



The Physical Activity Levels and Musculoskeletal Disorders in Semarang City Health Service Employees

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ABSTRACT

Modern occupational environments characterized by prolonged sitting, repetitive work activities, and limited movement may increase the risk of musculoskeletal disorders (MSDs) among employees. Physical activity is considered an important factor in maintaining physical fitness and reducing occupational health problems; however, evidence regarding its relationship with MSDs remains inconsistent. This study aimed to analyze the levels of physical activity and musculoskeletal disorders among employees of the Semarang City Health Service and to determine the relationship between these variables. This research employed a quantitative descriptive method with a correlational approach. Sampling was conducted using probability sampling with a proportionate stratified random sampling technique. A total of 64 respondents participated in the study. Data were collected using the Global Physical Activity Questionnaire (GPAQ) and the Nordic Body Map (NBM) instruments. Statistical analysis was performed using IBM SPSS Statistics, including descriptive analysis, the Kolmogorov-Smirnov normality test, and the Chi-Square test. The results showed that most respondents had moderate physical activity levels (51.6%), followed by high (40.6%) and low (7.8%) categories. MSD complaints were predominantly classified as low (68.8%) and moderate (31.3%), with no respondents in the high category. The most frequent complaints occurred in the lower neck, upper neck, and back regions. Furthermore, the Chi-Square test indicated no significant relationship between physical activity levels and musculoskeletal disorders ($p = 0.800$). It can be concluded that physical activity level is not significantly associated with MSD occurrence among employees. Therefore, other factors such as work posture, ergonomic conditions, and occupational habits should be considered in musculoskeletal disorder prevention efforts.

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INTRODUCTION

The rapid transformation of modern workplaces has significantly changed the pattern of occupational activities performed by employees. Advances in technology, digital administration systems, and organizational demands for efficiency have increased sedentary behavior among workers, particularly in office-based occupations. Employees



in government institutions and administrative sectors are increasingly required to spend prolonged periods sitting, operating computers, processing documents, and performing repetitive tasks with limited body movement. Although these work patterns improve administrative productivity, they also contribute to various occupational health problems, especially reduced physical activity levels and the emergence of musculoskeletal disorders (MSDs) (Romadhoni et al., 2022; Bull et al., 2020).

Physical activity is recognized as an essential component in maintaining physical fitness, mental well-being, and overall quality of life. According to the World Health Organization (WHO), adults aged 18–64 years are recommended to engage in at least 150 minutes of moderate-intensity physical activity per week to maintain cardiovascular health, musculoskeletal endurance, immune function, and psychological well-being (Bull et al., 2020). However, the reality of modern occupational settings demonstrates that many employees fail to achieve these recommendations due to long working hours, static work postures, and limited opportunities for movement during office activities. This condition is particularly evident among formal-sector employees whose work activities are predominantly administrative and computer-based.

Low levels of physical activity among workers are closely associated with the increasing prevalence of Musculoskeletal Disorders (MSDs). MSDs refer to disorders affecting muscles, tendons, ligaments, joints, cartilage, nerves, and supporting blood vessels, often characterized by pain, stiffness, reduced range of motion, numbness, and functional impairment (Nadiyah et al., 2025). These disorders commonly arise from repetitive movements, prolonged static postures, ergonomic mismatch, and insufficient physical conditioning. Employees who maintain improper sitting positions for extended periods frequently experience discomfort in the neck, shoulders, lower back, wrists, and lower extremities (Wildasari & Nurcahyo, 2023).

Globally, MSDs have become one of the most dominant occupational health issues. The Labour Force Survey (LFS) in the United Kingdom reported approximately 469,000 workers suffering from work-related MSDs during 2017–2018 (Grabara, 2023). Similarly, the WHO identified MSDs as one of the leading causes of work absenteeism and reduced productivity worldwide, contributing substantially to disability-adjusted life years and occupational inefficiency (Yosineba et al., 2020). Although MSDs rarely cause mortality, their long-term consequences negatively affect workers' quality of life, job satisfaction, physical performance, and institutional productivity.

In Indonesia, the prevalence of sedentary lifestyles and occupational MSD complaints has also increased, especially among office employees in government institutions. Health service employees represent a population with unique occupational characteristics. Despite working within the healthcare sector, many administrative health employees still engage in prolonged sitting, repetitive documentation tasks, and inadequate physical activity. Consequently, they are potentially vulnerable to musculoskeletal complaints. However, studies focusing specifically on the relationship between physical activity levels and MSDs among health service employees in Indonesian urban settings remain limited, including in Semarang City.

Recent studies have increasingly emphasized the relationship between occupational physical activity and musculoskeletal health. Several international studies reported that insufficient physical activity contributes to poor musculoskeletal adaptation, reduced muscle endurance, and increased vulnerability to MSD symptoms among office workers (Andersen et al., 2021; Cillekens et al., 2022; Oakman et al., 2023). Sedentary occupational behavior has also been associated with chronic neck pain, lower back pain, and shoulder discomfort due to sustained static loading and limited muscle recovery (Parry & Straker, 2019; Shariat et al., 2020).

Ergonomic factors are considered one of the strongest predictors of MSD occurrence. Workers exposed to awkward body postures, repetitive movements, and prolonged sitting positions are more likely to develop musculoskeletal complaints (Wildasari & Nurcahyo, 2023). Poor workstation design, inadequate seating support, and improper monitor positioning contribute significantly to neck and lumbar strain (Janwantanakul et al., 2021). In addition, psychosocial stress and high workload intensity may exacerbate muscle tension and increase pain perception among employees (Santos et al., 2022).

Several studies in Indonesia have investigated MSD prevalence among workers in various sectors, including office employees, factory workers, healthcare professionals, and educators. Research by Puspitasari et al. (2021) found that lower physical activity levels were significantly associated with increased musculoskeletal complaints among office workers. Similarly, Putu Wulan Aristina Dewi et al. (2026) reported that employees with moderate-to-low physical activity levels experienced higher MSD prevalence compared with physically active workers. These findings indicate the protective role of physical activity in maintaining musculoskeletal function and occupational health.

From a physiological perspective, regular physical activity improves muscular strength, joint flexibility, blood circulation, and neuromuscular coordination, thereby reducing biomechanical stress during occupational activities (Warburton & Bredin, 2017). Physical activity also enhances metabolic efficiency and postural endurance, which are important for workers performing static tasks for prolonged durations (Booth et al., 2021). Therefore, adequate physical activity may act as a preventive mechanism against the development of MSDs.

Conversely, several studies have demonstrated inconsistent findings regarding the relationship between physical activity and MSDs. Research conducted by Fiqrillah Wirayudha and Wahyuni (2022) reported no significant relationship between physical activity and musculoskeletal complaints among workers. Likewise, Nazhira et al. (2024) concluded that physical activity alone may not directly influence MSD incidence because ergonomic, psychosocial, and occupational factors also contribute substantially to musculoskeletal symptoms. These inconsistent findings indicate that the relationship between physical activity and MSDs remains complex and multifactorial.

Furthermore, previous studies have predominantly focused on industrial workers, healthcare practitioners, manufacturing employees, or students, while limited attention has been directed toward administrative health service employees. This occupational

group has distinct characteristics due to their dual exposure to administrative workload and healthcare-related occupational demands. Therefore, examining the interaction between physical activity levels and MSDs in this population is highly relevant for occupational health promotion and preventive workplace interventions.

Although numerous studies have explored MSDs and occupational health, several important gaps remain unresolved. First, previous research has produced inconsistent findings regarding the association between physical activity and musculoskeletal disorders. Some studies indicate a significant relationship between insufficient physical activity and increased MSD risk (Puspitasari et al., 2021; Putu Wulan Aristina Dewi et al., 2026), whereas others demonstrate no significant correlation (Fiqrillah Wirayudha & Wahyuni, 2022; Nazhira et al., 2024). These contradictory findings indicate the need for further empirical investigation using different occupational populations and contextual settings.

Second, most previous studies have concentrated on industrial laborers, healthcare practitioners, factory workers, or educational settings. Limited studies specifically investigate formal-sector government employees, particularly health service employees working in administrative divisions. Employees in the Semarang City Health Service possess unique occupational characteristics involving prolonged sitting, repetitive computer work, and limited physical movement, which may increase the risk of MSDs while simultaneously reducing physical activity levels.

Third, previous Indonesian studies often emphasize ergonomic assessment without integrating physical activity analysis comprehensively. As a result, there is still limited evidence explaining whether low physical activity independently contributes to MSD occurrence among office employees. Understanding this relationship is important for developing integrated occupational health interventions that combine ergonomic improvement with physical activity promotion.

Fourth, empirical evidence regarding occupational health among local government institutions in Indonesia remains scarce. Most studies are conducted in hospitals, factories, or educational institutions, while research focusing on government administrative offices is still underrepresented in scientific literature. Consequently, this study contributes important contextual evidence from Semarang City Health Service employees, providing a more specific understanding of occupational health conditions within the Indonesian public sector.

Based on the identified problems and research gaps, this study aims to determine the relationship between physical activity levels and musculoskeletal disorders among employees of the Semarang City Health Service. Specifically, this research seeks to analyze employees' physical activity profiles, identify the prevalence of musculoskeletal complaints, and examine whether physical activity levels are associated with MSD occurrence in formal-sector occupational settings.

The novelty of this study lies in several aspects. First, this research specifically focuses on government health service employees, a population rarely investigated in previous Indonesian occupational health studies. Second, this study integrates the

analysis of physical activity behavior with musculoskeletal health outcomes within an administrative occupational environment. Third, the study provides empirical evidence from an Indonesian urban government institution, contributing contextual data for occupational health policy development. Finally, this research offers practical implications for workplace health promotion programs, emphasizing the importance of increasing employee physical activity as a preventive strategy against MSDs.

In conclusion, the increasing prevalence of sedentary occupational behavior and musculoskeletal disorders among office employees highlights the urgency of occupational health research in modern workplaces. Although previous studies have explored the relationship between physical activity and MSDs, inconsistent findings and limited evidence among government health service employees indicate the necessity of further investigation. Therefore, this study is expected to provide scientific evidence regarding the relationship between physical activity levels and musculoskeletal disorders among Semarang City Health Service employees while contributing to the development of evidence-based workplace health interventions and occupational health policies.

METHODS

This study employed a quantitative descriptive method with a correlational approach to examine the relationship between physical activity levels and musculoskeletal disorders (MSDs) among employees of the Semarang City Health Service. Quantitative descriptive research is commonly used to systematically describe characteristics, distributions, and trends of research variables without manipulating the observed phenomena (Sugiyono, 2020). Meanwhile, correlational research aims to determine whether a statistical relationship exists between variables without establishing causal inference (Iting et al., 2025). This approach is considered appropriate because the present study focuses on identifying the association between employees' physical activity levels and musculoskeletal complaints in occupational settings.

The study consisted of two primary variables. The independent variable was physical activity level, while the dependent variable was musculoskeletal disorders (MSDs). Physical activity level refers to the amount and intensity of body movement performed by respondents during work, transportation, and leisure-time activities (Bull et al., 2020). MSDs refer to subjective complaints related to muscles, joints, ligaments, tendons, and skeletal structures experienced by employees during occupational activities (Meepradit et al., 2015).

The population of this study included all employees of the Semarang City Health Service, totaling 175 workers. Sampling was conducted using probability sampling with a proportionate stratified random sampling technique. This method was selected because the population was heterogeneous and consisted of several occupational strata. Proportionate stratified random sampling ensures that each member of the population has an equal opportunity to be selected while maintaining proportional representation

from each subgroup (Etikan & Bala, 2017). The sample size was determined using the Slovin formula with a 10% margin of error, resulting in 64 respondents. Sample distribution across each stratum was then calculated proportionally to maintain representativeness.

Table 1.

Presents the demographic characteristics of the participants.

Gender	N	Variable	Mean ± SD	Min	Max
Female	35	Age (Years)	36.31 ± 9.69	22	54
		Height (cm)	156.77 ± 2.70	152	162
		Weight (kg)	54.34 ± 5.35	45	65
		BMI (kg/m ²)	22.10 ± 1.99	18.8	27.7
Male	29	Age (Years)	37.72 ± 10.91	23	55
		Height (cm)	168.17 ± 2.42	164	173
		Weight (kg)	65.69 ± 7.46	52	80
		BMI (kg/m ²)	23.18 ± 2.09	18.9	27.0

This study utilized two standardized research instruments: the Global Physical Activity Questionnaire (GPAQ) and the Nordic Body Map (NBM). The GPAQ was developed by the World Health Organization to assess physical activity levels among adults in different domains, including work-related activity, transportation, and recreational activity (Hamonangan Hutabarat & Yuliana, 2020). The instrument consists of 16 questions that may be administered through self-report or interview methods. GPAQ categorizes physical activity into vigorous, moderate, and light intensity activities. Previous studies reported satisfactory psychometric properties with Cronbach's Alpha values ranging from $\alpha = 0.67$ – 0.73 and moderate validity coefficients ($r = 0.48$) (Cleland et al., 2014; Bull et al., 2009). GPAQ has been widely used in occupational and public health research due to its practicality and international standardization (Armstrong & Bull, 2018).

Musculoskeletal disorders were assessed using the Nordic Body Map (NBM), a subjective ergonomic assessment instrument designed to identify pain and discomfort in specific body regions (Zahra & Prastawa, n.d.). The NBM questionnaire contains 28 body complaint indicators in checklist format, allowing respondents to identify areas experiencing discomfort during work activities (Tjahjadi et al., 2024). The instrument has demonstrated strong validity and reliability in previous occupational health studies, with validity coefficients exceeding the minimum r -table value (0.387) and excellent reliability (Cronbach's Alpha $\alpha = 0.919$) (Burkon, 2022). The NBM is widely recognized as an effective screening tool for work-related musculoskeletal symptoms (Meepradit et al., 2015).

Data collection was conducted directly at the Semarang City Health Service office after obtaining institutional approval and participant consent. Respondents completed the GPAQ and NBM questionnaires under researcher supervision to ensure data completeness and accuracy. Anthropometric data, including height and body weight, were also recorded to calculate Body Mass Index (BMI). Ethical principles such as voluntary participation, anonymity, and confidentiality were strictly maintained throughout the research process (Creswell & Creswell, 2018).

Data analysis was performed using IBM SPSS Statistics version 23. Descriptive statistical analysis was first conducted to summarize respondent characteristics and the distribution of GPAQ and NBM scores using mean, standard deviation, minimum, and maximum values. Subsequently, a normality test was performed using the Kolmogorov-Smirnov test because the sample size exceeded 50 respondents. Data were considered normally distributed if the significance value (Sig.) was greater than 0.05 (Field, 2020). To examine the relationship between physical activity level and musculoskeletal disorders, the Chi-Square test was applied. The decision criterion was based on the significance value (Asymp. Sig.) at $\alpha = 0.05$. A significance value below 0.05 indicated a statistically significant relationship between the variables, whereas a significance value above 0.05 indicated no significant association (Pallant, 2020). Through this analytical procedure, the study aimed to provide empirical evidence regarding the relationship between physical activity levels and MSDs among formal-sector employees in the Semarang City Health Service.

RESULTS AND DISCUSSION

Result

This study examined the relationship between physical activity levels and musculoskeletal disorders (MSDs) among employees of the Semarang City Health Service. The findings are presented through descriptive statistics, frequency distributions, and inferential statistical analysis. The results provide an overview of respondents' physical activity profiles, MSD complaint levels, and the statistical relationship between the two variables.

Descriptive Statistics of Research Variables

Descriptive statistical analysis was conducted to identify the distribution characteristics of the Global Physical Activity Questionnaire (GPAQ) and Nordic Body Map (NBM) scores among respondents. The analysis included minimum score, maximum score, mean, and standard deviation values.

Table 2.
Descriptive Statistics

Variable	N	Minimum	Maximum	Mean \pm SD
Global Physical Activity Questionnaire (GPAQ)	64	2.08	4.38	3.34 \pm 0.43
Nordic Body Map (NBM)	64	0.95	1.57	1.25 \pm 0.12
Valid N (listwise)	64			

Based on Table 2, the GPAQ variable showed a minimum score of 2.08 and a maximum score of 4.38, with an average score of 3.34 ± 0.43 . These findings indicate that the respondents generally demonstrated moderate-to-high physical activity levels according to GPAQ standards. The relatively small standard deviation suggests that the respondents' physical activity levels were relatively homogeneous.

Meanwhile, the NBM variable demonstrated a minimum score of 0.95 and a maximum score of 1.57, with an average value of 1.25 ± 0.12 . This result indicates that

musculoskeletal complaints among respondents were generally within the low-to-moderate category. The low standard deviation also indicates a relatively consistent distribution of MSD complaints among employees.

Physical Activity Level Distribution (GPAQ)

The physical activity levels of respondents were categorized based on Metabolic Equivalent of Task (MET) scores obtained from the GPAQ questionnaire.

Table 3.
 Frequency Distribution of Physical Activity Levels (GPAQ)

MET Category	Classification	Frequency	Percentage
>3000 MET	High	26	40.6%
>600 - <3000 MET	Moderate	33	51.6%
<600 MET	Low	5	7.8%
Total		64	100.0%

The results indicate that the majority of respondents were classified in the moderate physical activity category, accounting for 51.6% of participants. Additionally, 40.6% of respondents were categorized as having high physical activity levels, while only 7.8% were classified in the low physical activity category.

These findings suggest that most employees of the Semarang City Health Service achieved the minimum recommended physical activity threshold established by the World Health Organization. Overall, the respondents demonstrated relatively adequate physical activity behavior despite working in predominantly administrative occupations.

Musculoskeletal Disorders Distribution (NBM)

Musculoskeletal disorder complaints were analyzed using the Nordic Body Map (NBM) instrument and categorized according to complaint severity levels.

Table 4.
 Frequency Distribution of Musculoskeletal Disorders (NBM)

Score Range	Complaint Level	Frequency	Percentage
0-20	Low	44	68.8%
21-41	Moderate	20	31.3%
42-62	High	0	0.0%
63-84	Very High	0	0.0%
Total		64	100.0%

Based on Table 4, the majority of respondents (68.8%) experienced low levels of musculoskeletal complaints, while 31.3% reported moderate complaints. No respondents were classified within the high or very high MSD categories.

These findings indicate that although musculoskeletal discomfort existed among employees, the severity level remained relatively manageable. This condition may reflect adequate workplace adaptation and relatively acceptable ergonomic conditions among respondents.

Most Frequently Reported Musculoskeletal Complaints

The study also identified the body regions with the highest frequency of discomfort complaints among employees.

Table 5.
 Most Frequent Musculoskeletal Complaints

Body Region	Frequency	Percentage
Lower Neck	82	6.9%
Upper Neck	77	6.5%
Back	71	6.0%

The lower neck was identified as the most frequently reported complaint area, followed by the upper neck and back region. These findings indicate that prolonged sitting posture, repetitive computer work, and static neck positioning may contribute substantially to musculoskeletal discomfort among administrative employees.

Normality Test Results

Before conducting inferential analysis, a normality test was performed using the One-Sample Kolmogorov-Smirnov test.

Table 6.
 One-Sample Kolmogorov-Smirnov Normality Test

Variable	Statistic	Sig.	Interpretation
Global Physical Activity Questionnaire	0.099	0.200	Normal
Nordic Body Map	0.075	0.200	Normal

Based on Table 6, both variables demonstrated significance values greater than 0.05. The GPAQ variable obtained a significance value of 0.200 (>0.05), indicating that the data were normally distributed. Similarly, the NBM variable also produced a significance value of 0.200 (>0.05), confirming normal data distribution. Therefore, the dataset fulfilled the assumptions required for further statistical analysis.

Chi-Square Test Results

The Chi-Square test was conducted to determine whether a significant relationship existed between physical activity levels and musculoskeletal disorders among respondents.

Table 7.
 Chi-Square Test Results

Test	Value	Sig.
Pearson Chi-Square	0.445	0.800

The Chi-Square analysis revealed a Pearson Chi-Square significance value of 0.800, which was greater than the significance threshold of 0.05. Therefore, the null hypothesis was accepted, indicating that no statistically significant relationship existed between physical activity levels and musculoskeletal disorders among employees of the Semarang City Health Service.

These findings suggest that musculoskeletal complaints among employees may not be solely influenced by physical activity levels. Other contributing factors, such as ergonomic posture, workstation design, occupational stress, repetitive work patterns, duration of sitting, and individual physical characteristics, may also play important roles in the occurrence of MSDs among administrative workers.

Discussion

The findings of this study indicate that the physical activity levels of employees at the Semarang City Health Service were generally categorized as moderate to high. Most respondents achieved physical activity scores above the minimum recommendation established by the World Health Organization, indicating that employees had relatively adequate awareness regarding the importance of maintaining physical fitness and health through daily movement activities. According to Bull et al. (2020), adults are encouraged to engage in at least 150 minutes of moderate-intensity physical activity per week to maintain cardiovascular endurance, musculoskeletal health, and psychological well-being. The present findings suggest that the majority of respondents had fulfilled these recommendations through a combination of occupational activities, transportation-related movement, household tasks, and recreational exercise.

The relatively good level of physical activity among respondents may also reflect increasing public awareness regarding healthy lifestyles among formal-sector workers. Previous studies have demonstrated that regular physical activity contributes significantly to physical fitness, metabolic efficiency, and mental health maintenance (Warburton & Bredin, 2017; Booth et al., 2021). Employees who engage in sufficient physical activity tend to have better muscular endurance, improved joint mobility, and lower risk of chronic disease development (Guthold et al., 2018). Furthermore, physical activity has been shown to improve work productivity, reduce fatigue, and enhance cognitive performance among office employees (Andersen et al., 2021).

Although the respondents demonstrated relatively good physical activity levels, the study still identified the presence of musculoskeletal complaints, particularly in the neck and back regions. The Nordic Body Map analysis revealed that lower neck, upper neck, and back discomfort were the most frequently reported complaints. This finding is consistent with studies conducted by Oakman et al. (2023) and Shariat et al. (2020), which reported that office employees commonly experience cervical and lumbar discomfort due to prolonged sitting posture, repetitive computer work, and static occupational activities. Administrative work often requires employees to maintain fixed body positions for extended periods, leading to sustained muscular tension and biomechanical stress on the cervical and lumbar regions.

The prevalence of neck and back complaints among employees can also be explained from an ergonomic perspective. Poor workstation arrangement, inappropriate monitor height, lack of lumbar support, and repetitive upper extremity movement may contribute substantially to musculoskeletal strain (Janwantanakul et al., 2021). In office-based occupations, prolonged sitting reduces muscle activation and blood circulation, causing muscle stiffness and discomfort over time (Parry & Straker, 2019). Additionally, static postures maintained continuously without adequate stretching or movement breaks may accelerate muscular fatigue and postural imbalance (Santos et al., 2022).

Despite these complaints, the majority of respondents in this study remained within the low-to-moderate MSD category. No respondents were classified within high or very high musculoskeletal complaint categories. This finding may indicate that

although employees experience discomfort, the severity level has not yet reached clinically severe conditions. Similar findings were reported by Tjahjadi et al. (2024), who found that administrative employees often experience mild-to-moderate musculoskeletal symptoms associated with repetitive occupational activities rather than acute musculoskeletal injuries. The relatively low severity observed in this study may also be influenced by the respondents' moderate-to-high physical activity levels, which potentially help maintain musculoskeletal function and reduce symptom severity.

From a physiological perspective, regular physical activity improves muscular strength, flexibility, and neuromuscular coordination, which are essential for maintaining postural stability during occupational tasks (Booth et al., 2021). Physical activity also enhances blood circulation and oxygen delivery to muscles, thereby reducing muscle stiffness and fatigue accumulation (Warburton & Bredin, 2017). Therefore, employees with sufficient physical activity levels may possess better musculoskeletal adaptation against occupational stressors compared to physically inactive individuals.

However, the inferential statistical analysis demonstrated that there was no significant relationship between physical activity levels and musculoskeletal disorders among employees of the Semarang City Health Service. The Chi-Square test produced a significance value of 0.800 (>0.05), indicating that physical activity level was not statistically associated with MSD occurrence in this population. This finding aligns with the studies conducted by Fiqrillah Wirayudha and Wahyuni (2022), who reported no significant association between physical activity and musculoskeletal complaints ($p = 0.247$). Similarly, Nazhira et al. (2024) found no statistically significant relationship between the two variables ($p = 0.842$). These studies suggest that musculoskeletal disorders are multifactorial conditions influenced by numerous occupational and ergonomic factors beyond physical activity alone.

Conversely, the present findings differ from studies conducted by Putu Wulan Aristina Dewi et al. (2026) and Puspitasari et al. (2021), both of which reported significant relationships between physical activity and MSDs. Puspitasari et al. (2021) demonstrated that lower physical activity levels significantly increased the risk of musculoskeletal complaints among office employees, while Putu Wulan Aristina Dewi et al. (2026) found that insufficient physical activity was associated with higher MSD prevalence. These contradictory findings indicate that the relationship between physical activity and musculoskeletal disorders remains inconsistent across populations and occupational settings.

The absence of a significant relationship in the current study suggests that physical activity may not be the primary determinant of MSD complaints among administrative employees. Instead, ergonomic and occupational factors may exert stronger influences on musculoskeletal health outcomes. Several previous studies emphasize that prolonged sitting duration, awkward body posture, repetitive movement patterns, and inadequate workstation ergonomics are major predictors of MSD development in office workers (Wildasari & Nurcahyo, 2023; Janwantanakul et al., 2021; Oakman et al., 2023). Employees may maintain adequate physical activity levels outside working hours, yet still

experience musculoskeletal discomfort due to continuous exposure to poor occupational posture during office activities.

Another possible explanation is that the physical activity measured in this study was general physical activity rather than occupation-specific physical exercise targeting musculoskeletal conditioning. GPAQ measures overall physical activity from various domains, including transportation, work, and recreation, but does not specifically evaluate corrective exercise, stretching behavior, or ergonomic movement patterns. Consequently, respondents categorized as physically active may still experience MSD symptoms if their occupational posture and workstation conditions remain unfavorable (Andersen et al., 2021).

Psychosocial and organizational factors may also contribute to musculoskeletal complaints among employees. Studies have shown that occupational stress, mental workload, job dissatisfaction, and work pressure are associated with increased muscle tension and pain perception (Santos et al., 2022; Cillekens et al., 2022). Government employees often face administrative demands, deadlines, and prolonged screen exposure, which may indirectly increase musculoskeletal discomfort regardless of physical activity behavior.

The findings of this study therefore emphasize the importance of adopting a comprehensive occupational health approach. Improving physical activity alone may not be sufficient to prevent musculoskeletal disorders among office employees. Workplace interventions should also include ergonomic workstation modifications, regular stretching programs, posture education, scheduled movement breaks, and occupational health promotion initiatives (Grabara, 2023). Adjustable chairs, ergonomic desk arrangements, monitor positioning, and active workplace strategies have been shown to reduce MSD prevalence significantly among administrative workers (Parry & Straker, 2019).

In addition, workplace-based exercise programs may provide substantial benefits in reducing musculoskeletal discomfort. Research by Andersen et al. (2021) demonstrated that short-duration strengthening and stretching exercises performed during working hours effectively reduced neck and shoulder pain among office employees. Educational interventions regarding proper sitting posture and movement mechanics may also improve employees' awareness of ergonomic risk factors (Wildasari & Nurcahyo, 2023).

Overall, the present study provides important evidence regarding occupational health among government employees in Indonesia. Although most respondents demonstrated adequate physical activity levels, musculoskeletal complaints remained prevalent, particularly in the neck and back regions. Furthermore, the absence of a significant relationship between physical activity and MSDs highlights the multifactorial nature of musculoskeletal disorders. Therefore, occupational health management should not focus solely on increasing physical activity but should also integrate ergonomic improvements, workplace health education, organizational support, and preventive intervention strategies to maintain employee well-being and productivity sustainably.

CONCLUSION

Based on the findings of this study, it can be concluded that the physical activity levels of employees at the Semarang City Health Service were generally categorized as moderate, followed by high and low categories. Specifically, 51.6% of respondents were classified within the moderate physical activity category, 40.6% within the high category, and only 7.8% within the low category. These results indicate that, overall, the employees demonstrated relatively adequate physical activity levels according to the standards of the World Health Organization, suggesting good awareness regarding the importance of maintaining physical fitness and health through daily physical activities.

In terms of musculoskeletal disorders (MSDs), the majority of respondents experienced low-to-moderate levels of musculoskeletal complaints. A total of 68.8% of employees were categorized in the low complaint level, while 31.3% were classified in the moderate category. No respondents were found in the high or very high MSD categories. The most frequently reported complaints were concentrated in the lower neck, upper neck, and back regions, indicating that prolonged sitting posture, repetitive occupational activities, and static administrative work may contribute to discomfort in these body areas.

Furthermore, the results of the Chi-Square statistical test demonstrated that there was no significant relationship between physical activity levels and musculoskeletal disorders among employees of the Semarang City Health Service, as indicated by the significance value ($p = 0.800 > 0.05$). These findings suggest that physical activity is not the sole factor influencing the occurrence of MSDs among employees. Other factors, including non-ergonomic work posture, prolonged working duration, repetitive movements, and unfavorable workplace ergonomics, may play more dominant roles in the development of musculoskeletal complaints.

Therefore, efforts to prevent musculoskeletal disorders among employees should adopt a comprehensive approach, not only by promoting physical activity but also by improving workplace ergonomics, providing posture education, implementing regular movement breaks, and creating healthier occupational environments to support employee well-being and productivity.

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