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Relationship Between Musculoskeletal Disorders on Job Performance

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Abstract

Background: The World Health Organization (WHO) and International Labour Organization (ILO) have identified musculoskeletal disorders (MSDs) as a rising epidemic within the workforce. These injuries account for 33% of all occupational injuries and 40% of medical costs.

Objectives: This study aimed to determine the effect of MSDs on the job performance of operating room employees.

Methods: This descriptive and analytical study was conducted on 100 participants. Job performance was assessed using the Patterson Job Performance Questionnaire (JPQ), and MSDs were evaluated using the NORDIC Questionnaire. Data were analyzed with SPSS version 16, employing Mann-Whitney, chi-square, and binary logistic regression tests.

Results: Among the participants, 43% were women, and 67% were men, with an average age of 27.37 ± 6.45. Sixty-two percent of participants did not have acceptable job performance. Additionally, 83% reported at least one musculoskeletal injury, 64% had at least two injuries, and 62% had three or more injuries across different body parts. The results indicated a significant relationship between job performance and variables such as hip, knee, lower back, upper back injuries, age, gender, literacy level, physical activity, and work experience. However, no significant relationship was found between neck injuries and marital status with job performance ($P < 0.05$).

Conclusions: This study demonstrates that MSDs can negatively impact employee job performance. Given the influence of various occupational factors on performance, it is recommended that future studies simultaneously examine the effects of other occupational hazards.

Keywords: Musculoskeletal Disorders (MSDs), Job Performance, Ergonomics, Occupational Disease

1. Background

Musculoskeletal disorders (MSDs) are among the most prevalent and costly work-related conditions globally (1). These disorders lead to losses that impact not only individuals but also the organizations and societies in which they reside (2). Both the International Labour Organization (ILO) and the World Health Organization (WHO) classify MSDs as work-related diseases, referring to them as a "new epidemic" that requires urgent investigation and intervention. These disorders significantly contribute to absenteeism and are a major cause of lost workdays (3).

The direct and indirect costs associated with MSDs account for approximately 1% of the gross national product in industrialized countries (4). Health care workers face a higher risk of MSDs compared to those in industries such as construction, mining, and manufacturing (5). Between 60 - 90% of adults experience back pain at some point in their lives, with around 15 - 20% of worker compensation claims related to these issues (6). Estimates from the ILO suggest that approximately 1.2 million workers have been forced to leave their jobs due to disability, with nearly 28% of these cases attributed to work-related MSDs (7). These disorders are among the most significant occupational challenges for healthcare providers (8). In Iran, nurses comprise 80% of the medical workforce, with a prevalence rate of MSDs reported between 60 - 80% among them (9).

Studies indicate a relationship between MSDs and job performance, with these disorders ultimately affecting productivity (1, 10-14). Limited research on operating room (OR) staff worldwide has shown a high prevalence of MSDs in this group. According to studies by Andersen et al. and the Canadian Centre for Occupational Safety and Health (CCOHS), various risk factors such as patient transfer, night shift stress, prolonged standing, fixed postures, and the physical demands of handling heavy equipment alongside personal factors like age, gender, and obesity, contribute to MSDs in the back, legs, and other areas of the body. Evidence suggests that OR staff experience musculoskeletal pain within one year of clinical work, with muscular pain affecting 58 - 90% of personnel (15).

Job performance is defined as an individual's efficiency in executing roles and responsibilities related to patient care. It encompasses the effective fulfillment of specified roles and responsibilities. Job performance is a complex, multidimensional concept influenced by factors such as personal characteristics, workload, job satisfaction, competencies, social support, and organizational climate (16, 17). These factors can be categorized into internal (e.g., intelligence, awareness, emotions, personality) and external (e.g., fatigue, stress) moderators, each influencing job performance in various ways (18).

In a high-stress environment like healthcare, job performance is closely tied to effectiveness, knowledge management, and quality, as well as organizational management, finance, and development. For healthcare professionals, job performance is crucial because of its direct impact on patient safety (14). Although research has been conducted on MSDs in hospital and medical center staff, there is a lack of interdisciplinary studies examining the impact of these disorders on job performance, a critical performance indicator. Given the sensitivity of OR work, where staff have direct patient contact, it is essential to assess the effects of MSDs on job performance. The findings of this study may serve as a guide for implementing managerial and technical controls in ORs.

2. Objectives

Therefore, the present study aims to investigate the prevalence of MSDs and their relationship with job performance among OR personnel.

3. Methods

A cross-sectional descriptive-analytical study was conducted among the OR staff at Abadan University of Medical Sciences in 1402.

3.1. Participant, and Collection Data

In this study, the sample size was determined to be 100 participants using statistical methods (Equation 1).

$$n = \frac{\left(\frac{Z^2 pq}{d^2}\right)}{1 + \frac{1}{N}\left[\frac{(z^2 pq}{d^2} - 1\right]} \quad (1)$$

The study utilized purposive sampling, the most frequently employed approach for selecting a sample based on the investigator's convenience. Convenience sampling, based on participant availability, is commonly used in clinical research. The study included healthcare professionals working in the OR department, comprising five anesthesiologists, four general surgeons, two neurosurgeons, seven orthopedists, two ophthalmologists, 40 anesthesiology personnel, and 40 OR staff members. Their attributes are presented in Table 1.

Inclusion criteria were as follows: No history of MSDs, no prior accidents resulting in fractures, no secondary employment, and working hours of at least six hours per day. In Abadan hospitals, due to the lack of specialized surgical procedures, staff members participated in a wide range of surgical interventions, making it challenging to assess specific variables. Additionally, the staff worked in rotating shifts. Therefore, these variables were omitted from the study to avoid introducing bias.

3.2. Tools and Data Collection

3.2.1. Tools

The tool employed for this investigation was a questionnaire. In this study, data was gathered using three distinct questionnaires: The first being a demographic questionnaire, the second being the Nordic Musculoskeletal Questionnaire, and the third being Patterson's Job Performance Questionnaire.

A questionnaire on demographic characteristics was used to collect data, including items such as occupation,

Table 1. Demographic Information [a]

Variables	Abundance
Job performance	
Lowest score (23)	38
Highest score (45)	62
Gender	
Female	43
Man	57
Marital status	
Single	62
Married	38
Education level	
Diploma	7
Associate degree	23
Bachelor's degree	61
Graduate	9
Having sports activities	
Yes	29
No	71
Wrist injury	
Yes	38
No	62
Thigh injury	
Yes	45
No	55
Yes	66
Neck injury	
No	34
Yes	62
Knee injury	
No	38
Yes	66
Shoulder injury	
No	34
Yes	66
Ankle injury	
No	34
Yes	69
Lower back injury	
No	31
Yes	63
Upper back injury	
No	37
Yes	58
Elbow injury	
No	42
Yes	76
Hip injury	
No	24
Total	100
Changeable	
Age	27.37 ± 6.45
Weight	69.02 ± 11.08
Work experience	13.23 ± 6.24

[a] Values are expressed as (%) or mean ± SD.

second occupation, history of illness, total working hours, work history, history of accidents, fractures, and hospitalizations.

The Nordic Musculoskeletal Questionnaire was used to evaluate MSDs. This questionnaire was developed and implemented in 1987 by the Institute of Occupational Health of Scandinavian countries with the aim of determining the prevalence of work-related MSDs. The validity and reliability of the Persian version of this questionnaire was verified by Choobineh et al.'s (19, 20).

This questionnaire includes three parts: In the first part, demographic information such as age, gender, marital status, education level, and Body Mass Index (BMI) is collected. In the second part, the participant indicates if they experienced pain in any of nine body parts (neck, shoulder, elbow, hand/wrist, upper back, waist, thigh/hip, knee, foot/ankle) over the past year. In the third part, participants answer whether these disorders led to any absences from work.

The job performance questionnaire was developed and assembled based on Patterson's survey (21). This questionnaire was translated and validated by Arshadhi and Shokrkon in Iran, ensuring its reliability (22). The questionnaire contains 15 questions and measures employees' performance in occupational and organizational duties. Each of the 15 questions is scored using a four-option format: "Very Poor (Rarely)" (0 points), "Poor (Sometimes)" (1 point), "Good (Often)" (2

Table 2. Relationship Between Independent Variables and Dependent Variable

Variables	P-Value
Age	< 0.001 [a]
Weight	0.018 [a]
Work experience	0.015 [a]
Gender	Chi-square
Marital status	0.018 [b]
Education level	0.032 [b]
Having sports activities	0.004 [b]
Wrist injury	0.002 [b]
Thigh injury	0.013 [b]
Neck injury	0.001 [b]
Knee injury	0.033 [b]
Shoulder injury	0.002 [b]
Ankle injury	0.001 [b]
Lower back injury	0.012 [b]
Upper back injury	< 0.001 [b]
Elbow injury	< 0.001 [b]
Hip injury	0.012 [b]

[a] Mann-Whitney test.
[b] Correlation.

points), and "Excellent (Always)" (3 points). The score range for each participant is between 0 and 45, with scores from 23 to 45 indicating acceptable job performance, while scores below 23 indicate unsatisfactory job performance.

3.2.2. Data Collection Process, and Data Analysis

Prior to the commencement of the study, written consent was obtained from all participants, who then received in-person training from a qualified individual on how to complete the questionnaires. Questionnaires were administered through semi-structured interviews, each lasting approximately 20 minutes, over a 9-month period. Data analysis involved descriptive statistics, including tables, mean, and standard deviation for descriptive variables. Analytical statistics, such as chi-square, Fisher's exact, Mann-Whitney, independent *t*-tests, and logistic regression, were used to determine relationships between variables. A significance level of 0.05 was considered for all tests in this study. SPSS version 16 statistical software was utilized for data analysis.

4. Results

This study included 100 participants, of whom 43% were women, with an average age of (37.27 ± 45.6). Of the participants, 38% demonstrated acceptable job performance (23 - 45 points), while 62% did not reach an acceptable performance level (scoring less than 23 points). The average weight was (69.02 ± 8.08) kg, and the average work experience was (23.13 ± 24.6) years. A total of 83% of participants reported at least one injury, 64% had at least two injuries, and 62% had three or more injuries in various body areas. The most frequently affected areas were the pelvic and upper back regions, while the thigh area had the lowest injury frequency among body parts. Additional injury details are comprehensively presented in Table 1.

In this study, we examined the relationship between various variables and job performance. Table 2 presents the associations between the independent variables and the dependent variable, providing a comprehensive overview of these relationships.

Initially, the variables were entered into the backward binary logistic model, followed by entry into

Table 3. Relationship Between Variables and Job Performance

Variables	Odd Ratio (OR)	CI (Confidence Interval)	P-Value
Age	0.926	0.217 - 0.784	0.018
Gender	0.435	0.217 - 0.784	< 0.001
Man			
Female			
Education level	2.361	2.130 - 2.635	0.036
Diploma			
Associate degree			
Bachelor's degree			
Having sports activities	1.369	1.123 - 1.409	0.005
Yes			
No			
Thigh injury	1.458	1.269 - 1.648	< 0.001
Yes			
No			
Damage to the lower back	1.963	1.685 - 2.128	0.030
Yes			
No			
Upper back injury	1.563	1.415 - 1.639	< 0.001
Yes			
No			
Hip injury	1.745	1.678 - 1.978	< 0.001
Yes			
No			
Work experience (y)	0.425	0.325 - 0.547	0.031

the final enter binary logistic model. According to the results in Table 3, variables including gender, literacy level, sports activity, wrist injury, hip injury, knee injury, shoulder injury, ankle injury, lower back injury, upper back injury, hip injury, age, weight, and work experience had a significance level of less than 0.02, allowing their inclusion in the model.

In the final model, variables such as gender, literacy level, sports activity, thigh injury, knee injury, lower back injury, upper back injury, hip injury, age, and work experience were found to be significant, indicating their influence on the job performance of employees.

5. Discussion

In this study, the results indicated that MSDs in the elbow, back, neck, hip, knee, wrist, ankle, shoulder, and thigh impact job performance. Statistical tests also showed that age, gender, sports activity, and literacy level are associated with job performance. A study conducted by Bhatia et al. in 2024 showed a high prevalence of MSDs in the back, neck, shoulder, and back, which aligns with the results of this study (23). Overall, MSDs are prevalent among nurses and other hospital staff (3, 24-27) as well as OR staff, as observed in this study (15, 28).

The results revealed that 62% of OR workers scored low in job performance, and a significant relationship exists between MSDs and job performance, which is consistent with other studies (29-31). In a 2016 study by Odebiyi et al., neck, shoulder, upper back, and lower back disorders were most common among the study population. Similar to the present study, discomfort in the neck, lower back, and knee was noted to impact job performance adversely due to MSDs (29). Research by Ou et al. in 2021 also determined that the prevalence of MSDs increases with workload, which, as in the current research, leads to decreased job performance (30).

In the 2019 study by Ghorbanpour et al., the impact of MSDs on job performance was also investigated, with findings indicating that such disorders can reduce performance, supporting the present study's results (31). Multiple studies have highlighted the role of physical activity in reducing MSDs, while inactivity has been linked to increased prevalence. In research by Ou et al., the frequency of symptoms was examined separately for upper and lower limbs, showing a significant

relationship between MSDs and job performance, except for symptom frequency in the upper limbs (30). In this study, only 29% of participants engaged in physical activity, which could contribute to the high prevalence of MSDs and their effect on job performance (32-34).

This study also showed that MSDs increase with age, a trend observed in other studies (24, 35-37).

5.1. Study limitations

The study faced several limitations. The relatively small sample size, particularly in the case group, may limit the generalizability of the findings. Future studies utilizing larger and more diverse samples could enhance the applicability of the results. Expanding the scope of research to include medical teams across various healthcare settings could provide a more comprehensive understanding of how occupational hazards impact individual performance. Additionally, the study's focus was restricted to assessing physical occupational hazards, limiting its ability to examine the long-term sustainability of improvements in physical complications. Future research could address this limitation by extending the duration of low-intervention follow-up assessments.

5.2. Conclusions

This research indicates that MSDs can adversely affect employees' job performance. Given the impact of multiple occupational factors on employee performance, it is recommended that future studies concurrently examine the effects of other detrimental occupational factors.

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Footnotes

Authors' Contribution: Study concept and design: Yaser Khorshidi Behzadi; analysis and interpretation of data: Fatemeh Maghsoudi and Mohsen Shafie; drafting of the manuscript: Yaser Khorshidi Behzadi.; critical revision of the manuscript for important intellectual content: Vahid Dehghan. and Zahra Aghajari; statistical analysis: Mohsen Shafie

Conflict of Interests Statement: The authors declare that they have no competing interests.

Data Availability: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval: The study protocol was approved by the Abadan University of Medical Science ethical board (IR.ABADANUMS.REC.1398.011). All methods followed relevant guidelines and regulations (Declaration of Helsinki).

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Informed Consent: All the participants have provided written informed consent to the researchers. The participants were told that their involvement in the study was voluntary, and had the freedom to withdraw at any time. They were also assured that participation in the research carried no risks.

References

1. Nasiry Zarrin Ghabaee D, Haresabadi M, Bagheri Nesami M, Talebpour Amiri F. Work-Related Musculoskeletal Disorders and Their Relationships with the Quality of Life in Nurses. *J Ergonomic*. 2016;**4**(1):39-46. https://doi.org/10.21859/joe-04015.
2. Buchman-Wildbaum T, Richman MJ, Varadi E, Schmelowszky A, Griffiths MD, Demetrovics Z, et al. Perceived loss among people living with mental disorders: Validation of the personal loss from mental illness scale. *Compr Psychiatry*. 2020;**96**:152146. [PubMed ID: 31726289]. https://doi.org/10.1016/j.comppsych.2019.152146.
3. Luan HD, Hai NT, Xanh PT, Giang HT, Van Thuc P, Hong NM, et al. Musculoskeletal Disorders: Prevalence and Associated Factors among District Hospital Nurses in Haiphong, Vietnam. *Biomed Res Int*. 2018;**2018**:3162564. [PubMed ID: 30225248]. [PubMed Central ID: PMC6129332]. https://doi.org/10.1155/2018/3162564.
4. Bhattacharya A. Costs of occupational musculoskeletal disorders (MSDs) in the United States. *Int J Indust Ergonomic*. 2014;**44**(3):448-54. https://doi.org/10.1016/j.ergon.2014.01.008.
5. Debela MB, Azage M, Begosaw AM. Prevalence of Occupational Injury among Workers in the Construction, Manufacturing, and Mining Industries in Africa: A Systematic Review and Meta-analysis. *J Occup Health Epidemiol*. 2021;**10**(2):113-26. https://doi.org/10.52547/johe.10.2.113.
6. Arslan SA, Hadian MR, Olyaei G, Bagheri H, Yekaninejad MS, Ijaz S, et al. Prevalence and Risk Factors of Low Back Pain Among the Office Workers of King Edward Medical University Lahore, Pakistan. *Physic*

Treat Specific Physic Ther. 2016;**6**(3):161-8. https://doi.org/10.18869/nrip.ptj.6.3.161.

7. Macpherson RA, Lane TJ, Collie A, McLeod CB. Age, sex, and the changing disability burden of compensated work-related musculoskeletal disorders in Canada and Australia. *BMC Public Health*. 2018;**18**(1):758. [PubMed ID: 29914425]. [PubMed Central ID: PMC6007009]. https://doi.org/10.1186/s12889-018-5590-7.
8. Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian J Occup Environ Med*. 2014;**18**(2):75-81. [PubMed ID: 25568602]. [PubMed Central ID: PMC4280781]. https://doi.org/10.4103/0019-5278.146896.
9. Soroush A, Shamsi M, Izadi N, Heydarpour B, Samadzadeh S, Shahmohammadi A. Musculoskeletal Disorders as Common Problems among Iranian Nurses: A Systematic Review and Meta-analysis Study. *Int J Prev Med*. 2018;**9**:27. [PubMed ID: 29619151]. [PubMed Central ID: PMC5869955]. https://doi.org/10.4103/ijpvm.IJPVM_235_16.
10. Arsalani N, Fallahi-Khoshknab M, Josephson M, Lagerstrom M. Musculoskeletal disorders and working conditions among Iranian nursing personnel. *Int J Occup Saf Ergon*. 2014;**20**(4):671-80. [PubMed ID: 25513802]. https://doi.org/10.1080/10803548.2014.11077073.
11. Etemadinezhad S SSYCJMAZ. A Structural Equation Modeling of the Relationship Between Occupational Stress and Job Performance in Health Care Workers. *Int J Occup Hyg*. 2018;**10**(1):52-9.
12. Kamijantono H, Sebayang MM, Lesmana A. Risk Factors and Ergonomic Influence on Musculoskeletal Disorders in the Work Environment. *J La Medihealtico*. 2024;**5**(3):660-70. https://doi.org/10.37899/journallamedihealtico.v5i3.1413.
13. Fan J, Tan X, Smith AP, Wang J. Work-related musculoskeletal disorders, fatigue and stress among gas station workers in China: a cross-sectional study. *BMJ Open*. 2024;**14**(7). e081853. [PubMed ID: 38969368]. [PubMed Central ID: PMC11227785]. https://doi.org/10.1136/bmjopen-2023-081853.
14. Platis C, Reklitis P, Zimeras S. Relation between Job Satisfaction and Job Performance in Healthcare Services. *Procedia - Social and Behavioral Sciences*. 2015;**175**:480-7. https://doi.org/10.1016/j.sbspro.2015.01.1226.
15. Tavakkol R, Kavi E, Hassanipour S, Rabiei H, Malakoutikhah M. The global prevalence of musculoskeletal disorders among operating room personnel: A systematic review and meta-analysis. *Clinic Epidemiol Global Health*. 2020;**8**(4):1053-61. https://doi.org/10.1016/j.cegh.2020.03.019.
16. Pourteimour S, Yaghmaei S, Babamohamadi H. The relationship between mental workload and job performance among Iranian nurses providing care to COVID-19 patients: A cross-sectional study. *J Nurs Manag*. 2021;**29**(6):1723-32. [PubMed ID: 33690932]. [PubMed Central ID: PMC8236996]. https://doi.org/10.1111/jonm.13305.
17. Foy T, Dwyer RJ, Nafarrete R, Hammoud MSS, Rockett P. Managing job performance, social support and work-life conflict to reduce workplace stress. *Int J Productivity Performance Manag*. 2019;**68**(6):1018-41. https://doi.org/10.1108/ijppm-03-2017-0061.
18. Lim JY, Kim GM, Kim EJ. Factors Associated with Job Stress among Hospital Nurses: A Meta-Correlation Analysis. *Int J Environ Res Public Health*. 2022;**19**(10). [PubMed ID: 35627328]. [PubMed Central ID: PMC9140361]. https://doi.org/10.3390/ijerph19105792.
19. Choobineh A. *[Posture assessment methods in occupational ergonomics]*. Tehran, Iran: Fanavaran publication; 2004. FA.
20. Choobineh A, Lahmi M, Shahnavaz H, Jazani RK, 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. [PubMed ID: 15182472]. https://doi.org/10.1080/10803548.2004.11076604.
21. Paterson TT, Husband TM. Decision-Making Responsibility. *Compensation Rev*. 1970;**2**(2):21-31. https://doi.org/10.1177/088636877000200204.
22. Arshadi N, Shokrkon H. Investigating the Relationship Between Psychological Stress Caused by Conflict and Role Ambiguity with Job Performance and Satisfaction Regarding to The Moderating Effects of Work Autonomy and Group Continuity in The Employees of the National Oil Company of Southwest Ahwaz. *J Edu Sci Psychol*. 2007;**14**(1):129-48.
23. Bhatia V, Vaishya RO, Jain A, Grover V, Arora S, Das G, et al. Identification of prevalence of musculoskeletal disorders and various risk factors in dentists. *Heliyon*. 2024;**10**(1). e23780. [PubMed ID: 38332878]. [PubMed Central ID: PMC10851298]. https://doi.org/10.1016/j.heliyon.2023.e23780.
24. Wang K, Zeng X, Li J, Guo Y, Wang Z. The prevalence and risk factors of work-related musculoskeletal disorders among nurses in China: A systematic review and meta-analysis. *Int J Nurs Stud*. 2024;**157**:104826. [PubMed ID: 38843644]. https://doi.org/10.1016/j.ijnurstu.2024.104826.
25. Ait Ali D, Oukhouya K, Aziz A, Bouhali H, El Khiat A, Koutbi M, et al. Prevalence of Musculoskeletal Disorders among Healthcare Professionals: A Hospital-based Study. *Adv Med Psychol Public Health*. 2024;**1**:12-25. https://doi.org/10.5281/zenodo.10598431.
26. Alabri T, Al Harrasi M, Al Jahwari M, Al Amri J, Al Najidiya H, Al Saadi G, et al. Prevalence and Risk Factors of Musculoskeletal Disorders among Nurses Working at a Tertiary Hospital in Oman. *J Musculoskeletal Res*. 2023;**27**(1). https://doi.org/10.1142/s0218957723500136.
27. Asuquo EG, Murphy-Tighe S, Ryan R, O'Sullivan K. How is social support defined, categorized and measured in studies of work-related musculoskeletal disorders among hospital nurses: A scoping review. *J Adv Nurs*. 2024;**2024**. https://doi.org/10.1111/jan.16356.
28. Basager A, Williams Q, Hanneke R, Sanaka A, Weinreich HM. Musculoskeletal disorders and discomfort for female surgeons or surgeons with small hand size when using hand-held surgical instruments: a systematic review. *Syst Rev*. 2024;**13**(1):57. [PubMed ID: 38326919]. [PubMed Central ID: PMC10848514]. https://doi.org/10.1186/s13643-024-02462-y.
29. Odebiyi DO, Akanle OT, Akinbo SR, Balogun SA. Prevalence and Impact of Work-Related Musculoskeletal Disorders on Job Performance of Call Center Operators in Nigeria. *Int J Occup Environ Med*. 2016;**7**(2):98-106. [PubMed ID: 27112718]. [PubMed Central ID: PMC6816511]. https://doi.org/10.15171/ijoem.2016.622.
30. Ou YK, Liu Y, Chang YP, Lee BO. Relationship between Musculoskeletal Disorders and Work Performance of Nursing Staff: A Comparison of Hospital Nursing Departments. *Int J Environ Res Public Health*. 2021;**18**(13). [PubMed ID: 34281022]. [PubMed Central ID: PMC8297183]. https://doi.org/10.3390/ijerph18137085.
31. Ghorbanpour A, Tabatabaei S, Gholamnia R. [Study of Risk Factors of Ergonomic Work Environment and Its Relation with Self-Efficacy and Job Performance of Employees of A Food Industry]. *Iran J Ergonomic*. 2019;**7**(3):75-84. FA. https://doi.org/10.30699/jergon.7.3.75.

32. Serra M, Camargo PR, Zaia JE, Tonello MGM, Quemelo PRV. Effects of physical exercise on musculoskeletal disorders, stress and quality of life in workers. *Int J Occup Saf Ergon*. 2018;**24**(1):62-7. [PubMed ID: 27690286]. https://doi.org/10.1080/10803548.2016.1234132.

33. Yao Y, Zhao S, An Z, Wang S, Li H, Lu L, et al. The associations of work style and physical exercise with the risk of work-related musculoskeletal disorders in nurses. *Int J Occup Med Environ Health*. 2019;**32**(1):15-24. [PubMed ID: 30793708]. https://doi.org/10.13075/ijomeh.1896.01331.

34. Jakobsen MD, Sundstrup E, Brandt M, Andersen LL. Effect of physical exercise on musculoskeletal pain in multiple body regions among healthcare workers: Secondary analysis of a cluster randomized controlled trial. *Musculoskelet Sci Pract*. 2018;**34**:89-96. [PubMed ID: 29414757]. https://doi.org/10.1016/j.msksp.2018.01.006.

35. Kinge JM, Knudsen AK, Skirbekk V, Vollset SE. Musculoskeletal disorders in Norway: prevalence of chronicity and use of primary and specialist health care services. *BMC Musculoskelet Disord*. 2015;**16**:75. [PubMed ID: 25887763]. [PubMed Central ID: PMC4392859]. https://doi.org/10.1186/s12891-015-0536-z.

36. Jordan KP, Kadam UT, Hayward R, Porcheret M, Young C, Croft P. Annual consultation prevalence of regional musculoskeletal problems in primary care: an observational study. *BMC Musculoskelet Disord*. 2010;**11**:144. [PubMed ID: 20598124]. [PubMed Central ID: PMC2903510]. https://doi.org/10.1186/1471-2474-11-144.

37. Lashkarbolouk N, Mazandarani M, Pakmehr A, Ejtahed HS. Evaluating the Role of Probiotics, Prebiotics, and Synbiotics Supplementation in Age-related Musculoskeletal Disorders in Older Adults: A Systematic Review. *Probiotics Antimicrob Proteins*. 2024;**2024**. [PubMed ID: 38907826]. https://doi.org/10.1007/s12602-024-10306-3.