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Original Research

Effect of Activity, Massage, Job Control-Demand on Ergonomic Posture of Office Workers

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ABSTRACT

Background: *Work-related musculoskeletal disorders (WMSDs) are common occupational injuries affecting muscles, joints, and the skeletal system. Effective management requires both individual and workplace support. Physical activity, therapy compliance, job control, and job demand are key factors influencing ergonomic posture and pain management outcomes. This study examined the effects of physical activity, massage therapy compliance, job control, and job demand on ergonomic posture of office workers in PT. X's musculoskeletal pain management program.*

Methods: *Quantitative and cross-sectional research using proportional random sampling, data from 100 office workers of PT X were analyzed with multiple linear regression (T-test and F-test) via SPSS. The ergonomic posture was evaluated through Rapid Assessment Office Strain (ROSA).*

Results: *All variables significantly affected ergonomic posture ($F = 227.621$, $p < 0.001$). Massage therapy compliance contributed the most (40.2%), followed by physical activity (33.1%), job demand (9.2%), and job control (8.1%).*

Conclusion: *Physical activity and therapy compliance had the strongest positive effects on ergonomic attitudes, emphasizing their role in improving musculoskeletal pain management at PT. X. It is recommended that workplace programmes prioritise efforts to increase physical activity and therapy compliance, as these two factors have the strongest positive influence on ergonomic attitudes and musculoskeletal pain management.*

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INTRODUCTION

The International Labour Organization (International Labour Organization, 2020) identifies musculoskeletal disorders (MSDs) as one of the most prevalent occupational diseases, affecting muscles, tendons, ligaments, bones, and the nervous system. Globally, MSDs account for approximately 60% of all occupational illnesses. In

Indonesia, the Social Security Agency for Employment (BPJS Ketenagakerjaan, 2024) reported a substantial increase in work-related MSD cases over the past three years—32% in 2022, 44% in 2023, and 56% in 2024—impacting an estimated 543.000 workers. MSDs rank as the second most common occupational disease, with non-ergonomic postures and repetitive movements identified as key contributing factors.

The Ministry of Health of the Republic of Indonesia highlights the office sector as having a notably high risk of MSD complaints, which informed the issuance of Regulation No. 48/2016 of Ministry of Health of Republic of Indonesia on occupational safety and health in office environments. MSD prevalence among office workers is shaped by both physical and psychosocial determinants. While excessive physical activity may increase pain risk, regular and appropriate activity supports musculoskeletal recovery. Evidence from demonstrates a significant association between physical activity and MSD complaints, as well as improvements in mood and productivity (Tatik & Eko, 2023).

Therapeutic interventions such as body massage also provide measurable benefits. reported that massage therapy can reduce analgesic use by up to 36%, with higher effectiveness observed among individuals who adhere consistently to treatment programs. Thus, adherence to massage therapy may contribute to reduced musculoskeletal pain and improved working posture (Bezzina et al., 2023).

Psychosocial factors—including job demand and job control—further influence MSD development. Job demand reflects the physical and mental workload, whereas job control pertains to workers' autonomy over task execution. Mateos-Gonzalez et al., (2024) found that high job demands increase the risk of musculoskeletal injury by 49%, while low job control independently elevates injury likelihood. The demand–control (JDC) model posits that job stress is highest when demands are elevated and control is limited.

Based on this explanation, the novelty of this study lies in combining three main determinants—physical activity, adherence to massage therapy, and psychosocial factors (job demand and job control)—into a comprehensive analysis model to predict musculoskeletal complaints among office workers, something that has not been widely researched simultaneously in the Indonesian context. Therefore, this study aims to analyse the relationship between these three factors and the incidence of MSD in office workers, while also identifying the most dominant factors contributing to the emergence of MSD complaints so that they can form the basis for more targeted ergonomic and occupational health intervention recommendations.

MATERIALS AND METHOD

This study employed a quantitative research design with descriptive and verificative approaches. This study examines and empirically tests the relationship between the specified variables. The aim is to produce findings that can be generalised more broadly. In addition, this study seeks to explain the causal relationship that influences ergonomic work posture in the context of treating musculoskeletal pain.

The study population comprised 150 PT. X employees who received treatment at the company clinic for musculoskeletal complaints between January and December 2024. Using the Slovin formula, a sample of 100 respondents was obtained. Proportional random sampling was applied to ensure representation from each work unit and reduce potential bias. Inclusion criteria included: (1) being registered as a patient at the PT. X clinic; (2) experiencing musculoskeletal complaints; (3) being aged 19–59

years; and (4) willingness to participate. Exclusion criteria included: (1) open wounds; (2) infectious diseases; and (3) comorbid conditions related to musculoskeletal fatigue.

The independent variables consisted of physical activity participation (X_1), compliance with body massage therapy (X_2), job control (X_3), and job demand (X_4). The dependent variable was ergonomic working posture (Y). Primary data were obtained using structured questionnaires distributed to respondents. The instruments consisted of: (1) the Global Physical Activity Questionnaire (GPAQ) to measure participation in physical activity through items assessing vigorous, moderate, and light activities performed by office employees at PT. X, scored by assigning 1 to "YES" responses and 0 to "NO" responses, where "YES" indicates frequent engagement in physical activity; (2) the Nordic Body Map (NBM) to assess the impact of therapy compliance on the reduction of musculoskeletal complaints, covering 27 body regions with a four-point pain scale (1 = no pain, 2 = slight pain, 3 = painful, 4 = very painful); (3) the Stress Prevention at Work Checkpoint to evaluate job control and job demand, where a predominance of "YES" responses indicates balanced control and workload; and (4) the Rapid Office Strain Assessment (ROSA) and the assessment form from the Indonesian Ministry of Health Regulation No. 48/2016 to evaluate ergonomic working posture.

Each respondent's posture and movement frequency were assessed, and final scores were calculated to determine ergonomic risk levels. In addition to primary data, secondary data were collected from company records, including clinic visit logs, employee medical records, and attendance data. Data analysis involved several stages. Instrument validity was tested using Pearson correlation in Microsoft Excel by comparing the calculated r-value with the r-table value using IF formulas, while reliability was assessed using Cronbach's Alpha, with values >0.60 indicating acceptable reliability.

The ordinal questionnaire data were then transformed into interval data using the Successive Interval Method (MSI) to meet the assumptions of multiple linear regression analysis, which requires interval-level data. Classical assumption tests included normality, multicollinearity, heteroscedasticity, and autocorrelation. Hypothesis testing was conducted using multiple linear regression with simultaneous (F-test) and partial (t-test) significance tests, as well as correlation coefficient (R) and coefficient of determination (R^2) analyses.

Ethical approval was obtained under protocol number 010/KEP/MM/USB/2025, and the ethical review and implementation were carried out in accordance with international standards established by the World Health Organization (WHO). The study adhered to General Ethical Principles—respect for human dignity, beneficence, and justice—as articulated in the Declaration of Helsinki, the CIOMS–WHO International Ethical Guidelines, Good Clinical Practice (GCP) standards, and the 3B-A-H principles (Beneficence, Autonomy, and Justice) as well as the Eight Nursing Ethical Principles. These principles were operationalized through voluntary participation, informed consent, protection of confidentiality, minimization of potential risks, equitable participant selection, and ensuring that all respondents retained the right to withdraw without penalty.

RESULTS
Characteristics of Research Respondents

Table 1. Respondent Characteristics (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Men	40	40
	Women	60	60
	Total	**100**	**100**
Age	20-30	21	21
	31-40	47	47
	41-50	23	23
	51-60	9	9
	Total	**100**	**100**
Educational Background	Bachelor	71	71
	Master	29	29
	Total	**100**	**100**
Length of work	< 5 years	25	25%
	> 5 years	75	75%
	Total	**100**	**100**

The study involved 100 office staff members of PT. X who reported musculoskeletal complaints, comprising 40 males (40%) and 60 females (60%). The highest prevalence of musculoskeletal complaints related to ergonomic working posture was observed in the 31–40 years age group (47%), followed by 41–50 years (23%), 21–30 years (21%), and 51–60 years (9%). Regarding educational attainment, the majority of respondents held a bachelor's degree (S1, 71%), while 29% possessed a master's degree (S2). In terms of employment duration, 75% of staff with musculoskeletal complaints had worked for more than five years, whereas 25% had less than five years of service. Detailed demographic and occupational characteristics of the respondents are summarized in Table 1.

Assumption Test Results

Validity and reliability tests in this study indicated that each questionnaire item for both independent and dependent variables had a calculated r-value greater than the critical r-value at a 0.05 significance level, confirming that the collected data were valid and the items were suitable for use in the study. Additionally, the questionnaire, consisting of 50 items, yielded a Cronbach's Alpha of 1.16, which exceeds the critical threshold (r-table = 0.06), indicating that the instrument is reliable.

Classical assumption testing was conducted using normality, multicollinearity, heteroscedasticity, and autocorrelation tests. First, the normality test showed that the plotted values followed the diagonal line of a bell-shaped histogram, indicating that the regression model data were normally distributed. Second, multicollinearity analysis revealed that all independent variables had Variance Inflation Factor (VIF) values below 10 and tolerance values above 0.10, indicating no multicollinearity among the variables.

Third, heteroscedasticity was assessed using the Glejser test, with significance values as the criterion. The results showed that physical activity participation, compliance with body massage therapy, job control, and job demand all had

significance values greater than 0.05, indicating the absence of heteroscedasticity in the data. Finally, the autocorrelation test, based on the Durbin-Watson statistic, yielded a value of 2.158, suggesting no autocorrelation. In general, Durbin-Watson values range from 0 to 4, and values close to 2 indicate the absence of autocorrelation.

Multiple Linear Regression Analysis

The results of the F-test (simultaneous) in this study indicated an F-value of 227.621 with a significance level of $p < 0.001$. Since the significance value is less than 0.05, the null hypothesis (H_0) is rejected. This indicates that, simultaneously, the variables of physical activity participation (X_1), compliance with body massage therapy (X_2), job control (X_3), and job demand (X_4) have a significant effect on ergonomic working posture (Y). The detailed results are presented in Table 2 below.

Table 2. F test (simultaneous)

F	p-value
227.621	<0.001

Meanwhile, the results of the t-test (partial) indicated that only the variable compliance with body massage therapy (significance value < 0.001) had a significance level below the 0.05 threshold. This demonstrates that compliance with body massage therapy has a significant effect on ergonomic working posture. In contrast, the variables physical activity participation (p = 0.947), job control (p = 0.947), and job demand (p = 0.294) had significant values greater than 0.05, indicating that these variables do not have a significant effect on ergonomic working posture. Shown on table 3. below:

Table 3. T-test (partial)

Variable	t	p-value
Physical Activity Participation (X1)	0.067	0.947
Body Massage Therapy Compliance (X2)	29.925	<0.001
Job Control (X3)	0.651	0.869
Job Demand (X4)	1.055	0.294

Subsequently, Pearson correlation analysis was conducted. In the context of multiple linear regression, the Pearson correlation test is used to measure the strength and direction of the linear relationship between two variables, specifically between the independent and dependent variables in this study. The results of the Pearson correlation (correlation coefficient, r) provide information regarding both the direction and strength of the relationship. The Pearson correlation coefficient (r) ranges from -1 to +1.

A positive r value indicates a positive relationship, meaning that as one variable increases, the other variable tends to increase as well. Conversely, a negative r value indicates a negative relationship, meaning that as one variable increases, the other variable tends to decrease. The closer the r value is to ±1, the stronger the correlation between the variables.

Table 4. Pearson Correlation

Variable	Pearson Correlation	p-value
Physical Activity Participation (X1)	0.020	0.842
Body Massage Therapy Compliance (X2)	0.951	<0.001

Variable	Pearson Correlation	p-value
Job Control (X3)	-0.062	0.542
Job Demand (X4)	-0.093	0.357

The results of the Pearson correlation analysis presented in Table 4 indicate that physical activity participation had a correlation coefficient of 0.020, suggesting a positive but very weak relationship with ergonomic working posture. The variable compliance with body massage therapy showed a correlation coefficient of 0.951 (significant at the 0.01 level), indicating a very strong positive relationship. In contrast, job control had a correlation coefficient of –0.062 and job demand –0.093, both demonstrating weak negative relationships with ergonomic working posture.

The significance value for the correlation between physical activity participation and ergonomic working posture was 0.842 ($p > 0.05$), indicating no statistically significant relationship. Conversely, compliance with body massage therapy exhibited a significance value of <0.001 ($p < 0.05$), indicating a statistically significant relationship. Job control ($p = 0.542$) and job demand ($p = 0.357$) did not show significant relationships with ergonomic working posture. Furthermore, the coefficient of determination (R^2) was used to assess the extent to which the regression model explains the variation in the dependent variable, ergonomic working posture (Y), based on the independent variables: physical activity participation (X_1), compliance with body massage therapy (X_2), job control (X_3), and job demand (X_4).

Table 5. Determination Coefficient (R2)

Variable	Correlation Zero Orders	Influence (%)
Physical Activity Participation (X1)	0.020	33.1
Body Massage Therapy Compliance (X2)	0.951	40.2
Job Control (X3)	0.062	8.1
Job Demand (X4)	0.093	9.2

The SPSS calculation results can be summarized using the formula: R^2 = (R Square) × 100%, yielding $R^2 = 0.906 \times 100\% = 90.6\%$. The R Square value of 0.906 (90.6%) indicates that the independent variables—physical activity participation (X_1), compliance with body massage therapy (X_2), job control (X_3), and job demand (X_4)—collectively explain 90.6% of the variance in ergonomic working posture (Y). The remaining 9.4% of the variance is influenced by other independent variables not examined in this study.

DISCUSSION

The proportion of workers by gender in this study indicates that female office employees experienced musculoskeletal pain more frequently, which aligns with both national and international data showing a higher representation of women in the health and insurance sectors. The International Labour Organization (ILO) reports that musculoskeletal pain is experienced 10% more frequently by female workers (RISKESDAS, 2023). National data from RISKESDAS indicates a musculoskeletal disorder (MSD) prevalence of 7.9%, while other studies report rates up to 24.7%, with women being more vulnerable due to hormonal, anatomical, and occupational factors.

Regarding age, the present study found that employees aged 31–40 years were the most affected group, which is consistent with national data showing higher MSD risk in employees over 31 years, attributed to early degenerative changes (Ministry of Health, 2024). The results also revealed a significant association between educational level and ergonomic working posture. Higher education was linked to better understanding of ergonomic principles, enhancing awareness and application of proper working postures (Eisele-Metzger, A., et al,2023).

Employees with greater knowledge were more capable of recognizing ergonomic risks and implementing preventive measures to reduce musculoskeletal complaints (Hargiani et al., 2024; Putsa et al., 2022). Similarly, length of employment influenced ergonomic working posture within the musculoskeletal pain management program. Longer employment duration was associated with increased risk of musculoskeletal disorders, corroborating previous studies showing a significant relationship ($p = 0.001$), as prolonged work duration can reduce muscle performance and physical endurance, increasing vulnerability to musculoskeletal complaints (Putsa et al., 2022).

Ergonomic working posture, defined as the position or alignment of an individual during work activities, affects both employee health and productivity, ultimately influencing organizational performance. Proper ergonomic posture yields numerous benefits, including reduced injury risk, improved comfort, and enhanced efficiency and productivity. This study found that physical activity participation positively influenced ergonomic posture among office staff involved in musculoskeletal pain management.

Higher physical activity participation was associated with better ergonomic posture, consistent with the findings of Kusuma et al., (2024) which reported a strong positive correlation ($r = 0.584$) between physical activity and musculoskeletal complaints. Moreover, Sohrabi and Babamiri (2022) highlighted that structured physical activity interventions, such as provision of exercise facilities, group exercise, stretching instructions during work, and physical activity education, can enhance physical activity adherence. Regarding compliance with body massage therapy, the t-value was 29.925 with a significance level of <0.001, and the Pearson correlation coefficient was significant at the 0.01 level, indicating a very strong positive relationship.

Higher compliance with body massage therapy corresponded to better ergonomic working posture. Therapy adherence plays a critical role in the success of musculoskeletal pain management programs, consistent with the research of Muzzaki, (2025) who reported that therapy adherence significantly improved range of motion and reduced pain in patients with knee osteoarthritis. These findings emphasize the importance of education and motivation to enhance adherence to physiotherapy programs for optimal therapeutic outcomes (Karatrantou & Gerodimos, 2024).

In terms of organizational factors, job control aligned with the Job Demand–Control model, which posits that increased job demands elevate stress when control is low. Kusuma et al., (2024) similarly found a significant relationship between job control and work stress (significance = 0.475), indicating that employees perceiving higher control over their tasks experience lower stress. Conversely, high job demand pressures employees to prioritize task completion over maintaining ergonomic posture, increasing work stress and exacerbating musculoskeletal complaints.

This is consistent with Farah Alya Nadilah et al., (2023) who demonstrated that the combination of high physical demands and low job control was significantly associated with musculoskeletal pain. Additionally Naseem and Ali, (2022) reported that occupational stress, mediated by reduced physical activity and increased sedentary

behavior, negatively affects employees' physical well-being. In summary, the findings suggest that individual factors (gender, age, education, length of employment), behavioral factors (physical activity and therapy adherence), and organizational factors (job control and job demand) play crucial roles in shaping ergonomic working posture and the risk of musculoskeletal pain among office employees. Female employees were more prone to musculoskeletal complaints, and those aged 31–40 years were most vulnerable due to early degenerative changes.

Higher education was associated with better ergonomic posture, while longer employment increased MSD risk due to decreased physical performance. Physical activity participation improved ergonomic posture and reduced musculoskeletal complaints, supporting the implementation of structured workplace exercise programs. Compliance with body massage therapy significantly enhanced ergonomic posture and the effectiveness of pain management programs. Adequate job control reduced stress and supported ergonomic behaviors, whereas high job demand diminished postural awareness and increased MSD risk.

These findings highlight the need for occupational health practitioners to integrate comprehensive ergonomics programs in office settings, including structured physical activity, therapy adherence education, workload management, and measures to enhance job control. Such interventions are expected to improve musculoskeletal health, reduce occupational injuries, and enhance overall workplace productivity. The study is limited by its cross-sectional design, which constrains causal inferences between variables.

Data were collected through self-reported questionnaires, which may be subject to recall or response bias. Future research is recommended to employ longitudinal or experimental designs to better establish causality, incorporate objective measures of physical activity and ergonomic compliance, and explore additional organizational and psychosocial factors that may influence musculoskeletal health outcomes.

CONCLUSION

Ergonomic work attitudes are a determinant of the success of a musculoskeletal pain management program implemented in a company. As a result of the research mentioned above, what has been discussed is the ergonomic work attitude of the office staff in the implementation of the musculoskeletal pain management program. After testing and analyzing the influence of variables that participated in physical activity, compliance with body massage therapy, job control, job demand and correlated with the ergonomic attitude, with the final results produced by data processing showing the data that has been described in the previous chapter, it can be concluded that the factors of individual condition that are measured through the participation of physical activity and compliance with body massage therapy are factors that have a significant positive effect, meaning that the better the participation of physical activity and the more compliant the employee in carrying out body massage therapy, So the higher the awareness of the employee's ergonomic work posture.

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