ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2022;7(2): 708-719.

Risk Assessment of Musculoskeletal Disorders and Its Correlation with Job Factors: Validating of an Assessment Questionnaire

ARTICLEINFO

Article Type
Original Article

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How to cite this article

Sheikhmozafari MJ., Mohammad Alizadeh P., Ahmadi O., Rashidi N., Jafari D. Risk Assessment of Musculoskeletal Disorders and Its Correlation with Job Factors: Validating of an Assessment Questionnaire. IJMPP. 2022; 7(2): 708-719.

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Article History
Received: Feb 28, 2022
Accepted: Mar 16, 2022
ePublished: Apr 20, 2022

ABSTRACT

Aims: Work-related Musculoskeletal Disorders (WMSDs) are one of the leading causes of job disability and absenteeism. Various occupational factors may increase the risk of developing WMSDs among individuals. Therefore, this study aimed to determine the validity and reliability of the Persian version of the Job Factors Questionnaire (JFQ) and determine the role of the occupational factors in the prevalence of WMSDs among individuals.

Method and Materials: We conducted this study in 2022 on 100 employees of an automotive industry in Kerman province in Iran. We used The Backward-Forward to translate the questionnaire. Cronbach's alpha coefficient and the Intraclass Correlation (ICC) Coefficient were used for reliability, and Content Validity Index (CVI) and Content Validity Ratio (CVR) tests were used for validity determination. To analyze the data, we used the SPSS-22. To evaluate the differences in demographic characteristics and questionnaire answers between the two groups, the T-test, and chi-square test were used.

Findings: The most WMSDs were in waist, knees, and ankles for workers and waist, neck, upper back, and shoulders for office employees. The Cronbach's alpha coefficient for all individuals, workers, and office employees' answer were 0.954, 0.955, and 0.924, respectively, and the ICC was in the range of 0.718 to 0.928. Validity was also in the acceptable range. For both groups, the occupational factor "Working in the same position for long periods" played the most significant role in the rate of WMSDs.

Conclusion: JFQ is a proper tool for predicting and controlling WMSDs in workplaces. We can use this tool to control the physical-ergonomic problems and review ergonomic improvements made in the workplace.

Keywords: Job Factors Questionnaire, Nordic Questionnaire, Risk Assessment, Work-related Musculoskeletal Disorders, Reliability, Validity

Introduction

Despite the increasingly development of industries and the mechanized advancement and automation of machines in the workplace, WMSDs are still the leading cause of lost working time, increased costs, and workers' injury in the workplace [1]. Work-related Musculoskeletal Disorders are responsible for 40% of the total compensation costs paid to workers in the workplace [2]. One study stated that MSDs play a critical role in causing global disability and back pain [3]. According to a report, in 2017, nearly 10 million working days were lost in the UK due to WMSDs, which is equivalent to 35% of the total working days lost due to occupational diseases [2]. Work-related Musculoskeletal Disorders are estimated to cost the United States $ 45 billion to $ 54 billion annually as well [4]. In the United States, over 14 years from 1999 to 2013, an average of 45,000 claims for work-related illnesses and injuries were filed annually, of which 43% were WMSDs. At the same time, the total direct medical and non-medical costs of WMSDs were estimated at 8.5 billion dollars, which is 44% of the total cost of compensation [5]. A study of working populations in Denmark found that the musculoskeletal pain ratio increased from 31% to 33% from 2012 to 2018 [6].

[DOR: 20.1001.1.24765279.2022.7.2.6.7]
[DOI: 10.52547/ijmpp.7.2.708]

The main reasons for MSDs prevalence among workers are working in inappropriate postures, sitting or standing for a long time, lifting and carrying heavy objects, exerting too much force, incorrect work cycles, working too fast, unfamiliar work tasks, lack of variety at work, etc [7, 8].

Ergonomics and occupational health professionals are trying to reduce occupational ergonomic hazards such as the prevalence of WMSDs using risk assessment of the exposure extent and ergonomic intervention methods [9]. Ergonomic intervention means modifying the work environment, behavior, and other long-term training approaches of workers to treat and prevent further injuries due to the prevalence of WMSDs [10]. There are different methods for executing ergonomic interventions in the workplace, such as postural assessment in Observational Methods, ergonomic checklists, different types of questionnaires, etc [11]. Using a questionnaire and conducting face-to-face interviews with workers in the workplace is a common strategy to identify the occurrence of WMSDs among workers. In addition, the questionnaire can be used to identify factors or tasks that affect the occurrence of MSDs.

One of the most appropriate questionnaires to evaluate job factors and tasks is the Job Factor Questionnaire (JFQ) [12]. Rosecrance et al. developed this questionnaire to assess workers' perception about 15 job factors and working conditions and their role in the prevalence of WMSDs. Its validity and reliability have been well established [12, 13]. Many studies used this questionnaire to evaluate job factors among metal industry workers [12], plastic mold industry workers [13], farmers [14], rancher workers [15], hospital workers [16], dental students [17], workers from various industries in Brazil [18], dairy industries [19], large automotive industries [20], carpenters [21], physiotherapists [22], etc. Although there are several questionnaires to assess various aspects of ergonomics in the workplace, there is no valid questionnaire to assess the job factors and tasks leading to WMSDs among Iranian workers. Several studies used this questionnaire in English, Portuguese and Brazilian languages mentioned above. When collecting information using questionnaires, the validation of the questionnaires must be evaluated first [23]. Since there is no complete and valid questionnaire regarding the evaluating job factors affecting the prevalence of MSDs among occupational groups in Iran, the purpose of this study was to validate the JFQ in an automotive industry in Kerman province -that located in south of Iran - using existing standards. The other purpose of this study is to confirm that we can use this questionnaire to assess various job factors and tasks and prevent the spread of MSDs among different occupational and non-occupational groups.

Method and Materials

The present study is a descriptive study conducted in 2022 on 100 employees of an automotive Industry in Kerman province of Iran. In this study the Backward-Forward technique was used to translate the questionnaire from the original language into Persian. This technique has four steps to translate the questionnaire: a) Initial translation of the questionnaire from the original language to the secondary language by two separate translators b) Combining the two translated versions and obtaining a single translation c) Back translating of the translated version, from secondary language to original language by two other independent translators d) Reviewing the first and secondary translated versions and match with the original questionnaire for the same semantic perception and linguistic validity of the two questionnaires, by a team of experts, experienced and familiar with the

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subject of the questionnaire [24].

For data collection in this study we used the Nordic Questionnaire (NQ) to determine the rate of WMSDs among employees in this industry. The Nordic Questionnaire includes demographic factors such as age, sex, weight, height, right or left hand, and the rate of MSDs in 9 areas of the body, including neck, shoulders, elbows, wrists, upper back, lower back, hips/thighs, knees, and ankles [1].

The other questionnaire was Job Factors Questionnaire (JFQ). This questionnaire consists of 15 job descriptive factors. We asked the participants to indicate, using a scale from zero to ten (where zero means no problem and ten means a major problem), how much each factor in their opinion leads to the prevalent of WMSDs symptoms. These 15 factors include doing repetitive tasks, working very fast, handling or grasping small objects, insufficient breaks or pauses during the workday, working in inappropriate situations and cramped places, working in the same positions for a long time, bending or twisting the waist improperly, working near or at physical limits, reaching or working over the head or away from the body, working in hot, cold, humid and wet conditions, continuing to work when injured or hurt, carrying, lifting or moving heavy materials or equipment, work scheduling (overtime, length of workday), using various tools and working without training courses. A score of 0, and 1 by the respondents, means a negative response (i.e. this factor in my opinion, has no role in the occurrence of WMSDs), and a score of 2, and greater than 2, means a positive response (i.e. this factor in my opinion, has a role in the occurrence of WMSDs and whatever. The closer it gets to 10, the more severe the effect [12].

Since this study aimed to determine the validity and reliability of the JFQ questionnaire in Persian language, we distributed the translated questionnaire among 100 workers in production line and office workers in an automotive Industry in Kerman province of Iran. First, the conditions and goals of the study were fully explained to the individuals, and then the individuals participated voluntarily and knowingly. Inclusion criteria were having more than one year of work experience, and exclusion criteria were congenital MSDs and improper completion of the questionnaire. SPSS software version 22 was used to analyze the data. To evaluate the reliability of the questionnaire, we used the test-retest method using the Intra-Class Correlation (ICC) and alpha coefficients. To use the ICC coefficient, the test questions were given to a single group twice under the same conditions and using the ICC, then the obtained scores were compared and were used as a reliability coefficient. To evaluate the content validity quantitatively, the relative Content Validity Ratio (CVR) and Content Validity Index (CVI) were used. To use the ratio of CVR we used the opinions of experts regarding the test content. In this regard, the objectives of the test were explained, and the operational definitions of the content of the questions were stated to the experts. Then they were asked to categorize each question based on the Likert three-part spectrum including: Essential, Useful but not essential, or Not necessary: After gathering the views of experts, the CVR was calculated using the following equation:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

N: Total number of specialists

Ne: The number of specialists who have indicated the essential option.

Based on the number of experts who evaluated the questions, the minimum acceptable CVR value was determined based on a table. Questions for which the

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Table 1) Demographic information of participants by job task type

Demographic information	Production line worker N (%)	Office worker N (%)
Age (Yrs)		
20-29	8 (11)	7 (25.9)
30-39	53 (72.6)	12 (44.4)
40-49	12 (16.4)	8 (29.6)
50-59	0 (0)	0 (0)
Height (cm)	174	173
Weight (Kg)	75.53	71
BMI (kg/M2)	24.77	23.73
Work Experience (Yrs)		
<1	1 (1.4)	3 (11.1)
1-5	3 (4.1)	5 (18.5)
6-10	33 (45.2)	9 (33.3)
11-15	21 (28.8)	3 (11.1)
16-20	12 (16.4)	6 (22.2)
20<	3 (4.1)	1 (3.7)
Marital status		
Married	71 (97.3)	22 (81.5)
Single	2 (2.7)	5 (18.5)
Divorced	0 (0)	0 (0)
Secondary job (Yes)	32 (43.8)	10 (37)
Sports activities (Yes)	38 (52.1)	12 (44.4)
Type of working conditions		
Standing	36 (49.3)	0 (0)
sitting	0 (0)	6 (22.2)
Standing- Sitting	37 (50.7)	21 (77.8)
work shift		
Standard shift (Day shift)	53 (72.6)	21 (77.8)
Non-standard Shift work (evening or night shift)	15 (20.5)	3 (11.1)
Standard- Non-standard Shift work together	5 (6.8)	3 (11.1)

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Table 2) The rate of musculoskeletal disorders of the studied participants in terms of their job

Body organs	Production line worker N (%)		Office worker N (%)	
	Last 12 months	Last 7 days	Last 12 months	Last 7 days
Neck	22 (30.1)	14 (19.2)	13 (48.1)	8 (29.6)
Shoulders	14 (19.2)	10 (13.7)	8 (29.6)	6 (22.2)
Elbows	7 (9.6)	4 (5.5)	0 (0)	0 (0)
Wrist/hands	9 (12.3)	7 (9.6)	3 (11.1)	0 (0)
Upper back	8 (11)	6 (8.2)	8 (29.6)	5 (18.5)
Lower back	32 (43.8)	26 (35.6)	18 (66.7)	16 (59.3)
Hips/thighs	6 (8.2)	6 (8.2)	2 (7.4)	2 (7.4)
Knees	29 (39.7)	25 (34.2)	5 (18.5)	4 (14.8)
Ankles/feet	25 (34.2)	18 (24.7)	2 (7.4)	0 (0)

calculated CVR value was less than the acceptable amount were excluded from the test because based on CVR, they did not have an acceptable validity range.

Content Validity Index (CVI): This index is also used to assess the validity of the questionnaire. For CVI calculations, experts were asked to rate the relevance of each item to a four-part spectrum. For the relevancy scale, a 4-point Likert scale was used and responses include: 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = very relevant. Ratings of 1 and 2 were considered invalid content while ratings of 3 and 4 were considered valid. A 4-point Likert scale was used for the clarity and essentiality scale. The clarity scale was: 1 = not clear, 2 = item needs some revision; 3=somewhat clear, and 4 = very clear, and for essentiality: 1 = not essential; 2 = useful, but not essential, 3 = essential, and 4= very essential. Then we divided the number of experts who have selected options 3 and 4 by the total number of experts. If the value was less than 0.7, the item was rejected. If it was between 0.7 and 0.79, the item was approximately acceptable, and if it was greater than 0.79, it was quite acceptable.

To determine the CVR and CVI indicators, we sent the JFQ to 12 specialists, including university professors, Ph.D. candidate students, and occupational safety and health specialists working in some industries. According to Lawshe, if the number of specialists was 12, the minimum acceptable CVR for each question was 0.56. Also, according to Waltz and Basel, if the CVI for each question was greater than 0.79, it was acceptable.

Findings

In this study, 100 male employees of an automotive Industry in Kerman province were studied. Of these 100 participants 73 participants (73%) were workers in production line and 27 participants (27%) were office workers. Table 1 lists the whole demographic information of individuals.

The prevalence of MSDs in the last 12 months and 7 days were shown in Table 2

According to Table 2, in the last 12 months and 7 days, the highest rate of MSDs for production line workers, were respectively in the waist, knees, ankles, and for office workers were in the waist, neck, upper back, and shoulders respectively.

Table 3 shows the rate of MSDs in the last 12 months, which has prevented workers from

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doing daily activities.

Table 3) Musculoskeletal disorders in the last 12 months with daily activity prohibition

Body organs	Production line worker N (%)	office worker N (%)
Neck	16 (21.9)	6 (22.2)
Shoulders	11 (15.1)	4 (14.8)
Elbows	4 (5.5)	0 (0)
Wrist/hands	6 (8.2)	1 (3.7)
Upper back	4 (5.5)	7 (25.9)
Lower back	32 (43.8)	16 (59.3)
Hips/thighs	4 (5.5)	2 (7.4)
Knees	23 (31.5)	5 (18.5)
Ankles/feet	17 (23.3)	1 (3.7)

According to findings in Table 3, in the last 12 months, MSDs in the region of lower back, knees, and ankles organs for workers in production line, and MSDs in the region of lower back, upper back, and neck for office workers made the conditions for them so difficult to perform routine and personal daily activities.

Figure 1 and 2 shows the reliability of the JFQ questionnaire using Cronbach's alpha and ICC coefficients.

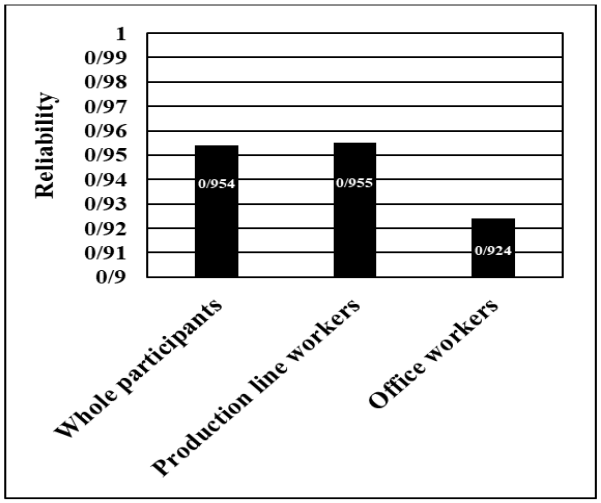

Figure 1) Cronbach's alpha coefficient

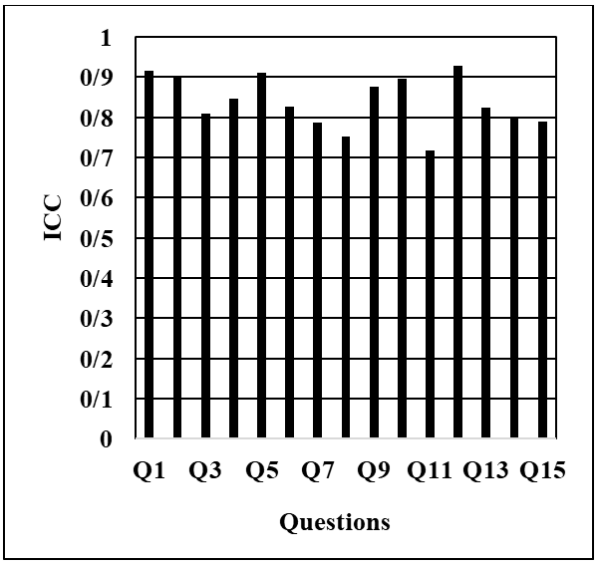

Figure 2) Intraclass Correlation coefficient

The CVR for all questions based on the proposed formula was higher than 0.56. Also for the CVI, since all the experts chose options 3 or 4 for all questions, the CVI rate for all questions was higher than 0.79. Table 4 shows the average scores obtained from the JFQ by job task type.

According to Table 4, the most difficult job factors for line workers were respectively working in the same position for long periods like standing, bent over, sitting, kneeling, etc, working in hot, cold, humid, wet conditions, and working in awkward or cramped positions. In this regard, most difficult job factors for office workers were working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), working near or at physical limits, and bending or twisting their back in an awkward way respectively.

In this study, there was a significant correlation between the following factors: between age factor and pain in the ankle area, between the work task type factor (being a worker or employee) and neck pain, upper back pain, back pain, knee pain, Ankle pain, between height factor and shoulder pain, elbow pain, wrist pain, back pain, shoulder pain, between weight factor

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Table 4) Average scores of the Job Factors Questionnaire by in terms of job kind

Job tasks or factors	Production line workers M (SD)	Office workers M (SD)	Whole participants M (SD)
Q1.Performing the same task over and over	6.04 (3.54)	4.62 (3.17)	5.58 (3.47)
Q2.Working very fast for short periods (lifting, grasping, pulling, etc.)	5.89 (3.44)	4.56 (3.23)	5.51 (3.41)
Q3. Having to handle or grasp small objects	5.21 (3.56)	3.44 (2.95)	4.75 (3.48)
Q4. Insufficient breaks or pauses during the workday	5.82 (3.29)	5.11 (2.99)	5.60 (3.20)
Q5. Working in awkward or cramped positions	6.09 (3.53)	3.77 (3.57)	5.42 (3.67)
Q6. Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.)	6.62 (3.67)	6.32 (2.88)	6.54 (3.44)
Q7. Bending or twisting your back in an awkward way	5.73 (3.60)	5.43 (3.92)	5.64 (3.67)
Q8. Working near or at your physical limits	5.50 (3.61)	5.72 (3.20)	5.56 (3.48)
Q9. Reaching or working over your head or away from your body	5.05 (3.67)	4.44 (3.38)	4.65 (3.65)
Q10. Hot, cold, humid, wet conditions	6.22 (3.43)	4.60 (3.52)	5.78 (3.51)
Q11. Continuing to work when injured or hurt	4.33 (3.77)	3.95 (3.96)	4.24 (3.80)
Q12. Carrying, lifting, or moving heavy materials or equipment	5.45 (3.62)	3.57 (4.14)	5.0 (3.81)
Q13. Work scheduling (overtime, length of workday)	5.60 (3.69)	4.48 (3.07)	5.28 (3.55)
Q14. Using tools (design, weight, vibration, etc.)	4.34 (3.48)	2.61 (2.35)	3.93 (3.32)
Q15. Working without any type of training	4.15 (3.77)	3.45 (3.63)	3.95 (3.72)

with back pain, between work experience factor and shoulder pain, upper back pain, back pain, between having a secondary job factor and neck pain, Between doing sports activities factor and neck pain, between the working position type factor (permanent standing, permanent sitting, standing-sitting together) and wrist pain, elbow pain, back pain, hips/thigh pain, and ankle pain, between BMI factor and shoulder pain, upper back pain, wrist pain, back pain, hips/thigh pain, knee pain, and ankle pain for production line workers, there was a significant correlation between the following job factors with WMSDs prevalence in body organs including: between "Performing the same task over and over" factor with upper back pain, hips/thighs pain, between "working very fast for short periods (lifting, grasping, pulling, etc.)" factor with shoulders pain, back pain, hips/Thigh pain, between "Having to handle or grasp small objects" factor with neck pain, elbows pain, between "Insufficient breaks or pauses during the workday" factor with lower back pain, between "bending or twisting your back in an awkward way" factor with shoulder pain, between "working near or at your physical limits" with elbow pain, between "working in hot, cold, humid, wet conditions" factor with knees pain and ankles pains, between "continuing to work when injured or hurt"

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factor with upper back pain, between "carrying, lifting, or moving heavy materials or equipment" factor with lower back and elbows pains, between "work scheduling (overtime, length of workday)" with ankles and lower back pains, between "using tools (design, weight, vibration, etc.)" factor with neck pain, shoulders pain, lower back pain and elbows pain and between "working without any type of training" factor with elbow pain. Also, for office workers, there was a significant correlation between the following job factors

with the prevalence of WMSDs in some body organs, including: between "performing the same task over and over" factor with thigh/ hips pain, between "Having to handle or grasp small objects" factor with neck pain, upper back pain, thighs/hips pain, Knees pain, between "insufficient breaks or pauses during the workday" factor with shoulder pain, between "working in the same position for long periods (standing, bent over, sitting, kneeling, etc.)" factor with shoulder pain, wrist pain, between "bending or twisting your back in an awkward way" factor with lower back and ankle pain, between "working near or at your physical limits" factor with neck and ankle pains, between "reaching or working over your head or away from your body" factor with wrists pain, thighs/ hips and ankles pains, between "continuing to work when injured or hurt" factor with Neck pain, between "carrying, lifting, or moving heavy materials or equipment" factor with the thigh/hips pain, between the "work scheduling (overtime, length of workday)" factor with neck and upper back pains, and between "using tools (design, weight, vibration, etc.)" factor with hip/thigh pain.

In this study, there was a significant correlation between age factor and the following job factors, so that with increasing age, the scores rate also increased: performing the same task over and over, Insufficient breaks or pauses during the workday, working in awkward or cramped positions, Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), Bending or twisting your back in an awkward way, Working near or at your physical limits, Reaching or working over your head or away from your body, working in Hot, cold, humid, wet conditions, Carrying, lifting, or moving heavy materials or equipment, Work scheduling (overtime, length of workday), Using tools (design, weight, vibration, etc.) and Working without any type of training. There was a significant relationship between weight factor and the "working near or at your physical limits" factors, between BMI index with "Insufficient breaks or pauses during the workday", and "Working near or at your physical limits" factors. Between work experience factor with "working very fast for short periods (lifting, grasping, pulling, etc.)", "bending or twisting your back in an awkward way", "working in Hot, cold, humid, wet conditions", "work scheduling (overtime, length of workday)", "Using tools (design, weight, vibration, etc.)", and "working without any type of training". Between doing sport exercise factor with "Insufficient breaks or pauses during the workday" and "Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.)" factors. Between job conditions type (standing, Sitting, standing-sitting together) factor with "performing the same task over and over" factor, "working very fast for short periods (lifting, grasping, pulling, etc.)", "Insufficient breaks or pauses during the workday" factor, "working in awkward or cramped positions" factor, "working in the same position for long periods (standing, bent over, sitting, kneeling, etc.)", "working near or at your physical limits", "continuing to work when injured or hurt", "Carrying, lifting, or moving heavy materials or equipment" factor, "work

scheduling (overtime, length of workday)" factor, "Using tools (design, weight, vibration, etc.)" factor, and "working without any type of training" factor. In this study, no significant relationship was found between the job shift type (standard or non-standard shift work) with any of the job factors.

Discussion

This study investigated the ergonomic conditions of 100 employees of an automotive Industry in Kerman province of Iran. According to the results of the present study, in the last 12 months and 7 days, the highest rate of WMSDs for production line workers was respectively in the lower back, knees, and ankles, and for office workers, it was in the lower back, neck, upper back, and shoulders respectively. In the previous studies it was found that the highest rate of WMSDs among workers was in the lower back organ [12, 25-33]. The results of the 11-mentioned studies are completely consistent with the results of the present study. However, in the some other studies, WMSDs were most prevalent in the shoulder and neck areas among workers, which are inconsistent with the results of the present study [34-36]. In the existed studies, the highest prevalence of WMSDs among office workers was in the lower back, which is completely consistent with the results of the present study [37-40]. However, in another studies, the highest prevalence of WMSDs among office workers was in the neck area, which is inconsistent with the results of the present study [41, 42]. As mentioned in the last part of the result section, there were relationships between some factors, therefore, according to and similar to our results, Ayub and Ahmadi et al. found a significant relationship between the work experience factor and WMSDs pain in different body organs [35, 43]. Ardalan et al. found a significant correlation between lower back pain and BMI, which agrees with the results of the present study, though, Ardalan and Shahrokhi as well found a significant relationship between age factor and shoulder, neck, and wrist pain, which is inconsistent with the present study [44, 45]. Mozafari et al. found a significant relationship between WMSDs prevalence with age and BMI factors [36]. Sheikhmozafari and Shahrokhi found A significant relationship between the working position type (permanent standing, permanent sitting, standing-sitting together) and lower back and elbow pain, consistent with the present study [1, 45].

According to the results of the mentioned studies and the results of the present study, it seems that production line workers and office workers generally suffer more pain in the upper body organs than in the lower body organs, and some factors including age, gender, height, and weight, and BMI index, exacerbate these pains, which indicates the need more attention from employers and provide control solutions to care of all working force to control pains in these areas. The reliability of the JFQ using Cronbach's alpha coefficient for all participants, production line workers, and office workers was 0.954, 0.955, and 0.924, respectively, which indicates the high reliability of this questionnaire. The reliability of the questionnaire using ICC was in the range of 0.718 to 0.928. The closer the ICC coefficient is to number one, the higher the reliability of the questionnaire is. Moreover, the validity results of the JFQ using two coefficients of CVI and CVR showed that the validity range of this questionnaire with both CVI and CVR indices is acceptable. The CVR index for all questions based on the formula and the number of experts was higher than 0.56. Also for the CVI index, since all the experts chose options 3 or 4, the CVI rate for all questions was higher than 0.79. In the study of Shimabukuro et al., the reliability

[DOR: 20.1001.1.24765279.2022.7.2.6.7]
[DOI: 10.52547/ijmpp.7.2.708]

of the JFQ using Cronbach's alpha was 0.91 for physiotherapists and 0.87 for office workers [22]. In the study of Coluci et al., the reliability of this questionnaire using the ICC coefficient ranged from 0.54 to 0.73 [12]. Also, in the study of Rosecrance et al., the reliability of the questionnaire using kappa coefficient and test-retest was in the range of 0.46 to 0.68 [13].

According to the average scores obtained from the JFQ, the most difficult job factors for line workers were respectively Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), working in hot, cold, humid, wet conditions, and working in awkward or cramped positions, and the most difficult job factors for office workers were Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), Working near or at physical limits, and bending or twisting their back in an awkward way respectively. Furthermore, in general, for both groups, the job factors including working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), working in hot, cold, humid, wet conditions, and bending or twisting their back in an awkward way respectively, gained the highest scores. In the study of Shimabukuro et al., the job factors including, working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), had the highest score [22]. In the study of Comper et al., The job factors of Working in the same position for long periods (standing, bent over, sitting, kneeling, etc.), working in Hot, cold, humid, wet conditions, and Bending or twisting their back in an awkward way, gained the highest scores respectively [46]. The study of Coluci et al. Also determined that job factors of working in the same position for long periods (standing, bent over, sitting, kneeling, etc.) and bending or twisting their back in an awkward way gained the highest scores from participants [12]. According to the findings of the present study, the higher the score in some job factors, the higher the rate of WMSDs in some areas (the lower back, upper back, knees, and neck). In other words, the higher the job factor score, the higher the prevalence of WMSDs. Coluci also mentioned this in his study [12].

Limitations of this study include difficult access to participants, low participation, and obstacles due to Covid-19. We suggest that in future studies, other questionnaires related to other job factors and musculoskeletal questionnaires be used, and the results be compared with the results of the present study.

Conclusion

The results showed that the highest rate of WMSDs in production line workers was in the lower back, knees, and ankles, and for office workers, it was in the lower back, neck, upper back, and shoulders, respectively. For both workers the job factor such as working in the same position for long periods had the most significant role in the rate of WMSDs that should be considered in future study. Furthermore, this study showed that JFQ is an appropriate and valid tool to predict WMSDs and control the conditions leading to WMSDs among working forces.

Acknowledgement

The authors would like to express their sincere gratitude to all participants of the present study.

Authors Contribution

MJSH analyses and interpret the data and wrote the first and final draft of the manuscript. PMA designed the study and collect data. OA supervised all stages of the study. NR designed the study and collect data.

Conflict of interest: The authors declare that there is no conflict of interest for this study.

[DOR: 20.1001.1.24765279.2022.7.2.6.7]
[DOI: 10.52547/ijmpp.7.2.708]

Ethical Permission: All principals of ethics were considered in study. Participants were satisfied to be studied and signed the consent form.

Funding/Supports: None

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[DOR: 20.1001.1.24765279.2022.7.2.6.7]
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