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Original Article

Investigating Musculoskeletal Discomforts and their Relation to Workplace Ergonomic Conditions among Computer Office Workers at Alzahra Hospital, Isfahan, Iran

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Keywords
Musculoskeletal diseases; Musculoskeletal pain; Ergonomic assessment

Abstract

Background: Musculoskeletal disorders (MSDs) are relatively prevalent among office employees of hospitals. These disorders are related to several ergonomic risk factors including failure to cope with physical job demands, repetitive motions, contact stress, and poor or inappropriate body postures. This study was conducted to evaluate MSDs in computer office workers at Alzahra Hospital, Isfahan, Iran.

Methods: This cross-sectional descriptive-analytic study was performed at Alzahra Hospital in summer 2014. Overall, 71 office workers were enrolled in the study via systematic sampling method. Ergonomic risk factors were evaluated using the Rapid Office Strain Assessment (ROSA) checklist. The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was used to assess MSDs. The collected data were analyzed using Spearman and Pearson correlation tests in SPSS software.

Results: Musculoskeletal discomfort was mostly prevalent in the neck, low back, and shoulder area, respectively. Moreover, 97.2% of participants had final ROSA scores of 5 and higher. Spearman correlation test showed a direct relationship between the final ROSA score and severity of musculoskeletal discomfort in the upper limb area including arm, forearm, and wrist ($P < 0.05$); this relationship did not exist for other parts of the body.

Conclusion: Based on the ROSA scores, most individuals working with computers were prone to MSDs. Therefore, it is necessary to implement suitable ergonomic interventions targeting body postures and work place improvements.

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Introduction

Nowadays, work-related musculoskeletal disorders (WMSDs) are a major issue for employees and their managers in the health sector of various countries.[1,2] WMSDs are common disorders and are among the major causes of occupational disability.[3] In addition, these disorders are the leading causes of the loss of working time, increased costs, and injuries to human resources, and are one of the biggest ergonomic problems in most countries.[4]

Based on previous studies, more than half of absences from the workplace are due to musculoskeletal disorders (MSDs).[5] According to the investigations conducted in the United States, WMSDs account for 60% of all new cases of ailments in the workplace,[6] to the extent that prevention of WMSDs has now become a national priority in most countries.[7]

Various risk factors contribute to the incidence of these injuries, which can be classified as biomechanical factors including undesirable conditions and tasks with repetitive motions and static work, environmental factors such as temperature and psychosocial factors, and individual factors such as gender, age, body mass index (BMI), etc.[8] The weak ergonomic design of the work stations is one of the causes of WMSDs and one of the ergonomic risk factors of the workplace, reducing productivity.[9] Meanwhile, in addition to increased computer usage, the development of technology has been accompanied by an increase in MSDs among users; computer-based technology has increased the prevalence and incidence rate of MSDs among individuals who use a computer on a daily basis.[10]

Studies performed in the United States and Germany have been indicative of a high incidence rate of WMSDs among computer users.[11] These disorders generally involve the upper limbs, head, neck, and waist. Repetitive movements of fingers, hands and wrists, continuous undesirable positions of the wrist and forearm, and contact pressure on the wrists have been considered as possible mechanisms of damage caused by the use of keyboard and mouse.[10]

Nevertheless, Office staff in hospitals, which act as the forefront of support for the medical sectors, are not exempt from this condition.[12] The incidence of MSDs among computer users of the administrative sectors and lack of attention to these disorders leads to increased treatment costs, reduced productivity, reduced job satisfaction, increased workplace absenteeism, negative psychological burden, decreased motivation in related departments, and impact on other parts of the department, a larger financial burden imposed on the society, as well as reduced quality of service. Moreover, ignoring ergonomic conditions in the working environment causes incomplete treatment and recurrence of problems in the individual. Therefore, paying special attention to the prevention of these disorders is necessary.

Since hospitals are one of the cornerstones of community health and are responsible for the major task of treatment, all structures and collections, including computer users of the administrative sectors, must be in good health so that they can play their roles well in the treatment and promotion of community health. Accordingly, the present study was carried out with the aim to investigate the status of MSDs among computer users of the administrative departments in Alzahra Hospital in Isfahan, Iran, using Rapid Office Stress Assessment (ROSA) method and its relationship with ergonomic risk factors in the workplace.

Methods

The present study was a cross-sectional descriptive-analytic study conducted on computer users of Alzahra Hospital in the city of Isfahan. The hospital was selected due to its high number of administrative staff and the presence of various administrative units; 71 people were selected systematically and randomly from the list of employees working in the administrative units in the human

resources department.

The study inclusion criteria were computer use in Alzahra Hospital, willingness to participate in the study, at least 1 year of work experience at the administrative units of the hospital, and at least 3 working hours a day with the computer. Before selecting the subjects and completing an anonymous questionnaire, a written consent form was obtained from them for participation in the study. All subjects were examined by a physical therapy practitioner before selection and participation in the study, and individuals with spinal fractures, kyphosis, lordosis, scoliosis, disc rupture and herniation, and other MSDs were not included in the study.

Initially, general health, including physical, psychological, and social health, was controlled among the individuals using the General Health Questionnaire-28 (GHQ-28). On the basis of this questionnaire, the staff with a final score of 23 or higher were excluded from the study (score 23 and higher indicated a poor physical-mental health status among the individuals). Data were collected using the observational and questionnaire methods. In addition, an assessment of the status of individuals was carried out by an ergonomist based on the Rapid Office Strain Assessment (ROSA) method.

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was exploited to assess the incidence rate of MSDs. This questionnaire was developed by Alen Hedge et al. to collect data on MSDs .[13] The CMDQ has been designed in the three stages of "discomfort frequency (the number of pain feelings among 12 hours)", "discomfort severity", and "impact on working capacity in the past week", and includes a body map analyzing 12 body parts (a total of 20 parts of the body) of the body. The mean discomfort frequency for the 12 parts of the body was calculated and considered as the score of the MSDs. At present, this questionnaire is being used in the United States and other countries worldwide and is recognized as a valuable tool in evaluating the severity of MSDs. In Iran, the validity and reliability of this questionnaire have been calculated with Cronbach's alpha coefficient ($\alpha = 0.986$).[13]

Among the observational methods for determining the ergonomic risk factors in the ergonomic workplace, the ROSA method has a high reliability and validity in evaluating the ergonomic risk factors in computer-based tasks.[14] This method includes 3 main evaluation steps; the final ROSA score was obtained after completing each section and identifying the scores in the sections regarding the chair, monitor and telephone, and mouse and keyboard in the corresponding tables. The final score of this method was in the range of 0-10, with scores of 3-5 and above 5 indicating an alert level and the need for ergonomic interventions, respectively.[10]

Demographic characteristics of the subjects including age, gender, BMI, work experience, and occupation type were also recorded. The collected data were analyzed using SPSS software (version 20.0, IBM Corporation, Armonk, NY, USA). Descriptive indices and tables were employed to calculate and determine the status of the studied indices. Moreover, the Pearson and Spearman tests were used to assess the relationship between ergonomic indices (ROSA score) and the severity of MSDs.

Results

The study was conducted on 71 computer users working at administrative units of the hospital in the summer of 2014. Among these individuals, 39 (54.9%) and 32 (45.1%) were men and women, respectively. Other variables are presented in table 1.

Table 1. Mean age, weight, height, and body mass index among the subjects

Variable	Mean	SD
Weight (kg)	73.9	73.90 ± 11.80
Height (cm)	168.28	168.28 ± 8.80
BMI (kg/m^2)	26.02	26.02 ± 3.57
Work experience (year)	15.5	15.5 ± 7.50

SD: Standard deviation; BMI: Body mass index

Table 2. Frequency of distribution of musculoskeletal discomforts among computer users of administrative units

Severity of musculoskeletal discomforts	Never	1-2 times weekly	3-4 times weekly	Once daily	Several times daily
Limb	n (%)	n (%)	n (%)	n (%)	n (%)
Neck	16 (22.5)	14 (19.7)	15 (21.1)	6 (8.5)	20 (28.2)
Shoulder	25 (35.2)	11 (15.5)	7 (9.9)	9 (12.7)	19 (26.8)
Back	27 (38.0)	11 (15.5)	8 (11.3)	6 (8.5)	19 (26.8)
Arm	37 (52.1)	7 (9.9)	10 (14.1)	9 (12.7)	8 (11.3))
Waist	19 (26.8)	10 (14.1)	13 (18.3)	6 (8.5)	23 (32.4)
Forearm	32 (45.1)	13 (18.3)	6 (8.5)	6 (8.5)	14 (19.7)
Wrist	32 (45.1)	6 (8.5)	6 (8.5)	8 (11.3)	19 (26.8)
Hip	41 (57.1)	13 (18.3)	2 (2.8)	8 (11.3)	7 (9.9)
Thigh	48 (67.6)	7 (9.9)	1 (1.4)	7 (9.9)	8 (11.3)
Knee	36 (50.7)	10 (14.1)	2 (2.8)	10 (14.1)	13 (18.3)
Leg	51 (71.8)	6 (8.5))	3 (4.2)	4 (5.6)	7 (9.9)
Sole	50 (70.4)	5 (7.0)	3 (4.2)	5 (7.0)	8 (11.3)

The frequency distribution of musculoskeletal discomfort revealed that the incidence of MSDs in the upper limbs of the computer users was higher. Pain in the cervical region (77.5%) accounted for the greatest complaint of the total discomfort in different organs of the body among the users, followed by pain in the waist (73.2%), shoulders (64.9%), upper back (62.0%), and wrists (59.9%). In addition, the least reported pain was in the leg, sole, and thigh regions with a prevalence of 28.2%, 29.6%, and 32.4%, respectively. The results indicated that the majority of individuals with pain and discomfort in an organ had experienced these symptoms several times a day (Table 2).

Based on the evaluations carried out using the ROSA method on 71 computer users, only 2.8% obtained a ROSA score of less than 5 and were ergonomically in good condition, and 97.2% of individuals had a score of 5 or more. The Spearman correlation coefficient used to compare the results of ROSA and MSDs showed a direct correlation between the severity of MSDs in the upper limbs (arm, forearm, and wrists) and the final score of ROSA ($P < 0.05$); however, there was no significant relationship with the final score of ROSA in other organs of the body ($P > 0.05$) (Table 3).

In addition, the relationship between demographic variables and the incidence rate of musculoskeletal discomfort was examined in order to determine the effect of BMI on the prevalence of MSDs and the final score of ROSA with Spearman and Pearson correlation coefficients.

Table 3. Spearman correlation coefficient between final score of Rapid Office Strain Assessment and musculoskeletal discomforts among computer users

Musculoskeletal discomforts	Musculoskeletal discomforts	
	Pearson correlation	P
Neck	0.070	0.309
Shoulder	0.211	0.001
Back	0.145	0.221
Arm	0.325	0.301
waist	0.233	0.141
Forearm	0.234	0.001
Wrist	0.211	0.001
Hip	0.045	0.503
Thigh	0.151	0.443
Knee	0.122	0.504
Leg	0.023	0.332
Sole	0.029	0.543

The results revealed that both MSDs and final ROSA score had a significant relationship with demographic variables and BMI; however, they had no significant relationship with height, weight, work experience, and gender ($P < 0.05$).

Discussion

The highest incidence rate of MSDs among the subjects was in the neck, waist, shoulders, and wrists. This issue is indicative of the critical message that in order to perform ergonomic interventions and modify

workplace conditions, addressing the risk factors of these areas of the body is of great importance. In most other scientific studies, MSDs in the upper extremities have been shown to have a high rate of incidence among administrative staff and computer users,[15,16] which can be reduced to a large extent with appropriate ergonomic interventions.[17]

In a study performed in an office work environment, Choobineh et al. examined the prevalence of MSDs and their associated risk factors. They also concluded that the waist and neck areas with the prevalence of, respectively, 49% and 47% accounted for the highest incidence rates of symptoms among the administrative staff.[18] Moreover, through determining the ergonomic indices of the administrative workplace, they also concluded that the improper ergonomic status of the administrative environments was the main cause of the high prevalence of these symptoms among the employees. Thus, the improper height of the desk and location of the monitor and keyboard, inappropriate distance of the monitor from the individual, lack of sufficient space for the feet under the desk, inappropriate location of the phone and other office supplies on the desk, lack of adjustability of the slope of the seat and back of the chair, the high seat depth, and the inappropriate position of the monitor relative to the windows are among the major ergonomic problems in the administrative work environments needing to be addressed.

Recent studies have indicated that complaints of musculoskeletal pains especially in the cervical, waist, arm, and wrist regions are extremely prevalent among computer users.[19] These complaints were because of the irregularity of the head and body positions, the severity of the activity, and the long hours of working with the computer, which led to disorders in their natural activities (40%) and work absenteeism (37%).[20]

The incidence of these disorders can be prevented by observing the ergonomic principles in the office workplace; hence, increasing employee productivity and ultimately increasing organizational productivity. Therefore, these risk factors must be recognized prior to the modification of the conditions or the design of the work environment in order to achieve the highest effectiveness at the workplace with the lowest cost. There are several methods for identifying and evaluating these factors.[21-23]

In the current study, one of the newest observational methods, called ROSA, was employed, which has been used in very few studies.[10] Based on the ROSA technique and statistical analyses carried out on the subjects in this study, about 97.2% of them had a score of above 5 and were at medium and high risk levels, indicating very poor ergonomic conditions in the office workplace of the hospital and the necessity of performing ergonomic interventions as soon as possible. The results indicated that high-risk level in ROSA technique had a direct and significant relationship with the incidence of musculoskeletal symptoms among computer users. These results were in agreement with the results of other studies conducted using different methods.[1,24]

Various studies in recent years have confirmed that the WMSDs can be greatly reduced through ergonomic interventions appropriate to the type of risk factor identified.[25-27] The results of the present study showed that the incidence of MSDs in upper extremities had a direct and significant relationship with ergonomic risk factors in these areas. Moreover, ergonomic interventions should be fitting to the risk factors affecting these areas; for instance, modification of improper neck position that can be because of the inappropriate height and distance of the monitor from the user, or deviation of the hand and arm from their normal position that can be due to inappropriate height of the desk and the location of the keyboard. The findings of this study can be used by managers of hospitals or other public and private institutions and organizations in order to reduce the rate of MSDs among their staff.

Conclusion

MSDs, especially upper limb discomfort, are very prevalent among computer users, and a very high percentage of individuals are at risk of MSD incidence based on the ROSA method. Therefore, ergonomic interventions are required as soon as possible in order to correct situations through appropriate training and redesigning of the workplace in accordance with ergonomic principles.

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Conflict of Interest

Authors have no conflict of interest.

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