Dela Fariha Fuadi - Work-Related Musculoskeletal Disorders (WMSDs) And Work Productivity Among University Employees: An Exploratory Cross- Sectional Study

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Work-Related Musculoskeletal Disorders (WMSDs) And Work Productivity Among University Employees: An Exploratory Cross-Sectional Study

Abstract

Study purpose: Work-related musculoskeletal disorders (WMSDs) are highly prevalent among office workers and have been associated with reduced work productivity. However, evidence examining both ergonomic risk and work productivity simultaneously among university employees remains limited, especially in developing countries. This study aimed to identify potential risk factors for WMSDs and examine their association with work productivity among university employees.

Materials and methods: This exploratory cross-sectional study involved 30 university employees selected through purposive sampling. WMSDs were assessed using the Nordic Body Map (NBM), and productivity (including absenteeism and presenteeism) was measured with the World Health Organization-Health and Work Performance Questionnaire (HPQ). Ergonomic risk was evaluated using the Rapid Office Strain Assessment (ROSA). Data were analyzed with descriptive statistics, as well as Fisher's Exact and Mann-Whitney U tests ($p<0.05$).

Results: The most common WMSDs were low back pain (LBP) (70%), upper neck pain (UNP) (66.7%), and right shoulder pain (RSP) (53.3%). Ergonomic risk was significantly associated with LBP ($p=0.021$). UNP was associated with lower work performance ($p=0.038$) and increased absenteeism ($p=0.013$), while LBP was also associated with higher absenteeism ($p=0.037$).

Conclusions: These findings suggest that WMSDs, particularly in the neck and lower back, are associated with reduced work productivity. Improving workplace ergonomics may help reduce these issues and enhance work performance.

Keywords: Work-related Musculoskeletal Disorders; absenteeism;

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Introduction

Work-related musculoskeletal disorders (WMSDs) are the most significant health issues among occupational problems, especially in office workers who engage in prolonged sedentary activities and adopt poor ergonomic postures, with reported global prevalence exceeding 70% (Geto et al., 2025; Okezue et al., 2020). These disorders are a leading cause of pain, functional limitations, and decreased productivity in the workplace (Ibrahim & Gaafar, 2024). WMSDs are conditions that affect the musculoskeletal system and are caused or exacerbated by the work environment (Greggi et al., 2024). In office environments, these complaints are commonly associated with prolonged computer use for more than three hours. They are also related to repetitive tasks like typing, and awkward postures, including slouching, forward head posture, elevated shoulders, or excessive wrist bending. Over time, these factors can generate muscle tension that may lead to injury (Iram et al., 2022; Mohammadipour et al., 2018).

WMSDs often receive less attention from employers compared to workplace accidents due to their less visible consequences. However, these disorders can negatively affect workers well-being, productivity, and overall social sustainability in the workplace (Zakariyyah et al., 2025). These conditions are largely related to ergonomic hazards in the workplace. According to the Regulation of the Ministry of Health of the Republic of Indonesia number 48 of 2016, offices, like any other workplace, are exposed to various environmental hazards that can impact employees' safety and health (Menteri Kesehatan Republik Indonesia, 2016). Workplace hazards include physical, chemical, biological, ergonomic, and psychosocial risks (Oakman et al., 2022). Each hazard should be properly identified and assessed to determine the level of risk (Anderson et al., 2020; Jackson et al., 2022).

However, many employers still consider office work to be relatively low risk compared to industries such as manufacturing or construction, where workers are more obviously exposed to heavy equipment and injury risks (Enya et al., 2020; Hunter & Silverstein, 2014; NOH et al., 2023). Office workers frequently experience WMSDs in the neck, shoulders, lower back, and wrists (Okezue et al., 2020). These issues typically manifest as discomfort or pain. Neck pain is often related to sitting for long periods without proper neck support. Shoulder complaints usually involve pain around the shoulders and upper back, especially when the shoulder is held in a static abduction position. Lower back pain is commonly linked to poor lumbar support from the chair and is one of the most frequent complaints among office workers, whose work mainly involves prolonged sitting (Basakci Calik et al., 2020). Another common issue is wrist and palm pain, known as Carpal Tunnel Syndrome (CTS). It's usually characterized by tingling and numbness in the wrist and the first to third fingers. The prevalence of CTS related to office work has been reported to be around 5-7% (Berhimpon et al., 2023). Besides their effects on workers' health, WMSDs also significantly impact work productivity, resulting in increased absenteeism (Ibrahim & Gaafar, 2024) and reduced on-the-job performance, known as presenteeism (Campo & Darragh, 2012). Absenteeism refers to employees being absent from work, including taking sick leave due to physical or mental health condition. While presenteeism refer to a condition in which employees continue working despite experiencing physical or psychological health problems that may reduce their work performance (Nowrouzi-Kia et al., 2025). Workers who continue working despite feeling physically or mentally unwell tend to have decreased ability, lower concentration, and less engagement in tasks. Common health issues linked to this include musculoskeletal problems, allergies, digestive disorders, sleep disturbances, and mental health concerns. A study by (Tangchareonsamut et al., 2022) found that presenteeism is more strongly associated with decreased work performance than absenteeism. Based on the points discussed above, this study aims to provide an initial overview of potential risk factors for WMSDs and their relationship with work productivity among university employees. Using an exploratory approach, the study seeks to describe how individual and work-related factors contribute to WMSDs and how these conditions may influence productivity. The findings are expected to serve as a foundation for future research and the development of workplace interventions in academic settings.

Materials and methods

Study participants

This study included 30 employees from a University in Jakarta, selected through purposive sampling based on their availability and willingness to participate. Participants were eligible if they worked as lecturers or administrative staff, used a computer or laptop as part of their daily work activities, and had experienced musculoskeletal discomfort or pain in at least one body region related to their working posture or job activities. All participants were aged 18 years or older and provided informed consent before participating in the study.

Participants were excluded if they had a recent history of acute musculoskeletal injury or trauma within the past six months, had neurological or systemic conditions affecting the musculoskeletal system, were on extended leave during the data collection period, or completed the questionnaire incompletely. Information on individual and work-related characteristics was collected using a structured questionnaire to provide a general profile of the participants.

Study organization

An exploratory cross-sectional design was used, and the study was carried out between February and April 2025. Data were gathered through a combination of interviews, direct workplace observation, and ergonomic assessment. WMSDs were assessed using the Nordic Body Map (NBM), while work productivity (absenteeism and presenteeism) was measured using the World Health Organization-Health and Work Performance Questionnaire (HPQ). The HPQ has been shown to be a valid instrument for measuring absenteeism and presenteeism, with strong correlation with health indicators and effectiveness in assessing the impact of health on work productivity (Kessler et al., 2003; Scuffham et al., 2014).

Ergonomic risk was evaluated using the Rapid Office Strain Assessment (ROSA) as shown in Figure 1. ROSA is a validated observational tool for identifying ergonomic risk in the office environment. It evaluates the placement of the chair, monitor, keyboard, mouse, and peripherals, with higher scores indicating greater ergonomic risk. Previous studies have demonstrated that ROSA has good construct validity and sensitivity to ergonomic intervention (de Barros et al., 2022) as well as fair to excellent reliability with ICC values ranging from 0.67 to 0.86, indicating consistent assessments across raters (Liebregts et al., 2016).

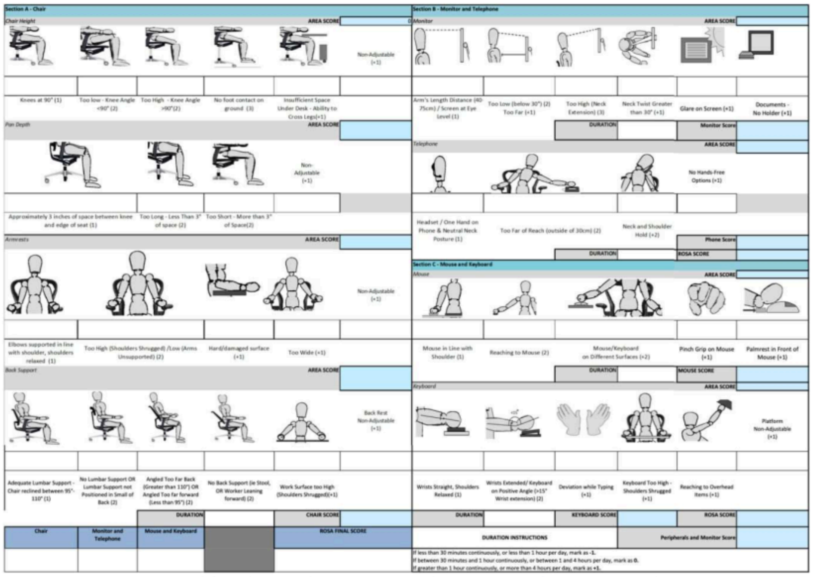

Figure 1. Rapid office strain assessment instrument (de Barros et al., 2022)

Statistical analysis

Participant characteristics and study variables were summarized using descriptive statistics. Associations between categorical variables were examined using Fisher's exact test, while differences in work productivity between groups were analyzed using the Mann-Whitney U test. A p-value of less than 0.05 was considered to indicate statistical significance.

Results

This study included 30 participants, consisting of 24 females (80%) and 6 males (20%). The participants were lecturers (70%) and administrative staff (30%), with most of their work involving prolonged sitting and laptop use. In terms of nutritional status, the majority of participants were classified as overweight (53.3%, n=16), followed by normal (36.7%, n=11) and obesity class I (10%, n=3). For analysis, nutritional status was further categorized into normal (36.7%, n=11) and abnormal (63.3%, n=19). The majority of participants were non-smokers (93.3%) and were under 35 years of age (60%).

Table 1. Descriptive Analysis

No	Characteristic	n (%)	Mean ± SD
1	Gender		
	Female	24 (80)	-
	Male	6 (20)	
2	Nutritional Status		
	Normal	11 (36.7)	-
	Abnormal	19 (63.3)	
3	Smoking Habit		
	Smoking	2 (6.7)	-

	Not Smoking	28 (93.3)	
4	Age	-	35.96±9.02
5	Ergonomic Risk Total	-	4.73±2.04
	Section A	-	4.73±2.05
	Section B		2.23±0.82
	Section C		2.10±0.80
6	Length of Employment	-	6.43±7.07
7	Sitting Duration	-	6.25±1.48
8	Upper Neck Pain (UNP)		
	No Pain	10 (33.3)	-
	Pain	20 (66.7)	
9	Lower Neck Pain (LNP)		
	No Pain	16 (53.3)	-
	Pain	14 (46.7)	
10	Left Shoulder Pain (LSP)		
	No Pain	20 (66.7)	
	Pain	10 (33.3)	-
11	Right Shoulder Pain (RSP)		
	No Pain	14 (46.7)	-
	Pain	16 (53.3)	
12	Right Upper Arm Pain		
	No Pain	24 (80)	-
	Pain	6 (20)	
13	Left Wrist Pain		
	No Pain	25 (83.3)	-
	Pain	5 (16.7)	
14	Right Wrist Pain		
	No Pain	21 (70)	-
	Pain	9 (30)	
15	Upper Back Pain (UBP)		
	No Pain	19 (63.3)	-
	Pain	11 (36.7)	
16	Low Back Pain (LBP)		
	No Pain	9 (30)	-
	Pain	21 (70)	
17	Gluteal Pain		
	No Pain	19 (63.3)	-
	Pain	11 (36.7)	
18	Absenteeism	-	0.93±0.79
19	Presenteeism	-	8.07±0.94

According to the ROSA assessment, the evaluation is divided into three sections: Section A assessed the chair and armrest; Section B assessed the monitor and telephone, and Section C assessed the mouse and keyboard. Section A contributed the highest score Table 1, mainly because most chairs lacked proper lumbar support, neck support, and had insufficient seat depth. The mean of ergonomic risk score assessed using ROSA was 4.73±2.04, indicating a moderate level of ergonomic risk approaching the high-risk category Table 1.

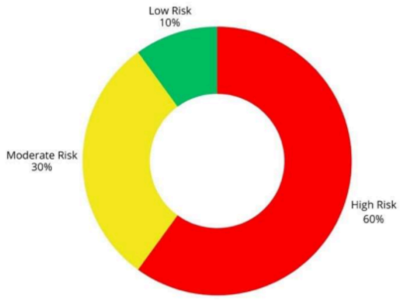

Figure 2. Distribution of ergonomic risk levels based on ROSA assessment

In total, 3 participants (10%) were classified as low risk, 9 participants (30%) as moderate risk, and 18 participants (60%) as high risk Figure 2. Most participants had less than 5 years of work experience (73.3%, n=22), with an average of 6.43±7.07 years. All participants reported sitting for more than 2 hours daily, with an average of 6.25±1.48 hours.

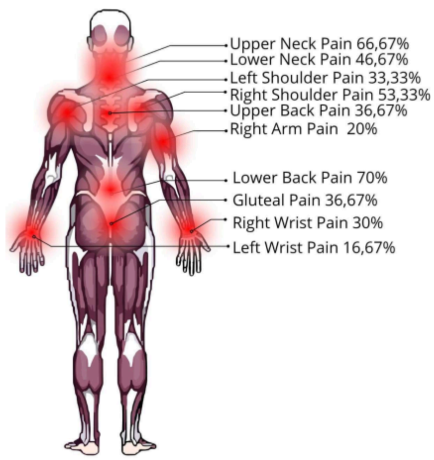

Figure 3. Distribution of WMSDs based on affected body regions

The most commonly reported WMSDs were LBP (70%), UNP (66.7%), and RSP (53.3%). These three complaints exceeded 50%, indicating that they are the primary sites of WMSDs among participants. Although less common, participants also reported other complaints such as lower neck pain, left shoulder pain, back pain, right upper arm pain, buttock pain, and pain in both wrists Figure 3. This suggests that the disorders are not limited to a single area but tend to involve multiple body regions. This may be associated with prolonged exposure to static postures and suboptimal ergonomic workstation setups during work activities.

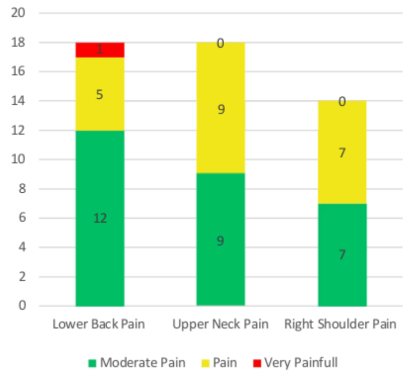

Figure 4. Severity of pain experienced in the three main locations

Figure 4 illustrates the pain intensity distribution across the three most commonly reported sites. LBP appears to be the most severe, with 1 participant reporting very severe pain, 5 reporting pain, and 12 reporting moderate pain. In contrast, none of the participants reported very severe pain in UNP or RSP. In both these regions, the number of participants experiencing pain and moderate pain was evenly distributed.

Table 2. Association between individual and occupational risk factors and WMSDs

Risk Factor	WMSDs		
	UNP	RSP	LBP
	p-value	p-value	p-value
Gender	1.000	0.457	0.704
Age	1.000	0.457	0.704
Smoking Habit	1.000	1.000	1.000
Nutritional Status	0.702	0.707	1.000
Ergonomic Risk	1.000	0.440	**0.029**
Length of Employment	0.440	0.484	1.000
Sitting Duration	0.333	0.467	0.300

Statistical analysis was performed using Fisher's Exact test with a significance level of α=0.05

The results of the bivariate analysis using Fisher's exact test showed that most individual factors, including gender, age, smoking habit, and nutritional status, were not significantly associated with WMSDs in the UNP, RSP, and LBP ($p>0.05$) Table 2. These findings suggest that, in this study sample, individual factors did not have a clear role in the occurrence of WMSDs, possibly due to the limited sample size. Similarly, occupational factors such as length of employment and sitting duration were not significantly associated with WMSDs.

In contrast to previous findings, a significant association was observed between ergonomic risk and LBP ($p=0.029$). This finding suggests that ergonomic factors may contribute to the occurrence of WMSDs, particularly LBP. Considering the preliminary nature of this study, the results should be interpreted with caution. Further studies with a more robust design and larger sample sizes are needed to confirm these findings.

Table 3. Association between WMSDs and work productivity (absenteeism and presenteeism)

Variable	Group	Presenteeism (Mean ± SD)	p-value	Absenteeism (Mean ± SD)	p-value
UNP	No	8.50±0.26		0.50±0.50	
	Yes	7.85±0.21	**0.038**	6.10±2.13	**0.013**
RSP	No	8.14±0.25		4.57±2.60	
	Yes	8.00±0.25	0.615	3.93±1.70	0.612
LBP	No	8.44±0.33		0.89±0.89	
	Yes	7.90±0.19	0.136	5.67±2.04	**0.037**

Statistical analysis was performed using the Mann-Whitney test with a significance level of α=0.05

This study also examined the association between WMSDs and work productivity, measured through presenteeism and absenteeism Table 3. The analysis revealed a significant difference in presenteeism scores between participants with or without UNP (p=0.038). The average presenteeism score was higher among participants without UNP (8.50±0.26) compared to those with UNP (7.85±0.21), indicating decreased work performance in individuals with this issue. Meanwhile, no significant differences in presenteeism were observed between participants with and without RSP (p=0.61) or LBP (p=0.136), though descriptively, those with complaints tended to perform worse. These findings suggest that WMSDs, especially in the neck area, may have a greater impact on work performance than those in other regions.

Discussion

This study highlights that WMSDs are common among university employees, with LBP, UNP, and RSP emerging as the most affected areas. Ergonomic risk levels were generally moderate to high, suggesting that many participants worked in suboptimal workstation conditions. The findings suggest that the chair and armrest contributed the highest scores, mainly because most chairs lacked proper lumbar and neck support, as well as sufficient seat depth. These conditions reduce support for the neck and back muscles, requiring them to work harder to maintain posture. Previous studies have shown that prolonged sitting in poor posture increases activation of neck and back muscles, which can lead to muscle fatigue, pain, and discomfort. In contrast, chairs that better support the natural lumbar curve have been shown to reduce muscle load and alleviate pain (Akbar et al., 2025; Park & Kim, 2022).

Most participants used a laptop with the screen positioned below eye level, resulting in a downward neck posture (neck flexion). This condition increases the risk of neck muscle pain, which aligns with the high prevalence of UNP observed in this study. Neck pain may be associated with poor sitting posture, particularly prolonged neck flexion, which can increase biomechanical load on the cervical spine and lead to continuous muscle contraction and fatigue. In addition, prolonged static flexion may increase cervical erector spine muscle activity and contribute to neuromuscular changes that can become risk factor for neck pain (Mousavi-Khatir et al., 2016; Septadina et al., 2025). Continuous activation of type I muscle fibers during low-intensity, long-duration activities may lead to the accumulation of calcium (Ca^{2+}), impair muscle homeostasis due to reduced local blood flow, and activate nociceptors caused by intramuscular shear stress. Nociceptors transmit pain signals via C fibers (unmyelinated, <2µm in diameter, conduction velocity <2m/s) and A∂ fibers (myelinated, 2-5 µm in diameter, conduction velocity up to 30 m/s), which are processed by the central nervous system and perceived as pain (Nikolenko et al., 2022). Activation of nociceptors serves as a warning signal of abnormal physiological conditions, underscoring the importance of identifying the underlying cause of pain. Improving workstation setup, such as adjusting screen height, using an appropriate chair and head support, and maintaining proper posture, may help reduce neck strain (Yadegaripour et al., 2021). Although the prevalence of wrist pain was below 50%, it affected both sides and may be linked to awkward wrist posture, as observed and assessed using ROSA. During typing, the wrist joint was kept in dorsiflexion, and the duration of work was also considered in this assessment.

Office work typically involves prolonged sitting and continuous use of a computer or laptop, often lasting 2-3 hours at a time and accumulating to around 6-8 hours per day. Such conditions require muscles to remain in a static position for extended periods, thereby increasing biomechanical load on muscles and joints. Over time, this may lead to microtrauma in muscles and soft tissues, as sustained muscle contraction can reduce blood flow, promote the accumulation of metabolites such as lactic acid, and accelerate muscle fatigue. These processes may also increase the risk of the structural damage to muscle and connective tissue (Dong et al., 2022). Collectively, these mechanisms contribute to the development of muscle pain. Although previous studies have reported that longer working hours are associated with an increased risk of WMSDs (OR=1.11; 95% CI=1.08-1.14) (Amiri, 2023) and greater severity of WMSDs (Patra et al., 2026), this study was unable to demonstrate such associations statistically, which may be due to the relatively uniform exposure among participants.

The findings also point to a possible role of ergonomic factors in LBP, while both UNP and LBP appear to be linked to reduced work productivity, in terms of both performance and absence from work. In particular, UNP seems to have more pronounced impact on work performance, although a general tendency toward reduced productivity was also observed in other affected regions. Neck pain can result from poor neck posture, such as bending the head forward for extended periods while using a computer. This position increases stress on the upper cervical joints and may cause compensatory changes in the shoulder, leading to an imbalance in neck muscle activity (Shah et al., 2024). Consequently, muscle tension can develop, disrupting blood flow in the cervical muscles and causing poor circulation (Kanda et al., 2022), as well as accumulating metabolites that intensify pain.

Additionally, these muscle issues may trigger neurogenic inflammation and peripheral sensitization, potentially causing primary headaches (Sollmann et al., 2023). Therefore, neck pain not only affects the local area but can also decrease work productivity by impairing concentration due to headaches. In addition to affecting concentration and performance, WMSDs can lead to absenteeism. The analysis demonstrated significant differences in absenteeism among participants with UNP and LBP with those experiencing WMSDs taking more days off. This aligns with previous research indicating that work absence is affected by physical workload and pain perception, with upper and lower back pain being the most common complaints (Mokhasi, 2022). The severity of pain across the three main WMSD locations, LBP was the most prevalent complaint, followed by UNP and RSP. Most participants reported moderate to severe pain. High pain intensity has been identified as an important prognostic factor influencing the duration of absenteeism, particularly in cases of LBP. Prior studies demonstrate a dose-response relationship between musculoskeletal pain intensity and the risk of long-term work absence, suggesting that reducing pain levels may help prevent absenteeism (Lötters & Burdorf, 2006; Skovlund et al., 2023).

Overall, absenteeism and reduced work productivity are complex issues. They are influenced not only by WMSDs but also by other factors, including individual characteristics (such as age and absence history), psychosocial factors (such as recovery expectations and perceptions of work), and workplace systems and policies (Wynne-Jones et al., 2025). Therefore, while this study found an association between WMSDs and both absenteeism and presenteeism, the analysis focused primarily on physical aspects and did not account for other potential influencing factors. This limitation opens opportunities for future research to explore these multidimensional factors more thoroughly, enhancing our understanding of the determinants of absenteeism and presenteeism and aiding in the development of more effective interventions.

This study has several limitations. First, the small sample size may limit the generalizability of the findings. Second, the cross-sectional design does not allow causal inference. Third, multivariable analysis was not performed due to the limited sample size. Finally, the use of self-reported measures may introduce response bias.

Conclusions

This study demonstrates that WMSDs are a common problem among university employees, mainly affecting the lower back, neck, and shoulders. Ergonomic risk factors may contribute to the development of WMSDs, especially in cases of LBP. Additionally, WMSDs are associated with reduced work productivity, with UNP affecting both presenteeism and absenteeism, while LBP is linked to increased absenteeism. These findings highlight the importance of ergonomic interventions and proper management of WMSDs to enhance both worker health and productivity.

Based on these findings, several practical ergonomic strategies may help reduce WMSDs in the workplace. For employees who work primarily using laptops, the screen height should ideally be positioned at eye level to avoid prolonged neck flexion. This may be achieved by using a laptop stand and combined with an external keyboard and mouse. In addition, the use of chairs with adequate lumbar, neck, and arm support may help improve posture and reduce muscle strain during prolonged sitting. If replacing office chairs is not feasible, regular stretching every 2-3 hours during work may serve as practical alternative. Stretching exercises may focus on the neck, wrist, and lower back muscles, which were the most commonly affected regions in this study. Furthermore, simple movements such as standing up, walking around the room periodically, and maintaining adequate hydration may help improve circulation and reduce the accumulation of muscle metabolites associated with prolonged static posture.

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Conflict of interest

The authors declare no conflict of interest. The funding sponsors had no role in the design of the study, the collection, analysis, or interpretation of data, the writing of the manuscript, or the decision to publish the results.

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