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Risk Factors of Musculoskeletal Disorders among Workers of Water Refilling Depot

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Abstract

Complaints of musculoskeletal disorders (MSDs) are common in workers with a reasonably heavy workload, such as workers at refill drinking water depots. MSDs can be caused by repetitive activities such as daily bending, lifting and lowering liters of drinking water refills. This study aimed to identify the risk factors of MSDs among workers at refilled drinking water filling depots and analyze the dominant factors that influence MSDs. This study was quantitative research with an analytical survey using a cross-sectional design conducted in Simpang Selayang Village, Medan City, Indonesia. A total of 40 refilled drinking water depot workers were involved in this study with a comprehensive sampling approach. Data was collected directly by distributing questionnaires to workers at refill drinking water filling depots. Data were tested statistically using the Chi-Square test and logistic regression. The analysis showed that work posture, workload, tenure and length of work are associated with MSDs complaints. The results of the logistic regression test showed that the dominant variable influencing MSDs complaints is work posture. Refillable drinking water depot workers with non-ergonomic working postures were likely to experience MSDs complaints 11 times as often as those with ergonomic work postures. The findings highlight the need for local health agencies to educate or empower workers at water refilling stations regarding MSDs complaints. Musculoskeletal disorders associated with work involving heavy loads could be prevented if workers know ergonomic work postures well. In addition, adequate rest is recommended to avoid musculoskeletal injuries.

Keywords: MSDs; refill drinking; risk factors; water depot workers

INTRODUCTION

Musculoskeletal disorders (MSDs) are a significant health problem worldwide with severe socioeconomic consequences (Bakhsh et al., 2021). As a result, MSDs are a severe health problem in almost all professions and countries, resulting from exposure to various work-related stressors, including repetitive movements, uncomfortable posture, fatigue and local mechanical stress (Hasheminejad et al., 2021). MSDs are also often associated with ergonomic risk factors (Padula et al., 2016). Most MSDs affect the neck, shoulders and lower back (Shariat et al., 2018). Workers in the informal sector frequently evade the authorities' notice. In this industry, inspection officers frequently encounter challenges in routine monitoring of

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fulfilling occupational health and safety requirements. The lack of authority supervision is also due to the insufficient data accessible for this group (Deribie, 2012).

According to a recent review of Global Burden of Disease 2019 data, 1.71 billion people worldwide suffer from MSDs, including rheumatoid *arthritis*, *osteoarthritis*, low back pain, neck discomfort, fractures and other injuries (Ferrett, 2020), as well as the top 20 significant causes of disease burden for all ages, deficient back pain (Vos et al., 2020). In addition, the Global Burden of Disease report in 2017 revealed that MSDs are the highest contributor to global disability at 16% of the world, with low back pain being the leading cause of disability since 1990 (Bakhsh et al., 2021).

Previous research has shown that physically exhausting work and difficult work situations, such as lifting or carrying heavy weights, tiring positions, awkward postures or repetitive actions are the direct causes of MSDs (Da Costa and Vieira, 2010; Ngan et al., 2010; Long et al., 2012). Repetitive activities or movements can be bending, lifting and lowering gallons of refillable drinking water. Because these activities are carried out repeatedly by workers every day, resulting in the occurrence of MSDs. Previous studies have reported that frequent activities requiring workers to perform various positions in a day, such as sitting, standing, squatting, bending over, lifting, moving and walking, have the potential to experience MSDs (Habibie et al., 2017). In addition, the length of working time and physical workload are significantly related to MSDs in workers in the informal sector (Sani and Widajati, 2021). Consequently, workers must grasp food safety and excellent food processing practices to reduce the risk of work-related injuries to protect themselves from various occupational diseases such as MSD complaints. According to the study Sartika (2020), nutritious eating will prevent sickness and other health issues since bad food management will have a negative influence.

Although numerous studies on MSDs in the formal and informal sectors (such as private employees, office workers and manufacturing workers) have been completed, research on the population of replenished drinking water replenishment depots in Indonesia has recently been of particular concern. Refilled water-filling workers can experience various types of MSDs because their work is repetitive, such as bending, lifting and lowering gallons of refillable drinking water daily for more than 8 hours per day. If the work is done for an extended period, the rest time will be shortened, and the muscles will work harder, increasing the likelihood of MSD issues (Habibie et al., 2017; Ramayanti and Koesyanto, 2021). In addition, they also work in an unnatural position where the back is too bent when lifting and lowering gallons filled with refillable drinking water daily. According to an initial study done through interviews with respondents, gallon refill drinking water depot workers encountered a variety of MSD concerns, including discomfort in the elbows, upper and lower neck, back and waist, left upper arm and shoulder, and legs. Moreover, many reported never receiving MSD education or empowerment from the local health office. As a result, it is critical to undertake this research to identify MSD risk factors in refilled drinking water depot workers and examine the primary factors that impact MSDs.

MATERIALS AND METHOD

Study design

This quantitative research design employs a cross-sectional design to conduct an analytical survey. In May 2022, this investigation was conducted in Simpang Selayang Village, Medan City, Indonesia.

Respondent

This research involved 40 drinking water depot employees in the Simpang Selayang Village region of Medan City (total sampling). Work posture, workload, tenure and length of work were the dependent variables in this study. MSD incidence constituted the independent variable. Age, education and sex comprise the respondent characteristics.

Data collection

Direct data collection was accomplished by delivering questionnaires to replenishing drinking water depot employees. Using the Rapid Whole Body Assessment (REBA) observation worksheet, workers at a drinking water depot were directly observed to assess whether their work posture was ergonomic or non-ergonomic (Al Madani and Dababneh, 2016). The score on the REBA worksheet ranges from 1 to 15 and comprises a score between 1 and 7 for an ergonomic working posture and a score

between 8 and 15 for a non-ergonomic working posture. The workload questionnaire comprises five questions with yes = 1 and no = 0 responses. Job tenure factors are categorized as ≥ 1 year = 1 and < 1 year = 2. The duration of works are categorized as ≥ 8 hours = 1 and < 8 hours = 2. The Nordic Body Map (NBM) questionnaire had 27 musculoskeletal system choice items (Wijaya, 2019) with the following answer options: score 0 = no pain, score 1 = slight pain, score 2 = pain, and score 3 = significant pain. The classifications are, therefore, as follows: low = 0 to 20, medium = 21 to 41, high = 42 to 62, and positively high = 63 to 84. All respondents were allowed to give informed permission indicating their willingness to participate in the study.

Data analysis

The data from this study were descriptively analyzed to determine the frequency distribution of work posture, workload, work tenure, length of work and MSD complaints. All results are shown as percentages and in tabular or graphical form. In addition, the researchers performed bivariate analysis to determine the effect of work posture, workload, work tenure and length of employment on MSD complaints, as well as calculated the value of the association prevalence ratio (PR) using the Chi-Square test at a significance level of 0.05 or a 95% confidence interval (CI) (Hulu and Kurniawan, 2021). Multivariate analysis used binary logistic regression tests to determine the dominant model or variable influencing MSDs complaints and Goodness of fit test (GoF) values. The function of the GoF value is to analyze the validity of the equation derived based on the calibration parameters, which can be observed in the Hosmer and Lameshow test (Dahlan, 2014). This study has received ethical approval from the Health Research Ethics Commission of Universitas Prima Indonesia with Number: 007/KEPK/UNPRI/III/2022.

RESULTS AND DISCUSSION

The study included 40 workers from a refillable drinking water filling depot and focused on determining the causes of the MSDs they experienced. The entire subject follows the data collection process from start to finish. Table 1 shows that the less than 30-year age group has the highest proportion of workers (52.5%). According to research Ramayanti and Koesyanto (2021), workers' MSD problems begin around age 30 and can worsen around age 40. Worker education was higher in the high school category by 40%, followed by the junior high school category by 35%. Education was not significantly related to MSD complaints (p = 0.783; OR = 0.87; CI 0.24-2.96) (Njaka et al., 2021). On the other hand, there were no female employees at the gallon drinking water depot. The results of the study Lestari et al. (2020) reported that gender had a significant relationship with the incidence of MSDs (p = < 0.001).

Table 1. Characteristics of respondents

Variables	Percentage (%)
Age	
< 30 years	52.5
> 30 years	47.5
Level of education	
Elementary school	25.0
Junior high school	35.0
Senior high school	40.0
Gender	
Male	100.0
Female	0.0

Table 2 shows that of the 19 people in the age category of respondents more than 30 years, those who experienced the most complaints of MSDs are in the high category, namely 52.6%. Workers with physical conditions that begin to deteriorate as the age of individuals increase are not expected to accept or perform heavy work excessively (Tjahayuningtyas, 2019). Based on education, most of the respondents who experienced complaints of MSDs are highly educated, namely 43.8%. However, previous studies reported that workers with low educational status are more likely to have less knowledge and skills in terms of ergonomics in the workplace (Kasaw Kibret et al., 2020).

Table 3 shows that the working posture of workers is most often in the non-ergonomic category, which is 62.5%, then more have a heavy workload of 62.5%. The longest work tenure is < 1 year, as much as 62.5%, and the length of work is ≥ 8 hours, as much as 52.5%. The number of workers who experienced complaints of moderate category MSDs was as many as 60%.

Table 4 shows that statistically, there was a significant association between working

Table 2. Cross tabulation of age and education on the incidence of MSDs

Variables	MSDs complaints					
	Moderate		High		Total	
	f	Percentage (%)	f	Percentage (%)	f	Percentage (%)
Age						
≥ 30 years	9	47.4	10	52.6	19	100
< 30 years	15	71.4	6	28.6	21	100
Level of education						
Elementary school	5	50.0	5	50.0	10	100
Junior high school	10	71.4	4	28.6	14	100
Senior high school	9	56.3	7	43.8	16	100

posture and MSDs complaints (p = < 0.001; OR = 47.6; 95% CI 7,016-323,857). Workers with non-ergonomic work postures have the potential to experience 47.6 times of complaints of MSDs. The study resulted that refill drinking water filling depot workers experience various complaints of MSDs during work, such as pain in the upper and lower neck, back and waist, left upper arm and shoulder, and legs. From the results of interviews with respondents, it turned out that the MSDs complaints were experienced from the first month they started working in lifting and lowering gallons of refillable drinking water every day to customers. These complaints could be influenced by ergonomic risk factors, namely posture and body position when lifting and lowering gallons of water. The findings of this study supported the results of previous studies (Park and Park, 2017; Permatasari and Widajati, 2018; Arjani et al., 2021).

Table 3. Frequency distribution of work posture, workload, work tenure, length of work and complaints of MSDs

Variables	n	Percentage (%)
Work posture		
Not ergonomic	25	62.5
Ergonomic	15	37.5
Workload		
Heavy	25	62.5
Mild	15	37.5
Work tenure		
≥ 1 year	15	37.5
< 1 year	25	62.5
Length of work		
≥ 8 hours	21	52.5
< 8 hours	19	47.5
Complaints (MSDs)		
Moderate	24	60.0
High	16	40.0

Furthermore, there was a significant association between workloads and MSDs complaints (p = < 0.001; OR = 21; 95% CI 4,007-110,057). Water depot workers with heavy workloads have the potential to experience MSDs complaints 21 times. If the muscle receives repeated loads for an extended period, it can cause complaints in the form of damage to joints, ligaments and tendons (Schlussel and Maykel, 2019). Complaints of MSDs can occur when the muscle receives a load with a static posture, or the work is done repetitively, and the work is done over a long period (Dong et al., 2022; Pramesti and Arini, 2022). The workload given to workers must correspond to their physical and psychic abilities of the workers concerned. Travel conditions, travel time from one place to another that is as minimal and safe as possible, affect occupational health and work fatigue.

There was a significant association between work tenure and MSDs complaints (p = 0.014; PR = 8.3; 95% CI 1,534-44,618). Water depot workers with work tenure ≥ 1 year tend to experience 8.3 complaints of MSDs compared to work tenure < 1 year. Work tenure is a risk factor that significantly influences a worker to increase the risk of musculoskeletal complaints, especially for types of work with high strength. Workers with long and monotonous tenures in activities tend to be more at risk of fatigue and injury (Younan et al., 2019; Kasaw Kibret et al., 2020).

There was a significant association between the length of work and complaints of MSDs (p = 0.001; PR = 13; 95% CI 2,753-61,786). Water depot workers with a working length of ≥ 8 hours were 13 times more likely to experience MSDs complaints than a working length of < 8 hours. Work length that is not ideal can increase the incidence of MSDs because

Table 4. Results of binary logistic test

Variables	MSDs complaints						P	OR	95% CI	
	Moderate		High		Total					
	f	%	f	%	f	%			Lower	Upper
Work posture										
Not ergonomic	22	88.0	3	12.0	25	100.0	< 0.001	47.6	7,016	323,857
Ergonomic	2	13.3	13	86.7	15	100.0				
Workload										
Heavy	21	84.0	4	16.0	25	100.0	< 0.001	21	4,007	110,057
Mild	3	7.5	12	80.0	15	100.0				
Work tenure										
≥ 1 year	13	86.7	2	13.3	15	100.0	0.014	8.3	1,534	44,618
< 1 year	11	44.0	14	56.0	25	100.0				
Length of work										
≥ 8 hours	18	85.7	3	14.3	21	100.0	0.001	13	2,735	61,786
< 8 hours	6	31.6	13	68.4	19	100.0				

Table 5. Logistic regression model

Variable	Stage 1	Stage 2	p-value GoF
	p-value; OR (95% CI)	p-value; OR (95% CI)	
Work posture	0.012; 15 (2,236-19,392)	0.008; 11 (2,464-24,850)	0.076
Workload	0.103; 6.1 (0,621-18,195)	0.032; 7 (1,718-17,252)	
Work tenure	0.619; 0.464 (0,022-9,618)	-	
Length of work	0.043; 12 (1,968-23,882)	0.040; 9 (1,972-21,142)	

the longer the worker is exposed to the risk, the greater the appearance of musculoskeletal complaints. These findings were also consistent with previous studies showing a link between long working hours and the incidence of MSDs (Lee et al., 2018; Sung et al., 2020; Amiri, 2022).

Table 5 shows that the dominant variable affecting MSDs complaints is working posture (p = 0.008; PR = 11; 95% CI 2,464-24,850). Refillable drinking water depot workers with non-ergonomic working postures are likely to experience MSDs complaints 11 times compared to ergonomic work postures. Furthermore, the p-value on the GoF is 0.076 > 0.05, meaning there is no difference between the predicted and observed classifications. Thus, the obtained logistic regression model equation is well calibrated so that the model has met the adequacy of the data (fit) and is feasible to use in subsequent analysis. Previous studies reported that work posture had a significant relationship with MSDs complaints (p = 0.005) (Mallapiang et al., 2021).

Recognizing the risk of musculoskeletal diseases among workers at water refilling stations, affiliated organizations must take preventive steps by engaging with the entrepreneurs in the informal sector (Mekonnen et al., 2020). Officials must continue to oversee the implementation of occupational health and safety management. In addition, health professionals must provide employees with information and preventative steps to avoid musculoskeletal disorders. According to studies, providing more rest to active employees with heavy loads reduces the severity of musculoskeletal symptoms in workers' bodies (Stock et al., 2018).

CONCLUSIONS

The majority of respondents in this study are under 30 and hold a junior high school. MSDs in water refilling depot workers relate to work posture, workload, tenure and length of work. Non-ergonomic work posture was found to be

the most common risk factor for MSD complaints. The findings highlight the need for local health agencies to educate or empower workers at water refilling stations regarding MSD complaints.

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