RHEUMATOLOGY RESEARCH JOURNAL

Vol. 4, No. 1, Jan 2019,
Webpage: http://rheumres.org
Email: editor@rheumres.org
ISSN:2476-5856
doi: 10.22631/rr.2019.69997.1063

Original Article Open Access

The Effects of Personal and Occupational Risk Position on Musculoskeletal Disorders

Ahmad Vakili-Basir[1], Mohammad Gholami-Fesharaki[2*], Mohsen Rowzati[3], Razieh Maghroori[4]

[1] Biostatistics MSC student, Biostatistics Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Islamic Republic of Iran. [2]Assistant Professor of Biostatistics, Biostatistics Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Islamic Republic of Iran. [3]General Practitioner, Worksite Follow-Up Unit, Occupational Health Center, Esfahan's Mobarakeh Steel Company, Isfahan, Islamic Republic of Iran. [4]Assistant professor of physical medicine and rehabilitation department of Isfahan University of medical sciences

Musculoskeletal disorders are among the most important health risks in various organizations, especially heavy industry. The current study purposed to determine the effects of personal and occupational position risks on musculoskeletal disorders.

This cross-sectional study was carried out from April 2015 to May 2016 in Esfahan's Mobarakeh Steel Company using a stratified random sampling method. In this study, the risk of occupational duties such as heavy lifting, load carrying, long sitting, standing, and moving as well as unsafe personal behaviors or risky actions involving the waist, shoulder/arm, wrist, neck, knee, elbow, ankle, and chamber were considered as independent variables, while musculoskeletal disorders (evaluated by NMQ) were considered as dependent variables.

The study sample included 300 male workers (with the mean age of 41.01±8.17 years and mean work experience of 16.00±7.66 years). The results showed a positive relationship between shoulder injury risk scores and shoulder/arm (OR=2.42, CI=(1.25-4.71)) and knee (OR=2.39, CI=(1.08-5.28)) disorders. The findings also showed such positive relationship between upper back risk scores and wrist/hand disorders (OR=2.41, CI=(1.01-5.76)), lower back risk scores and waist (OR=2.49, CI=(1.39-4.45)), shoulder/arm (OR=1.63, CI=(1.04-2.57)), and neck (OR=1.85, CI=(0.98-3.49)) disorders.

Based on the results, more consideration must be paid to personal and occupational risks, and it is highly recommended that convenient modifications be made in work environments in order to decrease musculoskeletal disorders in workers of the steel company.

Keywords: Musculoskeletal Disorders, NIOSH, Posture.

Introduction

Today's industrial world has brought about a growing trend of speed and production rate while also leading to adverse health outcomes, particularly an increased prevalence of musculoskeletal disorders among industrial workers [1, 2]. Musculoskeletal disorders depend on work patterns [3]. They are not limited to a specific industry or specialty, but rather are seen in all industries and professions. Symptoms are mainly observed in the areas of the lower back, neck, and upper extremities of the body [4, 5]. According to the National Institute for Occupational Safety and Health (NOISH) which specializes only in occupational hazards, work-related musculoskeletal disorders are ranked second after respiratory illnesses [6]. Unfortunately, statistical evidence confirms the upward trend of musculoskeletal disorders as a severe but dormant epidemic [7]. Studies have presented several factors involved in this pathology with physical, physiological, ergonomic, or psychological backgrounds. Inappropriate posture [6, 8-11], improper design of the work environment (including non-ergonomic tables) [6, 12-14], and insufficient rest [11, 12] are among those factors. There are other influential factors, such as repetitive movements and their repetition speed [11, 15, 16], severity, how force exposes the limbs to vibration, and lifting heavy loads [8, 10]. However, previous studies have shown that little consideration is paid to quantitative indicators of the effect of posture and its contribution to musculoskeletal disorders [17].

*Corresponding Author: Mohammad Gholami-Fesharaki, Assistant Professor of Biostatistics, Biostatistics Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Islamic Republic of Iran, Email: Mohammad.gholami@modares.ac.ir

Tel/Fax: (+98) 912895808898, 021-82883578

Received: 06 November 2018 ; **Accepted:** 28 January 2019

Objective

The present study evaluated the effect of posture during work hours on musculoskeletal disorders.

Materials and Methods

This cross-sectional study was conducted from May 2015 to June 2016 in Esfahan's Mobarakeh Steel Company, the largest steel company in Iran. In this study, the inclusion criteria were: 1) being an official or having contract employment; 2) having at least one year of work experience; 3) having no absenteeism during the last six months; 4) having at least 20 hours activity per week; 5) having a history of limb fractures during the prior year; and 6) having severe damage and a history of physiotherapy or surgery during the prior 6 months. Individuals with a fever, acute infection, acute inflammatory lesions, or fractured limbs during the study period and those unwilling to participate were excluded from the study.

The Medical Ethics Committee of Tarbiat Modares University Faculty of Medical Sciences approved the current study (code number: IR.TMU.REC.1395.398). After obtaining permission from the Ethics Committee, samples were selected using stratified random sampling. In the first stage, workers were divided into four categories: sitting, standing, bound, and animated. Then they were selected according to the proportion of each stratum by simple random sampling.

Tools

• Quick Exposure Check

For personal unsafe behaviors, the QEC tool was used to assess ergonomic risk factors of WMSDs. This tool includes assessments of the back, shoulder/arm, wrist/hand, and neck in regards to posture and repetitive movement. In QEC, task duration, the maximum weight handled, hand force exertion, vibration, visual demand of the task, and subjective responses to the work are also taken into account, and the required data is obtained from the worker. This tool was translated into the Persian language and validated [18, 19].

• Nordic Musculoskeletal Questionnaire

Participants were asked to indicate whether or not they had an episode of pain/discomfort in any of the body parts mentioned in the standardized Nordic musculoskeletal questionnaire [20]. This yes/no questionnaire included an image of the human body divided into nine anatomical regions (neck, shoulder, elbows, wrists and hands, upper and lower back, hip, knee, ankle, and feet). Participants were asked to respond to questions regarding the severity of work-related musculoskeletal disorders in the past 12 months (period prevalence) and the past 7 days (point prevalence). This questionnaire has been validated in a previous study [21]. This study point prevalence (MSDs in the past 7 days) was considered as a response variable.

• Evaluation of Occupational Risk Duties

For each participant, 4 days of a month were selected randomly on which the participant would be recorded on camera during work hours (8 hours per day) without being informed. In the next step, two expert evaluators independently (agreement coefficient = 0.79) observed and scored occupational risk duties based on the recorded films. For example, if a participant had 2 hours of sitting, 3 hours of standing, 1 hour of moving, and 2 hours of being in an awkward position, the scores for sitting, standing, moving, and awkward position were 0.250, 0.375, 0.125, and 0.250, respectively. For 1 hour of heavy lifting and 2 hours of load carrying, the scores of 0.125 and 0.250, respectively, were considered.

Data Analysis and Sample size

Data was analyzed using IBM's SPSS Software, version 21. Logistic regression was used to calculate the odds ratios and confidence intervals. The sample size was estimated at 300 workers based on a previous study (P value=40%, α=5%, d=0.05) [22]. A P value less than 0.05 was considered statistically significant.

Results

In this study, 300 workers with a mean age of 41.40±8.17 years and a work experience of 16.0±7.66 years were included. The results showed that the majority of participants were married, educated (high school diploma) day-workers. The prevalence of musculoskeletal disorders in different areas of the body are presented in the format of a human body heat map in Figure (1). As observed in this figure, lower back, knee, neck, and ankle disorders had high frequencies in the last 7 days of the study, while this order changed to lower back, neck, knee, and ankle disorders. The relationship between personal and occupational position risks with musculoskeletal diseases using OR are presented in Table (1). The results showed a positive relationship between shoulder injury risk score and shoulder/arm (OR=2.42), knee (OR=2.39), and elbow (OR=1.77) disorders. A positive relationship was also detected between wrist/hand injury risk score and knee (OR=1.88) and elbow (OR=1.42) disorders. The same relationship was found between lower back risk score and waist (OR=2.49), shoulder/arm (OR=1.63), and neck (OR=1.89) disorders. A positive relationship was also detected between upper back injury risk score and wrist/hand (OR=2.41) disorder. Moreover, a positive relationship was observed between knee injury risk score and waist (OR=1.81) disorder. Neck injury was demonstrated to be associated with the risks of heavy lifting, load carrying, and sitting position, while shoulder injury was associated with heavy lifting, load carrying, and awkward position risks. Elbow injury was associated with the risk of moving position; wrist/hand injury

with the risks of standing, sitting, and awkward positions; upper back injury with the risk of standing position; lower back injury with the risks of load carrying and standing position; hips/thighs/buttocks injury with the risks of heavy lifting and load carrying; knee injury with the risks of standing, sitting, and awkward positions; and finally, ankle/foot injury with risk of standing position.

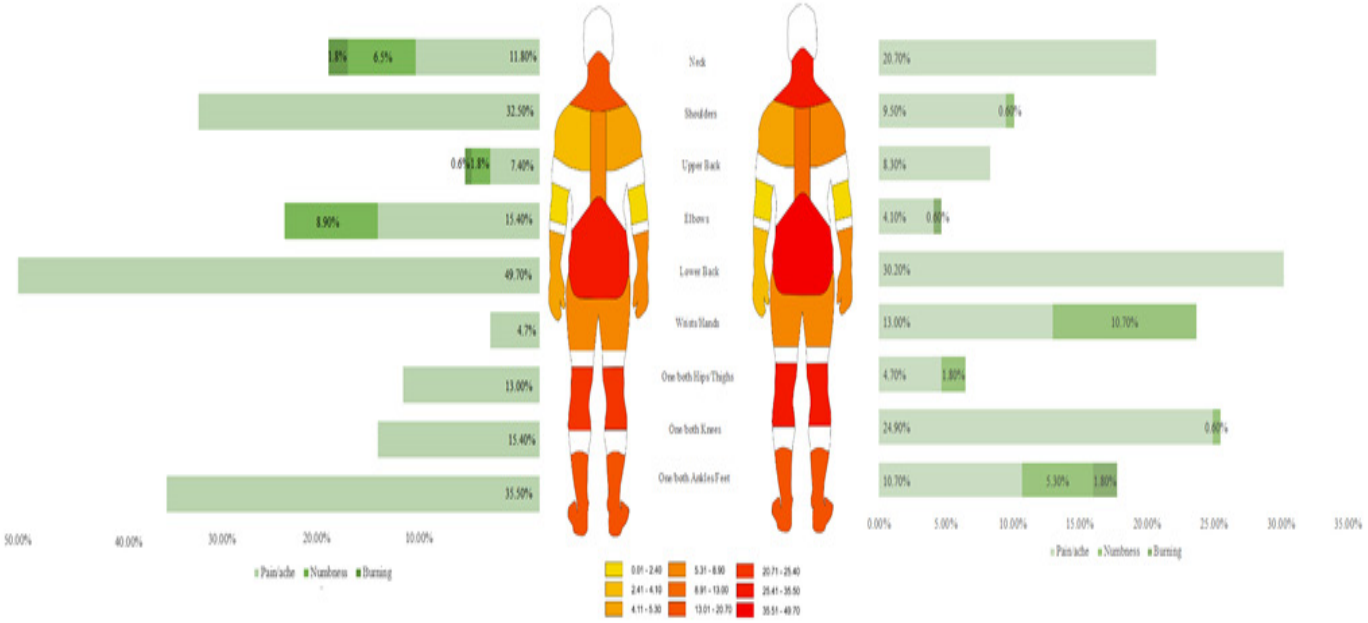

Figure 1. The Heat Map human body prevalence of musculoskeletal diseases Left: last 7 days, Right: last 12 Month

Table 1. The relationship between Personal and Occupational Risk Position with musculoskeletal diseases using Odds Ratio (OR)

Sub type of Risk	Neck	Shoulders	Elbows	Wrists/Hands	Upper Back	Lower Back	Hips/Thighs/ Buttocks	Knees	Ankles/Feet	Total
Waist	0.85	1.23	1.22	1.09	1.46	**2.49	1.62	**1.81	1.09	1.27
OR, 95% CI	(0.46-1.59)	(0.55-2.79)	(0.4-3.71)	(0.61-1.94)	(0.66-3.2)	(39-4.451.)	(0.67-3.94)	(1.02-3.2)	(0.58-2.04)	(0.69-2.34)
Shoulder /Arm	0.85	*2.42	0.95	1.05	1.08	**1.63	0.83	1.26	1.29	1.19
OR, 95% CI	(0.5-1.43)	(1.25-4.71)	(0.35-2.59)	(0.65-1.71)	(0.54-2.18)	(1.04-2.57)	(0.34-2.01)	(0.78-2.03)	(0.77-2.15)	(0.72-1.97)
Hand wrist	0.87	1.29	1.88	1.11	*2.41	1.85	0.5	1.75	1.26	1.59
OR, 95% CI	(0.42-1.79)	(0.5-3.31)	(0.58-6.15)	(0.56-2.18)	(1.01-5.76)	(0.98-3.49)	(0.11-2.21)	(0.91-3.38)	(0.62-2.59)	(0.75-3.35)
Neck	0.8	1.21	2.03	1.18	1.21	*1.89	0.29	0.89	0.75	1.44
OR, 95% CI	(0.41-1.56)	(0.54-2.75)	(0.8-5.16)	(0.66-2.12)	(0.54-2.75)	(1.07-3.32)	(0.04-2.03)	(0.48-1.67)	(0.36-1.56)	(0.74-2.81)
Knee	1.24	*2.39	0.61	*1.88	1.19	1.65	1.52	1.31	1.6	1.63
OR, 95% CI	(0.67-2.29)	(1.08-5.28)	(0.14-2.65)	(1.04-3.4)	(0.51-2.82)	(0.94-2.91)	(0.59-3.92)	(0.72-2.37)	(0.85-2.99)	(0.83-3.19)
Elbow	1.02	*1.77	0.88	*1.42	0.88	1.18	1.06	1.3	1.2	1.23
OR, 95% CI	(0.71-1.47)	(1.11-2.83)	(0.41-1.92)	(1.01-2.01)	(0.5-1.54)	(0.85-1.65)	(0.58-1.93)	(0.92-1.83)	(0.82-1.74)	(0.84-1.8)

Sub type of Risk	Neck	Shoulders	Elbows	Wrists/Hands	Upper Back	Lower Back	Hips/Thighs/Buttocks	Knees	Ankles/Feet	Total
Ankle	1.09	1.42	NC	1.29	1.14	1	0.95	1.24	1.13	2.84
OR, 95% CI	(0.71-1.67)	(0.86-2.34)		(0.86-1.92)	(0.64-2.02)	(0.67-1.5)	(0.44-2.07)	(0.83-1.85)	(0.73-1.76)	(0.93-8.66)
Chamber pot	0.97	1.33	NC	1.25	1.06	1.03	1.39	1.18	1.16	1.24
OR, 95% CI	(0.67-1.4)	(0.85-2.1)		(0.9-1.75)	(0.64-1.74)	(0.74-1.42)	(0.83-2.32)	(0.84-1.65)	(0.8-1.67)	(0.85-1.83)
Heavy lifting	1.04	*1.07	1.06	1.05	1.05	1.04	*1.07	*1.06	1.02	*1.04
OR, 95% CI	(0.99-1.09)	(1.01-1.13)	(0.97-1.15)	(1-1.1)	(0.98-1.12)	(1-1.09)	(1-1.15)	(1.01-1.11)	(0.96-1.08)	(1-1.08)
Carrying load	*1.08	*1.08	1.08	1.04	1.04	*1.08	*1.09	*1.06	1.04	*1.06
OR, 95% CI	(1.03-1.14)	(1.02-1.15)	(0.99-1.17)	(0.98-1.1)	(0.96-1.13)	(1.03-1.14)	(1.02-1.17)	(1.01-1.12)	(0.97-1.1)	(1.01-1.12)
Moving position	1	0.99	0.91	0.98	0.98	0.99	0.99	0.98	0.97	1
OR, 95% CI	(0.98-1.03)	(0.95-1.03)	(0.83-0.99)	(0.96-1.01)	(0.93-1.02)	(0.97-1.01)	(0.95-1.04)	(0.95-1.01)	(0.94-1.01)	(0.98-1.01)
Standing position	1.02	1.02	1.02	*1.04	*1.03	*1.02	1.03	*1.03	*1.03	*1.02
OR, 95% CI	(1-1.04)	(0.99-1.05)	(0.98-1.06)	(1.02-1.06)	(1-1.07)	(1-1.04)	(0.99-1.06)	(1.01-1.05)	(1.01-1.06)	(1-1.03)
Sitting position	*0.99	0.98	1.01	*0.98	0.99	0.99	0.99	*0.98	0.99	*0.99
OR, 95% CI	(0.97-1)	(0.96-1)	(0.98-1.04)	(0.97-0.99)	(0.96-1.01)	(0.98-1)	(0.96-1.01)	(0.97-1)	(0.97-1)	(0.98-1)
Awkward position	1.02	*1.04	1.01	*1.03	1.02	1.02	1.01	*1.03	1.02	*1.02
OR, 95% CI	(0.99-1.05)	(1.01-1.07)	(0.96-1.07)	(1.01-1.05)	(0.99-1.06)	(0.99-1.04)	(0.96-1.06)	(1.01-1.05)	(0.99-1.05)	(1-1.04)

RD: Risk Difference; OR: Odds Ratio; NC: Not Computed
**: P<0.05, **: P<0.01*

Discussion

This research aimed to study the effects of personal and occupational position risks on musculoskeletal disorders among the staff at Esfahan's Mobarakeh Steel Company. The findings showed a positive relationship between risk of neck injury and lower back disorder. A problem in the neck tends to increase the mobility of the lower back and indirectly cause lower back disorder [23, 24]. Further results exhibited a positive relationship between risk of waist injury and lower back and knee disorders. Those at risk of waist injury were likely to have to carry loads and do heavy lifting. As a result, they work their knees and lower back more; hence, the positive relationship was observed [25, 26]. Additional results showed a positive relationship between risk of knee injury and shoulder and wrist/hand disorders [27]. This relationship could be justified like the previous ones. Similarly, a positive relationship was observed between risk of elbow injury and shoulder and wrist/hand disorders [28]. In this study, the evidence was in agreement with that of previous studies indicating that more standing time causes more disorders primarily to wrists/hands and then, in order of most to least common, to lower and upper back, ankles/feet, and knees. A significant relationship was also observed between time spent in an awkward position and shoulder and wrist/hand disorders [29, 30]. This result indicates that, although sitting is a protective action against musculoskeletal disorders, an

improper sitting position leaves an adverse effect on the musculoskeletal system. Interestingly, the risk of elbow disorder in those with active mobility in their job was 91%, while the prevalence rates of neck, wrist, and knee disorders in individuals with an improper standing position were 99%, 98%, and 89%, respectively.

Strength and Limitation

One limitation to the current study could be sample selection from a single company with a job category. In contrast, making risk assessments of all staff members without their knowledge, the large sample size, and the use of a reliable statistical analysis method were considered to be the strengths of this study.

Conclusion

According to the results of the current study, more consideration must be given personal and occupational position risks. It is strongly suggested that convenient modifications be made to reduce the risk of musculoskeletal disorders in workers of the steel company.

Authors' contributions

Vakili-Basir, A. collected the data, analyzed it, and prepared a draft of the article. Gholami-Fesharaki, M. supervised this project. Rowzati, M. and Maghroori, R. were medical consultants for this project. Finally, all authors read and approved the manuscript.

Acknowledgments

The authors gratefully acknowledge Tarbiat Modares University for the financial support of this project. The authors also thank all personnel, especially the staff of Industrial Medicine in the Department of EMSC, for their cooperation throughout the study (Grant number: 52D/250, 2018/04/16).

Conflict of Interest

The authors declare no conflicts of interest

References

1. Mirmohammadi S, Mehrparvar A, Soleimani H, Lotfi MH, Akbari H, Heidari N. Musculoskeletal disorders among video display terminal (VDT) workers comparing with other office workers. ***Iran Occup Health***. 2010; 7(2):11-14. doi: 10.4028/www.scientific.net/AEF.10.300.
2. Mostaghaci M, Salimi Z, Javaheri M, Hoseininejad S, Salehi M, Davari M. et al. Evaluation of the musculoskeletal disorders and its risk factors in the workers of an agricultural equipment-manufacturing plant. ***Occup Med Quar J***. 2012; 3(3):19-25.
3. Yamalik N. Musculoskeletal disorders (MSDs) and dental practice Part 2. Risk factors for dentistry, magnitude of the problem, prevention, and dental ergonomics. ***Int Dent J***. 2007; 57(1):45-54. doi: 10.1111/j.1875-595x.2007.tb00117.x.
4. Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. ***J Electromyogr Kinesiol***. 2004; 14(1):13-23. doi: 10.1016/j.jelekin.2003.09.015.
5. Mortazavi SB, Khavanin A, Motamedzade M, Hajizade E, Mohseni M. The Effect of postures on musculoskeletal disorders in work places. ***J Kermanshah Univ Med Sci***. 2012; 16(5):367-74.
6. Choobineh A, Daneshmandi H, Deilami F, Khoshnami S. Ergonomic workplace assessment and survey of musculoskeletal injuries in a generator manufacturing company. ***J Health Syst Res***. 2013; 9:20-30.
7. Kheiri H, Moshfegh H, Hatani H, Ranjbarian M. Investigation of relationship between musculoskeletal disorders and working conditions among workers at a pharmaceutical industry in Iran (2011-2012). ***Iran J Health Saf Environ***. 2014; 1(3):145-50.
8. Nadri H, Nadri F, Heidari E, Toolabi A, Kazemzadeh Y, Raeisvandi A. Prevalence of musculoskeletal disorders in Aleshtar city bank staff and its associated factors. ***J Health Devel***. 2014; 3(2):163-74.
9. Shoja E, Hokmabadi R, Shoja M, M G. Ergonomic evaluation of musculoskeletal disorders risk by Quick Exposure Check (QEC) technique in a textile industry. ***J North Khorasan Univ Med Sci***. 6(2). doi: 10.29252/jnkums.6.2.259.
10. Halvani G, Fallah H, Hokmabadi R, Smaeili S, Dabiri R, Sanei B. et al. Ergonomic assessment of work related musculoskeletal disorders risk in Furnace Brickyard workers in Yazd. ***J North Khorasan Univ Med Sci***. 2014; 6(3). doi: 10.29252/jnkums.6.3.543.
11. Maghsoodi moghadam R, Farhadi R, Frasati F, A A. Ergonomic evaluation of exposure to risk Factors of musculoskeletal disorders in Cement factory by QEC technique. ***J Ilam Univ Med Sci***. 2013.
12. Halvani G, Salmani Nodousgan Z. Survey of Musculoskeletal disorders among bank staff in Yazd. ***Occup Med Quar J***. 2011; 3(1):1-7.
13. Choobineh A, Tabatabaei SH, Tozihian M, Ghadami F. Musculoskeletal problems among workers of an Iranian communication company. ***Indian J Occup Environ Med***. 2007; 11(1):32. doi: 10.4103/0019-5278.32462.
14. Kee D, Karwowski W. LUBA: an assessment technique for postural loading on the upper body based on joint motion discomfort and maximum holding time. ***Appl Ergon***. 2001; 32(4):357-66. doi: 10.1016/S0003-6870(01)00006-0.
15. Negahban A, Jalali M, Meshkani M, Rahimpoor R. Evaluation of Risk Factors in Musculoskeletal Disorders by HAL-TLV, SI and OCRA Methods and Comparison with other Methods. ***J Rafsanjan Univ Med Sci***. 2015; 13(9):749-64.
16. Nakhaei M, Faragzadeh Z, Tabiei S, Saadatjoo S, Rad GM, Hoseini M. Evaluation of ergonomic position during work in nurses of medical and surgical wards in Birjand University of Medical Sciences hospitals. ***Birjand Univ Med Sci***. 2006.
17. Fedorowich LM. Dissertation, Effects of two work postures on musculoskeletal disorder risk associated with computer work. McGill University Libraries; 2014.
18. Choobineh A, Tabatabaei SH, Mokhtarzadeh A, Salehi M. Musculoskeletal Problems among Workers of an Iranian Rubber Factory. ***J Occup Health***. 2007; 49(5):418-23. doi: 10.1539/joh.49.418.
19. Choobineh AR, Daneshmandi H, Aghabeigi M, Haghayegh A. Prevalence of musculoskeletal symptoms among employees of Iranian petrochemical industries: October 2009 to December 2012. ***Int J Occup Environ Med***. 2013; 4(4):195-204.
20. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G. et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. ***Appl ergon***. 1987; 18(3):233-37. doi: 10.1016/0268-0033(88)90149-0.
21. Choobineh A, Lahmi M, Shahnavaz H, Khani Jazani R, Hosseini M. Musculoskeletal symptoms as related to ergonomic factors in Iranian hand-woven carpet industry and general guidelines for workstation design. ***Int J Occup saf ergon***. 2004; 10(2):157-68. doi: 10.1080/10803548.2004.11076604.10.1080/10803548.2004.11076604.
22. Habibi E, Fereidan M, Pourabdian S. Prevalence of musculoskeletal disorders and associated lost work days in steel making industry. ***Iran J Pub Health***. 2008; 37(1):83-91.
23. Lietz J, Kozak A, Nienhaus A. Prevalence and occupational risk factors of musculoskeletal diseases and pain among dental professionals in Western countries: A systematic literature review and meta-analysis. ***PLoS One***. 2018; 13(12):e0208628. doi: 10.1371/journal.pone.0208628.
24. Kalte HO, Khoshakhlagh AH, Rahmani N. Prevalence of musculoskeletal pains and effect of work-related factors among employees on offshore oil and gas in***stallations in Iran. Work.*** 2018. doi: 10.3233/wor-182818.
25. Guo HR, Chang YC, Yeh WY, Chen CW, Guo YL. Prevalence of musculoskeletal disorder among workers in Taiwan: a nationwide study. ***J Occup Health***. 2004; 46(1):26-36.

26. Muto S, Muto T, Seo A, Yoshida T, Taoda K, Watanabe M. Effect of nursing assistance tools on preventing musculoskeletal pain among staff in schools for disabled children. ***J Occup Health***. 2008; 50(3):245-50.

27. Zhang CM, Zhang JF, Xu J, Guo YL, Wang G, Yang LH. Musculoskeletal ultrasonography for arthropathy assessment in patients with hemophilia: A single-center cross-sectional study from Shanxi Province, China. ***Medicine (Baltimore)***. 2018; 97(46):e13230. doi: 10.1097/md.0000000000013230.

28. Kesikburun S, Guzelkucuk U, Fidan U, Demir Y, Ergun A, Tan AK. Musculoskeletal pain and symptoms in pregnancy: a descriptive study. ***Ther Adv Musculoskelet Dis.*** 2018; 10(12):229-34. doi: 10.1177/1759720x18812449.

29. Ghosh T, Das B, Gangopadhyay S. Work-related Musculoskeletal Disorder: An Occupational Disorder of the Goldsmiths in India. ***Indian J Community Med***. 2010; 35(2):321-5. doi: 10.4103/0970-0218.66890.

30. Rosecrance J, Porszasz J, Cook T, Fekecs E, Karacsony T, Merlino L. et al. Musculoskeletal disorders among construction apprentices in Hungary. ***Cent Eur J Public Health***. 2001; 9(4):183-7.