

Standing, Sitting, Suffering: Prevalence and Predictors of Musculoskeletal Disorders (MSDs) Among School Teachers in Terengganu, Malaysia

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ABSTRACT

Every successful classroom has a committed teacher at its core, but many teachers suffer in silence from the physical strain of their work. Despite their detrimental effects on performance and well-being, musculoskeletal disorders (MSDs) have appeared as a hidden epidemic among school teachers. The prevalence and predictors of MSDs among 200 primary and secondary school teachers in Terengganu, Malaysia, were examined in this study. A validated questionnaire was used to gather demographic, occupational, and MSD-related data from the standardised Nordic Questionnaire in this cross-sectional survey. There was a high prevalence of MSD (35.6%, n=71), with the most affected areas being the neck (40.5%, n=81), knees (36.0%, n=72), and shoulders (36.0%, n=72). Pain in the neck (OR=4.17, p<0.001), shoulders (OR=4.72, p<0.001), and upper back (OR=2.59, p<0.001) was substantially more common in female teachers. On the other hand, men were more likely to experience knee pain (OR=2.28, p<0.05) and hand pain (OR=2.90, p<0.05). Significantly, overweight status and age between 30-39 years were paradoxically associated with pain and discomfort in the upper back (OR=5.10, p<0.05) and arm (OR=5.36, p<0.05). This study draws attention to

MSDs, a serious but little-known occupational health issue that affects educators. Educational institutions urgently need to implement more focused ergonomic interventions and enhance workplace design in schools. Resolving these problems supports sustainability goals by advocating for healthier working conditions for school teachers in school settings.

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INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) continue to be a major and costly issue for occupational health, affecting both developing and developed nations. Around the world, WMSDs are a major issue, resulting in significant costs for employees, employers, and governments alike (Fahmy et al., 2022). These disorders often arise when muscles, ligaments, and tendons are overworked, typically due to repetitive movements, awkward postures, or prolonged periods of immobility (Jeffrey et al., 2024). In fact, related research has identified various risk factors associated with musculoskeletal disorders (MSDs), which can generally be categorised into four main groups: individual and personality traits, biodynamic or physical risk factors, psychological or mental stressors and those less obvious or hidden risks (Darvishi et al., 2024). In addition to their primary role in teaching students in the classroom, teachers need to complete the work related to teaching assessment, such as marking paper examinations and evaluating students' homework on a daily basis. Without being aware of it, and as long as they do not experience discomfort or pain, they tend to maintain these prolonged postures to complete their tasks (Rahim et al., 2022).

Apart from packed teaching schedules, teachers always carry the heavy load of books and their teaching materials from one period of subject to the teachers' hall and this routine would be carried out repeatedly until the end of school hours. The heavy load is also due to having to bring their

personal laptop to fulfil their task and other administrative task that are not related to teaching sessions. The nature of their work can push them to adapt with various uncomfortable posture, and they need to bear with this body discomfort due to having limited time to complete their tasks (Gholami et al., 2023). By doing that, they are likely not to get enough rest and the pain could be getting worse especially when it comes to body parts that are directly affected by their awkward posture, prolonged standing and sitting. The pain eventually leads to stress and can affect their job performance as educators (Souza et al., 2023). Personal factors such age and gender as well as psychological factors may influence the symptoms of musculoskeletal illness and it is very important to look at various factors to maintain the good health of school teachers and by doing that giving a positive impact towards educational settings and school environment (Tahernejad et al., 2024).

The research study establishes multiple unique elements which add value to existing academic knowledge about musculoskeletal disorders (MSDs) that occur in school teachers. Teachers now experience extended periods of computer usage because of their work with online administrative reporting systems and screen-based classroom activities, which results in different ergonomic stressors when compared to their pre-pandemic working environment (Bahaman et al., 2025). The research study in Terengganu, which is located on the East Coast of Peninsular Malaysia, examines ergonomic risk factors that arise from

different school resource levels and various socioeconomic backgrounds, in contrast to existing Malaysian studies, which focus their research on urban teachers in Klang Valley and their research areas. The research study examines a specific geographical area, which delivers evidence about local conditions that existing studies have not documented sufficiently. The research study investigates task-specific occupational factors through their examination of administrative workload burden and computer use during classroom teaching and school sports activities (Abas et al., 2023).

To reduce their impact, this study intends to provide more comprehensive and significant findings on the prevalence of MSDs among teachers and what factors contribute to them across different areas of the body. The findings can be a useful starting point for occupational health specialists creating focused ergonomic plans and training courses to prevent MSDs and encourage safer, healthier working environments for teachers. The purpose of this cross-sectional study was to examine the prevalence of musculoskeletal disorders (MSDs) and the contributing factors among Terengganu school teachers.

MATERIALS AND METHODS

Selection of Participants

The list of schools was obtained by the respective Terengganu State Education Department with permission from the Ministry of Education. The schools were selected randomly based on the list provided, and a total of six schools were included in

this study. A total of 200 school teachers from primary and secondary schools were chosen to participate in the study. The sample size was finalised based on Lemeshow et al. (1990) formula, with the mean value of MSDs taken from the study conducted by Ng et al. (2020). The sample size calculation was based on the Z-score (1.96 for a 95% confident interval), prevalence of 80.1% of school teachers reported in musculoskeletal complaints, and a margin error of $\pm 5\%$ (0.05). Participants had to have taught for at least a year in order to meet the inclusion requirements. From a sampling frame that included a comprehensive list of teaching staff members acquired from the administrative offices of the chosen schools, teachers were chosen by simple random sampling. Prior to data collection, each participant provided written informed consent to ensure voluntary participation and ethical standards. The data collection was conducted in supervised sessions during allocated hours to ensure that the school teachers received a full explanation regarding any questions.

Questionnaire Survey

Data from school teachers was gathered using a self-administered questionnaire. All qualified school teachers who satisfied the inclusion and exclusion criteria of the study participated fully, therefore the distribution produced a 100% response rate with no missing data. A pilot study was conducted beforehand with a total of 20 respondents, representing 10% of the total sample size. A researcher-adapted questionnaire with three

primary sections meant to collect thorough data on socio-demographic traits (11 items), work-related variables (11 items), and musculoskeletal health concerns (11 items) served as the survey tool. The standardised Nordic Musculoskeletal Questionnaire was adapted in this section. The neck, shoulder, upper and lower back, elbow, hand, wrist, knee, thigh, calf, and feet are among the 11 anatomical regions highlighted in the human body diagram. During the previous 7 days and 12 months, respondents were asked if they had ever felt pain or discomfort in any of these areas, and if so, whether it affected their ability to go about their daily lives normally. The predictors and overall prevalence of MSDs among school teachers were identified through cross-analysis of these variables with 11 anatomical body regions (Jeffree et al., 2024).

Validity of Content

Five experts with a background of occupational health and ergonomics have reviewed the research instrument for content validity, using the Item-Content Validity Index (I-CVI) to independently assess the appropriateness and relevance of each questionnaire item. This process ensures alignment with the study's objectives and applicability to school teachers and their work environment. The overall I-CVI score of 0.83 confirmed strong content validity for assessing the prevalence of MSDs and related risk factors. The Nordic Musculoskeletal Questionnaire widely used to measure discomfort and pain across 11 body regions, was employed to update MSD

prevalence data, with its focus adapted to body regions most affected by teaching activities. In fact, studies have demonstrated its high inter-rater reliability, ranging from 0.60 to 1.00 and its consistent application across various occupational groups supports its effectiveness in producing valid prevalence findings (Vega-Fernandez et al., 2024).

Analysis of Statistics

Data were analysed using IBM SPSS Statistics version 30.0 (SPSS Inc., Chicago, USA). Descriptive statistics were applied to summarise the sociodemographic, occupational characteristics of respondents, and MSD prevalence based on reported pain or discomfort in specific body regions. Multiple logistic regression models with the Hosmer–Lemeshow test were applied to assess model fit for MSD predictors (Jeffree et al., 2024).

Approval and Ethical Consideration

The Ministry of Education Malaysia (MOE) granted permission to conduct this study, requiring submission of a complete research proposal before approaching school teachers. Ethical clearance was also obtained from the Ethics Committee of Universiti Putra Malaysia (JKEUPM-2024-876), confirming that the study adhered to established ethical standards.

RESULTS AND DISCUSSION

The study was conducted on 200 school teachers with an average age of 44.90 years (SD = 7.76) (Table 1).

Table 1
Socio-demographic characteristics of school teachers

Variables	Total (%) (n=200)	Mean (SD)
Age		44.90 (7.76)
20-29	10 (5%)	
30-39	33 (16.5%)	
40-49	98 (49%)	
50-59	59 (29.5%)	
Gender		
Male	47 (23.4%)	
Female	153 (76.1%)	
Education Level		
Diploma	15 (7.5%)	
Degree	165 (82.5%)	
Master's Degree	20 (10.0%)	
BMI		
<18.5 underweight	3 (1.5%)	
18.5–22.9 normal	88 (43.8%)	
23.0–24.9 overweight	62 (30.8%)	
> 25.0 obesity	47 (23.4%)	
Household Income		
> RM3,000	3 (1.5%)	
RM 3,000 – RM 6,000	53 (25.9%)	
>RM 6,000	145 (72.6%)	
Regular Sleeping Pattern		
Yes	95 (47.5%)	
No	105 (52.5%)	
History of Injury		
Yes	36 (18.0%)	
No	164 (82.0%)	
Marital Status		
Married	182 (91.0%)	
Unmarried	18 (9.0%)	
Have Children		
Yes	171 (85.5%)	
No	29 (14.5%)	

Source: Authors' own work

Most of them were aged from 40 to 49 years (49.0%). Additionally, 76.1% of them were females and 23.4% were male school teachers. The highest education attainment of teachers was a degree (82.5%), followed by a master's degree (10.0%), and

a diploma (7.5%) respectively. Regarding BMI, 43.8% (18.5–22.9) were normal, 30.8% were overweight (23.0–24.9) and 23.4% were obese (≥ 25.0). For the analysis of household income, most respondents are earning at least more than RM 6,000 which

comprises 72.6% of the total respondents. More than 50% of the study population was reported to have irregular sleep (47.5% regular vs approximately 52.5% irregular sleep). Teachers (18.0%) also reported a history of injury in any body's parts. Most of the teachers were married (91.0%) and had children (85.5%).

Table 2 shows that teaching experience varied, with 39.0% having 11 to 20 years and 43.0% having 21 to 30 years. Most were permanent employees (97.0%) and primary school teachers (67.0%). The teaching hours per day were mostly from 1 to 4 hours (80.5%), and 84.5% of the sitting hours were from 1 to 4 hours. A proportion of teachers stood for 5 to 8 hours (36.5%), while mostly 63.5% stood for 1 to 4 hours. Less than 200 students were taught by the majority of teachers (77.0%) each week. Teachers spent 1 to 4 hours a day writing on the whiteboard in their classrooms (94.5%), and administrative work was prevalent among school teachers, which contributed to 91.0% of across schools. In addition, teachers actively participated in school sports (71.5%), and they mostly utilised the computer in class for learning and teaching activities (92.0%). Teachers deal with a variety of daily tasks that can negatively impact their physical health in addition to juggling numerous responsibilities. Research indicates that compared to other occupational groups, school teachers are more likely to suffer from MSDs. The literature continuously emphasises that teachers are at a significant risk of developing MSDs, despite the fact

that schools are typically seen as positive work environments (Alias et al., 2020).

The study discovered that school teachers had a high prevalence of MSDs, as shown in Table 3, with 35.6% reporting having MSDs throughout their teaching career and continuing symptoms in vital body areas. The most affected areas within 12 months were the neck (40.5%, n=81) and shoulder (36.0%, n=72), with the knee (36.0%, n=72) and lower back (34.5%, n=69) coming in second and third, respectively. This suggests that poor ergonomic postures and repetitive motions, such as writing on whiteboards, are major contributors to these conditions. Due to prolonged standing during lessons, the feet (34.5% n=69) also displayed a high prevalence. However, compared to larger muscle groups, the elbow (12.5%, n=25) and hand (20.0%, n=40) for the past 7 days had lower but still noticeable rates, which may be related to less frequent strain. The prevalence was still high in the neck (39.0%, n=78), shoulder (36.0%, n=72), and knee (34.0%, n=68) when looking at recent symptoms (within the last seven days), confirming the chronic nature of these work-related musculoskeletal problems. According to the analysis of the current study and earlier research, a considerable proportion of teachers are susceptible to MSDs as a result of long-term exposure to ergonomic risk factors, such as prolonged standing and awkward postures during school hours (Tahernejad et al., 2024). In Malaysia, a recent study by Jeffree et al. (2024) in Sabah found that there is a high prevalence of MSDs with

Table 2
Work-related characteristics of school teachers

Variables	Total (%) (n=200)
Teaching Experience (Years)	
1-10 years	25 (12.5%)
11-20 years	78 (39.0%)
21-30 years	86 (43.0%)
31-40 years	11 (5.5%)
Type of School	
Primary	134 (67.0%)
Secondary	66 (33.0%)
Employment	
Permanent	194 (97.0%)
Contract	6 (3.0%)
Teaching Hours (daily)	
1-4 hours	161 (80.5%)
5-8 hours	39 (19.5%)
Sitting Hours (daily)	
1-4 hours	169 (84.5%)
5-8 hours	31 (15.5%)
Standing Hours (daily)	
1-4 hours	127 (63.5%)
5-8 hours	73 (36.5%)
Number of Students (weekly)	
<200 students	154 (77.0%)
>200 students	46 (23.0%)
Write on Whiteboard (daily)	
1-4 hours	189 (94.5%)
5-8 hours	11 (5.5%)
Administrative Work	
Yes	182 (91.0%)
No	18 (9.0%)
Sports Activity in School	
Yes	143 (71.5%)
No	57 (28.5%)
Use Computer in Classroom	
Yes	184 (92.0%)
No	16 (8.0%)

Source: Authors' own work

a rate of 77.9% among school teachers in special education, followed by studies in Terengganu and Klang Valley within the range between 40.4% and 80.1% (Alias et al., 2020; Ng et al., 2019).

The findings in Table 4 show a number of noteworthy correlations between school teachers' musculoskeletal pain and sociodemographic characteristics. With the exception of the elbow, female teachers

Table 3
Prevalence of MSDs among school teachers

Body Region	Prevalence (%) (Past 12 months)	Prevalence (%) (Past 7 days)
All regions		35.6%
Neck	40.5	39.0
Shoulder	36.0	36.0
Upper Back	29.5	31.0
Lower Back	34.5	32.0
Elbow	13.0	12.5
Hand	18.0	20.0
Arm	21.0	19.0
Knee	36.0	34.0
Thigh	21.5	20.5
Calf	26.0	25.0
Feet	34.5	34.0

Source: Authors' own work

reported significantly higher percentages of pain in most body parts. Gender emerged as a highly influential factor. Other than gender, arm pain was significantly correlated with age ($p=0.04$), BMI ($p=0.04$), and sleeping pattern ($p=0.01$), whereas upper back was also significantly correlated with BMI ($p=0.03$) and sleeping pattern ($p=0.001$). In most body areas, teachers with irregular sleeping patterns reported higher pain prevalence ($p<0.05$), and household income was linked to hand pain ($p=0.04$). A history of injuries showed a significant link to elbow pain ($p=0.04$), and interestingly, having children was also associated with elbow pain ($p=0.01$). These findings suggest that female teachers, those with a higher BMI, irregular sleep patterns, and lower income may be at a greater risk for musculoskeletal issues (Souza et al., 2023).

Jeffrey et al. (2024) reported that body mass index (BMI) and marital status were significantly associated with musculoskeletal pain. For married teachers, particularly women, additional household responsibilities such as caring for spouses and children may prolong physical strain from the school day into the evening, contributing to discomfort and pain (Souza et al., 2021). BMI has consistently shown a strong association with MSDs, with overweight and obese individuals more prone to lower back and knee pain. In addition, female teachers are more prone to being affected by musculoskeletal discomfort compared to male teachers. The reason for the low prevalence of MSDs among men is due to their active and regular involvement with physical activities.

Table 4
Risk factors based on socio-demographic characteristics of school teachers

Variables	Neck (%)	Shoulder (%)	Upper Back(%)	Lower Back(%)	Elbow (%)	Hand (%)	Arm (%)	Knee (%)	Thigh (%)	Calf (%)	Feet (%)
Age											
20-29	4.0	5.0	2.7	6.3	0.0	10.2	8.5	5.6	5.6	4.2	3.5
30-39	18.6	16.0	23.4	20.3	9.1	16.3	8.5	13.5	14.8	15.3	17.6
40-49	48.0	48.0	47.9	46.8	48.5	38.8	40.4	49.4	40.7	48.6	47.1
50-59	29.4	31.0	26.0	26.6	42.4	34.7	42.6	31.5	38.9	31.9	31.8
p-value	0.78	0.97	0.18	0.56	0.14	0.14	0.04*	0.75	0.33	0.92	0.77
Gender											
Male	11.8	10.0	5.5	10.1	21.2	10.2	6.4	13.5	9.3	8.3	10.6
Female	88.2	90.0	94.5	89.9	78.8	89.8	93.6	86.5	90.7	91.7	89.4
p-value	< 0.001**	< 0.001**	< 0.001**	< 0.001**	0.73	0.01*	0.002*	0.003*	0.004*	< 0.001**	< 0.001**
Education Level											
Diploma	9.8	5.0	4.1	5.1	9.1	10.2	8.5	6.7	9.3	8.4	5.8
Degree	82.4	81.0	84.9	82.2	78.8	77.6	87.2	86.6	87.0	81.9	82.4
Master	7.8	14.0	11.0	12.7	12.1	12.2	4.3	6.7	3.7	9.7	11.8
p-value	0.29	0.09	0.38	0.38	0.83	0.56	0.32	0.34	0.18	0.94	0.61
BMI											
<18.5 underweight	2.0	3.0	4.1	2.5	0.0	2.0	4.3	1.1	3.7	2.8	2.4
18.5–22.9 normal	49.0	48.0	50.7	46.8	39.4	44.9	40.4	39.3	42.6	45.8	48.2
23.0–24.9 overweight	27.5	26.0	23.3	24.1	24.2	22.5	21.3	32.6	25.9	26.4	25.9
> 25.0 obesity	21.5	23.0	21.9	26.6	36.4	30.6	34.0	27.0	27.8	25.0	23.5
p-value	0.45	0.15	0.03*	0.29	0.25	0.38	0.04*	0.59	0.31	0.53	0.46
Household Income											
> RM3,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RM 3,000 – RM 6,000	30.4	28.0	34.2	31.6	39.4	38.8	31.9	32.6	29.6	30.6	28.2
>RM 6,000	69.6	72.0	65.8	68.4	60.6	61.2	68.1	67.4	70.4	69.4	71.8
p-value	0.09	0.19	0.07	0.15	0.13	0.04*	0.38	0.06	0.47	0.26	0.29

Table 4 (continued)

Variables	Neck (%)	Shoulder (%)	Upper Back(%)	Lower Back(%)	Elbow (%)	Hand (%)	Arm (%)	Knee (%)	Thigh (%)	Calf (%)	Feet (%)
Regular Sleeping Pattern											
Yes	60.8	57.0	63.0	54.4	60.6	67.3	63.8	58.4	61.1	65.3	58.8
No	39.2	43.0	37.0	45.6	39.4	32.7	36.2	41.6	38.9	34.7	41.2
p-value	<0.001**	0.007*	0.001*	0.11	0.10	0.001*	0.01*	0.006*	0.02*	<0.001**	0.006*
History of Injury											
Yes	20.6	20.0	16.4	24.1	30.3	16.3	17.0	23.6	16.7	16.7	23.5
No	79.4	80.0	83.6	75.9	69.7	83.7	83.0	76.4	83.3	83.3	76.5
p-value	0.33	0.46	0.66	0.07	0.04*	0.73	0.84	0.07	0.77	0.71	0.08
Marital Status											
Married	94.1	90.0	93.2	89.9	97.0	87.8	89.4	92.1	96.3	91.7	91.8
Unmarried	5.9	10.0	6.8	10.1	3.0	12.2	10.6	7.9	3.7	8.3	8.2
p-value	0.12	0.62	0.42	0.65	0.19	0.36	0.65	0.62	0.11	0.81	0.75
Have Children											
Yes	88.2	81.0	87.7	84.8	100.0	79.6	83.0	84.3	87.0	86.1	83.5
No	11.8	19.0	12.3	15.2	0.0	20.4	17.0	15.7	13.0	13.9	16.5
p-value	0.26	0.07	0.51	0.82	0.01*	0.18	0.58	0.66	0.71	0.85	0.50

*Significant at p<0.05

**Significant at p<0.001

Source: Authors' own work

High musculoskeletal complaint also was received from women compared to men due to women being more likely to report and more sensitive to their discomfort and pain of any body part. Compared to men, they are more likely to endure the pain and discomfort of any body parts and receive late treatment (Amit & Gerald, 2020; Fahmy et al., 2022).

A number of important work-related factors that contribute to teachers' MSDs are highlighted in Table 5. In several body regions, such as the neck, shoulder, upper back, lower back, elbow, hand, arm, knee, calf, and feet, longer teaching hours (5-8 hours per day) were significantly linked to higher MSD prevalence (all $p < 0.05$), indicating that long-term occupational strain exacerbates musculoskeletal stress. Prolonged sitting (5-8 hours daily) was associated with thigh, hand and arm pain ($p < 0.05$), possibly from repetitive administrative tasks, while prolonged standing (5-8 hours daily) significantly affected the upper back, knee, calf, and feet ($p < 0.05$), probably due to sustained postural load. While involvement in school sports seemed to contribute to musculoskeletal discomfort in the neck ($p = 0.02$), upper back ($p = 0.01$), and feet ($p = 0.03$), perhaps as a result of impaired physical conditioning. Besides, administrative work was linked highly to neck ($p = 0.002$) and shoulder pain ($p = 0.01$), most likely as a result of extended desk work. The need for improved workstation ergonomics was highlighted by the correlation ($p < 0.05$) between computer use in the classroom and MSDs in the neck,

shoulder, lower back, calf, and feet. All of these findings point to the significance of poor ergonomics, teaching-related physical demands, and inadequate movement breaks in causing MSDs (Tahernejad et al., 2024).

School teachers around the world continue to face musculoskeletal disorders (MSDs) as their most common workplace health issue. A study conducted in the United Arab Emirates discovered that school teachers experienced high rates of work-related MSDs, which resulted from their lack of physical activity and their continuous work responsibilities. The research demonstrated that contemporary teaching positions require educators to spend extended periods either sitting or standing while they conduct lessons and handle administrative responsibilities, which heightens their risk of developing musculoskeletal disorders (Abu Zohair et al., 2024). A study on school teachers in Tanzania has discovered that teachers experience MSDs as a major work-related health issue, which occur when they perform repetitive tasks while maintaining fixed body positions during their teaching duties. The research results showed that workplace ergonomic standards and workplace organisation and workload distribution systems played a crucial role in determining the risk of MSDs, which educators experienced (Gikaro et al., 2025).

After adjusting for confounding variables, the final logistic regression model identifying important predictors of MSDs is shown in Table 6. Because there are no multicollinearity problems or inter-

Table 5
Risk factors related to the work characteristics of school teachers

Variables	Neck (%)	Shoulder (%)	Upper Back(%)	Lower Back(%)	Elbow (%)	Hand (%)	Arm (%)	Knee (%)	Thigh (%)	Calf (%)	Feet (%)
Teaching Experience (Years)											
1-10 years	14.7	15.0	16.4	19.0	3.0	16.3	10.6	15.7	13.0	15.1	15.3
11-20 years	38.2	39.0	45.2	39.2	33.3	32.7	34.0	32.6	35.2	37.5	37.6
21-30 years	44.2	44.0	37.0	40.5	57.6	49.0	55.4	46.1	46.2	43.1	42.4
31-40 years	2.9	2.0	1.4	1.3	6.1	2.0	0.0	5.6	5.6	4.2	4.7
p-value	0.34	0.14	0.07	0.03*	0.16	0.34	0.12	0.34	0.92	0.77	0.76
Type of School											
Primary	68.6	63.0	69.9	69.6	75.8	65.3	68.1	59.6	70.4	68.1	69.4
Secondary	31.4	37.0	30.1	30.4	24.2	34.7	31.9	40.4	29.6	31.9	30.6
p-value	0.62	0.23	0.51	0.52	0.24	0.77	0.86	0.04*	0.54	0.81	0.53
Employment											
Permanent	96.1	95.0	98.6	94.9	100.0	89.8	91.5	95.5	94.4	97.2	96.5
Contract	3.9	5.0	1.4	5.1	0.0	10.2	8.5	4.5	5.6	2.8	3.5
p-value	0.44	0.09	0.31	0.17	0.27	0.001*	0.01*	0.27	0.20	0.89	0.71
Teaching Hours (daily)											
1-4 hours	74.5	74.0	69.9	73.4	63.6	69.4	70.2	74.2	74.1	70.8	70.6
5-8 hours	25.5	26.0	30.1	26.6	36.4	30.6	29.8	25.8	25.9	29.2	29.4
p-value	0.02*	0.02*	0.002*	0.03*	0.01*	0.02*	0.03*	0.03*	0.13	0.01*	0.001*
Sitting Hours (daily)											
1-4 hours	84.3	83.0	82.2	83.5	75.8	75.5	72.3	79.8	75.9	79.2	82.4
5-8 hours	15.7	17.0	17.8	16.5	24.2	24.5	27.7	20.2	24.1	20.8	17.6
p-value	0.94	0.56	0.49	0.76	0.13	0.04*	0.01*	0.09	0.04*	0.12	0.47
Standing Hours (daily)											
1-4 hours	61.8	58.0	50.7	59.5	57.6	55.1	61.7	55.1	61.1	52.8	54.1
5-8 hours	38.2	42.0	49.3	40.5	42.4	44.9	38.3	44.9	38.9	47.2	45.9
p-value	0.71	0.14	0.01*	0.41	0.48	0.19	0.83	0.04*	0.74	0.03*	0.03*

Table 5 (continued)

Variables	Neck (%)	Shoulder (%)	Upper Back(%)	Lower Back(%)	Elbow (%)	Hand (%)	Arm (%)	Knee (%)	Thigh (%)	Calf (%)	Feet (%)
Number of Students (weekly)											
<200 students	81.4	80.0	78.1	78.5	81.8	69.4	74.5	77.5	79.6	77.8	76.5
>200 students	18.6	20.0	21.9	21.5	18.2	30.6	25.5	22.5	20.4	22.2	23.5
p-value	0.13	0.31	0.78	0.69	0.47	0.15	0.64	0.87	0.59	0.85	0.88
Write on Whiteboard (daily)											
1-4 hours	90.2	90.0	86.3	87.3	87.9	89.8	89.4	89.9	90.7	86.1	88.2
5-8 hours	9.8	10.0	13.7	12.7	12.1	10.2	10.6	10.1	9.3	13.9	11.8
p-value	0.01*	0.01*	< 0.001**	< 0.001**	0.07	0.10	0.08	0.01*	0.16	< 0.001**	0.001*
Administrative Work											
Yes	97.1	96.0	95.9	94.9	97.0	93.9	91.5	91.0	94.4	94.4	95.3
No	2.9	4.0	4.1	5.1	3.0	6.1	8.5	9.0	5.6	5.6	4.7
p-value	0.002*	0.01*	0.06	0.12	0.19	0.42	0.89	0.99	0.30	0.20	0.07
Sports Activity in School											
Yes	79.2	74.0	83.6	77.2	84.8	77.6	78.7	91.0	81.5	79.2	80.0
No	20.8	26.0	16.4	22.8	15.2	22.4	21.3	9.0	18.5	20.8	20.0
p-value	0.02*	0.50	0.01*	0.17	0.07	0.31	0.23	0.99	0.07	0.08	0.03*
Use Computer in Classroom											
Yes	96.1	96.0	95.9	98.7	100.0	98.0	97.9	98.1	94.4	97.2	97.6
No	3.9	4.0	4.1	1.3	0.0	2.0	2.1	1.9	5.6	2.8	2.4
p-value	0.03*	0.04*	0.12	0.01*	0.06	0.07	0.09	0.05	0.27	0.04*	0.01*

*Significant at p<0.05

**Significant at p<0.001

Source: Authors' own work

Table 6
Predictors of MSDs among school teachers

Body Regions	Predictors	Adjusted B	Adjusted Odds Ratio	95% CI	p-value
Neck	Gender (female)	1.43	4.17	2.01,8.65	<0.001
	Regular sleeping pattern (Yes)	-1.12	0.33	0.18,0.58	<0.001
	Teaching hours, daily (1-4)	1.02	2.77	1.52,5.05	<0.001
	Write on whiteboard, daily (1-4)	0.89	2.45	1.16,5.19	0.03
	Administrative work (Yes)	-1.76	0.17	0.04,0.70	0.01
Shoulder	Gender (female)	1.55	4.72	2.10,10.61	<0.001
	Administrative work (No)	-1.54	0.22	0.06,0.75	0.02
Upper Back	Gender (female)	0.95	2.59	1.35,4.96	<0.001
	Regular sleeping pattern (Yes)	-0.73	0.48	0.24,0.97	0.04
	Sport Activity in School (Yes)	-1.18	0.31	0.14,0.69	0.004
	BMI (Overweight)	1.13	5.10	1.11, 8.65	0.03
Lower Back	Use computer in class (Yes)	1.39	4.02	1.69,9.60	0.002
	Teaching Experience, Years (1-10)	-2.44	0.09	0.01,0.85	0.04
Elbow	Teaching hours, daily (1-4)	0.94	2.55	1.09,5.93	0.03
Hand	Gender (Male)	1.07	2.90	1.03,8.16	0.04
	Employment (Permanent)	0.95	2.60	1.33,5.09	0.005
Arm	Teaching hours, daily (1-4)	1.86	2.42	1.75,4.62	0.01
	Age (30-39)	1.68	5.36	1.40, 20.52	0.01
	Age (40-49)	0.91	2.49	1.06, 5.82	0.04
	Age (50-59)	1.32	2.51	1.15,3.32	0.03
Knee	Gender (Male)	0.83	2.28	1.05, 4.97	0.04
	Standing hours (1-4)	0.64	4.53	0.29, 7.98	0.04
	School (Primary)	0.70	2.01	1.07, 3.81	0.03
Thigh	Sitting Hours (1-4)	1.30	3.67	1.35, 9.95	0.01
	Regular sleeping pattern (Yes)	-0.69	0.50	0.26, 0.97	0.04
Calf	Write on white board-daily (1-4)	1.39	4.02	1.52, 10.67	0.01
	Regular sleeping pattern (Yes)	-0.99	0.37	0.19, 0.72	0.003
Feet	Standing hours (1-4)	1.33	3.76	1.57, 8.99	0.003

Logistic regression was applied to significant factors from chi-squared test.

Source: Author's own work

variable interaction effects, the model is robust, and the estimated effects of each predictor are independent and reliable. According to body region, the study found different predictors of MSDs in school teachers. While male gender increased the risk for hand pain (OR=2.90, p=0.04) and knee pain (OR=2.28, p=0.04), female

gender significantly increased the odds of MSDs in the neck (OR=4.17, p<0.001), shoulder (OR=4.72, p<0.001), and upper back (OR=2.59, p<0.001). Regular sleeping lowered the risk in thigh (OR=0.50, p=0.04), calf (OR=0.37, p=0.003), upper back (OR=0.48, p=0.04), and neck (OR=0.33, p<0.001). In fact, 1 to 4 hours of daily

teaching hours has increased the likelihood of arm pain (OR=2.42, $p=0.01$), elbow (OR=2.55, $p=0.03$) and neck (OR=2.77, $p<0.001$). Shorter periods of time (1–4 hours) spent writing on the whiteboard increased the likelihood of calf (OR=4.02, $p=0.01$) and neck (OR=2.45, $p=0.03$) pain. Administrative work was a significant risk factor for shoulder pain (OR=0.22, $p=0.02$) and neck pain (OR=0.17, $p=0.01$).

Permanent employment was strongly linked to hand pain (OR=2.60, $p=0.005$), while longer teaching experience may be a risk factor for lower back, as evidenced by the significantly lower incidence of lower back MSDs among school teachers with 1 to 10 years of experience (OR=0.09, $p=0.04$). Arm pain was significantly correlated with age, especially for those between the ages of 30 and 39 (OR=5.36, $p=0.01$), 40 and 49 (OR=2.49, $p=0.04$), and 50 and 59 (OR=2.51, $p=0.03$). The odds of upper back pain increased with overweight BMI (OR=5.10, $p=0.03$). Significant predictors for the knee included teaching in a primary school (OR=2.01, $p=0.03$), being male (OR=2.28, $p=0.04$), and standing for 1 to 4 hours (OR=4.53, $p=0.04$). Thigh pain was significantly related to sitting period by 1 to 4 hours (OR=3.67, $p=0.01$). Lower back discomfort was found to be more common among teachers who used computers during lessons (OR=4.02, $p=0.002$). Foot pain was also reported more frequently by those who spent only 1 to 4 hours standing in a day (OR=3.76, $p=0.003$). Employment status as part of the predictors of this study reflected the duration of exposure of school

teachers towards continuing teaching workload, teaching duration and exposure intensity during school hours throughout their entire career. These patterns point to the need for educational institutions to prioritise ergonomic adjustments, ensuring that classroom furniture and workstation layouts encourage healthier posture and reduce strain. Since musculoskeletal disorders (MSDs) often develop through a combination of work demands and personal factors, effective prevention and management efforts, particularly for teachers, should address both elements in tandem (Souza et al., 2021).

In their daily routines, teachers often remain bent forward for long stretches while marking papers, preparing teaching materials, or entering grades. Many also carry out repeated physical movements such as lifting and bending, which can accumulate physical stress over time. Teaching spaces themselves can add to the problem, with prolonged standing being common in classrooms that lack adequate ergonomic support (Alias et al., 2020). Over time, these conditions raise the likelihood of MSDs, which can adversely affect both work performance and quality of life. Previous studies have shown that MSDs are a persistent concern in the profession, with the back, neck, and upper limbs most often affected (Prieto-González et al., 2021).

However, the development of these disorders is influenced by multiple factors, including being female, having sleep issues and poor posture. Despite the rising concern, there aren't many studies that have

investigated the prevalence and risk factors of MSDs among teachers. Some studies have only looked at one gender (Alharbi et al., 2020), overlooked a thorough examination of certain body areas (Alqahtani, 2020), or did not even distinguish between genders at all (Aldukhayel et al., 2021). So far, no study has thoroughly examined the long-term prevalence of MSDs in both male and female teachers while considering a wide range of risk factors (Althomali, 2022).

Professional groups exposed to various ergonomic risk factors include teachers. They perform monotonous work, hold still positions, and occasionally put in long hours. Aside from delivering lessons, teachers are also responsible for reviewing and grading students' homework and in-class assignments (Coledam et al., 2019). Their work often involves moving or carrying heavy materials such as books, laptops, and other teaching supplies. Long periods spent in fixed positions can cause physical strain, a problem compounded by the mental demands of the job. Awkward body positions are common. For example, tilting the head upward while writing on the board, leaning forward during computer work, or bending over when grading and handling administrative duties. Repetitive motions, including writing on boards with arms raised above shoulder height, standing for extended periods without proper posture, sitting in unsupported positions, and frequently twisting or bending to interact with students, can further increase musculoskeletal stress. Such physical demands may place teachers at higher risk of developing MSDs (Rahim et al., 2022).

To address this concern, the present study examines the occurrence of MSDs in teachers while considering sociodemographic, occupational, and ergonomic factors.

The study needs to acknowledge its existing limitations, which exist despite its valuable contributions. First, the study used self-reported data to assess musculoskeletal disorders and work-related factors, which created reporting bias because participants tended to answer based on their personal views and social expectations. Second, the study required participants to remember their previous activities, which included standing, sitting and doing office work, thus creating recall bias, which decreased correct exposure assessment. Lastly, while this data has been collected in a certain district of Terengganu due to the availability of schools to participate and time constraints, this finding may not be fully generalisable to school teachers in other states of Malaysia and other countries.

CONCLUSION

This study sheds light on the high prevalence of MSDs among primary and secondary school teachers in Terengganu, Malaysia, revealing that 35.6% of those surveyed reported experiencing MSD symptoms. The neck, knees, and shoulders were the most commonly affected areas, with noticeable differences in pain distribution between genders. It turns out that female teachers often experience more pain in their necks, shoulders, and upper backs, while male teachers tend to feel more discomfort in their knees and hands. Additionally, certain

factors like teaching for 1 to 4 hours a day, being overweight, having a permanent job, and being between the ages of 30 and 39 are strongly associated with higher rates of MSDs, particularly in the neck, upper back, hands, and arms.

Tackling the significant prevalence of MSDs among teachers requires a structured and evidence-based strategy within a longitudinal study. This begins with identifying and addressing task-related and posture-related risk factors through classroom-specific ergonomic assessments. Once these risks are identified, tailored ergonomic training programmes should be introduced to equip teachers for preventing severe injuries. Improving classroom ergonomics as part of an intervention approach can be further achieved by providing height-adjustable furniture and supportive teaching aids that promote healthy posture and reduce biomechanical stress. This research provides a valuable foundation for future studies and policy initiatives aimed at improving occupational health standards for teachers and fostering supportive and sustainable learning environments. By doing so, SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth) are supported, highlighting the importance of inclusive and sustainable workplace practices in education.

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REFERENCES

- Abas, A. H., Daud, A., Mohd Hairon, S., & Shafei, M. N. (2023). Prevalence and risk factors of low back pain in Malaysia: A scoping review. *Malaysian Journal of Medical Sciences*, 30(3), 32-41. <https://doi.org/10.21315/mjms2023.30.3.3>
- Abu Zohair, H. M., Girish, S., & Hazari, A. (2024). Work-related musculoskeletal disorders among United Arab Emirates schoolteachers: An examination of physical activity. *BMC Musculoskeletal Disorders*, 25, 134. <https://doi.org/10.1186/s12891-024-07256-w>
- Aldukhayel, A., Almeathem, F. K., Aldughayyim, A. A., Almeshal, R. A., Almeshal, E. A., Alsaud, J. S., & Albaltan, R. I. (2021). Musculoskeletal pain among school teachers in Qassim, Saudi Arabia: Prevalence, pattern, and its risk factors. *Cureus*, 13(8), e17510. <https://doi.org/10.7759/cureus.17510>
- Alharbi, T. A., Abadi, S., & Awadallah, N. J. (2020). Prevalence and risk factors of musculoskeletal pain among governmental male secondary school teachers. *Middle East Journal of Family Medicine*, 18(2), 77-85. <https://doi.org/10.5742MEWFM.2020.93752>
- Alias, A. N., Karuppiyah, K., How, V., & Perumal, V. (2020). Prevalence of musculoskeletal disorders among primary school female teachers in

- Terengganu, Malaysia. *International Journal of Industrial Ergonomics*, 77, Article 102957. <https://doi.org/10.1016/j.ergon.2020.102957>.
- Alqahtani, T. (2020). The prevalence of foot pain and its associated factors among Saudi school teachers in Abha sector, Saudi Arabia. *Journal of Family Medicine and Primary Care*, 9(9), 4641-4647. https://doi.org/10.4103/jfmpc.jfmpc_898_20
- Althomali, O. W. (2022). Long-term prevalence and risk factors of musculoskeletal disorders among schoolteachers in Hail, Saudi Arabia: A cross-sectional study. *BioMed Research International*, 2022, Article 3610196. <https://doi.org/10.1155/2022/3610196>
- Amit, L. M., & Gerald, T. M. (2020). Prevalence and risk factors of musculoskeletal disorders among provincial high school teachers in the Philippines. *Journal of UOEH*, 42(2), 151–160. <https://doi.org/10.7888/juoeh.42.151>
- Bahaman, N. I., Feisal, N. A. S., Tengku Ibrahim, T. N. B., Cheah, W. Y., & Kamaludin, N. H. (2025). Prevalence of musculoskeletal disorders and associated ergonomic risks among Pahang school teachers. *Malaysian Journal of Medicine and Health Sciences*, 21(Suppl. 5), 336-346.
- Coledam, D. H. C., Júnior, R. P., Ribeiro, E. A. G., & de Oliveira, A. R. (2019). Factors associated with musculoskeletal disorders and disability in elementary teachers: A cross-sectional study. *Journal of Bodywork and Movement Therapies*, 23, 658-665. <https://doi.org/10.1016/j.jbmt.2018.05.009>
- Darvishi, E., Osmani, H., Aghaei, A., & Moloud, E. A. (2024). Hidden risk factors and the mediating role of sleep in work-related musculoskeletal discomforts. *BMC Musculoskeletal Disorders*, 25, 256. <https://doi.org/10.1186/s12891-024-07387-0>
- Fahmy, V. F., Momen, M. A. M. T., Mostafa, N. S., & Elawady, M. Y. (2022). Prevalence, risk factors and quality of life impact of work-related musculoskeletal disorders among school teachers in Cairo, Egypt. *BMC Public Health*, 22, 2257. <https://doi.org/10.1186/s12889-022-14712-6>
- Gholami, M., Choobineh, A., Karimi, M. T., Dehghan, A., & Abdoli-Eramaki, M. (2023). Investigating glenohumeral joint contact forces and kinematics in different keyboard and monitor setups using OpenSim. *Journal of Biomedical Physics and Engineering*, 13, 281. <https://doi.org/10.31661/jbpe.v0i0.2210-1450>
- Gikaro, J. M., Goi, G. C., Taamala, F. H., Hamadi, H. H., Welema, J. C., Minduva, Z. M., & Swai, E. A. (2025). Prevalence and factors associated with musculoskeletal disorders among primary and secondary school teachers. *Frontiers in Public Health*, 13, Article 1654131. <https://doi.org/10.3389/fpubh.2025.1654131>
- Jeffrey, M. S., Abdul Rahim, A. A., Ag Daud, D. M., Pang, N., Sazali, M. F., Sudi, S., et al. (2024). Predictors of musculoskeletal disorders among special education teachers in Sabah, Malaysia. *Heliyon*, 10, e30873. <https://doi.org/10.1016/j.heliyon.2024.e30873>
- Lemeshow, S., Hosmer, D. W., Klar, J., & Lwanga, S. K. (1990). *Adequacy of sample size in health studies*. John Wiley & Sons.
- Ng, Y. M., Voo, P., & Maakip, I. (2019). Psychosocial factors, depression, and musculoskeletal disorders among teachers. *BMC Public Health*, 19, 234. <https://doi.org/10.1186/s12889-019-6553-3>
- Prieto-González, P., Šutvajová, M., Lesňáková, A., Bartík, P., Buřáková, K., & Friediger, T. (2021). Back pain prevalence, intensity, and associated risk factors among female teachers in Slovakia during the COVID-19 pandemic. *Healthcare*, 9(7), 860. <https://doi.org/10.3390/healthcare9070860>

- Rahim, A. A. A., Jeffree, M. S., Ag Daud, D. M., Pang, N., & Sazali, M. F. (2022). Factors associated with musculoskeletal disorders among regular and special education teachers: A narrative review. *International Journal of Environmental Research and Public Health*, 19, Article 11704. <https://doi.org/10.3390/ijerph191811704>
- Souza, C. S., Cardoso, J. P., Aguiar, A. P., Macedo, M. M. S. R., & Oliveira, J. D. S. (2021). Work-related musculoskeletal disorders among schoolteachers. *Revista Brasileira de Medicina do Trabalho*, 19(1), 140-150. <https://doi.org/10.47626/1679-4435-2020-545>.
- Souza, J. M. D., Tebar, W. R., Delfino, L. D., Tebar, F. S. G., Gobbo, L. A., Franco, M., et al. (2023). Association of musculoskeletal pain with sedentary behavior in public school teachers. *Pain Management Nursing*, 24, 196-200. <https://doi.org/10.1016/j.pmn.2022.08.005>
- Tahernejad, S., Hejazi, A., Rezaei, E., Makki, F., Sahebi, A., & Zangiabadi, Z. (2024). Musculoskeletal disorders among teachers: A systematic review and meta-analysis. *Frontiers in Public Health*, 12, Article 1399552. <https://doi.org/10.3389/fpubh.2024.1399552>
- Vega-Fernandez, G., Gonzalez-Torres, C., Solis-Soto, M., & Lizana, P. A. (2024). Musculoskeletal disorders and quality of life for Chilean teachers during the COVID-19 pandemic. *Frontiers in Public Health*, 12, Article 1277578. <https://doi.org/10.3389/fpubh.2024.1277578>