

ORIGINAL ARTICLE

Work-related Musculoskeletal Disorders in the Laundry Workers: Gender, Age, Work Experiences, Work Duration, and Marital Status Differences Perspective, North Sulawesi Indonesia

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ABSTRACT

Introduction: A nonconductive and at-risk work environment provides an opportunity for the occurrence of significant Work-related Musculoskeletal Disorders (WMSDs), affecting the physical, psychological, and social aspects of workers' health. This study aims to analyze differences in individual characteristics, such as gender, age, work experience, work duration, and marital status. **Materials and methods:** This study was a quantitative observational study with a population of laundry workers in Tomohon and Tondano, Minahasa, North Sulawesi, Indonesia. A sample of 225 people was selected using an incidental sampling technique with inclusion criteria aged 19-60 years. The instrument used the Nordic Musculoskeletal Questionnaire (NMQ) to measure musculoskeletal disorders, with statistical analysis involving Spearman rank and Mann-Whitney tests. **Results:** There is a significant positive relationship between age and the risk of WMSDs with a correlation coefficient ($R = 0.226$, $p = 0.001$) for age, with male and married workers exhibiting higher susceptibility ($R = 0.242$, $p = 0.000$; $R = 0.257$, $p = 0.000$, respectively). Surprisingly, work experience demonstrated a negative association, indicating increased vulnerability in new workers (<2 years) compared to seasoned counterparts ($R = -0.317$, $p = 0.000$). Mann-Whitney analysis confirmed significant disparities between genders, work experience durations, and marital statuses. However, age and work duration showed no significant differences between those experiencing WMSDs and those who did not ($p > 0.05$). **Conclusion:** Our findings found that age, gender, and marital status were significantly associated with the risk of WMSDs, with findings that older, male, and married workers were at higher risk. In contrast, work experience showed a negative association with WMSDs, suggesting that new workers are more vulnerable. Although BMI, education level, and work duration were not significant. Limitations: Some variables that may affect musculoskeletal complaints, such as personal medical history, physical activity outside work, and psychosocial factors, were not controlled or measured in this study. This may affect the interpretation of the study results.

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INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are conditions that affect the human musculoskeletal system due to work, including muscles, bones, joints, tendons,

ligaments, and nerves.(1–3) WMSDs cause serious health and social problems with significant impacts on individuals, the work environment, and society.(4,5) WMSDs cause pain, discomfort, physical disability, and decreased quality of life for sufferers.(6) In addition, WMSDs reduce worker efficiency, productivity, and performance.

According to the European Agency for Safety and Health at Work, WMSDs are the most common work-

related health problem in Europe, affecting around 60% of workers and costing up to 2% of GDP.(7) In China, 65.58% of a total of 1325 coal mine workers experienced musculoskeletal disorders. Research in 8 different sectors in Indonesia stated that WMSDs were experienced by 31.6% of oil palm farmers in Riau, 18% of onyx crafters in West Java, 16.4% of gold miners, and 16.4% of coal miners in Indonesia. (8) In Indonesia, the prevalence of WMSDs was 69% over the past 12 months.(9)

A study conducted on 66 laundry workers in Percut Sei Tuan found that 75.7% of respondents experienced WMSDs complaints.(10) In addition, a case study on 12 informal sector laundry businesses in Beji Sub-district, Depok City, showed that activities such as lifting laundry to the dryer, ironing, and folding laundry can increase the risk of WMSDs.(11) This shows that laundry workers are prone to WMSDs complaints due to repetitive work activities and non-ergonomic work postures.

Ideally, laundry workers should work in a safe and ergonomic environment, where equipment, furnishings, and layouts are designed to minimize physical load and optimize worker posture and movement.(12,13) In addition, laundry workers should receive adequate training, supervision, and feedback on how to perform their tasks correctly and safely, as well as regular breaks, rest, and recovery time. In addition, laundry workers should also have access to health and social support services, such as medical check-ups, physiotherapy, counseling, and compensation, should they develop WMSDs or experience work-related problems.

However, in reality laundry workers in Indonesia often face poor and dangerous working conditions, such as outdated and malfunctioning machinery, inadequate and unsuitable tools and materials, overcrowded and poorly ventilated rooms, long and irregular working hours, low wages and benefits, and lack of regulations and law enforcement on occupational safety and health. (14) These conditions not only increase the risk and severity of WMSDs among laundry workers but also limit their ability and opportunity to prevent, manage, and recover from WMSDs.

As a consequence, laundry workers suffer from a range of physical, psychological, and social consequences, such as pain, impairment, disability, reduced productivity and performance, absenteeism, turnover, depression, anxiety, and low self-esteem.(15,16) These consequences not only affect the individual worker, but also the family, community, and company.

Previous similar studies have only focused on the prevalence and risk factors of WMSDs in general, without considering differences related to gender, age, work experience, work duration, and marital status.

These studies were also conducted in different places with working conditions that tend not to be the same as laundry workers in North Sulawesi, Indonesia. Accordingly, this study aims to fill the gap in knowledge and understanding of WMSDs among laundry workers by considering differences based on gender, age, work experience, work duration, and marital status.

MATERIALS AND METHODS

Design and Participants

This study used a quantitative method with an observational study. The study population was all laundry workers in Tomohon and Tondano, Minahasa, North Sulawesi, Indonesia. The research sample was determined using the accidental sampling technique, which is a sampling technique carried out by chance, without prior planning, and without providing equal opportunities to each member of the population.(17,18) The inclusion criteria were laundry workers aged 19-60 years. Subjects who did not meet the inclusion criteria were excluded from the study. Based on the results of data collection, the sample size was 225 people who met the inclusion criteria.

Instrument and data collection

Data collection was conducted using the Nordic Musculoskeletal Questionnaire (NMQ),(19) which is a questionnaire used to measure musculoskeletal disorders in workers. The NMQ uses a 4-point Likert scale to measure the severity of the complaint from "no pain" to "extreme pain". Potential limitations of using the NMQ such as self-reporting bias, pain quality assessment, as well as pain perception. The NMQ relies on self-reporting by respondents regarding their level of musculoskeletal complaints. This may lead to reporting bias, where respondents may not be completely accurate in reporting their level of pain or discomfort. Factors such as reluctance to report complaints or a tendency to exaggerate or underestimate symptoms may influence the results. The NMQ measures pain levels using a Likert scale, which may not fully reflect the perceived quality or intensity of musculoskeletal pain. For example, the NMQ does not distinguish between acute and chronic types of pain or its effect on daily function. As well as pain perception can vary greatly between individuals, and the NMQ cannot fully capture these differences. Differences in individual pain tolerance and sensitivity may affect reported results.

Each respondent was given an explanation of the purpose of the study and how to complete the questionnaire. After that, respondents filled out the questionnaire which included questions about musculoskeletal complaints in various parts of the body such as the neck, shoulders, back, and upper and lower extremities. The data collected was then validated to ensure completeness and consistency.

In this study, the risk of work-related musculoskeletal disorders (WMSDs) was categorised based on the total score obtained from the Nordic Musculoskeletal Questionnaire (NMQ). A total score exceeding a threshold value of >50 was considered to indicate a high "WMSD risk".

Data analysis

The descriptive statistical method was used to measure the frequency and percentage of individual characteristics including, gender, age, body mass index, education level, marital status, work experience (years), and work duration in workers.

For data analysis, the Spearman Rank non-parametric test was used to measure whether there is a relationship between variables such as age, work experience, work duration, and level of musculoskeletal complaints. The Spearman Rank test was chosen because the data used is ordinal in scale, does not fulfil the assumption of normality, and is effective for determining the correlation between two variables that do not necessarily have a linear relationship. In addition, the Mann-Whitney test was used to determine whether there was a significant difference in the level of musculoskeletal complaints based on gender, age, work experience, education level, work duration, and marital status. The Mann-Whitney test was chosen because it is suitable for comparing two independent groups with ordinal data, does not require the assumption of normality, and can identify median differences between two groups. For all variables, an alpha value of 0.05 was considered significant.

The analysis procedure began with data description using descriptive statistics such as mean, median, and frequency distribution. Next, Spearman Rank correlation analysis was performed to evaluate the relationship between ordinal variables, and the correlation results were reported with the correlation coefficient value and significance. The Mann-Whitney test was then conducted to compare the level of musculoskeletal complaints between groups based on gender, age, work experience, work duration, and marital status, with the test results reported with p-values and significance. With this approach, the authors were able to evaluate the relationship between the variables studied and understand the factors contributing to musculoskeletal complaints among laundry workers.

Ethical Clearance

This research has been approved by the Research Ethics Commission of Bali International University, Indonesia Number: 01.036/UNBI/EC/IV/2023.

RESULTS

Table I shows the results of descriptive analysis of the demographic characteristics of 225 respondents. Respondents consisted of two groups based on gender,

namely female (n=155; 69.9%) and male (n=70; 31.1%). The majority of respondents were between 19-27 years old (n=87; 38.7%), followed by 28-36 years old (n=67; 29.8%), 37-45 years old (n=40; 17.8%), 46-54 years old (n=19; 8.4%), and more than 54 years old (n=12; 5.3%). The mean age of respondents was 30.4 years with a standard deviation of 8.7 years.

Table I: Descriptive analysis of the Demographic characteristics

Variable	Category	Number (n)	Percent-
		N=Total 225	age (%)
Age (year)	19-27	87	38.7
	28-36	67	29.8
	37-45	40	17.8
	46-54	19	8.4
	> 54	12	5.3
Gender	Female	155	69.9
	Male	70	31.1
BMI (Kg/m2)	Very Underweight: < 17	7	3.1
	Underweight: 17 - < 18,5	13	5.8
	Normal 18,5 - 25,0	170	75.6
	Overweight > 25 - 27	35	15.6
	Obese > 27	0	0
Education Level	Elementary School	7	3.1
	Junior High School	11	4.9
	High School / Vocational School	182	80.9
	Bachelor	25	11.1
Marital Status	Single	104	46.2
	Married	121	53.8
Work Experience	New (< 2 Years)	178	79.1
	Old (≥ 2 Years)	47	20.9
Work Duration	< 8hr	200	88.9
	≥ 8hr	25	11.1

In terms of body mass index (BMI), most respondents had a normal BMI (18.5-25.0 kg/m²) (n=170; 75.6%), while the rest fell into the categories of very thin (n=7; 3.1%), thin (n=13; 5.8%), or fat (n=35; 15.6%). No respondents fell into the obese category (>27 kg/m²). The mean BMI of the respondents was 21.6 kg/m² with a standard deviation of 2.3 kg/m².

Respondents' education level varied from primary school (n=7; 3.1%), junior high school (n=11; 4.9%), senior high school/vocational school (n=182; 80.9%), to university degree (n=25; 11.1%). Most respondents were single (n=104; 46.2%), while those who were married totaled 121 people (53.8%). In terms of work experience, the majority of respondents were new workers (<2 years) (n=178; 79.1%), and the rest were old workers (≥2 years) (n=47; 20.9%).

The average work duration of respondents was 7.2 hours per day with a standard deviation of 1.4 hours. A total of 200 respondents (88.9%) worked less than 8 hours per day, and 25 respondents (11.1%) worked more than or

equal to 8 hours per day.

Based on Table II, it can be seen that age has a positive relationship with WMSDs, meaning that the older the worker, the greater the likelihood of experiencing WMSDs. The R-value for age is 0.226 and the p-value is 0.001, meaning the relationship is significant at the 99% confidence level. Gender also has a positive relationship with WMSDs, meaning that male workers are more at risk of WMSDs than female workers. The R-value for gender is 0.242 and the p-value is 0.000, which means the relationship is significant. Marital status has a positive relationship with WMSDs, meaning that married workers are more at risk of WMSDs than unmarried workers. The R-value for marital status is 0.257 and the p-value is 0.000, meaning the relationship is significant at the 99% confidence level. The work experience has a negative relationship with WMSDs, meaning that newly employed workers (<2 years) are more at risk of experiencing WMSDs than long-time workers (≥2 years). The R-value for work experience was -0.317 and the p-value was 0.000, meaning the relationship was significant at the 99% confidence level.

Table II: The Correlation Between Workers Characteristics and Work-Related Musculoskeletal Disorders (n=225)

Characteristics	No WMSDs		WMSDs		R	p-value
	n	(%)	n	(%)		
Age						
19-27	58	66.7	29	33.3	0.226	0.001
28-36	40	59.7	27	40.3		
37-45	18	45	22	55		
46-54	6	31.6	13	68.4		
>54	5	41.7	7	58.3		
Gender						
Female	52	74.3	18	25.7	0.242	0.000
Male	75	48.4	80	51.6		
BMI (Kg/m2)						
Very Underweight <17	7	100	0	0	0.097	0.147
Underweight: 17 -<18,5	10	76,9	3	23.1		
Normal 18,5 - 25,0	90	52.9	80	47.1		
Overweight >25 - 27	20	57.1	15	42.9		
Obese >27	0	0	0	0		
Education Level						
Elementary School	5	71.4	2	28.6	-0.078	0.244
Junior High School	2	18.2	9	81.8		
Senior High School	105	57.7	77	42.3		
Bachelor's	15	60	10	40		
Marital Status						
Single	73	70.2	31	29.8	0.257	0.000
Married	54	44.6	67	55.4		
Work Experience						
New (<2 Years)	111	62.3	67	37.7	0.317	0.000
Old (≥2 Years)	16	34.1	31	65.9		
Work Duration						
< 8 Hours	117	58.5	83	41.5	0.117	0.079
≥ 8 Hours	10	40	15	60		

Whereas BMI, education level, and work duration did not have a significant relationship with WMSDs. The p-value for the three variables was greater than 0.05, which means the relationship was not significant. The R-values for the three variables were also very small, indicating a very weak relationship between the variables.

Based on Table III, it can be seen that male workers have a lower mean rank than female workers on the gender variable, namely 19.16 and 121.96. This indicates that male workers experience more WMSDs than female workers. The p-value for the gender variable is 0.002, which means the difference is significant. Workers who have less than 2 years of work experience have a lower mean rank than workers who have more than or equal to 2 years of work experience on the work experience variable, which is 97.54 and 135.76, respectively. This shows that new workers experience more WMSDs than workers who have been working for a long time. The p-value for the work experience variable is 0.001, which means the difference is significant. The single workers had a lower mean rank than the married workers on the marital status variable, which was 102.30 and 122.20, respectively. This shows that single workers experience more WMSDs than married workers. The p-value for the marital status variable is 0.022, which means the difference is significant.

Table III: Gender, Age, Work Experiences, and Work Duration Differences Among Workers Regarding Work-Related Musculoskeletal Disorders (n=225)

Variable	Work-Related Musculoskeletal Disorders (WMSDs)			
	n	Mean Rank	Mann-Whitney	p-value
Gender				
Male	70	19.16	3923	0.002**
Female	155	121.96		
Age				
< 30 Years Old	123	107.38	5582	0.155
≥ 30 Years Old	102	119.77		
Work Experience				
< 2 Years	134	97.54	4026	0.001****
≥ 2Years	91	135.76		
Work Duration				
< 8 Hours	200	110.86	2072	0.162
≥ 8 Hours	25	130.14		
Marital Status				
Single	104	102.30	5179	0.022*
Married	121	122.20		

Significantly)*p=0.01;)**p=0.001;)***p=0.0001

However, age and duration of work did not have a significant difference between workers who experienced WMSDs and those who did not. The p-value for both variables was greater than 0.05, which means the difference was not significant. The mean rank values for both variables are also not significantly different

between the groups of workers. More details can be seen in Figure 1.

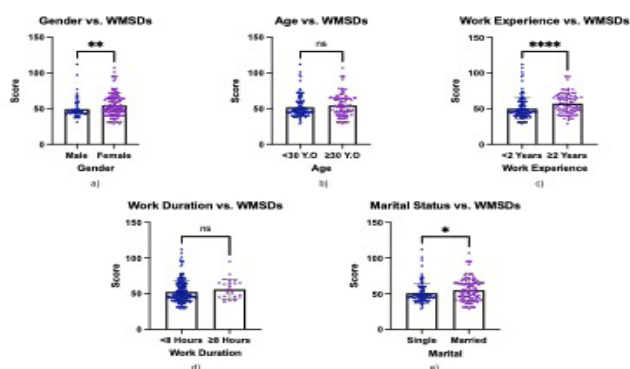


Figure 1: The Comparison of Mean Work-related Musculoskeletal Disorders vs. Gender, Age, Work Experiences, Work Duration and Marital Status. (Significantly)*p=0.01;)p=0,001;)****p=0001; ns=not significantly**

DISCUSSION

This study evaluated work-related musculoskeletal disorders among laundry workers, comparing the perspectives of gender, age, work experience, work duration, and marital status with work-related musculoskeletal disorders in the laundry sector in Minahasa, Indonesia.

The relationship between demographic characteristics of workers and the incidence of WMSDs. Age, gender, marital status, and work experience are factors that influence the risk of WMSDs.

Workers' age has a positive relationship with WMSDs, which means that the older the worker, the greater the likelihood of experiencing WMSDs. This can be explained by the fact that age is one of the factors that affect the physical condition of workers, such as muscle strength, joint flexibility, and endurance.(20) Older workers tend to have decreased physical function which can increase the risk of injury or musculoskeletal disorders.(21–23) In addition, older workers may also have a history of chronic diseases, such as diabetes, hypertension, or arthritis, which can exacerbate WMSDs. (24,25)

Older age is often associated with an increased risk of WMSDs. This is due to the decline in tissue elasticity and muscle strength that generally occurs with age. In addition, the accumulation of micro-injuries and the body's decreased ability to recover quickly may contribute to the increase in musculoskeletal complaints among older workers.

The gender of workers also has a positive relationship with WMSDs, which means that male workers are more at risk of WMSDs than female workers. This can be explained by the different types of work performed by male and female workers. Male workers tend to

do heavier work, such as lifting, pulling, or pushing loads, which can cause mechanical stress on the musculoskeletal system.(26–28) Male workers may also pay less attention to aspects of ergonomics, such as posture, rest, or warm-up, that could prevent or reduce the risk of WMSDs.(29–31)

Gender has been shown to influence the risk of WMSDs. However, women are more susceptible to certain types of musculoskeletal complaints than men, possibly due to differences in muscle strength and working postures.

The marital status of workers also has a positive relationship with WMSDs, which means that married workers are more at risk of WMSDs than single workers. This can be explained by the different levels of stress experienced by married and single workers. Married workers may have more responsibilities, both at work and at home, which can lead to psychological stress. (32,33) Psychological stress can affect workers' physical and mental health, such as increasing blood pressure, heart rate, or muscle tension, which can trigger or further compound WMSDs.(34,35)

Workers' work experience has a negative relationship with WMSDs, which means that new workers (<2 years) are more at risk of WMSDs than old workers (≥2 years), this means that as work experience increases, the risk of WMSDs tends to decrease. This can be caused by differences in the knowledge, skills, and adaptations of new and older workers. A new worker may lack the knowledge and skills necessary to do a good job, such as recognizing and avoiding risk factors for WMSDs, using assistive devices or personal protection, or performing correct work practices.(36,37) New workers may also lack adaptations to the work environment, such as temperature, noise, or lighting, which can affect worker wellness and well-being.(38,39) Furthermore, convenience sampling methods may affect the results. For example, if more experienced workers tend to work in more accessible locations or are selected in the sample, this may affect the distribution of work experience in the data. This may lead to unrepresentative results regarding the relationship between work experience and WMSDs.

The BMI of workers did not have a significant association with WMSDs, meaning there was no difference in the risk of WMSDs. This means that workers' weight did not affect their likelihood of experiencing WMSDs. Workers had a normal BMI, which was between 18.5-25 kg/m², so there was not enough variation in BMI to show an association with WMSDs. In a study conducted by Yang et al. (2023), they found that BMI does not accurately reflect a worker's nutritional status, as it does not take into account the proportion of muscle, fat, or bone in the worker's body. (2023),(40) which found that BMI had no significant relationship with WMSDs in electronic industry workers in China. The study also mentioned that most of the respondents had normal BMI

(75.6%), so there was not enough variation in BMI to test the relationship with WMSDs. This research contradicts that conducted by Tembo et al. (2023),(41) who found that high BMI (>25 kg/m²) is a risk factor for WMSDs in healthcare workers. The study found that a high BMI can cause an increased load on the musculoskeletal system, especially on the lower back, neck, and shoulders.

In this study, no significant relationship was found between workers' Body Mass Index (BMI) and work-related musculoskeletal disorders (WMSDs) because the range of BMI in the laundry worker population was quite narrow, so the difference in BMI between workers was not large enough to produce a visible effect on the level of musculoskeletal complaints. If most workers are within a similar BMI range, the difference in body burden may not be significant enough to affect the risk of WMSDs.

The education level of workers also did not have a significant relationship with WMSDs, which means that there is no difference in the risk of WMSDs between workers with low, medium, or high education. This can be because most of the respondents had the same level of education, i.e. high school/vocational school (80.9%), so there was not enough variation to test the association between education level and WMSDs. The present study is by the research conducted by Yang et al. (2023),(40) which found that education level did not affect WMSDs, because the work performed by participants did not require special skills or knowledge related to education.

Work duration also did not have a significant association with WMSDs, indicating that there was no difference in the risk of WMSDs between workers working less than 8 hours per day or more than or equal to 8 hours per day. This can be explained by the fact that most respondents worked less than 8 hours per day (88.9%), so there was not sufficient variance to test the relationship between work duration and WMSDs. In another study, duration of work may not be an influential factor on WMSDs, as the work performed by respondents did not involve strenuous or repetitive physical activity that could cause fatigue or injury. In contradiction with research carried out by Niu in Trembearth and Crawford (2021),(42) found that workers who worked more than 8 hours per day had a higher risk of occurrence of WMSDs than workers who worked less than 8 hours per day in construction workers in Taiwan. The study suggests that workers who work for longer hours may have higher workloads, higher stress, or less rest, which can contribute to physical and mental fatigue that can trigger or make WMSDs more severe.

Long-duration of work every day can increase the risk of WMSDs. Workers who work for long periods of time without adequate rest are at risk of muscle fatigue and strain, which can trigger or exacerbate musculoskeletal

complaints. High workloads and the frequency of strenuous physical tasks can also exacerbate these conditions.

More male workers experience WMSDs than female workers, which can be explained by the different types of work performed by male and female workers. Male workers tend to perform heavier work, such as lifting, pulling, or pushing loads, which can place mechanical stress on the musculoskeletal system.(43,44) There is also less attention paid by male workers to ergonomic factors, such as posture, rest, or exercise, that can reduce or prevent the risk of WMSDs.(45)

The work experience of workers influences the incidence of occupational musculoskeletal disorders (WMSDs). New workers have a high risk of developing WMSDs than workers who have been working for a long time. This is because new workers have lower knowledge, skills, and adaptations than workers who have been working for a long time.(46) The knowledge and skills in this regard are about the risk factors of WMSDs and ways to reduce or overcome it.(47) The adaptation in question is about the safety and health of workers in the work environment.(46,48) By the results of research conducted by Le et al. (2024) who found that work experience of less than 2 years is a risk factor for WMSDs.(49)

Single workers experience more WMSDs than married workers, which may be explained by the different levels of stress experienced by single and married workers. Single workers may have higher workloads, higher expectations, or higher pressure, which can bring about psychological stress.(50)

Marital status may influence the risk of WMSDs through psychosocial factors. Workers who are married or have family responsibilities may experience different levels of stress compared to those who are not married, and this stress may affect their physical well-being and musculoskeletal health.

Whereas age and duration of work did not have significant differences between workers who experienced WMSDs and those who did not, which could be explained by the fact that most of the participants had similar ages and duration of work, so there was not enough variation to test for differences between these variables. In addition, age and duration of work may not be dominant factors in determining WMSDs, as the work performed by the participants did not include any repetitive or physically demanding activities that could cause fatigue or injury. (40)

In conclusion, age can affect the risk of WMSDs. Older age is often associated with an increased risk of WMSDs due to decreased tissue elasticity, muscle strength and the body's ability to recover from injury. This research

also suggests that older workers may have accumulated micro-injuries and musculoskeletal conditions that worsen over time.

Gender and risk of WMSDs show significant differences. Women may be more susceptible to some types of WMSDs than men, possibly due to differences in muscle strength, work posture and other physiological factors. However, these results vary depending on the specific type of work and work environment.

However, in this study, researchers did not find a significant relationship between the education level variable and the BMI variable with the risk of WMSD, perhaps because other factors were more dominant in influencing the results.

Work experience and WMSDs suggest that longer work experience may be associated with lower risk. Workers with more experience may have developed better ergonomic skills and work techniques to reduce the risk of injury.

Long work duration is often associated with an increased risk of WMSDs. Research shows that workers who work for long periods of time without adequate rest are more susceptible to muscle fatigue and musculoskeletal injuries. High workloads and the frequency of strenuous physical tasks can exacerbate these conditions.

Marital status may influence the risk of WMSDs through psychosocial factors. Research suggests that workers who are married or have family responsibilities may experience different levels of stress, which may affect their physical health. However, these results are often variable and influenced by other contextual factors.

This means that workers need to pay attention to factors that can increase the risk of WMSDs and make appropriate prevention and treatment efforts. Employers and the government also need to provide adequate support and facilities for workers to maintain the health and comfort of the workers' musculoskeletal system.

Therefore, urgent policy action is needed at both organisational and national levels to protect the health and well-being of laundry workers i.e. existing regulations related to occupational health and safety need to be updated and strengthened to cover the specific risks faced by laundry workers. Ergonomics standards should be more strictly applied, including adjustments to worktable height, use of assistive devices, and provision of adequate personal protective equipment. Stricter enforcement is needed to ensure compliance with occupational health and safety regulations. Regular inspections and audits of laundry workplaces should be conducted to ensure that the work environment meets the set health and safety standards.

A comprehensive support system should be developed to assist laundry workers. This could include ergonomics training programmes, access to healthcare and counselling, and fitness programmes to strengthen muscles and improve workers' flexibility. Awareness campaigns and education on the risks of WMSDs and how to prevent them need to be increased among both workers and laundry employers. Education on proper work techniques, the importance of good posture, and the need for adequate rest should be delivered regularly. Support from the government and related agencies is essential in facilitating the improvement of working conditions in the laundry industry.

By implementing these recommendations, the health and well-being of laundry workers can be significantly improved. Better policies and effective law enforcement will ensure that workers are protected from health risks that can affect their quality of life and productivity.

A limitation of using the NMQ could be the potential for self-reporting bias as the NMQ relies on self-reporting by respondents regarding the level of musculoskeletal complaints they experience. Self-reporting bias can occur when respondents do not accurately report their symptoms, either due to reluctance to admit pain or discomfort, or due to subjective perceptions of pain severity. This can affect the accuracy of the data and lead to results that do not fully reflect the true condition.

CONCLUSION

In conclusion, this study presents the demographic profile of participants and identifies factors associated with Work-related Musculoskeletal Disorders (WMSDs). The results of the analysis suggest that age, gender, and marital status are significantly associated with the incidence of WMSDs, with the findings that older age, male workers, and those who are married are at increased risk. In contrast, work experience showed a negative association with WMSDs, suggesting that new workers are more susceptible to the occurrence of WMSDs. Although the variables BMI, education level, and work duration did not show significant correlations, an understanding of the demographic factors may provide insight into the design of worker well-being intervention strategies, such as optimising workplace ergonomics, ergonomic training and education, setting healthy work schedules, improving work environment conditions, and health monitoring and wellness programmes.

Recommended interventions for older workers by providing specialised training on ergonomic work techniques and ways to reduce physical strain can help older workers manage their risk of WMSDs. Specialised training programmes on ergonomic techniques appropriate for women and health support specific to musculoskeletal problems. Implement health and wellness programmes that support weight management

and improve workers' physical fitness. As well as strengthening regulations related to ergonomics in the workplace and ensuring strict enforcement to comply with ergonomic standards. This may involve regular inspections and audits of workplaces to ensure that regulations are followed.

Limitations in this study, firstly, the use of convenience-based sampling methods may affect the representativeness of the data, as the sample may not reflect the overall laundry worker population. Secondly, reliance on self-reported data through the Nordic Musculoskeletal Questionnaire (NMQ) may introduce bias, as respondents may not always accurately report musculoskeletal complaints. In addition, subjective variations in pain perception and limitations in measuring contextual factors such as work techniques and work environment may also affect the study results. The influence of external factors such as stress and general health conditions not covered in this study may further affect the interpretation of the data.

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