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Relationship between Work Posture and Musculoskeletal Disorders among Farmers in North Metro, Lampung Province

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ABSTRACT: Musculoskeletal disorders (MSDs) are a high prevalence health problem in the farming population with a significant impact on productivity and quality of life. This study aims to analyze the relationship between work posture and the risk of MSDs complaints in farmers in North Metro District, Lampung Province. This study used a cross-sectional design with quantitative analysis conducted in April-July 2025 on 329 farmers in North Metro District using *stratified random sampling* technique. The research instruments included *Nordic Body Maps* for MSDs screening and *Anthropometric Workplace Biomechanical Assessment* questionnaire for work posture assessment. The results of the *Nordic Body Maps* questionnaire showed 41.3% of respondents experienced a high risk of MSDs with a homogeneous distribution of complaints in all anatomical segments. Non-ergonomic work postures were mostly in the slightly high category (45.6%). The analysis showed that there was a relationship between work posture and the risk of *MSDs* complaints (*(p-value <0.005, OR 68.933, 95% CI 26.521-179.171)*). Comprehensive interventions through ergonomic modifications, optimal posture education, and lifestyle management are needed to mitigate the prevalence of MSDs in the farming population.

KEY WORDS: Ergonomics, Farmers, Musculoskeletal disorders.

INTRODUCTION

Musculoskeletal disorders (MSDs) are pathological conditions that affect the body's movement system, including muscles, joints, bones, and soft tissues that play a role in mobility and movement function. The clinical manifestations of these disorders are very diverse, ranging from low back pain, neck pain, to *carpal tunnel syndrome*, which can have a significant impact on the quality of life and productivity of individuals. In the context of ergonomics, MSDs have been identified as an occupational health problem whose prevalence continues to increase, especially in sectors that involve intensive physical activity such as agriculture. The significance of MSDs in a global perspective of public health cannot be ignored. According to World Health Organization (2022) musculoskeletal conditions are the largest contributor to *years lived with disability* (YLDs) worldwide with a contribution of approximately 149 million YLDs, accounting for 17% of all global YLDs. Epidemiological data shows that the prevalence of MSDs in the farming population is alarming. A comprehensive study conducted by Kongtawelert *et al.*, (2022) identified the prevalence distribution of MSDs in the agricultural sector with the most common anatomical locations in the low back (37.1%), knee (28.7%), shoulder (22.9%), wrist (19.9%), and hip (8.3%).

The Southeast Asian regional context shows a more complex picture regarding the prevalence of MSDs in farmers. A comprehensive study revealed that as many as 81.27% of farmers in Indonesia experience musculoskeletal complaints, indicating a much higher prevalence than the global average (Akbar *et al.*, 2023) . Regionally, Lampung Province recorded 47,525 cases of musculoskeletal complaints based on diagnosis according to the Lampung Provincial Statistics Agency, while at the local level, Metro City through the Metro City Health Office reported 4,625 cases diagnosed and undergoing outpatient care at primary health facilities in 2023 (Metro City Health Office, 2024) . The impact of MSDs on agricultural productivity has been the focus of attention in contemporary scientific literature. Longitudinal studies have demonstrated a significant correlation between MSDs and reduced work effectiveness of farmers (Rahdiana *et al.*, 2022) . There are studies identifying that farmers with MSDs experience substantial reductions in productivity, with implications not only on individual income but also on the stability of food security and local economies (Monoarfa *et al.*, 2023) . The urgency of addressing MSDs is all the more critical given the potential long-term impacts that can result in permanent disability in the farming population.

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Aspects of work posture are determinant factors in the pathogenesis of MSDs. This study identified that non-ergonomic work positions, such as *prolonged* lumbar flexion or *squatting* positions of long duration, result in excessive mechanical stress on the vertebral column and articular structures (Simanungkalit *et al.*, 2019) . The discomfort and potential injury caused by these improper postures show how important it is to design an ergonomic work environment. By understanding the negative impacts of poor working positions, we can take the necessary steps to minimize risks and improve worker health and productivity.

North Metro sub-district, Lampung Province, was selected as the research site based on its representative demographic and geographic characteristics for the farming population. According to the Metro City Statistics Agency, North Metro has the highest farmer population with 5,114 farmland users and *smallholders*, significantly higher than South Metro (3,432 farmers) and West Metro (2,345 farmers). Geographical conditions that support agricultural activities make this region ideal for epidemiological investigation of MSDs in farmers. The vitality of the agricultural sector in Indonesia's national economy cannot be denied. This study shows that the agricultural sector absorbs around 27.5% of the national workforce, making it one of the largest contributors in Indonesia's employment structure. At the regional level, Lampung Provincial Manpower Office (2024) reports that the agriculture sector absorbs 1.9 million workers, which is the highest compared to other business sectors. The importance of this sector in the context of food security and the national economy underlines the urgency to address health issues such as MSDs.

The Metro City Government's commitment in realizing a holistic healthy community is realized through various public health initiatives. The collaboration between the Metro City Agriculture and Fisheries Food Security Office and the Metro City Health Office in organizing the Agro Ceria Farmers Market demonstrates an integrative approach that combines the promotion of local agricultural products with public health programs, including healthy heart exercises and health screening for the community (Public Health Sector, 2023) .

RESEARCH METHODS

This study used a *cross sectional* design with a quantitative approach to analyze the relationship between work posture and complaints of *musculoskeletal disorders* (MSDs) in farmers in North Metro District, Metro City. *Cross sectional* design was chosen because it allows observation of independent and dependent variables in the same period of time, so as to provide a comprehensive picture of the relationship between variables at a certain point in time. The analytical method used was a quantitative approach to obtain objective and statistically measurable results.

The target population of this research is all farmers who are members of farmer groups in North Metro District Metro City as many as 1,849 people. The sample studied was farmers who are members of farmer groups in North Metro District who have or do not have a history of MSDs complaints. Inclusion criteria include farmers who are members of farmer groups in North Metro District and are willing to become respondents by signing *informed consent* to participate in the study. Meanwhile, the exclusion criteria included farmers with a history of fracture trauma, farmers with anatomical abnormalities in the bones, and farmers who used modern technology in the farming process. The sample size was determined using the Slovin formula with a *margin of error of* 5%. This formula was chosen because the study population is relatively small and to control the error rate in the study and is expected to provide an adequate sample size to achieve the desired level of confidence. Based on the calculation $n = N / (1 + N.e^2)$, with N = 1,849 and e = 0.05, the result obtained $n = 1,849 / (1 + 1,849 \times (0.05)^2) = 1,849 / 5.62 = 329$ respondents. The sampling technique uses *stratified random* sampling, which is a sampling technique used to determine the object to be studied stratified. Based on the sample calculation, the research sample amounted to 329 farmers spread across 4 villages in North Metro District with each different number of farmers. Sampling in each village was taken proportionally, namely Purwosari Village as many as 53 respondents (297/1,849 × 329), Purwoasri as many as 47 respondents (263/1,849 × 329), Banjarsari as many as 94 respondents (528/1,849 × 329), and Karangrejo as many as 135 respondents (761/1,849 × 329).

This research was conducted at the North Metro District Farmer Group in Metro City from April to July 2025. The selection of the research location was based on the characteristics of the area that has a large enough and representative population of farmers to describe the condition of farmers in the area.

The variables in this study consisted of independent and dependent variables. The independent variable in the study is work posture, and the dependent variable is the risk of MSDs complaints. Each variable has a clear and measurable operational definition to ensure consistency in data collection.

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Musculoskeletal complaints are defined as complaints in the skeletal muscles felt by farmers ranging from no pain to pain felt by farmers in the body area, calculated and categorized based on the risk level of the *Nordic Body Maps* (NBM) questionnaire into high risk (score 71-122), medium risk (score 50-70), and low risk (score 28-49) (Dewi, 2020). Work posture was measured using the *Anthropometric Workplace Biomechanical Assessment* (AWBA) method and categorized into high (score 3-4), slightly high (score 2), and moderate (score 1).

The source of data in this study is primary data obtained through filling out questionnaires conducted by giving questionnaire sheets directly to farmers who become respondents, with researchers previously explaining in advance the purpose of the study and guaranteeing the confidentiality of the respondents' identity in the study. The questionnaire used contains questions and assessments related to MSDs complaints and observations made by researchers related to posture using AWBA. Data analysis was performed with the Chi Square test on IBM SPSS Statistics 25 software to determine the relationship between work posture and the risk of MSDs complaints.

RESULTS

This study involved 329 farmers spread across four villages in North Metro District, Lampung Province. Analysis of respondent characteristics showed an interesting distribution in terms of the risk of *Musculoskeletal Disorders* (MSDs) complaints. A total of 41.3% of respondents (136 people) fell into the high risk category with a score of 71-112, followed by 58.7% of respondents (193 people) in the low risk category with a score of 28-70.

Table 1. Research Variables

Variable	n	%
Complaints of *Musculoskeletal Disorders* (*MSDs)*		
- High Risk: Score 71-112	136	41,3
- Low Risk: Score 28-70	193	58,7
Work Posture		
- High: Scores 3-4	93	28,3
- Medium : Score 1-2	236	71,7
Total	**329**	**100,0**

Most respondents' work posture was categorized as moderate (71.7%). Analysis of the distribution of musculoskeletal complaints using *Nordic Body Maps* showed a complex pattern of complaints and evenly distributed throughout the body. This study indicates that agricultural activities impose a comprehensive biomechanical load on the musculoskeletal system of farmers. The majority of respondents reported "slight pain" compared to the "pain" or "severe pain" categories, indicating a possible adaptation process to the chronic pain experienced.

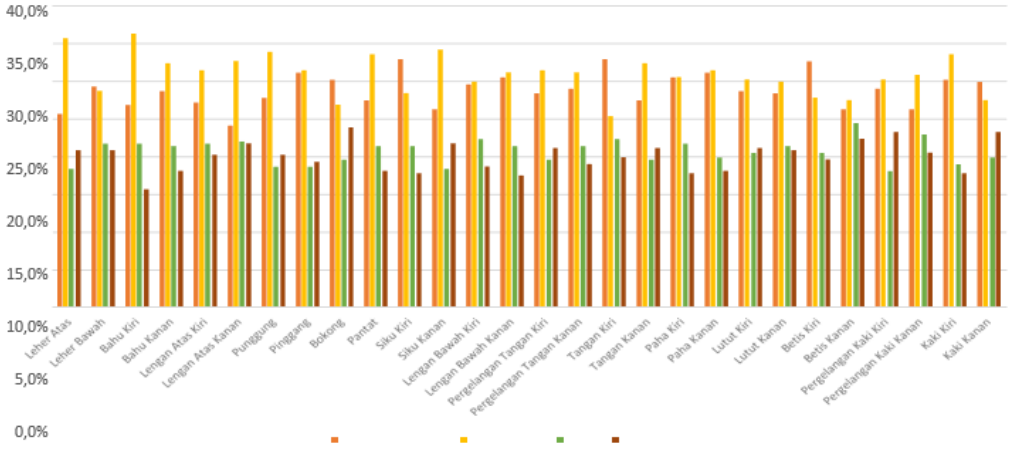

Figure 1: Percentage of Location of Musculoskeletal Disorders

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Complaints in the upper extremities showed a significant distribution, with the left shoulder reported as having "slight pain" by 36.2% of respondents (119 people), followed by the upper neck 35.6% (117 people), and the right shoulder 32.2% (106 people). The left and right upper arms were reported by 31.3% (103 people) and 32.5% (107 people) of respondents, respectively. This pattern is consistent with agricultural activities that involve repetitive movements of the upper extremities, such as hoeing, harvesting and lifting. Complaints in the back and waist areas showed a high prevalence, with back complaints reported by 33.7% of respondents (111 people) and waist complaints by 31.3% of respondents (103 people). The buttocks area also showed significant complaints with 33.4% of respondents (110 people). This study indicates a high biomechanical load on the *spine* and mid-body support structures due to unergonomic work postures in agricultural activities.

Lower limb complaints showed a relatively even distribution, with left and right thighs reported by 30.4% (100 people) and 31.3% (103 people) of respondents, respectively. The left and right knees showed similar prevalence with 30.1% (99 people) and 29.8% (98 people) of respondents. The right calf was reported by 27.4% of respondents (90 people), while the left and right ankles by 30.1% (99 people) and 30.7% (101 people) of respondents, respectively. The left foot showed complaints in 33.4% of respondents (110 people). This relatively even distribution pattern of complaints indicates that farming activities place a comprehensive burden on the entire musculoskeletal system. The absence of predominance of complaints in one particular body area indicates the complexity of exposure to risk factors in agricultural work. This study also found that the majority of respondents reporting "slight pain" may indicate a process of physiological adaptation to chronic pain, where the neuroperception system has adjusted pain thresholds as a *coping* mechanism.

Chi Square test on IBM SPSS Statistics 25 software to determine the relationship between work posture and the risk of MSDs complaints. The analysis results show that there is a relationship between work posture and the risk of MSDs complaints (*p-value* <0.005, OR 68.933, 95% CI 26.521-179.171).

Table 2. The relationship between work posture and the risk of MSDs complaints in farmers in North Metro District

	Risk of MSDs Complaints		Total (%)	*p-value*	OR	95% CI	
	High Risk	Medium Risk				*Low*	*Up*
Work Posture							
High	88	5	93	>0.001	68.933	26.521	179.171
Medium	48	188	236				
Total	43 (46,7)	49 (53,3)					

DISCUSSION

Musculoskeletal disorders (MSDs) are health problems that cause painful manifestations in the musculoskeletal system, covering a spectrum of complaints ranging from low back pain, cervical pain, to *carpal tunnel syndrome*. The highest prevalence of this condition is found in the farming population, as stated by Du *et al.* (2025) that the complaints experienced include various manifestations such as lumbar, knee, superior thoracic, and cervical pain that significantly impair work capacity. MSDs conditions in farmers contribute to decreased productivity which not only impacts individual economic aspects, but also has implications for food security and regional economic stability. This study revealed that farmers in North Metro sub-district demonstrated a relatively homogeneous pattern of complaints with a predominance of the "slight pain" category at various anatomical locations. This distribution indicates physiological adaptation or pain tolerance that has developed in the farmer population. This phenomenon contrasts with vegetable farmers who exhibit specific complaints due to prolonged bending postures. The variability of complaints correlated with commodity type and harvest methodology, with coconut farmers experiencing similar complaints with high workload and non-ergonomic postures.

Slouching posture can cause a significant increase in pressure on the intervertebral discs in the lower back. This study is in line with the results of research conducted by *Bausad et al.* (2023)) in Marioriawa District, Soppeng Regency, which is located in South Sulawesi Province. The study showed that the way a person works and the posture taken when doing activities have a real impact on the occurrence of musculoskeletal disorders (MSDs). When a person performs the same movements or positions repetitively every day, this can accelerate the degeneration process in the intervertebral discs.

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In the context of occupational health and safety, it is important to understand how poor posture can affect long-term health, especially in the back. Intervertebral discs serve as supports and shock absorbers between the vertebrae, and when excessive pressure is exerted on them, it can lead to serious problems such as disc herniation or chronic back pain. Research by Bausad et al. confirms that attention to good work posture is essential to prevent the development of MSDs that can impair a person's productivity and quality of life (Akbar *et al.* ., 2023)

It is important to provide education on correct posture techniques to farmers. Training programs that teach how to maintain good posture while working can help reduce the risk of injury. For example, correct lifting techniques, such as bending the knees and keeping the back straight, can reduce the load on the lower back *Rashidi-Molkesari et al.*, (2023) In addition, the use of assistive devices such as ergonomic paddy plows or tractor machines while working can help improve comfort and reduce the risk of injury.

CONCLUSION

It can be concluded that there is a relationship between work posture and the risk of musculoskeletal disorders in the population of farmers in North Metro District. The homogeneous distribution of complaints across anatomical segments of the body indicates a comprehensive biomechanical load from agricultural activities, with pain tolerance adaptation as a physiological coping mechanism.

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