

## A Study on Musculoskeletal Disorders in Computer Game Users Compared with Other Users

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### Abstract:

**Introduction:** The development of computer game technologies have led to the expansion of the number of computer game players. This, in turn, has caused some side effects like stress and an increase in the number of people with musculoskeletal disorders because of prolonged sitting positions, work with computer, repetitive movements, unsuitable static postures, and improper environmental conditions. This study was conducted to compare the musculoskeletal disorders in computer game users with other users.

**Method:** This study was performed on 144 computer game home users (the experiment group) and 290 general computer users (the control group). To study the musculoskeletal disorders and the stress, we used Nordic and Beck questionnaires. The questionnaires were filled by direct interview method. T-tests, Chi-square, Fisher and Regression logistics analysis tests were used.

**Results:** The frequency of Musculoskeletal disorder in the experiment group in the last 12 months prior to the study in areas of neck, shoulder, back, and wrists were 56/94, 73/61, 60/41 and 65/27, respectively. Grievance frequency over Musculoskeletal disorders in areas of neck, shoulder, back, and wrists and the average stress score in the experiment group was higher in the control group and the statistical difference was significant.

**Conclusion:** Since computer games are mostly related to teenagers and young people, it can directly affect on their future career goals. We should know that working with computers can be considered as one of dangerous jobs for causing Musculoskeletal disorders. In this study, the frequency of musculoskeletal disorders, especially in the areas of high hazard, for computer game users was higher than in other general computer users.

**Key words:** Musculoskeletal, Ergonomics, Computer User, Computer Games

## 1-Introduction

The ever-expanding technologies and sciences regarding the human life, especially the computer games, have resulted in an increase in excitement and analytical intelligence in young people, as well as, an increase in production and efficiency. On the other hand, it has imposed some side effects like low physical activity, fatigue, nervous stresses and increase in musculoskeletal disorders on humans. Several teenagers and youth spend a large amount of their time in recreational centers, mostly on computer games. Computer games can play an important role on their career path. For this reason, the spread of work-related musculoskeletal disorder (WMSDs) is high, and it is the most important cause for work hour loss, absence from work, cost increase, efficiency reduction, injury and work disability and financial loss (2Ladou et al,2007, 3Mirmohammadi et al,2009). Among the most important reasons for these work-related problems and injuries, we can refer to repetitive moves, improper position of the body while working, the stress caused by positional contacts and standing positions while playing or working with computers (1Bathaei et al,2005 , 3Mirmohammadi et al,2009 , 4Bongers et al,2002 , 7Fisher et al,2008 , 8Delisle,2006). Based on the studies done in America, 60% of all the new cases of physical problems are related to WMSDs (26Vanwonterghem,1996) and eventually, the important characteristic of work-related illnesses is that they are preventable - by studying them and making suggestions for ways to prevent them.

Considering the various ergonomic encounters, working with computers, especially computer games, can lead to some musculoskeletal diseases in different parts of body, such as in neck, shoulder, elbow, wrists, and fingers (5Vorman,2007 , 6BaiatTork et al,2001). It can cause some musculoskeletal disorders beside some environmental ergonomic encounters such as temperature, mental factors; and some personal factors such as sex, age, BMI, job satisfaction, etc. (3Mirmohammadi et al,2009, Fisher et al,2008 , 8Delisle,2006, 25Lorussu et al,2007).

Several studies have been conducted around the world on the musculoskeletal disorders due to the work with computers or performing office tasks. The ministry of health and safety in England (HSE) has set WMSDs as one of its priorities in improving the work condition of the employees (27HSE News,2001). In a study in the U.S., the frequency of musculoskeletal disorders was 54% for the computer users and especially in girls and in the areas of neck and shoulders (12Kristensen et al,2005). In another study on the computer users in Germany, the most common disorders were observed in neck and shoulders, and then in

elbows; the symptoms in people who spend more than 6 hours on computers were more common (10Rempel et al,2006). There have been other studies in this area in which a high frequency of musculoskeletal disorders was observed for the computer users (13Rurkhamet et al,2004 , Street et al,2003, Ferreira et al, 2002, Berner et al, 2002, 17Cotrim et al,2005). Therefore, by considering the high frequency of job hazards among the computer users and the maximum frequency of musculoskeletal disorders among this work group and also the high number of computer game users, and importance of preventing such diseases in work places, a study was designed for evaluating the frequency of musculoskeletal disorders in computer game users and the most involved parts of the body.

## **2-Method:**

On a temporary study on computer users in some video game arcades and the internet cafes around the city of Isfahan, the frequency of musculoskeletal disorders was estimated. The users were divided into two groups of computer game users (people who play computer games for at least 20 hours a week) and other users (people who spend less than 5 hours a week on a computer). Based on the previous studies and by considering the confidence level of 95% and error level of 20%, the sample size was set to be 144 in each group. However, because of some expectations for error in the experiment group results, we doubled the size of this group to 290 people (other users). The Sampling was done in the form of targeted available among all the video game arcade and internet café users of the city of Isfahan. The entry of the people in this study was with full awareness and complete freedom and a written consent was signed by all participants.

At first, the demographic data of the participants (such as age, sex, gaming records, type of game) was collected by the researchers in a personal interview and then the Persian version of the Nordick questionnaire about musculoskeletal disorders of different body parts for both groups was filled and compared. In addition, the frequency of such disorders was studied based on the age, sex, gaming records, type of game. On the other hand, the stress level in these two groups was studied through a standard questionnaire. Admissibility and durability of this questionnaire is proved through various studies (18Descatha et al,2007, 19Lowman et al,2002, 28Mir Mohammadi et al,2010).

To analyze the data using the SPSS (V. 16) and T-test, Chi-square, Fisher and Logistic regression analysis statistical methods were used.

### 3-Findings:

Out of the 434 participants of this study, 144 persons (33.17%) were in the computer game group and 290 persons (66.82%) were in the non-user group. Out of the whole population, 313 persons were boys (72.11%) and 121 people (27.88%) were girls and most of them (54.86%) had game playing experience of less than 1 year. In the computer game users, 135 people (93.75%) were boys and 9 people (6.25%) were girls, and in the non-user group 178 people (61.37%) were boys, and 112 people (38.62%) were girls. The difference between the two groups based on sex was quite significant ( $P < 0.001$ ). The average age of the computer game users and other users were  $15.94 \pm 6.45$  years and  $17.16 \pm 8.03$  years, respectively which was not statistically significant ( $P = 0.27$ ).

The frequency of musculoskeletal disorders in most body parts in computer users was significantly higher from other users. The most number of complaints were reported in the area of neck. Table 1 shows the frequency of musculoskeletal disorders in different parts of the body in computer game users in comparison with other computer users.

In various age groups, the musculoskeletal disorders frequency in both computer game users and non-users were calculated. With the exception of 25 years and older group, the level of disorders in all other computer game users was significantly higher than that in non-user group. The disorder in boys was higher than in girls, so much so that the disorders in neck, shoulder, and wrist areas were significantly higher in boys ( $P < 0.05$ ). Considering the much smaller number of girls in the experiment group, an analysis was done between the boys and girls for the computer game users for disorders in neck, shoulder, and wrists was higher ( $P < 0.001$ ). However, in the girls' population, there was no significant difference between the user and non-user groups. Table 2 shows a comparison in the frequency of musculoskeletal disorders in various body parts based on the sex.

In the computer game user group, the frequency of musculoskeletal disorders in shoulder and back was statistically higher based on their experience duration (table 3). The stress values were not statistically significant ( $P = 0.73$ ). In a comparison between the two computer game users and non-users, the stress average score was significantly different in computer users ( $P = 0.005$ ). To eliminate the sex difference effect, we used the regression analysis on the stress average score in both groups of computer users and non-users and it was still significant ( $P = 0.043$ ).

#### 4-Discussion:

The current study was conducted on computer game users of the arcades and internet cafes in Isfahan in both groups of computer game users and non-users for understanding their musculoskeletal disorder differences. The most common complaint was about the disorders in the neck area and among the computer game users (75% of the population) and the least common complaint was about the hand and wrist and among the other users (25.5%). Overall, around 50% of the people complained about problems and pain in one of the four areas (neck, shoulders, back, hands and wrists) and this matter was significantly higher in computer game users. In several studies, these problems have been reported by computer game users and other computer users. For example, in a study by Dr. Bayaat on some computer users, around 35.95% of the people had musculoskeletal disorders (6BaiatTork et al,2001). In a study by Klussmann, the 12-month frequency of these disorders in the neck, shoulder, hand and wrist were 55%, 38%, 21%, and 15%, respectively (10Rempel et al, 2006).

In our study, the most number of complaints were from the neck area, and this is compliant with the results by Dr. Bayaat and also a study by NIOSH organization (6BaiatTork et al,2001 and 21Putz-Anderson et al,1992). This is highly expected in people who constantly bend up and down their neck and also keep their neck in a forward bending position.

In this study, the back disorder problems did not show any difference in computer game users and other general users. Considering that the most important factor for backache, among the computer users, is sitting on a non-ergonomic chair or desk for a long period of time. This matter is almost the same for both computer user groups, and it is not expected to see a significant difference between the two groups.

In our study, the disorder frequency in neck, shoulder, and hand area was higher in boys, and this result was also confirmed in a study by Jenkins and Szeto (12Kristensen et al,2005, 22Szeto et al,2008, 23Jensen et al,1998). Of course, considering the low number of girls in this study, this analysis was conducted for boy users in both groups. The results in both groups showed higher frequency for boys in all cases. Lack of any difference between the girls of the two groups can not be conclusive, and may be because of their small sample size.

In our current study, the gaming history is effective on musculoskeletal disorders' frequency. This is proved by results of another study by Gerr (24Gerr et al,2002).

This study had some limitations, too. For instance, not having any possibility for back translation and erroneous responses by some participants to the questions by the surveyors are among these limitations.

### **5-Conclusion:**

Based on the findings of this study, the frequency of musculoskeletal disorders in computer users and especially in computer game users was very high. Considering the importance of these disorders in users' efficiency and increase in the number of sick time absence by the employees due to their musculoskeletal disorders, much more attention must be given to this problem in order to prevent it from happening in the future. Following the ergonomic principles in designing machines and devices related to the computer and purchasing the ergonomically designed equipment and training employees for these matters can drastically reduce the number of disorders in the country's future employee population.

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**Table 1-** Musculoskeletal disorders frequency in computer game users in comparison with that of other users based on the body parts involvement

Variable	Group				P-Value
	Computer game users	Non-users			
	Frequency	Percent	Frequency	percent	
Neck area Positive disorder	106	73.61	140	48.27	<0.001
negative	38	26.39	150	51.73	
Should area Positive disorder	82	56.94	86	29.65	<0.001
negative	62	43.06	204	70.35	
Back area Positive disorder	87	60.41	163	56.2	0.32
negative	57	39.59	127	43.8	
Hand and Positive wrist disorder	94	65.27	80	27.58	<0.001
negative	50	34.73	210	72.42	

*Table 2* - A comparison on the musculoskeletal disorders in all the samples based on the sexes.

Variable		Quantity (percent)			
		Boy		Girl	
Neck area disorder	Positive	User 101(74.81)	Non-user (50.45%)81	User (5.50%)5	Non-user (67.52%)59
	Negative	34(25.18)	(5.54%)97	(5.44%)4	(47.33%)53
	Significance level	P<0.001		P=0.7	
Should area disorder	Positive	76(56.29)	(15.24%)43	(66.66%)6	(71.35%)40
	negative	59(43.7)	135(%84.75)	3(%33.33)	72(%28.64)
	Significance level	P<0.001		P=0.26	
Back area disorder	Positive	(60%)81	103(%86.57)	)77.77(%7	60(%57.53)
	negative	(40%)54	75(%13.42)	)22.222(%	52(%42.46)
	Significance level	P<0.18		P=0.63	
Hand and wrist disorder	Positive	92(14.68%)	62(%83.34)	2(%22.22)	18(07.16)
	negative	43(86.31%)	116(%16.65)	7(%77.77)	94(%92.83)
	Significance level	P<0.001		P=0.17	

**Table 3** – The frequency of musculoskeletal disorders in computer game users based on the gaming records

Variable		Game Record (percent)			P-Value
		Frequency Less than 1 year	Frequency from 1 to 3 years	Frequency more than 3 years	
Neck area disorder	Positive	56(70/88)	22(70/96)	28(82/35)	0/68
	negative	23(29/11)	9(29/03)	6(17/64)	
	Total	79(100)	31(100)	34(100)	
Should area disorder	Positive	49(59/47)	)35(19/6	)94(52/18	0/039
	negative	50(40/32	)64(80/25	)05(47/16	
	Total	(100)79	(100)31	(100)34	
Back area disorder	Positive	02(62/49	)03/299(	)23/88(30	0/029
	negative	9830(37/	)96/70(22	)76/114(	
	Total	(100)79	(100)31	(100)34	
Hand and wrist disorder	Positive	)88(70/56	)06(58/18	19(55/88)	0/87
	negative	)11/29(23	)93(41/13	15(44/11)	
	Total	(100)79	(100)31	34(100)	