

Correlation between work posture, smoking habits, and Musculoskeletal Disorders (MSDs) complaints among construction workers at Dewi Sinta Residence Housing project, Gunung Kidul Regency

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ABSTRACT

Inadequate ergonomic conditions at work can lead to the development of muscle and skeletal ailments, such as Musculoskeletal Disorders (MSDs). The construction sector, for instance, is a common setting where these MSDs occur due to non-ergonomic practices. Several factors, including work posture and smoking habits, play a role in influencing the onset of Musculoskeletal Disorders (MSDs). Construction workers may experience MSDs as a consequence of unfavorable work postures that lack ergonomic considerations. The aim of this investigation is to explore the interconnections between work posture, smoking habits, and complaints of Musculoskeletal Disorders (MSDs) among the construction workers at the Dewi Sinta Residence housing project in Gunung Kidul Regency. This study employs a cross-sectional quantitative approach and was conducted at the Dewi Sinta Residence housing project in Gunung Kidul Regency, involving 60 participants. Data collection utilized the Nordic Body Map (NBM) questionnaire and the REBA worksheet. Data analysis involved univariate and bivariate analyses as well as the Chi-Square statistical test. The research findings indicate that work posture (p value = $0.00 < 0.05$) and smoking habits (p value = $0.003 < 0.05$) are associated with complaints of Musculoskeletal Disorders (MSDs). This study reveals a significant correlation between work posture and smoking habits and the occurrence of Musculoskeletal Disorders (MSDs). They should do short stretching to reduce the pain complained.

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1. Introduction

In Indonesia, the construction industry plays a crucial role in regional development projects, and the high demand for construction activities can inspire innovation and the use of construction technology to improve efficiency, effectiveness, environmental safety, and production quality.

Those in this sector may evaluate the health conditions of workers, including Musculoskeletal System Disorders (MSDs) (Burhanuddin, 2018). Non-ergonomic work positions can lead to decreased workers' productivity and performance, which, in turn, can result in workplace accidents (Jalajuwita & Paskarini, 2015). This industry sector may cause musculoskeletal disorders, especially in the construction sector. The construction industry involves intensive physical labor. Manual work can result in accidents and health risks. While rarely fatal, many workers experience injuries such as muscle strain or sprains, especially in the back and waist areas, due to improper activities and prolonged exertion (Tarwaka, 2015). Individual, environmental, occupational, and psychosocial factors, including physical posture at the workplace, are some of the major causes of musculoskeletal complaints (MSDs) (Aprianto et al., 2021). Several factors may have impacts on work efficiency, including the location where workers carry out their tasks. Inappropriate positions and repetitive tasks in an unsuitable workplace can make workers quickly tired, ultimately affecting work capacity (Pramestri, 2017).

Smoking can damage lung function, reduce the body's ability to absorb oxygen, and ultimately lead to decreased physical fitness (Tarwaka, 2014). As individuals age, smoking is considered a common and acceptable habit, especially among men in Indonesia. This increases the risk of musculoskeletal disorders because it is not just the quantity and frequency of smoking consumed daily that play a role but also the total time spent by smoking workers. Complaints increase when workers smoke over longer periods and with higher frequency (Nurhikmah, 2011).

From observations on three construction workers at the Dewi Sinta Residence development project, it can be seen that various stages of the construction process, such as cement mixing, casting and foundation stone installation, and wall construction, involved work positions that strain the back, legs, and arms with repetitive movements. They used manual tools such as shovels and cement buckets. In addition, during wall construction work, workers often adopted non-ergonomic bending positions. According to interviews with these three construction workers at the project site, they worked 8 hours a day with a break from 12:00 to 13:00. The majority of them smoked, consuming 5-10 cigarettes a day, and carried materials weighing 40-50 kg of cement daily. Common complaints they experience included shoulder, leg, knee, hand, and back pains.

2. Materials and Method

This research is a quantitative study with a cross-sectional approach. The independent variables under investigation are work posture and smoking habits, while the dependent variable is complaints of MSDs (Musculoskeletal Disorders). The research was conducted on construction workers working at the Dewi Sinta Residence housing project in Gunung Kidul from December 2022 to September 2023. The research population consisted of 70 construction workers. For sample selection, the simple random sampling method was used, resulting in 60 respondents, with the sample size determined using the Slovin formula. In this study, the Nordic Body Map (NBM) and Rapid Entire Body Assessment (REBA) were used as tools to measure the risk of work posture among construction workers and their level of MSDs complaints. The statistical analysis used in this research was the Chi-Square (χ^2) statistical test.

3. Results and Discussion

This section may be divided by subheadings. It provides a concise and precise description of the research which was carried out at the Dewi Sinta Residence housing project in Gunung Kidul Regency. PT Wahana Panderma Karya is the contractor responsible for the implementation of this project, involving 70 construction workers. Construction workers at Dewi Sinta Residence have different roles in the construction process. This construction project consisted of several stages, starting with the planning phase, which included soil analysis, permits, design, equipment and labor preparation. The next stage was the construction phase, where the construction of house foundations, walls, casting, and roofs was carried out. The final stage was the post-construction phase, involving finishing work.

3.1. Results

3.1.1. Characteristics of the Respondent

Table 1. Distribution of Respondent Characteristics Based on Gender, Age, Highest Education, Work Experience, and Accident History among the Construction Workers at the Dewi Sinta Residence Housing Project, Gunung Kidul Regency, in the Year 2023.

Variable	Category	Frequency	Percentage (%)
Age	Adult (19-44)	33	55
	Elderly (45-60)	27	45
	Total	60	100
Education	Junior High School	13	21.7
	Senior High School	47	78.3
	Total	60	100
Work Experience	<10	22	36.7
	11-20	33	55.0
	21-30	5	8.3
	Total	60	100

Source: Primary Data

Based on [Table 1](#), it is evident that the characteristics of the respondents' data show a significant difference in the age groups. More respondents fell into the Adult age group (19 - 44), with a total of 33 individuals (55%), compared to the Pre-Elderly age group (45 - 60), which consisted of only 27 individuals (45%). In the variable of highest education level, it can be observed that the majority of respondents, namely 47 individuals (78.3%), had junior high school (SMP) level, while only 13 individuals (21.7%) were from other levels of education. For the variable of work experience, it is known that the majority of respondents, 33 individuals (55.0%), had work experience ranging from 11 to 20 years, while 22 individuals (36.7%) had less than 10 years, and only 5 individuals (8.3%) had worked for 21-30 years.

3.1.2 Univariate Analysis

This study conducted univariate analysis. The data used for univariate analysis were related to work posture, smoking habits, and Musculoskeletal Disorders (MSDS) complaints as shown in the following table.:

Table 2. Distribution based on work posture, smoking habits, and Musculoskeletal Disorders (MSDs) complaints among construction workers at Dewi Sinta Residence Housing Project in Gunung Kidul Regency, 2023.

Variable	Category	Frequency	Percentage
Work Posture	High Risk	40	66.7
	Medium Risk	20	33.3
	Total	60	100.0
Smoking Habit	Yes	39	65.0
	No	21	35.0
	Total	60	100.0
MSDs	High	34	56.7
	Medium	26	43.3
	Total	60	100.0

Source : Primary Data

Based on [Table 2](#), it can be seen that regarding the population of the construction workers, there were 40 people (66.7%) with high risk related to work posture and 20 people (33.3%) with medium risk related to work posture. In terms of the smoking habit variable, there were 39 people (65%) with higher smoking habit and 21 people (35.0%) without smoking habit. Whereas, with regard to the MSDs complaints variable among the construction workers, it was found that 34 people (56.7%)

experienced a high level of complaints related to Musculoskeletal Disorders (MSDs), while 26 people (43.3%) experienced a medium level of complaints.

3.1.3. Bivariate Analysis

Bivariate test results were found, among other things, based on the following table.

Table 3. Correlation between Work Posture and Musculoskeletal Disorders (MSDs) Complaints among Construction Workers at Dewi Sinta Residence Housing Project, Gunung Kidul Regency, 2023.

Work Posture	MSDs				Total		RP & CI (95%)	P Value
	High		Medium		n	%		
	n	%	n	%				
High Risk	32	53.3	8	13.3	40	66.7	36.000 (6.889-188.1)	0.00
Medium Risk	2	3.3	18	30.0	20	33.3		
Total	34	56.7	26	43.3	60	100		

Source : Primary Data

Based on the data in Table 3 above, it can be observed that there were 32 respondents (53.3%) who experienced a high level of Musculoskeletal Disorders (MSDs) complaints, while 8 respondents (13.3%) experienced a moderate level of MSDs complaints with high-risk work posture. Conversely, 2 respondents (3.3%) with a moderate-risk work posture experienced high MSDs complaints, and 18 respondents (30.0%) had a moderate-risk work posture. The Chi-Square test results indicated that the p-value was 0.00 (p-value < 0.05). This indicates that there was a significant correlation between work posture and Musculoskeletal Disorders (MSDs) complaints among construction workers at Dewi Sinta Residence, Gunung Kidul.

Based on the data in Table 9, the Prevalence Ratio is 36.000. This can be interpreted that construction workers who work with high-risk work posture are 36 times more likely to experience high musculoskeletal complaints compared to construction workers who work with low-risk work posture. The Confidence Interval (CI) value is (6.889 - 188.126).

Table 4. The Correlation Between Smoking Habits and Musculoskeletal Disorders (MSDs) Complaints Among Construction Workers at the Dewi Sinta Residence Housing Project in Gunung Kidul Regency in 2023

Smoking Habit	MSDs				Total		RP & CI (95%)	P Value
	High		Medium		n	%		
	n	%	n	%				
Yes	28	46.7	11	18.3	39	65.0	6.364 (1.963-20.625)	0,003
No	6	10.0	15	25.0	21	35.0		
Total	34	56.7	26	43.3	60	100		

Source: Primary Data

Based on Table 4, individuals who smoked and experienced high Musculoskeletal Disorders (MSDs) complaints were 28 people (46.7%), and those who smoked and experienced moderate Musculoskeletal Disorders (MSDs) complaints were 11 people (18.3%). On the other hand, those who did not smoke and experienced high Musculoskeletal Disorders (MSDs) complaints are 6 people (10.0%), and those who did not smoke and experienced moderate Musculoskeletal Disorders (MSDs) complaints were 15 people (25.0%).

The results of the bivariate Chi Square test showed that the p-value was 0.003 (p<0.05). This implies that there was a statistically significant correlation between smoking habits and Musculoskeletal Disorders (MSDs) complaints among construction workers in Dewi Sinta Residence, Gunung Kidul. According to Table 12, the Prevalence Ratio is 6.364, indicating that construction workers who smoked were 6 times more likely to experience Musculoskeletal Disorders (MSDs) complaints compared to those who did not smoke. The Confidence Interval (CI) was found to be (1.963-20.625).

3.2. Discussion

3.2.1 *The Correlation Between Work Posture and Musculoskeletal Disorders (MSDs)*

Based on this research, it was found that work posture had an impact on Musculoskeletal Disorders (MSDs) complaints with two levels of risk, namely high (score 8-10) and moderate (score 4-7). The assessment of work posture using the REBA sheet involved seven aspects, including the neck, waist, fingers, upper arms, lower arms, legs, and additional activities. The values from this assessment were then used in the REBA assessment sheet to calculate Score A (body, neck, and legs), Score B (lower arms and wrists), and finally, Score C (Grand Score). The results of the study involving 60 respondents showed that 66.7% of them had a high risk of work posture (REBA score 8-10), while 33.3% had a moderate risk (REBA score 4-7).

Bivariate analysis results using the Chi-Square test showed a significance value of 0.000 (p -value <0.05), indicating a significant correlation between work posture and Musculoskeletal Disorders (MSDs) complaints. There were no cells in the table with an expected count value of less than 5% (less than 20%), indicating a correlation between work posture in construction workers at the Dewi Sinta Residence housing project, Gunung Kidul Regency, and Musculoskeletal Disorders (MSDs) complaints.

Furthermore, the Ratio Prevalence (RP) value was 36.000 (95%, CI= 6.889-188.126), meaning that the risk of MSDs complaints in construction workers with a high-risk work posture (REBA score 8-10) was 36,000 times greater compared to workers with a moderate-risk work posture (REBA score 4-7). This finding is consistent with the research conducted by Putri in 2020, which also showed a correlation between work posture and Musculoskeletal Disorders (MSDs) complaints with a p -value of 0.023 ($p < 0.05$).

In this study, the impact of work posture on Musculoskeletal Disorders (MSDs) complaints is divided into two categories, namely low level and high level. The purpose of using REBA assessment is to evaluate the risk of muscle and bone disorders that workers may experience when performing tasks involving movements from the upper part of the body to the lower part.

The measurement results from 60 respondents who were the subjects of the study showed that 40 respondents (with REBA scores of 8-10) were classified as having a high level of work posture risk. They fell into Action level 4, indicating the need for immediate improvement measures to reduce the risk. Meanwhile, the assessment of work posture in the other 20 respondents (with REBA scores of 4-7) fell into the moderate risk category. They were in Action level 3, indicating the need for improvement measures, although not as immediate as in the high-risk level.

In relation to Musculoskeletal Disorders (MSDs), the correlation with working posture can be influenced by several factors:

- a. **Non-Ergonomic Working Posture:** MSDs complaints can arise due to non-ergonomic working postures. For example, in the construction industry, workers often have to undergo unnatural positions, such as bending while mixing concrete or lifting heavy equipment. These positions can cause excessive pressure on the hips, lower back, and hand muscles due to improper placement. Awkward working postures like these can increase the risk of MSDs. It is important for workers to work in natural and ergonomic positions to prevent these complaints.
- b. **Non-Ergonomic Work Equipment:** Working posture is also closely related to the equipment used. The use of work equipment that is not supportive or comfortable can affect working posture. Replacing non-ergonomic work equipment with more comfortable and job-appropriate ones can help reduce the risk of MSDs.
- c. **Repetitive Working Postures:** Repetitive working postures, as in activities performed for extended periods, can lead to MSD complaints. Construction workers who often spend time standing and bending while working can experience repeated stress on certain body parts, such as the neck, lower back, and wrist muscles. This can increase the risk of musculoskeletal complaints.

To prevent and address MSD complaints, some control and improvement efforts that can be undertaken include:

- a. Substitution Actions: Replacing old work equipment or materials with safer and ergonomic alternatives. This includes adjusting the dimensions of tools to match workers' heights and contact angles.
- b. Management Engineering: Providing ergonomic education and training to workers so they understand the correct work postures and positions. This can help workers identify innovations and changes that can reduce the risk of work-related injuries.
- c. Administrative Management: Scheduling work and breaks in a balanced manner to reduce excessive exposure while working. Proper muscle stretching is also recommended to reduce muscle injuries.
- d. Healthy Lifestyle: Workers need to maintain a healthy lifestyle, including exercise and eating nutritious food, to improve stamina and body endurance while working.

Additionally, it is also important to match the workplace with the workers' positions to adhere to ergonomic principles to prevent musculoskeletal complaints (MSDs) (Tjahayingtyas,2019).

3.2.2. Correlation Between Smoking Habits and Musculoskeletal Disorders (MSDs) Complaints

Based on the results of a study involving 60 construction workers at the Dewi Sinta Residence project in Gunung Kidul Regency, it was found that 39 of them were smokers, while 21 others were non-smokers. The statistical analysis using the Chi-Square method showed that the p-value for the test was 0.03 (p value <0.05). These results indicate a correlation between the smoking habit and Musculoskeletal Disorders (MSDs). In this case, the Prevalence Ratio (PR) is 6.364 (95% CI; 1.963-20.625), indicating that smokers have a 6.364 times higher risk of experiencing Musculoskeletal Disorders (MSDs) complaints compared to non-smokers.

This research finding is in line with a study conducted by Putri (2020) on weavers at Lurik Kurnia Krapyak Wetan Sewon Bantul. The study also found a correlation between the smoking habit and Musculoskeletal Disorders (MSDs) complaints with a p-value of 0.035 (p value <0.05).

Furthermore, research conducted by Abdillahtulkhaer et al. (2022) on LPG filling workers showed that 55% of respondents who smoked experienced severe musculoskeletal disorders, while only 20% of non-smoking respondents experienced similar issues. The Chi-Square test in this study resulted in a p-value of 0.015 (p <0.05), indicating that the smoking habit was associated with Musculoskeletal Disorders (MSDs) among LPG filling workers.

These findings also support a study conducted by Sari (2020), which also found a correlation between the smoking habit and muscle disorders (MSDs) with a p-value of 0.026 (p <0.05). In this context, smoking was identified as a factor that could influence muscle and skeletal disorders (MSDs) in employees.

Overall, the results of this research indicate that the smoking habit can increase the risk of Musculoskeletal Disorders (MSDs) complaints among workers, and these findings are consistent with previous research that has documented a similar correlation between smoking and musculoskeletal disorders.

The research findings are further supported by the discoveries revealed in Hanif's (2020) on transport workers at UD Maju Makmur in Surabaya City. This research shows that there is a strong correlation between smoking habits and Musculoskeletal Disorders (MSDs) complaints. In the study, a correlation coefficient of 0.542 was found, indicating that individuals who smoke are more likely to experience back pain complaints compared to non-smokers. This can be explained by the adverse effects of excessive smoking, which can increase pressure on the abdomen and lead to tension in the back or spine. Therefore, reducing or quitting smoking early and improving physical fitness can be effective measures to reduce the risk of MSDs. However, these research findings are not consistent with previous research by Ningrum & Febriyanto (2021) on firefighters in the city of Bontang. This research indicates that there is no significant correlation between smoking habits and Musculoskeletal Disorders (MSDS) complaints in the firefighters' department. This is due to the fact that the number of smokers in the Bontang city firefighting department is still relatively low to moderate, with an average of 11 cigarettes per day and a minimum of 2 and a maximum of 21. According to the WHO, the low category is 1 to 10 cigarettes per day, the moderate category is 11 to 20 cigarettes per day, and the heavy category is more than 20 cigarettes per day (Sundari et al., 2018).

The correlation between smoking habits and Musculoskeletal Disorders (MSDs) complaints in Hanif's study (2020) is due to the fact that the majority of workers who smoked consumed 11-20 cigarettes per day, with an average smoking duration of 5-10 years. Additionally, the lack of health promotion in the workplace, especially in reducing active smoking among workers, also contributes to these results. Therefore, steps to control and improve health promotion in the workplace, such as banning smoking in the area and creating a comfortable working environment, can help curb smoking habits among workers in the workplace and reduce the negative impacts caused by smoking in the workplace.

According to Tarwaka (2015), smoking habit is one of the individual habits that increases a worker's vulnerability to Musculoskeletal Disorders (MSD) when he/she smokes intensively. This is due to the adverse effects of smoking on the physical health of workers, which potentially reduce their lung capacity to perform their functions effectively.

4. Conclusion

The conclusions of this research are as follows:

1. There is a correlation between working posture and musculoskeletal disorders among construction workers at the Dewi Sinta Residence housing project in Gunung Kidul.
2. There is a correlation between smoking habits and musculoskeletal disorders among construction workers at the Dewi Sinta Residence housing project.

Declaration

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