The Relationship Between Work Posture and Musculoskeletal Disorders (MSDs) Among Photocopying Workers Around Muhammadiyah University Surakarta

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Abstract.

This study intends to evaluate the association between work posture and musculoskeletal disorders (MSDs) among copier workers around Muhammadiyah University Surakarta. The study used a quantitative approach with a cross-sectional design and was conducted in February 2025 at photocopying businesses located in several areas around the campus, namely Duwet Raya Street, Mendungan Street, Garuda Mas Street, Gatak 1 Street, Gatak 2 Street, and Menco Raya Street. Using total sampling technique, all 78 photocopying workers around Muhammadiyah University Surakarta were included, and 56 people were willing to participate in the study. Work posture was examined using the Rapid Entire Body Assessment (REBA) method to establish the level of ergonomic risk, whereas MSDs complaints were measured using the Nordic Body Map (NBM) questionnaire. Data analysis was performed univariately and bivariately using the Spearman Rank Correlation test with a significance threshold of 0.05. The results showed that most workers were in the low to moderate and high ergonomic risk categories, with the most prevalent MSDs complaints in the neck, back, waist, right wrist, and calves. The Spearman Rank test showed a significant, fairly strong, and unidirectional relationship between work posture and MSDs complaints (p-value = 0.000; r = 0.531), indicating that an increase in work posture risk was followed by an increase in musculoskeletal complaints among photocopying .

Keywords: *Ergonomics; MSDs; Nordic Body Map; Photocopier Workers and Work Posture.*

I. INTRODUCTION

The Global Burden of Disease (GBD) indicates that musculoskeletal problems impact roughly 171 million people globally and can affect all age categories, even in high-income nations and the Western Pacific and Southeast Asia areas [1], in line with the International Labor Organization's report noting an increasing trend in musculoskeletal disorders (MSDs) in various countries [2]. MSDs are considered a serious threat to labor productivity and economic growth, especially in the informal sector, which generally has limited knowledge and awareness of occupational risks [3]. In Indonesia, MSDs are classified as an occupational health problem, with a prevalence of 16% among workers in 12 districts/cities in Indonesia [4]. In general, MSDs risk factors include non-ergonomic work postures, repetitive movements, manual material handling, vibration, mechanical compression, exposure to extreme temperatures, and inadequate lighting [5]. Musculoskeletal Disorders (MSDs) are a group of disorders affecting the musculoskeletal system and can cause damage to tendons, ligaments, joints, and soft tissues [6]. Musculoskeletal disorders cause pain, stiffness, limited movement, and decreased individual function, both acute and chronic [7]. Manual work that requires high physical strength and endurance, especially involving repetitive movements and improper work posture, causes MSDs [8]. Improper work posture can cause musculoskeletal disorders and even long-term abnormalities in bone structure [9].

Improper work posture, such as bending over, increases the risk of musculoskeletal disorders (MSDs) [10]. The most common MSDs complaints among workers are in the back, neck, wrists, elbows, and legs [11] Work activities involve various postures, such as standing, sitting, walking, squatting, and bending, which are adapted to the task's characteristics. However, non-ergonomic working conditions and unsafe work practices can increase the risk of accidents and health problems, particularly musculoskeletal disorders (MSDs) [12]. For photocopying workers, job demands often include repetitive movements over long periods, using the same muscle groups, and require coordination of body posture and high levels of concentration to maintain work quality [6]. In addition, the need to maintain certain postures, such as lifting loads, bending

over, and standing in non-ergonomic positions for prolonged periods, can increase biomechanical load, thereby increasing the risk of MSDs among photocopying workers.Muhammadiyah University Surakarta (UMS) is one of the largest private universities in Indonesia, located in Central Java.

As part of the Muhammadiyah university network, UMS is highly committed to the development of Islamic-based education and has a large number of students and academic staff. With a large number of students, the demand for photocopying services around UMS is very high. Photocopying shops have proliferated in the UMS area to meet student needs, including printing and duplicating documents. Work in photocopying shops often involves non-ergonomic postures and repetitive movements, which, if performed daily, can increase musculoskeletal complaints.Musculoskeletal disorders (MSDs) among photocopying workers around Muhammadiyah University Surakarta were confirmed through interviews with four photocopying workers from three different shops, who reported performing repetitive movements every day, such as bending, standing, sitting, and lifting and moving documents. According to the workers' answers, they had pain and discomfort in their upper neck, back, and waist, which usually resulted from working eight to fifteen hours a day and executing repeated motions. Thus, this study is crucial for figuring out how posture and musculoskeletal problems (MSDs) are related among Muhammadiyah University Surakarta photocopying employees.

II. METHODS

This study examined the association between work posture and musculoskeletal disorders (MSDs) in photocopying employees at Muhammadiyah University Surakarta using a quantitative, cross-sectional design. It was conducted in February 2025 using a total sampling approach, covering all photocopying workers at Muhammadiyah University Surakarta, totaling 78 workers, of whom 56 were willing to participate in the study. The steps in this study were to obtain Ethical Clearance. After Ethical Clearance was issued, data collection was conducted among photocopy workers located on Duwet Raya Street, Mendungan Street, Garuda Mas Street, Gatak 1 Street, Gatak 2 Street, and Menco Raya Street. Data collection was carried out by administering the NBM (Nordic Body Map) questionnaire and documenting respondents while they were doing a Rapid Entire Body Assessment (REBA).

Work posture was positioned as an independent variable and measured using the ordinal-scale Rapid Entire Body Assessment (REBA) to identify the level of ergonomic risk with assessments covering the neck, back, legs, upper arms, forearms, and wrists, while MSDs as the dependent variable were measured using the Nordic Body Map (NBM) ordinal scale to map the level of musculoskeletal complaints consisting of 28 questions. Primary data were gathered through direct observation, questionnaire completion, and documentation undertaken after the respondents agreed to engage in the study, and were backed by secondary data from relevant literature. Work posture measurements were taken using the Rapid Entire Body Assessment (REBA) method, with angle measurements performed using the Angulus application. Data processing was performed using Excel and SPSS, and data analysis included univariate analyses to describe respondent characteristics and distributions of risk and complaints, as well as bivariate analyses using Spearman's Rank Correlation test with a significance level of 0.05 to examine the relationship between work posture and MSDs.

III. RESULT AND DISCUSSION

Research Location Description

This study was conducted at a number of photocopying businesses located around Muhammadiyah University Surakarta (UMS), specifically on Duwet Raya Street, Mendungan Street, Garuda Mas Street, Gatak 1 Street, Gatak 2 Street, and Menco Raya Street, which are administratively located in Pabelan Village, Kartasura District, Sukoharjo Regency, Central Java Province. This area is characterized by a high level of economic activity due to its proximity to a major university, which has encouraged the development of various service businesses, particularly photocopying. Geographically, Pabelan Village is bordered by Gonilan Village to the north, Ngadirejo Subdistrict to the west, Gumpang Village to the south, and Makam Haji Village and Surakarta City to the east. The strategic location also facilitates easy access for students and

the surrounding community, further supporting the sustainability of photocopying services in the area. In addition, photocopying businesses in this area generally operate with relatively long daily working hours and rely heavily on manual labor. Workers are commonly required to perform repetitive tasks, such as standing for extended periods, bending, lifting paper stacks, and operating photocopy machines in static or awkward postures. These working conditions potentially raise the risk of musculoskeletal problems. Limited attention to ergonomic work design and the absence of regular break times may further worsen physical strain among workers. Therefore, the selected research location is regarded relevant and typical for examining the association between working posture risk and musculoskeletal problems among copier workers.

Research Findings

Respondent Characteristics

Table 1. Characteristics of respondents

Respondent Characteristics	Number	Percentage (%)
Age		
17-22	12	21,43 %
23-29	22	39,29 %
30-35	11	19,64 %
36-41	7	12,50 %
42-47	4	7,14 %
Educational Level		
Junior High School/Equivalent	4	7,14 %
Senior High School/Equivalent	46	82,14 %
Higher Education	6	10,71 %
Length of Employment		
≤ 5 years	34	60,71 %
> 5 years	22	39,29 %
Working Hours		
≤ 8 hours/day	18	32,14 %
> 8 hours/day	38	67,86%

Source: Primary Data, 2025

This study was conducted around Muhammadiyah University Surakarta, involving 56 photocopy workers as respondents. Characteristic analysis showed that most respondents were in the productive age range of 23–29 years (39.29%), had a high school education or equivalent (82.14%), and had worked for ≤ 5 years (60.71%). The majority of workers also worked more than 8 hours per day (67.86%), a condition that can increase physical fatigue and the risk of musculoskeletal complaints, especially when activities are performed in non-ergonomic postures and repetitive movements without adequate rest periods.

Description of Research Variables

Table 2. Univariate Analysis of Working Posture and Musculoskeletal Disorders (MSDs) among Photocopy Workers

Variable	Category	Frequency	Percentage (%)
Working Posture	Low Risk	3	5.4
	Moderate Risk	38	67.9
	High Risk	15	26.8
Musculoskeletal Disorders (MSDs)	No Complaints	11	19.6
	Mild Complaints	40	71.4
	Moderate Complaints	5	8.9

The univariate analysis results show that most respondents fall into the moderate risk category, namely 38 people (67.9%). Meanwhile, 15 respondents were in the high-risk category and 3 in the low-risk category, while no respondents were in the no-risk or very high-risk categories.The results of the univariate analysis of musculoskeletal diseases using the Nordic Body Map (NBM) questionnaire suggest that most respondents (40, 71.4%) experienced minor discomfort. Eleven respondents reported no complaints, 5 reported moderate complaints, and none reported severe complaints.

Results of the Analysis of the Relationship between Working Posture Risk and Musculoskeletal Disorders Using the Spearman Rank Test

Table 3. Results of the Analysis of the Relationship between Working Posture Risk and Musculoskeletal Disorders

Work Posture Risk	Muskoloskeletal Disorders			Total	p-value	r
	None	Mild	Moderate			
Low Risk	2	1	0	3	0,000	0,531
Medium Risk	9	29	0	38		
High Risk	0	10	5	15		
Total	11	40	5	56		

A significant, moderately strong, and unidirectional relationship between work posture and musculoskeletal disorders (MSDs) complaints among photocopier operators was found by bivariate analysis using Spearman's rank correlation test ($r = 0.531$; $p = 0.000$), with an increase in work posture risk being linked to an increase in musculoskeletal complaints. The results reveal that 29 people are at moderate risk of work posture and mild musculoskeletal diseases.

Discussion

In assessing ergonomic risk, this study used the REBA (Rapid Entire Body Assessment) method, given that photocopying work involves the entire body. Most respondents were in the moderate work posture risk category and mild Musculoskeletal Disorders category, with a total of 38 people in the moderate work posture risk category and 40 people in the mild Musculoskeletal Disorders category. These findings confirm that more than half of workers require corrective measures to reduce work posture risks that could potentially cause musculoskeletal complaints.The predominance of moderate-risk work postures indicates that most photocopying workers perform work activities in positions that are not ergonomically sound, such as bending over, standing for long periods, sitting, and performing repetitive movements. This condition can lead to excessive pressure on the musculoskeletal system if performed continuously without improving work posture. MSDs reduce the body's ability to function, eventually causing pain, even though this disorder does not appear immediately [13]. This is in line with research by [14], which found that non-ergonomic work postures and prolonged static work positions are associated with increased musculoskeletal disorders. Work involving continuous, repetitive movements over a long length of time can injure joints, tendons, and ligaments and increase the risk of musculoskeletal disorders (MSDs) [15].Work involving specific physical activities, especially static, repetitive tasks, can lead to musculoskeletal complaints among workers.

Although the musculoskeletal complaints reported were predominantly mild, they already indicate discomfort and pain in the muscles and joints that require attention, as persistent mild complaints can develop into more severe conditions in the absence of ergonomic intervention due to prolonged static muscle loading that may damage tendons, ligaments, and joints [21]. The Nordic Body Map (NBM) results show that the most frequently reported complaints involved the neck, back, waist, right wrist, and calves, which are closely related to the characteristics of photocopying work, including static postures, bending, prolonged sitting or standing, and repetitive hand movements. Photocopying workers routinely operate machines and computers and organize documents for extended periods, exposing them to a higher risk of musculoskeletal complaints in these body regions [22]. These findings are consistent with previous studies that reported a significant relationship between work posture and musculoskeletal complaints among welding workers ($p = 0.005$) [16] and hospital nurses ($p = 0.011$) [17]. Although the complaints identified through the NBM were mostly classified as mild, long-term exposure may increase the severity of musculoskeletal disorders (MSDs) [18]. Furthermore, REBA assessment results indicate that sitting postures pose a higher ergonomic risk than standing postures, primarily due to the use of chairs without backrests, which fail to support the back and often result in hunched or unstable sitting positions. Similar findings were reported in garment workers, where high ergonomic risk exposure was associated with increased musculoskeletal complaints [19], and non-ergonomic workstation design has been shown to contribute to back, neck, and shoulder pain due to inadequate support and assistive facilities [20]. Overall, the REBA results strengthen the NBM findings, confirming that non-ergonomic work postures particularly prolonged sitting without back support are a major contributing factor to the occurrence of MSDs among photocopying workers.

In order to lower the risk of musculoskeletal disorders among workers, corrective measures must be implemented. The first is working hours in compliance with Law Number 11 of 2020 concerning Job Creation (Job Creation Law), which specifies two work hour schemes: a maximum of 7 hours per day and 40 hours per week for a 6-day workweek, or 8 hours per day and 40 hours per week for a 5-day workweek, both of which must be accompanied by sufficient rest periods. This provision aims to protect workers' health and safety, including preventing fatigue and musculoskeletal disorders (MSDs). The implementation of working hours in accordance with regulations, namely a maximum of 8 hours per day with regular breaks, is an important improvement to reduce physical workload, reduce the risk of MSDs, and improve the comfort and health of photocopying workers [23]. Second, Hierarchy of Control. Within the Hierarchy of Control, efforts to control the risk of musculoskeletal disorders (MSDs) among photocopy workers can be implemented through administrative controls, such as regulating workers' work patterns and working hours. Administrative controls that can be applied include rotating work every 2 hours to reduce exposure to static work postures and repetitive movements of the same muscle group, and providing 1 hour of rest during working hours in accordance with normal working hours.

Third: Ergonomic Chairs. The use of chairs with backrests is an important ergonomic improvement to reduce the risk of musculoskeletal disorders (MSDs), especially among photocopier workers, as chairs without backrests tend to cause a hunched sitting posture and increase static load on the back and waist muscles. In contrast, chairs with backrests provide support that helps maintain a more upright and stable posture, thereby reducing excessive pressure on the spine. Boxplot analysis identified two outlier values in respondents 8 and 48, which fall outside the whisker limits due to the relatively homogeneous data distribution and values outside the interquartile range. These outliers do not indicate measurement or data entry errors but reflect actual variations in field work posture conditions and are therefore retained in the analysis as they represent existing ergonomic risks.

IV. CONCLUSION

This study shows that the work posture of photocopying workers around Muhammadiyah University Surakarta, measured using the Rapid Entire Body Assessment (REBA) method, still shows exposure to ergonomic risks, ranging from low to high, indicating the potential for non-ergonomic work postures. The Nordic Body Map (NBM) questionnaire found that neck, back, waist, right wrist, and calves were the most common musculoskeletal problems. The Spearman Rank Correlation test revealed a significant, strong, and unidirectional relationship between work posture and musculoskeletal complaints in photocopying workers (p-value = $0.000 < 0.05$; $r = 0.531$).

As work posture risk increases, musculoskeletal complaints also tend to increase. However, this study has limitations in terms of the number of respondents and its cross-sectional design, which are unable to describe the long-term impact of work posture exposure. Therefore, improvements are recommended regarding regulations related to work schemes, the application of administrative control measures, and the provision of ergonomic chairs with backrests. Further research is expected to involve a larger sample and a longitudinal approach to obtain a more comprehensive picture of the risks and impacts of musculoskeletal disorders among photocopying workers.

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