



Comparative Analysis of Musculoskeletal Disorders Among Security Guards and Supermarket Employees Using Nordic Body Map

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Article Info

Submitted November 13, 2025

Revised December 14, 2025

Accepted January 05, 2026

Keywords:

Musculoskeletal disorders; Nordic Body Map; Occupational ergonomics; Security guards; Supermarket employees

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ABSTRACT

Musculoskeletal Disorders (MSDs) are common occupational health problems, particularly in jobs involving prolonged static postures and manual handling activities. This study aimed to analyze differences in the level of musculoskeletal complaints between security guards and supermarket employees using the Nordic Body Map (NBM) method. A quantitative comparative study with a cross-sectional design was conducted involving 30 respondents, consisting of 15 security guards and 15 supermarket employees, selected through total sampling. Data were collected using the NBM questionnaire and analyzed using descriptive and inferential statistics, with the Independent Samples *t*-test applied at a significance level of $\alpha = 0.05$.

The results showed that among security guards, 66.7% of respondents were classified as having low risk and 33.3% as moderate risk, whereas among supermarket employees, 53.3% were categorized as low risk and 46.7% as moderate risk. The mean NBM score for security guards was 46.46 ± 5.57 , while for supermarket employees it was 46.73 ± 11.04 . Statistical analysis indicated no significant difference between the two worker groups ($p = 0.934$). These findings suggest that despite differences in job characteristics, the ergonomic workload experienced by both groups is relatively comparable, particularly due to similarities in the duration of exposure to static working postures. The implications of this study emphasize that preventive ergonomic interventions—such as posture education, appropriate rest scheduling, and regular muscle stretching—should be broadly implemented for both groups to prevent an increased risk of MSDs in the future.

1. INTRODUCTION

The implementation of occupational safety and health (OSH) is a systematic effort to protect workers from potential hazards and work-related diseases while creating safe and productive working conditions. One of the most prevalent occupational health problems is musculoskeletal disorders (MSDs), which are closely associated with exposure to ergonomic hazards such as awkward working postures, prolonged static activities, repetitive movements, and manual material handling.

Globally, the World Health Organization (WHO) reports that approximately 1.71 billion people worldwide suffer from musculoskeletal disorders, with low back pain being the leading cause of disability and having a significant impact on work productivity. The Health and Safety Authority (HSA) also reports that the incidence of occupational diseases reaches 27.1 per 1,000 workers, with approximately 32% of these cases attributed to musculoskeletal injuries related to work activities and non-ergonomic postures. In addition, the Labour Force Survey (LFS) in the United Kingdom records more than 500,000 cases of work-related MSDs, while the Bureau of Labor Statistics (BLS) in the United States reports hundreds of thousands of MSD cases annually, accounting for nearly one-third of all occupational diseases.

In Indonesia, although MSD data are not comprehensively documented on an annual basis, this issue remains a significant occupational health concern. According to the 2018 Basic Health Research (Riskesdas), the prevalence of musculoskeletal complaints based on symptoms among the working population reached 24.7%, while prevalence based on diagnoses by health professionals was 11.9%. This high prevalence indicates that MSDs continue to represent an occupational health problem that requires serious attention and sustained preventive efforts.

Security guards and supermarket employees are service-sector worker groups with different job characteristics but similarly exposed to ergonomic risk factors. Security guards are generally exposed to prolonged static standing, walking patrol activities, and shift work systems, whereas supermarket employees perform manual handling tasks, repetitive movements, and prolonged standing while serving customers. These differences in physical job demands are presumed to influence the level and pattern of musculoskeletal complaints experienced by the two worker groups.

The Nordic Body Map (NBM) method is a widely used instrument for practically identifying the location and severity of MSD complaints in field settings. Therefore, this study was conducted to analyze differences in musculoskeletal disorder (MSD) complaints between security guards and supermarket employees using the Nordic Body Map (NBM) method, as a basis for strengthening ergonomic implementation and preventing occupational safety and health risks in the workplace.

2. METHOD

This study employed a comparative quantitative design with a cross-sectional approach to analyze differences in musculoskeletal disorder (MSD) complaints between security guards and Indomaret employees using the Nordic Body Map (NBM) method. A total of 30 respondents participated in the study, consisting of 15 security guards and 15 Indomaret employees, selected through a total sampling technique.

The data used in this study were primary data obtained through the direct administration of the NBM questionnaire to the respondents. The collected data were subsequently processed through editing, coding, and tabulation stages. Data analysis was conducted descriptively to describe respondents' characteristics and the level of MSD complaints, as well as comparatively using the Independent Samples t-test with the assistance of SPSS software to determine differences in mean MSD complaint scores between security guards and Indomaret employees. The level of statistical significance applied in this study was set at $\alpha = 0.05$. The results of the analysis are presented in the form of tables and narrative descriptions.

3. RESULTS

Musculoskeletal Disorder (MSD) complaints are influenced by various individual and occupational factors, including age, gender, length of employment, and anthropometric characteristics such as height and body weight. Therefore, this section presents the frequency distribution of workers' characteristics, including age, gender, length of employment, height, and body weight, to provide an overall description of the study respondents.

Table 3.1 Distribution of Security Guards' Characteristics

Characteristics	Categories	n	%
Age	20 – 31 years old	7	46.6
	32 – 43 years old	7	46.6
	> 43 years old	1	6.7
Gender	Man	14	93.3
	Woman	1	6.7
Length of Employment	1-5 years	9	60
	>5 years	6	40
Height	165 – 170 cm	11	73.3
	> 10 Years	4	26.6
Weight	58- 68 kg	2	13,3
	>68 kg	15	86,6

Table 3.2 Distribution of Security Guards' Characteristics

Characteristics	Categories	n	%
Age	21 – 22 years old	3	20
	23 – 24 years old	6	40
	> 24 years old	6	40
Gender	Man	15	100
	Woman	0	0
Length of Employment	1-2 years	8	53.3
	>2 years	7	46.6
Height	165 – 170 cm	9	60
	> 10 Years	6	40
Weight	60 – 64 kg	10	66.6
	>64 kg	5	33.3

Based on the factors influencing *Musculoskeletal Disorders* (MSDs) as described previously, an assessment of MSD complaints was subsequently conducted using the **Nordic Body Map** (NBM) questionnaire. This assessment aimed to identify the level of musculoskeletal complaints affecting various body regions among security guard workers.

The level of MSD risk was determined based on the individual total NBM **scores** obtained from 15 security guard respondents. These scores were then classified into MSD risk categories according to the Nordic Body Map scoring criteria. The results of the MSD risk assessment among security guard workers are presented as follows:

Table 3.3 Distribution of MSD Risk Level Assessment among Security Guard Workers

Total Score	Frequency	Percentage (%)	Risk Level	Control Measures
36	1	6.7	Low	No corrective action required
38	1	6.7	Low	No corrective action required
42	1	6.7	Low	No corrective action required
43	1	6.7	Low	No corrective action required
44	1	6.7	Low	No corrective action required
45	2	13.3	Low	No corrective action required
46	2	13.3	Low	No corrective action required
49	1	6.7	Low	No corrective action required
51	1	6.7	Moderate	Corrective action needed in the future
52	3	20.0	Moderate	Corrective action needed in the future
56	1	6.7	Moderate	Corrective action needed in the future

Based on the risk level analysis, it was found that the majority of respondents were classified in the low-risk category, totaling 10 respondents (66.7%). Furthermore, respondents classified as having a moderate risk level amounted to 5 individuals (33.3%). Meanwhile, no respondents were identified in the high or very high risk categories (0%). Overall, the distribution of risk levels indicates that most respondents were within the low to moderate risk range, suggesting that the observed conditions were relatively well controlled and did not yet demonstrate a high potential risk.

Considering the factors influencing the occurrence of *Musculoskeletal Disorders* (MSDs), further assessment was conducted among supermarket employees using the **Nordic Body Map** (NBM) questionnaire. This assessment aimed to identify the level of MSD complaints in different body regions among supermarket workers. The MSD risk level was

determined based on the individual total scores of 15 supermarket employee respondents, with the results presented as follows:

Table 3.4 Distribution of MSD Risk Level Assessment among Supermarket Employees

Total Score	Frequency	Percentage (%)	Risk Level	Control Measures
32	1	6.7	Low	No corrective action required
34	1	6.7	Low	No corrective action required
35	1	6.7	Low	No corrective action required
37	1	6.7	Low	No corrective action required
39	1	6.7	Low	No corrective action required
41	2	13.3	Low	No corrective action required
42	1	6.7	Low	No corrective action required
50	1	6.7	Moderate	Corrective action needed in the future
51	1	6.7	Moderate	Corrective action needed in the future
54	1	6.7	Moderate	Corrective action needed in the future
58	1	6.7	Moderate	Corrective action needed in the future

The analysis results indicate that the majority of respondents were classified into the low-risk category, comprising 8 respondents (53.3%). Furthermore, 7 respondents (46.7%) were categorized as having a moderate risk level. No respondents were identified as having high or very high risk levels. Overall, this distribution demonstrates that the respondents' risk levels were predominantly low to moderate, suggesting that the observed conditions were relatively well controlled and did not yet indicate a high potential risk.

To determine whether there was a difference in the level of Musculoskeletal Disorders (MSDs) complaints between the two groups of supermarket employees, a statistical analysis was conducted using the Independent Samples t-test. This test compared the mean total MSD complaint scores between the two respondent groups. The test results are presented in the following table, which includes the Levene's Test value, t-value, significance level (p-value), and the mean difference between groups, with the results obtained as follows:

Tabel 5. Hasil Analisa Perbandingan dengan Independent Samples Test

Variabel	N	Mean	Std. Deviation	p-value
Total NBM Score of Security Guards	15	46.46	5.566	0,934
Total NBM Score of Supermarket Employees	15	46.73	11.042	

The results of the comparative analysis using the Independent Samples t-test indicate that the mean musculoskeletal complaint scores between security guards and supermarket employees are relatively comparable, with a significance value (p-value) of 0.934. This finding demonstrates that there is no statistically significant difference between the two groups of workers. These results provide a basis for further discussion regarding the factors influencing the level of musculoskeletal complaints in each occupational group, as well as their implications for ergonomic risk control efforts in the workplace.

4. DISCUSSIONS

Security Guards

The results show that the security guard respondents were predominantly male (93.3%) and mostly within the productive age group, with the highest proportion having a length of service of 1–5 years. From an anthropometric perspective, most respondents had a body weight greater than 68 kg, which ergonomically has the potential to increase mechanical load on the musculoskeletal system, particularly on weight-bearing joints and the spine. However, the Nordic Body Map (NBM) assessment indicated that the majority of respondents were classified as having a low risk of musculoskeletal disorders (66.7%), while the remaining respondents were in the moderate-risk category (33.3%). No respondents were identified as having high or very high risk.

The predominance of low-risk classification is consistent with the findings of Ulandari et al. (2025), who reported a significant association between ergonomic knowledge and MSD risk among market workers in Bali, where adequate ergonomic awareness contributed to reduced musculoskeletal complaints. The variation in work postures among security guards—such as alternating between standing, walking, and sitting during duty—is assumed to facilitate recovery mechanisms that reduce the accumulation of muscle fatigue caused by prolonged static contractions. Similar findings were also reported in studies of construction workers by Ridwan et al. (2025).

Nevertheless, the presence of respondents in the moderate-risk category indicates that security work still involves prolonged standing and walking patrols, which may contribute to musculoskeletal complaints. The proportion of respondents with relatively high body weight should be considered in occupational health and safety (OHS) management, as increased compressive loads on joints have been associated with MSD incidence in other occupational sectors in Indonesia.

For example, studies among market laborers using the Nordic Body Map have identified significant distributions of musculoskeletal complaints related to work duration and posture. The overall low-risk profile observed in this study is also influenced by the relatively short duration of employment among respondents, suggesting that cumulative microtrauma to musculoskeletal tissues has not yet developed significantly. This finding supports existing evidence that work posture and exposure duration are critical factors in MSD risk control.

Supermarket Employees

All supermarket employee respondents in this study were male (100%) and predominantly belonged to the early adult age group, with most having a length of service of 1–2 years. The anthropometric characteristics of respondents were generally within normal ranges, which physiologically provides relatively good initial work capacity. However, the Nordic Body Map (NBM) assessment revealed that although the majority of respondents were classified as having low risk (53.3%), a considerable proportion were categorized as moderate risk (46.7%). No respondents were identified as having high or very high risk.

The relatively high proportion of moderate risk aligns with the findings of Ulandari et al. (2025), who reported that repetitive work postures and prolonged standing among market workers increased MSD risk despite overall classifications remaining within low to

moderate categories. The elevated moderate-risk proportion among supermarket employees is closely associated with the repetitive and static nature of their work, such as lifting, arranging goods, reaching shelves, and prolonged standing while serving customers. These activities impose consistent mechanical exposure on the lower back muscles and upper extremities. This finding is consistent with the study by Rosidah and Fahmi (2025), which identified a significant relationship between prolonged static standing and musculoskeletal complaints among education-sector workers using the NBM instrument.

Furthermore, the relatively short length of service (1–2 years) may contribute to the observed moderate risk, as newly employed workers generally have not fully mastered ergonomic work techniques and safe manual handling practices. This is supported by Sari et al. (2023), who reported that limited work experience is associated with an increased likelihood of MSD complaints among textile industry workers. Conversely, the majority of respondents had normal body weight, which serves as a protective factor and may explain the absence of high-risk classifications, as compressive loads on joints and the spine were not significantly increased. Overall, these findings indicate that although workers' physical capacity remains relatively good, repetitive and static work exposure without adequate ergonomic control may increase long-term MSD risk.

Comparative Analysis of MSD Complaints Between Security Guards and Supermarket Employees

To determine differences in musculoskeletal disorder (MSD) complaints between security guards and supermarket employees, an Independent Samples t-test was conducted on Nordic Body Map (NBM) scores. The analysis showed that the mean MSD score among security guards was 46.46, while that of supermarket employees was 46.73. The similarity of these mean values was further supported by the significance test result, with a p-value of 0.934. Statistically, because the p-value exceeded the significance level ($\alpha = 0.05$), it can be concluded that there is no significant difference in musculoskeletal complaint levels between the two occupational groups at the study site.

The absence of a significant difference suggests that despite differing job characteristics, the ergonomic workload experienced by both groups is relatively comparable. One contributing factor is the similarity in exposure duration to static work postures, as both groups are frequently required to stand for prolonged periods. This finding is supported by Rosidah and Fahmi (2025), who reported that prolonged static standing is associated with increased musculoskeletal complaint risk across various occupational sectors.

Additionally, compensatory postural mechanisms and individual characteristics differ between the two worker groups. Among security guards, moderate risk is primarily influenced by prolonged duty duration but may be mitigated by opportunities to alternate sitting and standing, as observed by Ulandari et al. (2025), who emphasized that postural variation reduces MSD risk. In contrast, the moderate-risk proportion among supermarket employees is more strongly influenced by manual handling activities and repetitive movements, although this is offset by their relatively younger age, which supports better muscle recovery capacity. The combination of these factors results in nearly identical mean NBM scores between the two groups.

These findings are consistent with Sari et al. (2023), who demonstrated that in work environments with similar durations of static and repetitive exposure, NBM scores tend to cluster within low to moderate risk categories, as the body is still able to adapt to daily workloads. Therefore, ergonomic intervention strategies do not need to be highly

differentiated between security guards and supermarket employees but can instead focus on general preventive measures, such as ergonomic posture education and regular muscle stretching during working hours, to prevent increased MSD risk in the future.

5. CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that the majority of security guards were classified as having a low risk of musculoskeletal complaints (66.7%), followed by a moderate risk category (33.3%). This condition is influenced by variations in work posture, including a combination of standing, walking, and sitting during duty. Meanwhile, supermarket employees were also predominantly classified as having a low risk (53.3%); however, they demonstrated a relatively higher proportion of moderate risk (46.7%), which is associated with prolonged static standing and repetitive manual handling activities performed throughout operating hours.

The Independent Samples t-test results showed that the mean Nordic Body Map (NBM) score among security guards was 46.46, while that of supermarket employees was 46.73, with a p-value of 0.934. These findings indicate that there is no statistically significant difference in musculoskeletal complaint levels between the two worker groups ($p > 0.05$).

Overall, the level of musculoskeletal disorder (MSD) risk in both occupational groups falls within the low to moderate category. Although immediate corrective ergonomic interventions are not urgently required, preventive control measures remain essential. These measures include muscle stretching education, adequate rest period arrangements, and increased awareness and compliance with ergonomic work principles to prevent the escalation of musculoskeletal risk in the future.

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