

THE RELATIONSHIP BETWEEN WORK POSTURE AND BACK PAIN LEVEL AMONG MANUAL HANDLING WORKERS

Naswa Kalya R, Lutfi Wahyuni, Emyk Windartik

University Bina Sehat PPNI, Mojokerto, Indonesia

Corresponding Author: naswatuhh@gmail.com

ABSTRACT

Back pain is one of the most common musculoskeletal disorders experienced by manual handling workers due to repetitive activities such as lifting, carrying, and moving loads. Non-ergonomic work posture can increase biomechanical stress on the spine, thereby increasing the risk of back pain. This study aimed to analyze the relationship between ergonomics (work posture) and back pain level among manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency. This study employed a quantitative correlational design with a time series approach. The sample consisted of 27 respondents selected using a total sampling technique. The independent variable was work posture, measured using the Rapid Entire Body Assessment (REBA), while the dependent variable was back pain level, measured using the Numeric Rating Scale (NRS). Measurements were conducted three times on the same respondents, and the results were averaged to obtain the final values for analysis with a significance level of $\alpha = 0.05$. The results showed that most respondents had a high-risk work posture (16 respondents; 59.3%), while nearly half experienced a moderate level of back pain (13 respondents; 48.1%). Cross-tabulation analysis indicated that respondents with a high-risk work posture were predominantly in the severe pain category (8 respondents; 50.0%). The analysis yielded a $p\text{-value} = 0.001$; $p < \alpha$ (0.05), with a correlation coefficient of $r = 0.613$, indicating a strong positive relationship between work posture and back pain level. The higher the work posture risk, the higher the back pain level experienced by the workers. Therefore, the implementation of ergonomic work postures should be improved to help reduce the risk of back pain among manual handling workers.

Keywords: *work posture, back pain level, manual handling.*

INTRODUCTION

Occupational health problems remain a concern because they can affect workers' ability to carry out activities and their work productivity. One of the complaints frequently experienced by manual handling workers is back pain, which is associated with repetitive lifting and moving activities (Hadji et al., 2025). Repetitive manual handling activities can impose mechanical loads on the musculoskeletal system, particularly when lifting tasks are performed using improper techniques (Permana et al., 2025).

According to Pane & Utami, 2023, non-ergonomic work postures can increase biomechanical pressure on the spine. Improper body positioning during work activities can cause the musculoskeletal structures to bear loads suboptimally, thereby triggering back pain complaints. This indicates that back pain complaints among workers are not only related to the manual handling activities performed but also to how body posture is maintained throughout these activities.

According to the World Health Organization (WHO), approximately 70% of the world's population has experienced back pain, while approximately 90% of lower back pain cases are associated with non-ergonomic work positions (Hadji et al., 2025). In Indonesia, the prevalence of musculoskeletal disorders based on diagnosis or symptoms reaches 24.7%, with the highest prevalence found among farmers, fishermen, and laborers at 31.2% (Hutama & Fenda Rifa'atunnisa, 2019). In addition, East Java Province has a back pain complaint rate

of 58.33% (Workload et al., 2024). The high prevalence of these complaints indicates that musculoskeletal disorders remain a problem among occupational groups with high physical activity demands. Working conditions involving physical loads and repetitive movements can increase stress on body structures, making musculoskeletal complaints more likely to occur (Permana et al., 2025).

Various factors can contribute to the occurrence of back pain, including both individual and occupational factors. Individual factors include age, body mass index, length of employment, physical activity, and smoking habits, while occupational factors include workload, work duration, manual handling activities, and work posture (Kaliky et al., 2023). Work positions involving bending, twisting the body, or lifting loads in a non-neutral position can increase biomechanical pressure on the spine and consequently trigger back pain complaints (Santos et al., 2025). Heavier loads can also cause workers to adjust their body positions to maintain balance while lifting or moving goods, thereby increasing the risk of non-ergonomic work postures (Pratiwi et al., 2021). Therefore, posture during work activities is an important aspect to consider when identifying factors associated with back pain complaints.

Several studies have shown that non-ergonomic work posture is associated with increased back pain complaints. According to research by Wicaksono et al., 2025 non-ergonomic work posture is associated with increased back pain complaints. Other research has shown that the application of ergonomic principles can help reduce the risk of musculoskeletal disorders through improvements in work posture and manual handling techniques (Sybromiilsy et al., 2025). These findings indicate an association between work posture and complaints involving the musculoskeletal system. However, the characteristics of activities, types of loads, lifting frequency, and workplace environmental conditions may vary across workplaces. Therefore, research among workers with specific occupational characteristics remains necessary to obtain a clearer picture of the relationship between work posture and back pain.

Although various studies have demonstrated that work posture is associated with back pain, research among manual handling workers in the furniture industry, particularly at PT Avery Sentosa Indonesia, Mojokerto Regency, remains limited. This condition provides an important basis for analyzing the relationship between ergonomics (work posture) and back pain level. Therefore, this study aims to analyze the relationship between ergonomics (work posture) and back pain level among manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency. This study is expected to provide empirical information regarding the relationship between work posture and the level of back pain complaints among manual handling workers in the furniture industry environment.

METHOD

This study obtained ethical approval from the Health Research Ethics Committee of Universitas Bina Sehat PPNI Mojokerto under approval number 70/KEP/UBS-PPNI/IV/2026, and research permission was obtained from Universitas Bina Sehat PPNI Mojokerto and PT Avery Sentosa Indonesia, Mojokerto Regency. Each respondent was provided with an explanation regarding the objectives and procedures of the study and then signed an informed consent form as an agreement to participate in the study. Data collection was conducted through direct observation of work posture using the Rapid Entire Body

Assessment (REBA) instrument to assess the level of ergonomic risk (work posture) and measurement of Back Pain Level using the Numeric Rating Scale (NRS). All data obtained were kept confidential and used solely for research purposes.

This study employed a quantitative correlational design with a time series approach. The research design was used to analyze the relationship between ergonomics (work posture) and back pain level among manual handling workers. The study was conducted at PT Avery Sentosa Indonesia, Mojokerto Regency, from April to May 2026. The population in this study consisted of all manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency, totaling 27 workers. The study sample consisted of 27 respondents selected using the total sampling technique, in which all members of the population were included as research respondents. The independent variable in this study was ergonomics (work posture), while the dependent variable was back pain level.

Data on work posture were collected using the Rapid Entire Body Assessment (REBA) through direct observation of respondents while performing manual handling activities. The REBA instrument was used to assess work posture risk based on the positions of the neck, trunk, arms, wrists, legs, and the load being lifted. Meanwhile, back pain level was measured using the Numeric Rating Scale (NRS) through interviews with respondents after completing their work activities on the same day. REBA and NRS measurements were conducted three times on the same respondents during the research period. The results of the three measurements were then calculated to obtain the mean value, which was used as the final score for each respondent. The research data were analyzed using IBM SPSS Statistics. Univariate analysis was used to describe the characteristics of the respondents, work posture, and back pain level. Subsequently, bivariate analysis was performed using the Spearman Rho test with a 95% significance level ($\alpha = 0.05$) to determine the relationship between ergonomics (work posture) and back pain level. The Spearman Rho test was selected because the research data were ordinal in scale and were not normally distributed.

FINDING AND DISCUSSION

RESEARCH RESULT

Tabel 1 Respondent Characteristics

Characteristics	Category	Frequency (n)	Percentage (%)
Age	Not at Risk (<30 years)	18	66,7
	At Risk (≥ 30 years)	9	33,3
Length of Employment	Not at Risk (<5 years)	21	77,8
	High Risk (≥ 5 years)	6	22,2
Load Weight	Light (<11 kg)	0	0,0
	Moderate (11–22 kg)	10	37,0
	Heavy (>22 kg)	17	63,0
Total		27	100,0

Source: Primary Data, 2026

Table 1 shows that the majority of respondents were in the not-at-risk age group (<30 years), consisting of 18 respondents (66.7%). Most respondents had a length of employment in the not-at-risk category (<5 years), totaling 21 respondents (77.8%). In terms

of load weight, the majority of respondents lifted heavy loads (>22 kg), totaling 17 respondents (63.0%).

Table 2 Distribution of Work Posture and Back Pain Level

Work Posture	Frequency (n)	Percentage (%)
Low Risk	11	40,7
High Risk	16	59,3
Total	27	100,0
Back Pain Level	Frequency (n)	Percentage (%)
Mild Pain	6	22,2
Moderate Pain	13	48,1
Severe Pain	8	29,6
Total	27	100,0

Source: Primary Data, 2026

Based on Table 2, the majority of respondents had a high-risk work posture, with 16 respondents (59.3%), while 11 respondents (40.7%) had a low-risk work posture. Regarding back pain level, nearly half of the respondents experienced moderate pain, with 13 respondents (48.1%), followed by severe pain in 8 respondents (29.6%) and mild pain in 6 respondents (22.2%).

Table 3 Relationship between Work Posture and Back Pain Level

Work Posture	Back Pain Level							
	Mild Pain		Moderate Pain		Severe Pain		Total	
	n	%	n	%	n	%	n	%
Low Risk	5	18,5	6	22,2	0	0,0	11	40,7
High Risk	1	3,7	7	25,9	8	29,6	16	59,3
Total	6	22,2	13	48,1	8	29,6	27	100

Spearman Rho Test: p-value = 0.001; correlation coefficient = 0.613

Source: Primary Data, 2026

Based on Table 3, among respondents with a high-risk work posture, the majority experienced severe pain, with 8 respondents (50.0%), followed by moderate pain in 7 respondents (43.8%) and mild pain in 1 respondent (6.3%). The analysis showed a p-value of 0.001 ($p < \alpha = 0.05$) with a correlation coefficient of $r = 0.613$, indicating a statistically significant relationship with a strong correlation and a positive direction between work posture and back pain level. As the risk level of work posture increases, the back pain level experienced by workers also increases.

DISCUSSION

The results of the study on work posture among manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency, showed that the majority of respondents were in the high-risk category, consisting of 16 respondents (59.3%), while 11 respondents (40.7%) were in the low-risk category. This condition indicates that manual handling activities in the furniture warehouse are still frequently performed with risky body positions,

such as bending, twisting the body, and reaching for or carrying loads away from the body. These conditions can increase biomechanical loading on the spine and back muscles, particularly when performed repeatedly during working hours (Chaiklieng, 2025). Hutama et al., 2019 explained that the application of ergonomics is necessary to adjust job demands to workers' physical capabilities. Meanwhile, Permana et al., 2025 explained that improper manual handling techniques can increase stress on the musculoskeletal system. These findings indicate that the characteristics of manual handling work may be one of the conditions associated with the high risk of work posture among respondents.

The work posture conditions in this study may also be associated with load weight and the way workers maintain their body positions while lifting. Pratiwi et al., 2021 explained that heavier loads can cause workers to adjust their body positions to maintain balance, resulting in less neutral postures. This is consistent with Simamora & Noeryanto, 2025 who explained that an ergonomic posture is characterized by a neutral spinal position, keeping the load close to the body, and using the legs when lifting. Conversely, bending, carrying loads away from the body, and twisting the body can increase biomechanical stress on the spine.

These findings are further supported by Nurkertamanda et al., (2017) who stated that work posture includes the position of various body parts during work, which, when inappropriate, can increase stress on body structures and the risk of musculoskeletal disorders. This is consistent with the REBA assessment, which considers body position, load, coupling, and work activity. According to the researcher, the predominance of high-risk work posture may be influenced by workers' activities in picking up, lifting, carrying, and placing goods. These movements may require workers to adjust their body positions according to the conditions of the goods being handled. When performed repeatedly during work activities, these conditions may increase the risk of loading on the musculoskeletal system.

The results showed that the majority of respondents experienced moderate pain, consisting of 13 respondents (48.1%), followed by 8 respondents (29.6%) who experienced severe pain and 6 respondents (22.2%) who experienced mild pain. These findings indicate variations in the level of back pain complaints among manual handling workers. Koesyanto, 2013 explained that repeated static loading over a long period can trigger disorders of the musculoskeletal system and cause pain. Similarly, Chaiklieng & Suggaravetsiri, 2020 explained that musculoskeletal disorders can cause complaints in several areas, including the upper and lower back. This condition is consistent with the findings of this study, which showed the presence of back pain complaints with varying levels of intensity among respondents.

Back pain complaints among respondents may also be associated with body posture during work activities. Pane & Utami, 2023 explained that improper body positions can increase loading on musculoskeletal structures and trigger back pain. Carpenedo et al., 2025 explained that back pain may occur due to pressure or irritation of structures surrounding the spine, such as muscles, ligaments, intervertebral discs, and bone tissue. When loading occurs repeatedly, these tissues may experience stress that is subsequently perceived as pain. Based on these two studies, the occurrence of moderate to severe pain among some respondents may be associated with the mechanical loading received by the body during work activities.

In this study, back pain includes complaints affecting the back area broadly, rather than only the lower back. Chaiklieng & Suggaravetsiri, 2020 explained that musculoskeletal complaints can occur in both the upper and lower back, while Pane & Utami, 2023 associated

back pain complaints with posture and loading during work. According to the researcher, the predominance of moderate pain indicates that the complaints experienced by workers have exceeded the level of mild discomfort. However, the intensity of pain may vary among respondents because back pain is influenced by various individual factors and occupational characteristics.

The analysis of the relationship between work posture and back pain level using the Spearman Rank test showed a p-value of 0.001 with a correlation coefficient of $r = 0.613$. A $p\text{-value} < \alpha (0.05)$ indicates a significant relationship between work posture and back pain level among manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency. The correlation coefficient of 0.613 indicates a positive relationship with moderate-to-strong strength, meaning that the higher the risk of work posture, the higher the back pain level experienced by workers. These results are supported by (Kaliky et al., 2023) who explained that back pain can be influenced by various occupational factors, such as workload, repetitive activities, and work posture. The loading received by the body during work can increase stress on the musculoskeletal system when it occurs continuously. These findings are further supported by Chaiklieng, 2025 who explained that exposure to mechanical loads and non-ergonomic work posture are important factors in the occurrence of back pain. Activities such as lifting, carrying, pushing, and pulling loads repeatedly can increase stress on the spine and paraspinal muscles. Based on these two studies, the relationship identified in this study can be explained by the greater mechanical loading experienced by workers with high-risk work posture.

The relationship between work posture and back pain may also be influenced by the duration of exposure to work activities. Syafitri et al., 2019 explained that long working durations can increase the biomechanical load received by the body. Activities performed for prolonged periods without adequate rest can cause muscle fatigue, leading workers to tend to maintain less ergonomic body positions. Meanwhile, Wildasari et al. 2023 explained that workers aged >30 years have a greater risk of back pain than workers aged ≤ 30 years, while longer employment duration increases exposure to repetitive work activities. These conditions may also contribute to the occurrence of back pain among manual handling workers. Thus, the relationship between work posture and back pain in this study may not only be associated with body position at a particular moment but also with repeated exposure to work activities and age.

In addition to posture, age, and duration of exposure, Raraswati et al., 2020 explained that lifting loads exceeding workers' physical capabilities can increase the risk of musculoskeletal disorders, including back pain complaints. Heavier loads require greater force to lift and maintain, thereby increasing the loading placed on the body. This condition is consistent with Pratiwi et al., 2021 who explained that load weight can cause workers to change their body positions to maintain balance during the lifting process. When these changes result in the body adopting a non-neutral posture, biomechanical stress on the spine may increase further. These two studies provide an explanation that work posture and physical load are interrelated in influencing body loading during manual handling activities.

Overall, the results of this study showed a significant relationship between work posture and back pain level among manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency. Workers with high-risk work posture experienced moderate to severe pain more frequently than workers with low-risk work posture. These findings indicate that

body posture during manual handling activities is associated with musculoskeletal responses in the form of back pain complaints. The results also reinforce previous research findings that work posture, physical loading, duration of exposure, and manual handling activities are associated with the occurrence of musculoskeletal disorders among workers.

CONCLUSION

This study showed that the majority of manual handling workers at PT Avery Sentosa Indonesia, Mojokerto Regency, had work posture in the high-risk category and back pain level in the moderate pain category. The analysis showed a significant relationship between work posture and back pain level, with a positive direction and a strong correlation ($p = 0.001$; $r = 0.613$). These findings indicate that the higher the risk of work posture, the higher the back pain level experienced by workers. Therefore, the results of this study can serve as a basis for increasing attention to the application of ergonomic work posture in manual handling activities to help reduce the risk of back pain among workers.

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