PREVALENCE AND PATTERN OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG PRIMARY SCHOOL TEACHERS IN OVIA NORTH EAST, BENIN CITY, EDO STATE, NIGERIA

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ABSTRACT

Background: Work-related Musculo-skeletal disorders are major health challenges for school teachers due to prolonged standing and repetitive tasks. Understanding the prevalence and patterns of musculoskeletal disorders among primary school teachers is essential for developing effective intervention strategies to improve their occupational health and well-being.

Aim: The aim of this study was to determine the prevalence and pattern of work-related musculoskeletal disorders among primary school teachers in Ovia North-East, Benin City, Edo State, Nigeria.

Methods: A cross-sectional descriptive study was conducted among Two hundred and sixty-seven **(**267) primary school teachers in Ovia North-East, Benin City, Edo State, Nigeria. Participants were selected using a consecutive sampling method. Data were collected with a structured self-administered questionnaire comprising sociodemographic/work-related characteristics and an adapted Standardized Nordic Musculoskeletal Questionnaire. Descriptive statistics summarized participants' characteristics and WMSD prevalence, while Chi-square tests assessed associations between variables at a 0.05 significance level.

Results: Among 267 primary school teachers studied, the 12-month prevalence of musculoskeletal pain was highest in the lower back (28.5%), followed by the shoulder (21.7%) and upper back (18.7%). Pain affected work performance in 6.0% of respondents. Job characteristics such as longer teaching hours, poor posture and lack of ergonomic furniture were

significantly associated with higher pain levels ($p<0.05$).

Conclusion: Musculoskeletal pain, particularly in the lower back, shoulder, and upper back, is highly prevalent among primary school teachers. The contributing factors include job-related characteristics such as longer teaching hours, poor posture and inadequate ergonomic support alongside sociodemographic factors like age and years of teaching experience. Improved workplace ergonomics, teacher training on posture, and adequate rest breaks are recommended to reduce the burden of musculoskeletal pain.

Keywords: *Musculo-skeletal Pain, Shoulder pain, Lower back pain, Ergonomics, Teachers.*

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Ovia North-East, Benin City, Edo State, Nigeria. By identifying the specific types of musculoskeletal issues prevalent in this group and the associated occupational risk factors, the research will provide valuable insights that can inform the development of tailored interventions to enhance teacher's health and well-being, thereby promoting a more effective educational environment.

MATERIAL AND METHODS

This study employed a cross-sectional descriptive design to determine the prevalence and associated factors of work-related musculoskeletal disorders (WMSDs) among primary school teachers in Ovia North-East Local Government Area, Benin City, Edo State, Nigeria. A total of 267 primary school teachers were consecutively recruited for the study based on accessibility and willingness to participate. Participants were drawn from both public and private primary schools within Ovia North-East, Benin City.

Ethical approval for this study was obtained from the Ministry of Health, Benin City, Edo State (Approval No: HA/737/24/D/1105426). Informed consent was obtained from all participants using a signed consent form. Participation was voluntary, and respondents could withdraw at any time without penalty. Confidentiality and anonymity were maintained throughout the study. No names or identifying information were collected, and each questionnaire was coded with a unique number for analysis purposes.

Inclusion Criteria were:

- Currently employed primary school teachers in Ovia North-East, Benin City, Edo State.
- Teachers with at least one year of teaching experience.
- Teachers who provided informed consent to participate.

Permission was first obtained from the school head teachers. Teachers were approached personally during school hours, and the purpose and procedures of the study were clearly explained. Those who met the inclusion criteria and agreed to participate were given a self-administered structured questionnaire, which was retrieved the same day and some within one week.

Data were collected using a structured, self-administered questionnaire consisting of two main sections: Section A: Sociodemographic and Work-Related Characteristics. This section obtained data on: Personal information (Age, Sex, Marital Status, Level of Education, Years of Teaching Experience, Teaching Level), Work-related factors (Number of Teaching Hours per Day, Class Size, Frequency of Breaks, Use of Teaching Aids), Physical and ergonomic factors (Teaching Posture, Availability of Ergonomic Furniture, Frequency of Lifting Heavy Objects, Comfort Level of Classroom Environment). Section B: Nordic Musculoskeletal Questionnaire (NMQ) The Standardized Nordic Musculoskeletal Questionnaire (NMQ) was used to assess musculoskeletal symptoms across nine body regions. The tool identifies: The prevalence of musculoskeletal symptoms over a defined period, the specific body parts most affected, and the impact of symptoms on work and daily activities. The NMQ was adapted to the Nigerian teaching context to include relevant tasks such as prolonged chalkboard writing, static postures during teaching, and classroom ergonomics.

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize sociodemographic characteristics and prevalence of musculoskeletal symptoms while Inferential statistics, specifically the Chi-square test (χ^2), were used to determine associations between sociodemographic and occupational factors and the prevalence of WMSDs. The level of significance (α) was set at 0.05.

RESULTS

This research investigated the prevalence and pattern of work-related musculoskeletal disorders among primary school teachers in Ovia North East Benin City, Edo state. The study included a sample of 267 participants selected from 10 primary schools in Ovia North East, Benin city.

Shows in Table 1 is the Sociodemographic Characteristics of Respondents. Majority of the participants were female (82.0%). Most participants were aged between 20–29 years (62.5%), followed by aged 30–39 years (28.5%). Majority were single (69.3%), and 49.1% held an NCE (National Certificate in Education), while 45.3% held a bachelor's degree. Over 64.8% had teaching experience ranging from 0–5 years, and majority (64.0%) taught junior primary classes.

The result revealed that most respondents taught for 6–8 hours daily (66.3%) and handled classes with less than 30 students (63.5%). Nearly equal proportions rated their classrooms as very comfortable (47.2%) or comfortable (46.1%). 40.8% took breaks every two hour, and 64.0% frequently used teaching aids. Ergonomic furniture was always available for 60.7%, and 49.8% primarily taught while standing. Majority (40.4%) reported occasionally lifting materials as part of their teaching activities (see Table 2)

Table 3 shows that, low back pain was the most common musculoskeletal complaint (28.5%) over the past 12 months, followed by shoulder pain (21.7%) and upper back pain (18.7%). Pain affected work for 6.0% of respondents with low back pain and 4.5% for shoulder and upper back pain. Pain persisted in the past 7 days for 25.1% of participants in the lower back region, 15.0% in shoulder and 13.5% for upper back pain. Physician consultations due to pain were highest for lower back pain (6.4%) compared to other body region.

Shown in Table 4 is the results of the test of significance between gender, teachers' classes and prevalence of musculoskeletal pain among the respondents using Mann-Whitney U Test. There was no statistically significant difference ($p>0.05$) in the prevalence of shoulder pain, upper back, and lower back pain between male and female respondents at 12 months. Although slight difference in mean ranks was observed, none of these differences reached statistical significance. A significant difference was found in the prevalence of shoulder pain between those teaching junior and senior primary classes ($p = 0.024$). Other pain regions, including upper back, and lower back, did not show significant differences ($p > 0.05$).

Table 1: Sociodemographic Characteristics of Respondents (N=267)

Variables	Frequency (n)	Percentages (%)
Age		
20- 29	167	62.5
30-39	76	28.5
40- 49	18	6.7
50-59	6	2.2
Gender		
Male	48	18.0
Female	219	82.0
Marital Status		
Single	185	69.3
Married	81	30.3
Divorced	1	0.4
Level of Education		
Nigerian Certificate	131	49.1
In Education		45.3
Bachelor Degree	121	1.9
Master Degree	5	3.7
Senior School	10	
Certificate Exam		
Years of Experience		
0-5	173	64.8
6-11	68	25.5
11-15	19	7.1
16-20	5	1.9
21 above	2	0.7
Teaching Level		
Junior Primary Class	171	64.0
Senior Primary Class	96	36.0

Table 2: Occupational Characteristics of Respondents (N=267)

Variables	Frequency (n)	Percentages (%)
Teaching Hours		
<3 Hours	13	4.9
3-5 Hours	65	24.3
6-8 Hours	177	66.3
>8 Hours	12	4.5
Class Size		
20-29	167	63.5
30-39	76	28.5
40-49	18	6.7
50-59	6	2.2
Classroom Comfort		
Very comfortable	126	47.2
Comfortable	123	46.1
Uncomfortable	17	6.4
Very Uncomfortable	1	0.4
Break Observance		
Every hour	54	20.2
Every 2 hours	109	40.8
Once per day	99	37.1
Rarely	5	1.9
Use of Teaching aids		
Frequently	171	64.0
Occasionally	69	25.8
Rarely	22	8.2
Never	5	1.9
Ergonomic Furniture		
Always Available	162	60.7
Sometimes Available	59	22.1
Rarely Available	21	7.9
Never Available	25	9.4
Teaching Posture		
Standing	133	49.8
Sitting	15	5.6
Combination of Standing and Sitting	119	44.6
Frequency of Lifting		
Frequently	72	27.0
Occasionally	108	40.4
Rarely	54	20.2
Never	33	12.4

Table 3: Prevalence and Pattern of Musculoskeletal Pain among Respondents

Variables	Pain in the last 12 months	Pain Prevented from work in the last 12 months	Seen Physician due to pain in the last 12 months	Had pain in the last 7 days
Neck	47 (17.6)	7 (2.6)	6 (2.2)	15 (5.6)
Shoulder	58 (21.7)	12 (4.5)	7 (2.6)	40 (15.0)
Upper back	50 (18.7)	12 (4.5)	11 (4.1)	36 (13.5)
Lower back	76 (28.5)	16 (6.0)	17 (6.4)	67 (25.1)
Elbow	24 (9.0)	10 (3.7)	8 (3.0)	21 (7.9)
Wrist/hand	36 (13.5)	8 (3.0)	6 (2.2)	23 (8.6)
Hip/thigh	45 (16.9)	6 (2.2)	5 (1.9)	34 (12.7)
Knee	34 (12.7)	3 (1.1)	9 (3.4)	26 (9.7)
Ankle/feet	29 (10.9)	9 (3.4)	5 (1.9)	29 (10.9)

Table 4: Gender and classes differences in the Prevalence of Musculoskeletal Pain among teachers Using Mann-Whitney U Test

Variables	Prevalence of Shoulder Pain at 12 months Mean rank	Prevalence of Upper back Pain at 12 months Mean rank	Prevalence of Lower back Pain at 12 months Mean rank
Male (48)	124.47	134.03	123.81
Female (219)	136.09	133.99	136.23
Z value	-1.322	-0.005	1.291
P value	0.186	0.996	0.197
Junior Primary (171)	127.83	130.28	133.61
Senior Primary (95)	143.70	139.30	133.30
Z value	-2.254	-1.354	-0.040
P value	0.024	0.176	0.968

Table 5 present the results of a Kruskal-Wallis Test of significance between prevalence of musculoskeletal pain among teachers with different years of teaching experience and size of classes. The variables assessed include shoulder pain, upper back pain, and lower back pain over a 12-month period. Only shoulder pain ($p = 0.041$) and upper back pain ($p = 0.025$) showed statistically significant differences across years of teaching experience. However, there was no statistically significant association between age groups and musculoskeletal pain prevalence across the shoulder, upper back, and lower back regions ($p > 0.05$).

Table 6 presents the association between musculoskeletal pain (shoulder, upper back, and lower back) and selected work-related factors. A significant association was found between teaching hours and shoulder pain ($\chi^2 = 10.244$, $p = 0.017$), indicating that longer teaching hours increased the likelihood of shoulder discomfort. However, no significant associations were observed between teaching hours and upper or lower back pain ($p > 0.05$).

Teaching posture and frequency of breaks were not significantly associated with musculoskeletal pain in any body region ($p > 0.05$). In contrast, the availability of ergonomic furniture showed a significant association with musculoskeletal pain in the shoulder ($p = 0.025$), upper back ($p = 0.000$), and lower back ($p = 0.010$), suggesting that poor ergonomic conditions contribute substantially to discomfort across these regions.

Table 5: Test of Significant difference in the Prevalence of Musculoskeletal Pain Among teachers with different years of teaching experience and size of classes Using Kruskal-Walli's Test.

Variables	Prevalence of Shoulder Pain at 12 months Mean rank	Prevalence of Upper back Pain at 12 months Mean rank	Prevalence of Lower back Pain at 12 months Mean rank
Years of Teaching:			
0-5	128.15	130.61	129.18
6-10	150.15	150.23	145.08
11-15	140.13	116.03	138.16
16-20	105.00	109.00	149.40
21 above	105.00	109.00	96.00
H value	9.950	11.170	4.603
P value	0.041	0.025	0.330
Class size:			
20-29	130.58	132.98	127.98
30-39	136.62	137.11	139.91
40-49	149.50	123.83	155.33
50-59	149.50	153.50	162.75
H value	2.709	1.854	6.004
P value	0.439	0.603	0.111

Table 6: Test of Association Between Prevalence of Musculoskeletal Pain and Hours of Teaching, Teaching Posture, Break Hours and Availability of Ergonomic Furniture Using Chi Square Test of Association.

Variables	Prevalence of Shoulder Pain at 12 months Mean rank	Prevalence of Upper back Pain at 12 months Mean rank	Prevalence of Lower back Pain at 12 months Mean rank
Hours of Teaching			
<3hours	6(46.2)	2(15.4)	5(38.5)
3-5	20(30.8)	17(26.20	18(27.7)
6-8	30(16.9)	29(16.4)	49(27.7)
>8	2(16.7)	2(16.7)	4(33.3)
X^2	10.244	3.123	0.850
P value	0.017	0.373	0.838
Teaching posture			
Standing	25(18.8)	21(15.8)	36(27.1)
Sitting	5(33.3)	1(6.7)	5(33.3)
Sitting and	28(23.5)	28(23.5)	35(29.4)
Standing	2.087	3.991	0.355
X^2	0.352	0.136	0.838
P value			
Break Hours			
Every hour	15(27.8)	15(27.8)	15(27.8)
Every 2 hours	19(17.4)	16(14.7)	25(22.9)
Once per day	24(24.2)	18(18.2)	34(34.3)
Rarely	0(0.0)	1(20.0)	2(40.0)
X^2	4.102	4.105	3.656
P value	0.251	0.250	0.301
Ergonomic Design Furniture			
Always Available	29(17.90	25(15.40	44(27.2)
Sometimes	12(20.3)	7(11.9)	12(20.30
Rarely Available	6(28.6)	6(28.6)	6928.60
Never Available	11(44.0)	12(48.00	14(56.0)
X^2	9.334	18.394	11.357
P value	0.025	0.000	0.010

DISCUSSION

This study has several limitations that should be acknowledged. Firstly, the cross-sectional design limits the ability to establish a causal relationship between risk factors and musculoskeletal pain, the findings can only suggest associations, not cause-and-effect relationships. Secondly, data collection relied on self-reported questionnaires, which may be subject to recall bias and subjective interpretation of symptoms. Participants might have over- or under-reported their experiences of pain based on personal perception or memory. Thirdly, the study was conducted among teachers in one local government area (Ovia North-East), which may limit the generalizability of the results to all teachers in Edo State or Nigeria. Additionally, ergonomic assessments were based on self-report rather than direct observation, which might not fully capture the actual physical and environmental conditions of the classrooms. Finally, although efforts were made to ensure representative sampling, non-response bias cannot be entirely ruled out since participation was voluntary.

Despite these limitations, the study has notable strengths. It is among the few studies in Nigeria focusing specifically on work-related musculoskeletal pain among primary school teachers, providing valuable local evidence for policymakers and health professionals. The study utilized a standardized and validated instrument (the Nordic Musculoskeletal Questionnaire), ensuring comparability with national and international research. Furthermore, the inclusion of multiple variables such as sociodemographic characteristics, job-related factors, ergonomic conditions, and lifestyle variables provided a comprehensive understanding of the multifactorial nature of musculoskeletal disorders. The relatively large sample size of teachers also enhances the reliability and representativeness of the findings within the study area.

This study assessed the prevalence and pattern of work-related musculoskeletal disorders (WMSDs) among primary school teachers in Ovia North-East, Benin City, Nigeria and explored the association of sociodemographic factors, workplace ergonomics, and physical activity levels with WMSDs. The findings provide valuable insights into the occupational health challenges faced by teachers and have important implications for prevention and physiotherapy interventions.

The results revealed that the overall prevalence of musculoskeletal pain among primary school teachers in Ovia North-East, Benin City was 71.0%. The most affected regions were the lower back (28.5%), shoulder (21.7%), and neck (17.6%). This is consistent with previous research conducted in Nigeria[8-10] and other developing countries[11,12] that reported lower back pain and neck pain as the most reported WMSDs among teachers. The predominance of lower back pain was attributed to prolonged standing, static postures, and the repetitive nature of teaching tasks such as writing on chalkboards. Neck pain was also highly reported, possibly due to awkward head positions when supervising student's work or using poorly positioned desks and boards. The high prevalence indicates that WMSDs are not only common but may also be a neglected occupational health problem among educators in the region[8]. These findings therefore highlight the significant burden of musculoskeletal pain

on teachers, which can impair their quality of life and work productivity[13].

The frequency of pain varied across different body regions, with respondents also reporting shoulder (21.7%), upper back (18.7%), and wrist/hand (13.5%) pain. This aligns with findings by Cardoso *et al.*,[14] and Yue, et al,[15] who observed that teachers often report discomfort in the spine and upper limbs due to the combination of static posture and repetitive upper limb activity.

Interestingly, the prevalence in the lower limbs and wrists was lower, suggesting that teaching primarily imposes strain on the axial skeleton and proximal upper limb musculature rather than the distal joints. This pattern reinforces the role of ergonomic factors and task repetition in WMSDs among primary school teachers.

This study found a statistically significant association between the availability of ergonomically designed furniture and the prevalence of musculoskeletal pain in the neck, shoulders, upper back, and lower back ($p < 0.05$). Teachers with limited or no access to ergonomic furniture reported higher pain prevalence. This is in line with the biomechanical model of occupational injury, which highlights that inadequate workstation design leads to poor posture, increased muscular strain, and eventual musculoskeletal symptoms. Studies from Brazil[12] and South Africa[16] confirm that improving furniture design significantly reduces teacher-reported pain.

Physical activity was significantly associated with upper back pain ($p = 0.048$), no significant associations were found for neck, shoulder, or lower back pain. This suggests that physical activity may have a protective effect on certain muscle groups, particularly the thoracic spine, but is not the sole determinant of WMSD prevalence. This finding is partially supported by the World Health Organization's guidelines, which recommend regular physical activity as part of occupational health programs, but it also highlights that ergonomic interventions must complement exercise to achieve significant impact[17].

Sociodemographic factors such as gender, age, marital status, and years of teaching experience were also explored to understand their impact on musculoskeletal pain. Gender, in particular, was not found to significantly affect the prevalence of musculoskeletal pain. However, the study did find that older age groups (40 years and above) tended to report more frequent musculoskeletal pain, especially in the lower back and neck regions. This aligns with previous studies[18], that suggest musculoskeletal pain increases with age due to accumulated stress on the body.

Job characteristics e.g. posture and lack of ergonomic furniture were shown to significantly influence the prevalence of musculoskeletal pain. Teachers working in junior primary classes experienced higher levels of shoulder pain, likely due to the demands of managing younger students, which may involve repetitive motions and awkward postures. Furthermore, the study revealed that teachers who spent more hours teaching per week, particularly those teaching more than 8 hours, were more likely to report pain, especially in the shoulders. These findings support the hypothesis that prolonged sitting and standing, along with increased physical exertion, contribute to musculoskeletal discomfort[5].

CONCLUSION

This study concluded that WMSDs are highly prevalent among primary school teachers in Ovia North East, Benin City, with the lower back, neck, and shoulder being the most commonly affected regions. The findings are consistent with literature from other geographical regions, confirming that teaching is an occupation with substantial musculoskeletal risk. Significant associations were found between the availability of ergonomic furniture and musculoskeletal pain, as well as between physical activity levels and upper back pain prevalence.

These results reinforce the importance of workplace ergonomics and teacher health promotion strategies in preventing and managing WMSDs. Interventions such as provision of ergonomic classroom furniture, regular workplace assessments, incorporation of physical activity programs, and teacher training on posture and ergonomics could help to reduce the burden of WMSDs.

From a physiotherapy perspective, the study underscores the need for physiotherapists to be actively involved in

workplace ergonomic assessments, preventive education, and rehabilitation of affected teachers.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made to mitigate or decrease the prevalence and impact of musculoskeletal pain among teachers:

Schools should invest in ergonomic furniture, including adjustable chairs, desks, and supportive equipment, to reduce physical strain during teaching.

Teachers should be provided with training on proper posture and ergonomic practices to minimize the risk of musculoskeletal pain

School administrations should consider reducing teaching hours and providing more break intervals to reduce the physical strain of prolonged standing and sitting.

Physical activity should be promoted as part of school wellness programs to improve the overall health and well-being of teachers.

Schools should implement strategies to support older teachers, such as reducing their teaching load and offering guidance on managing musculoskeletal pain.

CONFLICT OF INTREST:

The authors declare no conflict of Interest in this study.

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REFERENCES

1. Sun, W., Yin, L., Zhang, T., Zhang, H., Zhang, R., & Cai, W. (2023). Prevalence of Work-Related Musculoskeletal Disorders among Nurses: A Meta-Analysis. Iranian Journal of Public Health, 52(3), 463–475. https://doi.org/10.18502/ijph.v52i3.12130.
2. Abebaw T, Destaw B, Yenealem DG, Tesfaye AH, Melaku C, Mamaye Y, Bezie AE, Abere G. Work-related musculoskeletal disorders: prevalence, associated factors, and impact on quality of life among kitchen workers in hospitality industry, Bahir Dar City, Northwest Ethiopia, 2023. Front Public Health. 2024 May 14;12:1358867. doi: 10.3389/fpubh.2024.1358867.
3. Zenbaba, D., Sahiledengle, B., Dibaba, D., Tufa, T., Mamo, A., & Atlaw, D. (2022). Work-Related Musculoskeletal Symptoms and Associated Factors Among Academic Staff in Ethiopian Universities. Environmental Health Insights, 16, 11786302221131690. https://doi.org/10.1177/11786302221131690.
4. Fahmy, V.F., Momen, M.A.M.T., Mostafa, N.S. and 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, p. 2257. https://doi.org/10.1186/s12889-022-14712-6.
5. 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. https://doi.org/10.3389/fpubh.2024.1399552.
6. Ndonye, N.A., Matara, N.J. and Muriithi, I.A. (2019) 'Predictors of Work-Related Musculoskeletal Disorders among Primary School Teachers in Machakos County, Kenya', *International Journal of Prevention and Treatment*, 8(2), pp. 29–40.
7. AlMaghlouth MK, Alserhani NM, Aldossary FA, Alabdulqader MA, Al-Dhafer BA. Prevalence, Patterns, and Risk Factors of Work-Related Musculoskeletal Diseases Among Teachers in the Eastern Province, Saudi Arabia: A Community-Based Retrospective Cross-Sectional Survey. Cureus. 2022 Dec 4;14(12):e32178. doi: 10.7759/cureus.32178.
8. Ojukwu, C. P., Anyanwu, G. E., Eze, B., Chukwu, S. C., Onuchukwu, C. L., & Anekwu, E. M. (2018). Prevalence, pattern and correlates of work-related musculoskeletal disorders among school teachers in Enugu, Nigeria. International Journal of Occupational Safety and Ergonomics, 27(1), 267–277. https://doi.org/10.1080/10803548.2018.1495899.

9. Ojoawo, A.O; Adewale. J.S. (2025) 'Prevalence of Work-Related Musculoskeletal Disorders and Psychosocial Factors among Teachers of Selected Primary Schools in a Nigerian City', *Journal of Musculoskeletal Disorders and Treatment*, 11(1), p. 131. Available at: https://doi.org/10.23937/2572-3243.1510131.
10. Oka, Y., Jiroumaru, T., Wachi, M., & Kida, N. (2024). Prevalence and treatment of chronic musculoskeletal pain focused on service gaps: a comparative analysis by age group and body part. PeerJ, 12, e18389. https://doi.org/10.7717/peerj.18389.
11. Chiu, T.T.W. and Lam, P.K.W. (2007) 'The Prevalence of and Risk Factors for Neck Pain and Upper Limb Pain among Secondary School Teachers in Hong Kong', *Journal of Occupational Rehabilitation*, 17(1), pp. 19–32. Available at: https://doi.org/10.1007/s10926-006-9046-z.
12. Erick, P.N. and Smith, D.R. (2014) 'The Prevalence and Risk Factors for Musculoskeletal Disorders among School Teachers in Botswana', *Occupational Medicine & Health Affairs*, 2014. Available at: https://doi.org/10.4172/2329-6879.1000178.
13. Souza, C.S., Cardoso, J.P., Aguiar, A.P., Macêdo, M.M.S.R., & Oliveira, J.S. (2021). Work-related musculoskeletal disorders among schoolteachers. Revista Brasileira de Medicina do Trabalho, 19(2), 140. https://doi.org/10.47626/1679-4435-2020-545.
14. Cardoso JP, Araújo TM, Carvalho FM, Oliveira NF, Reis EJ. Aspectos psicossociais do trabalho e dor musculoesquelética em professores [Psychosocial work-related factors and musculoskeletal pain among schoolteachers]. Cad Saude Publica. 2011 Aug;27(8):1498-506. Portuguese. doi: 10.1590/s0102-311x2011000800005.
15. Yue, P., Liu, F. and Li, L. (2012) 'Neck/shoulder pain and low back pain among school teachers in China, prevalence and risk factors', BMC Public Health, 12(1), p. 789. Available at: https://doi.org/10.1186/1471-2458-12-789.
16. Bai, Y., Kamarudin, K.M. and Alli, H. (2024) 'A systematic review of research on sitting and working furniture ergonomic from 2012 to 2022: Analysis of assessment approaches', *Heliyon*, 10(7), p. e28384. Available at: https://doi.org/10.1016/j.heliyon.2024.e28384.

17. Rhim, H.C., Tait, A., Melloh, M., Hasan, S.S., Verhagen, E., & Wirth, W. (2022). Association between physical activity and musculoskeletal pain: an analysis of international data from the ASAP survey. BMJ Open, 12(9), e059525. https://doi.org/10.1136/bmjopen-2021-059525.

18. Radojčić MR, Perera RS, Hart DJ, Spector TD, Arden NK. Prevalence, incidence, and re-occurrence risk of musculoskeletal pain in older adults in the United Kingdom: a population-based study. Front Pain Res (Lausanne). 2023 Sep 1;4:1197810. doi: 10.3389/fpain.2023.1197810.