



Analysis of Factors Associated with the Incidence of Low Back Pain in Laborers at Soekarno-Hatta Port Makassar

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Abstract

Background: Low Back Pain (LBP) is one of the most common musculoskeletal disorders among workers engaged in physically demanding activities, including cargo handlers. Repetitive lifting, prolonged working hours, heavy workloads, and non-ergonomic work positions may increase the risk of LBP.

Objective: This study aimed to analyze the factors associated with the incidence of Low Back Pain among laborers at Soekarno-Hatta Port, Makassar.

Methods: A quantitative study with an analytical observational design and cross-sectional approach was conducted from January to March 2025. The study involved 88 cargo handlers selected through systematic random sampling from a population of 691 workers. Data were collected using structured questionnaires and ergonomic observations. The relationships between length of service, working duration, workload, work position, and LBP incidence were analyzed using the Chi-Square test with a significance level of $\alpha = 0.10$.

Results: The study found that length of service ($p = 0.047$), working duration ($p = 0.020$), workload ($p = 0.089$), and work position ($p = 0.008$) were significantly associated with the incidence of LBP among workers.

Conclusion: Length of service, working duration, workload, and work position are significant factors associated with Low Back Pain among laborers at Soekarno-Hatta Port Makassar.

Keywords: Low Back Pain, Length of Service, Work Duration, Workload, Work Position

Introduction

Low Back Pain (LBP) is classified as one of the most common types of musculoskeletal disorders (MSDs) experienced by workers, especially those involved in heavy physical work. The International Labor Organization (2019) reports that each year, approximately 2.78 million deaths due to accidents and illnesses are recorded in work-related reports, with MSDs being one of the main causes. LBP is defined as discomfort in the form of pain in the lower back, especially in the area between the lower ribs and the sacrum, and can be caused by various risk factors such as the work environment, individual characteristics, and the nature of the work itself. Several studies state that length of service, work attitude, and workload are the main risk factors most often associated with LBP complaints at work.¹

According to RISKESDAS data (2018), 3.71% of the Indonesian population suffers from low back pain (LBP), ranking second only to influenza. In South Sulawesi, the prevalence of LBP based on medical diagnosis among workers reaches 6.12%. One group of workers at high risk for LBP is port cargo handlers. Heavy physical activities, such as manually lifting, pulling, and pushing heavy loads without proper ergonomic techniques, cause repetitive mechanical stress on the body, particularly the lower spine. This is exacerbated by poor work posture and long working hours.^{2,3}

Soekarno-Hatta Port, as the largest port in eastern Indonesia, has a high volume of loading and unloading activities, with port workers at the forefront of the entire process of moving goods. Based on a study by Salcha & Suhaemi (2023), most non-mechanical workers at the Port of Makassar experience severe LBP, especially those who have worked for a long time, have excessive workloads, and work in non-ergonomic positions. Research by Firdayanti & Hidayat (2022) at the Nusantara Port in Parepare also shows a significant correlation between workload and length of service and the incidence of LBP among workers.^{4,5}

Several risk factors that contribute to the onset of LBP include length of service, duration of work, workload, and work position. Initial findings by researchers indicate that although some workers use tools such as hand trolleys, most of the work is still done manually. Activities such as lifting, lowering, pulling, and pushing excessive loads with incorrect body posture are often performed, which ultimately increases the risk of LBP complaints.

The objective of this study is to identify factors associated with the incidence of low back pain among workers at Soekarno-Hatta Port in Makassar.

Methods

This study is a quantitative study with an analytical observational design using a cross-sectional approach. The study was conducted at Soekarno-Hatta Port, Makassar City, South Sulawesi, from January to March 2025. The study population consisted of all 691 cargo handlers working at the port. The sample comprised 88 respondents determined using the Slovin formula with a 10% margin of error and selected through systematic random sampling.

The dependent variable in this study was the incidence of low back pain (LBP), while the independent variables included length of service, duration of work, workload, and work position. The incidence of LBP was measured using the Pain and Distress Scale (PAD) questionnaire, which consists of 20 items. LBP scores were categorized as no complaints (score 0), mild

complaints (score 1–20), moderate complaints (score 21–40), and severe complaints (score 41–60). The length-of-service variable was categorized as ≤ 5 years or > 5 years. Daily working hours were categorized as ≤ 8 hours/day and > 8 hours/day. Workload was measured based on the weight of the load lifted, then categorized into non-risky (< 40 kg) and risky (≥ 40 kg). Work posture was assessed using an ergonomic observation sheet and categorized into non-risky (score 0–24) and risky (score 25–48). Data processing was conducted through the stages of editing, coding, data entry, and data cleaning using statistical software. Data analysis was performed univariately and bivariately. Univariate analysis was used to describe the frequency distribution and percentage of each study variable. Bivariate analysis was performed using the Chi-Square test to determine the relationship between independent variables and the occurrence of LBP. The statistical significance level was set at $\alpha = 0.10$ with a 90% confidence level. A relationship was considered significant if the p-value was < 0.10 .

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Makassar with Ethical Clearance Number 0221/M/KEPK-PTKMS/II/2025, issued on February 26, 2025. All procedures were conducted in accordance with ethical principles for human subject research.

Results

The study was conducted on 88 workers at Soekarno-Hatta Port in Makassar. All respondents involved in the study were male. Details of the respondents' ages are presented in Table 1.

Table 1. Distribution of Respondents Based on Age Group in Laborers at Soekarno-Hatta Port Makassar in 2025

Age (Year)	Frequency (n)	Percent (%)
<25	10	11.4%
26-30	18	20.5%
31-35	33	37.5%
36-40	21	23.9%
>41	6	6.7%
Total	88	100%

Source: Primary Data, 2025

Distribution of respondents by age group. The age group of 31-35 years was 33 people (37.5%) while the age group of > 41 years was the group with the least number, namely 6 people (6.7%) Distribution of respondents by age group.

Univariate Analysis

The univariate results show that most workers experienced severe LBP complaints, with 47 people (53.4%), while 28 people (31.8%) experienced moderate complaints and 13 people (14.8%) experienced minor complaints. A total of 54 respondents (61.4%) had worked for more than 5 years, while the remaining 38.6% had worked for 5 years or less. In terms of working hours, 45 people (51.1%) worked more than 8 hours per day, and 43 others (48.9%) worked 8

hours per day or less. In terms of workload, 48 respondents (54.5%) manually lifted loads ≥ 40 kg, and 45 respondents (51.1%) were known to work in risky positions.

Bivariate Analysis

The chi-square test results showed a significant relationship between work period, work duration, workload, and work position with the incidence of LBP.

Table 2. The Relationship between Working Period and the Incidence of LBP in Laborers at Soekarno-Hatta Port in 2025

Scoliosis Prevalence Report for 2023									
Working Period	LBP Complaints						Total	%	p
	Minor Complaints		Moderate Complaints		Severe Complaints				
	n	%	n	%	n	%			
≤ 5 years	9	27	10	29	15	44	34	100	0.047
> 5 years	4	7.4	18	33.3	32	59.3	54	100	
Total	13	15	28	32	47	53	88		

Source: Primary Data, 2025

The chi-square test showed a p-value of 0.047 ($p < 0,1$). This indicates rejection of H_0 , which means that there is a correlation between length of service and the incidence of LBP among workers at Soekarno-Hatta Port in Makassar.

Table 3. The Relationship between Work Duration and the Incidence of LBP in Laborers at Soekarno-Hatta Port in 2025

Secondary Data Form 2025									
Work Duration	LBP Complaints						Total	%	p
	Minor		Moderate		Severe				
	Complaints		Complaints		Complaints				
	n	%	n	%	n	%			
≤ 8 hours	11	26	12	28	20	46	43	100	0.020
> 8 hours	2	4	16	36	27	60	45	100	
Total	13	15	28	32	47	53	88		

Source: Primary Data, 2025

The p-value from the chi-square test is 0,020 ($p < 0,1$). This indicates rejection of H_0 , suggesting that there is a relationship between work duration and the incidence of LBP among workers at Soekarno-Hatta Port in Makassar.

Table 4. The Relationship between Workload and the Incidence of LBP in Laborers at Soekarno-Hatta Port in 2025

Secondary Factor: LBP in 2023									
Workload	LBP Complaints						Total	%	p
	Minor Complaints		Moderate Complaints		Severe Complaints				
	n	%	n	%	n	%			
Not Risky	9	23	14	35	17	42	40	100	0.089
Risky	4	8	14	29	30	63	48	100	
Total	13	15	28	32	47	53	88		

Source: Primary Data, 2025

The chi-square test resulted in $p = 0.089$ ($p < 0.1$). Since H_0 was rejected, there is a relationship between workload and the incidence of LBP experienced by workers at Soekarno-Hatta Port in Makassar.

Table 5. Relationship between Work Position and the Incidence of LBP in Laborers at Soekarno-Hatta Port in 2025

Work Position	LBP Complaints						Total	%	p
	Minor Complaints		Moderate Complaints		Severe Complaints				
	n	%	n	%	n	%			
Not Risky	11	26	9	21	23	53	43	100	0.008
Risky	2	5	19	42	24	53	45	100	
Total	13	15	28	32	47	53	88		

Source: Primary Data, 2025

The chi-square test result obtained a p-value of 0.008 ($p < 0.1$). H_0 was rejected, indicating that there is a relationship between work position and the incidence of LBP experienced by workers at Soekarno-Hatta Port in Makassar.

Discussion

The purpose of this study was to analyze the factors affecting the incidence of LBP among workers at Soekarno-Hatta Port. The variables analyzed included length of service, working hours, workload, and job position.

Working Period

Work period is one of the factors that can potentially contribute to the development of low back pain (LBP) among workers. Continuous work activities performed over long periods can lead to the accumulation of physical strain on the musculoskeletal system. Prolonged exposure to repetitive workloads carries the risk of causing physical fatigue, reduced work capacity, and various health problems, including pain in the lower back. LBP generally develops gradually as a result of continuous mechanical stress on the spinal structures and their supporting tissues; thus, the longer a person is exposed to occupational risk factors, the greater the likelihood of developing this condition. In addition to increasing the accumulation of work-related stress, long working hours also increase the likelihood that workers will be exposed to non-ergonomic work postures and excessive physical activity. These conditions can lead to prolonged muscle strain, tissue fatigue, and increased pressure on the spine, which ultimately contribute to the onset of LBP. These findings are consistent with the results of a meta-analysis conducted by Prianggi et al., which showed that long working hours and exposure to non-ergonomic work postures are associated with an increased risk of low back pain among workers.⁶

The findings of this study are also supported by research by Salcha and Suhaemi, as well as Herawati and Bratajaya, who reported that workers with more than five years of service tend to experience more severe lower back pain than workers with shorter tenure. A longer tenure allows for the accumulation of exposure to ergonomic risk factors and physical strain, thereby increasing workers' susceptibility to musculoskeletal disorders, particularly in the lower back region.^{4,7}

Nevertheless, the results of this study indicate that lower back pain (LBP) is not only experienced by workers with long tenure but is also found among workers with less than five years of tenure. This condition is believed to be related to suboptimal adaptation to physically demanding work requirements, a lack of experience in applying proper work techniques, and the high intensity of loading and unloading activities that are still performed manually. Activities such as lifting, pulling, and moving loads with non-ergonomic body postures can increase pressure on the spine even with a relatively short tenure. Therefore, the risk of LBP is influenced not only by the length of tenure but also by the quality of ergonomic practice during work.

These findings are supported by a study by Harahap et al., which states that workplace ergonomic factors, including the duration of exposure to work activities and non-ergonomic postures, are important determinants of LBP incidence among workers.⁴ Therefore, preventive measures should be implemented by establishing appropriate work durations, providing sufficient rest periods, applying ergonomic work techniques, and using work aids to reduce the physical strain on workers.⁸

Working Duration

Daily work duration is one of the factors contributing to the onset of low back pain (LBP) among workers. The longer a person is engaged in work activities, the greater the accumulation of biomechanical stress on the musculoskeletal system, particularly in the lower back region. Nevertheless, the results of this study show that LBP complaints are not only experienced by workers with work durations exceeding 8 hours per day but are also found among workers who work for 8 hours or less. These findings indicate that the risk of developing LBP is influenced not only by the length of the workday but also by job characteristics, the intensity of physical activity, and ergonomic conditions during work.

Work activities involving repetitive lifting, pulling, and moving loads can increase mechanical stress on muscles, ligaments, and spinal structures even when performed during relatively short work shifts. Conversely, workers with longer work shifts tend to experience muscle fatigue due to continuous exposure to physical activity without adequate recovery time. This condition causes the muscles to remain in a state of prolonged contraction, which can impede blood flow and oxygen supply to the tissues. Consequently, metabolic waste accumulates, triggering pain, discomfort, and functional impairment in the lower back region. This mechanism is consistent with the views of Suryati and Nggarang, who explain that maintaining a static work posture for long periods can put pressure on blood vessels, disrupt circulation, and cause muscle dysfunction, all of which contribute to the onset of musculoskeletal complaints. These findings are further supported by a study by Shockey et al., which shows that the prevalence of LBP is not only influenced by work duration but is also associated with work organization factors, job demands, and the level of physical activity performed during work. In other words, workers facing high workloads and strenuous physical demands are at greater risk of developing LBP even if their working hours do not always exceed normal limits.^{9,10}

Furthermore, a study by Chaiklieng et al. found that repetitive work activities, high exposure to ergonomic risks, and continuous work are factors significantly associated with the occurrence of work-related back pain. These conditions indicate that the frequency of repetitive

movements and poor ergonomic work postures can accelerate muscle fatigue and increase pressure on the spinal structures. Therefore, long work hours further increase the risk of LBP when accompanied by strenuous physical activities performed repeatedly without adequate rest breaks.¹¹

In the context of loading and unloading work at ports, most activities are still performed manually, exposing workers to high physical strain throughout their work shifts. The repetitive lifting, moving, and stacking of goods place continuous stress on the lower back. This exposure has the potential to cause muscle fatigue, musculoskeletal disorders, and increase the risk of LBP. Thus, the results of this study reinforce the finding that work duration is one of the factors contributing to an increased risk of LBP, especially when workers are engaged in repetitive heavy physical activities over long periods. This risk is further exacerbated if the work environment lacks the application of sound ergonomic principles, appropriate workload management, and adequate rest breaks during work.

Workload

Physical workload in this study was measured based on manual lifting activities performed by workers while carrying out their duties. These activities are one of the ergonomic factors that contribute to an increased risk of low back pain (LBP), especially when workers are repeatedly exposed to heavy loads over a long period of time. Lifting loads that exceed the body's physical capacity can increase biomechanical stress on musculoskeletal structures—including muscles, tendons, ligaments, and vertebrae—thereby triggering muscle strain, tissue microtrauma, and functional impairments in the lower back region. This risk is further exacerbated when lifting is performed without applying ergonomic work techniques or without adequate recovery periods. The findings of this study are consistent with the results of a study by Sauter et al., which showed that workers engaged in manual heavy lifting have a higher prevalence of LBP compared to groups of workers not exposed to similar activities. Continuous exposure to high physical loads is known to increase the accumulation of stress on the musculoskeletal system and accelerate the onset of lower back pain.¹²

These conditions are relevant to the nature of loading and unloading work at ports, which is still dominated by manual material handling. The high frequency of lifting, moving, and stacking goods subjects workers to significant physical demands during working hours. A study by Gomes et al. reported that work activities involving manual material handling and heavy physical labor are associated with an increased incidence of LBP among workers. Thus, the higher the intensity of physical activity, the greater the likelihood of musculoskeletal disorders resulting from accumulated fatigue and mechanical stress on the body.^{5,13}

In addition to the weight of the load being lifted, workplace ergonomics also play a crucial role in determining the risk of LBP. Suboptimal application of ergonomic principles can lead to an unbalanced distribution of body weight, thereby increasing pressure on the spine and its supporting tissues. Harahap et al. emphasize that workplace ergonomics is a key determinant of LBP incidence among workers in Indonesia. Therefore, risk control measures must be implemented through the use of proper lifting techniques, mechanical aids, and a balanced

schedule of work and rest periods to minimize the impact of physical workloads on workers' health.⁸

Work Position

Work posture is one of the ergonomic factors that significantly contributes to the occurrence of low back pain (LBP) among workers. Body postures that do not conform to ergonomic principles, such as bending over, twisting the body, lifting loads using improper techniques, or maintaining a specific work posture for extended periods, can increase biomechanical stress on the spine. These conditions result in suboptimal body weight distribution, thereby increasing the risk of muscle strain, physical fatigue, and musculoskeletal disorders. Additionally, a mismatch between job characteristics, workplace facilities, and the worker's physical capabilities can exacerbate the load placed on the spinal support structures.¹ Work performed in a continuously static position—whether standing or sitting for long periods, can cause prolonged muscle contraction. This condition has the potential to impede blood circulation, thereby reducing the optimal distribution of oxygen and nutrients to muscle tissue. Consequently, metabolic waste accumulates, which can trigger pain and discomfort in the lower back. Rahmawati (2021) states that this condition contributes to the accelerated onset of LBP due to increased tension in the musculoskeletal structures that support the body during work.¹⁴

The results of this study indicate that workers with risky work postures are more likely to experience LBP than those who adopt ergonomic work postures. These findings are consistent with Anggreni's study, which identified a relationship between work postures and LBP complaints among healthcare workers in Bali Province. Non-ergonomic work postures are known to increase energy expenditure and accelerate fatigue because the transfer of load from the muscles to the skeletal system occurs inefficiently.¹⁵

Various work activities, such as reaching for objects, bending, twisting the body, kneeling, or holding a load statically, involve body parts that are prone to injury, particularly the shoulders, back, waist, and knees. If these activities are performed repeatedly over long periods without proper posture, the pressure on the spine will increase, potentially leading to musculoskeletal disorders. The results of a meta-analysis conducted by Prianggi et al. also indicate that improper sitting posture and long work hours are associated with an increased risk of low back pain (LBP) among workers.⁶

Furthermore, a study by Harahap et al. confirms that workplace ergonomic factors, including body posture while working, are important determinants of LBP incidence among workers in Indonesia. Therefore, the application of ergonomic principles through improvements in work positions, adjustments to workplace facilities, and education on proper work techniques must be implemented on an ongoing basis to reduce strain on the spine and prevent lower back pain.⁸

Conclusion

Based on the results of the study, it can be concluded that there is a significant relationship between factors such as length of service, working hours, workload, and job position with the incidence of low back pain (LBP) among workers at Soekarno-Hatta Port in Makassar. These

findings confirm that uncontrolled physical working conditions, in terms of duration, intensity, and body position, contribute to an increased risk of LBP among this group of workers.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication

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