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Work-Related Musculoskeletal Disorders in Ground Handling Crews at Mutiara Sis Al-Jufri Airport

Muhammad Aji Satria* [1], Leonard Crystianmars Cornelis [2], Muhammad Sabri Syahrir[3], Muhammad Jusman Rau[4], Rendhar Putri Hilintang[5]

[1235] Department of Occupational Health and Safety, Faculty of Public Health, Tadulako University
[4] Departement of Epidemiology, Faculty of Public Health, Tadulako University

Author's Email Correspondence (*): ajisatri1996@gmail.com (+62 858 2421 1060)

ABSTRACT

Musculoskeletal disorders are conditions characterized by symptoms ranging from mild discomfort to severe pain in the musculoskeletal area caused by improper work practices. Musculoskeletal Disorders affect approximately 1.71 billion people globally and are the leading cause of disability worldwide. Improper manual material handling, such as incorrect lifting and carrying techniques, can exacerbate Musculoskeletal Disorders such as pain, discomfort, and sleep disturbances, ultimately reducing productivity—particularly among airport ground handling personnel. Several factors, including age, working posture, body mass index (BMI), and length of employment, may contribute to these complaints. This study aimed to examine the association between age, working posture, BMI, and years of service with Musculoskeletal Disorders among ground handling workers at the apron area of Mutiara SIS Al-Jufri Airport, Palu, in 2025. A quantitative approach with a cross-sectional study design was employed, involving 41 ground handling personnel selected using a total sampling technique. Data analysis using chi-square and Fisher's exact tests revealed significant relationships between working posture (p = 0.015) and years of service (p = 0.021) with Musculoskeletal Disorders, while age (p = 0.492) and BMI (p = 1.000) showed no significant association. It is recommended that workers communicate effectively with their team to distribute workloads, maintain an ideal body weight, implement job rotation, and maintain proper posture when handling materials.

Keywords *: Musculoskeletal Disorders; Ground Handling; Airport Workers*

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INTRODUCTION

One of the main approaches to understanding occupational safety and health (OSH) is to ensure the safety of workers during work processes and to maintain their health during and after work, so that work activities can proceed optimally and without obstacles (1). This principle is supported by Law No. 13 of 2003 on Manpower, which emphasizes that employers are obliged to protect workers' occupational safety and health from potential hazards, as well as Law No. 1 of 1970 concerning Work Safety (2)(3).

The level of occupational risk varies depending on the type of work performed, such as lifting heavy objects. Errors in manual handling can harm muscles and bones, potentially leading to workplace accidents, injuries, and occupational diseases that may decrease performance, increase medical costs, and cause loss of workdays (4). Although the human body can adapt to certain conditions, prolonged exposure may result in musculoskeletal disorders (MSDs) (5).

According to the Global Burden of Disease (GBD) 2023 report, there were approximately 494 million people affected by MSDs in 2020—an increase of 123.4% since 1990—and the number is projected to rise to 1.06 billion by 2050 (6). Based on the 2018 National Basic Health Research (Riskesdas) data, the prevalence of musculoskeletal disorders in Indonesia was 7.9%, with occupational diseases affecting 123,041 workers. Of these, 32% of all occupational disease cases were related to musculoskeletal disorders caused by work activities such as lifting objects. Regionally, data from the Central Sulawesi Provincial Health Office (2018) reported approximately 41,211 cases of MSDs, with 11,303 cases in Palu, 14,815 in Sigi, and 15,093 in Parigi (7).

Mutiara SIS Al-Jufri Airport in Palu City is the only airport in the area, serving numerous flight schedules and logistics operations. In 2020, aircraft movements reached 12,456, equivalent to an average of 34 flights per day, and approximately 23,100 tons of

goods were transported by air, representing a 15% increase from the previous year. The ground handling units of airline operators are responsible for managing passenger services, transportation, cargo, mail, and operational equipment to support aircraft movements and parking at the airport (8). These responsibilities increase the workload of ground handling staff, who must perform various physically demanding tasks such as operational maintenance, baggage and cargo handling, and passenger assistance.

There is a notable lack of research specifically focusing on Musculoskeletal Disorders risk factors among ground handling workers in the aviation sector, despite the unique physical demands of this profession. Ground handling involves repetitive and high-intensity physical activities such as lifting, carrying, pushing, pulling, and handling heavy baggage and cargo. The increasing operational loads at airports—evidenced by the high number of aircraft movements and the growth in cargo volume—potentially elevate the risk of injury among ground handling personnel, who play a critical role in maintaining smooth airport operations. Therefore, this study aims to describe the determinants of MSDs among ground handling workers at Mutiara SIS Al-Jufri Airport in Palu.

METHODS

This study employed a cross-sectional design with an observational approach, followed by analytical processing using a quantitative method. The research was conducted from March 21 to April 1, 2025, at Mutiara SIS Al-Jufri Airport, Palu City. The study focused on ground handling personnel working in the airport's apron area, which employs a total of 41 workers.

A total sampling technique was applied to include all eligible participants within the population, resulting in 41 respondents being involved in this study. The primary data collected included Musculoskeletal Disorders assessed using the Nordic Body Map (GOTRAK) questionnaire, working posture evaluated through the Quick Exposure Check (QEC) method, and body mass index (BMI) measured using a digital scale and microtoise.

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Additional data on respondent characteristics were obtained through a structured questionnaire. All data were compiled and organized using Microsoft Excel, then tabulated and statistically analyzed using SPSS.

RESULTS

Bivariate Analysis

The cross-tabulation results and p-values for the relationship between each independent variable and the dependent variable are presented in the following tables:

Table 1
Association Between Age and Musculoskeletal Disorders

Age	Musculoskeletal Disorders				Total		ρ-*value*
	Symptomatic		Asymptomatic				
	n	%	n	%	n	%	
Young	19	67,8	9	32,2	28	100	
Old	7	46,1	6	53,9	13	100	0,492
Total	**26**	**63,4%**	**15**	**36,6%**	**41**	**100%**	

Source : Primary Data, 2025

In Table 1, there were 28 respondents in the younger age group, of whom 19 respondents (67.8%) reported Musculoskeletal Disorders, while 9 respondents (32.2%) did not experience such complaints. Among the 13 respondents in the older age group, 7 respondents (46.1%) reported Musculoskeletal Disorders, and 6 respondents (53.9%) reported no musculoskeletal disorders.

Table 2
Association Between Working Posture and Musculoskeletal Disorders

Working Posture	Musculoskeletal Disorders				Total		ρ-value
	Symptomatic		Asymptomatic				
	n	%	n	%	n	%	
High Risk	20	80	5	20	25	100	
Non-Risk	6	37,5	10	62,5	16	100	0,015
Total	**26**	**63,4%**	**15**	**36,6%**	**41**	**100%**	

Source : Primary Data, 2025

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In Table 2, a total of 25 respondents were categorized as having high-risk working postures, of whom 20 respondents (80%) experienced Musculoskeletal Disorders, while 5 respondents (20%) reported no complaints. Among the 16 respondents with non-risk working postures, 6 respondents (37.5%) reported Musculoskeletal Disorders, whereas 10 respondents (62.5%) did not experience any musculoskeletal issues.

Table 3
Association Between Body Mass Index and Musculoskeletal Disorders

Body Mass Index	Musculoskeletal Disorders				Total		ρ-*value*
	Symptomatic		Asymptomatic				
	n	%	n	%	n	%	
Abnormal	14	55,5	9	44,5	23	100	
Normal	12	69,6	6	30,4	18	100	1,000
Total	**26**	**63,4%**	**15**	**36,6%**	**41**	**100**	

Source : Primary Data, 2025

In Table 3, a total of 23 respondents had an abnormal body mass index (BMI), of whom 14 respondents (55.5%) reported Musculoskeletal Disorders, while 9 respondents (44.5%) did not experience any complaints. Among the 18 respondents with a normal BMI, 12 respondents (69.6%) reported Musculoskeletal Disorders, whereas 6 respondents (30.4%) reported no musculoskeletal disorders.

Table 4
Association Between Years of Service and Musculoskeletal Disorders

Years of Service	Musculoskeletal Disorders				Total		ρ-*value*
	Symptomatic		Asymptomatic				
	n	%	n	%	n	%	
Longer	8	42,1	11	57,9	19	100	
Shorter	18	81,8	4	18,2	22	100	0,021
Total	**26**	**62,4%**	**15**	**36,7%**	**41**	**100%**	

Source : Primary Data, 2025

In Table 4, a total of 19 respondents were categorized in the longer duration of service group, of whom 8 respondents (42.1%) reported Musculoskeletal Disorders, while 11

respondents (57.9%) did not experience any complaints. Among the 22 respondents with a shorter duration of service, 18 respondents (81.8%) reported Musculoskeletal Disorders, whereas 4 respondents (18.2%) were classified as having no musculoskeletal disorders.

DISCUSSION

Association Between Age and Musculoskeletal Disorders

Age is one of the key indicators of work capacity, and a mismatch between an individual's capacity and job demands can lead to musculoskeletal disorders (MSDs). Workers aged over 30 years are at a higher risk of experiencing musculoskeletal complaints compared to those under 30 years old (9). Increasing age is associated with a reduction in cartilage thickness and alterations in proteoglycan levels substances that contribute to cartilage resilience—resulting in weaker joints that are more susceptible to damage or injury (10). When these age-related physiological changes are combined with constant work demands and non-ergonomic postures, the likelihood of developing MSDs increases (9).

Based on the Fisher's exact test, age was found not to be associated with musculoskeletal disorders ($p = 0.492$; $p > 0.05$). Biologically, older workers remain a vulnerable group; however, they tend to adapt by taking on lighter tasks or adjusting to more comfortable postures. Younger workers, on the other hand, may be more susceptible to Musculoskeletal Disorders due to heavier workloads, higher physical demands, and increased task responsibility. Working posture and workload intensity are also among the major contributors to Musculoskeletal Disorders in younger workers. In this study, older workers were not found to be at a higher risk of developing musculoskeletal disorders compared to younger workers. Therefore, adjustments to working hours and workload distribution should be made according to workers functional capacity. It is recommended that work schedules and task distribution be adjusted according to workers physical

capacities, particularly for older personnel, who should be assigned lighter morning shifts with varied activities.

This finding is consistent with the study by Sani, Asfian, and Dewi (2025), who reported p = 0.196 (> 0.05), indicating no significant relationship between age and Musculoskeletal Disorders among public transport drivers in Kendari–Kolaka. The majority of passenger transport drivers on the Kendari–North Kolaka route are older (≥35 years) and fall within an age group that is vulnerable to musculoskeletal disorders (MSDs). Consequently, the likelihood of developing MSDs may increase if drivers continue working without appropriate preventive measures (11). Similarly, Maudy, Ruliaty, and Doke (2021) examined 36 dock loaders at Tenau Port and found no association between age and Musculoskeletal Disorders (p = 1.000; p > 0.05). Based on interviews with the workers, it was found that those aged >35 years had better work experience and had already adapted to physically demanding work activities, whereas workers aged <35 years required a longer period to adapt to such strenuous tasks (12). Comparable results were also reported in an international study by Thamrin et al. (2021a) among 224 fishermen and 56 port workers, showing p = 0.658 (> 0.05) and concluding that age had no influence on Musculoskeletal Disorders. This condition is related to the training received and the awareness among fishermen and workers in using equipment and paying attention to their work environment, enabling them to adapt and be innovative in efforts to prevent occupational diseases and workplace accidents (13).

However, this finding contrasts with the study by Rahmadani (2024), which identified a significant correlation between age and musculoskeletal disorders (p = 0.000; p < 0.05) among 75 respondents, revealing that older workers were 3.664 times more likely to experience Musculoskeletal Disorders than younger workers (14).

Association Between Working Posture and Musculoskeletal Disorders

Work posture refers to the arrangement and positioning of the body during work activities. Different working postures generate varying levels of physical force. Ideally, work should be performed using natural and neutral postures to minimize the risk of musculoskeletal injuries (15). The more abnormal a posture is—and the longer it is maintained—the greater the likelihood of alterations in the anatomical structure of bones and muscles, thereby increasing vulnerability to musculoskeletal complaints (16).

The chi-square analysis for working posture revealed a p-value = 0.015 ($p < 0.05$), indicating a significant relationship between working posture and Musculoskeletal Disorders among apron ground handling personnel at Mutiara SIS Al-Jufri Airport. It was frequently observed that workers adopted improper postures such as bending, overreaching, looking upward for prolonged periods, and pulling trolleys with one hand. The confined space within aircraft compartments also forced workers to bend repeatedly while handling baggage weighing over 40 kg. Such demanding tasks often lead workers to compromise ergonomic posture in order to meet time performance targets. This finding emphasizes the need for ergonomic supervision and balanced workload distribution to prevent excessive strain and promote healthy working postures.

The result is consistent with Putri and Kurniawan (2021), who found a significant relationship between working posture and musculoskeletal pain among tofu factory workers ($p = 0.040$; $p < 0.05$) (17). Similarly, Prayogi et al. (2024) studied 42 market porters and reported $p = 0.034$ ($p < 0.05$) with a correlation coefficient $r = 0.328$, indicating a weak but positive relationship between posture and Musculoskeletal Disorders (18). The international research by Thamrin (2021b) also supported these findings, showing a highly significant correlation ($p = 0.000$; $p < 0.05$) between working posture and musculoskeletal disorders among 224 fishermen and 56 industrial workers assessed using the Nordic Body Map and Rapid Entire Body Assessment (REBA) tools (19).

Conversely, Botto, Doda, and Ratag (2023) reported no significant correlation between working posture and MSDs among dock employees in Manado Port ($p = 0.367$; $r = -0.117$), suggesting a negative relationship in which better posture corresponded with lower MSD risk (20).

Association Between Body Mass Index and Musculoskeletal Disorders

Body mass index (BMI) is a measurement used to assess physical fitness and is one of the factors associated with the risk of musculoskeletal injuries. Ideally, the BMI of adults should fall within the range of 18.5–24.9. A BMI value below 18.5 is categorized as underweight, values between 25 and 29.9 are categorized as overweight, and values equal to or greater than 30 are classified as obese (21).

The present study found no significant correlation between body mass index (BMI) and musculoskeletal disorders ($p = 1.000$; $p > 0.05$). Workers with a normal BMI were often assigned to tasks involving awkward postures and heavy lifting, while those with non-normal BMI values occasionally had higher endurance or adaptive strength levels. An abnormal body mass index (BMI) is a known risk factor for musculoskeletal disorders. The results of the bivariate analysis indicate that workers with both normal and abnormal BMI experience musculoskeletal complaints, largely due to high work intensity and improper working postures. Workers with abnormal BMI, particularly those categorized as underweight, tend to have lower bone density and inadequate nutritional status, which may result in insufficient energy availability. Conversely, overweight workers carry additional weight loads that increase mechanical stress on the musculoskeletal system. Although workers with normal BMI generally have adequate nutritional status, prolonged exposure to high work intensity may still exceed the body's adaptive capacity, leading to musculoskeletal complaints despite their relatively lower vulnerability.

This finding aligns with Fadila, Sousanto, and Yuniastuti (2024), who studied 60 market laborers in Malang and concluded that BMI was not associated with Musculoskeletal

Disorders (22). Similarly, Dyana, Rusni, and Sukmawati (2024) reported no significant correlation between BMI and MSD risk (23).

However, Patandung and Widowati (2022) contradicted these results, finding a moderate positive correlation (ρ = 0.02; r = 0.359) between BMI and Musculoskeletal Disorders among Toraja–Makassar bus drivers (24). In contrast, Patel et al. (2023) in India observed a significant relationship between BMI and musculoskeletal disorders among 50 garment workers (25).

Association Between Years of Service and Musculoskeletal Disorders

Years of Service is one of the risk factors associated with musculoskeletal disorders (MSDs). Work tenure influences workers' postures over time; the longer an individual has been employed, the longer certain postures tend to be maintained (26). Prolonged work duration combined with repetitive movements can accelerate the onset of musculoskeletal complaints by exerting continuous pressure on specific body parts used repeatedly (27). Both physical and psychological fatigue resulting from long years of service may further increase the risk of developing MSDs. Workers with a tenure of ≥5 years are at greater risk of experiencing musculoskeletal complaints due to longer exposure to these risk factors compared to those who have worked for less than 5 years (28).The chi-square analysis showed a significant relationship between years of service and Musculoskeletal Disorders ($p = 0.021$; $p < 0.05$). Ground handling workers with shorter work tenure (< 5 years) were found to be more vulnerable to Musculoskeletal Disorders due to factors such as workload intensity, task repetition, and physical demands. Newer employees are also more frequently exposed to risk factors because of limited adaptation and experience.

This finding supports the study by Alisha et al. (2022), who reported $p = 0.018$, indicating a significant relationship between work tenure and the number of Musculoskeletal Disorders among palm-oil loading workers (29). Similarly, research conducted among 80 employees in the millhouse and machinery departments of PT X found

p = 0.005, confirming a significant relationship between years of service and muscle strain (30). An international study by Suherdin, Rohendi, and Sinaga (2023) among 64 textile and inspection division workers also reported p = 0.000 (p < 0.05), demonstrating a strong association between work tenure and the frequency of Musculoskeletal Disorders (31).

Contrary results were reported by Afifah (2023) in a study of container loading workers at PT Pelindo Makassar, which found no significant relationship (p = 0.085; p > 0.05) between years of service and MSDs. Among 73 respondents, both senior and junior workers experienced similar Musculoskeletal Disorders due to repetitive use of the same muscle groups over eight-hour shifts (32).

CONCLUSIONS AND RECOMMENDATIONS

A study conducted on 41 ground handling workers at Mutiara SIS Al-Jufri Airport in Palu City found that 26 of them experienced Musculoskeletal Disorders. There was no significant correlation between age and Musculoskeletal Disorders among the 19 younger workers (ρ-value = 0.492), likely due to other influencing factors such as working posture and workload. However, there was a significant correlation between working posture and Musculoskeletal Disorders (ρ-value = 0.015), indicating that 20 workers had high-risk postures, such as frequent bending and lifting heavy objects with one hand. Meanwhile, no correlation was found between age and Musculoskeletal Disorders among older workers. Finally, the study found a significant correlation between work duration and Musculoskeletal Disorders (ρ-value = 0.021), suggesting that work duration contributes to the occurrence of such issues. In conclusion, work duration is associated with musculoskeletal disorders among ground handling workers at the Mutiara SIS Al-Jufri Airport apron. It is recommended that workers collaborate as a team to distribute workloads evenly, consume high-protein and low-fat foods, exercise regularly, maintain

proper body posture, especially by keeping the back straight, and rotate tasks to avoid continuous exposure to heavy workloads.

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