

Association between Rapid Office Strain Assessment Scores and Musculoskeletal Symptoms among University Administrative Staff

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ABSTRACT

Work-related musculoskeletal disorders (MSDs) remain a major occupational health concern among office employees, despite growing awareness of workplace ergonomics. Evidence on the relationship between workstation ergonomic risk and musculoskeletal symptoms among university administrative staff remains limited. This study evaluated ergonomic risk using the Rapid Office Strain Assessment (ROSA), determined the prevalence of musculoskeletal symptoms, and examined their associations with workstation ergonomic risk and work-related factors among administrative staff at a Malaysian public university. A cross-sectional study was conducted among 54 full-time administrative employees selected through simple random sampling. Workstation ergonomic risk was assessed using ROSA, and musculoskeletal symptoms were measured using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). Descriptive statistics, Chi-square tests, Spearman's rank correlation, and linear regression analyses were conducted in SPSS version 27, with statistical significance set at $p < 0.05$. The mean ROSA score was 2.93 ± 0.82 , with 77.8% of workstations classified as low risk. Despite this, 96.3% of participants reported at least one musculoskeletal symptom, most commonly in the lower back (79.6%), neck (74.1%), and upper back (72.2%). No significant association was found between ROSA scores and MSD symptoms. Multiple regression identified years of employment ($\beta = 0.453$, $p = 0.024$), frequent bending ($\beta = 4.875$, $p = 0.045$), and arm and hand exertion ($\beta = -3.790$, $p = 0.028$) as independent predictors of total symptom scores. These findings suggest that cumulative occupational exposure and work demands may contribute more substantially to musculoskeletal symptoms than workstation ergonomic risk alone. Comprehensive ergonomic interventions integrating workstation optimisation, work organisation, and ergonomic education are recommended to reduce the MSD burden and improve occupational health among university administrative staff.

Keywords: *Ergonomics; musculoskeletal disorders; Rapid Office Strain Assessment; office workstation; administrative staff*

INTRODUCTION

Musculoskeletal disorders (MSDs) remain one of the most prevalent occupational health problems worldwide, accounting for a substantial proportion of work-related injuries, disability, sickness absence, and productivity loss across multiple industries. According to recent global estimates, approximately 1.71 billion people are affected by musculoskeletal conditions, making them the leading contributor to disability worldwide. Among working populations, recent systematic reviews report work-related musculoskeletal disorder (WMSD) prevalence ranging from 33.8% to 95.3% across occupational settings, with office workers particularly affected (Demissie et al. 2024). A meta-analysis of Sub-Saharan African office workers estimated a pooled WMSD prevalence of 73.13%, with regional prevalences of 46.48% for lower back pain, 43.43% for neck pain, and 39.6% for upper back pain (Demissie et al. 2025). MSDs not only impair workers' physical health and quality of life but also impose considerable economic burdens through increased healthcare expenditure, reduced work performance, absenteeism, and presentism. Consequently, preventing work-related MSDs has become a major priority in occupational health and ergonomics research.

Office-based occupations have traditionally been considered physically low-risk environments. However, rapid digitalisation and increasing dependence on computer-based tasks have substantially altered work demands. Administrative personnel frequently spend prolonged periods sitting, performing repetitive keyboard and mouse activities, maintaining static postures, and viewing computer monitors with limited opportunities for postural variation. These occupational exposures have consistently been associated with discomfort involving the neck, shoulders, upper limbs, and lower back. Prolonged sedentary work (≥ 4 hours/day) and limited postural variation have been associated with significantly higher odds of MSDs, with prevalence rates exceeding 86% in university computer users (Amer et al. 2025; Puts et al. 2022). Recent evidence demonstrates that frequent position changes (hourly) can reduce MSD risk by over 30%, while prolonged sitting combined with poor workstation design substantially increases the likelihood of developing MSD symptoms (Putsa et al. 2022).

The burden of MSDs among office workers remains considerable despite increasing implementation of ergonomic principles in modern workplaces. A recent meta-analysis estimated a pooled regional prevalence of 46.48% for lower back pain, 43.43% for neck pain, and 39.6% for upper back pain among office workers (Demissie et al. 2025). The neck, shoulders, and lower back continue

to be the most frequently affected body regions among computer users and administrative employees worldwide. In addition to physical ergonomic exposures, organisational and psychosocial factors, including prolonged working hours, insufficient work breaks, increasing workload, job demands, high stress, short sleep duration, and cumulative occupational exposure, have also been recognised as important contributors to the development and persistence of MSD symptoms (Besharati et al. 2020; Etana et al. 2021; Farhat et al. 2023; Putsa et al. 2022). Research has documented that elevated occupational stress, insufficient peer support, and sustained awkward postures for extended durations (≥ 2 hours) are significant predictors of WMSD (Etana et al. 2021; Farhat et al. 2023). These findings indicate that MSDs are multifactorial conditions that cannot be explained solely by workstation characteristics.

Ergonomic risk assessment plays an important role in identifying workplace conditions that may contribute to the development of MSDs. Various observational assessment tools have been developed to evaluate ergonomic risks in occupational settings, including the Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA), Ovako Working Posture Assessment System (OWAS), and Rapid Office Strain Assessment (ROSA). Among these methods, ROSA was specifically developed for office environments and is widely recognised as a practical screening tool for evaluating workstation ergonomic risks associated with prolonged computer use. The assessment incorporates multiple workstation components, including chair configuration, monitor position, telephone usage, keyboard and mouse arrangement, enabling practitioners to identify workstations requiring ergonomic intervention (Sonne et al. 2012). Recent applications in university and government office settings have demonstrated ROSA's sensitivity, with studies reporting that 70.8% of workstations in warning zones require corrective measures and 86.49% require ergonomic action (Kim, 2024; Salehi Sahlabadi et al. 2020). Ergonomic redesign interventions guided by ROSA have successfully reduced risk scores from high-risk levels (ROSA score 8) to acceptable levels (ROSA score 3), demonstrating measurable risk reduction (Betanti Ridhosari et al. 2024).

Several studies have demonstrated positive associations between higher ROSA scores and increased musculoskeletal discomfort among office employees. A study of university office staff found a mean ROSA score of 4.9 (± 1.02), with 70.8% of workstations in a warning zone and significant correlations between final ROSA scores and neck (62.5%), shoulder (57.3%), and low back (57.3%) symptoms (Salehi Sahlabadi et al. 2020). Similarly, ROSA scores have been associated with pain severity and regional MSD prevalence, with mental workload factors (effort, mental demand,

performance) also linked to musculoskeletal outcomes (Besharati et al. 2020). Combined ROSA and Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) surveillance approaches have identified high ergonomic risk and frequent neck and shoulder complaints in government office settings (Haqi et al. 2023). Nevertheless, findings across different occupational settings remain inconsistent. While some investigations reported significant relationships between ergonomic risk scores and MSD prevalence, others observed weak or non-significant associations, suggesting that workstation ergonomic assessment alone may not adequately explain the occurrence of musculoskeletal symptoms. This inconsistency implies that cumulative occupational exposure, work organisation, individual characteristics, and behavioural factors may influence MSD development beyond what is captured through workstation assessment alone (Etana et al. 2021; Putsa et al. 2022).

In Malaysia, research investigating MSDs among office workers has primarily focused on prevalence estimates or isolated ergonomic factors. A recent study of Malaysian office workers reported an exceptionally high WMSD prevalence of 99.3%, with upper back, right upper arm, and neck most commonly affected, yet identified significant gaps in ergonomics knowledge despite positive attitudes and generally good practices (Harithasan & Zulkipli, 2024). Although several local studies have reported high rates of neck, shoulder, and lower back discomfort among computer users, relatively few have simultaneously evaluated workstation ergonomic risk using ROSA together with musculoskeletal symptoms and work-related characteristics among university administrative personnel. Universities represent unique occupational environments in which administrative staff perform prolonged computer-based work while simultaneously managing increasing administrative workloads, yet evidence on ergonomic risks in this workforce remains limited. Furthermore, available findings have provided limited understanding of whether workstation ergonomic risk adequately reflects the high prevalence of MSD symptoms reported among office employees in higher education institutions.

Addressing this knowledge gap is important for improving workplace ergonomic management. Understanding whether MSD symptoms are primarily associated with workstation design or with broader occupational exposures may assist organisations in developing more comprehensive intervention strategies beyond workstation modification alone. Recent evidence suggests that organisational factors such as frequent position changes, adequate breaks, stress management, and moderate-to-vigorous physical activity (≥ 150 minutes/

week) may reduce MSD risk by over 30% (Putsa et al. 2022). Such evidence is particularly relevant for higher education institutions seeking to improve employee wellbeing, reduce productivity losses, and strengthen occupational health programmes.

Despite the availability of observational tools such as ROSA, there remains a clear research gap in understanding the mismatch between objective ergonomic scores and the exceptionally high musculoskeletal symptom burden reported in academic administrative settings. This study addresses this gap by investigating whether workstation configuration alone is a sufficient proxy for health risk in a population with high service seniority. The novelty of this work resides in its integrated approach, which assesses the physical workstation while concurrently considering the cumulative occupational characteristics that are frequently neglected in standardized ergonomic evaluations. Therefore, this study aimed to evaluate ergonomic risk among administrative staff using the Rapid Office Strain Assessment (ROSA), determine the prevalence of musculoskeletal symptoms using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), and examine the relationships between workstation ergonomic risk, work-related characteristics, and musculoskeletal symptoms among administrative staff in a university setting.

METHODOLOGY

STUDY DESIGN AND PARTICIPANTS

This study adopted a cross-sectional design, which is widely used in occupational health research to estimate the prevalence of musculoskeletal symptoms and explore their associations with workplace ergonomic exposures (Kibret et al. 2020; Melese et al. 2020). The target population comprised full-time administrative staff at a university situated on the east coast of Malaysia, who regularly engaged in computer-based tasks as part of their daily responsibilities.

Participants were selected through simple random sampling, a method that gives every eligible staff member an equal chance of being included and helps minimise selection bias (Melese et al. 2020). To be eligible, participants had to be permanent administrative staff aged 18 or older, employed for at least 6 months, and actively engaged in office-based work. We excluded staff who were pregnant, had sustained traumatic musculoskeletal injuries unrelated to work, had recently undergone orthopaedic surgery, or carried a physician-confirmed diagnosis of a musculoskeletal condition not attributable to occupational

exposure. These criteria were applied to reduce the influence of confounding factors on the measured MSD outcomes.

Sample size was calculated using the single-population proportion formula, $n = Z^2P(1-P)/d^2$, where Z is the standard normal deviate (1.96 for a 95% confidence level), P is the expected prevalence (0.50), and d is the margin of error (0.05). Based on a reported MSD prevalence of approximately 50% among Malaysian office workers in prior studies and applying a 95% confidence level with a 5% margin of error, the minimum required sample was estimated at 45 participants. After applying a 20% non-response adjustment, the final target was set at 54 participants, all of whom completed the study, resulting in a 100% response rate.

DATA COLLECTION

Each participant underwent two complementary assessments: a self-administered questionnaire and a direct workstation evaluation. Before data collection began, all assessors completed a standardised briefing session on ROSA scoring procedures to ensure consistency across evaluations.

Participants first provided written informed consent and then completed the structured questionnaire, which covered socio-demographic details, occupational characteristics, and the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). Workstation assessments were conducted immediately afterwards, individually during normal working hours, to capture typical working conditions without disrupting daily routines. Each assessment took approximately 10 to 15 minutes per participant.

STUDY INSTRUMENTS

CORNELL MUSCULOSKELETAL DISCOMFORT QUESTIONNAIRE (CMDQ)

Musculoskeletal symptoms were assessed using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), originally developed by Hedge et al. and subsequently validated in multiple languages and occupational settings (Carrasquero, 2024; Liyanage et al. 2023; Magnifica et al. 2021). The CMDQ asks respondents to rate discomfort across 20 body regions over the previous seven days using three subscales: frequency of discomfort (0 = never to 4 = always), severity (1 = slightly uncomfortable to 3 = very uncomfortable), and work interference (1 = not at all to 3 = interfered a lot). A total musculoskeletal symptom score

is derived by summing the products of these three subscales across all body regions, with a higher score indicating a greater overall burden of discomfort (Elghomati et al. 2022; Yazdanirad et al. 2022).

The CMDQ has demonstrated good psychometric properties across studies, including Cronbach's alpha values above 0.76 and intraclass correlation coefficients (ICCs) ranging from 0.74 to 0.95 (Magnifica et al. 2021), supporting its reliability as a symptom surveillance tool in sedentary worker populations.

RAPID OFFICE STRAIN ASSESSMENT (ROSA)

Workstation ergonomic risk was evaluated using the Rapid Office Strain Assessment (ROSA), a posture-based observational tool designed specifically for office environments (Cabegi de Barros et al. 2022). ROSA assesses five workstation components: seat height and pan depth, backrest and armrest configuration, monitor and telephone placement, and keyboard and mouse arrangement. Each component receives a score based on observed posture and workstation setup, which are combined into a final score on a scale of 1 to 10. Scores above 5 indicate elevated ergonomic risk and signal a need for corrective action (Cabegi de Barros et al. 2022; Janc et al. 2023).

ROSA has been applied across a range of office and administrative settings, from university staff (Janc et al. 2023) to call centre workers (Baguio et al. 2023). Previous studies have demonstrated responsiveness to workstation changes following ergonomic interventions (Cabegi de Barros et al. 2022). All assessments in this study were conducted by trained assessors using the standardised ROSA worksheet, and evaluations were performed at each participant's actual workstation during regular working hours.

STATISTICAL ANALYSIS AND ETHICAL CONSIDERATIONS

All data were analysed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics summarised participant demographics, occupational characteristics, ROSA scores, and CMDQ scores. Continuous variables are reported as mean $\pm$ standard deviation (SD); categorical variables as frequencies and percentages.

Chi-square tests examined associations between categorical variables, specifically whether ROSA risk categories differed across symptom-reporting body regions (Munir et al. 2021). Spearman's rank correlation was used to assess the relationship between ROSA scores and CMDQ symptom scores, given the ordinal nature of both measures

and the non-normal distribution of the data (Naserian et al. 2024). Variables showing potential associations in bivariate analyses were then entered into a multiple linear regression model to identify independent predictors of total CMDQ symptom scores (Yazdanirad et al. 2022). Variables with $p < 0.25$ during simple linear regression were entered into the multiple linear regression model using the Enter method. Prior to model development, assumptions of multiple linear regression, including linearity, normality of residuals, and multicollinearity, were examined. Variance inflation factor (VIF) values were below 5, indicating absence of multicollinearity. Statistical significance was set at $p < 0.05$ throughout.

Ethical approval for this study was obtained from the Human Research Ethics Committee of Universiti Sains Malaysia (JEPeM) prior to data collection (Reference No.: USM/JEPeM/KK/23121004). The host institution also granted institutional permission. All participants received a clear explanation of the study's purpose and procedures before being asked to sign a written informed consent form. Participation was entirely voluntary, and participants were free to withdraw at any point without consequence. All data were handled confidentially and analysed anonymously throughout.

RESULTS AND DISCUSSION

PARTICIPANTS CHARACTERISTICS

Fifty-four administrative staff completed the study, achieving a 100% response rate. Their socio-demographic

characteristics are presented in Table 1. On average, participants were 43.81 ± 7.73 years old and had been in service for 17.22 ± 7.17 years, indicating a workforce with substantial cumulative occupational exposure. The majority were female (74.1%), Malay (100%), married (88.9%), and held at least a bachelor's degree (51.9%). Over four-fifths (83.3%) had worked for more than ten years, and while the largest single group had a normal BMI (42.6%), more than half the sample fell into the overweight or obese categories.

These characteristics are worth noting because they carry real implications for MSD risk. Prolonged employment involves years of accumulated biomechanical loading, such as sitting, typing, and maintaining static postures day after day. These postures and work activities eventually wear on musculoskeletal tissues, even when individual work sessions seem unremarkable. Research has consistently shown that longer work experience is independently associated with higher MSD odds; Etana et al. (2021) reported an adjusted odds ratio of 2.16 for work experience among institutional workers, while Amalia and Wahyuningsih (2024) found years of service significantly associated with MSD complaints ($p < 0.001$) in office workers. Elevated BMI adds another layer of concern, particularly for weight-bearing joints. Rajpal and Singh (2025) found that overweight software professionals had nearly three times the odds of reporting MSDs compared to those with normal weight ($OR = 2.84$, $p = 0.011$). Overall, the demographic profile indicates a workforce that requires proactive musculoskeletal monitoring, not merely workstation assessments.

TABLE 1. Sociodemographic Characteristics of Respondents (N=54)

Variables	Category	Frequency (n)	Percentage (%)	Mean $\pm$ SD
Gender	Male	14	25.9	
	Female	40	74.1	
Age (years)				43.81 $\pm$ 7.73
Marital status	Single	6	11.1	
	Married	48	88.9	
Years of employment	< 10 years	9	16.7	$\pm$ 7.17
	>10 years	45	83.3	
Body Mass Index (BMI)(kg/m ²)	Underweight (< 18.5)	1	1.9	26.94 $\pm$ 5.28
	Normal (18.5 – 24.9)	23	42.6	
	Overweight (25 – 29.9)	15	27.8	
	Obese ($\geq$ 30)	15	27.8	
Education level	Certificate	8	14.8	
	Diploma	14	25.9	
	Bachelor	28	51.9	
	Master	4	7.4	
Chronic disease diagnosed	Yes	18	33.3	
	No	36	66.7	

ERGONOMIC RISK ASSESSMENT OF OFFICE WORKSTATIONS

The ROSA assessment results are summarised in Table 2. The mean overall ROSA score was 2.93 ± 0.82 , with 77.8% of workstations classified as low risk and the remaining 22.2% as moderate risk. No workstation reached the high-risk threshold (score > 5) that would typically prompt immediate corrective action. Scores across individual components, namely chair configuration, monitor and telephone placement, keyboard and mouse arrangement, were generally within acceptable ranges.

Initially, these results suggest a somewhat positive view of the work environment. The low scores probably indicate enhancements in office furniture quality and the presence of height-adjustable chairs throughout the institution. That said, this study's mean ROSA score of 2.93 is notably lower than those reported in comparable settings. Salehi Sahlabadi et al. (2020) found a mean ROSA of 4.9 among university office staff, with 70.8% in a warning zone, while Fatima and Farooqi (2023) reported a mean of 6.07 among administrative staff at Pakistani universities, with 68.9% classified as high risk. This contrast suggests that workstation conditions at USM Health Campus may be better configured, although it also raises the question of why MSD prevalence remains so high despite low ergonomic risk scores.

Cabegi de Barros et al. (2022) demonstrated that ROSA is responsive to change following ergonomic interventions, which confirms its value as a monitoring tool, but this also implies that what matters is not just the workstation configuration but the behaviour occurring within it. Organisational strategies that encourage hourly position changes, scheduled micro-breaks, and workload management are therefore just as important as adjusting the chair height. Putsa et al. (2022) found that office workers who changed position every hour reduced their risk of MSDs by more than 30%, a straightforward and cost-effective strategy that workstation redesign alone cannot replicate.

TABLE 2. ROSA score for each section

Section	ROSA scores (mean $\pm$ SD)	Min- max	Level ROSA
A – chair	2.43 $\pm$ 0.57	2 – 4	Low
B – monitor and telephone	2.04 $\pm$ 0.91	1 – 4	Low
C – mouse and keyboard	2.83 $\pm$ 0.93	2 – 5	Low
ROSA total score	2.93 $\pm$ 0.82	2 – 5	Low

PREVALENCE OF MUSCULOSKELETAL SYMPTOMS

The prevalence of musculoskeletal symptoms is presented in Table 3. Notably, 96.3% of participants experienced at least one musculoskeletal symptom during the assessment period. The lower back was the most affected region (79.6%), followed by the neck (74.1%), upper back (72.2%), right shoulder (66.7%), left shoulder and hip/buttocks (61.1% each), and right wrist (57.4%). Symptoms in the lower limbs were less frequent but still notable.

TABLE 3. Prevalence of symptoms of MSDs (N=54)

Variable	Respondents (n)	Percentage (%)
Neck	40	74.1
Shoulder – right	36	66.7
Shoulder – left	33	61.1
Upper back	39	72.2
Upper arm-right	26	48.1
Upper arm-left	21	38.9
Lower back	43	79.6
Forearm-right	25	46.3
Forearm-left	20	37.0
Wrist-right	31	57.4
Wrist-left	24	44.4
Hip-buttocks	33	61.1
Thigh-right	19	35.2
Thigh-left	17	31.5
Knee-right	29	53.7
Knee-left	24	44.4
Lower leg-right	27	50.0
Lower leg-left	24	44.4
At least one symptom of MSDs	52	96.3

This level of prevalence is high, though not entirely out of step with what has been reported in similar populations. Cobos-Bermeo et al. (2025) found that 94.5% of university administrative staff reported spinal discomfort, with cervical (91.7%) and lumbar (90.5%) regions most affected. Cruz-Salazar and Buele (2024) similarly reported 100% symptom prevalence in university administrative staff, with neck, lower back, and elbow most commonly involved. Broader pooled estimates tend to be somewhat lower; for instance, Demissie et al. (2025) reported a pooled WMSD prevalence of 73.13% among computer workers in Sub-Saharan Africa. However, these figures exhibit significant variability depending on symptom definitions and measurement methods.

The pattern of lower-back and neck dominance in the current study is consistent with the biomechanical demands of desk-based work. Prolonged sitting in sustained lumbar flexion, extended use of visual display terminals, and a fixed head-neck posture collectively increase mechanical loading on spinal structures and cervical musculature over the course of a working day. Grabara (2025) found that daily sitting time predicted most MSDs in a sample of 440 Polish white-collar workers, with lower back (65.9%) and neck (59.8%) again leading the distribution. What stands out in these findings is the contrast between the high symptom rates and the relatively low ROSA scores, a discrepancy that distinctly indicates influences beyond workstation design.

WORK CHARACTERISTICS ASSOCIATED WITH MUSCULOSKELETAL DISORDERS

Table 4 summarises the distribution of work characteristics among participants. Prolonged computer use was the dominant occupational exposure, as one-third of respondents (33.3%) reported working in front of a computer almost always. Activities involving arm and hand exertion, frequent bending, and uncomfortable postures

were less commonly rated as frequent (5.6% each in the “almost always” category).

There is a tendency to think of administrative work as physically light, but this framing misses something important. Sitting still for hours, holding a mouse, and staring at a screen is not as demanding as manual labour, but it is demanding in a quiet, cumulative way. Muscles that maintain static postures for extended periods fatigue without ever being pushed to their limits; circulation slows; discomfort builds. Demissie et al. (2025) found that prolonged computer use was associated with an adjusted odds ratio of 3.87 for WMSDs in a pooled analysis, and Putsa et al. (2022) showed that sitting at work for four or more hours per day was independently associated with higher MSD risk. The implication is that the duration of exposure matters at least as much as its intensity.

These findings reinforce the idea that addressing MSD risk in this workforce cannot stop at workstation configuration. Encouraging staff to step away from their desks periodically, vary their tasks, and be aware of their posture throughout the day are strategies with real, measurable impact. Putsa et al. (2022) found that hourly position changes alone reduced MSD risk by more than 30%, a reminder that some of the most effective ergonomic interventions are also among the simplest.

TABLE 4. Work characteristics of MSDs (N=54)

Work characteristics	n (%)			
	Seldom/ never	Sometimes	Often	Almost/ always
Sitting for long periods	1(1.9%)	20(37.0%)	17(31.5%)	16(29.6%)
Facing the computer for a long period of time	1(1.9%)	23(42.6%)	12(22.2%)	18(33.3%)
Manually handle workplace activities	3(5.6%)	18(33.3%)	23(42.6%)	10(18.5%)
Walking while working	5(9.3%)	14(26.0%)	25(46.3%)	10(18.5%)
Jobs require exertion of arms/hands.	12(22.2%)	25(46.3%)	14(26.0%)	3(5.6%)
Bend over.	17(31.5%)	31(57.4%)	14(26.0%)	3(5.6%)
Neck flexion	14(26.0%)	27(50.0%)	9(16.7%)	4(7.4%)
Working with uncomfortable postures	15(27.8%)	29(53.7%)	7(13.0%)	3(5.6%)
Working in same position for long periods	5(9.3%)	19(35.2%)	23(42.6%)	7(13.0%)
Doing repetitive tasks many times per minutes	10(18.6%)	18(33.3%)	17(31.5%)	9(16.7%)
Neck twisting	18(33.3%)	20(37.0%)	10(18.5%)	6(11.1%)

ASSOCIATION BETWEEN WORKSTATION ERGONOMIC RISK AND MUSCULOSKELETAL SYMPTOMS

Table 5 presents the associations between ROSA risk classification and musculoskeletal symptoms by body region. Chi-square analysis found no significant association between overall ROSA risk category and symptoms in any anatomical region ($p > 0.05$). Spearman's correlation analysis confirmed this pattern, with no significant

correlation found between total MSD symptom scores and any individual ROSA section: chair assessment ($r = 0.055$, $p = 0.694$), monitor and telephone assessment ($r = 0.216$, $p = 0.117$), keyboard and mouse assessment ($r = -0.066$, $p = 0.635$), or the overall ROSA grand score ($r = -0.075$, $p = 0.588$).

These results may seem counterintuitive given the high symptom burden in this sample, but they are not unusual in the ergonomics literature. Similarly, Hasri et al. (2024) found no significant association between work-related characteristics and WMSD prevalence ($p > 0.05$) among

office workers at a Malaysian university. Iram et al. (2022) found that ROSA total scores were significantly associated with shoulder ($p = 0.012$) and hand complaints ($p = 0.006$) in a sample of computer workers, and Salehi Sahlabadi et al. (2020) reported a relationship between ROSA final scores and MSD prevalence in neck, shoulder, and lower back regions. The results reflect that ROSA can detect meaningful risk in some contexts but appears less predictive when workstation risk is generally low, as in this study.

The absence of a strong link between ROSA scores and symptoms underscores an important ergonomic paradox: standardised workstation setups might show acceptable postural scores theoretically but do not address the 'internal exposure' from sustained static loading. This is where point-in-time observational tools show their limits.

ROSA depicts a workstation at a specific moment but doesn't account for total exposure time. Regression analysis indicates that years of employment, a measure of cumulative exposure, is a stronger predictor of discomfort among workers. Additionally, the relatively low ROSA scores in our sample imply that although the physical 'hardware' like chairs and desks is sufficient, the 'software' including work organisation and static task durations remains unaddressed. As Redivo and Olivier (2021) contended, ROSA should be considered alongside broader contextual measures rather than as an isolated predictor of symptoms. In this study, where the majority of workstations were already classified within the low-risk range, the variation in ROSA scores was too minimal to account for differences in symptom outcomes. The high prevalence of MSDs was influenced by other underlying factors.

TABLE 5. Association between workstation ergonomic risk and musculoskeletal symptoms. (N=54)

ROSA level	Symptoms of MSDs, n (%)		X ²	p-value
	Yes	No		
Neck symptom				
Low	30 (71.4)	12 (28.6)	0.059	0.808
Medium	9 (75.0)	3 (25.0)		
Shoulder symptom				
Low	32 (76.2)	10 (23.8)	0.441	0.507
Medium	8 (66.7)	4 (33.3)		
Upper back symptom				
Low	29 (69.0)	12 (31.0)	0.159	0.690
Medium	9 (75.0)	3 (25.0)		
Upper arm symptom				
Low	22 (52.4)	20 (47.6)	1.356	0.244
Medium	4 (33.3)	8 (66.7)		
Lower back symptom				
Low	32 (76.2)	10 (23.8)	0.276	0.600
Medium	10 (83.3)	2 (16.7)		
Forearm symptom				
Low	20 (47.6)	22 (52.4)	0.771	0.380
Medium	4 (33.3)	8 (66.7)		
Wrist symptom				
Low	24 (57.1)	18 (42.9)	0.005	0.914
Medium	7 (58.3)	5 (41.7)		
Hip/buttock symptom				
Low	27 (64.3)	15 (35.7)	0.801	0.371
Medium	6 (50.0)	6 (50.0)		
Thigh symptom				
Low	15 (35.7)	27 (64.3)	0.482	0.487
Medium	3 (25.0)	9 (75.0)		
Knee symptom				
Low	23 (54.8)	19 (45.2)	0.048	0.826

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Medium	7 (58.3)	5 (41.7)		
Lower leg symptom				
Low	21 (50.0)	21 (50.0)	0.260	0.610
Medium	5 (41.7)	7 (58.3)		
Total score of MSDs symptoms				
Score	r		p-value	
Section A – chair	0.055		0.694	
Section B – monitor and telephone	0.216		0.117	
Section C – mouse and keyboard	-0.066		0.635	
Total ROSA score	-0.075		0.588	

PREDICTORS OF MUSCULOSKELETAL SYMPTOMS AMONG ADMINISTRATIVE STAFF

Multiple linear regression identified three independent predictors of total MSD symptom scores: years of employment ($\beta = 0.453$, $p = 0.024$), arm and hand exertion ($\beta = -3.790$, $p = 0.028$), and frequent bending ($\beta = 4.875$, $p = 0.045$). An uncomfortable working posture showed a potential association in simple regression but did not remain significant in the multivariable model.

The finding that employment duration predicts MSD symptoms is consistent with the cumulative trauma framework, wherein the concept is that repeated low-level

mechanical stress accumulates over time and ultimately manifests as tissue damage and pain. Each additional year of employment was associated with an increase of 0.453 units in total symptom score. This aligns with Etana et al. (2021), who found that longer work experience was associated with an adjusted odds ratio of 2.16 for WMSDs among institutional workers, and with Amalia and Wahyuningsih (2024), who reported years of service as a significant predictor of MSD complaints ($p < 0.001$) among office workers. For a workforce where 83.3% have been employed for over a decade, this is a particularly relevant finding.

TABLE 6. Relationship between risk factors and total symptoms score of MSDs among administrative staff. (N=54)

Risk factors	SLR	MLR			
	B (95% CI)	p-value	Adjusted b (95% CI)	T-statistics	p-value
Constant			3.438 (-12.916, 19.792)	0.426	0.672
Age (year)	0.057 (-0.076, 0.191)	0.393	-0.300 (-0.626, 0.026)	-1.868	0.070
Duration of Employment (years)	0.123 (-0.019, 0.264)	0.088	0.453 (0.064, 0.843)	2.359	0.024*
Body Mass Index	-0.019 (-0.217, 0.179)	0.849	0.094 (-0.159, 0.346)	0.753	0.456
Marital status					
Married	0.292 (-3.001, 3.584)	0.860	-0.426 (-5.354, 4.502)	-0.175	0.862
Single	-0.292 (-3.584, 3.001)	0.860	Ref		
Disease					
Yes	-1.194 (-3.365, 0.976)	0.275	-1.024 (-3.832, 1.784)	-0.739	0.464
No	1.194 (-0.976, 3.365)	0.275	Ref		
Sitting for long periods					
Yes	2.472 (-5.175, 10.119)	0.519	Ref	1.111	0.274
No	-2.472 (-10.119, 5.175)	0.519	6.609 (-5.459, 18.676)		
Gender					
Female	1.346 (-0.986, 3.679)	0.252	0.880 (-2.246, 4.005)	0.571	0.572
Male	-1.346 (-3.679, 0.986)	0.252	Ref	0.753	0.456
Smoking					
Yes	-0.434 (-8.111, 7.243)	0.910	3.731 (-6.621, 10.083)	0.420	0.677
No	0.434 (-7.243, 8.111)	0.910	Ref		

continue...

...cont.

Jobs requiring exertion of arms/ hands				-2.284	0.028*
Yes	0.196 (-2.165, 2.558)	0.868	Ref		
No	-0.196 (-2.558, 2.165)	0.868	-3.787 (-7.150, -0.424)		
Bend over					
Yes	-2.787 (-5.770, 0.195)	0.066	Ref	2.074	0.045*
No	2.787 (-0.195, 5.770)	0.066	4.875 (0.108, 9.642)		
Neck flexion					
Yes	-1.049 (-3.297, 1.199)	0.353	Ref	0.626	0.535
No	1.049 (-1.199, 3.297)	0.353	1.155 (-2.585, 4.895)		
Working with uncomfortable postures				1.419	0.165
Yes	-2.021 (-4.316, 0.273)	0.083	Ref		
No	2.021 (-0.273, 4.316)	0.083	1.908 (-0.819, 4.636)		
Working in the same position for long periods				0.224	0.824
Yes	-3.335 (-6.783, 0.114)	0.058	Ref		
No	3.335 (-0.114, 6.783)	0.058	0.524 (-4.211, 5.259)		
Manually handle work activities				0.897	0.376
Yes	-2.350 (-6.248, 1.548)	0.232	Ref		
No	2.350 (-1.548, 6.248)	0.232	1.985 (-2.503, 6.472)		
Doing repetitive tasks many times per minutes				0.018	0.986
Yes	-1.750 (-4.370, 0.870)	0.186	Ref		
No	1.750 (-0.870, 4.370)	0.186	0.033 (-3.790, 3.857)		
Neck twisting				-0.393	0.697
Yes	-0.889 (-3.071, 1.293)	0.417	Ref		
No	0.889 (-1.293, 3.071)	0.417	-0.591 (-3.644, 2.462)		
Grand Final ROSA Score	-0.344 (-1.614, 0.925)	0.588	0.161 (-1.402, 1.175)	0.209	0.835

a Simple Linear Regression, b Multiple Linear Regression

The model reasonably fits well. Model assumptions are met. There are no interaction and multicollinearity problems.

The inverse association between arm and hand exertion and symptom scores ($\beta = -3.790$) warrants careful interpretation. This does not mean that using the arms protects against MSD. Rather, it likely reflects a difference in how work is structured. Staff whose roles occasionally require arm, and hand activities may naturally vary their posture more than those who spend their entire day at a keyboard and mouse. That kind of movement variability, even if incidental, can reduce the sustained static loading that drives upper limb and neck discomfort. A previous study showed that changing position hourly reduced MSD risk by over 30%, supporting the idea that even informal, task-driven movement has a protective effect (Putsa et al. 2022). This finding warrants further investigation, including more detailed exposure measurements, before any firm conclusions are drawn.

Frequent bending was identified as a positive predictor ($\beta = 4.875$, $p = 0.045$), associated with an increase in total symptom scores when observed. Although administrative tasks are predominantly sedentary, activities such as retrieving documents from low shelves, filing, or picking

up objects from the floor involve repeated trunk flexion, which cumulatively contributes to the overall effect. The lower back was the most commonly reported symptom site in this study (79.6%), and the bending finding offers a plausible mechanical explanation. Pooled data from Demissie et al. (2025) reported an adjusted odds ratio of 4.49 for awkward posture as a predictor of WMSDs, and Etana et al. (2021) reported an AOR of 4.09 for awkward posture among bank staff. Taken together, these results suggest that even in a predominantly sedentary job, moments of poor posture and trunk loading matter.

The regression results indicate that the MSD burden in this workforce is primarily influenced by factors such as overtime, years of tenure at their desks, and the physical demands of their daily tasks, rather than by the appropriateness of their chair height adjustments. Effective prevention in this setting would combine workstation optimisation with scheduled movement breaks, task redesign to minimise repetitive bending, and longer-term monitoring of employees with extended service records.

CONCLUSION

Despite predominantly low workstation ergonomic risk, musculoskeletal symptoms remained highly prevalent among university administrative staff, suggesting that workstation assessment alone does not adequately capture the complexity of musculoskeletal risk in office environments. The absence of significant associations between ROSA scores and musculoskeletal symptoms, together with the independent effects of cumulative occupational exposure and specific work activities, highlights the multifactorial nature of work-related MSDs.

These findings challenge the common assumption that improving workstation configuration alone is sufficient to reduce musculoskeletal disorders among office workers. Instead, effective prevention requires a comprehensive ergonomic management approach integrating workstation design, work organisation, behavioural modification, and continuous occupational health surveillance. Strategies that actively interrupt sedentary behaviour, such as scheduled movement breaks, hourly posture changes, and task rotation, have demonstrated measurable reductions in the risk of musculoskeletal disorders (MSD) and merit increased emphasis within institutional health programmes. For a workforce where over, eighty percent have been employed for more than a decade, targeted surveillance and early intervention for long-serving employees constitute a particularly valuable investment. By demonstrating the discrepancy between observed ergonomic risk and symptom burden, this study provides practical evidence to support the implementation of multidimensional ergonomic intervention strategies in higher education institutions and other office-based workplaces.

This study has several limitations that should be acknowledged. The cross-sectional design precludes causal inference, and the relatively small sample from a single institution limits generalisability. ROSA assessments captured workstation conditions at a single observation point, which may not reflect typical working postures across the full working day. Future research would benefit from longitudinal designs, objective measures of physical activity and sedentary time, and the inclusion of psychosocial and organisational variables that this study was unable to fully capture.

Further prospective studies involving larger populations are recommended to establish causal relationships and to evaluate the long-term effectiveness of integrated ergonomic intervention programmes in reducing musculoskeletal disorders among office employees. Ultimately, effective prevention of work-related musculoskeletal disorders should shift from a

workstation-centred approach towards a worker-centred ergonomic management strategy that recognises cumulative occupational exposure as a critical determinant of musculoskeletal health.

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DECLARATION OF COMPETING INTEREST

None.

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