | gender | Frequency | percentage | Reliable percentage | Collective percentage |
|---|---|---|---|---|---|
| 1 | male | 187 | 46.8 | 46.8 | 46.8 |
| 2 | Female | 213 | 53.3 | 53.3 | 100.0 |
| | total | 400 | 100.0 | 100.0 | |

**Table 2.** frequency distribution of the respondents based on family income

| Family income | number | | percentage | | Reliable percentage | | Collective percentage | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Under *400 | 40 | 35 | 21.4 | 16.4 | 21.4 | 16.4 | 21.4 | 16.4 |
| Upper 400 to 700 | 88 | 92 | 47.1 | 43.2 | 47.1 | 43.2 | 68.4 | 59.6 |
| Upper 700 to 1000 | 51 | 75 | 27.3 | 35.2 | 27.3 | 35.2 | 95.7 | 94.8 |
| Upper 1000 to 1500 | 4 | 5 | 2.1 | 2.3 | 2.1 | 2.3 | 97.9 | 97.2 |
| Upper 1500 to 2500 | 2 | 5 | 1.1 | 2.3 | 1.1 | 2.3 | 98.9 | 99.5 |
| Upper 2500 | 2 | 1 | 1.1 | 0.5 | 1.1 | 0.5 | 100.0 | 100.0 |
| total | 187 | 213 | 100.0 | 100.0 | 100.0 | 100.0 | | |

(*it is in Toman)

**Table 3.** Frequency distribution of the respondents based on age

| age | number | | percentage | | Reliable percentage | | Collective percentage | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 20-22 | 47 | 75 | 25.1 | 35.2 | 25.1 | 35.2 | 25.1 | 35.2 |
| Upper 22-24 | 99 | 105 | 52.9 | 49.3 | 52.9 | 49.3 | 78.1 | 84.5 |
| Upper 24-26 | 34 | 13 | 18.2 | 6.1 | 18.2 | 6.1 | 96.3 | 90.6 |
| Upper 26 | 7 | 20 | 3.7 | 9.4 | 3.7 | 9.4 | 100.0 | 100.0 |
| total | 187 | 213 | 100.0 | 100.0 | 100.0 | 100.0 | | |

According to table 3, it can be said that from 400 students, among male students %25.1 is in age range of 20-22, %52.9 is in age range of 22-24, %18.2 is in age range of 24-26 and % 3.7 is in age range upper than 26 years. Also among female students %35.2 is in age range of 20-22, %49.3 is in age range of 22-24, % 6.1 is in age range of 24-26 and % 9.4 is in age range upper than 26 years.

**Table 4.** frequency distribution of the respondents based on level of study

| Level of study | number | | percentage | | Reliable percentage | | Collective percentage | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Associate | 31 | 80 | 16.6 | 37.6 | 16.6 | 37.6 | 16.6 | 37.6 |
| BA | 122 | 123 | 65.2 | 57.7 | 65.2 | 57.7 | 81.8 | 95.3 |
| MA | 34 | 10 | 18.2 | 4.7 | 18.2 | 4.7 | 100.0 | 100.0 |
| total | 187 | 213 | 100.0 | 100.0 | 100.0 | 100.0 | | |

According to table 4, from 400 students, among female students %37.6 is associate, %57.7 is in BA and %4.7 is in MA level. Among male students %16.6 is associate, %65.2 is in BA and %18.2 is in MA level.

**3. Results**

Pearson correlation coefficient was used for test of hypotheses:

$H_1$: there is a relationship between age and EQ of male and female students of Tabriz Islamic Azad University.

$H_2$: there is a relationship between family income and EQ of male and female students of Tabriz Islamic Azad University.

$H_3$: there is a relationship between level of study and EQ of male and female students of Tabriz Islamic Azad University.

**Table 5.** Results of Pearson correlation coefficient based on age, gender, family income and EQ of male and female students

| Ser. | Hypotheses | Pearson correlation | | Significance | | results | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Male | Female | Male | Female |
| 1 | there is a relationship between age and EQ | 0.254 | -0.034 | 0.000 | 0.619 | Confirmed | Rejected |
| 2 | there is a relationship between family income and EQ | 0.284 | 0.028 | 0.000 | 0.686 | Confirmed | Rejected |
| 3 | there is a relationship between level of study and EQ | 0.067 | 0.008 | 0.362 | 0.912 | Rejected | Rejected |

According to table 5, the Pearson coefficient for H1 by separation of male and female students is 0.254 and -0.034 respectively. The significance level in H1 is 0.000 and 0.619 respectively for male and female students. It can

be said that there is a relationship between age and EQ among male students, but there is no significant relationship between age and EQ among female students.

The Pearson coefficient for H2 by separation of male and female students is 0.284 and 0.028 respectively. The significance level in H2 is 0.000 and 0.686 respectively for male and female students. This significance level is less than 0.05 for male students and it is more than 0.05 for female students. It can be said that there is a relationship between family income and EQ among male students, but there is no relationship between family income and EQ among female students; by confidence level of %95 the relationship between family income and EQ among male students is accepted and this relationship can be rejected in female students.

Table 6. Descriptive statistics of different groups

| Serial | Hypotheses | level | number | | mean | | SD | | Mean scale error | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Male | Female | Male | Female | Male | Female |
| 4 | The mean score of EQ is not equal in BA and MA students of Islamic Azad university | BA | 122 | 123 | 130.44 | 132.15 | 16.291 | 15.379 | 1.475 | 1.387 |
| | | MA | 34 | 10 | 135.29 | 126.20 | 15.213 | 25.516 | 2.609 | 8.069 |
| 5 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | Associate | 31 | 80 | 131.81 | 130.44 | 16.800 | 10.785 | 3.017 | 1.206 |
| | | BA | 122 | 123 | 130.44 | 132.15 | 16.291 | 15.379 | 1.475 | 1.387 |
| 6 | The mean score of EQ is not equal in associate and MA students of Islamic Azad university | Associate | 31 | 80 | 131.81 | 130.44 | 16.800 | 10.785 | 3.017 | 1.206 |
| | | MA | 34 | 10 | 135.29 | 126.20 | 15.213 | 25.516 | 2.609 | 8.069 |

The Pearson coefficient for H3 by separation of male and female students is 0.067 and 0.008 respectively. The significance level in H3 is 0.362 and 0.912 respectively for male and female students. This significance level is 0.362 for male students and it is 0.912 for female students. According to significance level higher than 0.05 and confidence level of %95 the relationship between level of study and EQ can be rejected

In order to test hypotheses 4, 5 and 6, table 6 shows descriptive statistics of level of study. Number, standard deviation and mean error of male students of associate degree are 31, 81, 131, 16.800 and 3.017 respectively and they are 80,130.44, 10.785 and 1.206 for female students respectively.

Number, standard deviation and mean error of male students of BA degree are 122, 130.44, 16.291, 16.800 and 1.475 respectively and they are 123,132.15, 15.379 and 1.387 for female students respectively.

Number, standard deviation and mean error of male students of MA degree are 34, 29, 135.29, 15.213 and 2. 609 respectively and they are 10,126.20, 25.516 and
8. 069 for female students respectively. For test of hypotheses 5 and 6, Levene test is required. In this test variance is assumed equal. The results are shown in table 7.

Table 7. the results of variance equality in different groups

| Serial | Hypotheses | Variance | Variance Equality for both populations | | | |
|---|---|---|---|---|---|---|
| | | | male | | Female | |
| | | | fd | sig | fd | sig |
| 4 | The mean score of EQ is not equal in BA and MA students of Islamic Azad university | equal | 0.039 | 0.843 | 11.950 | |
| | | Non equal | | | | 0.001 |
| 5 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | Equal | 0.047 | 0.829 | 9.392 | |
| | | Non equal | | | | 0.002 |
| 6 | The mean score of EQ is not equal in associate and MA students of Islamic Azad university | Equal | | 45.403 | | |
| | | Non equal | 0.0047 | | | 0.000 |

Table 7 shows degree of freedom and significance level of equality test of variances in different studies levels. In hypotheses 4, 5 and 6 significance levels of male students are 0.843, 0.829 and 0.727; so the figures are more than 0.05. Thus it can be accepted hypothesis of equality of variances in error level of 0.05 percent.

The significance level of equality of variance among female students with associate degree, BA and MA is 0.001, 0.002 and 0.000 respectively. Since these figures are less than 0.05, so the hypothesis of equality of variances is rejected. Thus in mean comparison test (hypotheses 4, 5 and 6), the results of hypothesis of equality and non equality are studied. Table 8 shows the results.

Table 8. T test results of equality of groups mean

| T test of equality of groups mean | | | | | | | |
|---|---|---|---|---|---|---|---|
| Serial | Hypotheses | T | | fd | | sig | |
| | | Male | Female | Male | Female | Male | Female |
| 4 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | -1.557 | 0.727 | 154 | 9.539 | 0.121 | 0.485 |
| 5 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | 0.414 | -0.934 | 151 | 199.819 | 0.680 | 0.351 |
| 6 | The mean score of EQ is not equal in associate and MA students of Islamic Azad university | -0.878 | 0.519 | 63 | 9.406 | 0.383 | 0.615 |

Table 8 shows significance level of equality test of variances in different studies levels. In hypotheses 4, 5 and 6 significance levels of male students are 0.121, 0.680 and 0.383. The significance level of equality of variance among female students is 0.485, 0.351 and 0.615 respectively. According to significance level, the reason is significance level higher than 0.05, so the hypotheses 4, 5 and 6 are rejected by confidence level of %95. It can be said that the mean score of EQ is equal in female and male student in different studies level.

Table 9. mean difference and upper and lower limit of mean equality of both groups

| T test for equality of mean of both groups | | | | | | | |
|---|---|---|---|---|---|---|---|
| Serial | Hypotheses | Mean difference | | Confidence level | | | |
| | | | | Low limit | | Upper limit | |
| | | Male | Female | Male | Female | Male | Female |
| 4 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | -4.851 | 5.954 | -11.007 | -12.408 | 1.304 | 24.317 |
| 5 | The mean score of EQ is not equal in associate and BA students of Islamic Azad university | 1.364 | -1.717 | -5.151 | -5.613 | 7.879 | 1.907 |
| 6 | The mean score of EQ is not equal in associate and MA students of Islamic Azad university | -3.488 | 4.238 | -11.422 | -14.098 | 4.446 | 22.573 |

Table 9 shows confidence level for hypotheses 4, 5 and 6. The results are shown in table 10.

Table 10. confidence level for hypotheses 4, 5 and 6

| | | |
|---|---|---|
| 1 | confidence level of hypothesis 4 for male students | $-11.007 \leq \mu_1 - \mu_2 \leq 1.304$ |
| 2 | confidence level of hypothesis 4 for female students | $-12.408 \leq \mu_1 - \mu_2 \leq 24.317$ |
| 3 | confidence level of hypothesis 5 for male students | $-5.151 \leq \mu_1 - \mu_2 \leq 7.879$ |
| 4 | confidence level of hypothesis 5 for female students | $-5.613 \leq \mu_1 - \mu_2 \leq 1.907$ |
| 5 | confidence level of hypothesis 6 for male students | $-11.422 \leq \mu_1 - \mu_2 \leq 4.446$ |
| 6 | confidence level of hypothesis 6 for female students | $-14.098 \leq \mu_1 - \mu_2 \leq 22.573$ |

Table 10 shows confidence level of hypotheses 4, 5 and 6. According to this fact that the lower limit is negative and upper limit is positive, it can be said that the mean difference is not significant and equality of mean of both groups is accepted. In other words: $\mu_1 - \mu_2 \rightarrow \mu_1 = \mu_2$

**4. Discussions**

This research aims to investigate the relationship between demographic traits and emotional intelligence of students of Tabriz Islamic Azad University. There is a significant relationship between age and EQ and Pearson correlation coefficient is 0.254 and -0.034 for male and female students respectively. According to table 5, the significance level in the first hypothesis is 0.000 and 0.619 for male and female students respectively. So there is a relationship between age and EQ in male students and there is no significant relationship between age and EQ in female students.

According to the second hypothesis, there is a significant relationship between family income and EQ; Pearson correlation coefficient is 0.284 and 0.028 for male and female students respectively. The significance level in the second hypothesis is 0.000 and 0.686 for male and female students respectively. This significance level is less than 0.05 for male students and it is more than 0.05 for female students. So there is a relationship between family income and EQ in male students and there is no significant relationship between family income and EQ in female students; by confidence level of %95 it can be accepted the relationship between family income and EQ in female students.

According to the third hypothesis, there is a significant relationship between level of study and EQ; based on the results, Pearson correlation coefficient is 0.067 and 0.008 for male and female students respectively. The significance level in the third hypothesis is 0.362 and 0.912 for male and female students respectively. This significance level is higher than 0.05. So by confidence level of %95 it can be rejected the relationship between level of study and EQ in students.

Concerning to hypotheses four, five and six there is a significant relationship in EQ of male and female students in associate, BA and MA degrees; according to table 8, the significance levels in the hypotheses 4,5 and 6 are 0.121 and 0.686 and 0.383 for male students respectively and these levels are 0.485,0.351 and 0.615 for female students respectively. This significance level is higher than 0.05. By confidence level of %95 it can be rejected the equality of EQ mean score in students in different level of studies.

Education system is the fundamental social discipline and education is an exalted concept and important national component. According to the contemporary theories, education plays an important role in structure and sustainable development in the country (Niyaz Azari, 2002).The importance of emotional intelligence and its application uncover the need to more researches.

There are many educational systems that avoid application of sciences and concepts by emphasizing on EQ and institutionalization of emotional intelligence in educational system as dominated paradigm. In this case, the students are trained in theory scopes and their minds fill with unusable concepts. So the students should get familiar with concepts like emotional intelligence and its applications and benefits. Thus it is necessary to identify the effective concept and components on emotional intelligence and measure the relationship among the components and invest in institutionalization of the effective components.

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# The relationship between Erythropoietin and adiponectin and the inflammatory cytokines .

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**Abstract:** Inflammatory cytokines, erythropoietin (EPO) and adipocytokines, including adiponectin, leptin and tumor necrosis factor-alpha (TNF-α) play a role in pathogenesis of type 2 Diabetes mellitus. However, the relationship between erythropoietin (EPO) level and the inflammatory cytokine in type 2 diabetic patients with or without renal complication are not clear. This prospective cohort study is aimed to investigate the relationship between erythropoietin, adipocytokines and inflammatory cytokines in type 2 diabetic patients with or without renal complications based on the serum levels of their urea and creatinine. Patients were classified as group-1 (n = 66), in comparison with those suffering renal complications as group-2 (n = 54). Serum levels of EPO, adiponectin and inflammatory cytokines, TNF- α and IL-6 together with other biochemical parameters were measured in total patients suffering type 2 DM (n=120). Serum levels of EPO, adiponectin and inflammatory cytokines including; TNF- α and IL-6 were measured using enzyme linked immunosorbent assay (ELISA). Our results showed that the typ2 diabetic patients in general, had significantly high interleukin-6 concentrations (mean=25.53±2.36) and no significant difference between the two groups ($p$>0.05). However, TNF-α were significantly higher in group2 than group1 ($p$=0.01). On the other hand, serum concentration of EPO, adiponectin and haemoglobin (Hb) levels were significantly lower in group-2 than group-1 ($p$=0.037, $p$<0.005, $p$<0.005 respectively). There were significant positive correlations between EPO and adiponectin in the two groups (r=0.316, $p$<0.01 and r=0.320, $p$<0.05 respectively); while no significant correlation was found between EPO and TNF- α or IL-6, in either groups. In conclusion: These results show that the low serum level of EPO may associate with the low serum level of adiponectin in patients with type-2 DM, especially in those with renal complications, but not with TNF- α or IL-6.

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**Keywords:** adiponectin, diabetes mellitus (DM), erythropoietin (EPO), interlukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α).

## 1. Introduction

Diabetes mellitus (DM) is a chronic disease characterized by hyperglycaemia, varying degree of insulin deficiency and/or impaired insulin action with disturbance in protein, lipid and carbohydrate metabolism. Complications of DM are several including; coronary heart disease, cerebrovascular disease, peripheral neuropathy, eye and kidney diseases [1].

Epidemiological studies of type 2 diabetes indicate that the disease is a rapidly growing problem in several countries. It affects large numbers of people from a wide range of ethnic group all over the world [2]. Type 2 diabetes is usually associated with the presence of insulin resistance which may sometime combine with a relative insulin deficiency [3].

Inflammation and activated monocytes will results in increasing the level of inflammatory markers, e.g., C-reactive protein, plasminogen activator inhibitor-1 and inflammatory cytokines including: TNF-α, IL-6, IL-1β and IFN-γ [4-6].

In type 2 diabetes the pancreatic islet β cells failure and reduction of β-cell mass are predominantly associated with the increase in circulating cytokines and free fatty acids as the chronic exposure of β cell to these mediators induces excessive production of reactive oxygen species (ROS) and activation of caspases which inhibit insulin secretion and promote apoptosis of pancreatic β cells [7-9]. Various pro-inflammatory cytokines including TNF-α , , IFN-γ, IL-6, leptin, resistin and adiponectin have been reported to be involved on pancreatic β-cell dysfunction and subsequently, in pathogenesis of type 2 diabetes [7,8].

Human and experimental animal studies of type 2 diabetes revealed the presence of abnormal changes in cytokine profile in both islet β-cell and plasma, where TNF- α, IL-1 beta, VEGF and IL-6 are involved in development of microvasular diabetic complications such as nephropathy and diabetic foot [10-12]. In addition to IL-6 and leptin which has been found to be elevated in newly diagnosed type 2 diabetes [13, 14]. Furthermore IFN-γ gene polymorphism has been detected in patients with type 2 diabetes and latent autoimmune diabetes of adult (LADA) [15].

Recently; there is an extensive work to study the relation and the involvement of erythropoietin (EPO) in diabetes mellitus. These studies indicate the presence of EPO deregulation in patients with type 2 diabetes and the presence of a strong cyto-protective effect of EPO on vascular cells that exposed to elevated glucose [16-19].

EPO is a 30.4 kDA glycoprotein, It is a hematopoietic growth factor that regulate red blood cell production by stimulating the proliferation and survival of erythroid progenitor. The primary organs of EPO production is the kidney; whereas, the secondary sites involved the liver and the uterus. Several other organs can secret EPO including peripheral endothelial cells (ECs), muscle, and insulin-producing cells [20]. The biological effects of EPO are exerted by its interaction with specific receptor on a target cell. EPO receptors are usually found in erythroid progenitor cells and in a variety of non- hematopoietic cell types including: neurons, endothelial cells, cardiomyocytes, and renal cells [21]. The primary biological function of EPO is to regulate the erythropoiesis; however, EPO has other several functions. It inhibits apoptosis in a wide variety of cell type, plays a potential neuro- and cardio-protective role against ischemia and involved in angiogenesis, neurogenesis. It also plays an important role in reducing inflammation and local edema and it has been reported that EPO enhance cognition in normal and diseased human subjects [22].

Recent interest has been focused upon the inhibitory effect of EPO on pro-inflammatory cytokines. It was found that EPO can directly inhibit several pro-inflammatory cytokines, such as IL-6, TNF-α, and monocyte chemoattractant protein 1 [23]. A number of experimental studies reveal the inhibitory effect of EPO on neuroinflammation in a number of autoimmune diseases [24]. However, a little information is available on the relation between the inflammatory cytokines and EPO in type 2 diabetes. Therefore, in this study we aimed to investigate the relationship between EPO and adiponectin, also between EPO and the pro-inflammatory cytokines, IL-6, TNF-alpha in type 2 diabetic patients with renal failure in comparison with diabetic subject without renal complications.

## 2. Materials and methods

The Current prospective study was carried out at King Abdulaziz University Hospital (KAUH) in Jeddah, Kingdom of Saudi Arabia between March 2010 and May 2011.

A total of 120 adult male Saudi patients were recruited in this cross sectional study from outpatient diabetic clinic at KAUH. Patients were classified into two groups; group-1 that includes 66 type 2 diabetic patients who have no renal involvement and have no other diabetic complication and group-2 that includes 54 type 2 diabetic patients who represented with renal complication based on high concentrations of serum levels of Blood Urea Nitrogen (BUN) and creatinine.

The diagnosis of type 2 diabetes was made according to the new criteria of American Diabetes Association based on fasting blood glucose ≥126 mg/Dl or glycosylated haemoglobin A1c (HbA1c) ≥6.5%. Type 2 diabetic patients were treated with hypoglycaemic drugs including insulin, metformin and sulfonylurea, lipid lowering drugs.

The following were excluded from the study:1) patients with type 1 diabetes, 2) patients with complicated type 2 diabetes other than renal complication such as patients with cardiovascular or peripheral neuropathy, 3) patients with clinical or laboratory evidence of other hormonal abnormalities or serious systemic disease such as acute/ chronic inflammations or malignancy, 4) patients with connective tissue diseases such as Rheumatoid arthritis.

Blood samples were collected from all participants. Fasting blood samples were obtained.

Red blood cell counts, erythrocyte mean cell volume (MCV) and haemoglobin were measured with automated cell counts on the Beckman-Coulter LH750 machine within 6 hours of phlebotomy. The presence of anemia was defined by Hb<130 g/L on the basis of definition of WHO [25].

BUN and Creatinine were measured by using plasma with automated Dimension-Vista® lab system (Siemens Healthcare Diagnostics Inc.).
Whole blood was used to measure HbA1c and it was assessed with Roche Cobas Integra 400 Plus analyzer (Roche Diagnostics Inc.).

Serum EPO, adiponectin, TNF-α and IL-6 were measured in all samples by using Aliquots of serum which prepared and stored at −80°C and thawed just prior to analysis. Serum EPO, adiponectin, TNF-α and IL-6 levels were measured in duplicate by high sensitivity enzymelinked immuno-absorbent assays (ELISA) kit. EPO was measured by IBL Immuno Biological Laboratories. TNF-α, adiponectin IL-6 were measured by commercial ELISA kit (Assay Max Human ELISA Kit). These assay detected only human cytokines and the minimum detectable concentration were 0.6 mIU/ml for EPO, <10pg/ml for TNF, 0.5ng/ml for adiponectin and<10pg/ml for IL-6. Any sample with level less than these detectable doses reported as 0.
Based on the kit used, the normal reference range of adiponectin, TNF-α and IL-6 are 8.3- 13.9 ug/ml, 5-20 pg/ml and 0-10 pg/ml respectively.

Statistical analysis was performed using MegaStat, an add-ins Microsoft Excel program. Data from the experiments were presented as mean + Standard error from the mean (SEM).

Differences between groups were analysed by unpaired t-test. Correlation coefficients were determined and a stepwise multiple linear regression analysis were performed to determine relationships between the EPO and other cytokines for each group. The level of significance was set at $p< 0.05$.

The protocol conformed to the ethical guidelines of our institutions, and consent was obtained from each participant.

## 3. Results

The demographic and biochemical parameters of all patients are detailed in Table 1. Most of the patients in group-2 were presented with anemia (49/54) 90.74%, compared to 25/66 (37.87%) patients in group-1. The mean value for the entire patients in both groups is 11.88+0.22 (60.67%). HbA1c is high in both group and there is no significant difference between the two groups ($p>0.05$).

In table 2 serum levels of EPO and adiponectin were significantly lower in the group-2 than group-1. On the other hand, TNF-α were significantly higher in group-2 than group-1 ($p=0.01$).

The type-2 diabetic patients in general, had significantly high interleukin-6 concentrations (mean=25.53±2.36). Nearly all the patients showed either high our upper limit IL-6 serum levels. Therefore, no significant difference between the two groups ($p>0.05$) were observed. To investigate the influence of renal complication on the levels of the studied cytokines, the percent of patients were calculated in the two groups (fig 1) Figure 1 shows that 31.48% (in group-2) patient with renal complication had low serum EPO and 48.15% had low adiponectin, compared with 7.56% and 3.03% respectively in those without renal nephropathy (group-1). On the other hand, 42.60% patients of group2 had high TNF-α and 57.41% had high IL-6 compare with 22.72% and 56.06% respectively in group-1.

Figure 1a, shows that 31.48% (in group-2) patient with renal complication had low serum EPO and 48.15% had low adiponectin, compared with 7.56% and 3.03% respectively in those without renal nephropathy (group-1). On the other hand, as shown in Figure1b, 42.60% patients of group2 had high TNF-a and 57.41% had high IL-6 compare with 22.72% 56.06% respectively in group-1.

Figure -2 shows significant differences in the two group on the prevalence of abnormal low EPO and adiponectin; and of the abnormal high of TNF-α; as more than the third of the patients in group 2 had low EPO while more than half of these patients had low adiponectin, compared with less than the tenth and less than 3% respectively. in group-1. Nearly 45% compared with 22% of the patients had high level of TNF-a in group2 and group-1 respectively. In comparison, patients with high IL-6 levels were nearly equal in both groups.

**Table I: Demographic Variables and General Laboratory Tests in the Studied Groups**

| | Group-1 (n=66) | Group 2 (n=54) | P value |
|---|---|---|---|
| age | 51.92±0.97 (35-67) | 49.24±1.08 (29-67) | NS |
| HbA1c | 8. 97± 0.277 (6.5-16) | 9.31 ± 0.298 (6.8-16) | NS |
| urea | 4.90 ± 0.155 (2-8.8) | 18.96 ± 1.43 (5.6-51.6) | p<0.005*** |
| creatinine | 75.08 ± 1.99 (36-114) | 626.52 ± 53.53 (125-1884) | p<0.005*** |
| Hb | 13.41 ± 0.209 (9-17.7) | 10.011 ± 0.250 (6.4-14.6) | P<0.005*** |

**Table II: Laboratory Variables between Group1 and Group 2of , EPO and the cytokines.**

| | Group-1 | Group-2 | P value |
|---|---|---|---|
| EPO | 13.33 ± 2.19 (0-125.194). | 8.34 ± 0.95 (0-34.28) | P<0.05* |
| Adiponectin | 22.37 ± 1.12 (7.01-47.93) | 11.19 ± 1.01 (5.89-36.81) | P<0.001*** |
| TNF-alpha | 35. 11 ± 5.18 (6-165) | 68.11 ±11.72 (10-500) | P<0.01** |
| IL-6 | 22.15±2.14 (0-70) | 29.74 ± 4.44 (10-170) | NS |

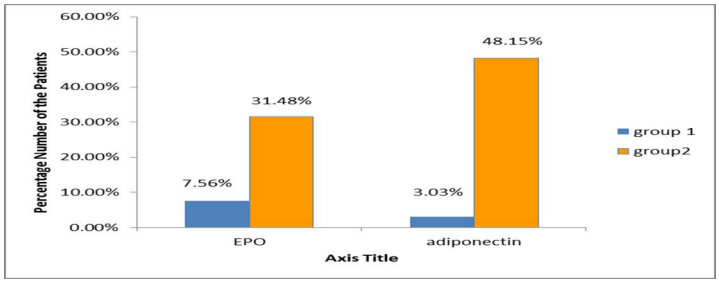



**Fig.1a, Comparison in the percentage of patients with abnormally low EPO and *adiponectin in both groups***

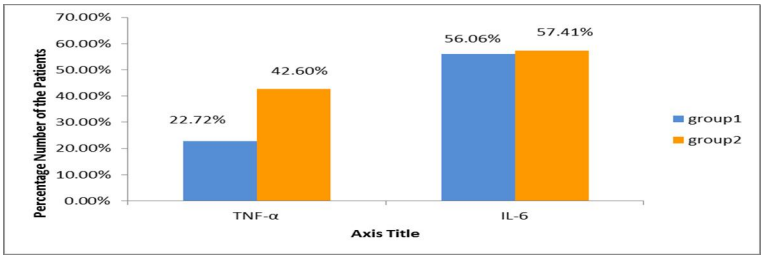
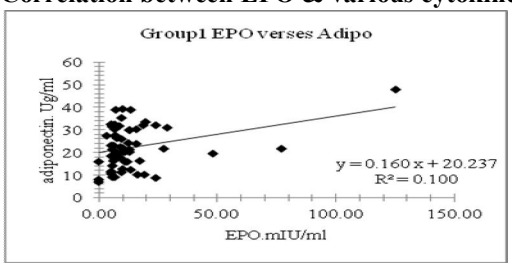
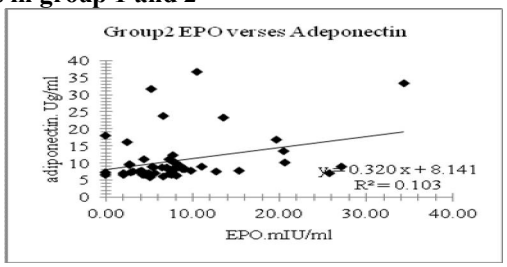



**Fig. 1b, Comparison in the percentage of patients with abnormally high TNF-α and IL-6 in both groups**

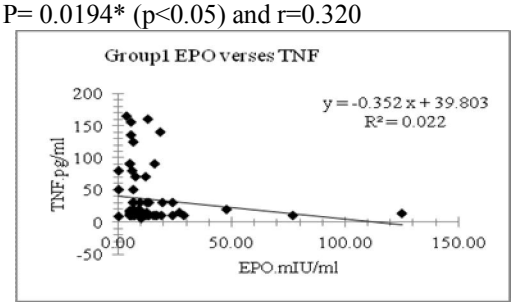
**Figure 2, Correlation between EPO & various cytokines in group 1 and 2**



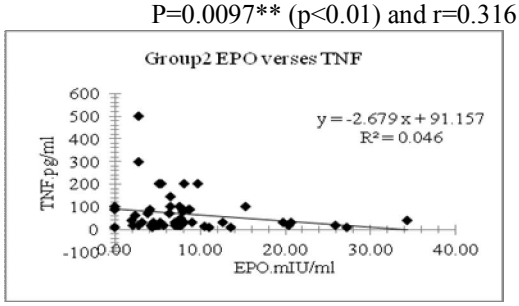

P= 0.0194* (p<0.05) and r=0.320



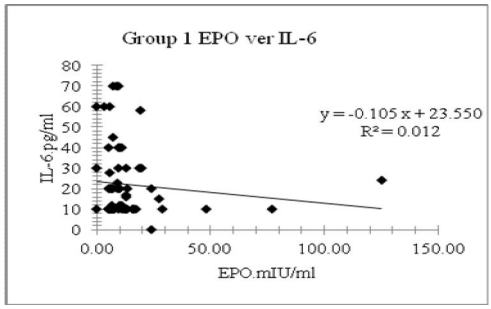

P=0.0097** (p<0.01) and r=0.316



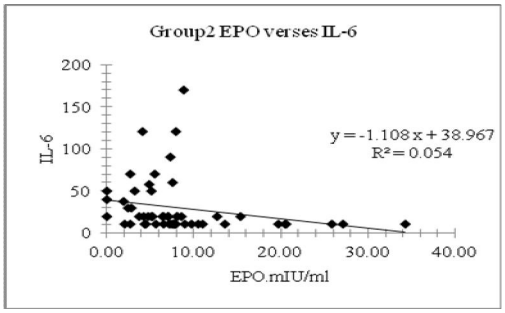

P=0.321 and r=-0.15




P=0.125 and r=-0.213




P=0.3897 and r=-0.108




P=0.937 and r=-0.233

**4. Discussion.**

Diabetic nephropathy (DN) is a common complication in patients with diabetes mellitus. In Saudi Arabia like several other countries; there are tremendously increasing trends in the incidence of diabetes and diabetic nephropathy. It was reported

that 20% of end stage renal failure in Saudi Arabia is due to diabetes mellitus [26].

In the current study about 45% (54/120) of our diabetic patients were presented with renal involvement in compare with 55% (66/120).

Prevalence of anemia is very common in our patients 60.67% of our diabetic patients present with anemia , particularly in those patients in group 2 with renal involvement as 90.74% of them present with anemia in compared with 37.87% patients in group 1. This results in agreement of previous studies these results which indicate the high preference of anaemia in type2 DM patients particularly in diabetics nephropathy patients and this may be attributed to the effect of diabetic nephropathy on vascular compartment of renal tissues [26-28].

The aetiology of anemia in diabetes is multifactorial including deficiency in erythropoietin synthesis and its release, systemic inflammation, iron deficiency, erythrocyte abnormalities, shortened erythrocyte half-life, increased osmotic stress, diminished sodium-potassium ATPaseactivity and reduced membrane fluidity and probably iatrogenic factors, e.g., angiotensin converting enzyme (ACE) inhibitors[29]. It has been reported that anemia is an independent risk factor for progression of diabetic retinopathy and renal failure and it not only has its own consequences, but also accelerate micro and macrovascular damage in diabetes mellitus[30].

Our results show that EPO concentration is significantly lower in group-2 than group-1 and this result is in agreement with previous studies which suggested that low EPO concentration could be a major factor in the genesis of anemia in diabetic patients, especially in patient with renal diseases [31]. ). However, another study indicated that plasma EPO concentration is often low in diabetic individuals even in absence of anemia [32]. It is hypothesized that chronic inflammation which associated dysregulation of adipocyte and excess of inflammatory cytokines have been have been implicated in the progression of diabetes and chronic kidney disease in both animal models and in human[33], In the current study; the serum adiponectin was significantly lower in group-2 in comparison to group-1.

Our results in agreement with other previous studies which indicate the antidiabetic effect of adiponectin, the patients who have high concentration of adiponectin are less likely to develop type-2 diabetes mellitus [34] and reduced levels of adiponectin have been reported in obese and type-2 diabetic patients [35].

The relation between adiponectin and renal impaired renal function has been extensively studied. Report of these studies are controversial; some reports indicate presence of high level of serum adiponectin concentrations in type 2 diabetic patients with renal impairment [36,37], In our study, we found a positive relation between EPO and adiponectin particularly in those patients with renal involvement in group-2, whereas many patients in group-2 have low level of both adiponectin and EPO. Although the study reflects a negative correlation between EPO and inflammatory cytokines, however; there are statistical significances in the association of EPO with TNF-α and EPO with IL-6 between the two groups, in type-1 diabetic patients with or without end-stage renal disease [38,39] and in nondiabetic patients with different degrees of renal dysfunction [40]. Whereas, another study indicated only weak relation between serum adiponectin and renal functions [41]. Moreover, the presence of a low blood adiponectin concentration in renal patients is associated with insulin resistant [42]. On other hand other studies reflect the presence of only high serum HMW adiponectin concentrations in type-2 diabetic patients with renal insufficiency and nephropathy [42].

The limitation of the present study is in the use of serum levels urea and creatinin as evidence of renal dysfunction, whereas, the estimation of glomerular filtration rate would be a better indicator.

In conclusion, the decreased serum level of EPO were observed in patients with type2 DM which was correlated with low serum level of Adiponectin especially in those with renal complications; however, this correlation was not observed between EPO and TNF-α or IL-6, in either group. Therefore, our study may suggest that the decreased level of EPO and adiponectin may directly be involved with impairment of kidney function in patients with type2 DM.

Further studies are needed to clarify the effects of the clinical use of both EPO and adiponectin in type 2 DM as a therapeutic agent.

**Acknowledgment**

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# The Effect of Topical Application of Honey on Management of Chemotherapy Induced Oral Stomatitis

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**Abstract:** Chemotherapy agents continue to be the mainstay of cancer treatment, but are associated with short and long term side effects. Oral side effects remain a major source of illness despite the use of a variety of agents to prevent them. One of these side effects is oral Stomatitis. These lesions may produce discomfort and pain which interfere with eating, patient compliance to treatment and potential risk of oral infection. The aim of this study is to determine the effect of topical application of honey in the management of stomatitis in patients undergoing chemotherapy.This study was conducted at the medical oncology department and outpatient clinics of El Mansoura University Hospital. The subjects of this study comprised 40 adults of both sexes. Patients were divided into two groups: group 1 (study group) received 20 ml honey and group II (control group) who was left to the routine hospital care. Tool consisted of two parts to collect the study data: patient's Bio socio-demographic data and Medical data; Oral assessment guide (OAG) tool. The main result showed that subjects among the study group had healthier oral cavity and lower degree of oral stomatitis compared to the subjects in the control group following 10 days of chemotherapy administration. The honey group improved better and foster, analysis of data and comparison of means revealed a statistically significant difference between the two studies groups as regarding the improvement of oral condition in honey group foster than control group. The change in weight between the two studied groups was statistically significant, meaning that the improvement of body weight was much more in experimental group than it was in the control group. According to the results, honey caused virtually better recovery of stomatitis among patients compared with routing solution administered at the ward. The study recommended that patients who suffers from stomatitis should encouraged to frequent and regular training programs to keep the oncology nurses updated with the most resent and effective oral hygiene practices.

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**Key words:** Chemotherapy, Oral stomatitis, Honey.

## 1. Introduction:

The Cancer is a group of disease characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can results in death **(Chan &Ingoffo,2005).** Chemotherapy plays an important role in the treatment of cancer,whether utilized alone or in combination with surgery, radiation therapy, or biotherapy, it can achieve significant improvement in both the cure rate and the length of survival of persons with cancer **(Krakoff, 1991).**

Stomatitis is perhaps one of the most debilitating and painful side effects of cancer therapy. Approximately 40% of all patients receiving chemotherapy endure stomatitis; 80% of all patients receiving radiation for head and neck tumors also are affected**(Sonis*et al.*,1999)**. Seventy-five percent of those with stomatitis complain of acute oral pain. The pain is sometimes so severe that patients receive narcotics to relieve it or they prematurely withdraw from their cancer therapy**(Brown, and Yoder, 2002).**

Oral stomatitis is one of the most debilitating complications following chemotherapy administration. Stomatitis is an inflammation of the oral mucosa accompanied by symptoms such as redness, swelling, and bleeding. Stomatitis can involve the tongue, lips, cheeks, gums, the floor and roof of the mouth **(Epstein & Schubert, 2004;Price & Gwin, 2008 and Kyle, 2008).** It is appeared around days four to five day from starting chemotherapy with a peak on the $7^{th}$ -$14^{th}$ day after chemotherapy **(Cheng*et al.*, 2001and Hicks, 2003).** Clinical manifestations progress from erythema, cracking, and inflammation, to pain, bleeding and ulceration (**Raber-Durlacher*et al.*, 2000).** It is essential that all members of the healthcare team are aware of the optimum management strategies for oral mucositis.

Honey was used to treat the infected wounds as long ago as 2000 years before the bacteria were discovered to be the cause of infection. More recently, honey has been reported to have an inhibitory effect to around 60 species of bacteria including aerobes and anaerobes, gram-positives and gram-negative microorganisms **(Nettina, 2007)**. Many research works have been done on the

antimicrobial effect of honey on different bacterial isolates. **Molan (1999)** reported that honey is becoming accepted as a reputable and effective therapeutic agent by practitioners of conventional medicine and by the general public. This is because of good clinical results that are being obtained. Honey has been reported to be effective in the healing of infected postoperative wounds (**Al-waili and Saloom, 1999**).

According to **Gupta*et al.*,2011)**, there is almost large volume of literature appearing on the effectiveness of honey in treating the infected wounds and skin ulcers describes the features that indicate that honey has potential for the therapy of periodontal disease, oral ulcers, and other problems of oral health. One of the most important features that may be particularly beneficial in promotion of oral wellness is its antibacterial activity**.**

## 2. Methods

**Aim:**

The aim of this study is to determine the effect of topical application of honey in the management of stomatitis in patients undergoing chemotherapy.

**Research design*:***

A quasi-experimental research design was utilized to conduct this study.

**Setting:**

The study was carried out in themedical oncology department and outpatient clinics of El Mansoura University Hospital.

**Subjects:**

A convenience sample of 40 adult cancer patients were selected according to the following criteria both sex (male and female),age ranged from 20 - 60 years and free from any oral lesion, patients who received chemotherapy for first time and were meeting the inclusion criteria of the study were selected. The exclusion criteria were that subjects suffering from head and neck cancer and neutopinc patients were excluded.

**Tools of data collection:**

This Questionnaire consisting of the following 2 parts was used in this study:

**I-Sociodemographic and medical data form,** which wasdesigned by the researchers. It was written in simple Arabic language anddivided into the following parts:

- Characteristics of the study subjects namely, age, gender,marital status, income, educational leveland working condition.
- Patients' medical data to identify diagnosis, duration of cancer, onset of treatment, number of cycle, weight, height.

**II-Oral Assessment Guide (OAG):**

Oral Assessment Guide (OAG) develops by **Eilers*et al.*, (1988)**and utilized by the researchers toassessthe patient's oral cavity and the degree of stomatitis.It included the following: voice; swallow; lips and angle of the mouth; tongue; saliva; mucus membrane; gingiva and teeth.It consists of eight-item,are using a 3-point rating scale,ranging from score (1) illustrate a normal findings and score (3) illustrate severe abnormality with compromise of either mucosal integrityor loss of function. The overall assessment scores were ranging from 8-24. The tools classified the patients into the following category:

- Where a score from 8 or less than 9, denotes healthy oral cavity.
- Where a score ranges from 9-16, denotes moderate stomatitis.
- Where a score ranges from 17-24, denotes severe stomatitis

**Ethical considerations:**

Informed patients consents were fulfilled before data collection after explaining the purpose and nature of study to them. Confidentiality of obtained data was assured, Subjects were informed about their voluntary right to accept or refuse participation in the study, and confidentiality was assured.

**Procedure:**

- Permission was obtained from the Director of El-Mansoura university Hospital for conducting the study in the Medical Oncology Department Clinic and Outpatient Clinics.
- Data were collected over 5 month started from the beginning April 2011 till to the end of August 2012.
- At the beginning of the study demographic data were collected by interviewing subjects individually, while medical information was obtained from patients medical records.
- The subjects who fulfill the inclusion criteria were selected randomly and divided alternatively into two equal groups, study group (I) and control group (II), 20 patients for each.
- All participants were interviewed individually at medical oncology department to collect data about sociodemographic and clinical characteristics using tool I.
- The sample was randomly divided into study and control groups. The study group, patients were treated by application of 20cc honey, applied by themselves on three times a day for two weeks only, when they started chemotherapy. They hold it in their mouth for 30-60 seconds and then gulped it down.
- In the control group received routine hospital care of oral hygiene on three times a day for two weeks.

- Oral assessment tool were filled by the researcher to identified changes in oral conditions for each subject before starting chemotherapy and after it and this was repeated around the day 10 of the treatment .i.e., two times of measurements for each subject to determine Oral Assessment Guide (OAG) profile during the period of the study. This was done for both groups. Indeed, a comparison was done between the two groups, for determining the effect of honey on prevention and management of oral stomatitis. It took approximately 20 minutes for each patient to complete the questionnaire.

**Data analysis:**

The collected data were coded as per variables and entered in SPSS data sheet and analyzed using the SPSS-PC statistical software (SPSS for Windows, version 10.0). Pearson's chi- square tests were used to determine the relationship between the use drugs and patient demographics. Chi square, t-test, Pearson's correlation coefficients (r) were also performed to evaluate the association between the variables. Statistical significance was considered at *p*-value < 0.05.

**3. Results**

**Table (1):**Describes sociodemographic characteristics of patients in the study and control groups. It shows that (50%) of patientsin the study group have age range between 35 to 45 years compared with (40%) of patients in the control group, with no statistically significant difference between both groups (p>0.05). As regard to sex, (50%) males and (50%) females in both groups. Regarding maritalstatus, this table revealed that (45%) in the study group and (60%) in the control group were married. While (35%) in the study group and (25%) in the control group were widowed. There was no statistically significant difference between both groups (*p*>0.05).Regarding educational level, it was observed from this table that the highest frequencies (65%) of studied control subjects, while 60 % in control group were literate. In relation to the residence, most of the studied subjects were from rural areas while lower in both groups were from urban areas.

**Table (2)**presents distribution of the studied sample according to their clinical data. As regard diagnosis 40 % of patient in study group suffered from cancer breast but 45 % in control group had the same diagnosis. While 10% in study group and 5% in control group suffered from cancer cervix. There was no statistically significant difference between both groups (*p*>0.05). As the number treatment cycle, the most of the patient in both group had 3-6 cycle. As regards to weight mean duration was higher in study group after 10 day (73.45+16.033). There are no statistically significant differences among the patients in the study and control groups.

**Table (3)** showed thatmean score of oral assessment categories in both groups at the basic assessment. It points that there was no statistically significant difference was existed between the study and control group respectively (*p*>0.05).

**Table (4)**shows themean score of oral assessment in both groups after implementation of the program. It points that no statistically significant difference regarding teeth, gingivitis (*p*>0.05). While there was highly statistically significant difference existed between patients in the both groups under study as regard to the patients' voice, swallow, lips, tongue, mucus membranes, and TOAG respectively( *p*<0.01).

**Table (5):** describes the correlation between total oral assessment categories and some variables of the studied groups at 10 days post of chemotherapy. It points a positive statistically significant correlation between post honey intervention score and education level (r=0.467, *p*<001), which means that teaching patients lead to improved scores of oral wellness. While there was no significant statistically difference between total oral assessment score and age, sex at 10 days post of chemotherapy (*p*>0.05).

**4.Discussion:**

Although chemotherapy is an important treatment modality, it brings various side effects to cancer patients because it can cause fast-dividing normal cells as well as tumor. The most distressing side effects of chemotherapy are nausea, vomiting, and mucosal ulceration (**Vokurka*et al.*,2005**).

The present study revealed that the majority of patient age ranged from 35- 45 years old. This result supported by the work of the **American Cancer Society (2009)** who concluded that the risk of begin diagnosed with cancer increases as individuals aged, most cases occur in adults in the middle aged or older. In the same line study by (**Nettina, 1996**) stated that it is worth mentioning that 55% of cancer occurs in people over 65 years of age.

The present study revealed that more than half of the study and control groups were female. This result agrees with **Smyth (1999)** reported that cancer is three times as common in women as in men. On the other hand; **Smeltzer and Bare (2004)** explained that men experience a higher incidence of cancer than do women.

**Table (I): Distribution of the studied sample according to their sociodemographic characteristics**

| Items | Study G. (n=30) | | Control G (n =30) | | X2 | *P*- value |
|---|---|---|---|---|---|---|
| | No | % | No | % | | |
| **Sex :** | | | | | | |
| Male | 20 | 50% | 20 | 50% | 0.00 | N.S |
| Female | 20 | 50% | 20 | 50% | | |
| **Age (years) :** | | | | | | |
| <25 | 5 | 25% | 2 | 10% | 4.61 | N.S |
| 25-34 | 2 | 10% | 6 | 30% | | |
| 35-45 | 10 | 50% | 8 | 40% | | |
| > 45 | 3 | 15% | 4 | 20% | | |
| **Marital status :** | | | | | | |
| Single | 4 | 20% | 3 | 15 % | 0.17 | N.S |
| Married | 9 | 45. % | 12 | 60% | | |
| Widowed | 7 | 35% | 5 | 25.% | | |
| **Education :** | | | | | | |
| Literate | 12 | 60% | 13 | 65% | 3.56 | N.S |
| Illiterate | 8 | 40% | 7 | 35% | | |
| **Work :** | | | | | | |
| Work | 10 | 50. % | 12 | 60% | 3.53 | N.S |
| Not work | 10 | 50% | 8 | 40% | | |
| **Residence:** | | | | | | |
| Rural | 13 | 65% | 15 | 75% | 3.33 | N.S |
| Urban | 7 | 35% | 5 | 25% | | |

N.S:Not significant

**Table (2): Distribution of the studied sample according to their clinical data.**

| Clinical data | Study (20) | Control (20) | X2 | *P*-value |
|---|---|---|---|---|
| **Type of cancer:** | No (%) | No (%) | | |
| Breast | 8(40) | 9(45) | 3.45 | NS |
| Hodgkin'slymphoma | 6(30) | 6(30) | | |
| Non hodgkin'slymphoma | 4(20) | 4(20) | | |
| Cervix | 2(10) | 1(5) | | |
| **Treatment cycle :** | | | | |
| 3- 6 | 14(70) | 16(80) | 4.03 | NS |
| 7 - 10 | 5(25) | 4(20) | | |
| 11-14 | 1(5) | 0(0) | | |
| **Body weight :** | | | | |
| Weight pre of therapy | 70.12+16.08 | 70.01+16.05 | t=0.870 | NS |
| Weight 10 days apost therapy | 73.45+16.033 | 71.34+15.083 | | |

*N.S: Not significant

**Table (3): Mean score of patient's oral assessment categories in the studies group atthe beforechemotherapy**

| Items | Study (*Mean* ± *S.*D) | Control (*Mean* ± *S.*D) | t-test | Remarks |
|---|---|---|---|---|
| **Voice** | 0.0034±(0.1719) | 0.0034± (0.1719) | 0.000 | NS |
| **Swallow** | 0.2666± (.0478) | 0.276 ± (.0479) | 0.159 | NS |
| **Lips** | 1.210± (0.402) | 1.564± (0.378) | 0.331 | NS |
| **Tongue** | 1.100±(0.2981) | 1.0667± (0.252) | 0.451 | NS |
| **Saliva** | 1.000± (0.000) | 1.000± (0.000) | - | - |
| **Mucous membrane** | 0.138(0.335) | 1.0654(0.2436) | 0.581 | NS |
| **Gingival** | 0.137(0.333) | 1.133(0.298) | 0.165 | NS |
| **Teeth** | 1.675(0.726) | 1.543(0.658) | 0.183 | NS |
| **TOAG** | 6.000(2.419) | 6.485(2.278) | 0.975 | NS |

NS: Not significant ; TOAG: total oral assessment guide

**Table (4): Mean score of patient's oral assessment categories in the studies group 10 days of post chemotherapy**

| Items | Study | Control | t-test | Remarks |
|---|---|---|---|---|
| Voice | 0.583 ± (0.753) | 0.781± (0.745) | 5.182 | *P*<0.05 |
| Swallow | 0.410±(0.0581) | 0.576 ± (.0479) | 5.10 | *P*<0.05 |
| Lips | 1.210±(0.402) | 1.904± (0.607) | 5.24 | P<0.05 |
| Tongue | 1.560(0.685) | 1.056(0.591) | 2.65 | P<0.05 |
| Saliva | 0.000(0.000) | 0.000(0.000) | - | - |
| Mucous membrane | 0.1345(0.433) | 0.543(0.657) | 8.43 | P<0.05 |
| Gingival | 1.032(0.1816) | 1.1673(0.388) | 1.735 | p>0.05 |
| Teeth | 1.465±(0.725) | 1.643± (0.698) | 1.760 | p>0.05 |
| TOAG | 6.3945± (3.218) | 7.670± (4.165) | 2.334 | P<0.05 |

*P*<0.05: Significant statistically; P>0.05: Not significant statistically; TOAG: total oral assessment guide

**Table (5):** Correlation between total oral assessment categories and some variables of the studied groups post 10 days of chemotherapy

| Research variable | Total t scores of oral assessment guide (OAG) | |
|---|---|---|
| | Day 1 | Day 10 |
| ***Age*** | | |
| r- value | .175 | .166 |
| *p*- value | .233 | .132 |
| ***Sex*** | | |
| r- value | .086 | .035 |
| *p*- value | .276 | .405 |
| ***Education level*** | | |
| r- value | .004 | .481 |
| *p*- value | .467 | .000* |

In relation to type of cancer, slightly half of the patients (50%) were breast cancer in study group and 45% in control group. This result was in agreement with **Beiki*et al.*,2012)** who stated that breast cancer is the most common tumor among women worldwide. While **El Hadaad (2000),** emphasized that non-Hodgkin's lymphomas represent a major health problem throughout the World. It is already a common malignancy and is, unfortunately, continuing to increase rapidly in incidence.

The result of the present study revealed that the majority of patients were from rural area in both groups. On contrary to the finding, **Higginbotham (2001)** found that there is evidence to suggest rural populations are diagnosed at a more advanced stage of cancer**.**This finding raises questions regarding availability and utilization of preventive, screening, and diagnostic services in rural areas as well as the existence of unique social and behavioral barriers. According to **(Monroe*et al.*, 1992)**the majority of data available indicate there are no differences between rural and urban populations with regard to cancer incidence and mortality, but a number of studies find cancer incidence increases with population density, which is a characteristic of relatively more urban settings.

In the present study, no statistically significant relations were detected between OAGL scores at start chemotherapy in the study and control group (p > 0.05).The current study showed improvement in oral assessment scores in patients who apply herbal than patients who apply pharmacology agent.

In the recent past honey has been used for the treatment of burn wounds, infected surgical wounds, pressure ulcers, and postoperative wound infections. Important factors which influence the effectiveness of honey are as follows: antibacterial, anti-inflammation, highly tissue nutrition minerals and vitamins that help repair tissue directly. This finding is congruent with that of **Rashad*et al.*,(2009)** which aimed to evaluate the efficacy of pure natural honey as prophylaxis against radiochemotherapy induced mucositis in head and neck cancer among forty patients. They found that prophylactic use of pure natural honey was effective in reducing mucositis resulting from radiochemotherapy in patients with head and neck cancer.

Regarding moisturizing and healing enhancement properties are explaining the rapid improvement in the condition of voice, swallow, lips, tongue, and mucus membranes of the study group more than the control group after 10 days of application of topical honey, these results were

congruent with the result of **Solomon(1986)** evaluated 18 patients with chemotherapy-induced mucositis during sucralfate treatment. After 7 days of treatment 10 patients were considered to have objective improvement and 11 subjective improvements.

Results of the current study showed a statistically significant improvement in the total oral assessment among patients over time ($p< 0.010$). This result was further supported by **Barahimi*et al.*, (2006)** showed that honey caused virtually better recovery of stomatitis among patients compared with routing solution administered at the ward among 70 patients with acute myeloid leukemia and lymphoid leukemia under chemotherapy. Also **Aldouri (2003)** found that experimental study quicker ulcer healing observed in honey treated rate than untreated. In the same line in **Mohamed & Al-Douri (2008)** noted that Honey has an obvious influence on the rate of healing process of the oral ulcers.

In the present study, showed a positive statistically significant correlation between post honey intervention score and education level ($r=0.467, p<001$), which means that educated patients lead to improved scores of oral wellness. The significant correlation mentioned above is illustrated graphically. While there was no significant statistically difference between total oral assessment score and age, sex post 10 days of chemotherapy ($p>0.05$).

**Conclusion:**

Based on the findings of the present study, it was concluded that honey was an effective preventing and decreasing oral stomatits and gingivitis in patients receiving chemotherapy. Analysis of data and comparison of means revealed a statistically significant difference between the two study groups as regard improvement in oral pain in the study groups faster than control group and body weight in two studied group following 10 days of chemotherapy administration and significant differences were illustrated.

**Recommendations:**

Based on the findings of the present study the following recommendations are suggested:

- Health education programs for patients receiving chemotherapy about the oral hygiene.
- Continuous visiting for dental physician to avoid oral complication
- Creating an oral care plan to patient with honey is an important recommendation in preventing oral complications and decreasing severity of oral stomasitis.
- Regular training programs to keep nurses in oncology unit updated with the most recent strategy for oral hygiene that promote oral wellness.
- Replication of the current study on a larger probability sample from different geographical areas, to achieve generalizable results.

**Implications**

**The results implicated that:**

Nurses providing care to cancer patients should be prepared to manage the toxicities of the chemotherapy. This includes careful assessment, providing patients with essential information and assistance with behavioral and physical nursing interventions that prevent and alleviate patient's side effects of pharmacological treatment.

The educational care plan must encompass the entire process of chemotherapy, the purpose and side effects of the medication prescribed, intervention to alleviate stomatitis and instruction about oral hygiene in order reduce pain in mouth and promotes oral wellness**.**

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# Application of Artificial Bee Colony Algorithm for Optimal Overcurrent Relay Coordination for Power System Including DGs

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**Abstract:** This paper presents a new approach for optimal simultaneous coordinated tuning of overcurrent relay for a power delivery system (PDS) including distribution generations (DGs). In the suggested scheme, instead of changing in protection system structure or using new elements, solving of relay coordination problem is done with revising of relays setting in presence of DGs. For this, the relay coordination problem is formulated as the optimization problem by considering two strategies: minimizing the relays operation time and minimizing the number of changes in relays setting. Also, an efficient hybrid algorithm based on Artificial Bee Colony (ABC) and linear programming (LP) is introduced for solving complex and non-convex optimization problem. To evaluate the efficiency and ability of the proposed method, a 30-bus IEEE test system is considered for simulation studies. Also, three scenarios are examined to evaluate the effectiveness of the proposed approach to solve the directional overcurrent relay coordination problem for a PDS with DGs. Simulation result show the efficiency of proposed method.

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**Keywords:** Directional overcurrent relay coordination, distributed generation, looped power delivery system, short-circuit analysis, Artificial Bee Colony, linear programming.

## 1. Introduction

Directional overcurrent relays (DOCRs) are good technical and economic alternative for the protection of interconnected subtransmission systems and back-up protection of transmission systems. These relays are coordinated to provide a reliable redundant protection scheme while minimizing load interruption. DOCRs have two types of settings: pickup current setting and time multiplier setting (TMS). Basically, to determine these settings, two different approaches are used; conventional approach, and optimization techniques. Several optimization techniques have been proposed to solve the overcurrent relay coordination problem. For example in [1-5], genetic algorithm (GA), evolutionary algorithm (EA), and particle swarm optimization (PSO) algorithms are used to calculate the optimal solution for relay settings. In [6] a novel hybrid GA method is developed. The hybrid GA method is designed to improve the convergence of conventional GA using a local LP optimizer.

Introducing DG into the PDS has both positive and negative impacts on system design and operation. One of the negative effects of DGs is system protection, especially the disturbance caused to the existing relay coordination [7-9]. This disturbance is caused by the change in value and direction of both the system's power flow under normal operation and short-circuits current under fault conditions due to DG implementation. Solving the identified relay coordination problem for PDS with DG is still under development. In[10] disconnecting of DGs in fault duration is recommended, so that before operation of relays in the event of fault the source of change in current and disturbance of the relay coordination's is removed. But disconnecting of DGs confines their benefits and on the other hand the problem of synchronization must be considered. In [11] authors suggested the implementation of a fault current limiter (FCL) to locally limit the DG fault current and thus restore the original relay coordination. This approach requires FCL design. Implementation of an advanced protection scheme based on automation and communication channels is another approach. This approach has many advantages but is costly [12].

In this paper, solving of relay coordination problem for PDS with DGs is performed with revising of relays setting. Actually instead of changing in protection system structure or using new elements, setting of current relays is changed. In this work, the revising relays setting in presence of DGs is done using the optimization framework suggested in [6]. For this aim, the relay coordination problem is formulated as the optimization problem and two strategies are recommended. Firstly, optimization the relays operation time and secondly, minimizing the number of changes in relays setting. Also, an

efficient hybrid algorithm based on Artificial Bee Colony (ABC) and linear programming (LP), which is called ABC-LP algorithm, is used for solving complex and non-convex optimization problem. artificial bee colony is a new metaheuristic optimization method imitating the music improvisation process where musicians improvise their instruments' pitches searching for a perfect state of harmony [13], such as during jazz improvisation.

In the proposed hybrid approach, the ABC and LP are used as global and local optimizers, respectively. These cause a decrease in the search space which results in time consuming and computational efficiency in finding the optimum solutions. To investigate the ability of the proposed method, the numerical results are presented on a 30-bus IEEE test system. Two scenarios are examined to evaluate the effectiveness of the proposed approach to solve the directional overcurrent relay coordination problem for a PDS with DGs. Moreover, to validate the results obtained by ABC-LP algorithm, the hybrid approach based on Genetic Algorithm (GA) and LP algorithm (GA-LP) is adopted from [6] and applied for comparison. Simulation results show the efficiency and superiority of the ABC-LP algorithm over the GA-LP algorithm.

The paper is organized as follows. In the next section an overview on the directional overcurrent relay coordination problem is presented. The basic concept of ABC briefly is explained in section 3. The normal coordination procedures and the hybrid method proposed to solve the relay coordination problem for a PDS with DGs are discussed in section 4. Section 5 provides the PDS understudy and several operating scenarios. Simulation results to evaluate the proposed method are provided in section 6 and some conclusions are drawn in section 7.

## 2. Relay Coordination Problem

The coordination problem of DOCRs is one of the most important problems to be solved in the operation and protection of a power system. The primary objective of the relay coordination problem is to determine the time multiplier setting and pickup current setting of each relay which would minimize the time of operation of the primary relays, while satisfying certain coordination constraints [1-10].

The optimal coordination problem of DOCRs, can be formulated as an optimization problem, where consists of minimizing an objective function (performance function) subject to limits on problem variables and certain coordination constraints. In [14], an overview on the objective functions formed by researchers to solve the relay coordination problem has been presented recently. In this work, the total time objective function, for primary relay near-end-fault, is considered as (1) by including the constraints aiming to avoid the sympathy trips. These constraints are relay setting constraints and backup-primary relay constraints that presented in the next subsections.

$$\min J = \sum_{i=1}^{n} w_i t_i \qquad (1)$$

In (1), $n$ is the number of relays. Also, $t_i$ is the operation time of $i^{th}$ relay for near-end fault and $W_i$ is the correspondent weighting factor and depends upon the probability of a given fault occurring in each protection zone. Commonly these weighting factors set to one. Figure 1 shows the concepts of near-end fault $(F_1)$ and far-end fault $(F_2)$.

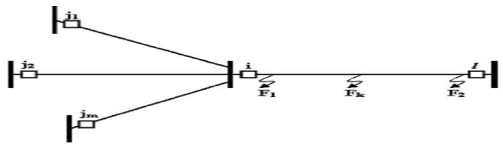


Figure 1. The concepts of near-end and far-end faults for $i^{th}$ relay [6].

### 2.1 Relay Characteristics

There are various linear and nonlinear overcurrent relay characteristics reported in the literature. In this work, relays were assumed identical and with characteristic functions approximated by the following nonlinear characteristics function based on IEC standard:

$$t_i = TDS_i\{\frac{A}{M_i^c - 1} + B\} \quad , \quad M_i = \frac{I_{fi}}{I_{pi}} \qquad (2)$$

Where $TDS_i$ stand for the time multiplier setting, and also, $I_{pi}$ and $I_{fi}$ are pickup current setting of the $i^{th}$ relay the fault current passing through $i^{th}$ relay, respectively.

### 2.2 Primary -Backup Relay Constraints

In the relay coordination problem, to ensure the relay coordination, it is necessary that the operating time of the backup relay be greater than that of the primary relay for the same fault location by a coordination time interval (*CTI*) . For this, the coordination constraints between the primary $i^{th}$ relay and its/their backup relay(s) for the near-end and the far-end faults are considered as follows:

$$\begin{aligned} t_j^{F1} - t_i^{F1} &\geq CTI \\ t_j^{F2} - t_i^{F2} &\geq CTI \end{aligned} \qquad (3)$$

Where $t_i^{F1}$ is the operating time of $i^{th}$ primary relay for the near-end fault. Also, $t_j^{F1}$ is defined in the $j^{th}$ backup relay. Moreover, *CTI* is the minimum interval that permits the backup relay to

clear a fault in its operating zone. In the other words, the *CTI* is the time lag in operation between the primary and its backup relay. It includes many factors, such as the breaker operating time and a safety margin. The value of *CTI* is usually chosen between 0.2 and 0.5 s.

**2.3 Bounds on the Relay Settings**

The limits on the relay parameters can be written as following inequalities:

$$TDS^{k}_{min} < TDS^{k} < TDS^{k}_{max} \quad (4)$$

$$Ip^{k}_{min} < Ip^{k} < Ip^{k}_{max} \quad (5)$$

**3. Artificial Bee Colony Algorithm**

Over the last decades there has been a growing concern in algorithms inspired by the observation of natural phenomenon. It has been shown by many researches that these algorithms are good alternative tools to solve complex computational problems.

Artificial Bee Colony (ABC) algorithm, proposed for real parameter optimization, is a recently introduced optimization algorithm and simulates the foraging behavior of bee colony [15] for unconstrained optimization problems [16]. For solving constrained optimization problems, a constraint handling method was incorporated with the algorithm [17]. In a real bee colony, there are some tasks performed by specialized individuals. These specialized bees try to maximize the nectar amount stored in the hive by performing efficient division of labor and self-organization. The minimal model of swarm-intelligent forage selection in a honey bee colony, that ABC algorithm adopts, consists of three kinds of bees: employed bees, onlooker bees, and scout bees. Half of the colony comprises employed bees and the other half includes the onlooker bees. Employed bees are responsible from exploiting the nectar sources explored before and giving information to the other waiting bees (onlooker bees) in the hive about the quality of the food source site which they are exploiting. Onlooker bees wait in the hive and decide a food source to exploit depending on the information shared by the employed bees. Scouts randomly search the environment in order to find a new food source depending on an internal motivation or possible external clues or randomly. Main steps of the ABC algorithm simulating these behaviors are given below:

**Step 1**. Initialize the food source positions.

**Step 2**. Each employed bee produces a new food source in her food source site and exploits the better source.

**Step 3**. Each onlooker bee selects a source depending on the quality of her solution, produces a new food source in selected food source site and exploits the better source.

**Step 4**. Determine the source to be abandoned and allocate its employed bee as scout for searching new food sources.

**Step 5**. Memorize the best food source found so far.

**Step 6**. Repeat steps 2-5 until the stopping criterion is met.

In first step of the algorithm, $x_i (i = 1,\ldots, SN)$ solutions are randomly produced in the range of parameters where SN is the number of the food sources. In the second step of the algorithm, for each employed bee, whose total number equals to the half of the number of food sources, a new source is produced by (6):

$$v_{ij} = x_{ij} + \varphi_{ij}\left(x_{ij} - x_{kj}\right) \quad (6)$$

Where $\varphi_{ij}$ is a uniformly distributed real random number within the range [-1, 1], k is the index of the solution chosen randomly from the colony (k=int (rand * SN) + 1), where j = 1, . . ,D and D is the dimension of the problem. After producing $\vec{v_i}$, this new solution is compared to $x_i$ solution and the employed bee exploits the better source. In the third step of the algorithm, an onlooker bee chooses a food source with the probability (7) and produces a new source in selected food source site by (6). As for employed bee, the better source is decided to be exploited.

$$p_i = \frac{fit_i}{\sum_{j=1}^{SN} fit_j} \quad (7)$$

Where $fit_i$ is the fitness of the solution $x_i$. After all onlookers are distributed to the sources, sources are checked whether they are to be abandoned. If the number of cycles that a source cannot be improved is greater than a predetermined limit, the source is considered to be exhausted. The employed bee associated with the exhausted source becomes a scout and makes a random search in problem domain by (8). General principle of ABC algorithm is shown in Figure 2.

$$x_{ij} = x_j^{min} + \left(x_j^{max} - x_j^{min}\right) * rand \quad (8)$$

**4. Proposed Approach to Solve Relay Coordination Problem**

There are two approaches for solving the relay coordination problem in presence of DGs: First, revising the protection system by optimization the relays operation time and second, revising the protection system by minimizing the number of changes in relays setting. The first approach is explained in section2. In this approach, the fitness value is defined based on the objective function in (1) which is the overall operating time of primary relays.

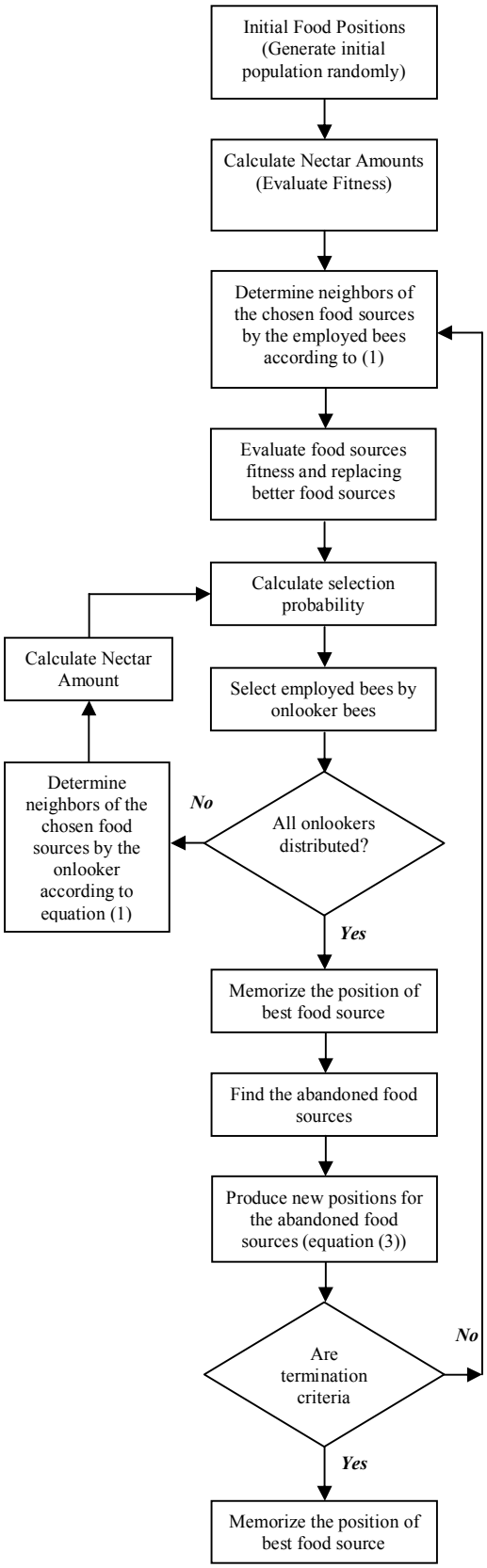



Figure 2. The general principle of ABC algorithm

In the second approach, the fitness function is defined as follow.

$$\text{Fitness} = \frac{1}{1+\text{noc}} \tag{9}$$

In (10), *noc* represents the number of relays that their setting is changed. In this paper a hybrid approach based on ABC and LP algorithms is employed to solve the optimization problem.

Here, the optimization framework suggested in [6] is adopted to develop a hybrid method based on ABC and LP algorithms for solving this complex and non convex optimization problem.

In the proposed hybrid approach, the ABC and LP are used as global and local optimizers, respectively. For this, the LP algorithm is employed as a local optimizer to improve the convergence of ABC algorithm and the ABC is used to solve the first sub problem [i.e., the nonlinear part of optimization problem (1)], in order to determine the $I_{pi}$ variables.

By extracting the candid solution information, the DOCRs coordination problem is converted to a Linear Programming problem. Therefore to evaluate the fitness value for each solution, the standard LP is solved to determine the corresponding *TMS* variables. The flowchart of the proposed hybrid method is shown in Figure. 3.

As can be seen from Figure 3, the LP sub problem is the main part of fitness function evaluation which is called several times by the ABC. To compute the fitness value for each solution, firstly, the values of the $I_{pi}$ variables are extracted by decoding the solution information. Based on the fixed values of the variables, the nonlinear DOCRS coordination problem is converted to a LP problem. Then, by solving this LP problem the corresponding fitness value and the *TMS* variables are computed. This causes a decrease in the search space which results in time consuming and computational efficiency in finding the optimum solutions.

For some individuals according to the values of the variables, the LP sub problem is not converged. In these cases, some of the inequality coordination constraints are violated. To decrease the chance of these solutions in the next process, their fitness values are penalized. The amount of penalty is composed of a fixed value and a variable value in proportion to the number of violated constraints. Whole approach can be summarizing as following steps: 1) Extracting of relays pickup current by decoding each solution. 2) Determination of *TMS* variables by solving LP problem. The objective function in LP sub problem is defined based on (1). 3) Comparison between the result of each iteration and current relays setting and calculating fitness value for each solution based on (10).

## 5. Case Study

### 5.1 The PDS under Study

In order to show the effectiveness of the proposed method, some numerical results are presented on a 30-bus IEEE test system [12]. The considered PDS system is modeled with all of its detailed parameters (synchronous condensers with their generation limits, shunt reactors, distribution transformers taking into consideration their turn's ratio, and aggregated loads represented by constant power models). This study system is illustrated in Figure 4. The considered PDS is fed from three primary distribution substations (132/33 kV) at buses 10, 12, and 27. Each primary distribution feeder is protected by two directional overcurrent relays, one relay at each end. The PDS is assumed to have 29 existing directional overcurrent relays and the system is originally well coordinated. It is assumed that all relays are identical and have the standard IEEE moderately inverse relay curves with the following constants 0.0515, 0.114, and 0.02 for A, B, and C, respectively [12]. Also, the *TMS* values can range continuously from 0.1 to 1.3; while seven available discrete pickup tap settings (0.5, 0.6, 0.8, 1.0, 1.5, 2.0 and 2.5) are considered [12].The ratios of the current transformers (CTs) are indicated in Table. I and the CTI is assumed to be 0.3 s for each backup-primary relay pair.

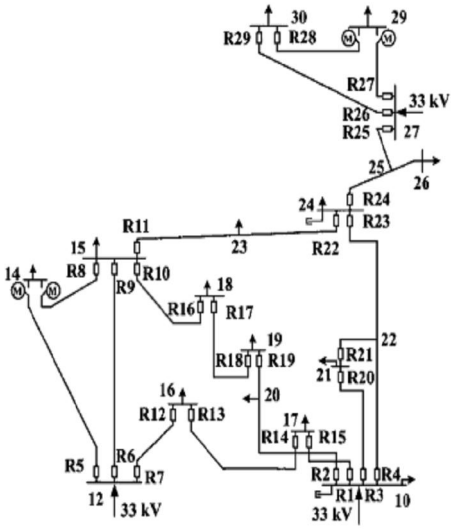



Figure 4. The 30-bus IEEE test system schematic.

Moreover, two CDGLs are considered which consist: PDS substation bus 12, and PDS load bus 19. The selected DG technology is a synchronous type, 10 MVA capacity, operating nominally at 0.9 lagging power factor, and 0.15 p.u. transient reactance based on its capacity. The DG is practically connected to the PDS bus through a transformer which is assumed to have 10 MVA capacity and 0.05 p.u. reactance based on its capacity. The DG is simulated with its required active power and constrained by the minimum and maximum reactive power that can be produced in normal operating conditions. In this work, the maximum individual DG capacity is assumed to be around 10% of the maximum PDS active power loading (115 MVA at 0.9 lagging power factor).

Table 1. The Ratios of The Current Transformers (CTs)

| Relay Number. | CT | Relay Number. | CT |
|---|---|---|---|
| 1 | 200/5 | 16 | 200/5 |
| 2 | 300/5 | 17 | 100/5 |
| 3 | 600/5 | 18 | 100/5 |
| 4 | 300/5 | 19 | 200/5 |
| 5 | 300/5 | 20 | 600/5 |
| 6 | 600/5 | 21 | 100/5 |
| 7 | 300/5 | 22 | 100/5 |
| 8 | 50/5 | 23 | 200/5 |
| 9 | 600/5 | 24 | 100/5 |
| 10 | 200/5 | 25 | 200/5 |
| 11 | 200/5 | 26 | 200/5 |
| 12 | 300/5 | 27 | 200/5 |
| 13 | 100/5 | 28 | 100/5 |
| 14 | 100/5 | 29 | 300/5 |
| 15 | 200/5 | | |

### 5.2 Scenarios under Study

There are three scenarios are to be considered to investigate the proposed method.

**Scenario A**: It is considered as the base case with well established relay coordination, in which there is no DG installed on the PDS.

**Scenario B**: DG as a power source is installed on the PDS territories.

**Scenario C**: Revising relays setting in presence of DG.

In this paper, revising relays setting is considered with two explained approaches and the results are compared. Furthermore, in order to validate the results obtained by ABC-LP algorithm, the hybrid approach based on Genetic Algorithm (GA) and LP algorithm (GA-LP) is adopted from [6] and applied for comparison.

## 6. Analysis and Results

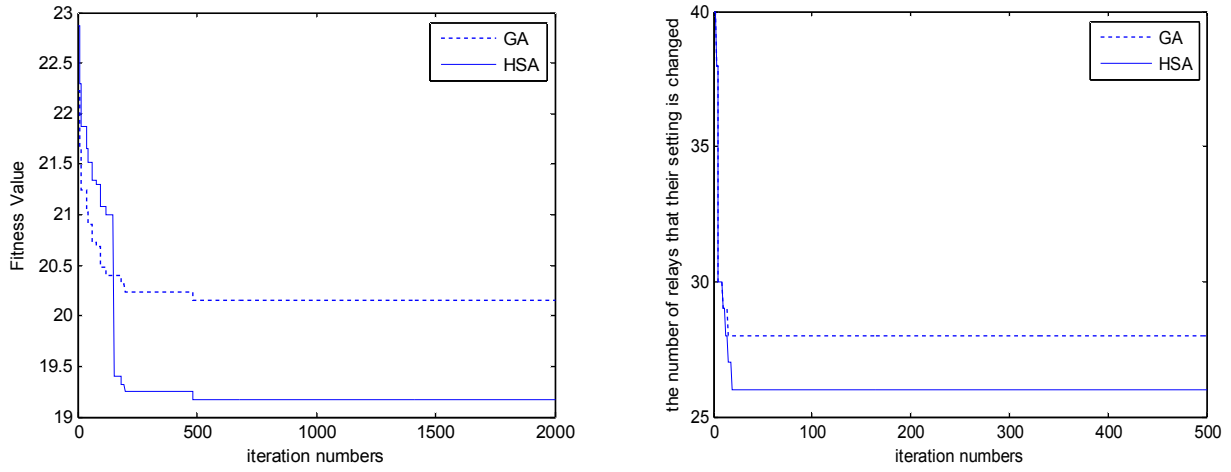
### 6.1 Scenario A: Relay Coordination for the Original PDS

This scenario is considered as a base PDS case without DGs. To evaluate the optimal tuned relay settings, the DOCRs coordination problem is solved using the proposed hybrid method. In this work, stopping criterion is set to be 2000 improvisations or iterations.

To validate the obtained result by ABC-LP, a GA-LP method is applied. The number of chromosomes in the population is set to be 100. One point crossover is applied with the crossover probability $p_c = 0.9$ and the mutation probability is selected to be $p_m = 0.01$ . Also, the number of iterations is considered to be 2000, which is the stopping criteria used in ABC.

To find the best value for the solution, the algorithms are run for 10 independent runs under different random seeds. The average best-so-far of each run are recorded and averaged over 10 independent runs. To have a better clarity, the convergence characteristics in finding the best values is given in Figure 5, where shows ABC performs better than GA at early iterations.

The optimal values of the decision parameters (i.e., pickup tap settings and TMS variables) are shown in Table. 2. Also, the final optimal total time obtained is 14.22s. Moreover, Table. 3 shows a sample of backup-primary relay pair short circuit currents, operating times




(a) (b)

Figure 5. a) Convergence characteristics of ABC and GA on the average best-so-far cost function. (Fitness function is based on Eq. (1) ). b) Convergence characteristics of ABC and GA (approach 2).

Table 2. Pick up Tap Settings And TMS Variables

| Relay No. | ABC | | GA | | Relay No. | ABC | | GA | |
|---|---|---|---|---|---|---|---|---|---|
| | Pikup Tap | TDS | Pickup Tap | TDS | | Pickup Tap | TDS | Pickup Tap | TDS |
| 1 | 2 | 0.907 | 2.5 | 0.9507 | 16 | 2.5 | 0.1212 | 2.5 | 0.2308 |
| 2 | 2 | 0.6656 | 2.5 | 0.6198 | 17 | 2 | 0.2489 | 2.5 | 0.6076 |
| 3 | 2.5 | 0.4312 | 2.5 | 0.4667 | 18 | 2 | 0.7502 | 2 | 0.7690 |
| 4 | 2 | 0.3367 | 2.5 | 0.1711 | 19 | 2.5 | 0.1 | 2.5 | 0.1879 |
| 5 | 2.5 | 0.1215 | 2.5 | 0.1 | 20 | 1 | 0.13 | 0.8 | 0.1 |
| 6 | 2.5 | 0.3337 | 2.5 | 0.4031 | 21 | 1.5 | 1.3201 | 2 | 0.9469 |
| 7 | 2.5 | 0.7694 | 2.5 | 0.8881 | 22 | 1.5 | 0.5726 | 2.5 | 0.7006 |
| 8 | 2 | 0.5126 | 2.5 | 0.4174 | 23 | 2.5 | 0.3234 | 2.5 | 0.3485 |
| 9 | 1.5 | 0.1 | 2 | 0.1 | 24 | 1 | 0.5568 | 2 | 0.4901 |
| 10 | 2 | 0.603 | 2.5 | 0.7363 | 25 | 1 | 0.5785 | 2.5 | 0.3214 |
| 11 | 1.5 | 0.3423 | 2.5 | 0.4082 | 26 | 1.5 | 0.26 | 1.5 | 0.2505 |
| 12 | 2.5 | 0.1346 | 2.5 | 0.1684 | 27 | 2 | 0.2159 | 2 | 0.1582 |
| 13 | 1 | 1.2046 | 2.5 | 0.0309 | 28 | 1.5 | 0.1 | 1 | 0.1 |
| 14 | 2 | 0.5517 | 2.5 | 0.6927 | 29 | 0.8 | 0.1 | 0.6 | 0.1 |
| 15 | 2 | 0.3741 | 2.5 | 0.4228 | | | | | |

Table 3. Sample of Backup-Primary Relay Pair (For ABC Results)

| Relay unit | Relay current(Amp.) | Operating time (sec.) | CTI |
|---|---|---|---|
| R1 | 6180 | 1.0232 | - |
| R19,1 | 627 | 1.3506 | 0.3274 |
| R23,1 | 880 | 1.3916 | 0.3684 |

### 6.2. Scenario B: Relay Coordination in Presence of DG

The presence of DG will change the normal power flow as well as the short-circuit current all over the PDS, which is not restricted to the DG connected bus. Table 4 shows the primary/backup (P/B) relay pairs and corresponding fault currents passing through them in presence of the DG at buses 12 and 19 (each at a time). Based on the reported results shown in Table 3, the PDS will face relay miss-coordination. For the DG at bus 12, three relay pair mis-coordinations, based on CTI threshold (0.3s). Similarly, six relay pair mis-coordinations are reported for a DG installed at bus 19 and different fault locations.

Table 4. Primary/Backup (P/B) Relay Pairs In Presence Of The DG At Bus 19

| Primary relay | | Backup relay | | |
|---|---|---|---|---|
| Relay No. | Realy current (Amp.) | Relay No. | Realy current (Amp.) | CTI |
| 1 | 6754 | 19 | 1104 | 0.0388 |
| 3 | 7316 | 19 | 1104 | -0.262 |
| 4 | 7511 | 19 | 1104 | 0.1852 |
| 6 | 6452 | 12 | 1256 | 0.2547 |
| 7 | 6463 | 9 | 279 | 0.0602 |
| 1 | 1536 | 31 | 1368 | 0.2142 |

## 5. Conclusion

This paper presents a new approach for simultaneous coordinated tuning of overcurrent relay for a power delivery system (PDS) including distribution generations (DGs). In the proposed scheme, solving of relay coordination problem is done with revising of relays setting in presence of DGs. For this aim, two approaches introduced. First, revising the protection system by optimization the relays operation time and second, revising the protection system by minimizing the number of changes in relays setting. For this, the relay coordination problem is formulated as the optimization problem and solved by an efficient hybrid algorithm based on artificial bee colony (ABC) and linear programming (LP). To investigate the ability of the proposed method, a 30-bus IEEE test system is considered with three scenarios. Moreover, to validate the results obtained by ABC - LP algorithm, the hybrid approach based on Genetic Algorithm (GA) and LP algorithm (GA-LP) is adopted from [6] and applied for comparison. Simulation results show the efficiency of the proposed approach in three scenarios.

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# Evaluation of Serum Levels of the Adipokines Chemerin and Resistin in Preeclampsia

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**Abstract: Objectives:** the aim of this study was to determine serum chemerin and resistin levels in preeclamptic patients as well as healthy pregnant women, and to evaluate the association of serum chemerin with markers of severity of preeclampsia and other metabolic parameters. **Methods.** In the current study, the serum concentrations of both chemerin and resistin were measured by enzyme linked immunosorbent assay (ELISA) in control and preeclampsia patients during pregnancy (Control: n=30, preeclampsia: n=29). Furthermore, the association between chemerin and markers of adiposity [weight, body mass index (BMI) and resistin], glycolipid metabolism [lipid profile, fasting insulin, and HOMA-IR] as well as markers of severity of preeclampsia [ blood pressure (BP), uric acid (UA) and lactate dehydrogenase (LDH)] were studied in pregnant patients. **Results.** Both median maternal chemerin and resistin concentrations were significantly elevated in preeclampsia patients (249.5 [range: 123.1–366.9] µg/l) as compared to controls (204.8 [138.5– 280.8] µg/l) (p=0.001). Serum chemerin level was higher in severe group when compared to the mild pre-eclamptic group. By multiple linear regression analysis SBP and UA were independently associated with serum chemerin levels, when the data were adjusted for preeclampsia triglycerides (TGs) still independently associated with serum chemerin levels in multiple regression analysis. **Conclusions.** Serum chemerin and resistin concentrations were significantly increased in preeclampsia relative to normal pregnancy. Moreover, serum chemirin was significantly up-regulated in severe preeclampsia, and was independently associated with marker of severity and dyslipidemia.

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**Keywords**: Chemerin; resistin, preeclampsia.

## 1. Introduction

Pre-eclampsia is a common multisystem pregnancy disorder in which diagnosis is based on hypertension and proteinuria, affecting 3–5% of all pregnancies. Pre-eclampsia generally occurs de novo in late pregnancy, and severe cases constitute a serious problem to the mother and the fetus [1]. This disorder is a major cause of prenatal and maternal morbidity and mortality worldwide, and associated with an increased risk of cardiovascular disease and type II diabetes later in life for the mother [2]. for materno-fetal safety it is better to understand preeclampsia, and to develop accurate screening, preventive and treatment strategies. Some previous studies have indicated that preeclampsia is associated with endothelial dysfunction, metabolic abnormality, inflammatory state and atherosclerosis, however the etiology of this disease remains elusive and multiple factors are implicated in pathogenesis of preeclampsia [3]. Many authors have demonstrated that– dysregulation of Adipocyte-secreted factors – so-called adipokines such as leptin, resistin and chemerin —might play an important role in the pathogenesis of preeclampsia, because of their role in insulin resistance, lipid metabolism, atherosclerosis, and low-grade systemic inflammation, therefore, it is reasonable to suppose that adipokines may directly or indirectly influence the function of endothelial cells [4]. Resistin is also known as adipose tissue-specific secretory factor, is a hormone that is secreted primarily by human adipocytes and mononuclear cells and is probably associated with insulin resistance. Resistin is expressed in the human placenta and has been postulated to play a role in regulating energy metabolism in pregnancy. Studies investigating maternal serum or plasma resistin levels in pathological pregnancies, including PE, however, the changes in serum resistin levels in normal pregnancy and in the setting of pre-eclampsia are far from understood [26]. Chemerin is a recently identified adipocytokine that acts through the G proteincoupled receptor chemokine-like receptor 1 (CMKLR1). It is expressed mainly by plasmacytoid dendritic cells, macrophages, natural killer cells, and adipocytes, promoting the recruitment of these cells to lymphoid organs and sites of injury [5]. Circulating concentrations of chemerin are altered in inflammatory states [3,6,7], and are significantly correlated with dyslipidemia and hypertension, both characteristic features of metabolic syndrome. Moreover, chemerin is a potent angiogenic factor and induces gelatinolytic activity of endothelial cells [7], in addition chemerin is involved in the regulation of adipose tissue insulin sensitivity [8]. In current study, we determine whether serum chemerin and resistin were elevated in preclamptic patients and whether these adipokines levels differ between patients with

severe preeclampsia and those with mild preeclampsia. The association between maternal serum chemerin concentration and clinical and biochemical parameters of the study subjects was also assessed.

## 2. Subjects and Methods:

**Study population:-**

The study protocol was approved by the local Ethics Committee of Umm AlQura University, and all participants gave informed consent. Fifty nine pregnant women were enrolled in this study, they were recruited from the Department of Obstetrics & Gynecology of AL-NOOR and HERRA Hospital, Makkah, Saudi Arabia. They were categorized as Group I: included pregnant Women with preeclampsia (n= 29). Group II: Control healthy-pregnant group (n= 30), both groups were matched for age, gestational age. Preeclampsia was defined according to criteria recommended by guidelines of the American College of Obstetricians and Gynecologists (ACOG) as gestational hypertension >140 systolic mmHg and >90 diastolic mmHg on at least two occasions, at least 6 hrs apart accompanied by proteinuria (≥1+ by dipstick or ≥0.3 g/24 hrs) occurring after 20$^{th}$ weeks in pregnant women who were previously normotensive [9]. The preeclampsia group was sub-classified into 2 groups, mild preeclampsia (n=19) and severe preeclampsia (n=10) . Severe pre-eclampsia was diagnosed if one or more of the following criteria were present: blood pressure of 160/ 110 mmHg or higher, excretion of 5 g or more of protein in a 24-hrs urine sample or a urine dipstick showing 3 or 4 in a random urine sample, oliguria of less than 500 ml in 24 hrs, pulmonary edema or cyanosis, visual or cerebral disturbance, impaired liver function, thrombocytopenia and HELLP syndrome. Patients with preeclampsia who were not met criteria of severe preeclampsia were diagnosed with mild preeclampsia [10]. Exclusion criteria include: All were non current or ex smokers participants, cardiovascular, chronic liver disease [11], chronic kidney disease and renal failure [12].

**Sample collection**

Five milliliters of venous blood were collected after 12 hours fasting under complete aseptic precautions and divided into two portions: one contained sodium fluoride, centrifuged and plasma separated for determination of fasting blood glucose. The second one was allowed to clot in plain test tubes, centrifuged (at 1500 xg for 15 minutes). The separated serum was divided into 3 aliquots, were stored at -20ºC for subsequent assay of both uric acid, lactate dehydrogenase (LDH) and lipid profile, the other 2 aliquots for ELISA assay of insulin, resistin and chemerin.

**Methods:**

**All participants were subjected to:-**

(a) A certain detailed questioner involves (personal, medical, family history), through general and abdominal examination ,arterial blood pressure and body mass index (BMI) were recorded Body mass index was calculated according to the equation: BMI = [(Weight)/ (Height) $^{2}$]. Ultrasonographic examination was conducted to confirm the gestational age, and to exclude the presence of fetal congenital abnormalities.

(b) Analysis of routine biochemical markers: plasma glucose, total cholesterol (TC)**, triglycerides** (TGs), **High density lipoprotein cholesterol** (HDL-C), Uric acid (UA) and Lactate dehydrogenase (LDH) were analysed using Automated (Cobas c 111/ applying UV assay method and enzymatic colorimetric method **[13, 14, 15, 16,17, 18]**) **Low density lipoprotein cholesterol (**LDL-C) value was calculated according to "Friedewald equation": LDL-C = Total cholesterol-(HDL-C+TG/5) This equation was applied provided that serum TG level is <400 mg/dL **[19]**

**(c) ELISA assay of Insulin:** maternal insulin concentrations were measured using a commercially available enzyme-linked immunosorbent assay (ELISA) kit supplied by (DRG, GmbH, Germany). According to the manufacture instructions [20]. **The homeostasis model assessment-insulin resistance index (HOMA-IR):** It was calculated using the equation: HOMA-IR = fasting glucose (mg/dL). Fasting insulin (µU/mL)/ 405 The cutoff point to define insulin resistance corresponds to HOMA-IR ≥ 3.8 **[21]**. (d) **Resistin:** maternal resistin concentrations were measured using a commercially available enzyme-linked immunosorbent assay (ELISA) kit supplied by (Catalogue no.ER1001-1-ASSAY PRO). According to the manufacture instructions. Concentrations of the unknown diluted samples were determined using the instructed standard curve and then multiplied by the dilution factor(1:5) to get the actual amount of resistin in the original serum [22]. **(e) Chemerin:** Chemerin concentrations were measured using a commercially available enzyme-linked immunosorbent assay (ELISA) kit supplied by (Biovender GmbH, Im Neuenheimer Feld 583, D-69120 Heidelberg, Germany), according to the manufacture instructions . Concentrations of the unknown diluted samples were determined using this the instructed standard curve and then multiplied by the dilution factor (1:100) to get the actual amount of chemerin in the original serum [23].

**Statistical analysis:-** Statistical analysis was done using SPSS software, version 16, Echosoft Corporation, USA. Descriptive statistics in the form of mean±SD were calculated for parametric data. On the other hand, non parametric data were expressed as median and interquartile range (25-75$^{th}$ percentile). The Kolmogorov-Smirnov test was

done to determine the distribution of data. Between group comparisons were done using the Student's t test in case of normally distributed data, and Mann-Whitney-U test was used in case of skewed data. The correlation between the variables were analysed using pearson ′s correlation (for normally distributed data), Spearrman's rank correlation (not- normally distributed data). To adjust the effects of covariates and identify independent relationships, multiple linear regression analyses were performed. *p* values <0.05 were considered significant, whereas *p* values <0.01 were considered highly significant.

**3. Results:-**

**Demographic and clinical characters are summarized in (table 1).** Systolic (SBP) (P=0.001) and diastolic (DBP) (P= 0.001) blood pressure, were significantly elevated in patients with preeclampsia as compared to controls

**Table1:- demographic and clinical character of studied groups**

| Parameters | | Healthy pregnant Control (n=30) (Means ± SD) | Preeclampsia (n=29) (Means ± SD) | *P* value and significance |
|---|---|---|---|---|
| Age (years) | | 31.96±5.27 | 34.37±5.79 | 0.1 NS |
| Gage (weeks) | | 33.76±3.29 | 32.68±4.88 | 0.3 NS |
| Parity | | 1.7±0.46 | 1.79±0.41 | 0.4 NS |
| BP | SBP | 117.47±7.37 | 147.9±26.03 | 0.001 HS |
| | DBP | 80.16±8.1 | 91.24±12.5 | 0.001 HS |
| BMI | | 29.36±2.69 | 30.46±1.3 | 0.051 |

GA: gestational age- BP: blood pressure SB: systolic blood pressure DBP: diastolic blood pressure

Regarding Glycometabolic parameters (FBG, F insulin) there were non-statistically significant difference in preeclamptic group as compared to healthy pregnancy control (P=0.068, P=0.27), accordingly HOMA-IR was non-significantly differ in preeclamptic group as compared to healthy pregnancy control (P=0.54), with regard to lipid profiles TGs are significantly higher in preeclamsia as compared to normal pregnancy (P=0.002). Although T. chol, LDLC were increased and HDLc were decreased in preeclampsia compared to healthy pregnant women the difference was non statistically significant (P=0.29, 0.6, 0.68 respectively). (Table 2)

**Table 2: laboratory parameters and chemerin of studied groups**

| Parameters | healthy pregnant Control | | Preeclampsia | | *P*-value and significance |
|---|---|---|---|---|---|
| | Means ± SD | Median (25-75$^{th}$ percentile ) | Means ± SD | Median (25-75$^{th}$ percentile ) | |
| FBG (mg/dl) | 96.3±12.35 | 98 (87.25-107.75) | 90.44±13.97 | 90 (79-105.5) | 0.068 NS |
| F insulin (uU/ml) | 15.63±11.38 | 15 (7-20) | 19.86±15.90 | 15 (11-28.5) | 0.27 NS |
| HOMA-IR | 3.99±2.82 | 3.85 (2.57-4) | 4.44±4.02 | 4 (2.2-5.65) | 0.54 NS |
| TC(mg/dl) | 200.25±55.99 | 227.8 (154.8-240.25) | 208.93±37.94 | 185.7 (181.65-236.6) | 0.29 NS |
| TG (mg/dl) | 183.96±50.69 | 160 (144-237.6) | 229.94±59.77 | 223.7 (206.7-276.3) | 0.002 HS |
| HDLc(mg/dl) | 45.28±13.93 | 50.8 (32.6-58.5) | 44.93±16.82 | 45.9 (27-56) | 0.68 NS |
| LDLc(mg/dl) | 118.16±44.14 | 123 (77.8-151.23) | 122.61±34.71 | 113.7 (92.85-143.1) | 0.6 NS |
| UA (mg/dl) | 3.94±1.28 | 3.8 (2.97-4.15) | 6.34±2.6 | 6.5 (3.55-9.5) | 0.001 HS |
| LDH (U/L) | 226.87±100.59 | 176 (160-281) | 370.34±206.23 | 296 (245-415) | 0.001 HS |
| Resistin (ng/ml) | 38.06±31.26 | 29 (13.1-47.37) | 61.98±32.26 | 75 (34-96.5) | 0.013 S |
| Chemerin (ng/ml) | 174.4±29.17 | 177 (148.75-196.25) | 349.9±147.92 | 375 (168.5-530) | 0.001 HS |

FBG: fasting blood glucose HOMA-IR: homeostasis model assessment HDLc: high density lipoprotein cholesterol. LDLc: low density lipoprotein cholesterol TGs; triglycerides TC: total cholesterol LDH: lactate dehydrogenase

Markers of severity (UA and LDH) were significantly higher in preeclampsia compared to healthy pregnant women (p=0.001) (table 2). Moreover, the patients with severe preeclampsia had the highest serum levels UA, LDH (p= 0.001, 0.002). Furthermore, glycolipid parameters F insulin, TG were significantly higher in severe preeclampsia as compared to mild cases (p=0.04, 0.024) ( table 3). Serum resistin was significantly higher in preeclampsia as compared to healthy pregnant control, however no significant difference between mild and severe cases regarding it.

**Table 3: laboratory markers in mild and severe preeclampsia**

| Parameters | Mild preeclampsia (n=19) | | Severe preeclampsia (n=10) | | *p*-value and significance |
|---|---|---|---|---|---|
| | Means ± SD | Median (25-75th percentile ) | Means ± SD | Median (25-75th percentile ) | |
| Finsulin uU/ml | 17.89±18.69 | 15 (11-15) | 23.6±8.01 | 28(12-29) | 0.04 S |
| HOMA-IR | 4.35±4.85 | 31 (2.3-4) | 4.62±1.76 | 5.3(2.1-6) | 0.19 NS |
| T chol mg/dl | 214.95±42 | 209 (185.7-241.8) | 197.51±26.99 | 181.7(179.5-236.6) | 0.17 NS |
| TG mg/dl | 213.17±62.69 | 209.6 (166.4-259) | 261.81±39.14 | 276.3(206.7-297.6) | 0.024 S |
| HDLc mg/dl | 48.3±18.02 | 47.7 (30.3-62) | 38.55±12.73 | 36.5(27-56) | 0.21 NS |
| LDLc mg/dl | 128.09±39.03 | 111 (97.6-170.6) | 112.2±22.7 | 113.7(83.4-139) | 0.6 NS |
| UA mg/dl | 512.63±2.18 | 4.8 (3.3-6.8) | 8.66±1.65 | 9.5(6.4-9.8) | 0.001 HS |
| LDH U/L | 267.3±78.72 | 246 (222-312) | 566±234.55 | 707(296-758) | 0.002 HS |
| Resistin ng/ml | 63.94±30.64 | 75 (40-99) | 58.25±36.57 | 75(17-96.5) | 0.35 NS |

FBG: fasting blood glucose HOMA-IR: homeostasis model assessment LDH: lactate dehydrogenase HDLc: high density lipoprotein cholesterol. LDLc: low density lipoprotein cholesterol TGs; triglycerides TC: total cholesterol

Serum chemerin concentrations were significantly increased in subjects with preeclampsia as compared to healthy pregnant. Moreover, maternal serum chemerin was significantly higher for severe preeclampsia as compared to mild preeclampsia and healthy pregnant (Figure1).

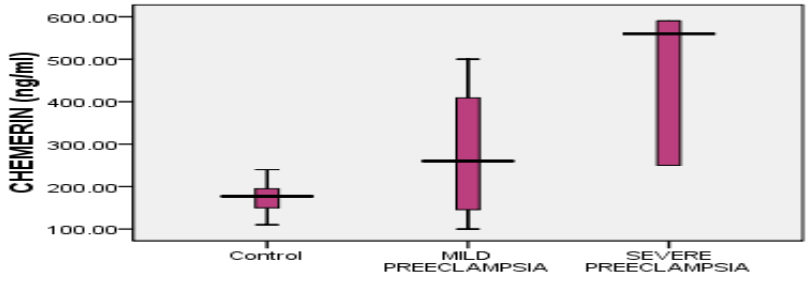
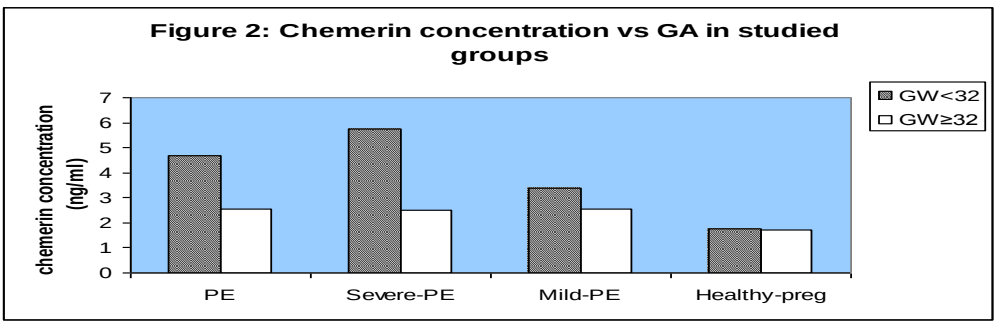



Figure 1: Chemerin concentration in healthy pregnant control and patients with preeclampsia

**Table 4: Chemerin in mild and severe preeclampsia**

| Parameters | Mild preeclampsia | | Severe preeclampsia | | *p*-value and significance |
|---|---|---|---|---|---|
| | Means ± SD | Median (25-75th percentile ) | Means ± SD | Median (25-75th percentile ) | |
| Chemerin (ng/ml) | 281.95±144.54 | 260 (135-433) | 479±158.56 | 560(250-590) | 0.002 HS |

Each of the studied groups (all patients with preeclampsia, severe preeclampsia, mild preeclampsia and healthy pregnant control) were divided according to GA into 2 groups GA<32W and GA≥ 32 W, serum chemerin levels were significantly higher in gestational age (GA)<32W compared to GA≥ 32 W in both total and severe preeclampsia. However, chemerin levels were non significantly different in subjects with GA<32W compared to GA≥ 32 W among control and mild preeclampsia (Figure 2).



**Bivariate analysis** in the 59 pregnant women revealed significant positive correlation between maternal serum chemerin and BP{ SBP (r=0.768,*p*=0.001) DBP (r=0.583, *p*=0.001)}, weight (r=0.45, *p* =0.001), TG (r=0.32, *p* =0.012), LDH(r=0.34, *p* =0.008) and uric acid(r=0.6, *p* =0.001) and significant negative correlation with GA (r= -0.551, *P=0*.001). Also, in 29 preeclampsia a significant positive correlation between maternal serum chemerin and both F insulin (r = 0.43, *P=0.02*) and HOMAIR(r=0.43, *p* =0.019) (Table 5). While, resistin was significantly positively correlated with SBP(r=0.25, p=0.047), LDH(r=0.35, p=0.005) and GA(r=.44, p=0.001), in contrast resistin was negatively correlated with parity(r=-0.35, p=0.005) (Table 6)

**Table 5: correlation of chemerin with all parameters in study subjects**

| Variables | | Bivariate correlation | | | |
|---|---|---|---|---|---|
| | | Studied groups | | Preeclampsia group | |
| | | r | *p* -value | r | *p* -value |
| Age | | 0.13 | 0.34 NS | -0.03 | 0.86 NS |
| G age | | -0.55 | 0.001 HS | -0.71 | 0.001 HS |
| Parity | | -0.06 | 0.84 NS | -0.15 | 0.42 NS |
| Weight | | 0.45 | 0.001 HS | -0.005 | 0.78 NS |
| BP | SBP | 0.768 | 0.001 HS | 0.66 | 0.001 HS |
| | DBP | 0.575 | 0.001 HS | 0.47 | 0.009 HS |
| F insulin | | 0.09 | 0.47 NS | 0.43 | 0.02 S |
| HOMA-IR | | 0.08 | 0.54 NS | 0.43 | 0.019 S |
| Resistin | | 0.07 | 0.57 NS | -0.20 | 0.28 NS |
| Total chol | | 0.2 | 0.12 NS | - 0.21 | 0.25 NS |
| Triglycerides | | 0.32 | 0.012 S | 0.45 | 0.014 S |
| HDLc | | 0.06 | 0.64 NS | -0.22 | 0.24 NS |
| LDLc | | 0.2 | 0.11 NS | 0.03 | 0.86 NS |
| UA | | 0.6 | 0.001 HS | 0.81 | 0.001 HS |
| LDH | | 0.34 | 0.008 HS | 0.25 | 0.18 NS |

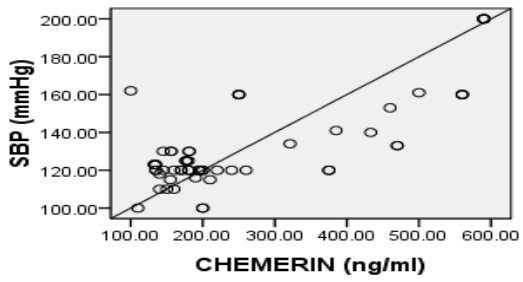



Figure 3: Correlation between serum chemerin and SBP in studied groups

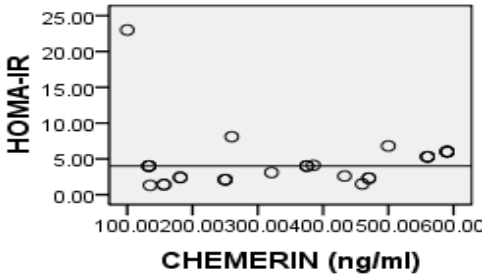



Figure 4: correlation between serum chemerin and HOMA-IR in preeclampsia

**Table 6: correlation of serum resistin with all parameters in study subjects**

| Variables | | *Studied groups* | |
|---|---|---|---|
| | | r | *p* -value |
| Age | | -0.15 | 0.23 NS |
| G age | | 0.44 | 0.001 HS |
| Parity | | -0.35 | 0.005 HS |
| Weight | | 0.17 | 0.18 NS |
| BP | SBP | 0.25 | 0.047 S |
| | DBP | 0.11 | 0.39 NS |
| F insulin | | -0.08 | 0.53 NS |
| HOMA-IR | | -0.07 | 0.59 NS |
| Total chol | | 0.09 | 0.46 NS |
| Triglycerides | | -0.09 | 0.45 NS |
| HDLc | | 0.22 | 0.08 NS |
| LDLc | | 0.08 | 0.53 NS |
| UA | | 0.06 | 0.64 NS |
| LDH | | 0.35 | 0.005 HS |
| Chemerin | | 0.07 | 0.57 Ns |

In multiple linear regression analysis only SBP and UA were independently associated with chemerin (dependant variable) among all cases (adjusted R square= 0.738, F=33.7 $p$ <0.001) regarding resistin only LDH and GA were independently associated with resistin (adjusted R square=0.4 F=10 , $p$ =0.001)

**Table 7: Multiple linear regression between chemerin (dependant variable) and both clinical and biochemical parameters**

| Independent variable | βeta | $p$ value |
|---|---|---|
| SBP | 0.607 | 0.000 |
| DBP | -0.2 | 0.07 |
| UA | 0.49 | 0.000 |
| LDH | -0.05 | 0.5 |
| GA | 0.15 | 0.053 |

The association between chemerin serum concentrations (dependant factor) on one hand and TG (independent variables) on the other hand persisted in multiple linear regression analysis after adjustment for preeclampsia (β=0.4& $p$ =0.021). Thus TGs are independent factor of chemerin.

## 4. Discussion:

Previous studies have indicated that preeclampsia is associated with endothelial dysfunction, a hypercoagulable state, metabolic abnormalities, an inflammatory response and atherosclerosis [24]. The etiology of these conditions remains elusive and multiple factors are implicated in pathogenesis of preeclampsia. Recently, increasing evidence has supported the diverse role of several so-called adipokines such as leptin, adiponectin, free fatty acid (FFA) and resistin in the pathogenesis of preeclampsia. Resistin is a novel peptide hormone that is specifically secreted by human adipocytes and mononuclear cells [26]. Our study reveled a marked elevation of maternal serum resistin levels in women with preeclampsia compared to healthy pregnant control women. This comes in accordance with **Haugen *et al.* and Seol *et al.* [25,26],** they demonstrated that Serum resistin levels were significantly elevated in women with preeclampsia compared to normal pregnant women. Although the exact function of resistin in the pathophysiology of preeclampsia remains unclear, the elevated serum resistin levels might be associated with exaggerated insulin resistance via the extensive systemic inflammatory response in preeclampsia. Extensive systemic inflammation is a well known characteristic of preeclampsia, and monocyte activation is one of the associated features of systemic inflammation. Monocytes may be the source of the increased serum resistin concentrations in preeclampsia. Increased resistin can not be explained through placental gene expression of resistin as it was found to be unaltered and , resistin mRNA levels in abdominal subcutaneous adipose tissues were similar between women with preeclampsia and normal pregnant women. **Sonagra *et al.* [27],** who reported that increased levels of both UA and LDH are seen as the disease severity increases, and significant positive correlation of these parameters with systolic and diastolic blood pressure in preeclampsia cases and estimation of serum LDH and UA at regular interval may give insight to ongoing disease progression and organ damage. They may prove to be a useful tool to predict the maternal and fetal complications even at an earlier stage of the disease. These results go hand in hand with our results which demonstrated that the mean serum triglycerides, serum UA and LDH were significantly higher in preeclampsia group when compared to healthy gestational age-matched control group. Women with pre-eclampsia are more likely than normotensive pregnant women to experience metabolic disturbances, such as obesity, hypertension, dyslipidemia, insulin resistance, systemic inflammation and impaired fibrinolysis, Demirci et al [28] reported alterations in the triglycerides concentrations early in the pregnancies of women who later develop pre-eclampsia. High concentrations of circulating triglyceride-rich lipoproteins may induce endothelial dysfunction through the generation of small dense LDL sub fractions, which have been found to be oxidized more readily than their larger counterparts. It was indicated that small dense LDL fractions had a greater capacity to stimulate the thromboxane synthesis by endothelial cells and an increase in intracellular calcium in vascular smooth muscle, which might be relevant to vasospasm in pre-eclampsia [29]. A previous study demonstrated that serum chemerin levels correlated with body fat, glucose and lipid metabolism, inflammation and hypertension, suggesting that this adipokine plays a role in the pathophysiology of metabolic syndrome [30].Our study revealed that maternal serum chemerin levels were significantly higher in preeclampsia group when compared to healthy gestational age-matched controls group. Moreover, patients with severe preeclampsia had significantly higher serum chemerin concentration as compared to patients with mild preeclampsia and healthy pregnant women. This is in agreement with **Stepan *et al.* [31],** they proved that maternal serum levels of the adipokine chemerin were significantly up-

regulated in preeclampsia patients as compared to healthy pregnant women. Also, they demonstrate that chemerin serum levels are significantly increased in pregnancy independent of preeclampsia as compared to non-pregnant subjects. Based on these findings, it can be hypothesized that a certain level of chemerin is required for or associated with normal pregnancy but further elevated chemerin levels could be a marker for and/or contributor to preeclampsia. Moreover, **Duan *et al.*** [32], found that all cases developed PE, irrespective of its severity, showed significantly higher maternal serum chemerin compared to levels estimated in control group, in addition patients with severe preeclampsia had higher chemerin concentration than either mild preeclampsia or healthy pregnant women. These findings pointed to an association between chemerin serum levels and the development of PE. In support of such assumption, there was a highly significant positive correlation between serum levels of maternal chemerin and estimated (SBP, DBP, UA and LDH), which are markers of severity. Moreover, by multiple regression analysis only SBP and UA were independently associated with chemerin among all cases. These results concerning blood pressure were in agreement with studies by **Stejskal *et al.*** **Bozaoglu *et al.*** **and Kaur *et al***. [33,34, 7]. They revealed that chemerin serum levels correlated positively with systolic and diastolic blood pressure. Chemerin may also be a novel regulator of blood pressure because of good correlations with both systolic and diastolic pressure. This hypothesis is supported by the fact that chemerin is highly expressed in the kidney, a key site of blood pressure regulation. Chemerin is an inducer of endothelial angiogenesis factors as kininogens, which proteolytic product is the vasoactive peptide bradykinin. Moreover, among patients with preeclampsia, but not in normal pregnant women, the serum chemerin was significantly higher in gestaional age <32weeks as compared to gestational age ≥32 weeks, this is supported in our work by a significantly negative correlation between serum chemerin with gestational age at blood collection (at the time of diagnosis of preeclampsia). Thus, the earlier the diagnosis, the higher was the maternal plasma chemerin concentrations. This is pertinent since the timing of the diagnosis of preeclampsia is an important index of severity. The physiological significance of increased maternal serum chemerin in preeclampsia remains to be elucidated, a significant positive correlations between chemerin and adiposity (body weight) was recorded amoung studied groups, this comes in line with ***Shin et al.*, *Yoo et al.*** and ***Yan et al.***[35,36,37]. They proved that serum chemerin levels were significantly increased in obese individuals compared with lean controls and circulating chemerin levels had a significant positive correlation with the body mass index, waist circumference, abdominal visceral fat area, ***Ernst et al.*** [38] stated that chemokine-like receptor 1 (CMKLR1 (-/-)) mice had lower food consumption, total body mass, and percent body fat compared with wild-type controls ***Blüher et al.***[39]. proved that insulin is tightly correspond to changes in body weight, with the trend to go to the opposite direction during the weight loss phase and downregulation of glucose transporter-4 (GLUT4) in adipose tissue is an important feature of insulin resistance. Moreover, significant positive correlation between serum chemerin and glycolipid metabolism {fasting insulin, HOMA-IR (in preeclampsia), In agreement with these in vitro findings **Sell *et al.*** [40] reported that chemerin induces insulin resistance in human skeletal muscle cells at the level of insulin receptor substrate and glycogen synthase kinase 3 phosphorylation, Chemerin konkout reduces the expression of genes involved in glucose and lipid metabolism, such as perilipin, GLU4, adiponectin and leptin are resulted in reduced basal lipolysis and phosphdiasterase inhibitor-stimulated lipolysis rates. **Ernst *et al.*** [30] reported that an administration of chemerin in rodents impairs glucose tolerance, lowers serum insulin levels, and decreases basal glucose uptake in diabetic mice *in vivo*. Furthermore, TGs remain independently associated with circulating chemerin in multiple linear regression analysis adjusted for preeclampsia, this result is in accordance with **Bozaoglu *et al.*** [41] who reported that significant and positive correlation between circulating chemerin levels and TG independent of age, gender, and BMI , **Stepan *et al.*** and **Duan *et al.*** [31,32] reported that maternal chemerin serum concentrations are significantly increased in preeclampsia and independently associated with markers of dyslipidemia. It was documented that multiple factors such as obesity, insulin resistance and dyslipidemia are implicated in pathogenesis of preeclampsia. Altered lipids, especially increased FFAs and increased TGs, may have an important role in the endothelial cell dysfunction seen in pre-eclampsia. Our data demonstrate that circulating TGs was markedly elevated in women with pre-eclampsia, moreover, TGs were significantly increased in severe preeclampsia as compared to both mild cases and healthy pregnant women. We speculated that dyslipidemia may have an important role in the pathophysiology of Preeclampsia. **Lei Q *et al.*** [3] indicates that pre-eclamptic women have higher circulating TG. Although. The interplay between dyslipidemia and insulin sensitivity in pre-eclampsia may be regulated by other factors, such as placental hormones. Another explanation for association between chemerin and preeclampsia, Widespread maternal endothelial dysfunction is the vital factor for preeclampsia, inevitably and sensitively

influencing the glomerular dynamics and renal function. [12] Chemerin is shown to be associated with inflammation which is involved in the pathogenesis of diabetic nephropathy. **Pfau *et al.*** and **Rutkowski *et al.*** [42,43] demonstrated Significant negative correlation between the change of serum chemerin concentration and the change of eGFR, as well as the significant positive correlation between the change of serum chemerin concentration and the change of serum creatinine suggest that serum chemerin is affected by renal function. Thus serum chemerin may reflect the degree of renal affection in these pre-eclamptic women. In conclusions, our results demonstrate that both maternal serum chemerin and resistin levels are significantly increased in preeclampsia and serum chemerin levels are up-regulated especially in severe preeclampsia. Moreover chemerin is independently associated with markers of severity of preeclampsia and dyslipidemia, indicating that chemerin could be a novel marker of preeclampsia. Further studies are needed to demonstrate whether increased chemerin is causally linked to preeclampsia and by which mechanisms circulating chemerin potentially influences metabolic and vascular health in humans.

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# Competency Based Training Need Assessment for IT Companies in Chennai

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**Abstract:** Competency assessment is an important activity that involves identification of the desired skills set for each role for meeting organizational goals and objectives. Competency models enable employees to know where they stand, which is then followed by acquisition of competencies through training and development or through employees' self-initiated efforts. This can enable training need assessment in more accurate terms and plan training activity in a manner that leaves little mismatch between training needed and training provided. Competency based training need assessment provides key inputs to the training department to harness their full potential enshrined in their Knowledge, Skills and Abilities (KSAs). This research reports a case study relating to competency based training need assessment for general and technical skills for middle level executives working in a IT companies at Chennai.

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**Keywords :** *Training Need Assessment, Information Technology, Competence, Training, Training and Development*

## 1. Introduction

These days most organizations operate in a business environment where uncertainty, risk and complexity in the external environment are a prevailing norm. Pressures of international competition and market globalization constrain Indian companies to match global standards of performance and corporate governance. Whatever their structure or business strategy, organizations are realizing that it is the performance of their human capital that can make a cutting edge. With growing emphasis on technology, productivity and quality standards, organizations need more competent and self-directed teams to suit changing work needs. More than consistency it is innovation and constant improvement that hold the key. This requires employees to learn new skills and competencies, adhered to values, behave professionally and enhance risk taking capabilities, all of which represent a set of competencies that can be cultivated through training and development. Competencies are a set of observable behaviour. Competency based approaches owe their evolution, among others, to David McCelland who is regarded as a pioneer in competency based models. A competency model approach is identification of competencies needed to perform organizational activities including assessment of competencies available. A competency model is essentially identification of gap between available and needed competencies and then taking necessary steps for reducing this gap. Thus, competency models can be particularly appropriate in employee selection (matching competencies of individuals with those required for a job), performance appraisal (identifying attainment of proficiency levels vis-à-vis specified competency), and training and development (identifying competencies that need to be improved through training and development). The subject of competency mapping has acquired added significance as a performance management tool (Sanghi, 2004).

Based on a study carried out during nineties at three leading performance management driven companies it was found that companies using competency based training and development achieve higher shareholder value (Menon, 2004). For taking stock of the state-of-art of training identification strategies in organizations, a study was undertaken in 1986 in US by the Opinion Research Corporation and supported by the American Society for Training and Development. This study, among others, found out that although identification of training needs should normally precede any training initiative but in reality it was seldom followed.

In India, among several such initiatives a study on training needs identification was carried out through a questionnaire based survey for senior middle and junior level executives in 75 odd public and private enterprises involving a large cross-section of Indian industry (Pattanayak, 1997).

As per the study findings majority of respondents favoured identification of training needs

as essential prerequisite for drawing a training calendar. As for the method of training need identification generally followed, as per the survey findings, personal interviews are most widely adopted option (83 per cent), direct interfacing with the workplace (80 per cent), evaluation of performance / productivity measures (75 per cent), questionnaire survey (66 per cent), and organisation analysis (64 per cent). As per the study findings, among different methods of training need assessment such as direct observation, interviews, surveys, group discussions, etc., 'questionnaire based survey' is by far most commonly followed technique (Sah, 1991).

## 2. Research Methodology

In this study identification of competency based training need assessment was carried out with the help of a questionnaire based survey. It aimed to analyze training needs for both managerial and technical training. This survey was, however, limited to training need assessment of middle management executives only that included deputy managers and managers. A training need assessment is considered important as it leads to the engagement of organizational resources more appropriately with maximum benefits otherwise time invested on training activity may not yield desired results. For carrying out competency mapping exercise for training need assessment a questionnaire involving 5-point scale ranging from 'strongly agree' to 'strongly disagree' was used.

Responses received from this survey were divided into three groups, namely, (i) individuals needing no training, (ii) individuals needing moderate training inputs but not on essential basis (optional) and (iii) individuals at the bottom line who need extensive and diverse training inputs. Individuals falling in the second category were primarily those whose training needs were 'desirable' but not 'essential' and could be even deferred and viewed as 'optional'. However, for technical skills category, training needs were divided into two groups only, i.e., (i) individuals who need no training, and (ii) individuals who require considerable training inputs.

After dividing training assessments into three groups for general skills as 'training not needed', 'training preferably needed (optional)' and 'training essentially needed' and for technical training in two groups as 'training not needed' and 'training needed'. Training schedule / calendar was developed in three phases for general and technical training in accordance with the suggested prioritization criterion on the basis of number of respondents opting for a particular skills set / competence (Table 4).

Phase I included identification of a set of competency comprising 'driving business acumen', 'driving cost leadership', 'planning for results', 'taking ownership', 'communicating effectively', 'delegation', 'building a competent team', and 'process oriented problem solving'. Phase II covered 'computer skills', 'presentation skills', 'decision-making skills', 'coaching and training skills', 'driving innovation', and 'managing performance'. Phase III included development of 'interpersonal effectiveness', 'customer centric behaviour', and 'passion for quality' (Table 4).

## 3. Analysis and Results

In this study identification of training needs for both general and technical skills categories are prioritized into three different phases. Number of preferences for specific training needed was taken as a basis for prioritizing training programmes. Competency based training needs of respondents were analyzed based on estimation of mean and standard deviation given in the decision table (Table 1).

Break-up of number of responses received for each competency (general skill) falling under three categories i.e., 'training not needed', 'training needed but optional' and 'training compulsorily needed' are given in Table 2. Break-up of the number of respondents who have opted for 'training needed' and 'training not needed' for each competency (technical skill) is summarized in Table 3. Training needs identified from the above analysis were then ranked to determine which training needs were more important and to be addressed immediately for imparting.

Programmes for general skills were included in Phase I if responses received for training on 'compulsory basis' and 'optional basis' exceeded 30. Programmes were included in Phase II when responses received for training on 'essential basis' and 'optional basis' were less than 30; or when there were no responses for training on 'optional basis' and responses received for training on 'compulsory basis' were less than 5. All such programmes which did not form part of Phase I and II were included in Phase III. For technical skills if number of responses for specific training programmes were more than 40 then such programmes were included in Phase I. On the other hand, if responses for different programmes (technical skills) were more than 20 but less than 40 then these were included in Phase II (Table 4 and 5).

**Table 1: Decision Criteria for Identification of General Skills**

| Competency | Mean | SD | Range | Category | | |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| Taking ownership | 2.64 | 1.439 | 1.201-4.079 | 1 | 2-4 | >4 |
| Interpersonal effectiveness | 1.40 | 1.485 | -0.085-2.885 | 0 | 1-3 | >3 |
| Communicating effectively | 5.10 | 1.909 | 3.191-7.009 | 3 | 4-7 | >7 |
| Presentation skills | 3.08 | 1.536 | 1.544-4.615 | 1 | 2-5 | >5 |
| Driving innovation | 3.18 | 0.896 | 2.28-4.07 | 2 | 3,4 | >4 |
| Customer centric behaviour | 2.78 | 1.130 | 1.65-3.91 | 2 | 3,4 | >4 |
| Displaying business acumen | 1.62 | 1.193 | 0.427-2.813 | 0 | 1-3 | >3 |
| Demonstrating passion for quality | 3.40 | 1.400 | 2-4.8 | 2 | 3-5 | >5 |
| Driving cost leadership | 3.88 | 1.409 | 2.471-5.28 | 2 | 3-5 | >5 |
| Planning for results | 2.70 | 1.418 | 1.282-4.118 | 1 | 2-4 | >4 |
| Process oriented problem solving | 1.78 | 1.447 | 0.330-3.227 | 0 | 1-3 | >3 |
| Decision making | 3.74 | 1.850 | 1.890-5.59 | 2 | 3-6 | >6 |
| Building a competent team | 2.84 | 2.198 | 0.642-5.03 | 0 | 1-5 | >5 |
| Managing performance | 1.22 | 1.234 | 0-2.45 | 0 | 1-2 | >2 |
| Delegating | 1.94 | 1.449 | 0.491-2.3 | 0 | 1-3 | >3 |
| Computer skills | 3.62 | 0.780 | 2.840-4.4 | 3 | 4 | >4 |
| Coaching/Training ability | 2.52 | 1.199 | 1.321-3.719 | 1 | 2-4 | >4 |

Note: 1 Training Not Needed; 2: Training Needed (optional) 3: Training Compulsorily Needed.

**Table 2: Identification of General Skill Requirement (Training Needs Assessment)**

| S.No. | Competency (KSA) | Training Not Needed | Training Needed | Training Needed Compulsorily | | | |
|---|---|---|---|---|---|---|---|
| | | No. of persons | Per cent | No. of persons | Percent | No. of persons | Per cent |
| 1. | Taking ownership | 13 | 26 | 31 | 62 | 6 | 12 |
| 2. | Interpersonal effectiveness | 18 | 36 | 29 | 58 | 3 | 6 |
| 3. | Communication skills | 9 | 18 | 35 | 70 | 6 | 12 |
| 4. | Presentation skills | 6 | 12 | 42 | 84 | 2 | 4 |
| 5. | Driving innovation | 6 | 12 | 41 | 82 | 3 | 6 |
| 6. | Customer centric behaviour | 22 | 44 | 25 | 50 | 3 | 6 |
| 7. | Business acumen | 3 | 6 | 42 | 84 | 5 | 10 |
| 8. | Passion for quality | 17 | 34 | 29 | 58 | 4 | 8 |
| 9. | Cost leadership | 4 | 8 | 40 | 80 | 6 | 12 |
| 10. | Planning skills | 9 | 18 | 35 | 70 | 6 | 12 |
| 11. | Problem solving | 11 | 22 | 34 | 68 | 5 | 10 |
| 12. | Decision making | 15 | 30 | 31 | 62 | 4 | 8 |
| 13. | Building a competent | 3 | 6 | 37 | 74 | 10 | 20 |
| 14. | Managing performance | 17 | 34 | 26 | 52 | 7 | 14 |
| 15. | Delegating | 3 | 6 | 38 | 76 | 9 | 18 |
| 16. | Computer skills | 21 | 42 | 23 | 46 | 6 | 12 |
| 17. | Coaching/training ability | 8 | 32 | 41 | 46 | 1 | 22 |

**Table 3: Identification of Technical Skill Requirement (Training Needs Assessment)**

| S.No. | Competency (KSA) | Training Needed | | Training Not Needed | |
|---|---|---|---|---|---|
| | | No. of Persons | % | No. of Persons | % |
| 1 | Continuous improvement methods | 46 | 92 | 4 | 8 |
| 2 | Knowledge of company products | 41 | 82 | 9 | 18 |
| 3 | Understanding other products | 46 | 92 | 4 | 8 |
| 4 | New methods available in maintaining Quality work | 47 | 94 | 3 | 6 |
| 5 | Knowledge about the current trend/technique Used globally. | 46 | 92 | 4 | 8 |
| 6 | Creative approach | 36 | 72 | 14 | 28 |
| 7 | Knowledge about various new Tools and software's designing | 10 | 20 | 40 | 80 |
| 8 | Various modern manufacturing processes | 14 | 28 | 36 | 72 |
| 9 | Vendor management techniques | 14 | 28 | 36 | 72 |
| 10 | Inventory management techniques. | 22 | 44 | 28 | 56 |

**Table 4. Phasewise Number of Programmes for Competency Upgradation and participants Planned / Prioritized for Training (General Skills)**

| *Phase* | *S.No.* | *Competency* | *No. of Person* | *No. of Programmes* |
|---|---|---|---|---|
| I | 1 | Driving business acumen | 47 | 3 |
| | 2 | Driving cost leadership | 46 | 3 |
| | 3 | Planning for results | 41 | 3 |
| | 4 | Taking ownership | 37 | 2 |
| | 5 | Communicating effectively | 41 | 3 |
| | 6 | Delegation | 47 | 3 |
| | 7 | Building a competent team | 47 | 3 |
| | 8 | Process oriented problem solving | 39 | 2 |
| II | 1 | Computer skills | 29 | 2 |
| | 2 | Presentation skills | 44 | 3 |
| | 3 | Decision making skill | 35 | 2 |
| | 4 | Coaching and training ability | 42 | 3 |
| | 5 | Driving innovation | 44 | 3 |
| | 6 | Managing performance | 33 | 2 |
| III | 1 | Interpersonal effectiveness | 32 | 2 |
| | 2 | Customer centric behaviour | 28 | 2 |
| | 3 | Developing passion for quality | 33 | 2 |

**Table 5. Phasewise Number of Programmes for Competency Upgradation and Participants Planned/Prioritized for Training (Technical Skills)**

| *Phase* | *S.No.* | *Competency* | *No. of Person* | *No. of Programmes* |
|---|---|---|---|---|
| I | 1 | Continuous improvement techniques | 46 | 3 |
| | 2 | Understanding other products | 46 | 3 |
| | 3 | New methods in quality maintenance | 47 | 3 |
| | 4 | Current trends and techniques used globally | 46 | 3 |
| II | 1 | Knowledge of products | 40 | 2 |
| | 2 | Creative approach for problem solving | 36 | 2 |
| | 3 | Inventory management techniques | 22 | 2 |
| III | 1 | Designing tools and techniques | 10 | 1 |
| | 2 | Modern manufacturing techniques | 14 | 1 |
| | 3 | Vendor management techniques | 14 | 1 |

## 4. Concluding Recommendation

In this study competency based training analysis was carried out in respect of middle management personnel of deputy manager / manager levels in IT companies. Training needs identified was shortlisted and prioritized in three phases depending on number of responses received for each category. Based on this prioritization training calendar was developed for fulfilling the competency development objectives. This calendar was developed in a manner that it did not affect normal work schedule of the concerned employees. As in many similar studies sample size was more representative rather than comprehensive due to practical constraints. While the study was limited to middle level executives only, but in the same way it can be extended to other grades of employees as well besides deputy managers and managers.

Competency models may prove helpful in aligning individual performance with organizational goals and in the process achieving competitive advantage. The value addition by a competency-based approach depends on a number of factors: (i) extent to which the competency study is based on the strategic needs of the organization; (ii) clarity with which the role or job is defined in relation to the strategy; (iii) rigour of the process used in defining the competencies; and the accuracy in matching individuals vis-à-vis job needs. Implementation of competency model may however invite resistance from certain quarters as sometime it may be in conflict with traditional 'mindsets' and remedial measures may become necessary to overcome 'mental roadblocks'.

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# Artificial Intelligence Approaches to Dynamic Project Success Assessment Taxonomic

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**Abstract:** Artificial Intelligence (AI) approaches are widely applied to various civil engineering problems. This paper focuses on an approach to assessing project success using AI approaches including K-means Clustering, Genetic Algorithm (GA), Fuzzy Logic (FL), and Neural Network (NN). As various factors at different construction stages affect project performance, project success criteria change dynamically and are hard to estimate accurately through reliance on experience alone. Information that is uncertain, vague, and incomplete is an inherent feature of this problem. CAPP (Continuous Assessment of Project Performance) software was used to study in a dynamic manner the significant factors that influence upon project performance. K-means clustering was employed to conduct an unsupervised clustering to extract similar cases for comparison. FL for was used to examine uncertainties, NN was employed for data mining, and GA was used for optimization. A developed Evolutionary Fuzzy Neural Inference Model (EFNIM) was used to achieve optimal mapping of input factors and project success output. Results show that EFNIM is able to estimate the degree of project success well and case clustering can greatly enhance project success assessments.

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**Keywords:** Project Success, Artificial Intelligence, K-means Clustering, Genetic Algorithm, Fuzzy Logic, Artificial Neural Network.

## 1. Introduction

In the construction industry, construction project success infers that certain expectations of participants, including owners, planners, designers, architects, contractors, and operators, are fulfilled. Once a construction project has been bid, the prime contract is typically subdivided into multiple subcontracts. Large numbers of participants are, therefore, involved in the project planning and implementation phases. Expectations can only be met by conducting a comprehensive analysis of participants (Sanvido et al., 1992). Project success is determined in terms of cost, schedule, performance, and safety by many events and resultant interactions, plans, facilities, participant changes and changes in the environment. Project managers who identify the key determinants to project success can monitor project performance continuously and make proper decisions based on objective performance predictions related to targeted project success.

Many published papers over the past several decades have reported the results of research conducted to identify critical project success factors. Griffith et al. (1999), using data collection and telephone interviews, developed an index designed to assess the success of industrial project execution for different types and sizes of projects. Hughes et al. (2004) developed a tool, the Construction Project Success Survey, to identify important success metrics prior to the start of a project and evaluate the level of success achieved at project completion. Wang and Huang (2006) surveyed Chinese construction supervisors to identify correlations between the performance of key stakeholders and project success. Ling et al. (2006) used tailored questionnaires, respectively, for international architecture, engineering, and construction firms to study key factors of foreign firm project success in China. Drawing from articles published in seven major construction industry journals, Chan et al. (2004) developed a conceptual framework on critical project success factors, in which five major groups of independent variables were identified, namely project-related factors, project procedures, project management actions, human-related factors, and external environment, as crucial to project success. Nguyen et al. (2004) expounded on the success factors typical to large construction projects in Vietnam, focusing his study on four factor categories and using a questionnaire survey returned by 109 valid respondents in 42 organizations.

The construction industry is replete with myriad an uncertainty that makes management exceedingly complex. Factors for success, therefore,

vary from project to project. Although human experts can often achieve a satisfactory project outcome, shortfalls nearly always occur due to managers failing to take all relevant factors into consideration and lacking access to all relevant information.

Artificial intelligence, a novel technology for extracting knowledge, is already widely applied to various civil engineering problems, including project management (Cheng and Ko, 2003). To predict project performance, Chua et al. (1997) employed a neural network with eight key factors for project success. Georgy et al. (2005) utilized a neurofuzzy intelligent system to predict the engineering performance in a construction project and compared such with the results of statistical variable reduction techniques.

An appreciation of critical factors is crucial to assess the requirements of project success and to achieve successfully project objectives. Statistical methods represent a basic approach to identify significant factors from historical data or questionnaire results. However, the dynamic nature of critical factors means that changes in project conditions must be monitored continuously. The Construction Industry Institute (CII, 1996) cooperated with the University of Wisconsin at Madison to develop a prediction software tool, named Continuous Assessment of Project Performance (CAPP) (Russell et al., 1997), which allows managers to identify significant factors continuously and dynamically.

In this study, CAPP software is employed to determine significant factors for project success and AI approaches are used to assess project success. Project managers can use the model to predict the degree of success of a new project, allowing managers to enhance their effective control over projects and prevent problems. The remaining sections of this paper include Section II: a introduction of AI approaches which comprehend K-mean clustering and Evolutionary Fuzzy Neural Inference Model with GA, FL, and NN involved; Section III: significant factors for project success are determined using CAPP software; Section IV: AI approaches apply to project success prediction; Section V: conclusions are described.

## 2. Artificial Intelligence Approaches

### 2.1 K-means Clustering

Many algorithms are able to identify specific domains. K-means clustering is a simple and fast approach to data clustering that starts with k centroids (seeds), which are usually generated randomly. Each data set (sample) is assigned to the cluster with closer centroid of the Euclidean distance measurement. It is customary to set a threshold on iteration numbers to prevent excessive calculation times. After a number of iteration steps, every clustering feature can be determined. As desired number of clusters can be set as a limitation for target convergence, perfect convergence cannot be guaranteed. K-means usually converges in practical applications, especially in pattern recognition problems. K-means clustering is widely and commonly employed owing to its simplicity, although it does present some inherent drawbacks such as a fixed setting for the optimal solution or time consumption (MacQueen, 1967).

While the input data set $S$ is composed of n points ($n$ $d$-dimensional vectors), the $k$ cluster centroids $C$ must be satisfied using the following descriptions (Maulik and Bandyopadhyay, 2000):

$$S = \{x_1 \quad x_2 \quad ... \quad x_n\} \qquad \text{……..……(1)}$$

$$C_m \neq \Phi, \quad m = 1 \sim k \qquad \text{……..…(2)}$$

$$C_m \cap C_n = \Phi, \quad m, n = 1 \sim k, \quad m \neq n \qquad \text{……..…(3)}$$

$$\bigcup_{i=1}^{k} \text{dataset}(C_m) = S \qquad \text{……..……(4)}$$

$$d(x_i, C_j) = (x_i - C_j)^T (x_i - C_j), \qquad \text{……..……..……(5)}$$

$$i = 1 \sim n, j = 1 \sim k$$

The above definition describes each cluster as having at least one dataset, with each belonging to a cluster of one-to-one relationships. Also, each dataset must attach to a cluster. $k$ cluster centroids are initially selected at random from $S$. During each iteration process, every data point $x$ is assigned to a particular cluster set by closest Euclidean distance measurement $d$. Once each data point has been assigned to its cluster, all centroids $C$ can be re-calculated by means of all attaching points. This describes the major concept of K-means algorithm: that K-means iterates until stable cluster centroids are found (Tou and Gonzalez, 1974).

### 2.2 Fuzzy Logic

Zadeh (1965) first proposed Fuzzy Logic (FL) as a tool to describe uncertainty and imprecision. Because it imitates the high order mode in which the human brain makes decisions in the face of uncertainty or vagueness, FL provides an effective way for automated systems to describe highly complex, ill-defined, or difficult-to-analyze subjects. In general, FL is composed of a fuzzifier, rule base, inference engine and defuzzifier (Cheng and Ko, 2003). The FL approach still has certain problems to overcome such as membership function configuration, composition operator determination, and application-specific fuzzy rule acquisition (Maier et al., 2000). Although the FL parameters can be determined using the experience and knowledge of experts, determining these parameters in the absence of such experts remains difficult for particularly complex problems (Gorzalczany and Gradzki, 2000).

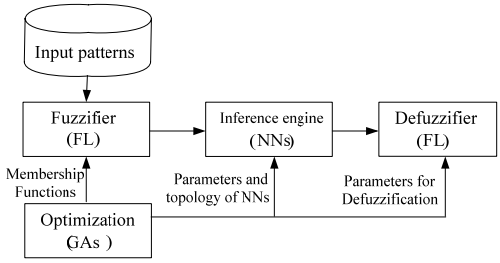


Figure 1 EFNIM Architecture

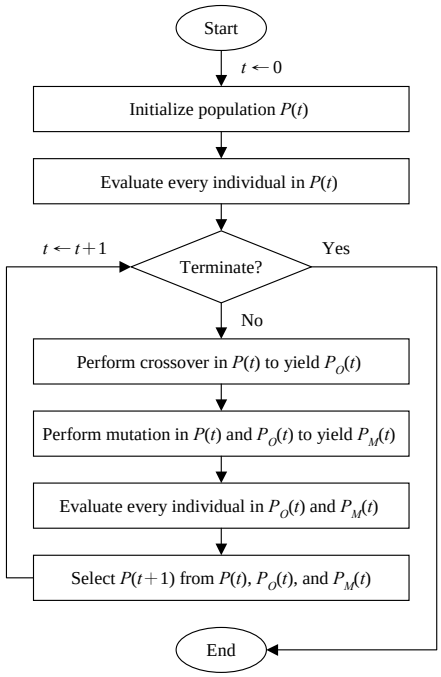


Figure 2. EFNIM Adaptation Process

**2.3 Neural Network**

Neural Networks (NN) focus primarily on computing and storing information within a structure composed of many neurons. Because NN imitates the human brain in terms of learning, recall and generalization, they are usually designed to solve non-linear or ill-structured problems (Haykin, 1999). An NN model frequently used is multilayer perceptron learning with error back-propagation. However, appropriate NN structures and parameters are essential to accurate problem assessment. As the optimal network topology is highly problem-oriented, such are difficult to determine (Liatsis and Goulermas, 1995). In addition, some real world applications are hampered by lack of training techniques able to find reliably a global optimum set of weights (Jagielska et al., 1999).

**2.4 Genetic Algorithm**

Genetic Algorithms (GA), which imitate parts of the natural evolution process, were first proposed by Holland (1975). GA is a stochastic search approach inspired by natural evolution that involves crossover, mutation, and evaluation of survival fitness. Genetic operators work from initial generation to offspring in order to evolve an optimal solution through generations. Also, its relatively straightforward and simple implementation procedure give the GA exceptional flexibility to hybridize with domain-dependent heuristics to create effective implementation solutions tailored to specific problems. Based on its merits, the potential of using GA in optimization techniques has been intensively studied (Gen and Cheng, 1997). However, simple GA is difficult to apply directly and successfully to a large range of difficult-to-solve optimization problems (Michalewicz, 1996).

**2.5 Evolutionary Fuzzy Neural Inference Model (EFNIM)**

EFNIM, which fused GA, FL, and NN to solve civil engineering problems, was proposed by Cheng and Ko (2006). The complementary combination of its three elements maximizes the positive merits of each and helps compensate for their individual inherent weaknesses. GA is used for optimization; FL deals with uncertainties and handles approximate inferences; and NN is employed in input-output mapping. The model architecture is shown in Figure 1.

Although FL can describe the high-order human inference process, making decisions regarding the appropriate distribution of membership functions, operator composition and regulations is not easy. EFNIM introduces NNs to resolve this issue as well as to infuse into FL a capacity for self-learning. The combination of FL and NNs is regarded as a "neuro with fuzzy input-output," i.e., a neural network with both fuzzy inputs and fuzzy outputs. For convenience, the term "neuro with fuzzy input-output" is termed a Fuzzy Neural Network (FNN), which is a general phrase used to express the fusion/union of FL and NNs (Hayashi et al., 1998). Even if FNN is more relevant than either the traditional FL in the inference process or the single NN in the imitating process, determining the fittest distribution of membership functions (MF), NN topology, and parameters of NN (including number of hidden layers and neurons, synaptic weights, bias shifting, slopes of activation functions) remains difficult. GA represents an effective approach to overcoming FNN drawbacks (Gorzalczany and Gradzki, 2000). GA, which is applied to optimization over wide territories, addresses the above-mentioned problems by searching for optimal MFs and identifying optimum network parameters. The EFNIM is able to self-adapt, as shown in Figure 2, where *P(t)* represents $\xi$ parents in generation *t*; *PO(t)* means that performing crossover $\xi$ parents yield $\sigma$ children; *PM(t)* means $\tau$

mutant individuals. The EFNIM can be constructed once all these constituent components are in place.

## 3. Factors of Project Success

Using CAPP software, 54 historical construction projects were collected from 17 CII member companies and analyzed using 76 variables.

### 3.1 CAPP analyzing process

Current project progress and the level of significance of each factor should be identified first using CAPP software. The analysis process is illustrated as follows:

Step 1: Progress setting.

Significant factors vary during project stages. To identify factors, a completion percentage should be selected for this analysis. For purposes of research in this paper, project progress is set at 67% complete.

Step 2: Significant level for factors.

A threshold level of significance should be selected to identify factors of greatest significance. CAPP recommends that an attached alpha below 0.1 identifies a referenced factor. In this paper, a threshold for the alpha was set at less than 0.025 in order to reduce the number of identified factors.

### 3.2 Project Success definition

According to project performance, CAPP defined the four degrees for project success of "successful", "on time or on budget", "less-than-successful", and "disastrous" (Russell et al., 1997). Basing on this definition, this paper assigned four quantitative values for project success linearly (see Table 1).

Table 1 Quantitative Project performance

| Project performance | Value |
|---|---|
| Successful | 1.000 |
| On time or on budget | 0.667 |
| Less-than-successful | 0.333 |
| Disastrous | 0.000 |

### 3.3 Significant Factors of Project Success

Sequentially, CAPP can be employed to calculate significant factors. Factors can be analyzed using CAPP software (see Figure 3). Histogram in CAPP Graphics shows level of significance, denoting high effectiveness at low quantity. With project progress set at 67% (selected in Section 3.1), the value of histogram is about 0.02 (below the threshold 0.025), indicating that the factor "cost of change orders" is identified as a significant factor in this study. Eleven factors significant to project success were identified in total (see Table 2). Forty-six of the 54 valid projects in the CAPP database met the criterion that all eleven factor values are non-null. Forty-two of the 46 were selected for training, leaving four valid projects available for testing (see Table 3).

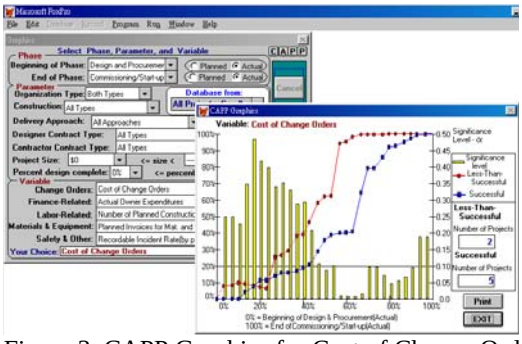


Figure 3. CAPP Graphics for Cost of Change Orders

Table 2. Time-dependent factors identified by CAPP

| Factors | Column I.D. in CAPP | Analyzed Significant Level |
|---|---|---|
| 1. Actual design % complete | C5_16 | 0.01 |
| 2. Actual owner expenditures | C3_10 | 0.01 |
| 3. Invoiced construction costs | C2_14 | 0.02 |
| 4. Designer planned effort hours | C2_13 | 0.01 |
| 5. Actual invoices for material and equipment | C3_28 | 0.01 |
| 6. Paid construction costs | C3_14 | 0.01 |
| 7. Cost of owner project commitments | C2_24 | 0.01 |
| 8. Recordable incident rate (by period) | C2_38 | 0.01 |
| 9. Cost of change orders | C2_17 | 0.02 |
| 10. Quantity of change orders | C3_17 | 0.01 |
| 11. Actual overtime work | C3_41 | 0.02 |

## 4. Project Success Assessment Model

### 4.1 Model design

To develop a dynamic project success assessment model, significant factors, which are time-dependent, were selected by the CAPP software with an assigned project completion percentage. A K-means algorithm was used to cluster similar projects. The Evolutionary Fuzzy Neural Inference Model (EFNIM), which, as stated above, fuses GA, FL and NN, employed project success learning to determine the relationships between quantities of significant factors (at 67% completion herein) and degree of final project success. Consequently, one can assess the degree of project success using significant factor quantity inputs (at 67% completion). Specific processes and employed facilities of the developed assessment model are shown in Figure 4. In EFNIM, GA plays an important role for global optimization. The fittest result was obtained through the following sequence: define initial population, evaluate individuals, evaluate fitness function, perform crossover, perform mutation, and select individuals.

Define initial population:

Initial solutions are generated randomly, with each solution composed of two FL and NN substring segments.

Evaluate individuals:

A fitness function is designed for global optimization of MF shapes, NN topology, and NN parameters. The objective function $f^{ob}$, which addresses model accuracy and model complexity, is defined as following:

$$f^{ob} = w^a m^a + w^c m^c \quad \text{.....(6)}$$

where $w^a$ is a weight of model accuracy; ma denotes model accuracy calculated by the discrepancy between predicted and desired outputs; $w^c$ represents a weight of model complexity; mc indicates model complexity formulated by number of activation connections.

Evaluate fitness function:

Fitness function $f^{fi}$, defined as the reciprocal of $f^{ob}$, is used to evaluate chromosomes. The larger the fitness value, the more objectives are achieved.

$$f^{fi} = \frac{1}{f^{ob}} \quad \text{.....(7)}$$

Perform crossover:

Crossover rate is used to select fitter parent individuals (crossover rate is 0.2 herein). One-cut-point crossover and exchanging the right-hand part of the parents are used for adaptation. All FL and NN parameters can be exchanged from parents to children.

Perform mutation:

A mutation rate is set to perform mutation operations (mutation rate is 0.02 herein). A probability is assigned to genes. The mutation operator will be excited when the probability reaches the mutation rate.

Select individuals:

Fitness for survival is the criterion for individual selection. To prevent fit chromosomes being lost during evolution, a new generation is composed of several parents, offspring, and their mutations.

Table 3. Testing data from the CAPP database

| No. | Inputs | | | | | | | | | | | Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C5_16 | C3_10 | C2_14 | C2_13 | C3_28 | C3_14 | C2_24 | C2_38 | C2_17 | C3_17 | C3_41 | |
| 1. | 0.000 | 0.000 | 0.118 | 0.150 | 0.154 | 0.135 | 0.000 | 0.000 | 0.251 | 0.456 | 0.961 | 0.000 |
| 2. | 0.074 | 0.841 | 0.657 | 0.079 | 0.622 | 0.000 | 0.000 | 0.249 | 0.000 | 0.000 | 0.000 | 1.000 |
| 3. | 0.000 | 0.277 | 0.166 | 0.000 | 0.000 | 0.000 | 0.000 | 0.941 | 0.138 | 0.200 | 0.635 | 0.333 |
| 4. | 0.000 | 0.807 | 0.585 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.081 | 0.211 | 0.000 | 0.667 |

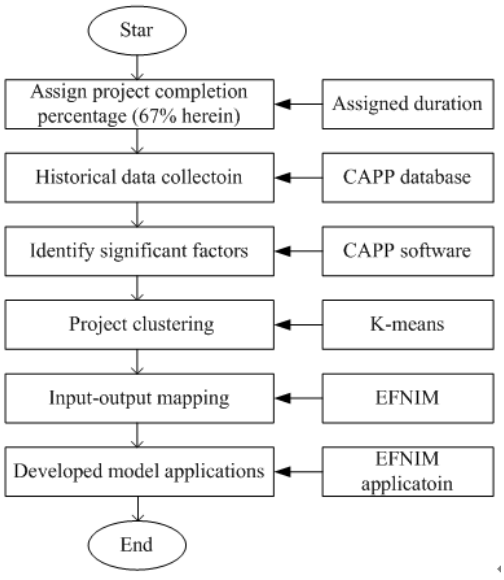


Figure 4. Model Processes

### 4.2 Project Success Assessment without Data Clustering

With CAPP's kind permission, 54 projects in CAPP database were employed in this study. Firstly, significant factors were analyzed using CAPP software, with a threshold of significant level set at 0.02 and project completion set at 67%. Eleven significant factors of influence in project success were determined. Forty-six projects fulfilled our criteria and were treated as raw data for project success learning. Of the 46 data sets, 42 were treated as training data and 4 were assigned as testing data for EFNIM learning. Although model complexity may lead to an over-learning result, model accuracy is more important than model complexity. Therefore, the weight of model accuracy in equation (6) was set as 1 and relatively 0.0001 for weight of model complexity. Model accuracy varies in correspondence with the dynamic factors of influence on project success. After 5,000 generations were trained / searched, the fitness value of the fittest individual was 0.1198, with mean fitness for all individuals determined as 0.06843. Training and testing RMSE were 0.1812 and 0.1303, respectively. Detailed training results are shown in Figure 5. While result trends are positive, they are not categorized well to determine project success, identify successful projects (project performance=1.000), or determine on-time or on-budget (project performance=0.667)

projects. Additional strategies should be employed to overcome such deficiencies.

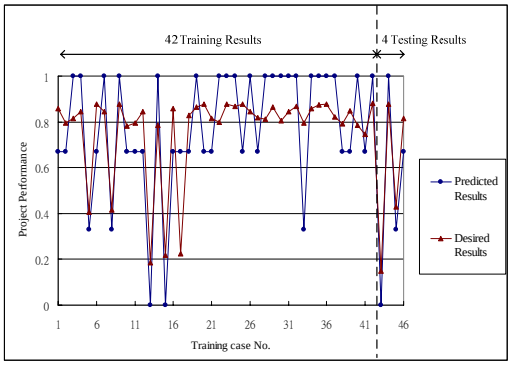


Figure 5 Results for Project Success Assessment without Prepared Data Clustering

### 4.3 K-means Cluster Analysis

K-means clustering is a multi-variable analysis data clustering method that aggregates similar data and identifies discrepancies between clustered categories. CAPP database data used in this study were gathered from different construction companies and vary in terms of project attributes (e.g., type of construction, cost, procurement approaches, etc.) To improve assessment accuracy, K-means clustering was used prior to EFNIM learning to collate training data sets that were most similar to the assessment target. SPSS, a commercial statistics software package, was the tool used to conduct K-means clustering analysis for this purpose. After the number of clusters been set, each cluster center iterated toward the fittest location by Euclidean distance measurement (see Figure 6). The number of clusters was chosen as 2 to represent positive and negative quality. The four testing data (CS1, CS2, CS3, and CS4) were treated as clustering targets respectively. For CS1, K-means clustering was employed for the 42 training data and CS1. The clustering results are shown in Table 4, in which the CS1 is attached to cluster 2, where there are 17 data sets in this cluster. Similarly, there are 24 training cases for CS2, 25 for CS3, and 17 for CS4. In other words, for each new project assessment, K-means clustering was applied to the assembly of the 42 training projects as well as the new one with 2 sets of clusters having been set. Thus, SPSS generated 2 cluster centers. Finally, data sets in which the new project had been clustered were treated as training data (part of 42 training projects, without the new one) for sequential EFNIM learning to assess new project performance. The reason for setting 2 sets of clusters was to avoid having only a small number of projects for EFNIM learning. Therefore, if the data pool is large enough in other studies, the selected number of clusters could be increased. In summary, time-dependent factors were not the only factors that changed dynamically with CAPP analysis. Training data sets also varied for different project performance assessment targets with SPSS K-means clustering.

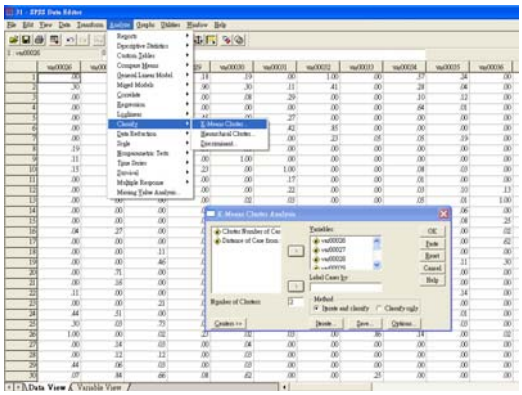

Figure 6 K-means Clustering Analysis of SPSS

Table 4 Results of K-means Clustering

| | Initial Cluster Centers | | Final Cluster Centers | |
|---|---|---|---|---|
| | Cluster | | Cluster | |
| Variable | 1 | 2 | 1 | 2 |
| C5_16 | 1.00 | 0.00 | 0.11 | 0.10 |
| C3_10 | 0.00 | 1.00 | 0.07 | 0.48 |
| C2_14 | 0.02 | 0.33 | 0.08 | 0.33 |
| C2_13 | 0.23 | 0.00 | 0.06 | 0.15 |
| C3_28 | 0.02 | 0.68 | 0.03 | 0.27 |
| C3_14 | 0.03 | 0.42 | 0.05 | 0.27 |
| C2_24 | 0.00 | 0.85 | 0.02 | 0.27 |
| C2_38 | 0.86 | 0.00 | 0.12 | 0.03 |
| C2_17 | 0.14 | 0.00 | 0.07 | 0.17 |
| C3_17 | 0.00 | 0.00 | 0.11 | 0.15 |
| C3_41 | 0.20 | 0.00 | 0.13 | 0.03 |

Notes:

1. Convergence achieved due to no or minimal distance change. The maximum distance by which any center has changed is 0.000. The current iteration is 3. The minimum distance between initial centers is 2.053.
2. There were 43 valid cases. Of which, 25 cases were in cluster 1 and 18 cases were in cluster 2. No cases were missing.

### 4.4 Project Success Learning with K-means Clustering Results

After K-means clustering analysis, EFNIM project performance learning for a particular case can follow sequentially. 5,000 generations were similarly set for GA iteration. Results of fitness values and RMSE are listed in Table 5, with results (not using prepared data clustering) shown in Section 4.2. Results show that K-means clustering does indeed improve project performance assessment. Therefore the project success assessment processes in Figure 4 have been demonstrated as representing a reasonable, feasible, and effective approach.

Table 5 Comparisons for K-means Clustering of Performance Assessment Results

| | Testing Case | Predicted Output | Desired Output | Best Fitness Value | Overall Fitness Value | Training RMSE |
|---|---|---|---|---|---|---|
| Without K-means Clustering | 1 | 0.1476 | 0.0000 | 0.1198 | 0.0684 | 0.1812 |
| | 2 | 0.8772 | 1.0000 | | | |
| | 3 | 0.4287 | 0.3330 | | | |
| | 4 | 0.8151 | 0.6670 | | | |
| With K-means Clustering | 1, CS1 | 0.0285 | 0.0000 | 0.4012 | 0.1563 | 0.0956 |
| | 2, CS2 | 0.9963 | 1.0000 | 3.1162 | 2.4366 | 0.0175 |
| | 3, CS3 | 0.3835 | 0.3330 | 0.3338 | 0.1456 | 0.1150 |
| | 4, CS4 | 0.7209 | 0.6670 | 0.6676 | 0.2702 | 0.0826 |

Notation: A larger fitness value or smaller RMSE indicates smaller differences between predicted and observed values.

## 5. Conclusion

This paper proposes a model for assessing project success using AI approaches that employ fuzzy logic, genetic algorithm, neural network, and K-means clustering. The two commercial software packages used include CAPP for project access and SPSS for data clustering. The results achieved in this paper can be summarized as follows:

1. Using CII's copyrighted CAPP software, the time-dependent factors that dynamically influence project performance can be managed in order to achieve precise project success assessment.
2. Although data in the CAPP database are representative of typical construction projects, their features vary widely. Extracting similar historical cases using K-means clustering can improve prediction accuracy. This study performs clustering using SPSS software.
3. The uncertain information and complex mapping in project performance assessment are conducted using EFNIM. EFNIM uses FL to handle uncertainties, NN to perform input-output mapping and GA to achieve global optimization. As its feasibility for project performance assessment has been demonstrated, therefore EFNIM is proposed herein.
4. Project assessment helps managers to make strategies in a time efficient manner and take correct actions to achieve final project success. With the proposed model, dynamic project performance assessment can be achieved using CAPP, SPSS, and EFNIM.

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# Relationship between human resources development and knowledge management value chain

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**Abstract:** Present research has analyzed the relationship between human resources development (Employee empowerment, Employee participation and Employee training) and KMVC by descriptive method in correlation type. 1221 employees of one of the Iranian Steal Company with B.S degree and upper took part in the statistical universe of this survey. 232 people were chosen by using systematic sampling method and the sample size formula. To collect data, two researcher-made questionnaires of KM and HRD have been used. Also content validity and face validity of questionnaires in this research were confirmed by experts. The validity of both questionnaires was estimated using Cronbach's alpha coefficient (α) which equals to 0.87 in KM and 0.83 in HRD. The result has shown that there is a relationship between KM and employee participation (r = 82%, α= 0.001), a relationship between KM and employee empowerment (r = 76%, α = 0.001) and a relationship between KM and employee training (r = 63%, α = 0.001).

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**Keywords:** empowerment, human resources development, knowledge management value chain, participation, training.

## I. INTRODUCTION

NOWADAYS, exponential increases in data volumes are increasingly viewed as important and essential sources of information that may eventually be turned into knowledge [1], so that knowledge is increasingly claimed to be a key critical resource and source of competitive advantage in the modern global economy, especially with the rise of the service economy, the growth in the number of 'knowledge workers', and the growing recognition of the importance of intellectual capital and intellectual property rights [2]. Although a firm has access to the knowledge, skills and expertise of employees, it also needs knowledge management mechanisms in place to ensure effective utilization human capital. Knowledge management is an approach to adding or creating value by more actively leveraging the know-how and experience resided in individual minds [3], [4], [5]. Consequently, HRM activities and program must focus on instilling, improving, and evaluating knowledge, skills, and abilities of human assets [6]. Examining the relationship between KM and human resource development activities may lead to increasing organizational efficiency and effectively. The purpose of this paper is to identify the relationship between human resource development activities and KM activities.

## II. LITERATURE REVIEW

As the world is becoming more competitive and unstable than ever before, manufacturing-based industries are seeking to gain competitive advantage at all cost and are turning to more innovative sources through HRM practices [7]. Human resource management (HRM) is an inevitable process that accompanies the growth of organizations [8]. The overall purpose of HRM is to ensure that the organization is able to achieve success through people. HRM system can be the source of organizational capabilities that allow firms to learn and capitalize on new opportunities [9]. And to this end Human resource development (HRD) activities are intended to ensure that organizational members have the skills or competences to meet current and future job demands [10]. Strategic human resource development involves introducing, eliminating, modifying, directing and guiding processes in such a way that all individuals and teams are equipped with the skills, knowledge and competences they require to undertake current and future tasks required by the organization [11]. HRD includes: paying attention to change management, to combining learning processes, KM, job development, team making, instructional technology, good job relations, information technology and HRD relation, leadership development and interference strategy [12]. In this survey, three tools such as staff participation, staff empowerment and staff training have been analyzed as the necessary tools to develop human resources in organization.

Training: is a useful investment and a key factor in development and If it is planned and applied well, will have a remarkable economic output. Staff training is a helpful action that can give credit to individual and in organizational level causes improvement and development to the organization and also in national and transnational level can increase productivity. So we can say one of the basic actions that causes efficiency to organization, is human resource development via training and its improvement continuously. Training and improvement of human force give abilities to the individuals to continue their activities effectively according to organization and environmental changes and increase their productivity and efficiency. So Training and improvement is a continued and planned attempt by management to develop staff competency and organizational operation [13].

Empowerment: is the process of enhancing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Central to this process are actions, which both build individual and collective assets, and improve the efficiency and fairness of the organizational and institutional context which govern the use of these assets. It identified empowerment as "the expansion of assets and capabilities of the people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives [14].

Participation: there are different definitions about participation that all show the role play, giving ideas and recommendations, issuing solution, work development and improvement. "Employee participation" is a partnership process that aims to stimulate and encourage staff for more commitment and collaboration in organization success [15]. Employee participation embraces employees in the organizational decision making on a collective basis [16].

A number of scholars, such as [17], [18], and [19] have argued on the missing link between HRM practices and organization outcomes. Reference [20] have recognized Knowledge management as the fundamental activity for obtaining, growing and sustaining intellectual capital in organizations and an intervening mechanism between organizational factors and organizational outcomes. Knowledge Management (KM) is an effort to increase useful knowledge within the organization. Ways to do this include encouraging communication, offering opportunities to learn, and promoting the sharing of appropriate knowledge objects or artifacts [21]. Knowledge management is a multidisciplinary approach that takes a comprehensive, systematic view to the information assets of an organization by identifying, capturing, collecting, organizing, indexing, storing, integrating, retrieving, and sharing them. Such assets include (1) explicit knowledge, such as databases, documents, environmental knowledge, policies, procedures, and organizational culture; and (2) the tacit knowledge of the organization's employee, their expertise, and their practical work experience [22].

The goal of KM is to improve tasks and sub-tasks, in most cases the creation or generation; acquisition; identification or capture; validation and evaluation; conversion; organization and linking; formalization or storage; refinement or development; distribution, diffusion, transfer or sharing; presentation or formatting; application and evolution of knowledge, with the help of systematic interventions, instruments or measures [23], [24], [25], [26], [27], [28], [29], [30].

The Art and science of KM is a frame for designing continuous systematic activities to make effective organizational decisions. In this field, KM is a strategic process by the goal of separating organizational from competitors and outstrips from their competitive advantages. To reach to this goal, the organization activities should be organized to create an appropriate model for KM [31]. According to [32], potential sources of competitive advantage are everywhere in the firm. To highlight the idea that competitive advantage grows fundamentally out of the value a firm is able to create for its customers [33] integrate different terminologies used by some authors in describing the KM process and aggregate their work as a simple KM value chain in Fig. 1 the KM value chain is divided into four activities knowledge creation, knowledge storage, knowledge distribution and knowledge application.

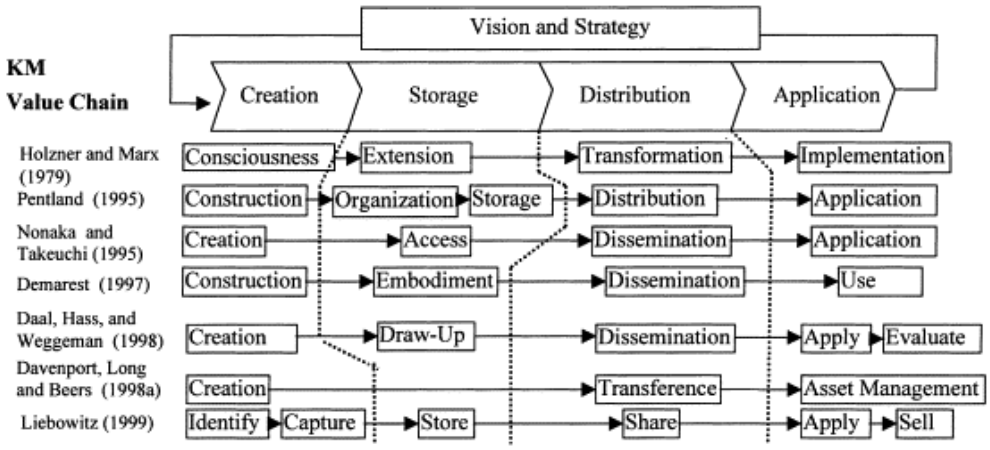


**Fig. 1** Knowledge Management value chain

These four activities are defined as a chain to create value for organization via knowledge [33]. Although different researchers have suggested different models to perform knowledge management system in the organization, all of them originate from these four levels. Nowadays the rapid growth of technology has led to an economy where competitive advantage is increasingly based on the successful application of knowledge [34]. The emphasis on HRD is also broadening to a focus on developing themes and creating environments conducive to learning, as well as to the acquisition and creation, sharing and dissemination and application of knowledge within organizations [35].

For instance employee participation is one of key factors in successful KM implementation because the nature of knowledge creation and sharing is unthinkable without employee participation, in addition employee training which can transfer tacit knowledge into explicit knowledge through education, organizations must build employee skills, competencies, and careers, creating "bench strength" [36], and also effective creation and sharing of knowledge will fail if employees do not have a sense of ownership in the overall aim of the organizational KM project so through empowerment, employers can value their employees' expertise and help them communicate their knowledge by creating ways to capture, organize and share knowledge [37].

The resource based view of the firm suggests that organizations will need to be able to combine distinctive, sustainable and superior assets, including sources of knowledge and information, with complementary competencies in leadership and human resource management and development to fully realize the value of their knowledge [38]. HRD in organizations should be structured to promote knowledge creation and mobilization, and how to develop a culture and set of HRM policies and practices that harness knowledge and leverage it to meet strategic objectives [2]. Obviously KM is first and foremost a people issue. The success of KM initiatives depends upon people's motivation, their willingness, and their ability to share knowledge and use the knowledge of others. People in organization, processes and technology will at all times be acting as either enablers of, or barriers to, effective KM practices. Barriers need to be identified and removed. Existing enablers also need to be enhanced and additional ones created. This is often where the greatest KM challenges lie [39]. Consequently, according to the broad goals of HRD in organization, it can help organization to reach its goals along with KM. In the other words, by integrating KM and HRD together, it is possible to follow up the ultimate goals of organization which called the organizational excellence.

## III. THEORETICAL FRAME OF RESEARCH

Knowledge management and human resource management are two significant issues in organizations management. In spite of wide literature about both of them, applying them still has been a challenge. When the knowledge capitals of an organization are mentioned, in fact human resources are supposed as the knowledge capitals. So in this situation, human resource systems have to be stated so that support learning environment and have harmony with organizational knowledge management system to respond organization knowledge needs and operate organizational goals. So, present research has tried to survey the relation between HRD (including

staff empowerment, staff training and staff participation) and knowledge management value chain in one of the big Irainian industrial companies.

## IV. RESEARCH METHODOLOGY

Present research has analyzed the relationship between human resources development (Employee empowerment, Employee participation and Employee training) and KMVC by descriptive method in correlation type. 1221 employees of one of the Iranian Steal Company with B.S degree and upper took part in the statistical universe of this survey. 232 people were chosen by using systematic sampling method and the sample size formula. To collect data, two researcher-made questionnaires of knowledge management and human resources development have been used. Also content validity and face validity of questionnaires in this research were confirmed by experts. The validity of both questionnaires was estimated using Cronbach's alpha coefficient (α) which equals to 0.87 in knowledge management and 0.83 in human resources development.

## V. HYPOTHESES

### A. There is a relation between employee empowerment and knowledge management value chain in organization:

TABLE I
CORRELATION COEFFICIENT BETWEEN EMPLOYEE EMPOWERMENT AND KNOWLEDGE MANAGEMENT VALUE CHAIN

| Predictor variables | Correlation Coefficient | $r^2$ | α |
|---|---|---|---|
| Knowledge Creation | 0.614 | 0.377 | 0.001 |
| Knowledge Storage | 0.658 | 0.433 | 0.001 |
| Knowledge Distribution | 0.674 | 0.454 | 0.001 |
| Knowledge Application | 0.785 | 0.616 | 0.001 |
| KM (Total Mark) | 0.767 | 0.588 | 0.001 |
| | | | P<0.01 |

Findings table I show that the correlation coefficient between employee empowerment and KMVC and its subscales in ($p<0.01$) level is meaningful ($r= 0.767$). It means that there is a meaningful relation between employee empowerment and KMVC and its subscales. According to determination coefficient ($r^2$) 58.8% variance of employee empowerment and KMVC was common. So the first theory that says "there is a relation between employee empowerment and knowledge management value chain" is confirmed.

The outcome is matched with [40]. They concluded that the role of applied KM in ISACO Company regarding to three indicators such as individual, group or organizational abilities is 68% (3.39 out of 5) from the responders view. So we can conclude that the applied KM in this company has been successful and increased individual, group or organizational abilities. Also this finding is matched with the result of [41] that shows in general level, there is a meaningful relation among transferring implicit knowledge and capability feeling on employee in decision making, taking responsibility of decision making in employee, Their access to related tools for decision making, implementation and finally accepting the responsibility of employee decision result, and its correlation coefficient is 0.6. This survey's results are not matched with [42] results. Because their research shows that there is a trivial relation between employee empowerment and knowledge creation, knowledge storage and knowledge distribution. Empowerment is one of the related factors to KMVC. In modern organizations, organizational knowledge is supposed as a persistent competitive advantage resource and whole KM pays attention to apply present knowledge in organization which results in organizational benefit. In the other hand the importance of knowledge doesn't mean that it is applied all the times in organization activities. So employee empowerment as a strategic and important resource in organizations is caused to persistent development and access to goals, in global approach. If KM process is organized and designed well in an organization, but the employees can't use this new management system, the entire manager's attempts will be useless. Employee empowerment is a factor

that facilitates using the KM project and develops the organization. So we can determine the relation between employee empowerment and KMVC.

**B. There is a relation between employee training and knowledge management value chain in organization**

TABLE II
CORRELATION COEFFICIENT BETWEEN EMPLOYEE TRAINING AND KNOWLEDGE MANAGEMENT VALUE CHAIN

| Predictor variables | Correlation Coefficient | $r^2$ | α |
|---|---|---|---|
| Knowledge Creation | 0.558 | 0.346 | 0.001 |
| Knowledge Storage | 0.506 | 0.256 | 0.001 |
| Knowledge Distribution | 0.557 | 0.310 | 0.001 |
| Knowledge Application | 0.618 | 0.382 | 0.001 |
| KM (Total Mark) | 0.634 | 0.389 | 0.001 |
| | | | P<0.01 |

Findings table II show that the correlation coefficient between employee training and knowledge management value chain and its subscales in ($p<0.01$) level is meaningful ($r=0.634$). It means there is a meaningful relation between employee

training and KMVC and its subscales. According to determination coefficient ($r^2$), 38.9% variance of employee training and KMVC was common. So the second theory of the research is confirmed.
The outcome is matched with the result of [31] that shows there is a meaningful relation in the role of quality management in human resource training and making KMVC in organization. Also it is matched with the outcomes of [5] that shows there is a positive meaningful relation between employee training and knowledge acquisition and also between employee training and knowledge application.
Human capital with its knowledge, proficiency and skills is a valuable resource for organizations. Modern organizations which apply and manage the knowledge and proficiency of people mind continuously and effectively, are able to make more value and achieve better competitive advantages. In order to develop KM, they use some useful procedures to expand human resources, such as training which makes them skillful and freed to act. So we can determine the relation between employee training and KMVC.

**C. There is a relation between employee participation and knowledge management value chain in organization**

TABLE III
CORRELATION COEFFICIENT BETWEEN EMPLOYEE PARTICIPATION AND KNOWLEDGE MANAGEMENT VALUE CHAIN

| Predictor variables | Correlation Coefficient | $r^2$ | α |
|---|---|---|---|
| Knowledge Creation | 0.727 | 0.528 | 0.001 |
| Knowledge Storage | 0.656 | 0.430 | 0.001 |
| Knowledge Distribution | 0.736 | 0.542 | 0.001 |
| Knowledge Application | 0.802 | 0.643 | 0.001 |
| KM (Total Mark) | 0.826 | 0.682 | 0.001 |
| | | | P<0.01 |

Findings table III show that the correlation coefficient between employee participation and knowledge management value chain and its subscales in ($p<0.01$) level is meaningful ($r=0.826$). It means there is a meaningful relation between employee participation and KMVC and its subscales. According to determination coefficient ($r^2$), 68.2% variance of employee participation and KMVC was common. So the third theory is confirmed.

The outcome is matched with the result of [31] that shows a meaningful relation between the role of quality management in the dimension of human resource participation and producing KMVC in organization. Reference [43] concluded that employee participation doesn't have an important effect to implement KM in the company and this result is not matched with the result of this research.

Knowledge has an abstract meaning and the culture of knowledge sharing and application in organization depends on individual attitudes. Employee participation is one of the most important challenges to implement KM in organization. The culture of participation effects knowledge producing by increasing knowledge exchange in organization and creates suitable situation to transfer knowledge between individuals and groups, because knowledge transferring needs people who cooperate in exchanging ideas, sharing and creating knowledge. The lack of the culture of participation that supports KM system, limits KM system efficiency.

## VI. CONCLUSION

Human resource management is the most important key in organization's success. If policies and procedures related to organization staff are in accordance and have a remarkable share in accessing strategic programs and organization goals, reaching the organizational success is more possible. Culture and general values, organizational situation and managerial behavior which originate form that culture, have a big effect on reaching to desirable excellence. On the other hand, KM causes to establish and improve competitive progresses for commercial organizations. In the other words knowledge improves the ability of competition in an organization and also helps the organizations to survive in present turbulence and changed situation. KM is not just a collection of software and hardware and the organization foundation such as culture and staff have an important role in it. The main duty of HRD is supervision, evaluation and interfering in staff's knowledge visualization, distribution and application. Also all the activities of HRD dimensions are effective in maintaining and making the abilities of organization staff. So if HRD involves human capitals education and if knowledge is the valuable resource for these capitals, in this case HRD and KM are dependent on each other strongly. HRD and KM share general goals and activities when forming work units, teams, multi-duty cooperation and also networks of communications inside and outside organization borders. So by surveying knowledge management cycle and human resource management process together, it is clear that there are a lot of common activities and a two-way relation between them. According to the result of research in this industrial company, we can confirm what was thought in research general. In other words we can say that there is a meaningful relation between HRD (empowerment, training, participation) and knowledge management value chain.

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# Relationship between Managers' Communicational Skills and Teachers' Organizational Commitment

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**Abstract:** The present research has been carried out to investigating the relationship between the managers ' communicational skills and the teachers ' organizational commitment in the middle schools of Sirjan. The method of research was descriptive – correlation and the specified group for that include all the managers and teachers in the middle schools of sirjan in 2011–12 that has 77 managers and 651 teachers. By applying the Cochran formula the statistical society for managers and teachers has been specified 54 and 169, (in respect) that were chosen stratified. The measurement devices include two questionnaires, the standard questionnaire of Queendom communicational skills (2011) and the questionnaire of organizational commitment. Both of them were based on demographic questions. For the analysis of data descriptive and deductive methods were used (Etta and Pearson correlation coefficient). Finally the result of the analysis revealed that all the dimension of managers' communicational skills relate positively with the teachers' organizational commitment. The results of this study can be used by administrative systems, managers of organizational and private sector.

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**Keywords:** Communicational Skills, Organizational Commitment, Middle Schools

## Introduction

Communication has been one of the oldest and greatest achievements of human. In the past for primitive people it has functions for surviving and taking help from others, apart from that it was important for social life. But in the present modern life communication is very vital and human always looks for the new ways and devices to communicate more efficiently (Bolton, 2009:12).

So it is clear that better communication is the key factor for success. Successful people with satisfactory work and home atmosphere think this satisfaction and improvement is due to new communication techniques. Having good family relationship, long – term friendship, good business and other good aspects of life is only possible through this way. (Coel, 2011:7) With this new development in communication, distances have been reduced centuries changed to decades and the speed of publishing information increased, it also changed the world of management and organization. The thing that is very important for the managers of the organizations is to make the basis of the organization based on the right principals and applying the kind of management system with new knowledge and skills in different parts, one of the most important is communications skills. To improve the function and attitude of employees, managers should be involved in different processes specially in using the best of communication skills (Rahimi & Ghorbani, 2001:54&56).

From the other hand, managers are not invested in all the attitudes of their employees, they are mostly interested in work attitudes, that one of the most important is organizational commitment. Organizational commitment in workplaces is one of the most challenging concepts in management, organizational behavior and management of human resources. (Cohen, 2007:339) Since efficient human force is the main criteria for a good organization, specialized, loyal employees with strong motivation and awareness to the values are very essential to an organization. Committed human force knows him as part of the organization and understands the goals of it as his own goals and attempts to fulfill them. This person is dependent on the organization and indentifies himself with it and helps the organization to meet its goals. Through this he helps himself to improve as well (kermani, 2010:377).

Thus organizational commitment can have positive consequences like reducing costs in control systems, better function, less absent in work. With knowing this managers should try to apply the right procedures. One

that affects employees' behavior is using the communicational skills. In this study were going to analyze the relationship of it with organizational commitment.

**The literature of the research**

Education system is one of the greatest systems in each society that makes the destiny of the society in long term. So if this system has been planned well for its aims and resources it will develop the society in long term (Jahromi et al., 2009:9). In this respect, teachers are the basic structure of the society. This system should be perfect from different aspect and directly influence teachers' functions and affects a lot of other things. If the education condition is not perfect, teachers won't have any motivation and interest. Then it would not be a big loss to the body of education system. On contrast in a good condition of education that teacher are interested in their job with great motivation, they will always remain loyal to the system and it will increase educational standards (Zolghadrnasa, 2005:1). The educational system in our country needs hard working, committed teachers that feel responsible in their job and help this system to be more productive (Hoshyar, 2009:289).

Organizational commitment is a professional attitude that is very important due to various reasons (Walumbwa, 2008:254). Porter and his colleagues defined organizational commitment as a relative factor to identify a parson with the organization. In this definition, organizational commitment includes 3 elements: 1) to believe in the values of the organization and accept them. 2) To be interested in working hard toward catching the goals of the organization. 3) To be interested a lot in being a member of the organization (Chughtai & Zafar, 2006:39-40).

Simply we can say that organizational commitment is the tendency of employees for working hard in a system based on cooperation (Semerceoz et al., 2010:77). The studies of the last two decades have focused on different dimensions in work place. They explained multi dimensions of organizational commitment in scientific background. In this study we are going to talk about organizational commitment according to Allen & Meyer. Based on Allen & Meyer ideas, organizational commitment is a mental state which shows need and interest continue working in an organization and it has three dimensions: a)Emotional Commitment: The most general way of dealing with organizational commitment is the emotional way towards the organization. In this respect, the person who is very commitment identifies himself / herself with the organization, participates in it and enjoys from being a member of it. b) Permanent Commitment: This is based on costs due to leaving the organization. In this respect the more employees invest in the organization, the less they leave it. On the other hand, by spending time, life and working hard most people cannot leave their job easily and according to their need, continue working. c) Behavioral Commitment: In this dimension people know working in the organization as their duty and feel responsible and try to do them in the best way (Allen & Meyer, 1990:3&4). According to the studies, there is significant relate between the quality of work life and organizational commitment (Hosseini at el., 2009:172), organizational atmosphere with organizational commitment (Shayan Jahromi at el.2009:120) and also between the style of managers and the organizational commitment of employees (Rezaie & Saatchi, 2009:110).

Saatchi and his colleagues in 2008 (reported by David Sirota and his colleagues) mentioned that in today' s world art and management are one of the most difficult and important tasks and are known as one of the main criterion of the civilization that is important for social, cultural and economical developments in societies. From different managements, the management of educational systems is very important and has a strategic role, because all aims and elements of this organization are human beings. One of the main behaviors of managers in this organization is caring about motivation, satisfaction and organizational commitment of employees that in recent years have been as an important and challenging subject for managers. On the other hand, since organizational commitment influences the behavior of people, it shows their dependence on the organization and no organization can be successful without the working of the members. Employees that are committed have more principle and stay longer in the
organization and this is the duty of managers to keep themselves and employees committed and responsible (Yaghoubi Poor at el.,2009:27).

Coeling (2000) and Ogbimi (2006) in their studies found out that with suitable communicational skills in organization, employees can have better interrelation with each other (zeighami & Haghighi, 2009:126). Also Robbinz declared that there is a positive and significant relate between effective communication with employees ' productivity. Communicational skills are kind of skills that though them people can participate in interactions and interchange thoughts and feelings. These skills include different dimensions related to understanding verbal and nonverbal messages skill, emotion regulation skill, listening skill, being aware of communication process skill and assertiveness skill which are the basis of communicational skills (Coeling,2000:65) because mastering these skills has a great effect on promoting the employees ' commitment and success of the

organization (Ghorbani,1999:25) studies shown that between managers ' communicational skills and motivation of trainees (Rahimi & Ghorbani,2001:62), between managers ' communicational skills and employees satisfaction (Amiri at el.,2008:10), between communicational skills and educational functions (Amini at el, 2010:100), between communicational skills and the amount of co-operation (Zeighami & haghighi,2009:123) and between managers ' communicational skills and organizational health(Ahanchian & Manidari,2004,46), there is a positive and significant relate.

Thus we can claim that at this time the only advantage of schools and organizations in being competitive is not just using the new invention but is in increasing the confidence of employees and their commitment to the goals of organization that in this respect effective communication and the right use of communicational skills is its key. School managers can make positive interaction in organization by communicational skills and increase teachers satisfaction, loyalty and commitment to their job.

Herbert Simon also believed that if managers can't use communicational skills in good ways to make motivation and commitment, the organization can't continue its life and he /she can't have a good effect on the organization and group (Doaee, 1994: 36). According to what said, this made researchers to investigating the relationship between the managers ' communicational skills and the teachers ' organizational commitment in the middle schools of Sirjan.

**Objective**

**Main Objective**

To determine the relationship between managers' communicational skills and teachers ' organizational commitment in the middle schools of Sirjan.

**Specific Objective**

1) To describe present condition of the managers' communicational skills in the middle schools of Sirjan.

2) To describe present condition of the teachers' organizational commitment in the middle schools of Sirjan

3) To determine relationship between managers 'communicational skills and teachers' organizational commitment in the middle schools of Sirjan

4) To determine the relationship between the teachers' individual traits and their organizational commitment in the middle schools of Sirjan

**Hypotheses**

**Main Hypothesis**

There is a positive and significant relation between managers 'communicational skills and teachers' organizational commitment in the middle schools of Sirjan.

**Specific Hypothesis**

1) There is relationships between managers ' understanding verbal, nonverbal messages skill and teachers' organizational commitment in the middle schools of Sirjan.

2) There is relationship between managers' emotion regulation skill and teachers 'organizational commitment in the middle school of Sirjan.

3) There is relationship between managers' listeningskill and teachers' organizational commitment in the middle schools of Sirjan,

4) There is relationship between managers' assertiveness skill and teachers' organizational commitment in the middle schools of Sirjan.

5) There is relationship between managers' being aware of communication processskill and teachers' organizational commitment in the middle schools of Sirjan.

6) There is relationship between teachers' individual traits (gender, age, experience, education and marital status) and teachers' organizational commitment in the middle schools of Sirjan.

**Research method**

The statistical society of this study includes all the managers and teachers in the middle schools of Sirjan in 2011-12. According to the following tables, the number of middle schools of Sirjan were 77, the number of managers were 77 (39 male and 38 female) and the number of teachers were 651 (376 male and 275 female).

**Table 1**: The state of Sirjan's middle schools managers in 2011-12

| Type of school / Gender | Secondary & pre-university schools | | Vocational schools | | Technical schools | | Total |
|---|---|---|---|---|---|---|---|
| | state | private | state | private | state | private | |
| For boys | 12 | 7 | 3 | 9 | 2 | 2 | 35 |
| For girls | 16 | 11 | 3 | 4 | 1 | --- | 35 |
| Total | 28 | 18 | 6 | 13 | 3 | 2 | 70 |

**Table 2**: The state of Sirjan's middle schools teachers in 2011-12

| Type of school / Gender | Secondary & pre-university schools | | Vocational schools | | Technical schools | | Total |
|---|---|---|---|---|---|---|---|
| | Official employment | Way of teaching | Official employment | Way of teaching | Official employment | Way of teaching | |
| Male teachers | 280 | --- | 83 | 3 | 10 | --- | 376 |
| Female teachers | 220 | --- | 52 | 2 | 11 | --- | 275 |
| Total | 500 | --- | 135 | 5 | 11 | --- | 651 |

For calculating amount of the sample, Cochran formula was used. Based on this formula, the sample amount for managers was 54 and for teachers were 169.

To choose the portions, firstly the amount of each part specified according to tables 3 & 4, then randomly the samples were chosen.

**Table 3**: managers sample amount for each school based on the specified samples

| Type of school / Gender | Secondary & pre-university schools | | Vocational schools | | Technical schools | | percent | Total |
|---|---|---|---|---|---|---|---|---|
| | state | private | state | private | state | private | | |
| For boys | 10 | 6 | 2 | 7 | 1 | 1 | 50% | 27 |
| For girls | 13 | 8 | 2 | 3 | 1 | --- | 50% | 27 |
| Total | 23 | 14 | 4 | 10 | 2 | 1 | 100% | 54 |

**Table 4**: teachers sample amount for each school based on the specified samples

| Type of school / Gender | Secondary & pre-university schools | | Vocational schools | | Technical schools | | percent | Total |
|---|---|---|---|---|---|---|---|---|
| | Official employment | Way teaching | Official employment | Way teaching | Official employment | Way teaching | | |
| Male teachers | 73 | --- | 21 | 1 | 3 | --- | 58% | 98 |
| Female teachers | 56 | --- | 13 | 1 | 1 | --- | 42% | 71 |
| Total | 129 | --- | 34 | 2 | 4 | --- | 100% | 169 |

**Research Instruments**

For this study two questionnaires were used:

1) Questionnaire for managers' communicational skills: The Queendom (2011) standard questionnaire was used. At first demographic questions regarding gender, age, experience, education and marital status provided. This questionnaire includes 25 questions (5-choice questions) that were based on Coeling' measurements. To measure the desired elements Likert' five – degree criteria was used. The options for each question include: never, rarely, sometimes, most of the times and always that shown 1, 2, 3, 4 and 5 (in respect).

b) The questionnaire of organizational commitment: It was a type of planned questionnaire that at the first of it there were demographic questions about gender, age, experience, education and marital status. The questionnaire includes 18 questions each with 5 choices. Although we can find different definitions of commitment in the literature of this topic, each of them reflects one of the three general topics of emotional dependence, costs and duty (Bagheri &Tavallaee, 2010:76). Also Allen & Meyer in 1990 considered three dimensions for organizational commitment. So their ideas have been used in this study. To analyze the desired elements, research used Likert' five degree criteria. The options for each question include: I'm totally disagree, I'm disagree, I have no ideas, I'm agree and I'm totally agree, that in turn were rated 1, 2, 3, 4 and 5.

**Reliability of Instrument**

In this study, we used symbolic or pictorial method to measure the stability of tools. So the designed questionnaire with preface and some explanations regarding variables and hypotheses were given to five professors of Azad University in management field (M.A.) and they were asked to express their ideas about the questionnaire. The result revealed that the assessment tools have got a great stability. In this

respect, a primary survey has been carried out on 30 people of the statistical society and by a software called SPSS, the stability of the questionnaire of managers' communicational skills calculated 0.785 and teachers ' organizational commitment calculated 0.891. The amount of this statistic shows that questionnaires have great stability.

**Result**

The results showed that 50 percent of the statistical sample for managers was female and 50 percent were male and 57.4 percent of the statistical samples for teachers were female and 42.6 percent were male. 88.9 percent of managers and 82.6 percent of teachers were married. Age range 41-50 were the most sample of managers (%57.4) and age range 31-40 were the most sample of teachers (%36.5). 92.6 percent of managers' statistical society and 82.6 percent of teachers' statistical society were officially employed. Most academic degree were B.A. with 81.5 percent for managers and 86.1 percent for teachers and job experience more than 20 years was for 55.6 percent of managers and 27.8 percent of teachers. To analyze the amount of managers' communicational skills in the middle schools of Sirjan, the answers from questionnaires were gathered to get the right score for managers. According to the average number, 3.4519, managers' communicational skills was ascendant.

Also to analyze the amount of teachers ' organizational commitment in the middle schools of Sirjan, the right information from 18 questions shown that, the average was 3.8981, that means was teachers' organizational commitment was ascendant.

To get the third aim of this study planned one main hypothesis and six secondary hypotheses. To test the hypotheses, SPSS software has been used. To evaluate the correlation between variables Pearson and Etta'correlation testhavebeen used. The result of the study shows that: Main hypotheses: Significant amount of Pearson correlation test for analyzing the relationship between two variables, the managers ' communicational skills and the teachers ' organizational commitment was 0.000 and this was less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.504, that these amounts shown a positive and significant relationship between two variables. Some other research like Ghorbani (1999), Coeling (2000) , Rahimi & Ghorbani ( 2001), Hargie & Dicson (2004), Amiri at el. (2008), Hosseini at el. (2009) and Zeighami at el. (2009) also support this hypotheses.

First specific hypotheses: The amount of Pearson correlation test for analyzing the relationship between the managers ' understanding verbal and nonverbal messages skill and the teachers' organizational commitment was 0.020 and this was less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.315, that these amounts shown a positive and significant relationship between two variables. Some other research like Robbinz (1999), Coeling (2000), Hargie & Dicson (2004) and Zeighami at el. (2009) also supported this hypothesis.

Second specific hypotheses: The amount of Pearson correlation test for analyzing the relationship between the managers ' emotion regulation skill and the teachers' fforganizational commitment was 0.022 and this is less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.310, that these amounts shown a positive and significant relationship between two variables. Some other research like Coeling (2000) and Zeighami at el. (2009) also supported this hypothesis.

The third specific hypotheses: The amount of Pearson correlation test for analyzing the relationship between the managers ' listening skill and the teachers ' organizational commitment was 0.032 and this was less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.293, that these amounts shown a positive and significant relationship between two variables. Some other research like Porter at el. (1995), Coeling (2000), Hargie & Dicson (2004) and Zeighami at el. (2009) also supported this hypothesis.

The fourth specific hypotheses: The amount of Pearson correlation test for analyzing the relationship between the managers ' assertiveness skill and the teachers ' organizational commitment was 0.001 and this was less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.425, that these amounts shown a positive and significant relationship between two variables.

The fifth specific hypotheses: The amount of Pearson correlation test for analyzing the relationship between the managers ' being aware of communication process skill and the teachers' organizational commitment was 0.009 and this was less than 0.05 which was the lowest significant level. Also Pearson coefficient was 0.351 that these amounts shown a positive and significant relationship between two variables. The summery of the above description have been written in table 5:

**Table 5**: The summery of the relationship between all the dimension of manager' communicational skills and the teachers ' organizational commitment in the middle schools of Sirjan

| Managers' communicational skills | | Teachers'organizational commitment |
|---|---|---|
| understanding verbal an nonverbal messages | Pearson correlative coefficient | 0.315 |
| emotion regulation | Pearson correlative coefficient | 0.310 |
| listening | Pearson correlative coefficient | 0.293 |
| assertiveness | Pearson correlative coefficient | 0.425 |
| being aware of communicatio process | Pearson correlative coefficient | 0.351 |

According to table 5, the dimension of assertiveness with 0.425 had the most influence and the dimension of listening with 0.293 had the least influence on teachers' organizational commitment.

The sixth hypotheses: To determine the fourth secondary goal, the relationship between the teachers' individual traits and their organizational commitment has been analyzed through Pearson and Etta test; the results have shown in table 6.

**Table 6**: the relationship between the teachers' individual traits and their organizational commitment

| Individual traits | | Teachers organizationa commitment | Result |
|---|---|---|---|
| Gender | Etta correlative coefficient | 36.698 | Refute the hypotheses |
| | significant level | 0.345 | |
| Age | Pearson correlative coefficient | 0.221 | Accept the hypotheses |
| | significant level | 0.023 | |
| Experience | Pearson correlative coefficient | 0.199 | Accept the hypotheses |
| | significant level | 0.047 | |
| Education | Etta correlative coefficient | 74.45 | Refute the hypotheses |
| | significant level | 0.276 | |
| Marital status | Etta correlative coefficient | 49.989 | Accept the hypotheses |
| | significant level | 0.038 | |
| employment | Etta correlative coefficient | 28.869 | Refute the hypotheses |
| | significant level | 0.717 | |

**Conclusion**

1) Based on the results of the survey, between the managers ' communicational skills and the teachers ' organizational commitment in the middle schools of Sirjan is a positive and significant relationship. It means the more managers' communicational skills will have the more teachers' organizational commitment. Thus, managers with great communicational skills will help to develop work condition, have better co-operation, organizational commitment and increase job satisfaction. So these hypotheses can be supported.

2) There is a positive and significant relationship between the managers ' understanding verbal and nonverbal messages skill and teachers' organizational commitment in the middle schools of Sirjan. In most of organizations like schools, among all the tasks that a manager does, speaking is of great importance. Also some nonverbal messages skills like gesture and closeness to others are very important. If managers use best of these skills, specially admiring, supporting and developing good reactions, they actually are working towards increasing organizational commitment.

3) There is a positive and significant relationship between the managers'emotion regulation skill and teachers' organizational commitment in the middle schools of Sirjan. In fact, managers should try increase the quality of work life and also organizational commitment by showing their feelings in the right time and controlling them as well.

4) There is a positive and significant relationship between the managers'listening skill and teachers' organizational commitment in the middle schools of Sirjan. In work life the art of well listening, increases the quality of our interactions with our colleagues and

with other organizational people. This helps managers to arise love, co-operations and sympathy among employees and make a batter relationship among them. It reduces tension and miss-understanding and helps managers have better control over them and increase their responsibility and commitment toward their job, then it helps the organization to get its goals. Thus, well listening can be an element for developing the quality of work life in the organization and increase teachers' organizational commitment.

5) There is a positive and significant relationship between managers'assertiveness skill and the teachers' organizational commitment in the middle schools of Sirjan. In fact, by being aware of how to influence social relations and how to understand others, managers can increase organizational commitment.

6) There is a positive and significant relationship between the managers ' being aware of communication process skill and the teachers ' organizational commitment in the middle schools of Sirjan. Stability for managers means being able to show ideas, feelings and define belief and urge on sensible attitudes. By this skill managers can improve the condition of work life and increase organizational commitment as well.

The basis of independence in each society is based on educational systems. Many scholars believe that among all the elements of these systems, teachers are very important in education process. Thus caring about their needs and fulfilling them by the managers can increase their job satisfaction and commitment toward the organization. Teachers have various abilities, skills and interests and also they have different values and attitudes. So it is clear this different effects their behavior. In this situation by relevant relations, managers can give their employees honor and dignity to increase their commitment. Lacking enough communicational skills in managers will decrease collaboration, operation of policies relations, job satisfaction, functions and will increase tensions. (Stein, 2002) found out that using communicational skills and improving the relation of doctors and nurses has a direct relation with job satisfaction and will increase the quality of care. (Zeighami at el. 2009:125) Since high interaction skill makes a feeling of harmony in managers'personality and increase their identity, these kinds of people are acceptable for others due to their great personality and character. For this reason, they also have complicated and flexible thoughts and with high inner-control, they understand others better, interpret massages and give good feedbacks to others. They increase organizational commitment and make employees to be creative, feel satisfied, dependent have better functions, be socially active, benevolent stay longer in the organization and don't leave it. These decrease their stress and make the organization successful and productive. These good consequences cause development and are beneficial to the society.

**Limitations**

1) Managers and teachers were not aware of the importance of the studies but it led to collaboration of some of them.

2) Dependence of finding of this survey on questionnaires, because they have some limitations (It may not show the ideas of the samples in the right way).

3) The data of the direct studies was not available.

4) There were some problems in using academic library and also in valid science centers.

5) Not enough studies about communicational skills.

**Recommendations**

1) It is recommended that the authorities of the educational system should teach social interactive skills to managers and pass out brochures and magazines to help them to make more stable and effective relations. So that great organizational consequences will be increased.

2) The role of communicational skills as a dependent variable and effective on job satisfaction and organizational commitment should be emphasized.

3) Redoing this study in other levels of education and other organizations can give a broader understanding of the issue. Since individual and situational factors (geographical aspects, study of climate and …) are effective on interactions between people, the study and analyzing the influence of these elements can prepare a good condition for people who are interested in this issue, to study more and research about it in future, so that we will have good educational systems with efficient managers and employees.

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# Analysis of Mechanisms for Water Management Improvement from the Viewpoint of Tehran Province Farmers

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**Abstract:** The purpose of this research is to identify the most important mechanisms for improving management of water resources in Tehran Province agricultural sector. This is an applied research in terms of its objective, a field research in terms of the degree of control it exerts on variables, and a descriptive (non-experimental) research in terms of its method of gathering information. The statistical population for this research was Tehran Province water farmers (45652 persons), and the statistical sample size was calculated as 243 from the Cochran Formula. Due to the uneven distribution of farmers in the 14 counties of Tehran Province, in the first step only 5 counties were selected: Shemiranat on the north, Varamin on the south, Firouzkouh on the east, Shahriar on the west, and Tehran in the center of the province. Then, in the second step, in proportion to each county's farmer population percentage in the whole statistical population, the selected sample sizes for each county were determined as fractions of the total sample size (243 persons). The randomly selected farmers in each county were consequently interviewed and the required information was obtained from them through questionnaires. The stability of the scale used for the present research was confirmed by a Cronbach's alpha value of greater than 0.70, and the validity of the questionnaires was ascertained through seeking the opinion of academic advisors. Ultimately, the obtained data was analyzed by using the SPSS software. Based on the results obtained from prioritizing the effective mechanisms influencing water management, the following three items were determined by farmers under study as the most effective mechanisms on management improvement: replacing traditional irrigation methods with modern, high efficiency methods, avoidance of digging wells unnecessarily, and attending educational-extensional classes organized to give instruction on water resources management. Factor analysis shows the following mechanisms to be effective on water management improvement: 1) extension-educational mechanisms, 2) preventive mechanisms, 3) managerial mechanisms, and 4) executive-operational mechanisms. These mechanisms explained collectively 56.49 percent of the total variance.

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**Key word**: Mechanism, Water Resources Management Improvement, Educational-Extension Activities, Tehran Province.

## Introduction

The growing trend of population increase as well as expansion of urban areas would necessitate supply of drinking water, healthcare, food security, environmental protection for the society, as well as water for agriculture and industry, which are all vital for human beings. However, competition among consumers of drinking, industrial, and agricultural water, as well as competition for watersheds on one hand, and occurrence of crises such as draughts as a result of climatic changes on the other, can lead to new challenges for countries (Kiani, 2010). Today, agriculture is facing crises at different levels: water shortage, water resources contamination, water transfer to other

consumption sectors, low water consumption efficiency, etc. Water management is needed to alleviate the severity of these problems (Jin and Youhg, 2001).

Geographically, Iran is situated in an arid area, so that, according to researchers, water shortage is its main agricultural bottle neck (Keshavarz et al., 2005). The reason is that annual precipitations accumulated as surface water in rivers and water ways are the only source of water this country has access to (Karpisheh, 2011). Statistics show that Iran has an annual rainfall of only one third of the mean global rainfall. As 70% of this evaporates, Iran is ranked as a country with low water reserves (Almasavandi, 2010). Investigation of the cultivated land in Iran shows that out of an area of about 37 million hectares of potential farmland, only 7.8 million hectares are water farmed due to water shortage (Ehsani, 2003). Some researchers believe the agricultural sector to be the greatest consumer of water in Iran, so that more than 95% of usable water is consumed by this sector. Therefore, due to the importance of agriculture in producing strategic products as well as food for the society, planning for optimum water management should be given priority in accordance to every region's potentials. In fact, in the new millennium, preserving water, i.e., more productivity in water consumption, is a key factor in maintaining life and food security in the society, and any activity initiated in this way could be astep forward in economic development, particularly in rural areas (Sharifi, 2008). That is why management of agricultural water should be considered as a systematic approach for controlling water consumption and meeting irrigation and drainage needs on farms (Forest, 2002). From another perspective, water management could be defined as organizing and controlling water in order to utilize it wisely for obtraining better performances (Mohammadi et al., 2009). Some believe that without optimum water management, the third millennium goals of elimination of poverty and hunger, as well as a stable global environment could not be realized (Surendra, 2007). Therefore, a broad comprehensive view with regard to improving water managemen is of great importance and could actually safeguard sustainable development (Dungumaro and Modulu, 2003). This issue can be further clarified if we consider water shortage and its consumption in agriculture in the context of population growth and concerns regarding food shortages (Howarth et al., 2005).

Tehran Province has, due to its climatic and geographic situation, been subject to water shortage and draught. That is why optimum management of water in the agricultural sector is a great challenge facing farmers and planners in this province. No doubt, efficient management that can utilize water resources sustainably would need mechanisms for saving water and increasing the area of cultivated land.

Now, the question is, "What are the most important mechanisms for improving management of water resources in the agricultural sector?" Water resources management improvement mechanisms are a series of timely actions which would alleviate management problems and prepare the ground for control and optimum use of water, i.e., increase the efficiency of water consumption. Obviously, much research is neede to identify these mechanisms.

The present research is aimed at identifying the most important mechanisms in the management of water resources in the agricultural sector, and making them available to farmers and agricultural planners. Different studies have been conducted on mechanisms for water management improvement. For brevity, these cases are listed in Table 1.

**Table 1**: Mechanisms for Water Management Improvement in Agricultre

| Researcher (Year) | Mechanisms |
|---|---|
| Fazampour (2001) | Raising social awareness, Coordination among organizations, Integration of agricultural land, Protection of water resources. |
| Alizadeh (2001) | Technical approaches: land leveling, suitable irrigation methods; Managerial approaches: correct irrigation planning, processing soil for water storage capability, better canal and irrigation equipment maintenance; Organizational approaches: development of non-governmental organizations for public participation; Farming approaches: selection of plant types that yield the most crop, cultivation of plants compatible with climatic condistions, selection of hardy plants, combined cultivation to use water most efficiently. |
| Saadat & Mahdavi(2001) | Artificial Feeding of Subterranean Waterbeds |
| Jin & Young(2001) | Use of efficient technologies in irrigation (drip and spray methods), recycling lost water, planting of crops that require less water |
| Preira et al.( 2002) | Acceptance and implementation of combined and integrated land-water resources, optimum usage through improving old irrigation systems, recycling waste water, adopting irrigation technologies for reducing water loss, raising awareness on water shortage and participation |
| Ehsani et al.( 2003) | Avoiding mid-day irrigation, using various covers for farmland, destroying weeds, frugal irrigation to increase productivity, mending soil to increase water productivity, recycling waste water, farmers' participation in management of irrigation systems, Paying attention to education, research and extention in increasing productivity. |
| Tayebi & Jahanbanifar(2004) | Using sewage from refining processes and placing it to enhance subterranean water beds, preventing unlawful operation of wells, Artificial Feeding of Subterranean Waterbeds. |
| Zehtabian(2005) | Heeding the region's extension and educational activities, change of irrigation system, reviving of traditional systems, integration and leveling of land, determination of plant water requirements, alteration of farming plants, covering of canals, reviving ghanats, bracing of surface water. |
| Nazemi(2005) | People's participation in planning and management of water, raising public awareness, protection of water resources. |
| Jahani(2005) | People's active participation in planning management of water, efficient utilization of waste water, recycling unconventional waters. |
| Davarpanah(2005) | Educating people to bring about change in water consumption, Considering the importance of public participation, implementation of water consumption projects, production of crops that tolerate saltwater, using saltwater for farming. |
| Rahimi(2005) | Regular inspection of canals, timely dredging, controlling weeds, repair and maintenance of canal linings/cover plates. |
| Farshi(2005) | Development of modern water transfer systems, implementation of scientific irrigation and modern methods, extension of irrigation/informing farmers, suitable farming models to increase water consumption efficiency, planting crops that tolerate dry conditions. |
| Osareh et al.( 2005) | Regular dredging of canals and destroying weeds, prevention of land division, participation of farmers and people in water distribution and maintenance of water network, round the clock irrigation, implementation of recommended farming models, Teaching modern irrigation techniques to gfarmers. |
| Heidari et al.(2006) | Management of farming, increasing farmers' efficiency and know-how. |
| Nikbakhtjahromi(2006) | Increasing water consumption efficiency through mending farming models, cultivation of high efficiency crops. |
| Nouri(2006) | Improved management and irrigation methods. |
| Amirkhani et al.(2010) | Increasing farmers' knowledge of optimum water management. |
| Shahidasht & Abassnejad(2011) | Prevention of surface water loss, protecting subterranean water beds. |
| Mortazavi et al.( 2011) | Raising farmers' awareness, controlling water consumption, sealing unauthorized wells, changing irrigation methods, raising irrigation efficiency, irrigation cooperative companies and integration of canals, transfer of water from well to farm through suitable means, preventing the of expansion of orchards. |

## Materials and Methods

This study is an applied research in terms of its objective, a field research in terms of the degree of control it exerts on variables, and a descriptive (non-experimental) research in terms of its method of gathering information. The statistical population for this research was Tehran Province water farmers (45652 persons), and the statistical sample size was calculated as 243 from the Cochran Formula. Tehran Province is situated to the north of central Iran. Due to the uneven distribution of farmers in the 14 counties of Tehran Province, in the first step only 5 counties were selected: Shemiranat on the north, Varamin on the south, Firouzkouh on the east, Shahriar on the west, and Tehran in the center of the province. Then, in the second step, in proportion to each county's farmer population percentage in the whole statistical population, the selected sample sizes for each county were determined as fractions of the total sample size (243 persons). The randomly selected farmers in each county were consequently interviewed and the required information was obtained from them through questionnaires. The stability of the scale used for the present research was confirmed by a Cronbach's alpha value of greater than 0.70, and the validity of the questionnaires was ascertained through seeking the opinion of academic advisors. Ultimately, the obtained data was analyzed by using the SPSS software.

## Conclusions

### Descriptive Statistical Results

The descriptive statistical results concerning personal particulars of the farmers showed the average age of the farmers to be 43 years old and the age group of the majority of farmers (35.8 %) to be between 50 and 60 years old. Their average working experience was 20 years with a 32% majority aged between 10 and 20 years old. A 31.7% majority had secondary school education. The mean dimension for farmers' households was 5.30 persons and a 49.8% majority consisted of households with 6 or more persons. The mean farming workforce was 3.77 with a 48.2 % majority having fewer than 3 working persons. The average annual income for a farmer was 7.805 million tomans (1 toman=10 rials. Rial is the official monetary unit of Iran), with a 32.5% majority earning between 9 and 12 million tomans a year. The mean total cultivated area per farmer was 2.555 hectares with a 46.9% majority being in possession of less than 2 hectares of farmland. The mean number of farmed land plots was 4.94 per farmer with a 41.6% majority having 6 or more plots for farming. The farmers were mostly small landowners (42.4%) or had acquired ownership of their own land and water rights (51.8%). The water for irrigation of their land was supplied through a combination of several sources (35%) and a 48.2 % majority transferred water via earth canals to their farmland. The 48.2% majority used traditional irrigation techniques. The majority of traditional farmers (53.4%) implemented the flood irrigation system, and the majority of farmers (69%) implementing pressurized irrigation techniques used the spray irrigation system. The degree of social participation demonstrated by most farmers (32.9%) with respect to better water management for agriculture was low: a 32% majority had never taken part in training courses related to water management.

### Prioritizing Effective Mechanisms for Water Management Improvement from the Respondents' Viewpoint

To prioritize effective mechanisms for water management improvement from the respondents' viewpoint, 35 mechanisms were introduced to them in the form of a table. The farmers were then asked to express their views about each mechanism in a Likert 5 Point Scale (from very low to very high). Then the mean and standard deviation of their responses were calculated from the scores assigned to each item, attributing a score to each answer from 1 (very low) to 5 (very high). Coefficient of variation was obtained by dividing the standard deviation to the mean value. The items could subsequently be ranked in terms of the coefficient of variation for each. The less the coefficient of variation of an item, the more important that item would be in the ranking. Table 2 shows the 3 most important items (mechanisms) from the farmers' point of view that could improve water management in their area as: changing traditional irrigation methods into modern techniques, avoiding irregular well digging, and attending educational-extension classes on optimum water management.

**Table 2**: Prioritizing Effective Mechanisms for Water Management Improvement from the Res pondents' Viewpoint

| Items | Mean Value | Standard Deviation | Coefficient of Variation | Rank |
|---|---|---|---|---|
| Changing traditional irrigation methods into modern techniques | 4.687 | 0.543 | 0.116 | 1 |
| Avoiding irregular well digging | 4.669 | 0.574 | 0.123 | 2 |
| Attending educational-extension classes on optimum water management. | 4.578 | 0.585 | 0.128 | 3 |

3. Inferential Statistics

In this study, the purpose was to perform factor analysis to summarize the mechanisms that could be used for better management of Tehran Province water resources. So, 35 mechanisms were introduced to farmers in the form of a table. They were then asked to express their views about each mechanism in the form of a Likert 5 Point Scale. The suitability of the data for factor analysis was established through KMO statistics and Bartlett's Test. The obtained KMO value was 0.856 and the significance level of Bartlett's Test was less than 0.01. Both these values indicated that the extracted data were suitable for factor analysis. An important point in factor analysis is the number of extractable factors. In Table 3, these factors are presented along with the corresponding specific value, variance percentage, and accumulated variance percentage values for the effective mechanisms of management improvement.

Table 3: Extracted Factors with their Specific Value, Variance Percentage, and Accumulated Variance Percentage Values

| Item | Factors | Specific Value | Variance Percentage | Accumulated Variance Percentage Values |
|---|---|---|---|---|
| 1 | Educational-Extension Activities | 4.129 | 18.78 | 18.78 |
| 2 | Preventive Measures | 3.765 | 15.56 | 34.34 |
| 3 | Managerial Measures | 3.345 | 12.60 | 46.94 |
| 4 | Executive Measures | 2.558 | 9.55 | 56.49 |

As shown in Table 3, there are four improvement mechanisms (factors) which explain 56.49 % of the total variance. The Educational-Extension mechanisms, as the most important factor with a specific value of 4.129, account for 18.78% of the total variance. The other three factors, namele, Preventive Measures, Managerial Measures, and Executive Measures explicated 15.56, 12.60, and 9.55 percent of the total variance respectively. Table 4 represents each factor with its associated variables and their factor loading.

**Table 4:**

| Mechanism | Item | Factor Loading |
|---|---|---|
| Educational-Extension Mechnisms | Attending Educational-Extension Classes on Agricultural Water Management | 0.846 |
| | Applting New Irrigation Methods with Higher Efficiency Recommended by Experts | 0.790 |
| | Heeding the Educational-Extension Recommendations by Experts on Optimum Utilization and Management of Wells | 0.651 |
| | Cooperation with Other Farmers in Utilizing Water and Maintaining Canals | 0.612 |
| | Using the Experiences by other Farmers who already Use Modern Irrigation Systems | 0.578 |
| | Applying the Cultivation Models Recommended by Experts | 0.509 |
| Preventive Mechanisms | Using Irrigation Systems in accordance with Climatic and Topographic Conditions of the Area | 0.712 |
| | Avoiding Unnecessary Digging of Wells | 0.703 |
| | Making the number of Wells Proportional to each Farmer's Farming Area | 0.634 |
| | Observing Distancing and water right for each Well | 0.621 |
| | Avoidding to use Well Water that is too Salty/ Using Permits for Displacement and Digging of New Wells | 0.587 |
| | Observing Proportion between the amount of Extracted Water and the Farming Area | 0.553 |
| | Suitable Canal Design for Carrying the Specified Water Volume | 0.539 |
| | Avoiding Day-Time Irrigation to Prevent Direct Evaporation | 0.518 |
| | Avoiding Day-Time Operation of the Winch Motor when Evaporation is at its Highest and Waterlevel at its Lowest | 0.506 |
| Managerial Mechanisms | Replacing old Irrigation Methods with Modern high efficiency Methods | 0.722 |
| | Implementation of Frugal Irrigation Methods to Increase Productivity | 0.717 |
| | Implementation of Alternation if Farming to Preserve Soil Moisture | 0.693 |
| | Combination of Salt and Fresh Water in Irrigation Irrigation | 0.622 |
| | Implementation of Agricultural sewage for Re-Irrigation | 0.567 |
| | Irrigation of Plants according to their Water Needs/ Studying Water Requirements for each Plant | 0.533 |
| | Controlling Growth of Weeds | 0.524 |
| | Using more than one person for Irrigating at night to Prevent Water Loss | 0.510 |
| Executive and Operational Mechanisms | Artificial Feeding of Subterranean Waters | 0.617 |
| | Regular Inspection of Canals | 0.601 |
| | Construction of Concrete Canals with Polyethylene Pipes to Reduce Water Penetration/ Improve Efficiency | 0.588 |
| | Dredging of Canals to Prevent Water Loss | 0.579 |
| | Using Motor Winches to Increase Efficiency of Pumping Subterranean Water | 0.563 |
| | Regular Repair/Maintenance of Canal Linings | 0.534 |
| | Land Integration and Leveling to Reduce Water Loss in Farms | 0.525 |
| | Eliminating the Bends along Traditional Canal Ways | 0.519 |
| | Covering of Waterways in places where Water Loss is evident | 0.513 |
| | Installing Flow meters on Wells to determine the amount of Allowable Water for each Farmer | 0.507 |
| | Conducting Soil Texture Tests to Determine the type of Soil and the amount of Water Required by it | 0.501 |

**Discussion**

Today, in many scientific, as well as policy-, and decision-making circles, management of water resources is a hot topic for discussion. This is due to the fact that in many parts of the world, water shortage and problems associated with low productivity water consumption are acute. Among the most important topics discussed are the machanisms that could be used to improve water resources management. In this study, an effort was made to investigate some of these mechanisms which can be categorized as follows: 1) Educational-Extension Mechanisms, which are activities promoted for improving farmers' knowledge, skills, and managerial insight into water consumption in an effort to improve water resources management by the relevant organizations in charge of agriculture, and can include the following items: farmers' attending educational-extension classes held by the agricultural mobilization organization om water management, employing new higher efficiency irrigation techniques recommended by experts and heeding these recommendations, learning from the experiences of other farmers who already use modern irrigation methods, etc. These mechanisms can assist farmers at the time of water shortage or other problems associated with bottle necks of optimum water management. Therefore, these mechanisms can, due to the support they receive from authorities and in particular the management of agricultural mobilization organization, play an important role in improving water resources management in agriculture. 2) Preventive Mechanisms which are the measures taken before the occurrence of accidents or natural disasters in order to prevent their occurrence or alleviate their negative consequences. The cost of such measures is usually far less than the inevitable costs one has to pay if those events actually happen. Some of these preventive mechanisms are as follows: Using Irrigation Systems in accordance with Climatic and Topographic Conditions of the Area, Avoiding Unnecessary Digging of Wells, Making the number of Wells Proportional to each Farmer's Farming Area, Making the number of Wells Proportional to each Farmer's Farming Area, Avoiding to use Well Water that is too Salty/ Using Permits for Displacement and Digging of New Wells, Suitable Canal Design for Carrying the Specified Water Volume, Avoiding Day-Time Irrigation to Prevent Direct Evaporation, Avoiding Day-Time Operation of the Winch Motor when Evaporation is at its Highest and Water level at its Lowest, etc, 3) Managerial Mechanisms which include a series of innovative measures on the farmers' part for better management of water at farm level, such as: Replacing old Irrigation Methods with Modern high efficiency Methods, Implementation of Frugal Irrigation Methods to Increase Productivity, Implementation of Alternation if Farming to Preserve Soil Moisture, Combination of Salt and Fresh Water in Irrigation, Implementation of Agricultural sewage for Re-Irrigation, Irrigation of Plants according to their Water Needs/ Studying Water Requirements for each Plant, Controlling Growth of Weeds, and Using more than one person for Irrigating at night to Prevent Water Loss. And Finally, 4) Executive and Operational Mechanisms which are measures taken at a practical level by farmers to better manage water resources, and include the following: Artificial Feeding of Subterranean Waters, Regular Inspection of Canals, Construction of Concrete Canals with Polyethylene Pipes to Reduce Water Penetration/ Improve Efficiency, Dredging of Canals to Prevent Water Loss, Using Motor Winches to Increase Efficiency of Pumping Subterranean Water, Regular Repair/Maintenance of Canal Linings, Land Integration and Leveling to Reduce Water Loss in Farms, Eliminating the Bends along Traditional Canal Ways, Covering of Waterways in places where Water Loss is evident, Installing Flow meters on Wells to determine the amount of Allowable Water for each Farmer, and Conducting Soil Texture Tests to Determine the type of Soil and the amount of Water Required by it.

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# Reviewing the dissociation forms of the political offences, the revolt and the fighting offence from the jurisprudence viewpoint

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**Abstract:** Islam, as a comprehensive religion, has inspected the offence designations such as the political offences, the revolt and the fighting. Political and revolt offences have been neglected in the penal code of Iran and have not been paid enough attention to them. In the lows of Iran, designations (titles) which are reckoned as a revolt from jurisprudence point of view are evidences for fighting. Nowadays, attentiveness about the distinction between the fighters and the revolters seems to be very essential. To administer justice, it is time to reinvestigate this subject, so that injustice disappears.

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**Keywords:**Dissociation,Revolt.Political Offences,fighting,Designations

## Introduction

### A) The Political offence from the viewpoint of the Islam

Political offence is the action in which a group of Muslims (who have gained powerful organizations and, because of some unfounded dubieties, disobeyed Muslims' guardian- *valye- amr*) do some actions intentionally, Whether these actions are done through corruption, fighting, spying for foreign governments or through armed war against Islamic government and also other actions. And political offenders are those who have such characteristics in the domain of this definition. So, if the action has not been committed as a group, but as a personal action, and if the action has been committed as a group without strong organization, that offence will not be considered as a political action. If the offenders are armed and create fear and horror in the society, they will be considered as the fighters. And if their action isn't based on mistake opinion and unfounded dubiety, rather is for gaining power and suppressing the Islamic rightful government, their action will be considered as a political offence. And if they are armed, according to conditions of fighting, they will be considered as a fighter. In any case if they aren't armed, the government will forgive them. The reason for stipulating the word «Muslim» in the definition is that; based on low, if the mentioned offenders are apostate or fighting unbeliever, they will be judged according to special decrees of apostates and unbelievers.

Muslim jurists in religious jurisprudence books have discussed this issue on detail. So in the case of political offence, believing in the Islam and school is one of the elements of political offence, thus we can't recognize apostasy as a political offence.

### B) The Revolt offence from religious jurisprudence viewpoint

The late *Seyyed Esmaeel sadr* says in the foot-article of his book, *al-tashrio-aljenayi p.144*:

(البغي في عرف الفقه الجعفري هو الخروج عن طاعه الامام كما في كتاب جواهر الكلام للفقيه الكبير الشيخ محمد حسن النجفي و كتاب المنتهي آيه الله العلامه حلي)

And then says:

(و الباغي هو من خرج علي امام عادل و قاتله و منع تسليم الحق اليه كماجاء في تاب الخلاف لشيخ الطائفه محمد بن الحسن الطوسي ره).

That is, in *the imami-ye shi'a*, jurisprudence terminology, the revolt offence (baqy) consists of disobeying the fair governor (Imam). As mentioned by *sahib javaher* and *ayat-ollah Allame Helli* in the book, *Montahi, p.183*: belligerent Muslim (baqi) is one who disobeys fair the governor (Imam), fights with him and abstains giving his rights. High-ranking Muslim jurist, *sheikh Ja'far kashef-olqeta*, says in his *kitab-e-jihad p.98*:

(ويدخل في البغي كل باغ علي الامام او نائبه الخاص او العالم ممتنع عن طاعته فيما امر به و نهي عنه فمن خالف في ترك زكوه او خمس اورد حقوق حاربوه.)

That is, fight with those who revolt against religious leader (Imam) (peace be upon him) or his private and common deputy and disobey him, and abandon his forbidding. And disagree with him by giving up charity *(zakat)* and *khoums* (almsgiving one- fifth of his wealth).

### C) The Fighting offence from the Muslim jurists point of view

1) Sheikh Baha'i (God bless him):

The Fighter is one who unsheathes his sword in the city, desert or sea, at night or during the day, for frightening Muslims. Whether be man or woman. Whether be weak or strong. Whether be from Muslims or not. *(jame-ol-abbasi,p418)*.

2) Sahib Javaher (God bless him):

«المحارب كل من جرد السلاح او حمله لاخافه الناس ولو واحد لواحد علي وجه يتحقق به صدق اراده الفساد في الارش... و لعل الموافق لعموم الكتاب و السنه و معقد الاجماع تحققه باخافه كل من يحرم عليه اخافته من الناس من غير فرق بين المسلم.

و غيره و في بلاد الاسلام و غيرها.... و محاربه الله و رسوله تصديق بالاخافه المزبوره لكل من حرم الله اخافته... في برّ او بحر ليلا او نهارا في مصر و غيره» (جواهر الكلام، ج 41، ص 564).

Then he propound the idea of *shahid sani* about the kind of armor which is used in this offence and says; «perhaps this opinion is due to the outward of the verse, otherwise the word "armor" (*selah*) doesn't include "stone" and "stick"». At the same time he doesn't agree with the *shahid sani*'s idea about the substance of the armor, and at last he found some reason in the idea of *shahid sani* about entitling the action of oppression and bullying as an evidence of fighting, even without using armor.

3) Imam khomeyni (God bless him):

«المحارب هو كل من جرّد سلاحه او جهّزه لاخافه الناس و اراده الافساد في الارض في برّ كان او في بحر في مصرا و غيره ليلا او نهارا. و لا يشترط كونه من اهل الريبه مع تحقق ماذكر.... و في ثبوته للمجرد سلاحه بالقصد المزبور مع كونه ضعيفا لا يتحقق من اخافته بل يتحقق في البعض الاحيان و الاشخاص، فالظاهر كونه داخلاً فيه (تحرير الوسيله، ج 2، ص 492).

**Second chapter: evidences and documentations about the political, revolt and fighting offences from the religious jurisprudence point of view:**

**A) Political offence in the criminal law of Islam**

Since political offence is formed against special kind of sovereignty of political system or against some fundamental liberty and rights of individuals in the society, naturally when we speak about the sovereignty, which has religious nature, especially in Islamic government or sovereignty, political offence found its own especial components in relation to elements and formatters of that political system. In other words, according to this idea, political offence consists of aversion with political system sovereignty, and this system has its own especial rules and conditions. Therefor political offence should be distinguished based on norms and criteria of Islamic laws. So in the legal norm 168, Islamic republic legislator has delegated the definition and demarcation of political offence to the general legislator, based on Islamic norms.

Lawyers and scientists from many Islamic countries, when defining political offence within canon law of Islam, have pointed to revolt offence (*baghy*) and took it as the most obvious example of political offence or sometimes synonymous to it. Also some authors assorted it as an evidence of offences against country's internal security.

From jurisprudence point of view, the revolt offence *(baghi*) is discussed in the holy-war book (*ketab-e-jahad*), and primarily there is some dissension about the title of mentioned offence, that is, whether the offence is a case in point which deserves amercement? *Sunnah* tradition scholars have distinguished revolt (*baghy)* as an explicit offense which deserve amercement and have mentioned related subjects to it in the amercement book (ketabe-e-hodud)[1]. (oode,1,p.79), whereas the *Imaiye jurists* didn't consider amercement applicability for it.(Imam-khomeyni,2000:455- shahid sani,9:11) and while mentioning it in the holy-war book (*ketabe-e-jihad*), they consider confronting with revolter (Belligerent Muslim) a kind of holy war (najafi,21:324); but both of the religions agree that fighter's punishment is to battling them, that is fighting and conflicting with them.

Whereas only one kind of political offence,ie revolt *(baghy*), has been indicated plainly in Islam's retributive jurisprudence, and realization of this offence is also concomitant with fighting, some people misconceived that political offence takes place only in the wartime, fighting and revolution, but this issue is only one characteristic of the revolt, and it is likely that other political offences take place in the peace time.

In the positive laws of Islamic republic of Iran, the revolt offence isn't included in the offences which deserve amercement, and in some of the Islamic penal statute Articles such as: the Articles 186,187 and 188, the legislator has proclaimed that, some actual examples of revolt and its preliminaries are included in fighting titles.

In defining political offence, the writer represents the ideas and definitions of the jurists about the concept of the revolt and inspects its other aspects such as: evidences, documentaries, elements and the conditions of occurring revolt, and also, rules related to belligerent Muslims. And lastly the writer inspects

[1] - A law book in which the amercement of the fighters is distinguished.

revolt and political offences and their relationship comparatively.

**B) Evidences and documentaries about the revolt offence:**

We alleged the holy Koran (*Quran-e- karim*), tradition, general agreement (consensus) and the reason for the revolt offence:

**The holy Koran:** the jurists have invoked many verses about revolt offence, the most important are as follow:

«و إنْ طائِفتانِ مِنَ المُؤمِنينَ اقْتَتَلُوا فَأَصْلِحُوا بَيْنَهُما فَإِنْ بَغَتْ إِحْداهُما عَلَي الأُخري فَقاتِلُوا الَّتي تَبغي حَتّي تَفيءَ إلي امرِ اللهِ فَإن فآءَتْ فَأَصْلِحُوا بَيْنَهُما بِالْعَدْلِ و أَقْسِطُوا إن اللهَ يُحِبُّ المُقْسِطينَ» (حجرات، آيه 9).

That is; when two groups of Muslims fight and conflict with each other, reconcile them. And if one group transgresses upon the other group, fight the oppressor tribe till they obey God's command. Whenever they obeyed (and the way paved for peace), reconcile them according to the justice and do justice, since God loves righteous people. (Surah: Hojarat, verse: 9). This verse is the most important documentary for the revolt offence, which jurists and exegetists have had many discussions about it. the statues of this verse is as follow: there was a quarrel between *oos* and *khazraj* tribes, some group of these tribes conflicted and beat each other by stick and shoe: two men from *Ansar* had grudge against each other and one said to the other: I would got my right by force, since my tribe is populace. The other man answered: let's refer to the prophet for judgment. The first man rejected this proposal, so the quarrel continued harshly, and some men from two tribes attacked each other, so the mentioned verse descended from God and made clear the responsibility of Muslims in such situations (*shirazi Makarem, Tafsire Nemune, 1999,22: ps.166-165).*

In the above mentioned holy verse, the word "*baghat*",belligerent Muslim, which is derived from the word "*baghi*", means; cruelty and unjustly infringe upon the right, and the word "*fay'*i", which is the root of the verb "*taf'y*", means; "to return", and the word "*amr-ollah*" is God's commands. The meaning of this verse is as follow: "If one of the two tribes attacked the other unjustly, the infringer tribe should be battled in return, till they return and submit to God's commands" *(Tabatabaiy, riyaz-ol-masael fi bayane ahkam beldalayel, 1988, b: 18, p: 469)*. There are some opinion differences between jurists about the indication of above verse on revolt offence *(baghi)*.

The writer of the *kanz-ol-erfan* believes that; this verse doesn't indicate revolt offence, because revolt against Imam (peace be upon him) causes profanity, while conflict between Muslims only cause vice (commission of cardinal sin), so the holy Quran entitles two groups as being Muslim and brother-in-faith. So we can't generalize the laws of belligerent Muslims to such individuals. *Ravandi* also has denied the indication of this verse about revolt offence. (sivari, kenzol-erfan fi fegh-el-Quran,b:1, p:386).

Some other jurists, such as: *Allame Helli* (gavaed-ol-ahkam, 1419 A.H., b:9, p.391), *Sheikh Tusi* (Al-tazhib,bita, b:7, p:262) and *Gazi Ebne Baraj* (Mohzeb, 1406, b:1, p:322), consider this verse denoting to the revolt offence.

**Consensus of opinions:**

In many jurisprudence books, it has been recommended for referring consensus, in the case of necessity of fighting against belligerent Muslims. For example, *Sahib Javaher* says:

« و كيف كان فلا خلاف بين المسلمين فضلاً عن المؤمنين في أنّه يجب قتال من خرج علي إمامٍ عادلٍ ـ عليه السلام ـ بالسيف و نحوه... بل الإجماع بقسميه عليه...» (نجفي، پيشين، ج 21، ص 324)

And *Allame Helli* says in his book, Takerat-ol-fogaha:

: «قتال اهل البغي واجب بالنص و الاجماع» (1419، ج 9، ص 391).

In any case, there is no difference of opinions among Muslims; about the question of necessity in fighting against belligerent Muslims, and the discovery consensus [1] indicates this question. Of course, it is likely that this consensus is as a document, under these circumstances it won't have any authenticity and legal justification, and its details are settled and well-reasoned.

**The reason:**

As an evidence from the holy Quran, verse 9 in surah *Hajarat*, we deduce that revolt offence is a case point of cruelty, on the other hand, the reason can deduce the abomination of cruelty independently, without depending on the law and the order to suppressing cruel and fighting against cruelty. According to the following doctrine:

«كلما حكم به العقل حكم به الشرع»,

This law also is confirmed by the holy legislator. Furthermore, one of the duties of the government is creating security and arrangement in the society and this necessitate enough authority for the government, so eliminating authority barriers is exordium of the government and making security.

**c) Evidences and documents for fighting offence and moral turpitude:**

1- Discovery (by a religious scholar) as the result solely of personal scholarship of the existence of previously unknown consensus over an issue among religious scholars.

fighting offence and moral turpitude, which in Islamic texts sometimes are discussed as "battling" (*harabe),* "highway rubbery" *(gat-ol-tarig)* or "grand larceny", are included as offences against public security and peace, and it also is included in the offences which are agreed by all of the Islamic religions.( *Musavi Bojnurdi, feghe tatbigy*, 2003, p.:219).

The noun "moharebe" (fighting) is infinitive of the verb "mofaele. Its third person singular is "haraba" which means "to plunder somebody", and "harba" means: "to battle", and its plural is "horub". As we read in the *lesan-ol-arab*:

«الحَرَب بالتحريك نهبُ مال الانسان و تركُه لا شيءَ لَه» (ابن منظور، 1412، ج 3 ،ص 99)

*Fazel megdad* says in Kanzol *Erfan:*

«اصل الحرب السلب و منهُ حربُ الرجل مالَهُ أي سَلَبَهُ فَهو محروبٌ و حَريبٌ» (سيوري، پيشين ، ج 2، 352).

*Mohaggeg Helli* says: the fighter (mohareb) is one who draws his weapon for frightening people. The following comment is from *Javaher-ol-kalam* about the above mentioned expression: “av hamala", (to carry), that is; the fighter also is one who carries arm with himself. Thus, fighting actuality is drawing weapon for frightening people or disposing security of the society.

Imam Khomeini says about the definition of the fighter: the fighter is one who draws and unsheathes his weapon or makes it in the state of shooting and cause corruption in the land. (*fesade felarz 2000*1379,b:2, p.:439).

Based on this opinion, for occurring fighting, in addition to using arms and the intention for frightening people, the intention for causing corruption is another condition. This opinion is based on the interpretation of a verse from surah *Maeede*, based on this verse the subject of the law has two parts: one is the fighting, another is the corruption. That is, the main subject is the "fighting in the form of the corruption". So if one of the conditions of fighting doesn't realize, the subject of the mentioned decree will not realize in the verse. Because both, fighting and corruption, are parts of cause; when two parts of the cause occur, the effect, i.e. the fourfold punishments mentioned in the verse, will be capable of coming to force. As a result, based on this idea, the subject of the fighting, corruption and its punishment is the subject of the cause and effect, in which, occurring part of the cause doesn't lead to applying the effect, rather, when the fighting leads to the corruption, the punishment will be performable, otherwise, if the fighting doesn’t cause the corruption, it will not be in the scope of the decree in the verse.

The words "battle" and "fighting" have many different meanings in Quran, one meaning is; war and battle, opposite of the peace. This meaning which has been cited in the surah *Maede*, verse 33, is the most important document about the fighting offence:

«إِنَّما جَزاءُ الَّذينَ يُحارِبُونَ اللهَ وَ رَسُولَهُ وَ يَسْعَوْنَ فِي الأَرْضِ فَساداً أَنْ يُقَتَّلُوا أَوْ يُصَلَّبُوا أَوْ تُقَطَّعَ أَيْديهِمْ وَ أَرْجُلُهُمْ مِنْ خِلافٍ أَوْ يُنفَوْا مِنْ الأَرْضِ ذلِكَ لَهُمْ خِزْيٌ فِي الدُّنيا وَ لَهُمْ فِي الآخِرَةِ عَذابٌ عَظيمٌ».

That is, the retribution for those who fight with God and his prophet, and those who excite a sedition on the earth, is killing or hanging them or cutting their hand and foot conversely, or to exile them. This retribution is their notoriety in the world, there is also a great torment for them in the afterlife.

The status of this verse is as follow: A group of the nonbelievers were admitted to the presence of the prophet and converted into Islam, but the weather of Madine did not agreed with them. They got pale and ill. The prophet ordered them to go out of the city, which has nice weather and the donated camels graze there, so that they could use the nice weather and nourish from camels milk. They do so and got better soon, but instead of giving thanks, they cut off herder's hands and foot and made blind them, then killed all of them and despoiled the camels and heathenized again. The prophet commanded to capture them and do the same act with them as punishment, blinded them, cut off their hands and foots and killed them, till be a byword for others. (*Mokarem shirazi*, , 1999, p.:358, *Tabatabayi, Tafsirol mizan*, p.:231).

**Second part: the comparative reviewing of the trial offences; political, revolt and fighting offences:**

**Frist chapter: the comparative review of revolt and political offences:**

Undoubtedly, we should not expect to find mentioning about political offence or something like that in the Islamic penal jurisprudence, which its antiquity is about one thousand and four hundred years. Since, the Political offence is a new terminology which doesn't have much historical record. But by reviewing the history of the political offence, we notice that, the "high misdemeanor" or "high treason" terminologies have been used in the same meaning in the criminal law; but primarily, in Islamic penal jurisprudence, criminal titles are specified and political offence doesn't match with them in concept. There are many cases and examples of minor criminals in this legal system, which nowadays we can account them as examples of the political offences.

We mentioned above that a group of Islamic scientists, who have had valuable studies and researches on Islamic penal jurisprudence, have

proposed this theory that; there is a title and concept in Islamic penal jurisprudence which is synonymous of political offence and reflects its concept exactly. These scientists believe that revolt offence is the very same the political offence and the belligerent Muslim is the very same the political offender (*oode, Al-tashri-ol-jenai-ol-salami, mogarna belganunnel vazii, book:1, p.:100).*

There are many similarities between the terms and conditions of assessment and principles on the realization of the revolt offence in particular and the political offence in common. We can find similar and sometimes equal effects and consequences in both phenomenons, on the other hand, these similarities cannot synonym them in concept but can propound the revolt offence as one of the evidences of the political offence among its other evidences. Some similar aspects between the political offence and the revolt offence are as follow:

1) In the political offences extradition of criminals is rejected primarily and no criminal is returned because of political reasons. And belligerents, who run away from battlefield, are not sued or captured.
2) In comparison with other criminals, under an international custom, political offenders get much leniency. Such that the belligerents, in case they are not against the government, after being arrested they are forgiven without any punishment or annoyance.

There are also many differences between political offence and revolt offence; these differences are the reason for multiplicity of the concepts and distinction. Some of these differences are as follow:

1) In the revolt offence, the belligerent, as a member of coherent and organized group, should revolt. Even some jurists have this opinion that: these organizations should have enough glory and power so that can create danger for the government. So, if somebody revolts against the government solely or confront with the system as a member of a weak group, his act is not considered as a revolt offence. While in political offence, the number of offenders or the quality of their strength in party political offences is not determiner.
2) One condition for fighting back belligerents and quelling them is that they should have armed rebellion and physical fighting. Thus, merely expressing opinions and creating organization for enouncing ideas against government, till these actions don't lead to armed rebellion, doesn't considered as the revolt offence, and the Islamic government doesn't take action against them. While in the political offence, necessarily it is not the armed revolt and the confliction which are considered offence and are blamable, but many political offences are not with confliction and war, and political offences can be punished based on law.

**Second chapter: comparative review of fighting and political offence:**

After inspecting the political offence and the corruption, and citing jurists' ideas about definition and nature of it, and recognizing the concept of fighter, using verses and traditions, now we proceed to the most important part of this chapter; that is, the comparison of the fighting and the political offence. In this article, we will proceed to this point: whether fighting offence, in comparison with new divisions of the offences, according to the psychotic element or offender's motive or based on the subjects and effects of committing offence and based on the criteria of this division, is included within the common offences or it belongs to the political offence group and is considered as an evidence of the political offence?

Referring to the last part, about the conditions of recognizing political offence, we concluded that political offences take place for defending from the freedom, the human dignity and conflicting with cruel and dictatorial governments or dependent to alien. So political offenders are prized and supported by the public and the society. So we conclude that two basic conditions are necessary for occurring political offence:

The sense of justice and benevolence motivation in the offender. 2- The Unlawfulness of the government, even though because of dubiety in the offender's mind.

So offenders of the political offence are those who take action for emendation of the society, but, from government administrator's point of view, these actions are considered as offences. Consequently, we can say; such persons, who have positive characteristics, never do actions such as murdering, coarse actions, depredation of the government or public properties, in challenging with the government, for emending society conditions. And primarily they are bound to the security of the country, although they take different methods for weakening government, the main purpose of these offenders is protecting the liberty of the country, securing the legal liberties and expanding the social equanimity. Even though offender takes wrong way in detecting evidence (in legal systems), he\she is doing the right action in his own opinion.

So, the way that political offenders use, is resorting to the freedom of the speech principle, freedom of the societies and the other freedoms, which with a view to materiality, it cause lesion to the government political authenticity, and with a view to personal, offender has a political motivation. But by

no means, fighting is an evidence of the political offence, because its doer's intention is creating intimidation and divesting security and freedom from people. In addition, the main purpose of the fighter is not challenging with the government or the political sovereignty, rather he draws his weapon for depredating and violating to the population.

One reason of taking for equal these offences is that both of them will cause disorder in public arrangement. Although the fighting takes place for frightening people, indirectly, it is considered an offence against the government, because the protection of the public security is government's duty, In fact it is an offence against the government indirectly.

The fact is that, benevolence and honorable motivation are grounds for occurring fighting and frightening population by using arm, though through frightening one person. As mentioned by *Javaher*: "even, if the fighter frightens only one person, in the event that, corruption purpose is obtainable, offending has been occurred"(*Najafi*, book: 41, 564). So the fighter doesn't have honorable and amendatory motivation, so there is no evidence, by which, dubiety of his offence, as a political action, can be proved.

But the fact is that benevolence and honorable motivation in the political offence, totally conflict with the intention of frightening, opposing and attacking to the population, which are elements of the fighting offence (*zeinali* p:78).

In addition, in political offence, the aim is governments and political systems, but in fighting the aim is divesting the public peace. So, just these two basic differences are reasons for differentiating these offences. Consequently, the fighting offence is a public offence and it is not possible to be an evidence of the political offence. (And Allah is erudite).

**Third chapter: comparative review of fighter and belligerent's offence**:

The questions which mentioned above show that; the "fighter and the belligerent Muslim are different; both in the subject and the decree. Following is a few outlines about these distinctions:

1) Difference in definition: the fighter and the belligerent concepts have two different definitions; the first one is to draw arm for frightening population, the second is revolting against Imam (peace be upon him). The components involved in the definitions are different completely, as follow:
   a) Purpose: the purpose of the fighter is depredation, murdering, rioting or vicious ostentation. The fighter is either a burglar or one of the rascals and villains. In any case his aim is the people not the government. But the aim of the belligerent Muslim is overthrowing the government and rebellion against Imam not people *(Ayat-ollah Khoyi, Menhaj-ol-salehin,1,:357).*
   b) The Criminal device: for many jurists, the fighter draws his arm upon people, but belligerent doesn't use arm.
   c) The Quality of commission: sometimes the fighter is alone, sometimes more or with a group. But, the revolt offence is always committed by a group who has power and is numerous. Perhaps it is not possible to imagine a revolt offence can be committed by only one person.
   d) Doer of the offence: there is controversy about this matter; whether the fighter can be a Muslim or not? There is no explicit wording about this matter. Perhaps it can be said; though being a Muslim, while committing offence the fighter is apostate. But, according to the explicit wording of the Quran, the belligerent has been Muslim formerly, and has involved in apostasy now.
   e) The Radix of committing the offence: perhaps it can be said that: the belligerent's insurrection against Imam is based on a belief and a deviational theory, but the fighter doesn't have such characteristic, instead he\she is a wicked person, thief or rascal and villain, who frighten defenseless people (*Mohaggeg Helli, 1, p: 522).*
2) Difference in the decree:
   a) Assigning punishment: in surah *Maeede*, verse 33, penalty of a fighter is in four forms??????And Imam executes one or some of these punishments according to the proportionality of the offence or his own consultation. But penalty of the revolter is fighting with him and no other amercement has been cited.
   b) The conditions of executing punishment: as soon as the fighter begin his\her criminal act, he is prosecuted and punished. Even though his action doesn't lead to murdering or plundering population's property, while this is not true about belligerent. "Having different opinion from Imam or even citing that opinion doesn't lead to punishment, only when the belligerent begin his activities against Imam, he is prevented. In other words the commencer of the war is the belligerent not Imam."(*Sheikh Tusi, Mabsut,p: 260).*
   c) Imam shows the belligerent the right way and removes his doubt, if the belligerent Muslims accept his advices, the war won't start. But such an action and behavior is not done about the fighters.

d) Decrees issued after the war and punishment are different about these two groups. After fighting with the belligerent Muslims ( those groups who don't have leader or organization) and dispersing them, the war wounded and the reminded belligerents after war are pardoned, while this decree is not executed about the fighters, they are pursued and their wounded and fugitives are punished. But the wounded and runaway belligerents are not punished. Totally Imam's treatment about the belligerents is remission, while about the fighter is severity (Javaherolkalam, 21. 328).

e) The Repentance of the belligerent Muslims is accepted both before and after being arrested, and they are not punished, but the repentance of the fighters is only accepted before being arrested and they are punished after being arrested.

In short, these two offences are different in the quality. Fighting is a public offence, but the revolt offence is considered as a political offence. Consequently, the only source for recognizing the revolt offence is Amir almomenin- Ali's (peace be upon him) policy in treating with *KHavarej* (apostatrs), Saffein and Jamal people. It is worthy to deliberate about his treatment.

I have chosen some pages of the book "*Jazebe va dafeeye Ali*"(Ali's charisma and????) from the author *Motahari* (may God bless his soul):

Ali's (peace be upon him) democracy:

Ali (the chief of the faithful) behaved with *Khavarej* in the most extent of the democracy and the freedom. Ali is the caliph (successor) and they are the peasant. Ali was in a position to do every kind of diplomatic acts, but he neither imprisoned nor lashed them, and even he did not discontinue their allowance from treasory. He behaved with them as others. This is not a strange subject in the history of Ali's life. But this is a rare case. They had the freedom of speech, Ali and his followers treated and spoke with them with free opinion and they answered each other's argumentations.

Perhaps this degree of freedomness is unique in the world, and a government has democratic demeanor with its adversaries. They came to the mosque and caused jam in Ali's orations. Once, the chief of the faithful was orating, at that time a man came and asked a question from him, and Ali answered extemporaneously. One of the apostates said aloud among people: God kill him, how wise he is. The other audiences objected to him, but Ali (peace be upon him) stated: leave him, because he cursed only at me.

Apostates (*khavarej*) did not follow Ali in collective prayers, because they considered him as an unbeliever, they came the mosque but did not pray with him. Occasionally they annoyed him. Once Ali (peace be upon him) was saying his prayer and the people were following him, one of the apostates; called Ebn-el-ku', yelled and cited a verse of the holy Quran as an allusion to Ali (peace be upon him):

«ولقد اوحي اليك و الي الذين من قبلك لئن اشركت ليحبطن عملك و لتكونن من الخاسرين» (زمر، آيه 65)

This verse is addressing the prophet, « it is inspired to you and to the prophets before you, that, if you became dualist, your deeds would annihilate and you would be from prejudiciouses» . *Ebnel-kava's* aim in citing this verse was to speak allusively to Ali, and allude to him that " we are aware of your past, you are Muslim, the prophet has chosen you as his brother and you endangered yourself in the *Leilat-ol-Mabit* and slept in prophet's bed and endangered your life in front of swards, and your services to Islam is not deniable. But God has said to his prophet; if you became unbeliever, your deeds would be spoiled, and since you are unbeliever now, your deeds are spoiled.

What did ALI do in response? While the man was reading verse, Ali was silent so that the verse finished and then he started his prayer, again *Ebnelku* repeated the verse and ALI (peace be upon him) became silent again, because it is the command of Quran that says: «when somebody is reading Quran, listen to it and be silent».

And this is why, when the chief Mullah is reciting prayer, the followers should be silent and listen to him. When *Ebnelku* recited the verse several times, and created disorder in the prayer, ALI (peace be upon him) cited this verse:

«فاصبر ان وعد الله حقّ و لا يستخفنك الذين لا يوقنون»

That is: have patience, God's promise is true, don't let these unbeliever people shock and make you frivolous.

**Conclusion:**

According to the above mentioned discussion about political offences, we conclude that, if political offenders are Muslims, they will be divided in two groups: the first group is those who never committed an armed rebellion, so the governor should guide them, if they are not guidable and are not dangerous to the system, they shall not be punished, but if they are dangerous to the government and do propagatory activities against the system, for overthrowing it, the governor shall encounter them harshly and ensue them, and, on the base of their cases, imprison them as their punishment, and another group is those who have committed armed rebellion, and this group also is divided in two subgroups: the first group is consist of those who have a leader and an independent government, the second group is consist of those who

don't have a leader . In regard to the first group, who are dangerous, the wounded are killed and the fugitives are sued, but in regard to the second group, who are not dangerous, the wounded are treated medically , and their fugitives are not sued but they are forced to repent, and if they did not repent and were not dangerous, they would be set free, and if they were dangerous, they would be imprisoned till they repent, and if they did not repent, they would stay in prison till thy die. Now it is necessary to mention two points: the first is that; if political offenders commit a crime in fighting, they will not be punished, because the chief of the faithful, Ali (peace be upon him) did not punish somebody after Jamal war, though they were sentenced to the punishment, because the retaliation is the right of the authorities of the killed person (*oliyaye dam*). And he should ask them to decide about the retaliation, but Ali (peace be upon him) not only did not take action about punishment, but also he forgave all of them. The second point is that, as the Muslim jurists has cited; if the wounded have an independent government, they shall be killed; they are killed because they did not repent and are dangerous to the Islamic government, but if they repent they will not be dangerous to the Islamic government, and in case they don't repent but avoid accompanying and helping with the belligerents or the belligerents surrender before killing the wounded or leave revolting and fighting with the Islamic government.

The legislator of the Islamic republic of Iran has defined the fighter and the seditious beside each other, not the fighter only. Using the words "fighting" and " corruption in the country" (*efsad-fel-arz*) beside each other in the title of seventh chapter of the Islamic penal code of Iran, ratified in 1991, and also in the articles of this chapter show that, these two words have been used synonymously and are considered as a unique offence in our law. (*Mir-Mohammad Sadegi*, *private penal law3, 2001, p: 45*). According to the definition of the legislator, it is plain that in his view the fighting and the corruption are as follow: "using arm for frightening the people and spoiling the freedom and security from the society.

As we mentioned in the definition of the fighting, for occurring the fighting offence, the intention of using arm or carrying it or showing it in order to frightening people is a necessary conditions. And according to material elements, the offender should use arm, show it or carry weapon, in the law this action is called «drawing weapon», so the definition of the law coincide with the jurists pinion, and even despite the fact that many of the penal laws of Iran has been arranged based on the jurisprudencal theories of *Imam Khomeini*, but the legislator has not followed Imam's ideas about «the intention of corruption» that Imam has considered it one condition.

In surah Meade, verse 33, the punishment for the fighter has been explained as follow:

«... أَنْ يُقَتَّلُوا أو يُصَلَّبُوا أوْ تُقَطَّعَ أيْديهِمْ و أرجُلُهُمْ مِنْ خِلافٍ أَوْ يُنْفَوْا مِنَ الأرضِ...».

So the legislator of the Islamic republic of Iran has issued in the article no. 190 of the Islamic penal law that; the amercement for the fighting and corruption is one of the four punishments: 1) the killing; 2) hanging; 3) cutting off right hand and then his left hand; 4) to exile.

So, in relation to the kind of punishment for the fighter, the above mentioned verse is explicit and the fighter's punishment is one of the four aforementioned punishments, and there is no disagreement about the explicitness of this theory and the holly book and the tradition are evidences for it. (*Fazel lankarani, tafsil-ol-sharyie Fi Tahrir-ol-Vasile, 1406A.H. p.513).*

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# The Cytotoxic and Ultrastrctural Perturbations of Aluminum Exposed Nile Catfish with Special Reference to the Mitigating Effect of Vitamin C

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**Abstract:** The genotoxic parameters are currently among the most valuable fish biomarkers for environmental risk assessment. So, the present study was directed to explore the toxic impacts of Aluminum chloride ($AlCl_3$) on DNA damage, apoptosis, antioxidant status and ultrastructural investigations of Nile catfish. The experiment was carried out on 48 fish that randomly divided into four equal groups with two replicates; the first group exposed to 1/20 $LC_{50}$ of $AlCl_3$, the second group exposed to the combined doses of $AlCl_3$ (1/20 $LC_{50}$) and vitamin C (Vit. C) at dose of 5 ppm, the third group exposed to Vit C at the dose previously mentioned and the fourth group was kept as negative control. The experiment was terminated after six months where the fish were sacrified and specimens from liver and gills of all groups were obtained and kept at -20°C till applying the required measurements and another specimen from the same organs were fixed in 10% neutral –buffered formalin and 3% glutaraldehyde solution for histopathological examination. The results indicated pronounced significant increase in malondialdehyde (MDA) concentration and significant decrease in both reduced glutathione (GSH) concentration and superoxide dismutase (SOD) and catalase (CAT) enzyme activity. $AlCl_3$ elicited an obvious increase in oxidative DNA damage and frequency of apoptotic cells, these manifestation were markedly ameliorated in the group exposed to the combined doses of $AlCl_3$ and Vit C. The ultrastructural histopathological findings proved the aforementioned results. It could be concluded that $AlCl_3$ elucidated a marked ruinous effects on the oxidative and genotoxic impacts as well as the histopathological alterations which were alleviated by Vitamin C.

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**Key words:** Aluminum chloride, Apoptosis, DNA damage, Oxidative stress, Ultrastructural investigations**,** Vitamin C.

## 1. Introduction

In aquatic ecosystems, the levels of toxic metals have increased either directly, as a result of atmospheric deposition, waste –water discharge and run off (eg., Pb, Hg, Cu and Zn) or indirectly, through increased solubilization and mobilization from sediments (eg., Fe and Al). Diverse studies had demonstrated that Aluminum (Al) is toxic to aquatic fauna, especially in fishes on which may produce gill damage due to metal deposition and changes in osmoregulation as well as oxidative stress in lymphocytes **(Garcia-Medina *et al.*, 2010).**

In last years the problems of the drainage canals in Egypt have extremely increased. These problems include the presence of high concentrations of different metals and pesticides in both water and various fish organs **(Khallaf *et al.*, 2003 and Authman *et al.*, 2008)**. As a result, fish are exposed to water that contains high concentrations of metals including aluminum **(Authman, 2011).**

Aluminum (Al) is the third most common and ubiquitous element on earth□s lithosphere after oxygen and silicon **(Camargo *et al.*, 2009)**. This metal has numerous applications including most notably the manufacture of kitchen utensils and food and drink packaging, the production of dyes, baking powder and antiacids and as an anticoagulant of organic matter in water purification **(Atli *et al.*, 2006).** Al toxicity are restricted to fish species from the Northern hemisphere **(Monette and McCormick, 2008)**. In the tropical and neotropical areas such studies are still rare **(Barcarolli and Martinez, 2004)**. Physiological alterations frequently observed in different fish species exposed to Al are mainly related to disturbances, beyond structural gill damage **(Peuranen *et al.*, 1993)**, cardiovascular (**Laitinen and Valtonen, 1995)**, hematologic **(Barcarolli and Martinez, 2004)**, respiratory, ionoregulatory **(Poléo, 1995)**, reproductive **(Vuorinen *et al.*, 2003)**, metabolic **(Brodeur *et al.*, 2001)**, and endocrine **(Waring *et al.*, 1996)**.

The liver is the main and important detoxifying organ in fish and is essential for both the metabolism and the excretion of toxic substances in the body **(van Dyk *et al.*, 2007)**, and the gills are a multi-functional organ playing an important role in osmoregulation of fish **(Hwang and Lee, 2008)**. Al binds to the gills of many species such as Atlantic Salmon *(Salmo salar)* and brook Trout *(Salvelinus*

*fontinalis)* **(Smith and Haines, 1995)**; which leading to ionoregulatory and respiratory stress **(Bonga, 1997)**. In addition it induces damage at gill level due to increased mucus production which alters osmoregulation and respiratory processes **(Ward *et al.*, 2006)**.

In order to assess effects of environmental pollutants on aquatic ecosystems, there is a suite of fish biomarkers which may be examined. The analysis of DNA alterations in aquatic organisms has been shown to be a highly suitable method for evaluating the genotoxic impacts of environments. The comet assay has wide application as a simple and sensitive method for evaluating DNA damage in fish exposed to various xenobiotics in the aquatic environment **(Frenzilli *et al.*, 2009).** In regard to aquatic organisms, studies on the geno/cytotoxic effects of Al are scarce. However, in the larvae of the *dipteran Chironomus riparius*; diverse chromosomal aberrations were demonstrated **(Michailova *et al.*, 2003)**; in the hemocytes of the *leech Hirudo verbena* and in erythrocytes of the mosquitofish *Gambusia holbrooki*, authors have found an increase in DNA damage measured with the comet assay **(Kovačević *et al.*, 2009 and Ternjej *et al.*, 2010).** Morever, most studies on the genotoxic and cytotoxic potentials of Al have been made *in vitro*. In cultured human lymphocytes, **Banasik *et al.* (2005)** demonstrated an increase in the number of apoptotic cells. Also, Al is considered to be a non-redox active metal, it promotes biological oxidation both *in vitro* and *in vivo* **(Turner and Lysiak, 2008).**

Some vitamins contribute to the detoxification process from reactive oxygen species (ROS) such as ascorbic acid, which is considered as the most water soluble antioxidant in extracellular fluids **(Blokhina *et al.*, 2003)**. The molecular mechanisms of the antiscorbutic effect of Vitamin C are largely, although not completely understood **(Carr and Frei, 1999 and Yousef, 2004).**

In the light of the above and because there is paucity of reports concerning Al impacts in catfish, this study aimed to clarify DNA damage and apoptotic effect by using comet assay and flow cytometry, also to elucidate the level of antioxidant enzymes activity and ultrastructural perturbations using electron microscopy technique in liver and gills with special reference to vitamin C in mitigating these effects.

## 2. Material and methods

### Fish and experimental protocol

A total number of forty eight Nile catfish with an average body weight ranged from 140-160 gm were used in the present study. Fish were obtained from Abbassa fish Hatchery at Sharkia Province, Egypt. Fish were apparently healthy and free from skin lesions or external parasites, they were maintained in glass aquaria (80x 40x 30 $cm^3$ capacity for each) having 96 liters of dechlorinated tape water. Each aquarium provided with aerator, thermostatically controlled with heater and thermometer. Fish were acclimatized for two weeks to laboratory environment. They were fed with basal diet 35.4 % crude protein, the amount of food per day (on dry matter basis) was 3% of fish body weight and fed three times daily. Fish were randomly divided into four equal groups each of two replicate (six fish each).

The fish of first group exposed to Aluminum chloride ($AlCl_3$) at a dose of 1/20 $LC_{50}$ according to **Hamed (2012)**; the second group exposed to both combination of $AlCl_3$ at the same dose previously mentioned and vitamin C (Vit C) at dose of 5 ppm in the water **(Kumar *et al.*, 2009),** the third group exposed to the dose of Vit C lonely and the fourth group was kept as negative control. The experiment was terminated after six months.

### Chemicals

Aluminium chloride ($AlCl_3$) and vitamin C (Vit C) used in the present experiment were purchased from El- Gomhoria Chemical Company. Egypt.

### Sampling and measurements

At the end of experiment, fish were sacrificed by decapitation and dissected. Specimens from liver and gills of both treated and control groups were obtained and kept at -20°C till applying the required antioxidant measurements and both comet and flow cytometry assays. Another specimen from the same organs of all groups preserved in 10% neutral –buffered formalin for histopathological examination, also very small specimens were fixed by immersion in 3% glutaraldehyde solution for ultrastructural investigation.

### Evaluation of oxidative stress

### Preparation of tissue Homogenate

About one gram of the liver and gills were homogenated with 9.00 ml potassium phosphate buffer solution pH 7.40, then briefly solicited and centrifuged at 3000 rpm for 15 min. the supernatant was separated and used freshly for estimating the biochemical assays of antioxidant activity.

### Determination of lipid peroxidation (Measurement of malondialdehyde; MDA level)

Lipid peroxides in both liver and gills homogenates were ascertained by measuring malondialdehyde (MDA) through thiobarbituric acid method **(Ohkawa *et al.*, 1979).**

### Determination of reduced glutathione (GSH) concentration

GSH was estimated in liver and gills homogenates according to the method described by **Beutler *et al.* (1963)**

### Determination of Superoxide dismutase (SOD) activity

SOD activity was estimated in liver and gills homogenates according to the method of **Misra and Fridovich, (1972).**

**Determination of Catalase (CAT) activity**

CAT activity was determined according to the method of **Sinha (1972)**.

**Single cell gel electrophoresis (SCGE); Comet assay**

Liver and gills pieces of the treated and control groups were placed into a small Petri dish with ice-cold mincing solution ($Ca^{2+}$- and $Mg^{2+}$-free HBSS containing 20 mM EDTA and 10% DMSO). The viability of the cells of both examined organs was indirectly determined by analyzing the comet images after electrophoresis **(Endoh *et al.*, 2002)**. The samples were cut into smaller pieces, using a disposable microtome razor blade, and the solution was aspirated. Then, a fresh mincing solution was added and the samples were minced again to finer pieces. Resulting cell suspensions were collected and filtered (100 µm nylon meshes). All samples were stocked on ice in appropriate conditions to avoid light until the comet assay procedures.

The Comet assay was performed under alkaline conditions according to a previously described standard protocol **Collins and Dunsinka (2002)**. Briefly, an aliquot of 5 µl of each prepared cell suspension was mixed with 120 µl of 0.5% low melting point agarose at 37°C and layered onto conventional microscope slides, precoated with 1.5% normal melting point agarose. The slides were placed overnight in freshly prepared cold lysing solution (1% Triton X-100, 2.5 mM NaCl, 0.1 mM $Na_2EDTA$, 10 mM Tris with 10% DMSO, pH 10.0) and then in a horizontal electrophoresis cube with alkaline electrophoresis solution (0.3 M NaOH, 1 mM $Na_2EDTA$, pH >13) at $4^oC$ for 20 min. The electrophoresis was performed at 25 V and 300 mA for 20 min. After electrophoresis, the slides were washed twice for 5 min in neutralizing buffer (0.4 M Tris-HCl, pH 7.5), fixed for 5 min in absolute alcohol, air-dried, and stored at room temperature. In order to evaluate extremely low molecular weight DNA diffusion, two slides from each animal were removed after lysis procedure, rinsed with neutralizing solution, fixed and air-dried, and stored until analysis.

Immediately before analysis, the DNA was stained with 50 µl of 20 µg/ml ethidium bromide. The slides were examined with a 40X objective lens with epi-illuminated fluorescence microscopy (Olympus-Bx60, excitation filter: 515-560 nm; barrier filter: 590 nm) attached to a color CCD video camera and connected to an image analysis system (Comet II, Perspective Instruments, UK). The Comets were analyzed by a visual scoring method and computerized image analysis (**Liu *et al.*, 2002)**. To quantify DNA damage, tail length (TL), tail DNA (%) (TDNA) and tail moment (TM) were analyzed using Comet Assay Project Software (CAPS), generally 50-100 randomly selected cells are analyzed per sample.

**Flow cytometry assay of apoptosis**

Tissue specimens were prepared as follow, the specimens were washed with isotonic tris EDTA buffer, 3.029 gm of 0.1 M tris (hydroxymethyl amino methane, 1.022 gm of 0.07 M sodium chloride and 0.47 gm of 0.005 M EDTA), then dissolved in 250 ml of distilled water and then adjust the pH at 7.5 by using 1 N HCl. The cell suspension was centrifuged at 1800 rpm for 10 min., where upon the supernatant was aspirated. If they were macroscopically contaminated with blood, it was then subjected to hemolysis with filtered tape water for 10 min., after centrifugation and aspiration of the supernatant the cell is fixed in ice-cold 96-100% ethanol in approximately 1 ml of each sample. After at least 12 hour of fixation the sample was again centrifuge, excessive ethanol was removed by twice wash with phosphate buffer **(Vindelov, 1977)**. 200 µl of cell suspension in citrate buffer were transferred in a 5 ml tube. The solution of propidium iodide (0.05µl/ml) was protected against light with tinfoil during preparation, storage and the staining procedure. The solutions were mixed and the sample was filtered (12x75mm, cat. no.2058, falcon comp). The samples were run in the flow cytometr (Becton Dickinson, Sunnyvale, CA, USA) within 1 hour after the addition of propidium iodide and the stained samples were stored over night in room temperature to measure the sub G1 peak for apoptosis % in the same tubes according to **Cohen and Al-Rubea (1995)**. The DNA fluorescent histogram derived from flow cytometry was obtained with a computer program for Dean and Jett mathematical analysis **(Dean and Jett, 1974).**

**Histopathological examination**

Specimens which collected from liver and gills were fixed in neutral buffer formalin and were processed for histopathological investigation using light microscope according to **Bancroft and Stevens (1996)**. Another samples which fixed by immersion in 3% glutaraldehyde solution for 2 hrs followed by post-fixation in 1% osmium tetraoxide ($O_2O_4$) in 0.1 M phosphate buffer (pH 7.3) for 2 hrs at 4°C. Then the tissues were dehydrated in up-graded ethanol and finally embedded in. Araldite 502 resin. Semi-thin sections (1µm) were stained with double stained with uranium acetate and lead citrate and photographed with a transmission electron microscopy (TEM).

**Statistical analysis**

Data of the current study was statistically analyzed using the computer program **SPSS/PC (2001)**. The statistical method was one way ANOVA test.

## 3. Results

### The effect on MDA, GSH concentration and the antioxidant enzymes activity

Table 1 demonstrated that Nile catfish exposed to 1/20 $LC_{50}$ of $AlCl_3$ for six months showed significant increase ($P \square 0.05$) in the concentration of MDA in liver and gills comparing with the corresponding control groups, meanwhile this increase was mitigated in the group exposed to combined doses of $AlCl_3$ and Vit C. Moreover, the obtained data in Table 1 recorded an obvious significant decrease ($P \square 0.05$) in the activity levels of SOD and CAT and GSH concentration in liver and gills of fish exposed to $AlCl_3$ which alleviated in that group exposed to the combined doses comparing with the control group.

**Table (1):** The effect on MDA, GSH concentration and the antioxidant enzymes activity in liver and gills of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$), Vit C (5 ppm) and the combination for six months comparing with control group (Mean ±SE) (n=12).

| Parameters / Organs and Groups | MDA (nmole/g. tissue) | GSH (mg/g. Tissue) | SOD (U/g. tissue) | CAT (µmole $H_2O_2$ decomposed /g. tissue) |
|---|---|---|---|---|
| **Liver** | | | | |
| **$AlCl_3$** | 87.04±1.40 [a] | 114.60±3.52 [d] | 53.40±1.20 [c] | 23.48±0.70 [c] |
| **$AlCl_3$+Vit C** | 76.26±1.65[b] | 146.52±8.05 [c] | 64.60±1.56[b] | 34.68±2.26[b] |
| **Vit C** | 55.58±0.40[d] | 260.06±17.9[a] | 76.40±2.97 [a] | 68.80±4.57 [a] |
| **Control** | 71.36±1.19 [c] | 198.56±4.66[b] | 66.00±1.41[b] | 32.74±3.25[b] |
| **Gills** | | | | |
| **$AlCl_3$** | 44.20±1.53 [a] | 42.82±3.69[d] | 22.00±2.94 [c] | 9.64±0.92 [c] |
| **$AlCl_3$+Vit C** | 36.04±0.86 [b] | 58.22±1.15[c] | 34.80±1.56 [b] | 14.80±0.28 [b] |
| **Vit C** | 18.20±2.08[c] | 83.22±1.79 [a] | 41.60±1.07[a] | 17.72±0.45[a] |
| **Control** | 35.00±1.37 [b] | 70.26±1.63 [b] | 35.60±1.63 [b] | 14.90±0.44[d] |

Means within the same column carrying different superscripts are significant at $p \square 0.05$

### The effect on the level of DNA damage

As determined in the present study; the alkaline comet assay has adequate sensitivity for assessing the levels of primary DNA damage in liver and gills of both treated and control groups as depicted in Table 2 and Figures 1&2; which indicated that $AlCl_3$ exposed group recorded significant increase ($P \square 0.05$) in value of all parameters in both liver and gills (tail length, tail moment and DNA%) when comparing with corresponding control group. However the fish exposed to the combined doses of $AlCl_3$ and Vit C, ameliorated the level of primary DNA damage which illustrated via significant decrease ($P \square 0.05$) of all comet parameters compared to control groups of both liver and gills.

**Table (2):** The effect on oxidative DNA damage level (tail length, DNA% and tail moment) and apoptotic cell population (apoptosis %) in liver and gills of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$), Vit C (5 ppm) and the combination for six months comparing with control group (Mean ±SE) (n=12).

| Parameters / Organs and Groups | Tail length (µm) | DNA (%) | Tail moment (Units) | Apoptosis % |
|---|---|---|---|---|
| **Liver** | | | | |
| **$AlCl_3$** | 9.46±0.23 [a] | 10.18±0.56 [a] | 91.24±0.63[a] | 78.45±6.32[a] |
| **$AlCl_3$+Vit C** | 7.61±0.58[b] | 7.27±1.122[b] | 70.89±3.92[b] | 63.92±3.92[a] |
| **Vit C** | 2.56±0.098 [c] | 2.74±0.117 [c] | 7.51±0.432 [c] | 26.60±1.69[c] |
| **Control** | 2.53±0.094[c] | 2.81±0.02 [c] | 7.81±0.26[c] | 27.77±2.20[c] |
| **Gills** | | | | |
| **$AlCl_3$** | 9.20±0.164 [a] | 10.31±0.427 [a] | 92.23±3.21 [a] | 63.92±3.92[a] |
| **$AlCl_3$+Vit C** | 7.85±0.044[b] | 8.44±0.566[b] | 69.49±3.44[b] | 45.72±1.002[a] |
| **Vit C** | 2.54±0.043 [c] | 2.59±0.040[c] | 6.61±0.083 [c] | 25.02±1.29[c] |
| **Control** | 2.75±0.047 [c] | 2.80±0.023[c] | 7.32±0.319 [c] | 24.47±2.11[c] |

Means within the same column carrying different superscripts are significant at $p \square 0.05$

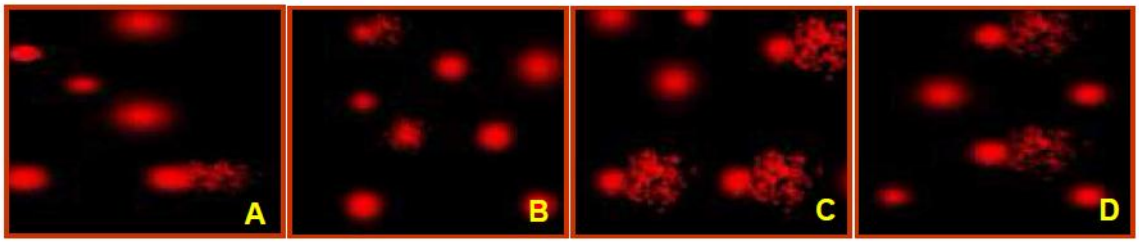


**Figure (1):** Comet images of cells derived from liver of Nile catfish of control group (A), Vit C (5 ppm) exposed group (B), $AlCl_3$ (1/20 $LC_{50}$) exposed group (C) and combined doses of $AlCl_3$ and Vit C exposed group (D) for six months.

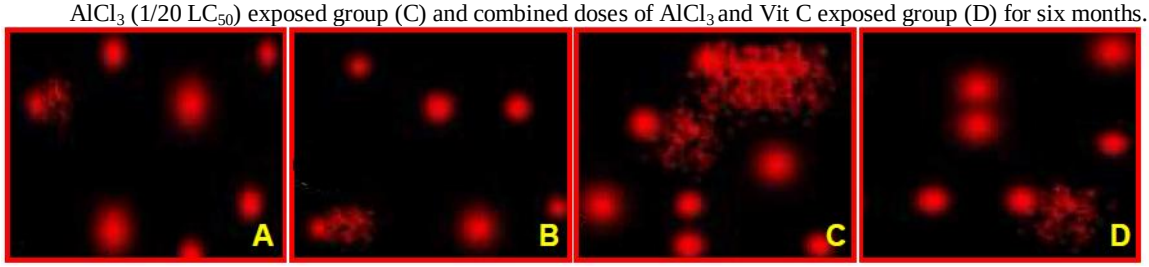


**Figure (2):** Comet images of cells derived from gills of Nile catfish of control group (A), Vit C (5 ppm) exposed group (B), $AlCl_3$ (1/20 $LC_{50}$) exposed group (C) and combined doses of $AlCl_3$ and Vit C exposed group (D) for six months.

**The effect on the population of apoptotic cells**

The results of apoptotic cell population are presented in Table 2 and Figure 3 which revealed pronounced significant induction ($P$□0.05) in the percentages of apoptotic cells in liver and gills of $AlCl_3$ exposed group comparing with the control groups. Meanwhile, the frequency of apoptotic cells was significantly declined ($P$□0.05) in both liver and gills of catfish exposed to the combined doses of $AlCl_3$ and Vit C when comparing with corresponding control groups.

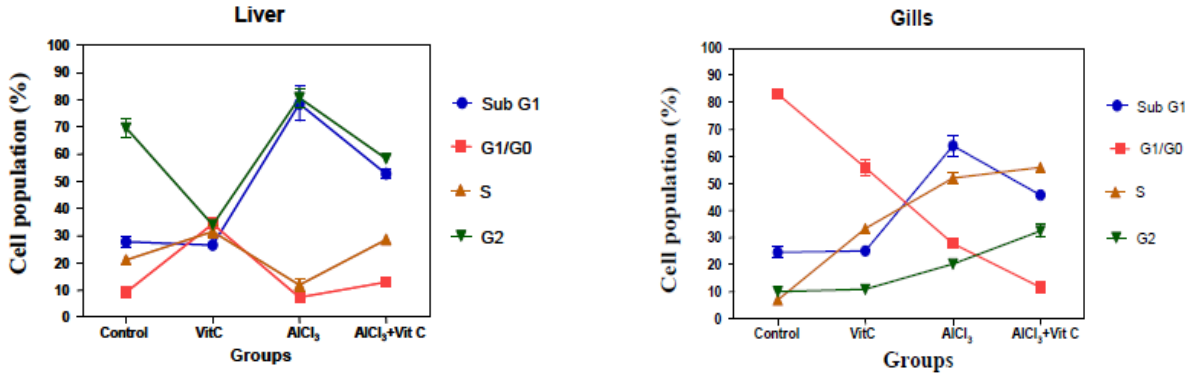


**Figure (3):** The effect on the apoptotic cell population (Sub G1 %) by flow cytometric analysis in liver and gills of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$), Vit C (5 ppm) and the combination for six months comparing with control group (Mean ±SE) (n=12).

**Histopathological results**

Light microscopical examination of liver and gills of control and Vit C groups showed normal histopathological structure **(Figures 4A, 5A)**. In group exposed to 1/20 $LC_{50}$ of $AlCl_3$; The liver revealed multifocal areas of coagulative necrosis which represented by pyknosis and karyolysis. Some of these areas were focally replaced by lymphocytes and macrophages and others displaced by melanomacrophages (**Figure 4B**). Diffuse hepatocyte degenerations of vacuolar and hydropic types and fatty change were seen besides, activation of melanomacrophages centers. The hydropic degeneration was accompanied with severe congestion of the hepatic sinusoids and the central veins (**Figure 4C**). The epithelial lining of the bile ducts showed vacuolar degeneration and others revealed hyperplasia in the lining epithelia. The pancreatic acini were necrotic and infiltrated with lymphocytes. The gills of the same group showed telangiectasia of the branchial blood capillaries, hemorrhages and lymphocytes aggregations particularly at the base of the primary lamellae. Focal patches of coagulative necrosis in the gill-filaments were observed with lymphocytic aggregations at the gill-tips (**Figure 5B**). Focal fusions of the secondary lamellae were manifested by hyperplasia of its epithelial lining and obliteration of interlamellar spaces. There was also an increase in activity and number of the goblet cells. Lamellar disorganization and desquamation or sloughing of its epithelia was focally detected.

While, in the group exposed to the combined doses of $AlCl_3$ and Vit C. The liver showed mild focal hydropic degeneration in the hepatocytes and sinusoidal congestion (**Figure 4D**). The hepatocytes showed vacuolated cytoplasm and rarely individual cell necrosis (**Figure 4E**). The portal areas were infiltrated with few lymphocytes. Few extravasated erythrocytes were rarely seen among the degenerated hepatic cells. The gills of that group showed mild congestion and hyperplasia of the respiratory epithelium with basal fusion of the secondary lamellae (**Figure 5C**). Few lymphocytes together with a considerable number of EGC were detected at the base of gill filaments.

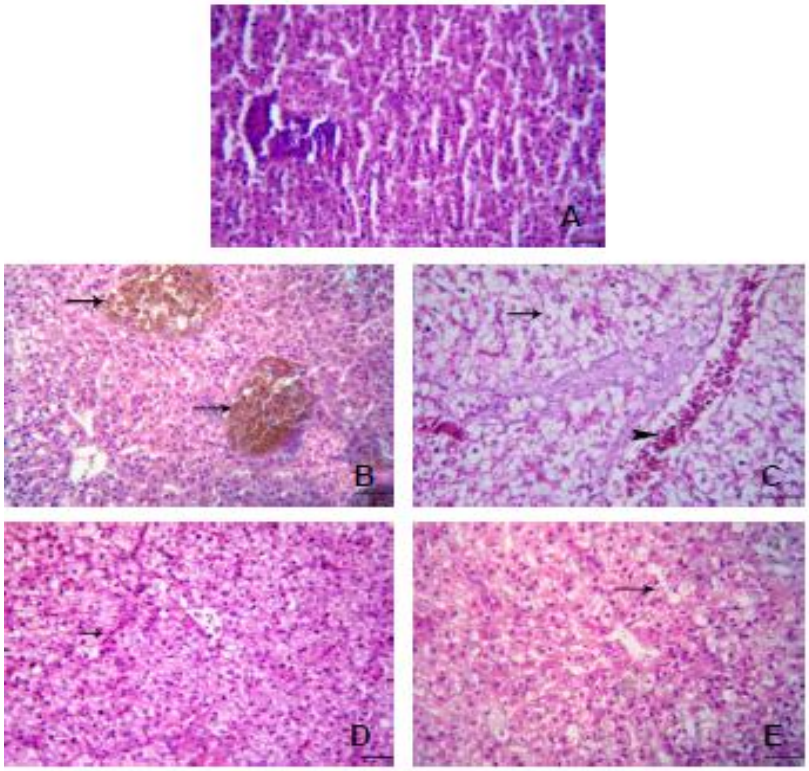


**Figure (4): A;** Section of control Nile catfish liver showing normal hepatocyte and sinusoidal architecture, HE (Bar = 100 µm).
**B** and **C;** Section of Nile catfish liver of $AlCl_3$ (1/20 $LC_{50}$) exposed group for six months showing, **B;** necrotic areas replaced by numerous melanomacrophages (arrows), **C;** diffuse hepatocytes degenerations (arrow) and severe congestion (arrowhead), HE (Bar = 100 µm).
**D** and **E;** Section of Nile catfish liver of the group exposed to combined doses of $AlCl_3$ and Vit C (5 ppm) for six months showing, **D;** mild hydropic degeneration and sinusoidal congestion (arrow), **E;** focal vacuolations in the hepatocytes (arrow), HE (Bar = 100 µm).

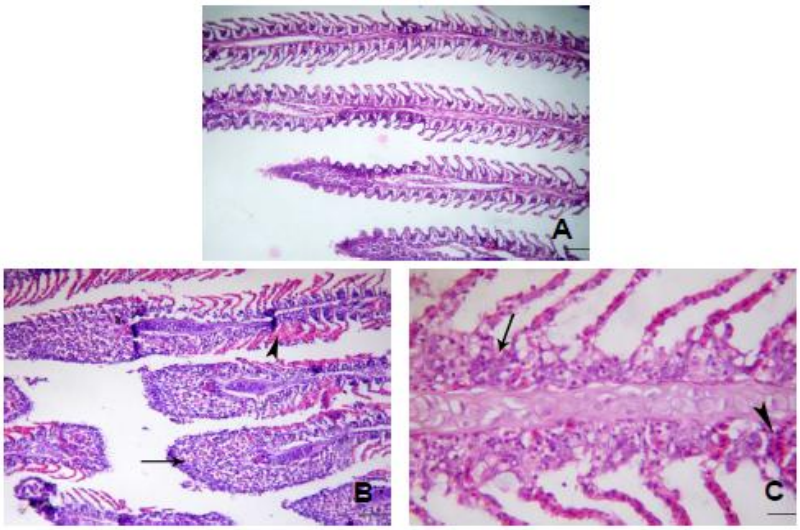


**Figure (5): A;** Section of control Nile catfish gills showing normal filaments and lining epithelium, HE (Bar = 100 µm).
**B;** Section of Nile catfish gills of $AlCl_3$ (1/20 $LC_{50}$) exposed group for six months showing focal patches of coagulative necrosis in the lining epithelia of secondary lamellae (arrowhead) and extensive round cells aggregations on the the tips of primary lamellae (arrows), HE (Bar = 100 µm).
**C;** Section of Nile catfish gills of the group exposed to combined doses of $AlCl_3$ and Vit C (5 ppm) for six months showing mild congestion (arrowhead) and hyperplasia of the respiratory epithelium with basal fusion of the secondary lamellae (arrow), HE (Bar = 100 µm).

Ultrastructural findings of liver cells of control and Vit C exposed group were identical with that generally known. The cytoplasm showed numerous mitochondria, rough endoplasmic reticulum, Golgi apparatus, glycogen granules and few fat lipid globules. The nucleus was normal round with centrally located nucleolus and dispersed granular chromatin. Moreover, the Vit C exposed group showed an increase of the leukocytes in the blood sinusoids and proliferation of bile canaliculi with large aggregates of RER (**Figure 6**). The hepatocytes of the group exposed to aluminum chloride showed severe vacuolation and lysis of the cytoplasm (rarefaction) with complete disappearance of the mitochondria, Golgi apparatus and glycogen. Narrowing or complete obliteration of the spaces among the hepatocytes were visualized with thinning of the cytoplasmic microvilli. Few rough endoplasmic reticulums were aggregated and condensed around the nuclei with partial lysis of its membranes and detached ribosomes. The nucleus showed marked crenation (indentation) and vacuolar detaching of nuclear membranes, dislocation of nucleolus, clumping and condensation of chromatin in the shape of an irregular homogenous ring of a snowflake form with peripheral migration into the cytoplasm. Partial lysis of the outer and intactness of the inner nuclear membrane was also observed with appearance of irregular shaped nucleus (polypoid). Fragmentation of the nuclear chromatin was detected and dispersed in the cytoplasm with absence of the nuclei inside the hepatocytes. Numerous inflammatory cells of macrophages and neutrophils containing numerous lysosomes were seen among the degenerated or necrotic hepatocytes (**Figures 7 and 8A**).

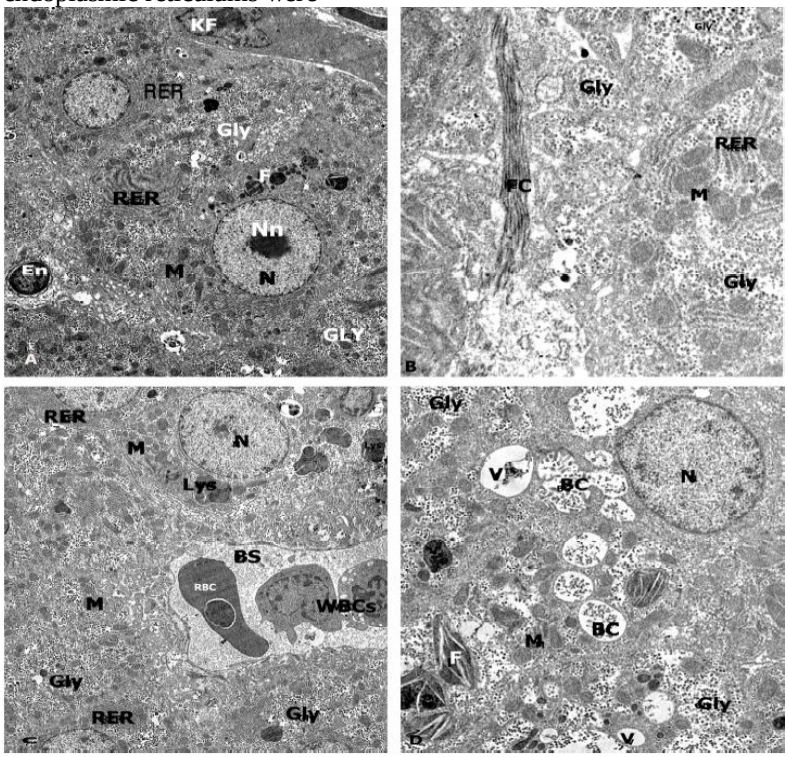


**Figure (6): A** and **B;** The hepatocytes of control. (N=nucleus, Nn= nucleolus, KF=kupffer cell, En= endothelium, M=mitochondria, RER=rough endoplasmic reticulum, FC=Golgi apparatus, Gly=glycogen, F=lipid globule, Lys=lysosome). **C** and **D;** Vit C exposed group, the liver showing increase the numbers of leukocytes in the blood sinusoid (WBC) and proliferation of bile canaliculi (BC) between the hepatocytes. TEM x 5850.

The hepatocytes of group exposed to the combined doses of $AlCl_3$ and Vit C showed mild to moderate vacuolations of the cytoplasm with few swollen mitochondria with amorphous deposits in the matrix and dilated regular shaped RER. Depletion or complete absence of glycogen and increase lipid globules in the cytoplasm was detected. Activated cytosome (peroxisome) and proliferation of bile canaliculi were also detected. The nucleus was nearly normal with mild clumping of chromatin. The inflammatory cells of predominate neutrophils were noticed (**Figures 8 B,C,D**).

The gills of control and Vit C exposed groups were normal with gill filaments, lamellae and surface epithelium. Meanwhile the gills of aluminum chloride exposed group showed severe vacuolation and necrosis pavement (PC) and epithelial cells (EPC) with dilated mucous cells (MC). These cells were separated from secondary lamella by edema containing fibrin and inflammatory cells. The previous findings were lowered or absent with restored the lining epithelium in group exposed to the combined doses of $AlCl_3$ and Vit C; Mild activation of the mucous and chloride cells (CC) were detected **(Figure 9)**

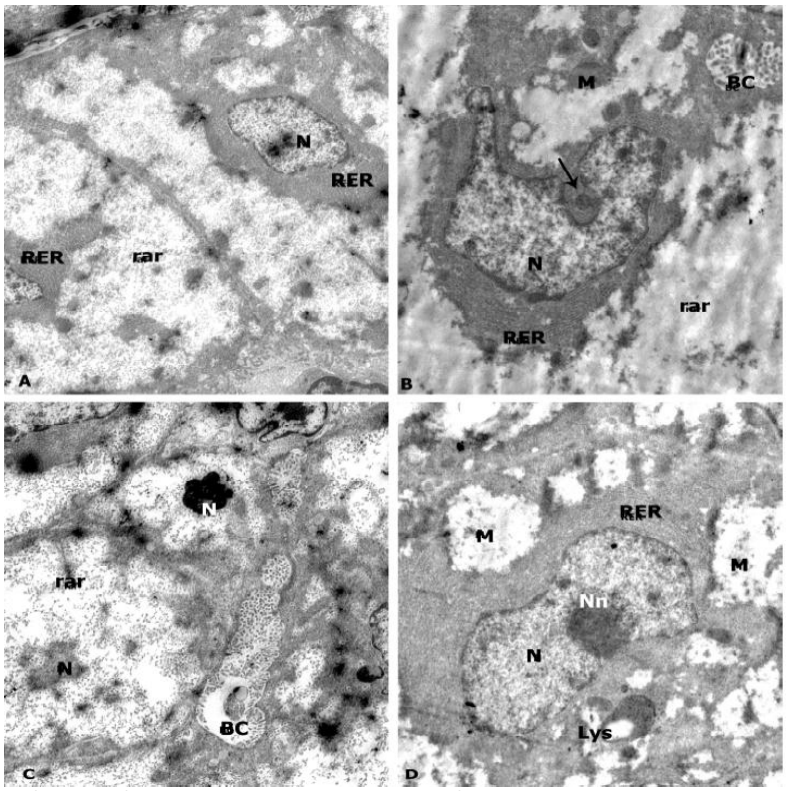


**Figure (7):** Section in liver of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$) for six months; **A;** The hepatocytes vacuolation and lysis of the cytoplasm (rar) with complete disappearance of the mitochondria, Golgi apparatus and glycogen. **B;** Marked crenation (indentation) and vacuolar detaching of nuclear membranes. **C;** Clumping and condensation of chromatin in the shape of polypoid mass. **D;** Macrophages among the hepatocytes (N=nucleus, RER=rough endoplasmic reticulum, BC=bile canaliculi). TEM x 5850.

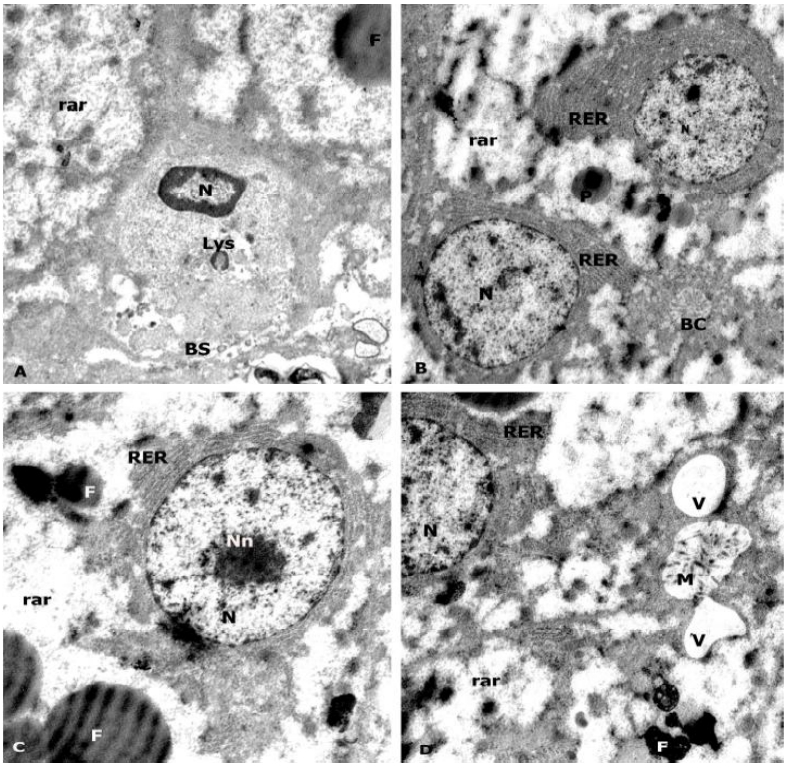


**Figure (8):** **A;** Section in liver of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$) for six months showing neutrophil containing numerous lysosomes (Lys) inside the blood sinusoid. **B, C** and **D;** Section in liver of Nile catfish exposed to combined doses of $AlCl_3$ and Vit C (5 ppm) for six months showing **B;** Moderate vacuolations of the cytoplasm (rar) with few swollen mitochondria, dilated regular shaped RER and peroxisome. **C;** Normal nucleus (N) and nucleolus (Nn) with deposition of lipid globules (F). **D;** Swollen mitochondria with amorphous deposits (M), vacuoles, lipid globules (F) and rarefaction (rar). TEM x 5850.

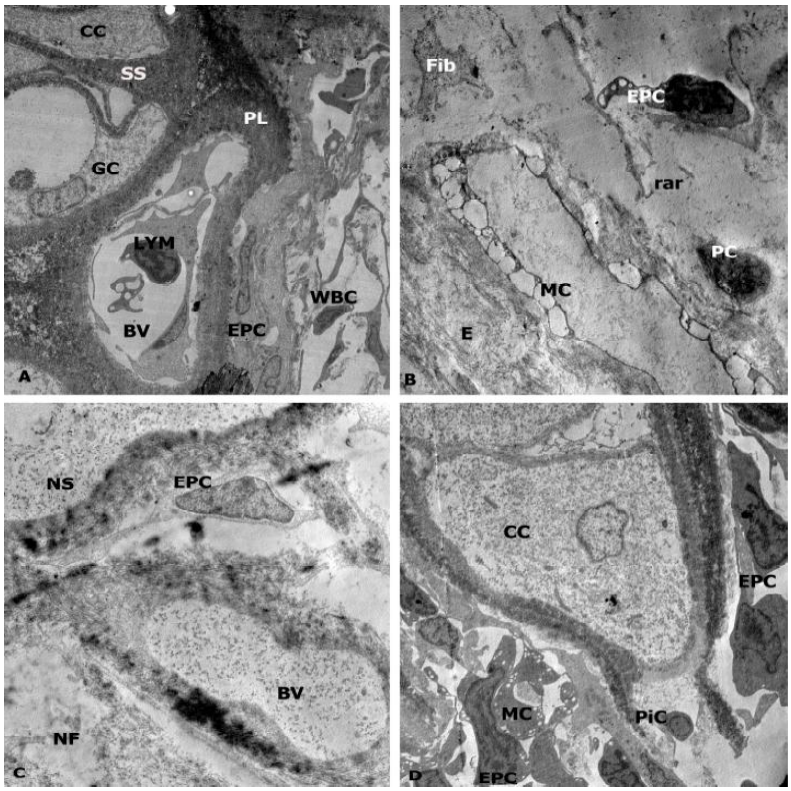


**Figure (9): A;** Section in gills of control Nile catfish showing normal primary (PL) and secondary (SS) lamellae, epithelial lining (EPC), chloride (CC), pavement (PC), goblet (GC) and pillar (PiC) cells besides normal blood vessels (BV). **B** and **C;** Section in gills of Nile catfish exposed to $AlCl_3$ (1/20 $LC_{50}$) for six months showing moderate vacuolations of the cytoplasm (rar) with edema (E) containing fibrin (Fib), dilated mucous cells (MC) and necrotic pavement (PC) and epithelium (EPC). **D;** Section in gills of Nile catfish exposed to combined doses of $AlCl_3$ and Vit C (5 ppm) for six months showing slight activation of mucous (MC) and chloride (CC) cells with normal other lining epithelia. TEM x 5850.

## 4. Discussion

The pollution of the aquatic environment with metals has become a serious health concern because of their toxicity and accumulation by organisms **(Mendil *et al.*, 2010 and Shah *et al.*, 2010)**. Due to its ubiquity, environmental exposure to aluminum may play an important role in the etiology of several diseases **(Migliore and Cappede, 2002)**. Fish in comparison with invertebrates, are more sensitive to many toxicants and are a convenient test subject for indication of ecosystem health **(Moiseenko, et al., 2008)**. The pro-oxidant/ antioxidant balance and scavenging of ROS are essential in order to maintain cellular homeostasis **(Valavanidis *et al.*, 2006)**.

Concerning MDA which is a byproduct of lipid peroxidation, its concentration reflects the level of lipid peroxides (LPX) very well **(DeZwart *et al.*, 1999)**. The data of the present study revealed significant increase in mean values of MDA concentration in liver and gills of $AlCl_3$ exposed fish (Table 1). Meanwhile, SOD which is an endogenous enzymatic scavenger that can counterbalance the oxidative destruction of free radicals **(Ryan *et al.*, 2008)**, the effect of $AlCl_3$ on the level of the antioxidant enzymes activities including SOD and CAT and GSH concentration was mirrored in our study by significant decrease in all activities and concentration in both liver and gills (Table 1).

The results are in accordance with **Dua and Gill (2001)** who observed a significant decrease in the activities of SOD and CAT in cerebrum, cerebellar hemisphere and brain stem after AL exposure. In alike manner those findings previously reported by **Yousef (2004)** and **Newairy *et al.* (2009)** who mentioned that that Al-induced changes in biochemical parameters, increased lipid peroxidation and decreased the activities of the antioxidant enzymes in plasma and different tissues of male rabbits and rats. **Yousef and Salama, (2009)** mentioned that $AlCl_3$ caused significant decrease in the activities of CAT and glutathione S-transferase (GST) and GSH concentration in male rats. Similarly, **Raina *et al.* (2010)** depicted that exposure to Aluminum phosphide at the concentration of 10 mg/kg/day results in enhancement of 20% in the levels of lipid peroxidation. Also, **Ding and Yang (2010)** found that $AlCl_3$ induced increase of LPX in the cells which was reflected by a reduction of SOD activity.

One possible alternative scenario which speculate the suppressive effect of aluminum on the antioxidant enzymes activities and its inducible effect on MDA reported by **Xie and Yokel (1996)** who indicated that the mechanism of Al-induced

toxicity may attributed to the potentiation of $Fe^{2+}$ to $Fe^{3+}$ to cause oxidative damage. Also, we could attribute our results to that opinion reported by **Kong *et al.* (1992)** and **Exely (2004)** who suggested a number of mechanisms had been proposed the ability of aluminum to increase the susceptibility of membrane lipids to peroxidative damage by producing rearrangement in cellular fluidity through binding to lipids in phospholipids membranes, others had proposed the ability of aluminum to catalyze superoxide radical anion-mediated biological oxidation.

Another explanation; Aluminum may have altered the cellular redox state by inhibiting the enzyme involved in antioxidant defense (SOD and CAT ) which function as blockers of free radical processes as postulated by **Nehru and Anand (2005)**. Moreover, it can be hypothesized the oxidative stress during aluminum exposure was attributed to electron leakage, enhanced mitochondrial activity and increased electron chain activity. ROS subsequently attack almost all cell components including membrane lipids and producing lipid peroxidation **(Flora *et al.*, 2003 and Turner and Lysiak, 2008).**

In the opposite direction, **Bhalla and Dhawan (2009)** found that administration of $AlCl_3$ (100 mg/kg b.wt/day/orally)in rats significantly increased the enzyme activities of CAT, SOD and glutathione reductase (GR) which speculated by the explanation of **Goncalves *et al.* (2008)** who point out that this increased SOD activity may be related to a potential adaptation mechanism of the organisms aimed at offsetting Al-induced oxidative stress. Also, **Bagnyukova *et al.* (2006)** state LPX products appear to be involved in the up-regulation of some antioxidant enzymes while diverse studies have shown that exposure to Al induces the expression of certain genes, including some which encode the synthesis of antioxidant enzymes **(Simonovicova *et al.*, 2004)**. The variations from our results may be attributed to the difference in species, dose and duration of exposure.

The aforementioned picture of the present study regarding the oxidative stress came in harmony and confirmed by our histopathological findings (Figures 4-9) including coagulative necrosis, pyknosis, karyolysis, hydropic and vacuolar degeneration, rarefaction, indentation, fragmentation of nuclear chromatin and vacuolar detaching of nuclear membranes.

In this respect, our results tie in that recorded by **Gonzalez *et al.* (2007)** and **Tripathi *et al.* (2008)**, they stated as a matter of fact, interactions between oxidative stress and hepatic damage may accelerate the progression of chronic hepatodegenerative disorders, including enzymes increase induced by aluminum. Also, in this direction our results are nearly similar with those obtained by **Wilhelm *et al.* (1996)** and **El-Demerdash *et al.* (2004)** who postulated that the hepatic tissue damage reflects the direct toxic effect of aluminum.

Concerning to alleviating effect of vitamin C, the level of both MDA concentration and antioxidant enzyme activity in the group exposed to the combined doses of $AlCl_3$ and Vit C in the current experimental work could be supported by the attribution recorded by **Tsao (1997)** and **Huang *et al.* (2002)** where they mentioned that two major properties of Vitamin C make it an ideal antioxidant. First is the one-electron reduction potentials of both ascorbate and its one-electron oxidation product, the ascorbyl radical. These low reduction potentials enable ascorbate and the ascorbyl radical to react with and reduce basically all physiologically relevant radicals and oxidants. The second major property that makes Vit C such an effective antioxidant is the stability and low reactivity of the ascorbyl radical formed when ascorbate scavenges a reactive oxygen or nitrogen species.

With respect to aquatic organisms, information on the matter is scarce. Although a few reports have indicated that exposure to Al can affect their molecular and cellular structure and function, no previous studies on genotoxic and cytotoxic effects had been carried out in Nile catfish. In regard to the assessment of genotoxic effects provoked by exposure to $AlCl_3$ which was detectable by the alkaline comet assay; the present work depicted an obvious statistically significant increase in the number of DNA breaks in both liver and gills (Figures 1&2).

These results were compatible with those reported by **Lankoff *et al.* (2006)** and **Lima *et al.* (2007)** who recorded that aluminum- treated human cells indicated an increased level of DNA damage. Also, Our results coincide with the findings previously mentioned by **Mihaljević *et al.* (2009)** and **Ternjej *et al.* (2010)** where they found that aluminum induced DNA damage in *leech Hirudo verbena* hemocytes and erythrocytes of the mosquitofish *Gambusia holbrooki* respectively by measuring the comet tail length, tail intensity, and tail moment. Theoretically, Al could induce DNA damage via three mechanisms; modification of chromatin structure, induction of ROS, and liberation of DNase from the lysosomes. The first mechanism is supported by the finding that Al can influence the structure of chromatin **(Bharathi *et al.*, 2003)**. In addition many metals, possibly Al as well are known to inhibit DNA repair mechanism which would lead to DNA damage. The second mechanism is supported by the observations that treatment of cells with Al can lead to the formation of reactive oxygen species **(Anane and Creppy 2001)**, and the third mechanism is supported by the finding that Al can change the permeability of hepatic lysosomal membranes (**Vander Voet *et al.*,**

**1992)** and that is also inhibits the lysosomal proton pump **(Zatta *et al.*, 2002)**. Enhanced lysosomal membrane could lead to DNase being liberated into the cytoplasm and to its passage into nucleus, where it could cut DNA, it has been shown that DNase introduced into cytoplasm by electroporation is a potent inducer of cytogenetic damage **(Sayed Aly *et al.*, 2002)**. Another hypothesis could be explain our findings previously reported by **Alves de Almeida *et al.* (2007)** they mentioned that AL inducing DNA strand breaks via generating ROS which may alter nucleotide bases. The hydroxyl radical may remove hydrogen atoms from the sugar, particularly from carbon 4 of ribose, besides the reaction of the singlet oxygen with DNA gives rise to OH-8 oxoguanine, which may newly react with another singlet oxygen and produce O OH-8 oxoguanine, oxidation in the sugar or DNA bases can generate mutations and DNA damage.

On that contention our experiment revealed that the group exposed to the combined doses of $AlCl_3$ and Vit C recorded an obvious reduction in oxidative DNA damage, which may be supported by the opinion of **Carr and Frei (1999)** as they found that Vit C can protect indispensable molecules such as proteins, lipids and nucleic acids (DNA and RNA) from damage by free radicals and ROS that can be generated either during normal metabolism or through exposure to toxins and pollutants.

Our study imply a significant increase in the frequency of apoptotic cells in both liver and gills of Nile catfish exposed to 1/20 $LC_{50}$ of $AlCl_3$ (Table 2 & Figure 3) on the same context those findings previously recorded by **Griffioen *et al.* (2004)** they mentioned that incubation of Al with human neuronal cells (NT2) produced significant apoptosis even in lower doses. Similary the study of **Banasik *et al.* (2005)** demonstrated an increase in the number of apoptotic cells in cultured human lymphocytes. Besides, **Tuneva *et al.* (2006)** recorded that in acutely isolated cerebellar granular cells, Al has been found to cause a rapid neurotic cell death. One possible mechanism is that Al binds to certain functional groups in the gill epithelium, increasing its permeability to ions and accelerating cell death **(Exley *et al.*, 1991)**, another attribution is that Al enhance the production of cytochrome C, which trigger the cell death cascade process **(Griffioen *et al.*, 2004)**. Moreover, the explanation of **Verstraeten and Aimo (2008)** where they declared that Al is able to displace Fe and promote the fenton reaction as well as to directly damage mitochondrion affecting electron transport in the respiratory chain, consequently, this increase ROS production, disrupts the membrane potentional, decrease the ATP stock and leads to disturbances of the cell cycle and apoptosis. Also, in situations where the generation of free radicals exceeds the capacity of antioxidant, defense, oxidative stress may lead to cell membrane degradation, cellular dysfunction and apoptosis **(Lucca *et al.*, 2009)**. Besides, it could be supported by the findings of **Griffitt *et al.* (2011) where** they depicted that exposure to $AlCl_3$ resulted in down regulation of genes involved in cell cycle regulation and inhibition of apoptosis.

The aforementioned results of the present experiment concerning $AlCl_3$ inducing apoptosis could be confirmed by our histopathological manifestations previously recorded. Meanwhile, the group exposed to the combined doses of $AlCl_3$ and Vit C showed a pronounced reduction in the percentage of apoptotic cells. This picture supported by the postulation based on the findings of **Satoh *et al.* (2007)** who indicated that Vit C protect Al induced cell death by increasing the concentration of intracellular GSH as confirmed in our experimental work.

## Conclusion

The present study points out relevant results that $AlCl_3$ elucidated marked ruinous effects on the oxidative and genotoxic impacts as well as the histopathological alterations which were alleviated by Vitamin C.

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# Perspective of nurses working in medical-training hospitals in Kohkiloyeh and Boyer-Ahmad province towards continuing education

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**Abstract:** Information about perspective of nurses on continuing medical education is important in promoting the program. In this descriptive study, 184 nurses working in medical-education hospitals of Kohkiloyeh and Boyer-Ahmad were participated. A questionnaire was developed in five sections: demographic and content-area information, management information, satisfaction information, and motivation information. The collected data was analyzed using SPSS. Based on the results, at most, 63% of the participants in the study were satisfied with agreement of the contents with new scientific discoveries, 63% were satisfied with the appropriateness of the contents with their needs, and 52% were satisfied with the management of the programs. In general, nurses had average evaluation, about the contents of the program, management, satisfaction, and motivation in continuing education programs. The majority of nurses, participating in continuing educational programs, had average evaluation towards content of the program, program management, satisfaction with programs, and motivation for participation. It is suggested to review the various parts of the programs and implement the requirement evaluation before any education progress.

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***Key words:*** *Continuing education, Nursing, Perspective*

**Introduction**:

At every level of education, learning reserves decrease over time (1). One of the problems is trying to keep the acquired knowledge especially about sciences whose domains are changing rapidly (2). Knowledge has a half life of approximately two and a half years and after that time, it is not considered up-to-date, and is considered old (3). Nurses are persons who have a close relationship with patients, other health teams and the society, and due to the rapid advance of science and technology, they should be aware of all skills and new techniques about care. So, considering the importance of nurses' knowledge, continuing nursing education can be used as a useful method to maintain professional formalization and prevention of its stagnation. On the other hand, continuing nursing education is needed as a way to deal with retardation and a guarantee of qualitative and quantitative work improvement and increased levels of professional motivation and courage (4). Continuing nursing education is a means for nurses to respond to rapid changes in health system and increase their professional skills (3).

Today, continuing nursing education is an inevitable necessity which aims to preserve and promote knowledge and professional skills of medical graduates community, and ultimately to increase public health. Trying to hold programs decently, selecting appropriate methods for teaching and continuing education programs and then evaluating learners in order to improve their qualities are essential (5). Experts believe that university education does not prepare nurses to do practical cares enough and they need to have continuing education in this regard (6).

**Literature Review**

In a study conducted by Charkazi et al in Golestan, results showed that subjects had "very poor" and "poor" viewpoints about retraining programs and expressed that their motivation to participate in programs is to gather points for job promotion (7). In another study conducted by Zahdpasha and Canaani in Babol, results showed that 3.13 percent of the subjects participated in a retraining program for the first time. 75 percent believed that the number of participants will be reduced after removing the points of retraining, 44.7 percent were aware of the continuing education rules, and 61.7 percent had full knowledge of its goals. 68 percent evaluated programs in accordance with their job requirements, 30.3 percent believed in the necessity of the presence and absence and 45.2 percent considered necessary to pay the registration fee. Also, 71.6 percent of general practitioners and 59.7 percent of specialists considered programs containing new information (8).

**Method:**

In this study that was conducted as census, the nurses participating in continuing education programs in the Yasuj University of Medical Sciences (184 people) in the period of 2008-2009 were selected as the sample. The data collection tool was a questionnaire that was evaluated by faculty experts and education experts, and after the necessary modifications, its formal and content validity was accepted and its reliability was determined after a preliminary study, through the calculation of Cronbach's Alpha with a Pearson correlation coefficient of 0.85. The questionnaire included demographic characteristics and questions regarding four areas: program content (7 questions), management (6 questions), satisfaction (5 questions), motivation (4 questions) and two open end questions. The sampling method was simple and based on objective, and the interviewers were presented during the preset retraining programs in three cities, namely Yasuj, Gachsaran and Dehdasht, and after the programs, they provided participants with questionnaires.

After data collection with the help of questionnaires, data analysis was performed using SPSS software and descriptive statistics (absolute and relative frequency, mean and standard deviation).

**Discussion and Conclusion:**

In general, in programs held at the three cities, 184 people attended (Table 1 shows the demographic characteristics of the studied subjects.) 60 percent of nurses were formal employees, 20% treaty employees, 10% initiative employees and 10% contract employees. Also, the maximum and minimum numbers of participants in continuing education programs were in Yasuj (71%) and Dehdasht (25%), respectively.

Table 1: Frequency distribution of samples based on sex, age, work experience, education, workplace and the number of periods

| Variable | Demographic Characteristics | Number | Percentage |
|---|---|---|---|
| **Sex** | Male | 5 | 27.2 |
| | Female | 134 | 72.8 |
| **Age Groups** | 15-20 | 2 | 1.1 |
| | 21-30 | 45 | 24.5 |
| | 31-40 | 116 | 63 |
| | 41-50 | 21 | 11.4 |
| **Work Experience** | 5-10 | 103 | 56 |
| | 11-15 | 24 | 13 |
| | 16-20 | 49 | 26.6 |
| | 21-25 | 4 | 2.2 |
| | 26-30 | 4 | 2.2 |
| **Education** | Associate | 17 | 9.2 |
| | Bachelor | 167 | 90.8 |
| **Workplace** | Yasuj | 71 | 38.6 |
| | Gachsaran | 67 | 36.4 |
| | Dehdasht | 46 | 25 |
| **Number of Periods** | 1-4 | 124 | 67.4 |
| | 5-8 | 51 | 27.7 |
| | 9-12 | 9 | 4.9 |

In the area of program content; conformity with new scientific programs was evaluated high by 60.6 percent of learners in Yasuj, 62.7 percent in Gachsaran and 63 percent in Dehdasht. In this section,

the content appropriateness of programs was evaluated high by 44.7 percent in Yasuj, 56.7 percent in Gachsaran and 63 percent in Dehdasht which has accounts for the maximum points.

In the area of program management; the correct way of holding programs was evaluated high in Yasuj 50.7 percent, in Gachsaran 50.7 percent and in Dehdasht 52.2 percent, and in response to another question of this section about the points allocated to each program, learners evaluated it high in Yasuj 45.1 percent, in Gachsaran 52.2 percent and in Dehdasht 45.7 percent.

In the areas of satisfaction of programs; appropriate time for holding training classes was evaluated high by learners in Yasuj 53.5 percent, in Gachsaran 50.7 percent and in Dehdasht 52.2 percent. In response to a question about appropriate location for classes, learners' answers were high in Yasuj 47.9 percent, in Gachsaran 47.8 percent and in Dehdasht 47.8 percent. About the correct and proper use of training devices, learners' answers were high in Yasuj 46.5 percent, in Gachsaran 49.3 percent and in Dehdasht 47.8 percent. Teachers' scientific mastery was high in Yasuj 49.3 percent, in Gachsaran 41.8 percent and in Dehdasht 45.7 percent.

In the area of motivation; reconsidering previous information was evaluated high by learners in Yasuj 42.3 percent, in Gachsaran 49.3 percent and in Dehdasht 45.7 percent. Also in response to a question about point gathering, learners evaluated it medium in Yasuj 54.9 percent, in Gachsaran 52.2 percent and in Dehdasht 52.2 percent (Table 2.)

51 percent in Yasuj, 53.7 percent in Gachsaran and 54.3 percent in Dehdasht considered workshops as the best way to implement continuing education programs, also, 93 percent in Yasuj, 95.5 percent in Gachsaran and 93.5 percent in Dehdasht considered codified and in-person programs as the best method to implement continuing education programs.

About the content of continuing nursing education programs from the perspective of participants, the results showed that 50.7 percent (36 people) in Yasuj, 50.7 percent (34 people) in Gachsaran and 52.2 percent (24 people) in Dehdasht evaluated the content of programs as medium.

About the management of continuing nursing education programs from the perspective of participants, the results showed that 56.3 percent (40 people) in Yasuj, 59.7 percent (40 patients) in Gachsaran and 56.5 percent (24 people) in Dehdasht evaluated the management programs as medium.

About the satisfaction level of continuing nursing education programs from the perspective of participants, 50.7 percent (36 people) in Yasuj, 50.7 percent (34 people) and in Gachsaran 52.2 percent (24 people) in Dehdasht evaluated it as medium.

About the motivation to participate in continuing nursing education programs from the perspective of participants, the results showed that 54.9 percent (39 people) in Yasuj, 59.7 percent (40 people) in Gachsaran and 60.9 percent (28 people) in Dehdasht evaluated the motivation to participate in continuing nursing education programs as medium.

The results of this study showed that in the area of program content; the participants stated that the content was highly consistent with their job needs. In the study conducted by Zahid Pasha and Canaani (1999) in the city of Babol, 68.1 percent of participants had the same views, which is consistent with the present study (11). Continuing nursing education programs can be part of manpower improvement plans if they are correct, principle and based on staff needs. Perhaps the coordination between continuing nursing education units and nursing offices has made continuing education programs to be compliance with the professional needs of nurses in Kohgiloyeh & Boyerahmad province. In this section, nurses expressed that retraining programs have been highly consistent with new science. This result is inconsistent with the study conducted by Salem Safi et al (2002) in Urmia because the results for GPs in Urmia showed that 77.6% evaluated program success in terms of providing new academic material at a low level (12). Using experienced professors and faculty members and using new and scientific resources have been effective in the success of this sector. Overall assessment of the content of continuing nursing education programs indicates that participants evaluated the content of programs as medium which is consistent with the study conducted by Mohammadi and Dadkhah in Ardebil. Also, participants in the Ardebil continuing nursing education programs have evaluated the content of programs as medium (13.)

In the area of program management; the correct way to hold programs is evaluated by participants as highly favorable, that is consistent with the study conducted by Sadeghi and Bakhshi (2009) in Rafsanjan. Also in Rafsanjan, 30.6% had favorable satisfaction and 69.4% were moderately satisfied and none of doctors in that study were dissatisfied with the quality of programs (14). In response to another question of this section, under the title of points allocated to each program, learners were highly satisfied about the scores assigned to each one-day program (5 points), which is consistent with the study by Yousefi and Rabii (2006) in Golestan province (15). In other studies, participants also wanted a 25-hour program to be divided into 5-hour programs

since this will increase the possibility of participating in programs. It seems that 5-point codified programs are more successful than 25-point codified programs in consolidating previous information and providing new scientific materials due to higher proficiency, presenting material in smaller volumes and in shorter times.

In the area of satisfaction of programs; learners were highly satisfied with the right time and place for holding training classes as well as timely and appropriate use of training devices. This result is consistent the study by Canaani et al (2002) in Yasuj (16). Given the holding time and training plan based on the needs of paramedics participating in these programs, these programs can increase motivation and productivity because according to the law of readiness in learning, attending night classes after work and lack of physical - mental preparation will lead to a severe drop in learning. This is associated with building and equipping conference halls in these three cities which have made good places for participants in retraining programs. Given that personnel retraining program is announced with earlier notice and a codified calendar in the Yasuj University of Medical Sciences, personnel can provide the necessary coordination, the time and place for holding continuing education programs in this province have been satisfactory, and the study results also indicate the same. About the appropriate use of educational tools in the programs implemented, comments have been highly favorable, but according to the study by Mohammadi and Dadkhah (2005) in Ardebil, 54.3 percent of nurses evaluated the way of using training tools as poor. About training on devices and equipments required in the clinical training, the satisfaction level of nurses in Kohkiloyeh & Boyerahmad province has been medium which is consistent with the study by Mohammadi and Dadkhah (2005) in Ardebil. 19.2 percent of Ardebilian nurses declared that the maintenance methods and principles of machinery and equipment are not taught. Also, 43.8 percent expressed that the operation methods of new equipment are not trained because some of continuing education programs require that operation methods of different devices to be trained first and even, for doing the right thing, it is necessary to add maintenance methods of devices and then theoretical and practical training (13). About scientific mastery, learners believed that the teachers' scientific mastery was high which is consistent with the study by Charkazi et al (2009) in Golestan, and the greatest satisfaction of continuing nursing education programs in Golestan is associated with the teachers' scientific mastery (17). In this regard, the cooperation of specialist physicians and faculty members in continuing education programs are notable which have made the participants more satisfied.

In the area of motivation, learners responded that their motivations were high for reconsidering the previous data and were medium for point gathering. This result is not consistent with the study by VahidShahi et al (2007) in the Mazandran University of Medical Sciences because in that study, 60% of respondents were motivated to participate in retraining by point gathering and 28% by consolidating previous information and obtaining new information (18). In the study by Charkazi et al (2009) in Golestan province, 55.5 percent of participants stated that their most important motivations for participating in continuing education programs are point gathering for employment promotion benefits (super special) and 21.2 percent stated reconsidering previous information. This result is not consistent with the present study (17). Also, in the study conducted by Salem Safi et al (2005) in the Urmia University of Medical Sciences, the point gathering section accounts for the highest percentage which is not consistent with the results of this study (12). However, participation in retraining programs is needed in order to achieve career promotions, many nurses like to get new information in relation to diseases, new devices and so on.

The majority of participants in the three cities stated that the best way for implementing continuing education programs is workshop, and the best method to implement continuing education programs is codified and in-person classes. Also, in the study conducted by Salem Safi et al, participants stated that the best way and method for implementing continuing education programs are workshops, codified and in-person classes. This result is consistent with the results of the present study. More than half of the participants in the three cities have also requested for self-taught through magazines, articles and books (12). As an effective method, online continuing education programs are expanding day by day. It seems that lack of easy access to the Internet among the medical community and lack of online continuing education in Iran have made this method the last priority. Of course, the academic skills that can be achieved with practice and experience are not possible through computers (19).

Overall Conclusion: generally, it is concluded that nurses' views on continuing education programs in Kohkiloyeh & Boyerahmad province in four areas of program content, program management, satisfaction of programs and motivation to participate in continuing education programs were medium, and the majority of nurses stated workshop and in-person methods as the best way for implementing such

programs, and requested for them. It seems that using the results of this study, the authorities of nursing education offices can take effective steps in the design, planning and quality improvement of continuing education programs that will lead to the increased quality of patient care which is the pillar of the nursing profession.

One of the limitations of this study is lack of cooperation of some nursing staff to participate in retraining programs; they could not devote much time to continuing education programs due to the large volume of work and staff shortage.

Suggestions: reducing the working hours of nurses, assigning certain days (a few days in month) to continuing education programs, qualitative and quantitative evaluation of the nurses performance, and involving these valuations in the promotion of nurses can be appropriate solutions for encouraging nurses to participate in continuing education programs. Additionally, it is suggested to do further research such as the present study on other medical staff and to determine and compare the effects of continuing education on them.

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# A New Efficient Fuzzy Wavelet Neural Network Based Imperialist Competitive Algorithm for Control of Nonlinear Industrial Processes

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**Abstract:** Among various control methods, artificial intelligence based control techniques, becomes one of the major control strategies and has received much attention as a powerful tool for the control of nonlinear systems. This paper presents a design of Fuzzy Wavelet Neural Network (FWNN) trained Imperialist Competitive Algorithm (FWN-ICA) for control of nonlinear industrial process. The FWNN is applied to approximate unknown dynamic of the system and ICA is employed to train and optimize the FWNN parameters. In the proposed control scheme, neural control system synthesis is performed in the closed-loop control system to provide appropriate control input. For this, the error between desired system output and output of control object is directly utilized to tune the network parameters. The controller is applied to a highly nonlinear industrial process of continues stirred tank reactor (CSTR). Simulation results show that the proposed FWNN-ICA controller has excellent dynamic response and adapt well to changes in reference trajectory and system parameters.
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**Keywords:** Fuzzy Wavelet neural network, Imperialist Competitive Algorithm, nonlinear CSTR.

## 1. Introduction

Fuzzy technology is an effective tool for dealing with complex, nonlinear processes characterizing with ill-defined and uncertainty factors. Fuzzy rules are based on expert knowledge. The constructing of knowledge base for some complicated processes is difficult. Thus, there are some methods for constructing of fuzzy rules [1, 2]. On the other hand, some characteristics of neural networks such as learning ability, generalization, and nonlinear mapping are used to deal with signal processing, control system, decision making, and so on. However, the main problem of neural networks is that they require a large number of neurons to deal with the complex problems. Moreover, they also result in slow convergence and convergence to a local minimum. In order to overcome these disadvantages, wavelet technology is integrated into neural networks [3].

Recently, based on the combination of feed-forward neural networks and wavelet decompositions, wavelet neural network (WNN) has received a lot of attention and has become a popular tool for function learning [4]. The main characteristic of WNN is that some kinds of wavelet function are used as the nonlinear transformation in the hidden layer of neural network, so time–frequency property of wavelet is incorporated into the learning ability of neural networks.

However, the main problem of WNN with fixed wavelet bases is the selection of wavelet frames because the dilation and translation parameters of wavelet basis are fixed and only the weights are adjustable. The appropriate wavelet transform will result in the accuracy of approximation. Therefore, there are several different methods proposed to solve the problems [5, 6].

The complexity and uncertainty of the system can be also reduced and handled by the concepts of fuzzy logic. The local details of non stationary signals can be analyzed by wavelet transforms. The approximation accuracy of the plant can be improved by the self-learning capabilities of neural networks. Therefore, there are many papers that discuss the synthesis of a fuzzy wavelet neural inference system for signal processing, control problems, identification and pattern recognition [3, 7, 8].

In recent years, Fuzzy Wavelet Neural Networks (FWNN) have become very popular and have been applied in many scientific and engineering research areas such as system identification, function approximation and control of nonlinear systems. This is due to its information processing characteristics such as nonlinearity, high parallelism, fault tolerance as well as capability to generalize and handle imprecise information [4].

The Continuous Stirred Tank Reactor system (CSTR) is a complex nonlinear chemical system that one of its states, reaction consistence, cannot be measured. Anyway, the value of the state is necessary for control, so state estimation is used [9]. In this paper, a FWNN combined with ICA (FWN-ICA) is used for identification and tracking control of

a nonlinear continuous stirred tank reactor (CSTR). The FWN is employed to estimate the value of the state and unknown dynamic of system. FWNN consist of a set of fuzzy rules that each rule corresponding to a sub-WNN consists of single scaling wavelets. The difficulties of selecting wavelets are reduced and orthogonal least-square (OLS) algorithm is used to determine the number of fuzzy rules and to purify the wavelets for each rule. Also, ICA is used to train and optimize the FWNN parameters. In the proposed control scheme the error between desired system output and output of control object is directly utilized to tune the network parameters. The capability and efficiency of the proposed method is illustrated by the temperature control of a nonlinear CSTR.

The paper is organized as follows. To make a proper background, the basic concepts of FWN and ICA are briefly explained in section II. In section III, the proposed FWN- ICA based controller and its learning algorithm are described. Section IV descried CSTR system. The results of the proposed approach on the simulation example are given in Section V and finally, some conclusions are dawn in Section VI.

## 2. Fuzzy Wavelet Network and Imperialist Competitive Algorithm

The basic concepts of FWN and ICA are briefly described in this section.

### 2.1. Fuzzy Wavelet Neural Network

A typical fuzzy wavelet neural network for approximating function $y$ can be described by a set of fuzzy rules such as follow [4]:

$R_i$ : If $x_1$ is $A_1^i$ and $x_2$ is $A_2^i$ and … and $x_q$ is $A_q^i$,

then

$$\hat{y}_i = \sum_{k=1}^{T_i} w_{M_i,t^k} \Psi_{M_i,t^k}^{(k)}(\underline{x}), \quad M_i \in z, t^k \in R^q, w_{M_i}^{t^k} \in R, x \in R^q \quad (1)$$

where $R_i$ is the ith rule, c is the number of fuzzy rules. $x_j$ and $\hat{y}_i$ are jth input variable of $\underline{x}$ and output of the local model for rule $R_i$, respectively. Also $M_i$ is dilation parameter and $T_i$ is the total number of wavelets for the ith rule. $t^k = [t_1^k, t_2^k, ..., t_q^k]$, where $t_j^k$ denotes the translation value of corresponding wavelet k. Finally, $A_i^j$ is the fuzzy set characterized by the following Gaussian-type membership function.

$$A_j^i(x_j) = e^{-((\frac{(x_j - p_{j1}^i)}{p_{j2}^i})^2)^{p_{j3}^i/2}} \quad (2)$$

$p_{j1}^i$ , $p_{j2}^i \in R$ and $p_{j3}^i = 2$ where $p_{j1}^i$ represents the center of membership function, $p_{j2}^i$ and $p_{j3}^i$ determine the width and the shape of membership function, respectively. Wavelets $\psi_{M_i,t^k}^{(k)}(\underline{x})$ are expressed by the tensor product of 1-D wavelet functions:

$$\psi_{M_i,t}^{(k)}(\underline{x}) = 2^{\frac{M_i}{2}} \psi^{(k)}(2^{M_i}\underline{x} - \underline{t}^k) = \prod_{j=1}^{q} 2^{\frac{M_i}{2}} \psi^{(k)}(2^{M_i} x_j - t_j^k) \quad (3)$$

By applying fuzzy inference mechanism and let $\hat{y}_i$ be the output of each sub-WNN, the output of FWN for function $y(\underline{x})$ is as follow:

$$\hat{y}_{FWN}(\underline{x}) = \sum_{i=1}^{c} \hat{\mu}_i(\underline{x}) \hat{y}_i \quad (4)$$

where $\hat{\mu}_i(\underline{x}) = \mu_i(x) / \sum_{i=1}^{c} \mu_i(x)$ , $\hat{\mu}_i(x) = \prod_{j=1}^{q} A_j^i(x_j)$

and for current input $\underline{x}$ and each function, satisfies $0 \le \hat{\mu}_i \le 1$ and $\sum_{i=1}^{c} \hat{\mu}_i = 1$ . Also $\hat{\mu}_i(x)$ determines the contribution degree of the output of the wavelet based model with resolution level $M_i$ .

A good initialization of wavelet neural networks leads to fast convergence. Numbers of methods are implemented for initializing wavelets, such as Orthogonal Least Square (OLS) procedure and clustering method [11]. In this paper the OLS algorithm is used to select important wavelets and to determine the number of fuzzy rules and network dimension. More details about construction of FWNN and network parameter initialization can be found in [4]. Also, details of OLS algorithm can be found in [10].The structure of applied FWNN is shown in Fig.1.

Furthermore, it is important to adjust the required network parameters in the design of dynamic systems. In order to avoid trial-and-error, a self-tuning process is used by employing the ICA to determine significant parameters such as dilation, translation, weights, and membership functions. In other words, during the learning process, these network parameters are optimized using ICA. To make a proper background, the concept of ICA is given in the next subsection.

### 2.2. Imperialist Competitive Algorithm

Imperialist competitive algorithm (ICA) is a new evolutionary optimization algorithm inspired by the socio-political process of imperialistic competition. Compared with the conventional evolutionary optimization algorithms, ICA has proven its superior capabilities, such as faster

convergence and better global minimum achievement [12]. Flowchart of the ICA is illustrated in Fig. 2.

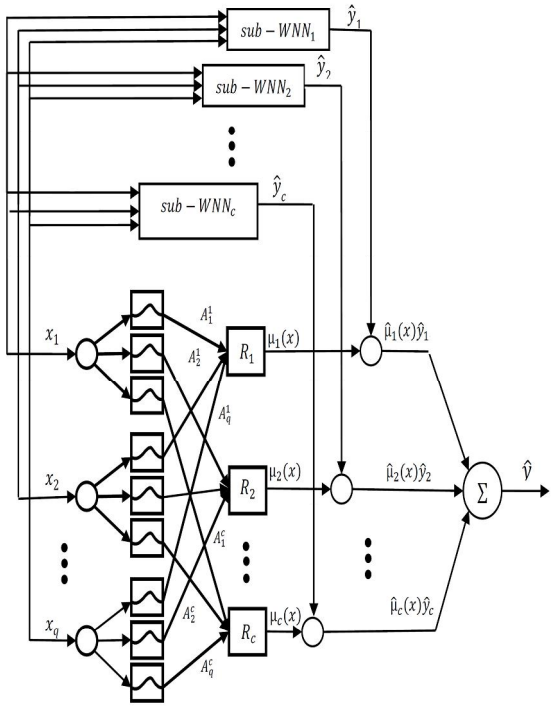


Figure 1. Structure of FWNN [4].

Similar to other evolutionary algorithms, this algorithm begins with an initial population. Each individual of the population is called a country. Some of the best countries (countries with the best fitness value) are selected to be the imperialist states and the rest form the colonies of these imperialists. Based on the imperialists' power, each country is distributed to their states. The power of an empire is proportional to its fitness value.

After creating initial empires, their colonies begin moving toward the relevant imperialist country. This movement is a simple model of assimilation policy that was pursued by some imperialist states [13]. Fig. 3 shows the movement of a colony towards the imperialist.

In this movement, θ and $x$ are random numbers with uniform distribution as shown in (5), (6) and $d$ is the distance between colony and the imperialist.

$$x \sim U(0, \lambda \times d) \quad (5)$$

$$\theta \sim U(-\gamma, \gamma) \quad (6)$$

where $\lambda$ and $\gamma$ are arbitrary numbers that modify the area that colonies randomly search around the imperialist.

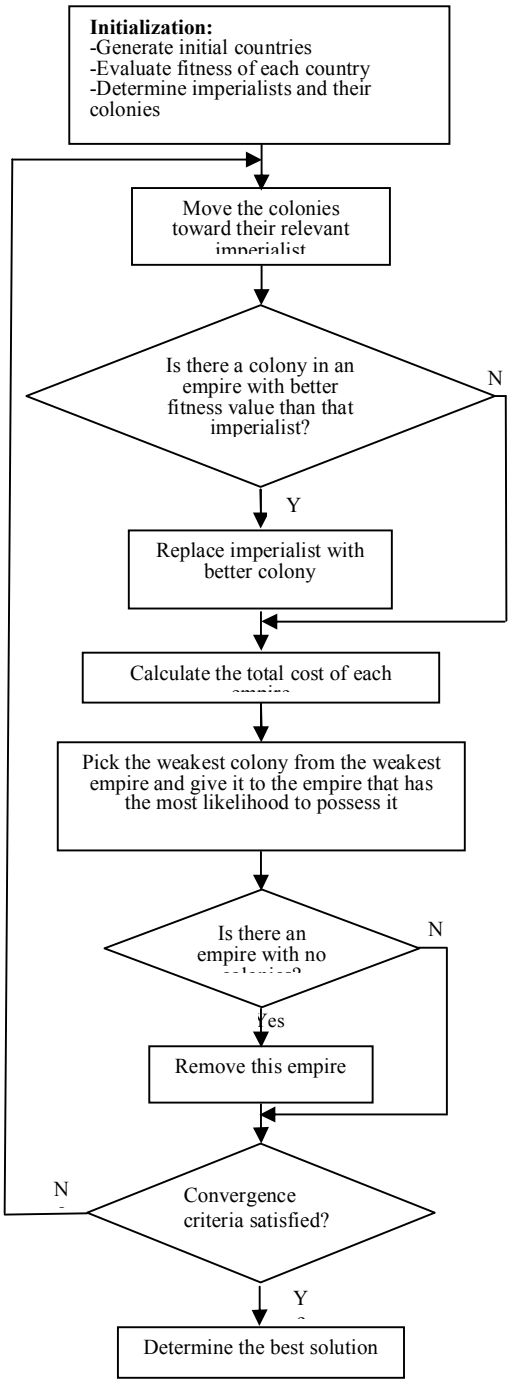


Figure 2. General principle of the ICA

The power of an imperialist country and its colonies represents the total power of an empire. In this algorithm, the total power of an empire is calculated by the power of imperialist state plus a percentage of the mean power of its colonies. In imperialistic competition, every empire tries to take possession of colonies of other empires and control them. As a result, a gradually decrease in the power

of weaker empires and therefore increase in the power of more powerful ones will happen.

This competition is done by picking some (usually one) of the weakest colonies of the weakest empires and making a competition among all empires to possess them (that) colonies. In this competition, each of empires will have a likelihood of taking possession of the mentioned colonies, based on their total power. The more powerful an empire, the more likely it will possess these colonies. In other words, the possession probability of the colonies depends on the power of the empires trying to possess them. Any empire that is not able to succeed in imperialist competition and cannot increase its power (or at least prevent decreasing its power) will be eliminated. The imperialistic competition will gradually result in an increase in the power of great empires and a decrease in the power of weaker ones. The power of weak empires will gradually loose and ultimately they will collapse.

The above procedures cause that all the countries converge to a state in which there exist just one empire in the world and all the other countries are its colonies.

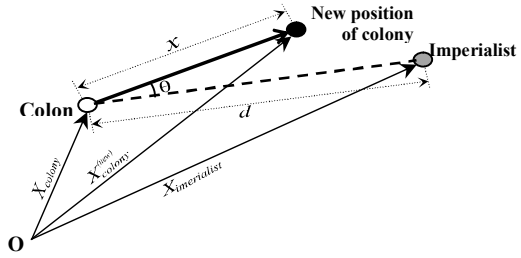


Figure 3. Motion of colonies toward their relevant imperialist

## 3. Proposed Control Scheme

The FWNN and its learning algorithm are used for identification and control of nonlinear CSTR system. Following, the architecture of proposed control strategy and its optimization method based on ICA are described in subsections A and B, respectively.

### 3.1. Architecture of Proposed FWNN-ICA controller

The structure of control system is given in Fig. 4. As can be seen, in this diagram FWNN is utilized as a controller and identifier.

The control scheme consists of the FWNN plant model, FWNN controller and the optimization block. Where $r(t)$ is desired output and $y(t)$ is the output of control system. In the proposed control strategy, neural control system synthesis is performed in the closed-loop control system and $e(t)$ is used for tuning network weighs to provide appropriate control input. By minimizing a quadratic measure of the error between desired system output and the output of control object, i.e. $e(t)$, the design problem can be characterized by the ICA formulation. On the other hand, the ICA is used to correct the network parameters for adjusting of FWNN controller and identifier in real time operation.

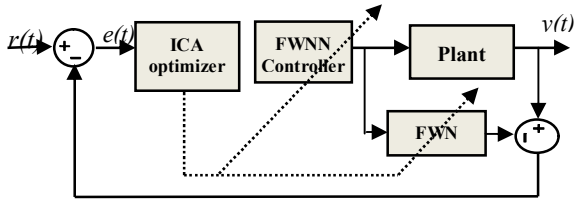


Figure 4. Proposed FWNN-ICA control scheme.

### 3.2. FWNN Training

In the learning step, the FWNN parameters are calculated by minimizing a fitness function that using the difference between the desired and real output as follow:

$$E_k = \sum_{l=1}^{H} \left| \hat{y}_{RNN_k}(x(l)) - y(l) \right|^2 \quad (7)$$

and, the *Kth country* is represented as

$$F_N = [p_{j1}^{iN} p_{j2}^{iN} \underline{t}^{kN} w_{M_i}^{N}] \quad (8)$$

which are all free design parameters that to be updated by ICA in our FWNN model. $H$ is number of network training data. According to Fig. 1, the output is measured in each iteration and will be given to the ICA optimizer after being compared to the reference. Then the solution vector is obtained by ICA by minimizing the fitness function which gives the FWNN parameters. By using the obtained parameters, the network output is calculated and applied to system followed by calculating the new output. The procedure continues until a termination criterion is met. The termination criterion could be the number of iterations, or when a solution of minimal fitness is found.

Equation (8) shows that the free parameters to be trained in FWNN are $[p_{j1}^{iN} p_{j2}^{iN} \underline{t}^{kN} w_{M_i}^{N}]$. Our task is to design the FWNN structure such that the error between output and reference is minimized. Therefore ICA is applied for tuning parameters of FWNN by optimizing the (7) objective or cost function. Where $E_N$ is the fitness of $N$th chromosome. In the ICA, each population is a solution to the problem which determines the parameters of FWNN, i.e. $[p_{j1}^{iN} p_{j2}^{iN} \underline{t}^{kN} w_{M_i}^{N}]$.

## 4. The Continuous Stirred Tank Reactor system

Continuous stirred tank reactor (CSTR) is a highly nonlinear process. A schematic of the CSTR

system is shown in Fig.5. The process model consists of two nonlinear ordinary differential equations [14]:

$$\frac{dC_A}{dt} = \frac{Q}{V}(C_{Af} - C_A) - k_0 \exp(\frac{-E_a}{RT})C_A$$
$$\frac{dT}{dt} = \frac{Q}{V}(T_f - T) - \frac{H_r}{\rho c_p V} k_0 \exp(\frac{-E_a}{RT})C_A + \frac{UA}{\rho c_p}(T_j - T) \quad (9)$$
$$\frac{dT_j}{dt} = \frac{UA}{\rho c_p V_j}(T - T_j) + \frac{u}{V_j}(T_{jf} - T_j)$$

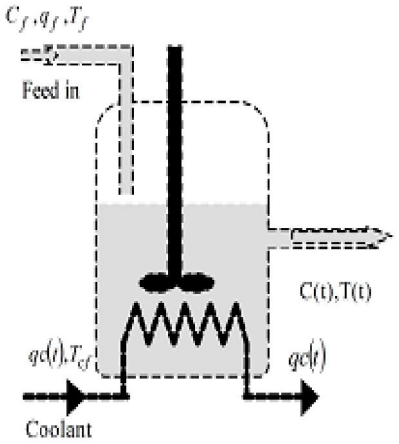


Figure 5. CSTR plant model

where the x = [x1; x2; x3] state-variables of the model are the CA (mol/m3) concentration of the A component in the reactor, the T (oC) reactor temperature, and the Tj (oC) temperature of the jackect of the reactor, while the input of the process is the u [m3/min] flow rate of the cooling material. The controlled output y of the process is the reactor temperature, y = x2. The parameters and its nominal values of the model are given in Table 1. Details of the system data and its properties are given in [15].

**5. Simulation Study**

In the first stage, we should generate input-output data for obtaining the FWNN model of the process (Fig. 4). The training data was generated by closed-loop experiment and the proposed approach in section III is used to train the model. Fig. 6 shows the obtained training data set.

The combined servo and regulatory control problem was defined between two unstable operating points: 70 0C - 80 0C. The coolant feed temperature changed from 10 0C to 20 0C at t = 10 h what was the unmeasured disturbance. In the ICA, each country represents a candidate solution for the problem. In the initialization step, a set of countries are generated randomly where *n* is set to be 200. The numbers of *imperialist states* is set to be 20 and thus, 180 *colonies* will be existed. Based on the author's previous experience λ and γ are set to 2 and 0.5 (radian), respectively. The number of iterations is considered to be 200, which is the stopping criteria used in other methods available in the literature. Fig. 7 shows the model's output and the real output. From Fig. 7 can see that performances of the controllers are good, and the FWNN controller based on ICA achieved good dynamic performance.

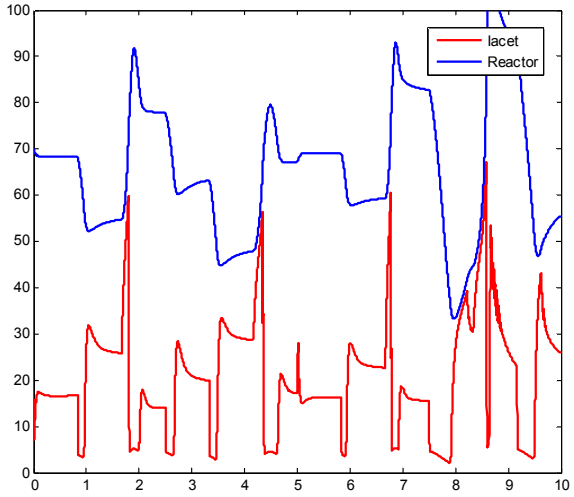


Figure 6. Traning date

Table 1. Nominal values of the model parameters

| Notation | Description | Value and unit |
|---|---|---|
| $Q$ | Feed flowrate | 0.2 $m^3$/min |
| $V$ | Reactor volume | 2 $m^3$ |
| $K_0$ | Reaction rate coefficient | 3.5 . $10^6$ 1/min |
| $E_a$ | Activation energy | 49.884 kJ/mol |
| $R$ | Ideal gas constant | 8.314 . $10^{-3}$ kJ/mol $^oC$ |
| $H_r$ | Heat of reaction | 500 kJ/mol |
| $C_{Af}$ | Concentration of A in feed | 1000 mol/$m^3$ |
| $T_f$ | Feed temperature | 30 $^oC$ |
| $\rho$ | Density of solution | 1000 kg/$m^3$ |
| $c_p$ | Heat capacity of solution | 4.2 kJ/kg $^oC$ |
| $UA$ | Heat transfer coefficient | 252 kJ/min $^oC$ |
| $V_j$ | Jacket volume | 0.4 $m^3$ |
| $T_{jf}$ | Inlet temperature of coolant | 10 $^oC$ |

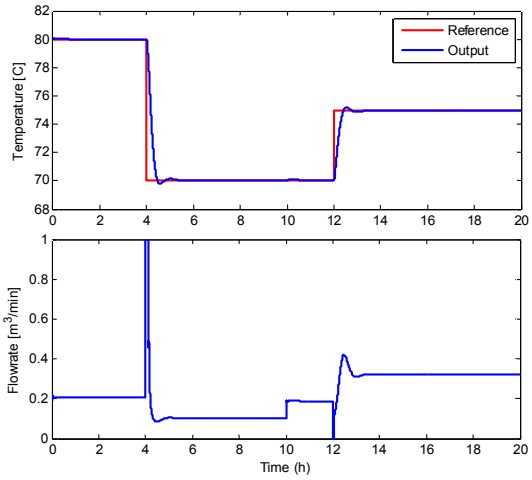


Figure 7. Model's output and real output

## 6. Conclusion

This paper presented the development and evaluation of an FWNN based ICA controller. The controller was designed to control the temperature of a CSTR. The nonlinear plant identification was done on-line using the ICA for quick learning. With this method any changes in the parameters of the system could be detected and remedial functions can be done. Simulation results show good dynamic performance of the proposed FWNN-ICA controller.

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11/24/2012

# Obstacles to Clinical Education from the Viewpoint of Nursing Students of Yasuj University of Medical Sciences

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**Abstract:** Clinical education takes up half of the time nursing students spend over the academic courses of study. In fact, clinical education can be considered a series of activities to facilitate learning in a clinical environment, purpose of which is to create measurable changes in students as to enable them to carry out clinical care. Selected in the present descriptive research were 108 nursing students who had passed at least an internship semester. The survey sheet designed here contains questions regarding personal information and the current obstacles to learning clinical skills in four aspects: trainer, environment, educational program, and student. After having the questionnaires filled out, data were collected in order to be analyzed by the statistical software SPSS 17. As viewed by this group of students, the most important obstacles to clinical learning were un clarified educational goals (85.9%), failure of the students to maintain hospital disciplines (62.1%), unsuitability of working hours (66.6%), poor communication between students and nursing staff (77.8%), presence of visitors at hospital during the educational practices (61.2%) undetermined duties and obligations of interns (50%), lack of practical test to take at work (52.8%), unsuitability of the hours assigned for clinical education (50%), unfamiliarity of students to the laws and regulations in clinical education (48.1%). There are significant obstacles felt in the four aspects of clinical education, all of which could influence the practical skills of nursing students. Therefore, it seems necessary for educational authorities and trainers to pay more attention to the issue and take useful actions in order to create a desirable clinical learning environment.

[Masood Moghimi, Khierollah Nooryan, Zohera Karimi, Sima Mohammad Hossini, Mohsen Salari, Ardashir Afrasiabifar, Mohammadali Moghimi, Hasan Abidi, Ebrahim Momeni, Mohammad reza Rabani, Mahintaj Gohargani. **Obstacles to Clinical Education from the Viewpoint of Nursing Students of Yasuj University of Medical Sciences.** *Life Sci J* 2012;9(4):5222-5225] (ISSN:1097-8135). http://www.lifesciencesite.com 776

**Keywords:** clinical education, nursing students, learning obstacle

## 1. Introduction

The purpose of clinical education is to cause critical and creative thinking, self-directed learning, improve mental-physical skills, time management ability and boosting self-confidence, building appropriate relationships, and prevent them from being passive (1). Clinical education is a dynamic process through which students gradually become experienced by attending patients in hospital bedrooms, and eventually put what they have acquired into practice by interaction with trainers and environment( 2). Certainly, the major stage of training nursing students takes place in actual clinical environments (3). Having theoretical knowledge alone is not enough for nursing care, but applying clinical skills along with the gained knowledge is essential. Furthermore, Clinical education makes up one of the fundamental components of nursing academic curriculum (4), and has been recognized as the heart of nursing education and also as the evolving phase of professional maturity (5). Mastering the basic skills of nursing and becoming an “expert” in the medical community depends on the quality of education in a clinical environment (6). Hence, clinical internship courses play a crucial role in forming the professional personality of students. In fact, clinical education builds the foundation of academic curriculum in nursing studies; that is, the more productive the clinical education becomes, the

faster the field of nursing advances (7). Two points should be regarded as highly important; the remarkable effect of clinical education on developing the basic skills and professional abilities of nursing and midwifery students, and the initial step taken toward improving the quality of this course of study which would lead to identifying the problems and barriers to clinical education as viewed by students themselves, who are going through the process of training (8). Accordingly, the present research has been conducted to find out the obstacles to clinical education as viewed by nursing students at Yasuj University of Medical Sciences, final results of which would be evaluated by educational programmers who could make great effort to improve the clinical skills of nursing students by reorganizing the current clinical courses.

**2. Literature review**

In the research done by Rahimi and Ahmadi (2005) at Tehran University of Medical Sciences, the quality of clinical education regarding the working environment and educational facilities were reported by trainers to be average, while other related conditions were complained about as poor. The lack of enthusiasm and motivation in students at working environment was mentioned as the most challenging obstacle to clinical education, which then invited policy-makers and academic programmers to arrange suitable nursing courses for clinical studies, as the best solution available to recuperate the current situation (9).

In another research done by Abedini and colleagues (2006-2007) at Hormozgan University of Medical Sciences, the most important problems of clinical education as viewed by students were insufficient facilities (71.2%), lack of suitable workplace for internship (39%), inadequacy of training aids to be employed in clinical environment (37.3%), lack of facilities and resources in educational centers (35.6%), and finally, lack of experienced and proficient trainers in clinical environments (35.6%) (10).

3. **Methodology**

The present research has been conducted descriptively in 2009. The examined population was nursing students who were required to have at least one course of clinical education passed in their studies. Sampling was done as a census covering the whole population to be surveyed. The questionnaire, data collection instrument, was designed based on scientific instructions and consultations with several university professors and undergraduates. Every sheet consisted of questions regarding personal information (age, sex, degree, etc.), as well as questions regarding the troublesome obstacles to learning clinical skills, divided into four sections; trainer, environment, educational program, and student, responses of which were scored according to a 5-point Likert model ranging from the highest item “strongly agree” to the lowest “strongly disagree”. Content validity of the questionnaire was confirmed by expert opinions, and its reliability was assessed through a pilot experiment, surveying 10 students at 10-day intervals (r=0.81). Having met the correspondents in person upon their permission, interviewers explained the goals, terms and conditions of participation in the study, and also giving students the right to withdraw if not interested. Next, the survey sheets were handed out to sample students to fill in. Finally, all the obtained data were gathered to be described by statistical parameters and analyzed by independent T-test. Furthermore, SPSS 17 was used as statistical software in order to analyze the data.

**4. Results and Discussion**

According to the obtained results, the majority of samples under study (79.6%) were female whose age ranged from 20 to 27 years old and were averagely 22.37±1.45. Moreover, 90.7 percent of the students were Bachelors of Science. The final results regarding the influential obstacles a trainer faces to carry out clinical skills education includes: un clarified educational goals to be pursued in the beginning of internship (85.9%), insufficient experience and proficiency of trainers (23.9%), unfamiliarity of trainers with modern methods of clinical education (60.2%), poorly supported students in clinical environments (32.2%), frustrating effect of trainers on students’ career prospects (25.9%), unnecessary jobs assigned to students (25%), lack of appropriate evaluation criteria (13.9%), poor communication between trainer and student (29.6%), lack of practical test to be taken at workplace (52.8%), absence of the trainer in urgently needed hours (60.2%). The opinions of students concerning the challenges to learning clinical skills and the obstacles felt in environment and facilities have been illustrated in table 1, followed by table 2 showing the obstacles felt by students. As to the aspect of education program, several challenges were stated: poor communication between students and nursing staff (62.1%), failure of students in maintaining disciplines (77.8%), practicing clinical examinations without the help of a trainer (36.1%), resorting to the routine activities of workplace (42.6%), unfamiliarity of students to the laws and regulations in clinical education.

Clinical education can be defined as a series of activities to facilitate learning in a clinical environment in which trainer and student are equally engaged. Purpose of such a program is to create measurable.

Changes in students. Accordingly, the present research has been conducted to identify the obstacles to clinical education from the viewpoint of nursing

students of Yasuj University of Medical Sciences. The final results indicated that the most challenging obstacles a trainer may face to carry out clinical skills education are un clarified educational goals to be pursued in the beginning of internship and unfamiliarity of trainers with modern methods of clinical education, both of which are consistent with the research done on Tehran's nursing schools by Rahimi and Ahmadi (2005) (9). However, lack of practical test to be taken at workplace and absence of the trainer in urgently needed hours is two other obstacles to clinical education at Yasuj University of Medical Sciences, none of which have been mentioned in the compared research. The most challenging obstacles regarding the working environment and facilities were undetermined duties and obligations of interns, which is consistent with the results obtained by Abedini and colleagues (2006-2007) at Hormozgan University of Medical Sciences (10). Undetermined duties and obligations of interns is the same problem reported in the study done by Zeighami (2008) at Shiraz Nursing and Midwifery School (11). Therefore, determining the duties and obligations of interns not only plays an effective role in learning, but it also leads to proper reactions and attitude of nursing staff towards students. Unsuitability of the hours assigned for clinical education was another obstacle which here refers to afternoon shifts that provide very little training field. Unsuitability of the time schedule for internship was yet another obstacle stated by students, which is consistent with the research done by Rahimi and Ahmadi (2005) in Tehran (9). Seen from the students' viewpoint, the obtained results regarding the influence of obstacles on clinical skills education showed the most challenging problem was crowded workplaces with too many students, which is consistent with the research done by Omidvar and colleagues (2003) at Babol University of Medical Sciences (12).

Table 1: Frequency distribution of positive responses from nursing students regarding the hindering influence of working environment and facilities on learning clinical skills

| Obstacles | Positive responses (I agree) | |
|---|---|---|
| | Frequency | Percentage |
| | | |
| Undetermined duties and obligations of interns | 54 | 50 |
| Unsuitability of the hours assigned for clinical education | 64 | 50 |
| Unsuitability of the time schedule for internship | 72 | 66.6 |
| Unsuitability of practical programs and courses | 39 | 36.1 |
| Interference between the working schedule of interns with that of Ph.D. students | 44 | 40.7 |
| Little attention paid to clinical skills in practice | 20 | 18.5 |
| Inconsistency of clinical education with the regular schedule | 35 | 33.4 |
| Non-standard courses of study designed for clinical education | 50 | 46.3 |

Table 2: Frequency distribution of positive responses from nursing students regarding the obstacles to learning clinical skills

| Obstacles | Positive responses (I agree) | |
|---|---|---|
| | Frequency | Percentage |
| Unsuitability of working environments an facilities | 28 | 25 |
| Discrimination between nursing students and those in other majors | 27 | 25 |
| Crowded workplaces with too many students | 88 | 81.5 |
| Improper communication among physicians, nursing staff and students | 27 | 24 |
| Presence of people who come to visit or accompany patients during clinical training | 66 | 61.2 |
| Lack of job security when treating patients or carrying out medical procedures | 23 | 21.3 |
| Inconsistency of theoretical knowledge with practical experiences | 31 | 28.7 |
| Lack of appropriate educational facilities for students in clinical environment | 29 | 26.8 |

Furthermore, students have complained that presence of people who come to visit or accompany patients during clinical training is another obstacle which has not been mentioned in other studies. With regard to educational programs, the most important obstacle is improper communication between trainer

and students, which is in contrary with the results obtained by Ghods-Bin and Shafah-Khah (2004) at Shiraz Nursing and Midwifery School. In their research, the majority of samples were happy about the communication between trainer and students. The ability to properly communicate and guide students is one of the greatest characteristics of a successful trainer, which can facilitate the process of learning and ultimately bring about satisfaction to students. Moreover, poor communication between students and nursing staff was another obstacle which is consistent with the research done by Ghods-Bin and Shafah-Khah (2004) in Shiraz (13). In his research, Cheraghi (1998) also obtained similar results at Hamedan University, where midwifery students complained that nursing and paramedics' staff barely cooperated with them at work (14). In the study done by Ghiyasvand (2004) in Tehran, 63 percent of students complained about non-cooperation of nursing staff and improper behavior of personnel and even dissatisfaction with internship courses (15). Hence, it seems necessary to create a sense of responsibility and motivation in the medical and nursing staff as to better dealing with interns, because the collaborative function of nurses in clinical education will eventually help students acquire professional skills over internship courses.

**5. Conclusion**

There are significant obstacles felt in the four aspects of clinical education, all of which could influence the practical skills of nursing students. Therefore, it seems necessary for educational authorities and trainers to pay more attention to the issue and take useful actions in order to create a desirable clinical learning environment.

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# An Enhanced Solution of the Universal Lambert's Problem

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**Abstract:** In this paper, an iterative method of arbitrary order of convergence $(p \geq 2)$ is developed for solving the universal Lambert's problem using homotopy continuation technique. The method does not need any priori knowledge of the initial guess, a property which avoids the critical situation between divergent to very slow convergent solution, that may exist in the application of other numerical methods depending on initial guess. Computational algorithms and numerical applications will b e applied for some orbits.
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**Keywords:** Lambert's Problem; Boundary value problem; orbit determination; Homotopy continuation method.

## 1. Introduction

The basic problems of space dynamics are initial and boundary value problem. In the present paper we shall consider the second one which is known as Lambert's problem.

Lambert's problem was studied in **Escobal 1965, Herrick 1971 and Battin 1964**. Also, in **1969 Lancaster and Blanchard** and **Mansfield 1989** established a unified forms of Lambert's Problem. In **1990, Gooding** developed a procedure for the solution. Recently, an algorithm was developed for Batten's method of the universal Lambert's Problem **(Alshaary 2008).**

The independent variables used in Lambert's Problem satisfied transcendental equation, which is usually solved by iterative methods, which in turn need: (1) initial guess, (2) an iterative scheme. In fact, these two points are not separated from each other, but there is a full agreement that even accurate iterative schemes are extremely sensitive to the initial guess. Moreover, in many cases the initial guess may led to drastic situation between divergent and very slow convergent solutions (**Sharaf et al. 2007).** In the field of the numerical analysis, very powerful techniques have been devoted**(Allgower and George 1990)** to solve transcendental equations without any priori knowledge of initial guess these techniques are known as homotopy continuation methods, this technique has been used in initial value problem leading to encouraging results (**Alshaary 2003).**

In this paper, an iterative method of arbitrary order of convergence $(p \geq 2)$ is developed for solving the universal Lambert's problem using homotopy continuation technique. The method does not need any priori knowledge of the initial guess, a property which avoids the critical situation between divergent to very slow convergent solutions that may exist in the application of other numerical methods depending on initial guess. Computational algorithms and numerical applications will be applied for some orbits.

## 2. Mathematical Modelling

### 2.1 Basic equation of Lambert's problem

In Lambert's problem, two positions vectors $r_1 \equiv (x_1, y_1, z_1)$ ; $r_2 \equiv (x_2, y_2, z_2)$ and the time interval between them $\Delta t$ which assumed positive are given and its required to find the orbit passing through the two points. Then the quantities of Lambert's problem are; the lengths of the position vectors $|r_1|$ , $|r_2|$ and the chord c between the two points, where

$$r_1 = |\boldsymbol{r_1}| = (x_1^2 + y_1^2 + z_1^2)^{\frac{1}{2}},$$
$$r_2 = |\boldsymbol{r_2}| = (x_2^2 + y_2^2 + z_2^2)^{\frac{1}{2}},$$
$$c = |\boldsymbol{r_2} - \boldsymbol{r_1}|$$
$$= \{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2\}^{\frac{1}{2}}$$

and the related quantities:

$$\lambda_1^2 = r_1 + r_2 + c; \quad \lambda_2^2 = r_1 + r_2 - c.$$

The basic equation of the universal Lambert's theorem could be written as **(Vallado and Mcclain 2007).**

$$L(z) = C_1 Q_1(z) + C_2 Q_2(z) - \frac{2}{3} C_3 z^{-\frac{3}{2}} - \Delta t = 0, \quad (1)$$

where $z = \frac{1}{a}$ [a is the semi-major axis of the orbit connecting the two points] and Q′s are given in terms of the hypergeometric function as:

$$Q_i(z) = F\left(\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{z\lambda_1^2}{4}\right); \; i = 1,2 , \quad (2)$$

$$C_1 = \pm\frac{\lambda_1^3}{6K}, \; C_2 = \pm\frac{\lambda_2^3}{6K}, \; K = \sqrt{\mu}, \quad (3)$$

where μ is the gravitational parameter and the upper or lower sign is chosen depending on whether the orbital segment does not (case 1) or does (case 2) respectively include the attracting focus, while

$$C_3 = \begin{cases} 0 & \text{for case1} \\ \frac{-3\pi}{K} & \text{forcase2} \end{cases} \quad (4)$$

**2.2 One-point iteration formulae**

Let $Y(x) = 0$ such that $Y: R \to R$ smooth map and has a solution $x = \xi$ (say). To construct iterative schemes for solving this equation, will state some basic definition:

1. The error in the $k^{th}$ iterate is defined as
$$\varepsilon_k = \xi - x_k .$$
2. If the sequence $\{x_k\}$ converges to $x = \xi$, then
$$\lim_{k\to\infty} x_k = \xi . \quad (5)$$
3. If there exists a real number $p \geq 1$ such that
$$\lim_{i\to\infty} \frac{|x_{i+1}-\xi|}{|x_i-\xi|^p} = \lim_{i\to\infty} \frac{|\varepsilon_{i+1}|}{|\varepsilon_i|^p} = L \neq 0. \quad (6)$$
The iterative scheme is of order $p$ at $\xi$. The constant L is called a asymptotic error constant. For $p = 1$, the convergence is linear; for $p = 2$, the convergence is quadratic; $p = 3, 4, 5$ the convergence is cubic, quadratic and quintic, respectively.
4. We shall consider only stationary one-point iteration formulae which has the form
$$x_{i+1} = R(x_i), \quad i = 0, 1, \ldots \quad (7)$$
5. The order of one point iteration formulae could be determine either from: (a) The Taylor series of the iteration function $R(x_n)$ about $\xi$ **(Ralston and Rabinowitz 1978)** or from, (b) The Taylor series of the function $Y(x_{k+1})$ about $x_k$ **(Danby and Burkard 1983).**
By the last approach (b), it is easy to form a class of iterative formulae containing members of all integral orders **(Sharaf and Sharaf 1998)** to solve $Y(x) = 0$ as
$$x_{i+1} = x_i + \sigma_{i,m+2}\,; \quad i = 0,1,2,\ldots \; m = 0, 1, 2, \ldots, \quad (8)$$
where`
$$\delta_{i,m+2} = \frac{-Y_i}{\sum_{j=1}^{m+1}\left(\delta_{i,m+1}\right)^{j-1} Y_i^{(j)}/j!};$$
$$\delta_{i,1} = 1; \ \forall i \geq 0, \quad (9)$$
$$Y_i^{(j)} = \frac{d^j Y(x)}{dx^j}\Big|_{x=x_i}; \quad Y_i \equiv Y_i^{(0)}. \quad (10)$$

The convergence order is $m + 2$, and given as
$$\epsilon_{i+1} = -\frac{1}{(m+2)!}\,\frac{Y(\xi)^{(m+2)}}{Y_i^{(1)}(\xi_1)}\,\epsilon_i^{m+2}, \quad (11)$$
where $\xi$ between $x_{i+1}$ and $x_i$ and $\xi_1$ between $x_{i+1}$ and $\xi$.

**2.3 Homotopy continuation method for solving $Y(x) = 0$**

Suppose one wishes to obtain a solution of a single non-linear equation in one variable x (say)
$$Y(x) = 0, \quad (12)$$
where $Y: R \to R$ is a mapping which, for our application assumed to be smooth, that is , a map has as many continuous derivatives as requires. Let us consider the situation in which no priori knowledge concerning the zero point of Y is available. Since we assume that such a priori knowledge is not available, then any of the iterative methods will often fail to calculate the zero $\bar{x}$ , because poor starting value is likely to be chosen. As a possible remedy, one defines a homotopy or deformation $H: R \times R \to R$ such that
$$H(x, 1) = Q(x); \ H(x, 0) = Y(x),$$
where $Q: R \to R$ is a (trivial) smooth map having known zero point and H is also smooth. Typically, one may choose a convex
$$H(x, \lambda) = \lambda\, Q(x) + (1 - \lambda)\, Y(x), \quad (13)$$
and attempt to trace an implicity defined curve $\Phi(z) \in H^{-1}(0)$ from a starting point $(x_1, 1)$ to a solution point $(\bar{x}, 0)$. If this succeeds, then a zero point $\bar{x}$ of Y is obtained. The curve $\Phi(z) \in H^{-1}(0)$ can be traced numerically if it is parameterized with respect to the parameter $\lambda$, then the classical embedding methods can be applied **( Allgower and George 1990).**

**3. Computational Developments**

**3.1 Recurrence formulae for the nth. derivative of $L(z)$**

For the iterative formulae of Equation (1), we establish for the nth derivative of L(z) the following recurrence formula:
$$2zL^{(n+1)}(z) = 3C_1 G_1^{(n)}(z) + 3C_2 G_2^{(n)}(z) - (2n + 3)L^{(n)}, \quad (14)$$
where the $G's$ functions satisfy the recurrence formulae:
$$G_i^{(n)}(z) = 0.125(2n - 1)\lambda_i^2 \left(G_i^{(0)}(z)\right)^2 G_i^{(n-1)}(z);$$
$$i = 1,2; \ m = 1,2, \ldots, k, \ G_i^{(0)}(z) = \left(1 - \frac{z\lambda_i^2}{4}\right)^{\frac{-1}{2}}. \quad (15)$$

**3.2 Computational Algorithms**

Two algorithms are established in this section:

- The first one is for tracing the curve $\Phi(z) \in H^{-1}(0)$ from $\lambda = 1$ to $\lambda = 0$.
- The second one is for solving the basic equation of universal Lambert problem (1).

**3.2.1 Computational Algorithm 1**

- **Purpose:** To solve $Y(x) = 0$ by embedding method.
- **Input:** (1) The function Q(x) with defined root $x_1$ such that $H(x_1, 1) = 0$
(2) Positive integer m.
- **Output:** Solution x of $Y(x) = 0$.
- **Computational Sequence:**
1. Set $x = x_1, \ \lambda = (m - 1)/m, \ \Delta\lambda = 1/m$

2. For $i = 1$ to $m$ do
Begin
Solve $H(y,\lambda) = \lambda\, Q(y) + (1-\lambda)\, Y(y) = 0$, iteratively for using $x$ as starting value
$x = y; \quad \lambda = \lambda - \Delta\lambda.$
End.

### 3.2.2 Computational Algorithm 2

- **Purpose:** To solve the basic equation of Lambert's theorem by iterative schemes of quadratic up to l th convergence orders without priori knowledge of the initial guess using homotopy continuation method with $Q(z) = z + 1$.
- **Input:** $r_1, r_2, c, \Delta t, l, m$ (positive integer), Tol (specified tolerance), $\mu$.
- **Output:** The solution z of the basic equation of the universal Lambert's theorem.
- **Computational steps:**

1. Set $z = -1;\ \Delta\lambda = \frac{1}{m};\ \lambda = 1 - \Delta\lambda;$
$\lambda_1 = \sqrt{r_1 + r_2 + c};\ \lambda_2 = \sqrt{r_1 + r_2 - c}$
$C_1 = \pm\frac{\lambda_1^3}{6K};\ C_2 = \mp\frac{\lambda_2^3}{6K};\ K = \sqrt{\mu};$
$C_3 = \begin{cases} 0 & for\ case1 \\ \frac{-3\pi}{K} & for\ case2 \end{cases}$
2. For $i := 1$ to $m$
Begin {i}
$q = 1 - \lambda;\ A_1 = F\left(\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{z}{4} * \lambda_1^2\right);$
$A_2 = F\left(\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{z}{4} * \lambda_2^2\right)$
$u = z^{-\frac{5}{2}};\ FV = C_1 * A_1 + C_2 * A_2 - \frac{2}{3} * z * C_3 * u - \Delta t$
$L = \lambda * (z+1) + q * FV;$
$S_1 = \left(1 - \frac{z}{4} * \lambda_1^2\right)^{-\frac{1}{2}};\ S_2 = \left(1 - \frac{z}{4} * \lambda_2^2\right)^{-\frac{1}{2}}$
$Q_1 = \frac{3}{2z}(S_1 - A_1);\ Q_2 = \frac{3}{2z}(S_2 - A_2);$
$F[1] = C_1 Q_1 + C_2 Q_2 + C_3 Q_3.$
$Fa[1] = \lambda + q\, F[1];\quad \Delta z = -\frac{L}{Fa[1]};$
If $l = 2$ go to step 5
$G_1 = 0.125\,\lambda_1^2\, S_1^3;\ G_2 = 0.125\,\lambda_2^2\, S_2^3$
$F[2] = \frac{3}{2z}\left[3C_1G_1 + 3C_2G_2 - 5\,F[1]\right];$
$Fa[2] = q\,F[2]$
$H = Fa[1] + \Delta z\,\frac{Fa[2]}{2};\ \Delta z = -\frac{L}{H}$
If $l = 3$ go to step 3
For $k = 1,4$
Do: $H = Fa[1];\ B = 1;\ n = k - 1$
$G_1 = 0.125\,(2n-3)\lambda_1^2\, S_1^2 G_1;$
$G_2 = 0.125\,(2n-3)\lambda_2^2\, S_2^2 G_2.$
$F[n] = \frac{1}{2z}\left[3C_1G_1 + 3C_2G_2 - (2n+1)F[n-1]\right];$
$Fa[n] = q\,F[n]$
For j: 1 to $n-1$ Do: $B = \Delta z\frac{B}{j+1};\ H = H + B\,Fa[j+1]$
end {j} ; $\Delta z = -\frac{L}{H};$ end {k}
3. $z = z + \Delta z; \quad \lambda = \lambda - \Delta\lambda$
If $|\Delta z| \le Tol$ go to step 4;
go to step 2.
4. End
Finally, the accuracy of the computations could be checked by the following condition $\epsilon = L - [\lambda\,(z+1) + q\,FV].$

### 3.3 Numerical Applications

We used nine orbits with the initial and final position vectors and $\Delta t$ listed in Table I, components of the position vectors are expressed in geocentric canonical unit ER ( ER=6378.1363 km) and time is expressed in unit of time TU (TU = 13.446849 solar minute).

Computational algorithm 2 is then applied for each orbit with $\mu = 1$, $Tol = 10^{-8}$ and the computational check is satisfied within this tolerance, the solutions of the basic equation of the universal Lambert's problem and the check ε are listed for each case in Table II.

Table I. Initial and final position vectors of the test orbits

| *Orbits* | $x_1$ | $y_1$ | $z_1$ |
|---|---|---|---|
| $O_1$ | 0.702533 | 0.380583 | -0.299824 |
| $O_2$ | 4.54359 | -4.52863 | -5.66845 |
| $O_3$ | -0.483842 | 7.37763 | 1.49529 |
| $O_4$ | 0.303061 | -0.168102 | 0.666923 |
| $O_5$ | -0.0173445 | -0.333483 | -3.42012 |
| $O_6$ | -4.70915 | 3.25104 | 3.52456 |
| $O_7$ | 1.72008 | 0.225063 | 0.674954 |
| $O_8$ | -0.323474 | -1.47143 | -3.81656 |
| $O_9$ | 1.9652 | 0.72978 | 1.96275 |

| *Orbits* | $x_2$ | $y_2$ | $z_2$ | $\Delta t$ |
|---|---|---|---|---|
| $O_1$ | 0.702533 | 0.380583 | -0.299824 | 1.22361 |
| $O_2$ | 4.54359 | -4.52863 | -5.66845 | 2.90691 |
| $O_3$ | -0.483842 | 7.37763 | 1.49529 | 10. |
| $O_4$ | 0.303061 | -0.168102 | 0.666923 | 1.5 |
| $O_5$ | -0.0173445 | -0.333483 | -3.42012 | 2.28939 |
| $O_6$ | -4.70915 | 3.25104 | 3.52456 | 8. |
| $O_7$ | 1.72008 | 0.225063 | 0.674954 | 2.231 |
| $O_8$ | -0.323474 | -1.47143 | -3.81656 | 1.20888 |
| $O_9$ | 1.9652 | 0.72978 | 1.96275 | 2.231 |

Table II. The solution s of the universal Lambert's problem for each test orbits

| | s | Check |
|---|---|---|
| Orbit 1 elliptic | 1.2 4687 | $-2.22045 \times 10^{-16}$ |
| Orbit 2 hyperbolic | -0.66667 | 0. |
| Orbit 3 parabolic | 0. | $8.88178 \times 10^{-16}$ |
| Orbit 4 elliptic | 1.15666 | $1.33227 \times 10^{-15}$ |
| Orbit 5 hyperbolic | -1.24987 | 0. |
| Orbit 6 parabolic | 0. | 0. |
| Orbit 7 elliptic | 1.02598 | $4.44089 \times 10^{-16}$ |
| Orbit 8 hyperbolic | -0.999998 | $-1.11022 \times 10^{-16}$ |
| Orbit 9 parabolic | 0. | 0. |

**Conclusion**

In concluding the present paper, an iterative method of arbitrary positive integer order of convergence $\geq 2$ is developed for solving the basic equation of universal Lambert's problem. The method is characterized by: (1) it is of dynamic nature in the sense that, on going from one iterative scheme to the subsequence one, only additional instruction is needed, (2) it does not need any priori knowledge of the initial guess, a property which avoids it from falling in the critical situations between divergent to very slow convergent solution, that may exist in other numerical methods depending on initial guess as we mentioned before.

The algorithm based on powerful technique for solving transcendental equation without any priori knowledge of the initial guess, this technique is known as homotopy continuation method.

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# Effect of Genetic Counseling on Consanguineous Spouses Attending Maternal and Child Health Centers

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**Abstract:** Consanguineous spouses relation plays an important role in the prevalence of genetic disorders. Genetic counseling is directed towards reducing the number of children born with genetically determined disorders**. Aim:** The study aimed to evaluate the effect of genetic counseling on knowledge of consanguineous spouses' related to genetic disorders and making decision toward reproductive health. **Research design:** This is a quasi-experimental study. **Setting:** This study was carried out at maternal and child health centers affiliated to Ministry of Health in El-Qualiobia governorate. **Sample:** A purposive sample of one hundred spouses with 1st , 2nd or 3rd degree of consanguinity relation who attended the previously mentions MCH centers. **Tools:** Two tools were used for data collection; the first tool was an interviewing questionnaire to collect data about sociodemographic characteristics of spouses; past and present health history of spouse and spouses knowledge related to genetic disorders ,genetic counseling and making decision toward reproductive health. The second tool obtained from record review of laboratory investigations regarding to genetic tests. **Results:** This study proved that genetic counseling helps in increasing spouses' knowledge regarding purpose of genetic counseling, genetic disorders, how it will be inherited and the risk of having an affected child. Approximately one third of spouses conducted genetic investigations, 10 Out of 18 Pregnant women received antenatal care(more than half), and very few of them had using family planning methods. The study also showed significant statistical correlations between spouses' performances of genetic investigations and their monthly income. **Conclusion:** The finding of this study showed that genetic counseling increased spouses' knowledge regarding the effects of consanguinity marriage on their offspring's and helps them to make proper reproductive decision through suggestion of reproductive choices. **Recommendations:** The study recommended that, genetic clinics should be accessible in all maternal and child health centers especially in rural areas supplied with necessary facilities and coordinated team work for conducting genetic investigations and genetic counseling program..

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**Keywords:** Consanguinity relation, Genetic disorders, genetic investigations, Genetic counseling.

## 1. Introduction

Consanguineous marriage refers to unions contracted between biologically-related individuals. In clinical genetics, a consanguineous marriage means union between couples who are related as second cousins or closer. In population genetics, consanguinity may refer to union of individuals with at least one common ancestor such as those occurring within small towns and tribes **(Seronson and Cheuvront, 2005)**. Consanguineous marriage is widely favored in large majority of Egyptian population estimates of consanguinity ratios in different parts of Egypt rated from 29% -50%. The highest incidence is that in the rural areas. Research worldwide has indicated that consanguinity could have an effect on some reproductive health parameters such as postnatal mortality and rates of congenital malformation **(Mokhtar and Abdel Fattah, 2006).** Genetic disorders are diseases that are not acquired or caused from infection or trauma, but rather children inherit the gene from their parents. It could be congenital. It can be seen the disease at birth immediately but sometimes, if the children have the gene, the disease will develop later on **(El-Sobkey, 2007).** These disorders include the sickle cell gene, thalassemia, the hemophilia, inborn errs of metabolism and red cell enzymopaties **(Vessey and Jackson, 2006**). Genetic counseling services have been recommended by the World Health Organization to reduce the prevalence of genetic disorders **(WHO, 2008).** Genetic counseling is a process of communication between patients and trained professionals intended to provide patients who have genetic disease or risk of such a disease with information about their condition and its effect on their family. This allows patients and their families to make informed reproductive and other medical decisions **(Michie et al., 2005).**

Nurse as an important member in counseling team, plays a vital role in genetic counseling. She must use genetic knowledge in their clinical practice to know when and how to refer patients and families to experts in genetic health care **(Mckussick, 2006).**

**Significance of the study:**

Many studies have shown that 30% of admission and about 40-50%of deaths occurring in pediatric hospitals are accounted for children with genetic disorders or congenital malformations **(Gomaa, 2007).** The genetic disorders are chronic in nature and therefore require continuous support and health care. Consequently, the genetic diseases causes formidable economic and psychosocial burden on the family with negative reflection on the community at large. At the present time, the most effective means of preventing genetic diseases remains the provision of genetic counseling for individuals at risk of having a child with genetic disorders, especially spouses with consanguinity marriage.

**Aim of the study:**

The aim of this study is to evaluate the effect of genetic counseling on knowledge of consanguineous spouses' related to genetic disorders and making decision toward reproductive health.

**Hypotheses:**

Genetic counseling will improve consanguineous spouses' knowledge related to genetic disorders and help spouses make proper reproductive decision

**2. Subjects and methods:**

**Research design:**

This is a quasi-experimental study was conducted to explore the effect of genetic counseling on consanguineous spouses.

**Setting**

This study was carried out at 5% of maternal and child health (MCH) centers affiliated to Ministry of Health in El-Qualiobia governorate which represent 7 centers in rural areas from the total number of 140 MCH centers were chosen randomly for application of genetic counseling program where a large proportion of marriages are contracted between blood relatives.

**Sample:**

A purposive sample of one hundred (100) spouses who attended the previously mentioned MCH centers for antenatal follow up or for other MCH services were chosen according to the following inclusion criteria; spouses with 1st , 2nd or 3rd degree of consanguinity relation, at reproductive age from 18 to 49 years and didn't previously attend genetic counseling program.

**Tools of data collection:**

**First tool:** An interviewing questionnaire was developed to assess the socidemographic characteristics and spouses knowledge related to genetic disorders and genetic counseling. It consisted of three parts:

**A)** Sociodemographic characteristics of spouses which include age, level of education, job, consanguinity degree and income.

**B)** Past and present health history of spouses as regards family history, obstetric history, consanguinity degree (were documented in the form of pedigree **(Load, et al., 2005),** first degree: first cousin; second degree: second cousin; third degree: step or distant relative.

**C)** Spouses knowledge related to genetic disorders and genetic counseling, it was used before and after the counseling program.

Answer of individual knowledge questions were categorized on two-point scale as satisfactory and unsatisfactory. For the total evaluation of knowledge the correct answers was added for every participant and normalized to a value on a 100 point scale. A satisfactory overall knowledge level is considered if the total degree is more than or equal 50; otherwise it was regarded as unsatisfactory knowledge level.

**Second tool:** Data collection from medical record, it contained results of genetic investigations (kayrotype test, ultrasound and biological tests), ante natal care and reproductive decision.

Content validity revised by five expertise group from faculty members of Community Health Nursing and specialized physicians in genetic.

**Pilot study:**

A pilot study was carried out on seven spouses at El Qualiobia Governorate ;one from each maternal and child health center before embarking on data collection, in order to test the applicability of tools, as well its feasibility. The modification of tools was done to reach to the finalized form. Subjects in the pilot were not included in the main study sample to avoid bias.

**Field work:**

Official letters was issued to the directors of selected maternal and child health centers for permission of data collection and conducting the study. Oral consent was secured from each spouse after explaining the aim of the study and ensuring that all information will be used only for research purposes.

Data were collected over nine months (September 2010-June 2011)

**The Genetic counseling construction** has passed through different phases as follow**:**

**The preparatory phase and assessment phase:**

In this phase the researchers' revised current local and international related literature which helped in designing the tools.

The researchers attended the maternal and child health centers from 9.00 am to 1.00 pm for two days/week to collect data till the sample size reached the previously determined number. Based on actual educational needs 'assessment of spouses and guided by relevant literature, counseling sessions were

developed. **The general objective of genetic counseling** was to acquire the consanguineous spouses' knowledge related to genetic disorders and help them to make informed decisions toward reproductive health and genetic screening. At the end of counseling sessions, the spouses will:

- Explain the facts contributing to genetic disorders that may affect offspring.
- Comprehend how heredity affecting offspring.
- Take a decision toward their reproductive health.
- Propose the available management.

**The sessions** included theoretical background about genetic disorders. Every spouse was interviewed for about 45 minutes to fill the tools (pre test).Then the spouses in the study sample were provided by four constructive teaching sessions. Each session took about 45 minutes integrated with teaching points and the researchers before going on to a new topic used questions to check the spouse recall and understanding of the material already covered. Sessions were conducted by the researchers according to **GATHER** approach:

**Greet:** The investigators established relationship with spouses emphasizing the purposes and benefits of genetic counseling according to their tradition and religion. The investigator reassured spouses that what will be said is confidential.

**Ask:** The investigators asked spouses about their sociodemographic circumstances, past and present health status, and reproductive options. Assessing spouse's genetic knowledge and their levels of anxiety separately using questions similar to first tool constructed by the investigators.

**Tell:** The investigators told spouses about nature of genetic disorders and its consequences, why screening, causes of inherited characteristics, risk of recurrence, indications of genetic counseling, genetic investigations, antenatal care, family planning, life style, and places of genetic services in Qualiobea Governorate.

**Help:** The investigators helped spouses choose alternatives management as regards antenatal care, family planning and different methods that could be used.

**Evaluate:** The investigators explained different lines of alternatives of genetic harmful factors in their life style that can be modified to reduce the risk of defects of offspring and suggest appropriate referrals.

**Return to follow up visits:** The investigators returned for follow up evaluation through home phone and records in maternal and child health centers.

Different methods of counseling as face to face and interactive counseling with laptop. Using effective media as posters, real objects and a model for reproductive system, taking into consideration using simple and clear Arabic language to suit the level of all spouses. A booklet was constructed for spouses as an educational reference after counseling implementation. This booklet contains items about purpose of genetic counseling, risk of consanguinity marriage, early detection of risk factors, antenatal care, healthful factors in lifestyle, transmission of genetic traits from parent to children, types of genetic screening tests and community services of genetic counseling.

**Evaluation:**

A post test was conducted immediately at the end of counseling sessions using the aforementioned tools to evaluate the effect of counseling on spouses' knowledge while evaluation of spouses decision making regarding to reproductive health, genetic investigations were conducted three months later post counseling through reviewing spouses records and meeting in maternal and child health centers.

**Ethical considerations:**

The researchers took into consideration spouses 'rights based on their needs, giving complete information, assuring them that confidentiality will be obtained and no harmful effect on them. They had also the right to withdraw from the study at any time.

**Statistical Design:**

Data entry and analysis were performed using SPSS version 11.5

The quantitative data were presented using the arithmetic mean, standard deviation, and analyzed using t-test and analysis of variance ANOVA. Qualitative data are presented by the number and percentage and analyzed by chi-square test to assess the interrelationship among variables. Statistical significant was set at $p< 0.05$.

**3. Results:**

**Table (1)** reveals that the mean age of wives in this study was 24.7±5.13, 65 % of them in the age category from 20 to less than 30 years and 20% less than 20 years. The result shows also that the husbands' mean age was 29.5±6.08, about 63%of them in the age category from 20 to less than 30 years and 27% in the age category from 30 to less than 40 years. As regard to educational level, the secondary level had the highest percent (42%, 47%) for wives and husbands respectively. this result shows also that 73%of wives were housewives and all of husbands were working. The result of this study demonstrates that 26% of spouses monthly income was sufficient with a mean ±SD 358.3±110.06.As regards consanguinity degree between spouses 59% were first degree,29% were second degree and 12% were third degree.

**Table (2)** demonstrates The wives whom their age during first pregnancy less than 20 years were

33.7%,38.2% were aged between 20 to less than 25 years, while 28.1%were aged 25 or more with a mean age 23.0±3.86. The result also demonstrates that 25%of wives had history of spontaneous abortion less than 3times, and 2%of them had history of spontaneous abortion 3 times or more. The result indicates that 57% of wives delivered one to two times and 14% delivered three to four times. In relation to 18 pregnant wives in this study 33.3% were at first trimester, 50% of them at second trimester and 16.7% at third trimester.

**Table (3)** reveals that 50% of spouses had genetic family history, 39% had family history of diabetes mellitus, and 79.4%of them were relatives of second degree and 27.1% of first degree. Family history of Down syndrome was found among 10%, which 17.2%of them were relatives of second degree and 8.2%of the first degree. Family history of renal diseases was found among 9%, which 11.9%of them were relatives of first degree and 6.9% of the second degree. Family history of cystic fibrosis was 7% prevalence, 13.8% of them relatives of second degree. Blindness was common among 7%, 20.7% of them relatives of second degree. Hearing loss and muscle atrophy were found among 5% of family history followed by Epilepsy 4%.Thalassemia, sickle cell and hemophilia were found among 3% of family history.

**Table (4)** shows that 24% of children have genetic disorders, 5%of them have Down syndrome and 16.7%of these were third degree between spouses, 3%with cerebral palsy, 3.4%of these from first and second degree between spouses. This table also reveals that 2% an equal percentage of spouses have children suffering from sickle cell anemia, Juvenile D.M, G-6-PD deficiency, color blindness and hydrocephalus. The least equal percentages representing 1% of children were suffered from Thalassemia, PKU, meningocel, imperforated anus, hemophilia and congenital bilateral hip dislocation.

**Table (5)** indicates that there was improvement in the acquisition of knowledge related to genetic disorders, genetic counseling and investigations, for both wives and husbands post counseling.

**Table (6)** demonstrates the difference in the mean scores and standard deviation of knowledge pre genetic counseling between husbands and their wives was not significant (P > 0.05).However, in relation to post counseling it was statistically significant (P < 0.05). The same table also revealed that the mean score and standard deviation of knowledge between wives and husbands pre-post counseling was statistically significant (P < 0.05).

**Table (7)** shows that 30% of spouses performed genetic investigations. As regards karyotype 16.7%of wives and 10.0% of husbands had abnormal structural aberrations, 6.7% of husbands had abnormal numerical aberrations and 13.3% of wives had sex chromosome abnormality. As for three dimension ultrasound it was performed for 60.0% of pregnant wives, 6.7% of them had intrauterine growth retardation.3 (10.0%) 0f pregnant wives performed amniocentesis which revealed one abnormality representing 3.3%

**Table (1): Percentage distribution of spouses according to their sociodemographic characteristics (n=100).**

| Items | Wives | | Husbands | |
|---|---|---|---|---|
| | No | % | No | % |
| ***Age (Years):** | | | | |
| • <20 | 20 | 20 | 2 | 2 |
| • 20- | 65 | 65 | 63 | 63 |
| • 30- | 15 | 15 | 27 | 27 |
| • 40-50 | 0 | 0 | 8 | 8 |
| Mean ±SD | 24.7±5.13 | | 29.5±6.08 | |
| ***Educational level:** | | | | |
| • **Illiterate** | 26 | 26 | 13 | 13 |
| • **Read and write** | 19 | 19 | 18 | 18 |
| • **Secondary education** | 42 | 42 | 47 | 47 |
| • **University** | 13 | 13 | 22 | 22 |
| ***Job:** | | | | |
| • **Not working** | 73 | 73 | 0 | 0 |
| • **Working** | 27 | 27 | 100 | 100 |
| | **No** | | **%** | |
| ***Consanguinity degree:** | | | | |
| • First degree | 59 | | 59 | |
| • Second degree | 29 | | 29 | |
| • Third degree | 12 | | 12 | |
| ***Family monthly income:** | | | | |
| • 250- | 74 | | 74 | |
| • 500+ | 26 | | 26 | |
| Mean ±SD | 358.3±110.06 | | | |

**Table (2): Percentage distribution of wives according to their reproductive health history (n=100).**

| Items | No | % |
|---|---|---|
| ***Age at first pregnancy (Years): n=89** | | |
| • < 20 | 30 | 33.7 |
| • 20 - | 34 | 38.2 |
| • 25 + | 25 | 28.1 |
| Range | 17-32 | |
| Mean ±SD | 23.0±3.86 | |
| ***Number of spontaneous abortions :** | | |
| • **0** | 73 | 73 |
| • **< 3** | 25 | 25 |
| • **≥ 3** | 2 | 2 |
| *** Number of deliveries:** | | |
| • **0** | 29 | 29 |
| • **1-2** | 57 | 57 |
| • **3-4** | 14 | 14 |
| ***Current pregnancy gestational age (trimesters) (n= 18 )** | | |
| • First trimester | 6 | 33.3 |
| • Second trimester | 9 | 50 |
| • Third trimester | 3 | 16.7 |

**Table (3): Percentage distribution of spouses with family history of genetic disorders according to their consanguinity degree (n=100).**

| Items | Consanguinity degree | | | | | | Total 100 | |
|---|---|---|---|---|---|---|---|---|
| | First (n= 59 ) | | Second (n= 29 ) | | Third (n=12 ) | | | |
| | No | % | No | % | No | % | No | % |
| Family with genetic disorders | | | | | | | 50 | 50 |
| • Diabetes mellitus. | 16 | 27.1 | 23 | 79.3 | 0 | 0 | 39 | 39 |
| • Down syndrome. | 5 | 8.5 | 5 | 17.2 | 0 | 0 | 10 | 10 |
| • Renal disease. | 7 | 11.9 | 2 | 6.9 | 0 | 0 | 9 | 9 |
| • Cystic fibrosis. | 3 | 5.1 | 4 | 13.8 | 0 | 0 | 7 | 7 |
| • Hearing loss. | 2 | 3.4 | 3 | 10.3 | 0 | 0 | 5 | 5 |
| • Blindness. | 1 | 1.7 | 6 | 20.7 | 0 | 0 | 7 | 7 |
| • Muscle atrophy. | 1 | 1.7 | 4 | 13.8 | 0 | 0 | 5 | 5 |
| • Epilepsy. | 0 | 0.0 | 4 | 13.8 | 0 | 0 | 4 | 4 |
| • Thalassemia. | 0 | 0.0 | 0 | 0.0 | 3 | 25 | 3 | 3 |
| • Sickle cell anemia. | 0 | 0.0 | 2 | 6.9 | 1 | 8.3 | 3 | 3 |
| • Hemophilia. | 1 | 1.7 | 2 | 6.9 | 0 | 0 | 3 | 3 |

Items are not mutually exclusive.

**Table (4): Percentage distribution of spouses according to their children with genetic disorders (n=100).**

| Items | Consanguinity degree | | | | | | Total 100 | |
|---|---|---|---|---|---|---|---|---|
| | First (n= 59 ) | | Second (n= 29 ) | | Third (n=12 ) | | | |
| | No | % | No | % | No | % | No | % |
| Children with genetic disorders and congenital anomalies | | | | | | | 24 | 24 |
| • Down syndrome | 2 | 3.4 | 1 | 3.4 | 2 | 16.7 | 5 | 5 |
| • Cerebral palsy | 2 | 3.4 | 1 | 3.4 | 0 | 0 | 3 | 3 |
| • Sickle cell anemia. | 1 | 1.7 | 0 | 0 | 1 | 8.3 | 2 | 2 |
| • Juvenile D.M | 1 | 1.7 | 0 | 0 | 1 | 8.3 | 2 | 2 |
| • Thalassemia | 0 | 0 | 1 | 3.4 | 0 | 0 | 1 | 1 |
| • G-6-PD deficiency | 1 | 1.7 | 0 | 0 | 1 | 8.3 | 2 | 2 |
| • Color blindness | 0 | 0 | 2 | 6.9 | 0 | 0 | 2 | 2 |
| • PKU | 0 | 0 | 1 | 3.4 | 0 | 0 | 1 | 1 |
| • Meningocel | 0 | 0 | 0 | 0 | 1 | 8.3 | 1 | 1 |
| • Hydrocephalus | 1 | 1.7 | 1 | 3.4 | 0 | 0 | 2 | 2 |
| • Imperforated anus | 0 | 0 | 1 | 3.4 | 0 | 0 | 1 | 1 |
| • Hemophilia | 1 | 1.7 | 0 | 0 | 0 | 0 | 1 | 1 |
| • Congenital bilateral hip dislocation | 0 | 0 | 1 | 3.4 | 0 | 0 | 1 | 1 |

**Table (5): Percentage distribution of spouses according to their satisfactory knowledge related to genetic disorders, genetic counseling and investigations pre and post counseling (n=100).**

| Items | Wives | | | | Husbands | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | | Post | | Pre | | Post | |
| | No | % | No | % | No | % | No | % |
| *** Genetic disorders:** | | | | | | | | |
| • Risk of consanguinity marriage | 17 | 17 | 98 | 98 | 20 | 20 | 98 | 98 |
| • Genetic problems in consanguineous marriage. | 19 | 19 | 97 | 97 | 9 | 9 | 99 | 99 |
| • Warning from consanguinity marriage. | 10 | 10 | 98 | 98 | 12 | 12 | 99 | 99 |
| • Causes of increasing genetic disorders. | 16 | 16 | 98 | 98 | 13 | 13 | 99 | 99 |
| • Early detection of genetic disorders. | 14 | 14 | 100 | 100 | 10 | 10 | 100 | 100 |
| *** Genetic counseling & investigations:** | 12 | 12 | 97 | 97 | 7 | 7 | 100 | 100 |
| • Meaning of genetic counseling. | 13 | 13 | 99 | 99 | 5 | 5 | 99 | 99 |
| • Community services of genetic counseling. | 14 | 14 | 94 | 94 | 2 | 2 | 99 | 99 |
| • Indication of genetic counseling. | 14 | 14 | 95 | 95 | 5 | 5 | 99 | 99 |
| • Genetic investigation before pregnancy. | 10 | 10 | 99 | 99 | 14 | 14 | 93 | 93 |
| • Genetic investigation during pregnancy. | 22 | 22 | 93 | 93 | 12 | 12 | 98 | 98 |
| • Management of genetic disorders. | | | | | | | | |

**Table (6): Difference between Knowledge of husbands and their wives pre and post genetic counseling. (n=100)**

| Items | Mean | SD | t-test | P-value |
|---|---|---|---|---|
| ***Pre counseling** | | | | |
| • **Wives** | 14.5 | 29.5 | 1.33 | .183 |
| • **Husbands** | 9.7 | 19.6 | | P> 0.05 NS |
| ***Post counseling** | | | | |
| • **Wives** | 96.4 | 9.8 | -1.98 | 0.0487 |
| • **Husbands** | 98.8 | 7.5 | | P< 0.05 S |
| ***Post- Pre** | | | | |
| • **Wives** | 81.9 | 29.7 | -1.99 | 0.0481 |
| • **Husbands** | 89.9 | 20.4 | | P< 0.05 S |

**Table (7): Percentage distribution of spouses according to their conducting of genetic investigations post counseling (n=30).**

| Items | Wives | | Husbands | |
|---|---|---|---|---|
| | No | % | No | % |
| ***Karyotype:** | | | | |
| • Normal | 21 | 70.0 | 25 | 83.3 |
| • Abnormal structural aberrations | 5 | 16.7 | 3 | 10.0 |
| • Abnormal numerical aberrations | 0 | 0.0 | 2 | 6.7 |
| • Sex chromosome abnormality | 4 | 13.3 | 0 | 0.0 |
| ***Glucose tolerance test:** | | | | 96.7 |
| • Normal | 26 | 86.7 | 29 | 0.0 |
| • Impaired | 3 | 10.0 | 0 | 3.3 |
| • Diabetic | 1 | 3.3 | 1 | |
| ***HB electrophoresis:** | | | | 86.7 |
| • Normal | | 86.7 | | 6.7 |
| • Hemolytic anemia | 26 | 13.3 | 26 | 3.3 |
| • Sickle cell anemia | 4 | 0.0 | 2 | 3.3 |
| • Thalassemia | 0 | 0.0 | 1 | |
| ***Three-Dimension ultrasound of pregnant(n=18)** | 0 | | 1 | 0 |
| • Normal | | 53.3 | | 0 |
| • Intrauterine growth retardation | 16 | 6.7 | 0 | |
| • ***Amniocentesis: (n=3)** | 2 | | 0 | 0 |
| • Normal | | 6.7 | | 0 |
| • Abnormal | 2 | 3.3 | 0 | |
| | 1 | | 0 | |

Items are not mutually exclusive.

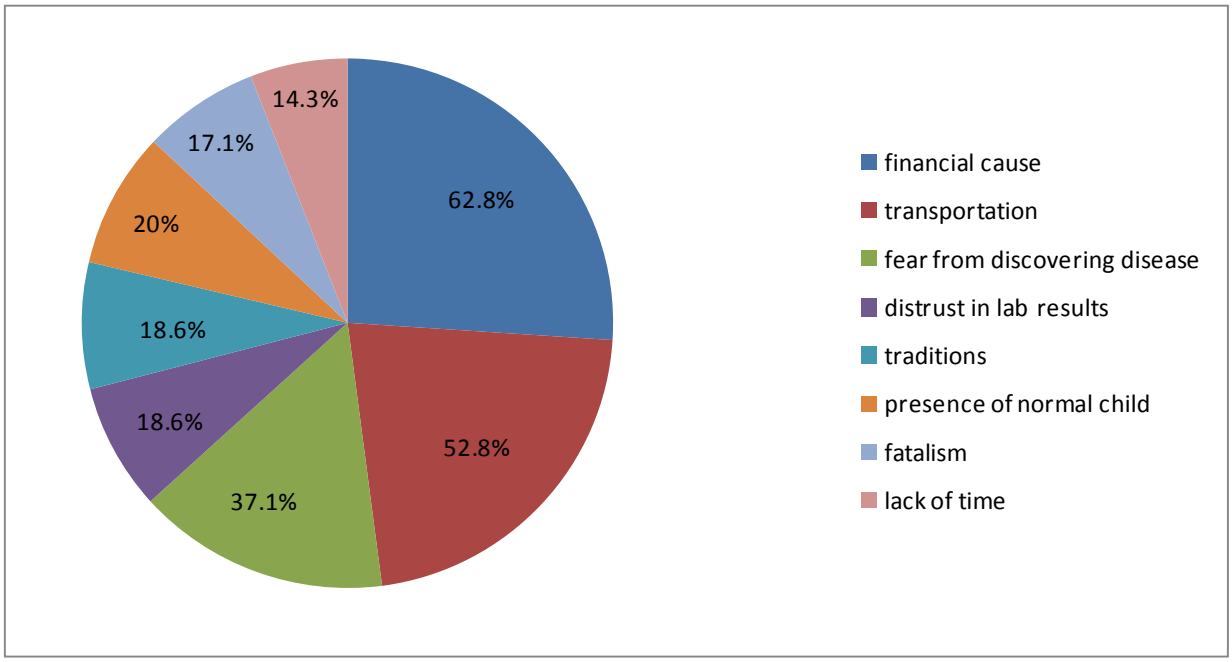


**Figure (1): Percentage distribution of spouses according to barriers against conducting genetic investigations post counseling (n=70).** All items are not mutually exclusive.

**Table (8): Percentage distribution of spouses according to their decision making toward reproductive health (n=100).**

| Decision making | No. | % |
|---|---|---|
| ***Pregnant wives (n=18)** | | |
| • Antenatal care | 10 | 55.6 |
| • Pregnancy termination due to growth retardation | 2 | 11.1 |
| ***Use of family planning method** | 9 | 9.0 |

**Table (9-a): Relation between spouses knowledge post genetic counseling and their educational level (n=100).**

| Items | Knowledge post genetic counseling | | |
|---|---|---|---|
| | Mean | SD | ANOVA |
| **Wife education level** | | | |
| • **Illiterate** | **88.81** | 16.52 | **F = 8.614** |
| • **Basic education** | **99.52** | 2.08 | **P = 0.00004** |
| • **Secondary** | **98.48** | 3.97 | **P<0.001 HS** |
| • **University** | **100.0** | 0.00 | |
| **Husband education level** | | | |
| • **Illiterate** | **92.31** | **19.93** | **F = 4.13** |
| • **Basic education** | **99.49** | **2.14** | **P = 0.008** |
| • **Secondary** | **99.81** | **1.33** | **P<0.001 HS** |
| • **university** | **100** | **0.00** | |

**Table (9-b): Relation between spouses knowledge pre - post genetic counseling and their consanguinity degree (n=100).**

| consanguinity degree | Wives Knowledge post-pre genetic counseling | | |
|---|---|---|---|
| | Mean | SD | ANOVA |
| • **First** | **88.81** | 16.52 | **F = 4.15** |
| • **Second** | **99.52** | 2.08 | **P = 0.0186** |
| • **Third** | **98.48** | 3.97 | **< 0.05 S** |
| **consanguinity degree** | **Husbands Knowledge post-pre genetic counseling** | | |
| | **Mean** | **SD** | **ANOVA** |
| • **First** | **88.81** | 16.52 | **F = 0.739** |
| • **Second** | **99.52** | 2.08 | **P = 0. 48** |
| • **Third** | **98.48** | 3.97 | **> 0.05 NS** |

**Table (9-c): Relation between spouses knowledge pre - post genetic counseling and presence of genetic family history (n=100).**

| Genetic family history | Wife's Knowledge | | | Husband's Knowledge | | |
|---|---|---|---|---|---|---|
| | No. | Mean | SD | No. | Mean | SD |
| **Pre** | | | | | | |
| • **Not present** | **50** | **13.64** | **28.7** | **50** | **10.0** | **20.1** |
| • **Present** | **50** | **15.27** | **30.48** | **50** | **9.45** | **19.26** |
| **t= -0.28 P =0.783 P>0.05 NS** | | | | **t=0.14 P = 0.89 P>0.05 NS** | | |
| **Post** | | | | | | |
| • **Not present** | **50** | **96.7** | **10.09** | **50** | **99.64** | **1.80** |
| • **Present** | **50** | **99.6** | **9.68** | **50** | **98.00** | **10.44** |
| **t = -0.37 P=0.714 P>0.05 NS** | | | | **t=1.09 P =0.277 P>0.05 NS** | | |
| **Post-Pre** | | | | | | |
| • **Not present** | **50** | **82.36** | **28.94** | **50** | **89.63** | **20.03** |
| • **Present** | **50** | **81.45** | **30.78** | **50** | **88.54** | **21.00** |
| **t = 0.15 P =0.88 P>0.05 NS** | | | | **t = 0.27 P =0.791 P>0.05 NS** | | |

**Table (9-d): Relation between spouses knowledge pre - post genetic counseling and presence of children with genetic disorders (n=100).**

| Children with generic disorder | Wife's Knowledge | | | Husband's Knowledge | | |
|---|---|---|---|---|---|---|
| | No. | Mean | SD | No. | Mean | SD |
| **Pre** | | | | | | |
| • Not present | 24 | 17.05 | 32.75 | 24 | 9.85 | 19.50 |
| • Present | 76 | 13.64 | 28.53 | 76 | 9.69 | 19.77 |
| t =0.49 P = 0.624 P>0.05 NS | | | | t =0.03 P = 0.972 P>0.05 NS | | |
| **Post** | | | | | | |
| • Not present | 24 | 94.70 | 12.26 | 24 | 99.62 | 1.86 |
| • Present | 76 | 96.89 | 8.98 | 76 | 98.56 | 8.53 |
| t = -0.95 P= 0.344 P>0.05 NS | | | | t = 0.6 P= 0.55 P>0.05 NS | | |
| **Post-Pre** | | | | | | |
| • Not present | 24 | 77.65 | 32.16 | 24 | 89.77 | 19.38 |
| • Present | 76 | 83.25 | 29.02 | 76 | 88.87 | 20.86 |
| t = -0.8 P = 0.424 P>0.05 NS | | | | t= 0.19 P = 0.852 P>0.05 NS | | |

**Table (10-a): Relation between spouse's performance genetic investigations and their age and family income post counseling (n=100)**

| Items | Performance of genetic investigations | | | |
|---|---|---|---|---|
| | Yes(n=30) | | No(n=70) | |
| | No. | % | No. | % |
| **Wife' age (Years):** | | | | |
| • <20 | 10 | 33.3 | 10 | 14.2 |
| • 20- | 14 | 46.7 | 51 | 72.9 |
| • 30-50 | 6 | 20.0 | 9 | 12.9 |
| **Pearson χ2 = 6.74 df= 2 P =0.034 P<0.05 S** | | | | |
| **Husband' age (Years):** | | | | |
| • <30 | 22 | 73.3 | 43 | 61.4 |
| • 30-50 | 8 | 26.7 | 27 | 38.6 |
| **Pearson χ2 = 1.32 df = 1 P = 0. 2 53 P<0.05 S** | | | | |
| ***Family monthly income (LE):** | | | | |
| • Sufficient | 18 | 60.0 | 56 | 80.0 |
| • Not sufficient | 12 | 40.0 | 14 | 20.0 |
| **Pearson χ2 = 4.37 df = 1 P = 0.0367 P<0.05 S** | | | | |

**Table (10-b): Relation between spouse's performance genetic investigations and their education level post counseling. (n=100)**

| Items | Performance of genetic investigations | | | |
|---|---|---|---|---|
| | Yes(n=30) | | No(n=70) | |
| | No. | % | No. | % |
| **Wife education level** | | | | |
| • **Illiterate** | 6 | 20.0 | 20 | 28.6 |
| • **Basic education** | 5 | 16.7 | 14 | 20.0 |
| • **Secondary** | 16 | 53.3 | 26 | 37.1 |
| • **University** | 3 | 10.0 | 10 | 14.3 |
| **Pearson χ2 = 2.32 df= 3 P=0.508** P> 0.05 NS | | | | |
| **Husband education level** | | | | |
| • **Illiterate** | 3 | 10.0 | 10 | 14.3 |
| • **Basic education** | 4 | 13.3 | 14 | 20.0 |
| • **Secondary** | 17 | 56.7 | 30 | 42.9 |
| • **University** | 6 | 20.0 | 16 | 22.9 |
| **Pearson χ2 = 1.75 df= 3 P =0.6269** P> 0.05 NS | | | | |

This table also shows that, the results of HB electrophoresis were 13.3% of wives and 6.7% of husbands had hemolytic anemia. Thalassemia and sickle cell anemia were found only in 3.3% of husbands. As for glucose tolerance test 3.3% of both wives and husbands had diabetes mellitus.

**Figure (1)** reveals that 62.8% of the spouses didn't perform genetic investigation due to financial causes, followed by 52.8% due to far distance, 37.1% due to fear from discovering disease,18.6% due to traditions and distrust in lab results,20.0% due to presence of normal child, 17.1% due to fatalism and 14.3% due to lack of time.

**Table (8)** demonstrates that 55.6% of pregnant wives decided ante-natal care, and 11.1%decided termination of pregnancy. This table shows also that 9% of wives used family planning methods.

**Table (9-a)** indicates that the relation between spouses educational level and their knowledge post genetic counseling is highly statistical significant P<0.001.

**Table (9-b)** reflects statistical significant relation between consanguinity degrees and wives knowledge pre and post genetic counseling. P<0.05.but it was not significant for the husbands.

**Table (9-c)** shows that there were no statistically significant associations between genetic family histories of the spouses and their knowledge pre or post genetic counseling (**P>0.05).**

**Table (9-d)** demonstrates that there were no statistically significant associations between presence of children with genetic disorders and spouses 'knowledge pre or post genetic counseling (**P>0.05).**

**Table (10-a**) shows that there were statistical significant relations between spouses genetic investigations and their ages and monthly income at P<0.05.

**Table (10-b)** reflects that there were no statistically significant associations between spouses genetic investigations and their educational levels (**P>0.05).**

**4. Discussion:**

The present study encompasses 100 spouses with consanguinity relation. It showed that the mean age of wives was 24.7±5.13 years and the mean age of husbands was 29.5±6.08 .Less than half of husbands and slightly more than two fifths of wives had secondary education. The current study finding demonstrated that all of husband and more than one quarter of wives were working. As regards consanguinity degree, more than half of spouses were first degree. The mean monthly income of spouses was 358.3±110.06.In accordance with these study findings, **(table, 1)**. **Load et al., (2005)** stressed on importance of collecting data about sociodemographic characteristics because some disorders increase in incidence with mothers' age and the education factor which affect knowledge acquirements. .

The current study findings revealed that, the mean age of wives at first pregnancy was 23.0±3.86 and one quarter of them had a history of spontaneous abortion less than three times. More than half of wives delivered once or twice, and half of pregnant wives were in the second trimester **(table, 2).** An Egyptian study conducted by **Mokhtar and Abdel-Fattah (2006),** revealed that, consanguinity among couples with repeated abortion constituted 60% with 44% first cousin. In Egypt chromosomal abnormalities are present in nearly half of all spontaneous miscarriages. In accordance with **Abdel Meguid et al., (2005),** the aggregation of abortions, stillbirth, neonatal and infant deaths is stronger in consanguineous families than those with unrelated marriage. **Ward et al., (2008),** stated that the reproductive history includes any type of pregnancy loss, spontaneous abortion, stillbirth and prenatal death. For those couples with three or more miscarriages for which no maternal anatomic or physiologic explanation can be found, cytogenic analysis should be considered.

These study findings demonstrated that, first consanguinity degree had eight genetic disorders. Diabetes mellitus was the commonest followed by renal diseases, Down syndrome, cystic fibrosis, hearing loss, blindness, and muscle atrophy. Spouses with second degree relation had ten genetic disorders. Diabetes mellitus was also the commonest followed by blindness ,Down syndrome ,cystic fibrosis ,muscle atrophy ,epilepsy ,hearing loss, renal disease, hemophilia and sickle cell anemia. Regarding to third consanguinity degree, thalassemia and sickle cell anemia were the two only genetic diseases found **(table 3).** These findings were incongruence with **Mokhtar and Abdel-Fattah (2006),** who found that family history of the previous genetic disease was present in approximately the majority of the couples, while **Albar (2004),** reported that first cousins have sixteenth of their genes in common because all individual are carriers of five to seven recessive gene**. Dale et al., (2007)** emphasized that one objective in medical genetic counseling is to identify the family genetic risk. Family tree is a powerful diagnostic tool for this purpose, taking and interpreting a basic family history to identify reproductive risk as an important element in preconception and early antenatal care.

The present study findings showed that about one quarter of the spouses had children with thirteen types of genetic disorders and congenital defects. The most common were Down syndrome representing five percent, followed by cerebral palsy accounting for three percent and equal percentage of

two percent for sickle cell anemia, juvenile diabetes, G6-PD deficiency, color blindness and hydrocephalus. The least equal percentages representing 1% of children were suffered from Thalassemia, PKU, meningocel, imperforated anus, hemophilia and congenital bilateral hip dislocation **(table, 4).**

In accordance with this study results of **Hamame et al.,(2006),** stated that the rate of children with Down syndrome in some Arab countries exceeds the 1.2 to 1.7 per 1000 typical for industrial countries.This may be related to the relatively high proportion of births to older mothers in the region. Up to 50% of children with Down syndrome in the region are estimated to be born to mothers aged 40 or over. In study conducted by **Reynold et al., (2006),** spouses had family history of different genetic disorders, genetic investigations revealed chromosomal abnormalities in 15%.

The finding of pre counseling showed that, unsatisfactory knowledge among approximately all spouses even the university educated. On the other hand, post counseling, there was a highly significant increase in spouses' knowledge **(table, 5).** In a study carried out by **Abo-Baker (2008)**, Three quarters of parents had deficit knowledge about genetic disorders; the majority did not know the meaning of genetic disorders and its causes. However, in spite of long term instructions, about one fifth of parents had adequate understanding about nature of the genetic disorders. This could be due to using different methods of counseling as face to face, interactive laptop, discussion and demonstration supported by using real objects, posters, models and handouts which are effective approaches for conveying information.

The study results emphasized a great improvement in the mean score knowledge post counseling for both husbands and their wives **(table, 6).**

In order to achieve screening tests, spouses under study were provided with adequate information regarding purpose, types of testing and Place of genetic investigations. However, the present study findings showed that less than one third only of spouses performed genetic investigations **(table, 7).** As regards ultrasound done for pregnant wives in this study, two out of eighteen had intrauterine growth retardation whereas; one out of three had abnormal amniocentesis. Investigation of HB electrophoresis done for spouses were six out of thirty had hemolytic anemia, one out of thirty husbands had sickle cell anemia and thalassemia. This table showed also that about one third of wives and more than one tenth of husbands had abnormality karyotype.The investigators found that spouses faced difficult decision about whether to terminate or to continue the pregnancy. This could be due to religion and cultural perception of rural community which refuse prenatal diagnosis and selective abortion. In accordance with **Abdel Meguid et al., (2005),** in their study about premarital genetic investigation; effect of genetic counseling found chromosomal analysis of cases revealed about 15% of the studied sample with chromosomal abnormalities, either structural aberrations or numerical aberrations or both. These results indicate the importance of chromosomal analysis as part of genetic investigations in premarital counseling to identify couples who may require post conception amniocentesis.

More than two thirds of spouses in this study did not perform genetic investigations which can be attributed to financial causes,transportation,fear from discovering diseases,tradition,distrust in laboratory results, presence of normal child, fatalism and lack of time **(figure,1).**These results were consistence with those of **Saleem et al.,(2004),** who reported that parental attitude to antenatal diagnosis and pregnancy termination is a consequence of a balance between parental understanding of the disease, its mode of inheritance and the prenatal diagnostic options available on the one hand; and traditional belief in fate,religious,social value and economic factors on the other hand. Genetic services are focused on those who are most able to pay for services.

The present study findings demonstrated that ten of the pregnant wives who received antenatal care, minority terminated their pregnancy due to intrauterine growth retardation **(table,8)** In accordance with this study findings, **Reynold et al.,(2006),** indicated that good antenatal care is essential to anticipate difficulties and complications of labour and to ensure the birth of healthy baby. Results in this table showed also that a very little percent of the studied sample used family planning methods. This could be due to some of spouses had no children or other problems as spontaneous abortion or still births or desire of large family size.

The present study finding revealed that the relation between spouses educational level and their satisfactory knowledge post genetic counseling was highly significant **(table 9-a)**.Incongruent to this results, **Tiller et al., (2005),** reported that women who reported lower level of education may be most likely to benefit from educational strategies designed to supplement genetic counseling to improve their knowledge level.

Concerning the consanguinity degree, the present study finding demonstrated that there was statistically significant correlation between first degree consanguinity and wives' knowledge pre and post genetic counseling **(table, 9-b).** This may be

attributed to first degree consanguinity associated with many genetic abnormalities which lead to increasing spouses' interest and experiences.

The current study finding showed insignificant associations between genetic family history of the spouses, and their knowledge pre and post genetic counseling **(table, 9-c).**

This study showed statistically insignificant associations between presence of children with genetic disorders and spouses' knowledge pre and post counseling **(table, 9-d).** In a similar study, **Antley and Hartlage (2004),** found that mothers of children with Down syndrome had a considerable amount of information regarding the nature of condition before counseling that was related to their educational background, but they lacked knowledge on recurrence risks. As for the post counseling results of the mothers, it was revealed that they understood the nature of the condition, understood the recurrence risk, and had a good understanding of both topics.

The finding of this study showed that there were no statistical significant correlation between spouses performance of genetic investigations and their age, or education**,(table 10 a ,b)** .These results could be due to that more than quarter of wives were illiterate ,and the highest percent that performed investigations were among secondary level of education. But there was statistical significant correlation with monthly income where the mean of the income was 358±110.06 L.E. as it puts them beyond their capabilities to conduct genetic investigations which are more than 500 L.E.

**5. Conclusion:**

In conclusion, this study proved that genetic counseling helps in increasing spouses' knowledge regarding purpose of genetic counseling, genetic disorders, how it will be inherited and the risk of having an affected child. Also, it helped to have decision for their reproductive health related to antenatal care and family planning. In addition, the study showed significant statistical association between spouses' performances of genetic investigations and their monthly income.

**Recommendations:**

The finding of this study projected the need for:

Genetic clinics should be accessible in all maternal and child health centers especially in rural areas due to high incidence of consanguineous marriage- supplied with necessary facilities and coordinated team work for conducting genetic investigations and genetic counseling program about:

- Risk of consanguineous marriage.
- Children with genetic disorders.
- Early detection of genetic disorders.
- Management of genetic disorders.
- Reproductive health, antenatal care and termination of pregnancy.
- Family planning.

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