Open Access Health Scientific Journal
https://oahsj.org/index.php/oahsj Vol. 6 No. 2 August 2025, pp. 324-329
Research article

Analysis Of Risk Factors For Musculoskeletal Disorders (MSDS) Among Water Depot Workers

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ARTICLE INFO

Keywords:
Age,
Length of Service,
Musculoskeletal Disorders,
Work Duration.

ABSTRACT

Background: Musculoskeletal Disorders (MSDs) are health problems frequently experienced by workers with repetitive and strenuous physical activities, such as manually transporting water gallons at water depots. This study aims to analyze the relationship between individual factors (age, work duration, and length of service) and ergonomic factors (work posture) with the incidence of MSDs among water depot workers in Indra Kasih Village, Medan City.

Methods: This study used quantitative methods with a total sampling of 40 respondents, using questionnaires and direct observation. Data analysis was performed using univariate, bivariate (Chi-Square test), and multivariate methods.

Results: The results showed that 25 respondents (62.9%) were diagnosed with MSDs, while 15 respondents (37.5%) were undiagnosed. No significant association was found between age (p=0.622), length of service (p=0.722), or length of service (p=1.000) with the incidence of MSDs. However, there was a significant association between work posture and MSDs (p=0.005, OR=7.071).

Conclusion: These findings indicate that unergonomic work postures significantly increase the risk of MSDs. This study recommends ergonomic interventions, the provision of lifting aids, and regular training for workers to minimize the risk of MSDs.

I. Introduction

Musculoskeletal Disorders (MSDs) represent a significant concern within the realm of occupational health, affecting the muscles, bones, joints, ligaments, and nerves, often as a direct consequence of work-related activities. Particularly in environments characterised by repetitive tasks and heavy lifting, such as water depots, the risk of developing these disorders is markedly elevated. The manual handling of heavy items, like 20-kilogram gallons of water, not only poses immediate physical challenges but also has long-term implications for the health and productivity of workers. The nature of this work frequently leads to fatigue, discomfort, and, in severe cases, debilitating injuries that can disrupt both personal and professional lives.

The World Health Organisation (WHO) reported in 2022 that approximately 1.71 billion individuals globally suffer from musculoskeletal conditions, with low back pain emerging as the leading cause of disability across 160 countries. This staggering figure encapsulates a vast array of disorders—over 150 distinct diseases—that can severely impair bodily function and diminish social engagement. In Indonesia specifically, a study conducted by RISKESDAS in 2018 revealed that the prevalence of musculoskeletal disorders among workers stood at 7.30%. This statistic is particularly alarming when considering the physical demands placed on workers in manual labour sectors, where the risk of injury is compounded by inadequate workplace ergonomics and insufficient protective measures.

In a typical water depot, the absence of mechanised systems means that workers are often required to rely solely on their physical strength to transport heavy loads. The manual lifting of water gallons not

Received 18 June 2025; Accepted 30 July 2025; Published 20 August 2025
 DOI: https://doi.org/10.55700/oahsj.v6i2.107

only involves high-risk postures but also subjects workers to repetitive strain, which can lead to chronic pain and injury over time. The lack of lifting aids, such as trolleys or conveyor belts, exacerbates this issue, forcing workers to adopt awkward positions that increase their susceptibility to musculoskeletal injuries. Furthermore, long working hours, often characterised by inefficient task organisation, contribute to the physical toll on workers, leading to cumulative fatigue and a heightened risk of injury.

Research has indicated that certain demographic factors can influence the likelihood of developing MSDs. For instance, workers under the age of 35 or those with over two years of service have been identified as being particularly vulnerable to these disorders. Interestingly, individuals aged 30 years and below are often associated with a heightened risk of experiencing muscle and postural problems. A study conducted by Hulu et al. in 2023 highlighted that the most prevalent complaints among workers occurred in the neck, back, arms, and waist, particularly affecting those over 30 years of age. This suggests that as workers age, or as they accumulate experience in their roles, the physical demands of their work can take a more significant toll on their musculoskeletal health.

Initial observations of the working conditions at water depots reveal a concerning reliance on manual labour for transporting heavy gallons. Workers frequently report experiencing pain in the lower back and right arm, symptoms that are indicative of the physical strain associated with their tasks. The repetitive nature of this work, combined with the absence of mechanical assistance, leads to cumulative fatigue, which in turn increases the likelihood of developing MSDs. The physical demands placed on these workers are not merely a matter of discomfort; they represent a serious occupational health issue that can lead to long-term disability and reduced quality of life.

This study aimed to comprehensively identify the level of MSD risk faced by water depot workers during the transportation of gallons. Through a detailed examination of the working conditions, task demands, and worker experiences, the research seeks to illuminate the specific factors contributing to the prevalence of musculoskeletal disorders in this sector. The findings of this study are anticipated to provide actionable recommendations for improving work methods, thereby minimising the risk of musculoskeletal injuries among workers. By addressing the ergonomic deficiencies present in the current working environment, it is possible to enhance worker safety and well-being.

The significance of addressing MSDs cannot be overstated, as they represent a critical occupational health challenge frequently encountered by workers in manual sectors like water depots. By systematically identifying risk factors and implementing targeted interventions—such as enhancing work methods and integrating assistive devices—organisations can significantly mitigate these risks. The potential for creating a safer and healthier work environment for workers is not only a moral imperative but also a practical necessity for sustaining productivity and ensuring the longevity of the workforce.

Prevalence of musculoskeletal disorders among workers in manual labour sectors, particularly in water depots, highlights a pressing need for intervention and reform. The physical demands of transporting heavy loads without adequate support systems pose significant risks to worker health, leading to a cycle of injury and decreased productivity. By recognising the multifaceted nature of these disorders and the various factors that contribute to their occurrence, stakeholders can develop more effective strategies for prevention and intervention. Ultimately, fostering a safer work environment is essential for safeguarding the health and well-being of workers, ensuring that they can perform their roles without the looming threat of debilitating injuries. Through continued research and the implementation of evidence-based practices, it is possible to create a future where workers are not only protected from the risks of MSDs but are also empowered to thrive in their roles.

II. METHODS

This study is a quantitative research with a descriptive-analytic approach, using the Quick Exposure Check (QEC)method to assess the risk of Musculoskeletal Disorders (MSDs) caused by non-ergonomic work postures. QEC is a simple, validated ergonomic risk assessment tool that is frequently used to evaluate work posture in various occupations. The study aims to identify and analyze the relationship between age, years of service, work duration, and work posture with the incidence of MSDs. The research design was carried out systematically, starting from data collection, univariate analysis, bivariate analysis, and multivariate analysis.

Data Collection Methods: primary data, secondary data

Operational Definitions: age, work duration, years of service, work posture, MSDs
Data Processing Steps: Editing, coding, entry, cleaning, tabulating
Data Analysis: Data analysis was performed using univariate, bivariate (Chi-Square test), and multivariate methods. This study has received approval from the Prima Indonesia University Health Research Ethics Committee with number 005/KEPK/UNPRI/IV/2025.

III. RESULTS

Univariate Analysis

- Age: Majority (90%) were <35 years old.
- Work Duration: 60% worked >8 hours/day.
- Years of Service: 70% had <3 years of service.
- Work Posture: 55% had non-ergonomic work postures.
- MSDs: 62.9% diagnosed with MSDs (QEC method).

Bivariate Analysis

a. Age vs MSDs Risk: No significant relationship (p=0.622). Older workers (>35) were 0.5 times less likely to develop MSDs.
b. Years of Service vs MSDs Risk: No significant relationship (p=0.722).
c. Work Duration vs MSDs Risk: No significant relationship (p=1.000).
d. Work Posture vs MSDs Risk: Significant relationship (p=0.005). Non-ergonomic postures increased the risk 7-fold (OR=7.071).

Spearman Correlation – Work Posture Components (QEC)

- Back (r=0.936)
- Neck (r=0.921)
- Hands (r=0.920)
- Shoulders (r=0.916)

All p-values <0.01, indicating strong and significant correlations.

IV. DISCUSSION

The findings of the study reveal a nuanced understanding of the relationship between age, years of service, work duration, and the risk of musculoskeletal disorders (MSDs). Contrary to what might be expected, the data indicate no significant association between age and the prevalence of MSDs. This observation supports the research conducted by Tjahayuningtyas (2019), which highlighted that younger workers are also at considerable risk for developing MSDs. The underlying reasons for this vulnerability can be attributed to a combination of factors, including a lack of experience and the tendency to employ improper techniques when performing tasks.

For instance, younger workers, who may be enthusiastic yet inexperienced, might not fully grasp the importance of ergonomic practices. They may engage in activities without adequate training, leading to poor posture and unsafe lifting techniques. An illustrative example could be a young warehouse employee who, eager to impress, lifts heavy boxes without using their legs, thereby increasing the strain on their back and shoulders. This scenario underscores the critical need for comprehensive training programmes that address ergonomic principles and safe lifting techniques, particularly for younger employees who may lack the wisdom that comes with experience.

Similarly, the study found that years of service did not have a significant correlation with the risk of MSDs, which aligns with the findings of Wahyuni (2021). This is particularly intriguing, as one might assume that longer tenure would equate to a higher level of skill and familiarity with safe working practices. However, new workers, who may not have had the time to adapt to the physical demands of their roles, can often adopt poor postures that negate any potential advantages gained from longer work experience. For example, a seasoned worker might have developed effective strategies for managing their workload, yet a new employee may still be struggling with the physical demands, leading to increased risk of injury.

The study's results indicate that work duration does not significantly affect the risk of MSDs. This finding suggests that factors such as task intensity, the techniques employed during work, and the availability of ergonomic aids play a more critical role in determining the risk of developing musculoskeletal disorders than the sheer number of hours worked. For instance, two workers might both

clock in for an eight-hour shift, yet one may engage in repetitive, high-intensity tasks without adequate breaks, while the other may have a more varied workload with ergonomic support. This highlights the importance of not merely focusing on the quantity of hours worked but rather on the quality and nature of the work performed.

The most striking finding of the study is the significant impact of work posture on the risk of MSDs. The data revealed that non-ergonomic positions increase the risk of developing musculoskeletal disorders by a staggering seven times. This statistic is particularly alarming, as it underscores the critical need for organisations to prioritise ergonomic assessments and interventions. For instance, the repetitive manual lifting of 20 kg gallons can lead to a range of biomechanical stresses, particularly when workers are forced to bend, twist, or lift asymmetrically. These actions are key contributors to musculoskeletal strain, and without proper training and ergonomic support, the likelihood of injury dramatically increases.

Spearman's correlation analysis reinforced the notion that the back is the most affected body part among workers, followed closely by the neck, shoulders, and hands. This pattern reflects the biomechanical stress associated with repetitive heavy lifting and highlights the need for targeted interventions. For example, implementing adjustable lifting aids or redesigning workspaces to facilitate better posture can significantly reduce the risk of injury. Additionally, regular training sessions focused on proper lifting techniques and body mechanics can empower workers to take control of their physical well-being.

Findings of this study illuminate critical insights into the risk factors associated with musculoskeletal disorders in the workplace. While age and years of service may not directly correlate with MSD risk, the influence of work posture and the nature of tasks performed cannot be overstated. It is imperative for organisations to implement comprehensive training programmes, ergonomic assessments, and supportive measures to mitigate the risk of injuries. By prioritising the health and safety of their workforce, companies can not only enhance productivity but also foster a culture of well-being that benefits both employees and the organisation as a whole. Thus, addressing these issues is not merely a matter of compliance but a strategic imperative for sustainable success in today's competitive landscape.

V. CONCLUSION

Of the four variables (age, years of service, work duration, and work posture), only work posture significantly affected MSDs risk.

There no significant relationship was found between age, years of service, or work duration and MSDs.

QEC analysis showed the back had the strongest correlation with MSDs, indicating it is the most vulnerable area in manual gallon lifting

VI. ACKNOWLEDGMENTS

We thank all the respondent who participated in this study.

VII. CONFLICTS OF INTEREST

The authors declare that this study is free from any conflicts of interest.

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