Study of musculoskeletal disorders prevalence and ergonomic conditions by ROSA in administrative staff of Mashhad University of Medical Sciences

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Abstract: *Background and Purpose: Musculoskeletal disorders are one of the most common occupational diseases in computer users which leads to increased employee absenteeism and reduced productivity in work environments. The aim of this study was to determine the prevalence of musculoskeletal disorders associated with work and its risk factors in administrative staff of Mashhad University of Medical Sciences. Method: This descriptive cross-sectional study was conducted on 138 administrative staff of Faculty of Nursing and Health of Mashhad University of Medical Sciences. A Nordic questionnaire was used to assess the prevalence of musculoskeletal disorders among administrative staff and the Rapid Office Strain Assessment (ROSA) method to assess the status of work postures. SPSS VER-16 software was used to analyze the data. Findings: The total number of participants was 138 in both colleges, of which 45 were male (32.6%) and 93 women (67.4%). The prevalence of musculoskeletal disorders in administrative staff over the past 12 months showed that the most common disorders were upper limbs (76.9%), lower back (72.2%), knees (70.0%) and wrists (65.3%), respectively. Posture assessment using ROSA method indicated that 7 (5.3%) in the low risk area (score less than 3), 119 (90.2%) in the warning zone (3-5 points) and 6 (4.5 %) in the area where the ergonomic intervention is needed (score above 5). There was no significant relation between the risk of musculoskeletal disorders with a Work Experience and BMI but was associated with age (p = 0.01), so that the score for subjects under the age of 30 was higher. The incidence of disorders in women was higher than that of men. Conclusion: The results show a high prevalence of musculoskeletal complaints especially in upper limbs in computer users. Considering the effect of these disorders on reducing organizational productivity, applying ergonomic principles in the workplace and conducting training courses is effective in reducing the level of risk and disruption of musculoskeletal disorders.*

Keywords: *Work Related Musculoskeletal Disorders, Nordic Questionnaire, Rapid Office Strain Assessment (ROSA).*

INTRODUCTION

In recent years, the use of computers is necessary in almost all cases, and less professional can be found in which the computer is not used. New technologies not only did not reduce musculoskeletal disorders due to labor, but increased repetitive movements, static conditions during work and increased occupational stress (Gerr, Marcus and Monteilh, 2004). Scientific reports and published articles show that the risk of musculoskeletal disorders in computer users is higher than other occupations. By definition, work-related musculoskeletal disorders (WMSDs) are caused by any damage or disturbance to the muscles, tendons, joints, bones and ligaments that result from an acute trauma or due to the occurrence of repetitive trauma during working time (Choobineh et al., 2013). In a study done by Dr. Halvani et all, upper limb musculoskeletal disorders have been reported to account for most of these disorders, which may be due to the elegance and vulnerability of these organs, and on the part of Another is due to the greater involvement of these organs during the work of the lower extremity. The prevalence of these disorders among computer users and those who spend most of their time working on it can reduce productivity and create job dissatisfaction. Musculoskeletal disorders are the most common cases of work-related illnesses, with the second highest occupational diseases (Choobineh et al., 2013; Robertson et al., 2009). Research has shown that feelings of pain and discomfort in various parts of the musculoskeletal system are major problems in working environments, which are the main cause of absenteeism, and also lead to permanent disabilities in the staff, and such symptoms as Pain, numbness, lethargy, loss of working time, reduced production, and increased labor costs. For people who spend a lot of time working with computers, these disorders are a common problem. Excessive use of the computer is associated with increased pain and numbness in the neck, shoulder, elbows and wrists (Habibi E, Soury, 2015; Hakala et al., 2006; Hossain et al., 2014; Kaliterna, Prizmic and Zganec, 2004). Due to various ergonomic exposures, working with computers can cause musculoskeletal disorders in various parts of the body, including shoulder, neck, wrists and lumbar spine (Voerman et al., 2007). It is important to note that the creation of musculoskeletal disorders, in addition to ergonomic exposures, depends on factors such as age, gender, work history, individual sensitivity and physical fitness (Delisle et al., 2006; Fisher and Gibson, 2008). Also, the key factors that contribute to the formation of the body's posture are the shape and location of the keyboard and mouse and the screen. Musculoskeletal disorders among computer users are commonly found in the upper limb, head, neck and lower back (Ferasati and Jalilian, 2014). In the study, the most important risk factors that have been involved in many occupations in musculoskeletal discomfort are repetitive activity, excessive force, awkward posture, contact pressure, vibration and physical fatigue. In computer users, in addition to some of the mentioned factors, there are other factors such as age, gender, obesity, physical activity and smoking as individual factors, issues related to the design of the workstation, such as the duration of using the computer, the frequency of people's rest, the way of working with the keyboard, The state of the computer monitor, the type and use of computers connected to the computer and psychosocial and social factors also contribute to musculoskeletal discomfort (Nasiri et al., 2015). In a study to assess the prevalence of musculoskeletal disorders among students using laptop and computer, 52.8% of people complained about the prevalence of musculoskeletal disorders in different areas of the body (Dockrell, Bennett and Culleton-Quinn, 2015). Working with the computer due to its nature and long-term sitting can cause many physical problems, including musculoskeletal disorders in various organs of the body. The present study was conducted among administrative staff of Faculty of Nursing and Nursing, Mashhad University of Medical Sciences, which has been working daily for a long time using computers. The purpose of this study was to evaluate the musculoskeletal disorders and its related risk factors among the administrative staff of the two colleges in order to use the results of this study to propose and implement the best strategies for reducing the risk of musculoskeletal disorders.

Methods

This descriptive and cross-sectional study was conducted among 138 administrative staff of nursing schools (75 nurses) and health (63 persons) from Mashhad University of Medical Sciences. Determining the sample size by census method and the criteria for entering individuals to study having more than one year work experience and working with computers during working hours. In addition, the existence of non-work-related musculoskeletal disorders and dissatisfaction and willingness to participate in the study are also considered criteria for withdrawal. A Nordic questionnaire was used to assess the prevalence of musculoskeletal disorders among administrative staff (Kuorinka et al., 1987). The Nordic questionnaire consists of three sections. The first part contains demographic information, the second part involves identifying 9 areas of the body that these disturbances can occur, and the third part contains additional questions about these areas of the body. Nordic standard questionnaire is a self-report questionnaire for qualitative evaluation of musculoskeletal disorders in the neck, shoulder, back, waist, elbow, wrists and hands, thighs, knees and feet (Rebelo and Soares, 2014). The ROSA (Rapid Office Strain Assessment) was used to assess the risk of musculoskeletal disorders. In this method, the posture of various organs of the body is observed and is graded according to certain principles. Higher scores represent greater pressure on the musculoskeletal system during labor. The ROSA method is a paper and observational method that can identify ergonomic risk factors and has good reliability for evaluating musculoskeletal disorders. The assessment steps in this method consist of three main parts: the points in the seats and the posture of the individual during sitting, the screen, the phone, the score of the mouse and keyboard, and the person's posture when using these tools and the length of time each of these tools is used. The relevant tables are placed for each section and the final score for ROSA is determined. In this method, first, the workstation and posture are ranked according to the ROSA checklist in different sections, and ultimately we get a final score between 0 and 10 that ranges from 0 to 3 low risk levels, points 3 to 5 alert levels And more than 5 points in the area require the intervention of ergonomics (Sonne, Villalta and Andrews, 2012). The significance level for statistical tests was considered to be 0/05.

Result

The total number of participants in this study was 138 in both colleges, of which 45 were men (32.6%) and 93 women (67.4%). The mean and standard deviation of the subjects age were 38.27 ± 8.77 years. Work experience is 10/84 ± 8/48 years. The working hours during the week are 45/84 ± 17/93 hours, and the duration of using the computer during the day is 5.85 ± 4.68 hours. The rest rate at work intervals is 44.08 ± 46.96 minutes. Body mass index (BMI) is 25.06 ± 3.89 between staffs. According to the World Health Organization (WHO), people based on their BMI were divided into four groups: low weight (less than 18.5), normal weight (18.5 - 24.9), overweight (25-29.9), and obese (More than 30) are divided (Anuurad et al., 2003). Table 1 shows the demographic information of the participants. The prevalence of musculoskeletal disorders over the past 12 months in the population of the staff surveyed is shown in diagram 1. Postural evaluation by ROSA revealed that 7 (5.3 %) in the low risk area (score less than 3), 119 (90.2%) in the warning zone (3-5 points) And 6 (4.5%) are in the area where the ergonomic intervention is needed (points above 5). According to Mann-Whitney test, there is no significant difference between women and men in ROSA scores (p = 0.75). Also, results of Kruskal-Wallis test showed that there was no significant difference in ROSA scores in subjects with different BMI groups (p = 0.18), as well as work experience (p = 0.08). According to Kruskal-Wallis test, there is a significant difference in the score of individuals with different age groups (p = 0.01). Comparison of two groups of age showed that the difference between the age group was less than 30 and the age group was more than 40 (p = 0.02), so that the score of people under the age of 30 was higher than that of people over 40 years old. There was no significant difference between the ages of 30 and 40 years. In a more detailed study between the two colleges, the administrative staff of the Faculty of Health was 21 (33.3%) male and 42 female (66.7%). In the staff of the Faculty of Nursing, 24 (32%) of the subjects were male and 51 (68%) were female. Diagram 2 shows the prevalence of musculoskeletal disorders among administrative staff of the two colleges.

Posture assessment by ROSA to determine the risk of musculoskeletal disorders in the School of Public Health revealed that 52 (91.2%) in the warning zone (3-5 points) and 5 subjects (8.8%) in the area of necessity Ergonomic intervention (more than 5) and in Nursing staff showed that 7 (9.3%) in the low risk area (score less than 3), 67 (89.3%) in the warning zone and 1 People (1.3%) are in the area where ergonomic intervention is required.

Table 1 : Demographic information of participants

| Number (percent)	Variable	
(%32.6)45	Male	Sex
(%67.4)93	Female	
(%4.3)6	Less than a BS degree	Educational
(%43.78)48	BS	
(%60)83	More than a BS degree	
(%1.44)2	Low weight(<18.5)	BMI
(%52.80)73	Normal (18.5-24.9)	
(%39.3)54	Overweight (25-29.9)	
(%50.7)7	Obese (>30)	
(%93.5)129	Right	Dominant hand
(٪6.5)9	Left	
(%52.2)3	Yes	Job change due to illness
(%97.8)135	No	
(%54.4)75	Sometimes/Regular	Smoking
(%45.6)63	No	
(%16.7)23	Single	Marital status
(%78.3)108	Married	
(%55)76	Yes	Regular sports activities
(%42.8)59	No	
(%8.7)12	Yes	Pass the posture class
(%93.1)126	No	
(%57.2)79	Yes	Knowledge of Ergonomic Errors of Occupation
(%42.8)59	No	
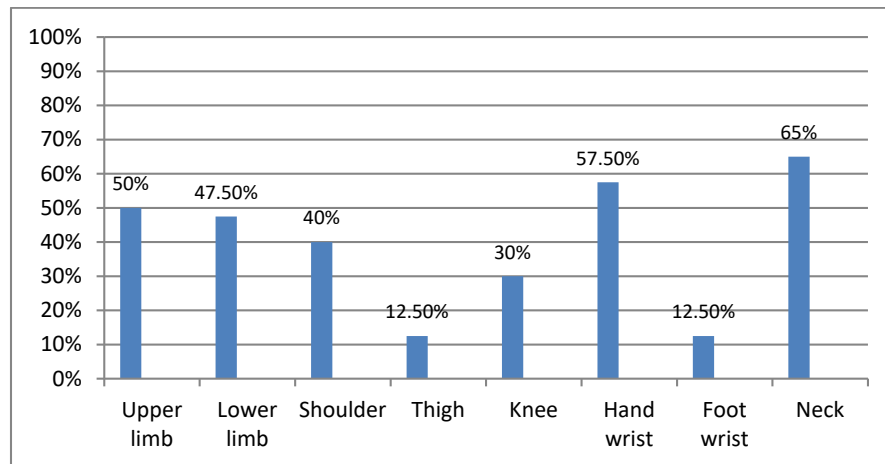
Diagram 1: prevalence of musculoskeletal disorders over the past 12 months among participants
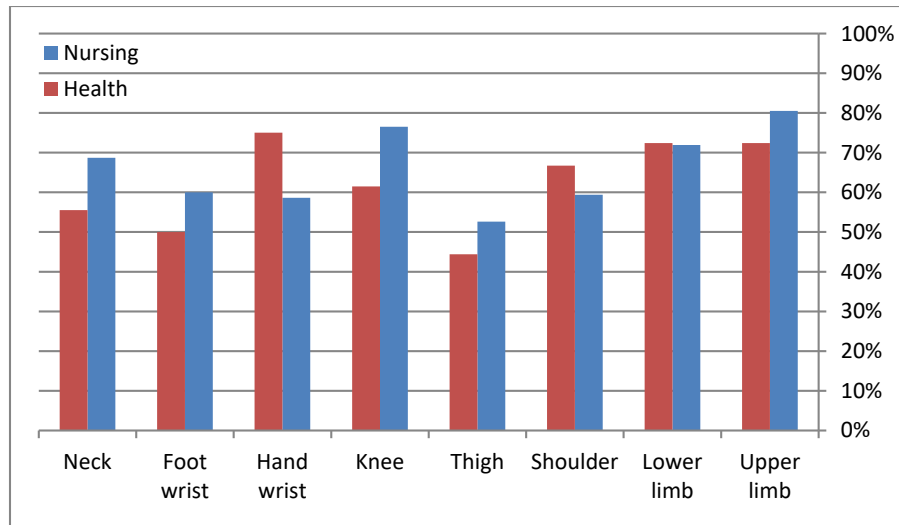
Diagram 2: prevalence of musculoskeletal disorders among administrative staff of the two colleges

Discussion and Conclusion

The results of this study showed that the highest prevalence of musculoskeletal disorders in the administrative staff of the Schools of Health and Nursing of Mashhad University of Medical Sciences was in upper limbs (%76.9), lower back (%72.2) and knee (%70) respectively. The results of the study on nurses in Japan reported a prevalence of musculoskeletal disorders in the lower back region of 71%, which is consistent with the prevalence of this study in office workers (Smith et al., 2006). In addition, in an assessment of New Zealand veterinarians, the prevalence of musculoskeletal disorders in the lower extremity was 73%, which is consistent with the results of the present study (Scuffham et al., 2010). These results are consistent with the results of Habibi et al. Study, in which the highest prevalence of musculoskeletal disorders is in the shoulder, neck and lower back, respectively, with the upper extremities of the back and lower extremities having the highest prevalence of these disorders (Ghanbary-Sartang and Habibi, 2015). In a study by MirMohammadi et al on computer users to investigate musculoskeletal disorders, it was concluded that these disorders were higher in the neck, shoulders, elbows, wrists and waist areas, respectively, with high prevalence Musculoskeletal disorders in the lower extremity of the back in the present study confirms this issue (Mirmohammadi et al., 2010). A study by Janwantanakul et al on administrative staff found that musculoskeletal disorders were high in office jobs and the highest prevalence of these disorders was in the neck, waist and back areas, which is consistent with the results of the present study (Janwantanakul et al., 2008). The findings of Ebrahimi et all research show that the most complaints of computer users are discomfort in the back, neck, upper back and shoulder areas, which is consistent with the results of the study (Ebrahimi et al., 2017). Also, in terms of ergonomic risk factor, based on the mean score of ROSA, 90.2% of the subjects were in the warning zone. In a study that evaluated the ergonomic risk level on the telephone staff, the final score of ROSA 3/52 was reported that this ergonomic risk level is not high compared to our results on university staff. The reason for this is the use of modern and advanced equipment at the telephone center staff as compared to the university's administrative work environment. In the office environment, equipment must be adjustable. Height of the chair, backrest, forearm support and work space should be in line with the individual characteristics of the staff in order to prevent the prevalence of musculoskeletal disorders among administrative staff (Poochada and Chaiklieng, 2015; Putz-Anderson et al., 1997). According to the results of this study, women are more likely to be exposed to ergonomic risk factors than men. This is due to the different physiological status of women, which has been confirmed in various gender studies as a risk factor for musculoskeletal disorders. The incidence of musculoskeletal disorders in women has been reported more than men. The small size of the body and the low volume of women's muscles compared to men and the lower

physical capacity of women than men, has led to an increase in the incidence of musculoskeletal disorders in women than men. Hence, women will have more workload in carrying out a similar activity between women and men. In addition, the difference in perception of pain in two different sex can be attributed to biological mechanisms. Like sex hormones that can affect the nervous system and affect the response to pain and its rejection (Widanarko et al., 2011). The results of the present study did not show a meaningful relationship between work experience and the risk of musculoskeletal disorders, which is not consistent with other studies that have a meaningful relationship between the work record and the final score of ROSA (Rowshani et al., 2013; Aminian, Pouryaghoub and Shanbeh, 2012). One of the reasons for this is that a number of staff at colleges operate in a formidable manner, which can not result in a definitive link between the risk of musculoskeletal disorders and work experience. In a study by Gerr et al., In order to investigate the prevalence of musculoskeletal disorders among computer users, there was a significant relationship between age and work history with the prevalence of these disorders, with an increase in age and work experience, the prevalence of musculoskeletal disorders increased (Gerr, Marcus and Monteilh, 2004). The results of the study are not consistent with the results of the present study, as the score for people under the age of 30 is higher than that of people over 40 years of age. Which represents a greater risk in people under the age of 30. In our study, there was no significant relationship between BMI and the risk of musculoskeletal disorders.

The higher prevalence of these disorders can reduce productivity in the workplace by influencing worker performance. The long static physical condition and static pressure on the muscle of neck and shoulders and waist are the main problems that administrative staff faces. Over time, these conditions can lead to musculoskeletal disorders. Consideration of such things as the preparation of Ergonomic table and chairs with adjustable height, observance of work-resting cycles, having athletic activities, and avoiding the uniforms states during working hours may reduce the incidence and prevalence of these problems. As a result, the implementation of ergonomic principles in the workplace and the training of ergonomic courses can reduce the risk of musculoskeletal disorders and the level of risk.

Acknowledgments

Reference

1. Aminian O, Pouryaghoub G, Shanbeh M. One year study of musculoskeletal disorders and their relation to occupational stress among office workers: a brief report. Tehran University Medical Journal. 2012;70(3).
2. Anuurad E, Shiwaku K, Nogi A, Kitajima K, Enkhmaa B, Shimono K, et al. The new BMI criteria for asians by the regional office for the western pacific region of WHO are suitable for screening of overweight to prevent metabolic syndrome in elder Japanese workers. Journal of occupational health. 2003;45(6):335-43.
3. Choobineh A, Daneshmandi H, Poor AF, Fard HR. Ergonomic assessment of musculoskeletal disorders risk level among workers of a petrochemical company. Iran Occupational Health. 2013;10(3).
4. Delisle A, Larivière C, Plamondon A, Imbeau D. Comparison of three computer office workstations offering forearm support: impact on upper limb posture and muscle activation. Ergonomics. 2006;49(2):139-60.
5. Dockrell S, Bennett K, Culleton-Quinn E. Computer use and musculoskeletal symptoms among undergraduate university students. Computers & Education. 2015;85:102-9.

6. Ebrahimi H, Barakat S, Habibi E, Mohammadian M. Comparing of RULA and ROSA method in assessing risk of musculoskeletal disorders and its relationship with mental health in computer users. Iran Occupational Health. 2017;14(5):142-34.

7. Ferasati F, Jalilian M. Evaluation of WMSDs in VDT users with Rapid office strain assessment (ROSA) method. Journal of Ergonomics. 2014;1(3):65-74.

8. Fisher T, Gibson T. A measure of university employees' exposure to risk factors for work-related musculoskeletal disorders. Aaohn Journal. 2008;56(3):107-14.

9. Gerr F, Marcus M, Monteilh C. Epidemiology of musculoskeletal disorders among computer users: lesson learned from the role of posture and keyboard use. Journal of Electromyography and Kinesiology. 2004;14(1):25-31.

10. Ghanbary-Sartang A, Habibi H. Evaluation of musculoskeletal disorders to method Rapid Office Strain Assessment (ROSA) in computers users. Journal of Preventive Medicine. 2015;2(1):47-54.

11. Habibi E, Soury S. The effect of three ergonomics interventions on body posture and musculoskeletal disorders among stuff of Isfahan Province Gas Company. Journal of education and health promotion. 2015;4.

12. Hakala PT, Rimpelä AH, Saarni LA, Salminen JJ. Frequent computer-related activities increase the risk of neck–shoulder and low back pain in adolescents. The European Journal of Public Health. 2006;16(5):536-41.

13. Hossain S, Amin M, Ahmed Z, Bhuyan M, Tarafdar M, Huq S. Musculoskeletal disorders among computer users in some selected hospitals of Dhaka city. Occup Med. 2014;227.

14. Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occupational medicine. 2008;58(6):436-8.

15. Kaliterna LL, Prizmic LZ, Zganec N. Quality of life, life satisfaction and happiness in shift-and non-shiftworkers. Revista de Saúde Pública. 2004;38:3-10.

16. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied ergonomics. 1987;18(3):233-7.

17. Mirmohammadi S, Mehrparvar A, Soleimani H, Lotfi H, Akbari H, Heidari N. Skeletal disorders-muscular computer users compared to other staff. J IOH. 2010;2:200-8.

18. Nasiri I, Motamedzade M, Golmohammadi R, Faradmal J. Assessment of risk factors for musculoskeletal disorders using the Rapid Office Strain Assessment (ROSA) Method and implementing ergonomics intervention programs in Sepah Bank. Health and Safety at Work. 2015;5(2):47-62.

19. Poochada W, Chaiklieng S. Ergonomic risk assessment among call center workers. Procedia Manufacturing. 2015;3:4613-20.

20. Putz-Anderson V, Bernard BP, Burt SE, Cole LL, Fairfield-Estill C, Fine LJ, et al. Musculoskeletal disorders and workplace factors. National Institute for Occupational Safety and Health (NIOSH). 1997;104.

21. Rebelo F, Soares M, editors. Advances in ergonomics in design, usability & special populations: Part II2014: AHFE Conference.

22. Robertson M, Amick III BC, DeRango K, Rooney T, Bazzani L, Harrist R, et al. The effects of an office ergonomics training and chair intervention on worker knowledge, behavior and musculoskeletal risk. Applied ergonomics. 2009;40(1):124-35.

23. Rowshani Z, Mortazavi SB, Khavanin A, Mirzaei R, Mohseni M. Comparing RULA and Strain index methods for the assessment of the potential causes of musculoskeletal disorders in the upper extremity in an electronic company in Tehran. KAUMS Journal (FEYZ). 2013;17(1):61-70.

24. Scuffham AM, Legg SJ, Firth EC, Stevenson MA. Prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians. Applied ergonomics. 2010;41(3):444-53.

25. Smith DR, Mihashi M, Adachi Y, Koga H, Ishitake T. A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses. Journal of safety research. 2006;37(2):195-200.

26. Sonne M, Villalta DL, Andrews DM. Development and evaluation of an office ergonomic risk checklist: ROSA–Rapid office strain assessment. Applied ergonomics. 2012;43(1):98-108.

27. Voerman GE, Sandsjö L, Vollenbroek-Hutten MM, Larsman P, Kadefors R, Hermens HJ. Effects of ambulant myofeedback training and ergonomic counselling in female computer workers with work-related neck-shoulder complaints: a randomized controlled trial. Journal of occupational rehabilitation. 2007;17(1):137-52.

28. Widanarko B, Legg S, Stevenson M, Devereux J, Eng A, Cheng S, et al. Prevalence of musculoskeletal symptoms in relation to gender, age, and occupational/industrial group. International Journal of Industrial Ergonomics. 2011;41(5):561-72.