

Investigating the Visual Fatigue in VDT Operators in the Banks of Qasr-e Shirin (Kermanshah-Iran)

Afshin Darsanj^a, Hamed Yarmohammadi^a, Mohsen Poursadeghiyan^{b,c}, Sahar Dalvand^d, Hossein Javadzad^e, Razie Salehi^f, Faramarz Gharagozlou^{a*}

^aResearch Center for Environmental Determinants of Health (RCEDH), School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

^bHealth in Emergency and Disaster Research center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

^cDepartment of Ergonomics, Pediatric Neurorehabilitation Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

^dDepartment of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.

^eDepartment of science, Farhangian university of Uremia, Uremia, Iran.

^fDepartment of Public Health, School of Health, Ilam University of Medical Sciences, Ilam, Iran.

*Correspondence should be addressed to Mr. Faramarz Gharagozlou, Email: gharagozlou@kums.ac.ir

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Background & Aims of the Study: Considering the increasing use of computers in the official and social environments of Iran, it seems in the near future, eye and physical discomfort caused by working with computers will become one of the most important health issues in our society, which seriously threatens the employee health and, as a result, leads to significant financial and industrial losses. The aim of this study is determination of the visual fatigue of video display terminal (VDT) operators in the banks of Qasr-e Shirin, Kermanshah province of Iran.

Materials and Methods: This study was carried out, using a descriptive-analytical method on all 58 VDT operators of Qasar-e shirin banks in 2017. A two-part questionnaire including demographic information and visual fatigue was used to measure visual fatigue. Data were analyzed by descriptive statistics (frequency, percentage, central indices and dispersion) as well as independent t-test, Mann-Whitney, ANOVA and Pearson correlation tests, using SPSS Ver. 16.

Results: The results showed the mean and standard deviation of visual fatigue was 48.76 ± 28.18 . Visual fatigue was not observed in 8.6% of subjects, but 24.1% had low, 24.1% had moderate and 43.1% had severe visual fatigue. The highest visual fatigue (3.49 ± 1.93) was found in subjects with glasses and the lowest (3.35 ± 2.43) was seen in single individuals. There were positive and significant relationships among working hours with visual strain and visual fatigue subscale; also, between the number of working hours with visual strain and visual fatigue subscale.

Conclusion: The findings suggest the high level of visual fatigue. Therefore, it is recommended to avoid visual fatigue by corrective and preventive measures such as reducing the working time with VDTs and/or using standard computers.

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Background

After decades of computer presence in human life, today computers have become the major part of life. According to some estimates, about

75 percent of all routine jobs in 2000 were somehow related to computer use (1). With the increasing trend of computer-related activities around the world, the number of users of this device has increased from around 700 million users in 2007 to one billion in 2010 (2). At the beginning of the development of computers and video displays, the researchers paid more attention to their radiation, but gradually eye-related complaints from work with video displays became a major issue and for the general explanation of these complaints, the term computer vision syndrome was arisen (3). Several studies have shown that about 75% of computer users have visual problems associated with work (4,5). Also, the harmful effects of working with VDTs are completely related to visual disorders and can affect the accuracy of effective staff (6). Visual fatigue includes a wide range of symptoms such as headache, unwilling to continue working, and eye pain. In the various studies performed on computer operators, the most complaints include pain and pressure on the eye, dry eye syndrome (DES), Epiphora, irritation and conjunctivitis, blurred vision, diplopia, neck pain, waist and shoulder pain (1,7).

The findings of a study in 2007 about visual fatigue of the telephone information center operators showed a positive and significant association between neck pain and eyestrain symptoms of the call-center operators (8). In a further study on 105 computer operators of Sadoughi University of Medical Sciences in Yazd, during the years 2007 and 2008, the prevalence of visual complaints in computer operators included visual fatigue (79%), epiphora (57%), eye irritation and conjunctivitis (30%), which these complaints generally had significant correlations with the inappropriate workplace conditions (9). Our findings showed that, when studying electronic books, visual fatigue was significantly higher than that of ordinary books, and when reading ordinary books visual acuity was significantly higher than visual acuity while studying electronic

books (10). Usually visual fatigue take places when the work is done carefully, or when low quality printed books or low-quality electronic texts are read, or when reading in insufficient light and exposed to flashing lights or refractive errors (11). Most visual activities can cause eye fatigue, especially in long periods of time (12).

Aims of the study:

Due to the increasing use of computers in the administrative and social structure of Iran, it seems that, in the near future, eye and body symptoms caused by computer work will become one of the most important health issues in our society, and threaten the health of the workforce and consequently, lead to significant financial and industrial losses. Therefore, this study aimed to determine the visual fatigue in VDT operators in Qasr-e Shirin banks.

Materials & Methods

This descriptive-analytical study was achieved on all computer operators of Qasr-e-Shirin banks with a minimum of one year of work experience with computer in 2017. People with a history of eye hereditary diseases or visual injuries caused by accidents were excluded from the study. Final population in this study is 58 people. To do this study, firstly, computer operators were informed of the purpose of the study and after getting informed consent, the data was gathered through a reliable and valid questionnaire verified by Habibi *et al.* (18).

The questionnaire used had two parts, the first part included demographic and occupational characteristics. This section includes information on age, sex, BMI, marital status, educational level, work experience, hours of work at a computer during the day, using or not using prescribed glasses, the type of glasses used and the type of monitor and the angle of the window relative to the computer screen. The second part was Visual Fatigue Questionnaire. This questionnaire contains 15 questions with 4 visual strain domains (4 sub-domains), Visual impairment (5 sub-domains), eye surface impairment (3 sub-domains), and

problems outside the eyes (3 sub-domains). The questions in this questionnaire consist of a 11-points Likert scale from zero to 10, which higher scores reflect more visual fatigue and lower scores indicating less visual fatigue. The total scores of these questions are calculated and then divided into 15. The minimum and maximum scores of the questionnaire were 0 and 10. The visual fatigue level includes no fatigue (score ≤ 0.65), low fatigue (0.66-2.36), moderate fatigue (score 2.37-3.88), and severe fatigue (score ≥ 3.89). This questionnaire was designed by Habibi et al. in 2011 to determine the visual fatigue of VDT operators. The validity and reliability of Persian version of this questionnaire were confirmed (13). At the end, the data gathered was analyzed through descriptive statistics (frequency, percentage, central indices and dispersion), as well as independent t-test, Mann-Whitney, analysis of variance and Pearson correlation using SPSS Ver. 16.

Results

The total number of participants was 58, of which 53 participants were male and 5 were women. In this study, 81% of the participants were married. The mean age of participants was 36.43 ± 6.85 years. Demographic and occupational characteristics are presented in Table 1.

The mean visual fatigue was 48.76 ± 28.81 . The average hours of working with computer was 7.24 ± 1.85 ranging from 1 to 10 hours. The analysis of variance showed no significant relationship between visual fatigue and educational level ($p=0.582$) and the angle of positioning the monitor relative to the window ($P=0.304$). Using independent t-test, the relationship between visual fatigue and variables of sex, marital status, wear glasses, displays, and lighting were investigated.

Table 1) Demographic and occupational characteristics of participants in the study

Variable	Condition	Number	Percent
Sex	Male	53	91.4
	Female	5	8.6
marital status	Single	11	19
	Married	47	81
Educational level	Diploma	13	22.4
	Associate	9	15.5
	Bachelor	31	53.4
	MSc	5	8.6
Home lamp type	LED	24	41.4
	fluorescent	34	58.6
Glasses	with	7	12.1
	without	51	87.9
Types of monitor	LED	18	31
	LDC	40	69
The angle of the monitor relative to the window	0 (facing)	3	5.2
	45	16	27.6
	90	12	20.7
	180 (back)	27	46.6

Table 2) Frequency of visual fatigue in VDT operators in Qasr-e Shirin banks (58 persons)

Visual fatigue	Frequency	Percent%
Without fatigue	5	8.6
Low	14	24.1
Moderate	14	24.1
Intense	25	43.1
Total	58	100

Table 3) Relationships among demographic variables and visual fatigue

	Variable	Condition	Mean \pm SD	p-value
Visual fatigue	Sex	Male	3.24 ± 1.97	0.895
		Female	3.36 ± 1.38	
	marital status	Single	3.05 ± 2.43	0.71
		Married	3.29 ± 1.81	
	Glasses	with	3.49 ± 1.93	0.723
		without	3.22 ± 1.94	
	The display	LED	3.48 ± 2.25	0.537
		LDC	3.15 ± 1.77	
	Lamp	LED	3.20 ± 2.15	0.868
		fluorescent	3.28 ± 1.77	

Accordingly, there are no found associations among visual fatigue level and any of these variables (Table 3). As shown in Table 3, the highest mean visual fatigue in subjects with glasses was 3.49 ± 1.93 and the lowest mean eye fatigue in single individuals was 3.05 ± 2.43 . The relationship between visual fatigue and all

of its sub-scales with glasses were measured using independent t-test and Mann-Whitney tests. According to the results of these tests, there were no statistically significant relationships among these variables. The relationship between demographic variables

with visual fatigue and its sub-scales is shown in Table 4. As this table shows, there were positive and significant relationships among the number of working hours with the visual strain and visual fatigue subscales.

Table 4) Relationships among demographic and occupational variables with visual fatigue and its subscales (58 persons)

Variables		Eye strain	Visual impairment	Eye disorders	Ocular problems	Tiredness
Age	R	.037	.134	-.089	.106	0.103
	P	.781	.316	.507	.429	.444
Number of working hours	R	.285	.157	.127	.245	.270
	P	.030	.241	.341	.064	.040
BMI	R	-.082	.020	.102	-.092	.010
	P	.542	.884	.444	.492	.938

Discussion

Our findings revealed that 8.6% of subjects didn't have any visual fatigue. Visual fatigue of 24.1% of subjects was low, 24.1% were moderate and 43.1% were severe. Generally, 91.4% of patients have experienced visual fatigue. This suggests a high prevalence of this complaint among computer operators. In the study of Zakerian et al., 20.7% had low visual discomfort, 70% had moderate discomfort and 9.3% had severe visual discomfort (14). In the study of Ziaee et al., 87.1% of computer operators had low visual fatigue (15). In the study of Dehghani et al., eye-related complaints of computer operators were 79% (3). Conlon et al. showed that 53% of the subjects had symptoms of visual discomfort, 35% had moderate discomfort and 12% had severe visual discomfort (3,16). Meanwhile, Borsting et al. detected that 83% of the patients had low discomfort, 16% had moderate discomfort and 1% had high visual discomfort (17). In our study, most participants experienced severe visual fatigue, while in the study of Zakerian, they had a moderate visual fatigue. In accordance with Borsting and Conlon, most of

the subjects experienced low visual disorders (16,17). In Ziaee et al study, 45.4% of the subjects had severe visual fatigue (15), which is in line with our study results. The amount of training given to people in relation with hours of work at a computer, the daily allowable time that people can work with their computer without damage to their vision, as well as the amount of time needed during work to prevent visual acuity, can also related to difference in visual discomfort in these studies (14). Although the computer itself does not cause an eye disease with a natural and unique origin, but operators complain of signs such as visual fatigue and pressure on the eyes, irritation, dry eye syndrome, and so on are very common. In a study, 10 to 15 percent of patients who referred for routine eye examination complained of headache and visual fatigue due to hours of work at computers. In addition to visual problems such as adaptive and refractory disturbances in the far and near distances, the workplace conditions including environmental lighting, the quality of the display device and minor issues such as comfortness, and the user's chair can contribute to creating or reducing these symptoms (18).

The average hours of working with computer in our study was 7.24 ± 1.85 ranging from 1 to 10 hours. Also, there was a positive and significant relationship between the number of hours of work with visual strain subscale and visual fatigue. A study by Futima *et al.* in 2002 suggested that long hours of work at the monitor did not change the visual functions such as matching, convergence, three-dimensional vision, or far or near visual acuity, and the changes reported in previous studies were mostly due to the work-related fatigue at near distance compared to the direct effect of the screen to create eye disease (19). In another study conducted on the staff of the Information Center 118 in 2007, the associations among visual fatigue and neck and shoulders pain were evaluated by a questionnaire. They found a positive and significant relationship between neck-shoulder discomfort and visual pressures (20). In the study of Arghawan Afra *et al.*, visual complaints had a significant relationship with age and hours of work at computers (21). OSHA's recommends that each operator should have 3 to 5 minutes of visual relaxation every hour and look at the objects at far distances. Therefore, it is important to apply the abovementioned recommendations and training to operators (22). With long hours of work at computers during the day, the eye did not have enough time to rest for the elimination of tensions on itself, and even at an earlier age, its effect was clearly observed and it is probably the main cause of visual fatigue in computer operators. Long-term viewing of the monitor at a closer range leads to fatigue in the eye adaptation and inadequacy and weakness, resulting in visual strain and headache (23). The study of Samavati *et al.* showed that the daily hours of working with a computer and the increase in the duration of annual work with a computer were effective in increasing the computer vision syndrome and statistically significant relationship was observed (24). In the present study, the highest mean visual fatigue in subjects with glasses was 3.49 ± 1.93

and the lowest mean visual fatigue in single individuals was 3.05 ± 2.43 . According to Ziaee *et al.*, the operators with glasses had a higher level of visual fatigue than users without glasses.

People with pre-existing problems, such as visual impairment, lens defects, and keratoconus, should wear glasses. These problems can contribute to visual fatigue, and the greater the sensitivity of people to light and the emission of monitors can increase the visual fatigue resulting from working on a computer (15).

Our study suggested no significant relationship between visual fatigue and educational level. Arghavan Afra *et al.* found a significant correlation between visual impairment and educational level and the statistically significant difference between the mean of visual discomfort at different educational levels, but no significant relationship with marital status (21). Their findings were not in line with our study that one of the reasons may be the difference in the population of the participants as well as the low sample size. We observed no relationship between age and sex in the study. Some reasons for this may be the low average age and the unequal number of women and men in the study. In the study of Manaviat *et al.*, the relationships among age and sex with visual complaints were not significant (9). In the present study, the relationship between visual complications and age may be due to unrecognized refractive errors in operators, therefore, it is important to accurately examine the visual acuity in the individuals (13). Ziaei *et al.* observed no relationship between sex and visual fatigue (15). If other form of fatigue is effect on this object, we suggest used of other questioner for evaluating (25).

Conclusion

Based on the US Occupational Safety and Health Administration Report, 10 to 15 percent of patients referred for a routine visual

examination complained of headaches and visual fatigue due to work at a computer which their working conditions such as lighting, monitor quality and suitability of operator chair were involved in creating or reducing these symptoms. In this study, the placement of tools in an irregular manner, the presence of nonstandard seats, or inappropriate use of standard seats, inappropriate user-to-monitor spacing, inappropriate ambient light conditions, improper positioning of the illumination source relative to the monitor, and light reflections may be the cause of the relationship between visual complaints and ergonomics of working conditions, chairs and monitors. Guarantee of occupational health, which is further enhanced by identifying the harmful factors at the workplaces, identifying at-risk workers and providing their health education are some of the most important tasks of community health nurses. Employers should also consider this important issue and take appropriate measures to prevent such complications.

Footnotes

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Conflict of Interest:

The authors declared no conflict of interest.

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