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Analysis of Factors Associated with Musculoskeletal Disorders Among Employees of the Asahan District Education Office

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ABSTRACT

Background: One of the major occupational health problems that can arise due to ergonomic risk is musculoskeletal disorders (MSDs). Office workers are among those most susceptible to chronic musculoskeletal health issues. This study aimed to identify factors associated with MSDs among employees of the Asahan District Education Office.

Subjects and Method: This study was conducted at the Asahan District Education Office from December to January 2025. A descriptive quantitative analysis using a cross-sectional design was applied. The total population was 71 employees, and total sampling was used. Data were analyzed statistically using the Chi-square test.

Results: There were significant associations between age (Mean=1.86; SD=0.350; p=0.004), work duration (Mean=1.65; SD=0.481; p=0.001), BMI (Mean=1.46; SD=0.502; p=0.001), and exercise habits (Mean=1.35; SD=0.481; p=0.001) with MSD complaints. However, gender (Mean=1.39; SD=0.492; p=0.683) was not significantly associated with MSDs.

Conclusion: Four factors were significantly associated with MSD complaints. These findings can serve as a reference for institutions to improve ergonomic intervention and prevention efforts, such as mandating employees to participate in morning exercise activities every Friday.

Keywords: office workers, individual factors, musculoskeletal disorders

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BACKGROUND

One of the occupational health problems that can arise due to ergonomic risks is musculoskeletal disorders. Musculoskeletal disorders (MSDs) are a group of conditions that affect muscles, tendons, ligaments, nerves, and other musculoskeletal structures. MSDs can be caused by various factors, including work activities involving repetitive movements, non-ergonomic postures, and excessive workloads (Salamah et al., 2020). These complaints are often characterized by pain, stiffness, discomfort, and tension in specific body parts such as the neck, back, shoulders, and upper extremities. MSDs are conditions that can be aggravated by sudden physical exertion or prolonged exposure to workplace risk factors (Badriyyah et al., 2021).

Musculoskeletal disorders (MSDs) are common complaints among office workers.

This group is particularly vulnerable to chronic musculoskeletal health issues. Office work represents a complex physical environment involving interactions among various components, including work-stations, equipment, and job content. A recent literature review confirmed a dose-response relationship between the number of hours spent using a computer and the risk of musculoskeletal disorders, including pain and other symptoms in the neck, shoulders, back, and upper extremities (Nurtanti & Tejamaya, 2023).

According to Gleadhill et al. (2021), the World Health Organization (WHO) reported in 2021 that approximately 1.71 billion people worldwide suffer from musculoskeletal disorders. Among these conditions, low back pain is the most prevalent, affecting 568 million individuals globally.

Based on the 2018 Basic Health Research (Riskesdas) in Indonesia, the prevalence of musculoskeletal disorders diagnosed by healthcare professionals was 11.9%, while the prevalence based on symptoms or self-reported diagnosis was 24.7%. Although exact national data on low back pain prevalence is unavailable, estimates range from 7.6% to 37%, with the highest prevalence in Aceh Province (13.3%) and the lowest in West Sulawesi (3.2%) (Kumbea, 2021).

Several factors are known to contribute to the occurrence of MSDs, including age, smoking habits, body mass index (BMI), and physical activity level (Puspitasari and Ariyanto, 2021). According to Tambuwun et al. (2020), age is a primary factor, as advancing age leads to decreased muscle strength, increasing the likelihood of MSDs. Work duration also influences MSDs. The longer the duration of employment, the greater the cumulative workload experienced by workers, which may result in musculoskeletal problems due to prolonged repetitive activities.

The Asahan District Education Office is a government institution responsible for the management, development, and quality improvement of education in Asahan Regency, North Sumatra. It is located on Jendral Ahmad Yani Street, Kisaran Naga. The office employs 71 workers: 44 are civil servants, 21 are APBD contract workers, and the remaining 6 are honorary staff (TKS). Employees typically work Monday through Friday from 08:00 AM to 05:00 PM. Due to high work demands, employees often sit for extended periods—approximately 7–8 hours per day in front of a computer.

A preliminary survey conducted with 10 employees showed that 7 reported moderate MSD symptoms and 3 reported mild symptoms. These findings indicate a high prevalence of MSD complaints among employees of the Asahan District Education Office. Based on this, the authors were motivated to conduct a study entitled “Analysis of Factors Associated with Musculoskeletal Disorders Among Employees of the Asahan District Education Office”. The study aimed to determine the factors associated with MSD complaints among employees of the institution.

SUBJECTS METHOD

1. Study Design

This study is a descriptive quantitative research using a cross-sectional design, conducted at the Asahan District Education Office from December 2024 to January 2025.

2. Population and Sample

Study subjects were employees at the Asahan District Education Office. A total of 71 workers was selected using total sampling.

3. Study Variables

The independent variables in this study were age, gender, work duration, body mass index (BMI), and exercise habits. The dependent variable was musculoskeletal disorder (MSD) complaints.

4. Operational Definition of Variables

Age: The duration of an individual's life since birth.

Gender: The biological differences between males and females, determined by factors such as sex chromosomes, reproductive organs, and hormones.

Work Duration: The length of time an individual has worked in a particular company or institution, calculated from the starting date of employment to the present.

Body Mass Index (BMI): A measure used to assess an individual's nutritional status based on the ratio of weight to height.

Exercise Habit: Physical activity performed regularly and integrated into an individual's lifestyle.

5. Study Instruments

a. Respondent Characteristic Questionnaire: Used to collect basic demographic information about the respondents.

b. Nordic Body Map (NBM) Questionnaire: Used to assess musculoskeletal complaints in various parts of the body.

6. Data analysis

Data were analyzed using the latest version of SPSS with the following steps:

a. Univariate Analysis: Frequency and percentage distributions were used to describe the characteristics of the sample.
b. Bivariate Analysis: The Chi-square test was used to assess the relationship between independent variables and MSD complaints.
c. Multivariate Analysis: Logistic regression was used to determine the most influential determinants of MSD complaints.

7. Research Ethics

This study received ethical approval from the Research Ethics Committee of the Faculty of Public Health, State Islamic University of North Sumatra. All respondents signed informed consent prior to participation.

RESULTS

1. Univariate Analysis

The respondents in this study consisted of 71 employees from the Asahan District Education Office. As shown in Table 1, the number of employees aged 20–35 years was lower, with only 10 individuals (14.1%), compared to 61 employees (85.9%) aged 36–56 years. The majority of the respondents were male, totaling 43 individuals (60.6%), while females accounted for 28 respondents (39.4%).

Regarding work duration, more employees had worked for 6–10 years (46 individuals or 64.8%) compared to those who had worked for 1–5 years (25 individuals or 35.2%). A total of 38 employees (53.5%) had an abnormal Body Mass Index (BMI), while 33 employees (46.5%) had a normal BMI.

In terms of exercise habits, 46 employees (64.8%) were categorized as having poor exercise habits, and 25 employees (35.2%) were categorized as having good habits. Regarding musculoskeletal disorder (MSD) complaints, 41 employees (57.7%) reported moderate complaints, while 30 employees (42.3%) reported mild complaints.

Table 1. Sample Characteristics of Employees in Asahan District Education Office

Variable	Frequency	Percentage (%)
Age (year)		
20-35 years	10	14.1
36-56 years	61	85.9
Gender		
Male	43	60.6
Female	28	39.4
Work Duration (years)		
1-5 years	25	35.2
6-10 years	46	64.8
Body Mass Index		
Abnormal	38	53.5
Normal	33	46.5
Exercise Habits		
Good	25	35.2
Poor	46	64.8
MSDs Complaints		
Mild	30	42.3
Moderate	41	57.7
Total	**71**	**100**

2. Bivariate Analysis

Bivariate analysis was conducted to evaluate the relationship between musculoskeletal disorders (MSDs) complaints and several respondent characteristics, including age, gender, work duration, body mass index (BMI), and exercise habits.

Table 2. Chi-square Test Results of Age and MSD Complaints

Age Group	MSD Complaint Level				Total		p
	Mild		Moderate				
	n	%	n	%	N	%	
20-35 years	0	0	10	24.4	10	14.0	0.004
36-56 years	30	100	31	75.6	61	86.0	

Table 2 shows that none of the employees aged 20–35 years reported mild MSD complaints, while 10 individuals (24.4%) reported moderate complaints. Meanwhile, among employees aged 36–56 years, 30 individuals (100%) experienced mild complaints and 31 (75.6%) reported moderate complaints. The Chi-square test yielded a p-value of 0.004, indicating a statistically significant relationship between age and MSD complaints. This suggests that older employees (>35 years) are more likely to experience moderate MSD complaints.

Table 3. Chi-square Test Results of Gender and MSD Complaints

Gender	MSD Complaint Level				Total		p
	Mild		Moderate				
	n	%	n	%	N	%	
Male	19	63.3	24	58.5	43	60.6	0.683
Female	11	36.7	17	41.5	28	39.4	

Table 3 shows that 19 male employees (63.3%) reported mild MSD complaints, and 24 (58.5%) reported moderate complaints. Among female employees, 11 (36.7%) reported mild complaints and 17 (41.5%) reported moderate complaints. The Chi-square test resulted in a p-value of 0.683, indicating that there is no statistically significant relationship between gender and MSD complaints.

Table 4. Chi-square Test Results of Work Duration and MSD Complaints

Work Duration	MSD Complaint Level				Total		p
	Mild		Moderate				
	n	%	n	%	N	%	
1-5 years	0	0	25	60.9	25	35.2	0.001
6-10 years	30	100	16	39.1	46	64.8	

Table 4 shows that none of the employees with 1–5 years of service reported mild MSD complaints, while 25 (60.9%) reported moderate complaints. Among employees with 6–10 years of service, 30 (100%) experienced mild complaints and 16 (39.1%) experienced moderate complaints. The Chi-square test yielded a p-value of 0.001, indicating a statistically significant relationship between work duration and MSD complaints.

Table 5. Chi-square Test Results of Body Mass Index and MSD Complaints

BMI Status	MSD Complaint Level				Total		p
	Mild		Moderate				
	n	%	n	%	N	%	
Abnormal	24	80	14	34.2	38	53.5	0.001
Normal	6	20	27	65.8	33	46.5	

Table 6. Chi-square Test Results of Exercise Habits and MSD Complaints

Exercise Habit	MSD Complaint Level				Total		p
	Mild		Moderate				
	n	%	n	%	N	%	
Poor	29	96.7	17	41.5	46	64.8	0.001
Good	1	3.3	24	58.5	25	35.2	

Table 6 shows that among employees with poor exercise habits, 29 (96.7%) reported mild MSD complaints and 17 (41.5%) reported moderate complaints. Meanwhile, among those with good exercise habits, only 1 (3.3%) reported mild complaints and 24 (58.5%) reported moderate complaints. The Chi-square test yielded a p-value of 0.001 (<0.05), indicating a significant relationship between exercise habits and MSD complaints.

3. Multivariate Analysis

Based on Table 7, the variables of age, work duration, body mass index (BMI), and exercise habits were significantly associated with MSD complaints among employees of the Asahan District Education Office ($p < 0.05$). The odds ratio (OR) for age was 1.968, indicating that employees aged 36–56 years had a 1.968 times higher likelihood of experiencing MSD complaints compared to those aged 20–35 years.

The work duration variable had an OR of 2.875, meaning that employees with 6–

10 years of work experience were 2.875 times more likely to experience MSD complaints than those with 1–5 years of work experience. For BMI, the OR was 7.714, indicating that employees with an abnormal BMI had a 7.714 times greater risk of experiencing MSD complaints compared to those with a normal BMI.

The exercise habit variable showed the strongest association, with an OR of 40.941. This means that employees with poor exercise habits were 40.941 times more likely to experience MSD complaints compared to those with good exercise habits.

From the multivariate analysis results, it can be concluded that exercise habit is the most dominant variable influencing the occurrence of MSD complaints, as evidenced by the highest OR value (40.941).

Table 7. Multiple Regression of Factors Related with MSD Complaints

Variable	OR (CI 95%)	p
Age	1.97 (1.54-2.52)	0.004
Work Duration	2.88 (1.94-4.27)	0.001
Body Mass Index	7.71 (2.56-23-25)	0.001
Exercise Habits	40.94 (5.07-330.36)	0.001

DISCUSSION

Association between Age and MSD Complaints

The results of this study showed a significant association between age and MSD complaints among employees at the Asahan District Education Office, with a p-value of 0.004 (<0.05). More than half of the employees were between 36–56 years old (61 individuals), indicating that older employees are at greater risk for developing MSDs.

This finding is consistent with the theory presented by Tarwaka (2015) in his book Ergonomics: For Safety, Occupational Health, and Productivity, which states that workers over the age of 35 are more prone to MSDs due to decreased muscle strength, flexibility, and tissue elasticity. These natural degenerative changes reduce the body's ability to withstand repetitive or static workloads for extended periods. MSD symptoms tend to appear in the working-age population, with initial complaints commonly occurring around the age of 35 and worsening with age.

A study by Purwati et al. (2023) also supports this finding, reporting that workers over 35 years have a high likelihood of experiencing MSDs. Likewise, research by Amalia & Wahyuningsih (2024) found a significant association between age and MSD complaints among office workers at Company X (p = 0.000).

Researchers concluded that as individuals age, degenerative processes occur, including tissue regeneration decline, which reduces muscle and bone strength—thereby increasing the risk of musculoskeletal complaints.

Association between Gender and MSD Complaints

The study found no significant association between gender and MSD complaints among employees (p= 0.683). The workforce was predominantly male (43 individuals), while female employees totaled 28. The data showed that 60.6% of male and 39.4% of female employees experienced MSD complaints.

According to Tarwaka (2015), women's muscle strength is approximately

two-thirds that of men, giving men greater muscle endurance. On average, women's muscle strength is only about 60% of men's, especially in the arms, back, and legs.

Rahayu (2020) noted that although women report higher MSD pain prevalence in the general population, individual posture and behavior at work can explain differing results. Both genders have an equal risk of MSDs up to the age of 60, depending more on the nature and intensity of their job rather than sex.

Gender refers to both biological differences and sociocultural roles (Agustin, 2020). Although muscle endurance may vary by sex, the physiological capacity of female muscle is generally lower than that of males. However, this study aligns with Shobur et al. (2019), who found no significant relationship (p= 0.702) between gender and MSDs among woven fabric workers.

Association between Work Duration and MSD Complaints

The study found a significant relationship between work duration and MSD complaints (p= 0.001). Most employees (46 individuals) had worked 6–10 years, while 25 had worked 1–5 years. The findings suggest that longer work duration increases the risk of MSDs.

This is in line with Irawati (2020), who found that workers with less than 5 years of experience reported fewer musculoskeletal complaints. Tarwaka (2015) categorizes work duration as "new" (≤5 years) and "long" (>5 years). Continuous and prolonged activities, especially sitting, can lead to MSDs, which often develop over a long period.

Indriyani et al. (2020) similarly found that longer work duration was significantly associated with moderate-to-severe MSD complaints among workers at the Department of Public Works and Spatial Planning in Palembang. Contributing factors include lack of experience, unfamiliarity with tasks, and the need for adaptation to tools and the work environment.

Association between Body Mass Index (BMI) and MSD ComplaintsThe study revealed a significant association between BMI and MSD complaints (p= 0.001). Employees with abnormal BMI had a higher risk of MSD complaints.

Proper nutritional status enhances physical endurance and work capacity. Excess body weight increases mechanical stress on the body and musculoskeletal system (Icsal et al., 2016). Therefore, employees should maintain a normal BMI to reduce the risk of MSDs, especially those who use computers regularly.

BMI is a general indicator of nutritional status. Those with higher BMI are more likely to experience MSDs due to increased joint pressure (Tarwaka, 2015). This result is in line with Rahman et al. (2021), who found a significant relationship between BMI and neck pain among employees at PT Angkasa Pura I, Makassar.

Association between Exercise Habits and MSD Complaints

The results also indicated a significant association between exercise habits and MSD complaints. A majority of employees (46 individuals) had poor exercise habits, which increased their risk of MSDs.

According to Tarwaka (2015), individuals with good physical condition have only a 0.8% risk of muscle complaints, compared to 7.1% in those with poor health. Regular exercise enhances physical fitness, which in turn reduces the risk of muscle injuries.

Putri et al. (2022) also found a significant association between exercise habits and MSDs among employees at the Port Health Office Class II Banten (p = 0.020). Exercise helps stretch muscles and prevent

injuries. Marcilin (2020) further reported that individuals who did not exercise were 2.627 times more likely to experience MSDs compared to those who exercised regularly.

AUTHOR CONTRIBUTIONS

All authors contributed to the preparation of this manuscript.

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CONFLICT OF INTEREST

None.

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