

Correlation between musculoskeletal pain and stress levels in teachers during the remote teaching period of the COVID-19 pandemic

Correlação entre dor musculoesquelética e níveis de estresse em professores durante o período de ensino remoto na pandemia de COVID-19

Nyvea Maria de Souza Matias ¹

Luciana Ângelo Bezerra ²

Sthefany Ellen de Araújo Nascimento ¹

Palloma Gabryela de Souza Ferreira ²

Maria Cristina Falcão Raposo ²

Renato de Souza Melo ^{2*}

¹ Faculdade de Integração do Sertão (FIS), Serra Talhada, PE, Brazil

² Universidade Federal de Pernambuco (UFPE), Recife, PE, Brazil

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*Correspondence: renatomelo10@hotmail.com

Abstract

Introduction: Remote teaching during the COVID-19 pandemic caused teachers to work under adverse conditions and sit in front of a computer rather than stand, which can lead to musculoskeletal pain and stress in this population. **Objective:** To observe the prevalence of musculoskeletal pain and its correlation with stress levels in teachers during the remote teaching period of the COVID-19 pandemic. **Methods:** A cross-sectional study carried out in elementary and high schools in the city of São José do Belmonte, Pernambuco state (PE). Sixty teachers of both sexes aged 18 years and older were evaluated. The Nordic Questionnaire of Musculoskeletal Symptoms (NQMS) was used to assess musculoskeletal pain, the Visual Analogue Scale to quantify pain intensity and the Maslach Burnout Inventory to identify symptoms of stress and burnout. **Results:** Seventy five percent (n = 45) of the teachers reported musculoskeletal pain, with a higher prevalence in the lumbar spine 68.3% (n = 41), followed by the cervical spine 45.0% (n = 27), thoracic spine, wrists and hands, both with 41.7% (n = 25). A positive correlation was observed between the presence of musculoskeletal pain and high levels of occupational stress (p = 0.036). **Conclusion:** A high prevalence of musculoskeletal pain was identified in teachers during the remote teaching period. The lumbar, cervical and thoracic spine, wrists and hands exhibited the highest pain prevalence. Teachers who experienced musculoskeletal pain had higher stress levels and there was a positive correlation between musculoskeletal pain intensity and high occupational stress levels.

Keywords: Coronavirus infections. Distance education. Low back pain. Professional burnout. School teachers.

Resumo

Introdução: O ensino remoto, ocorrido durante a pandemia de COVID-19, levou os professores a trabalharem em condições adversas e modificou a postura em que eles ensinavam, passando da posição ortostática para a sentada diante de um computador, o que pode favorecer a presença de dores musculoesqueléticas e estresse. **Objetivo:** Observar a prevalência de dor musculoesquelética e sua correlação com níveis de estresse em professores durante o ensino remoto na pandemia de COVID-19.

Métodos: Estudo de corte transversal realizado em escolas do ensino fundamental e médio do município de São José do Belmonte, em Pernambuco. Foram avaliados 60 professores, de ambos os sexos e faixa etária acima dos 18 anos. Para avaliar a presença de dores musculoesqueléticas, utilizou-se o Nordic Questionnaire of Musculoskeletal Symptoms; para quantificar a intensidade das dores, a Escala Visual Analógica; e para identificar sintomas de estresse e esgotamento profissional, o Maslach Burnout Inventory. **Resultados:** Setenta e cinco por cento ($n = 45$) dos professores avaliados apresentavam dores musculoesqueléticas, com maior prevalência na coluna lombar (68,3%, $n = 41$), seguida pela coluna cervical (45,0%, $n = 27$), torácica, punhos e mãos, ambos com (41,7%, $n = 25$). Observou-se também uma correlação positiva entre a presença de dor musculoesquelética e níveis elevados de estresse ocupacional nos professores avaliados ($p = 0,036$). **Conclusão:** Observou-se uma elevada prevalência de dor musculoesquelética nos professores durante o período de ensino remoto. A coluna lombar, cervical, torácica, punhos e mãos foram as regiões com maior prevalência das dores. Os professores que apresentavam dor musculoesquelética relataram maiores níveis de estresse e houve uma correlação positiva entre a intensidade da dor musculoesquelética e níveis elevados de estresse ocupacional.

Palavras-chave: Infecções por coronavírus. Educação à distância. Dor lombar. Esgotamento profissional. Professores escolares.

Introduction

Stress is a complex psychophysiological response by the body to certain threats to its homeostasis is caused by the need to deal with circumstances that lead to internal imbalance in the individual, which requires their adapting to a new situation.¹ Stress is the result of emotional imbalance that may occur in interpersonal work relationships such as excessive professional demands.²

Stress triggers a number of bodily symptoms, similar to reactions caused by toxic chemicals. This condition is directly related to discomfort that may interfere in homeostasis and a factor inherently linked to stress is musculoskeletal pain (MSP). MSP is a multifactorial symptom involving sociodemographic aspects, personal characteristics, lifestyle and working conditions. All of these factors may lead to the development or worsening of MSP or its perception.^{3,4} MSP has been an important health problem for teachers, musculoskeletal disorders being the main cause of absenteeism and occupational diseases.³ Changes in the education sector have led to an increase in teaching activities and unstable work relationships, demonstrating that health issues are common in teachers, predominantly musculoskeletal disorders, vocal problems and psychological disturbances.⁵

The COVID-19 pandemic has been one of the greatest challenges of this century. Lack of knowledge about the virus, its high dissemination, contagion and lethality, especially in vulnerable populations, has caused uncertainty regarding the best strategies to deal with the pandemic. The use of masks and social isolation were the most widely adopted strategies by several countries to prevent contamination.⁶ Thus, many hitherto in-person activities were adapted to a home office format. In Brazil, formerly in-person classes at the elementary, secondary and university level, became remote or hybrid, causing an abrupt change in teaching methods and completely altering teachers' routine, resulting in work overload, which can trigger high stress levels and may be associated with their MSP.⁷

School administrators and departments of education should think not only about teaching, but also the physical and mental health of all those involved in the teaching-learning process, primarily teachers, in order for them to adequately perform their role during this critical period.^{8,9} Thus, the aim of the present study was to observe the prevalence and intensity of MSP and its correlation with high occupational stress levels in elementary and secondary school teachers during the remote teaching period of the COVID-19 pandemic.

Methods

This is a cross-sectional study conducted at five public schools in São José do Belmonte, Pernambuco state, Brazil, following Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies.¹⁰

Elementary and secondary school teachers of both sexes were assessed. The following exclusion criteria were adopted: being an elementary or secondary teacher, aged 18 years or older, teaching for at least one year during remote teaching in São José do Belmonte. Excluded were teachers who were on leave or reassigned for health reasons, those with any osteomyoarticular and/or neurological disease, with a history of fractures, infected by Chikungunya fever and pregnant women. Eligible individuals gave their informed consent to participate in the study.

Four assessment instruments were used: an assessment chart containing sociodemographic data and work-related aspects of the volunteers; the Nordic Questionnaire of Musculoskeletal Symptoms (NQMS),¹¹ used to evaluate musculoskeletal pain; the Visual Analog Scale (VAS),¹² to quantify self-reported musculoskeletal pain intensity; and the Maslach Burnout Inventory (MBI),¹³ to observe the presence of stress and professional burnout.

Given that the study was carried out between April and August 2021, the most critical period of the COVID-19 pandemic in Brazil, it adhered to the guidelines in force at the time, as follows: The researchers telephoned school administrators to explain the study objectives and were asked to inform their teachers about the study characteristics and those interested in taking part authorized the administrator to provide the researchers with their contact information (telephone number and email). The interested teachers were contacted and once again explained the study characteristics and invited to participate. An opaque envelope containing the informed consent form and instruments used was delivered to their residence. At a pre-determined time, the researchers telephoned the teachers, who completed the questionnaires at that time and if needed, resolved any doubts they had. The researchers then returned to the teachers' residence to collect the envelopes.

MSP was assessed by the NQMS, an instrument validated for Brazil,¹¹ consisting of dichotomous choices regarding the presence or not of osteomuscular symptoms in the cervical spine, shoulders, arms, forearms, wrists and hands, thoracic and lumbar spine, hip, thighs, knees, legs, ankles and feet. The only osteomuscular symptom assessed in the present study was MSP. Pain intensity was quantified by the VAS,¹² between zero and ten, where zero represents absence of pain and ten intense pain. After the scale was explained, the teachers quantified MSP intensity.¹⁴

Stress and professional burnout were evaluated using the MBI,¹³ consisting of twenty questions on work-related psychophysical characteristics scored on a Likert scale from 1 to 5 (1 = never, 2 = annually, 3 = monthly, 4 = weekly and 5 = daily), assessing the frequency the individual experiences stress reactions. The final MBI values are classified as follows: 0-20 points, no indication of burnout syndrome; 21-41, possibility of developing the syndrome; 41-60, initial phase of the syndrome; 61-81, installation phase of the syndrome; and 81-100, advanced phase of the burnout syndrome.

The data were recorded on the instruments and then included in the databases. Data were entered in Microsoft Excel 2010 by two independent researchers in order to avoid digitizing errors and ensure more reliable findings.¹⁵⁻¹⁷ This study was assessed and approved by the Research Ethics Committee of the Faculdade de Integração do Sertão (CAAE: 38977720.6.0000.8267).

Statistical analysis

The Kolmogorov-Smirnov was used to test the normality of the quantitative variables. The Mann-Whitney test was used for cases of non-normal data distribution to compare the presence of not of musculoskeletal pain between the two groups, or the Student's t-test for normal distribution. Pearson's chi-squared or Fisher's Exact test were applied to the dichotomous variables, when necessary. Pearson's linear correlation coefficient was calculated between MSP intensity (in each of the body segments) and the occupational stress scores of the sample. The data collected were analyzed in the Statistical Package for the Social Sciences (SPSS), version 20.0, where all the analyses were conducted, adopting a significance level of $p < 0.05$.

Results

The sample characterization data are described in Table 1. A total of 60 teachers were evaluated to form a convenience sample, 45 (75%) of whom exhibited MSP. The body regions most affected by pain were the lumbar spine (68.3%), followed by the cervical spine (45.0%), thoracic spine (41.7%), wrists and hands (41.7%). Pain was less intense in the lumbar (4.45 ± 0.43) and cervical spine (3.62 ± 0.39), wrists and hands (3.30 ± 0.36), according to Table 2.

Table 1 - Sample characterization

Sample characterization	n (%) or mean \pm standard deviation
Sex	
Female	38 (63.3)
Male	22 (36.7)
Age (years)	37.10 \pm 1.00
Height (m)	1.65 \pm 0.96
Weight (kg)	76.00 \pm 2.85
Body mass index	25.90 \pm 0.42
Race	
White	11 (18.4)
Brown	41 (68.3)
Black	8 (13.3)
Marital status	
Married	45 (75.0)
Single	13 (21.6)
Divorced	2 (3.4)

Table 2 - Musculoskeletal pain and its intensity in teachers during the remote teaching period of the COVID-19 pandemic

Body regions	Pain n (%)	Intensity mean \pm standard deviation
Cervical spine	27 (45.0)	3.62 \pm 0.39
Shoulders	14 (23.3)	1.28 \pm 0.32
Arms	9 (15.0)	1.67 \pm 0.21
Forearms	4 (6.7)	1.98 \pm 0.33
Wrists and hands	25 (41.7)	3.30 \pm 0.36
Thoracic spine	25 (41.7)	3.22 \pm 0.38
Lumbar spine	41 (68.3)	4.45 \pm 0.43
Hip	14 (23.3)	2.13 \pm 0.28
Thighs	9 (15.0)	1.78 \pm 0.26
Knees	16 (26.7)	1.12 \pm 0.27
Legs	5 (8.3)	1.51 \pm 0.48
Ankles and feet	14 (23.3)	1.00 \pm 0.28

The teachers obtained a mean of 46.80 ± 1.33 in terms of occupational stress, indicating the initial phase of the burnout syndrome according to the MBI. The teachers who displayed MSP obtained even higher means (49.40 ± 1.38) than those without pain (39.00 ± 2.49), demonstrating significant differences ($p = 0.036$) (Table 3).

There was also a positive correlation between high MSP intensity and stress levels in the following body regions: shoulders ($p = 0.029$), wrists and hands ($p = 0.011$), thoracic spine ($p = 0.029$), hip ($p = 0.003$) and ankles and feet ($p = 0.035$) (Table 4).

Table 3 - Mean and standard deviation of the Maslach Burnout Inventory assessment between the teachers with and without musculoskeletal pain

With pain	Without pain	p-value
49.40 \pm 1.38	39.00 \pm 2.49	0.036

Note: Mann-Whitney Test. Bold numbers indicate $p < 0.05$.

Table 4 - Correlation between the pain intensity and stress levels of teachers during the remote teaching period of the COVID-19 pandemic

Variables	Pearson's correlation	p-value
Cervical spine	0.242	0.062
Shoulders	0.281	0.029
Arms	0.189	0.149
Forearms	0.137	0.121
Wrists and hands	0.327	0.011
Thoracic spine	0.281	0.029
Lumbar spine	0.233	0.733
Hip	0.378	0.003
Thighs	0.076	0.390
Knees	0.176	0.179
Legs	0.074	0.189
Ankles and feet	0.273	0.035

Note: Bold numbers indicate $p < 0.05$.

Discussion

A high prevalence of MSP was observed in the teachers who took part in this study. This pain may be related to the work characteristics of these individuals during the remote teaching period and should be thoroughly investigated, since it involves young professionals (37.10 ± 1.00 year) with significant productive capacity, and the presence of this pain may compromise their work performance and negatively affect student learning.

It is important to note that the remote teaching period required a change in body posture, predominantly the sitting position. Prolonged sitting may lead to muscle tension in the cervical and thoracolumbar spine and periscapular region, triggering pain symptoms in these regions,¹⁸ as observed in this study.

This high prevalence of MSP could be due to the poor posture that the teachers may have adopted at work, caused by the lack of ergonomics in their new work environment, which they were most likely unprepared for, and the high work demands imposed on them during this period.¹⁹

Moreover, in the interviews, a significant number of teachers reported adopting poor posture during the numerous meetings with coordinators in the lockdown period to plan the semesters, alter activities, create and correct tests, and attribute this to not having an ergonomically adequate environment and equipment to perform their activities. The teachers also reported not receiving any technical or electronic support for their classes, which may also have contributed to the emergence or worsening of the MSP identified in the study sample.

The prevalence of MSP in teachers was also investigated before the COVID-19 pandemic. Carvalho et al.²⁰ assessed 157 teachers using the NQMS, and found a high prevalence of MSP (64.3%), primarily in the cervical (28.7%), lumbar (27.4%), and thoracic spine (27.4%), wrists and hands (14.6%). Although the findings of the present study corroborate those of Carvalho et al.,²⁰ the teachers assessed here exhibited a higher prevalence of MSP in both general pain and separately in each body segment.

The following question should be asked: is the increased prevalence of MSP found in the present study related to changes in teachers' activities during the remote teaching period and/or intrinsic factors of the pandemic, such as anxiety, depressive symptoms, stress and fear, common symptoms and feelings in the general population^{21,22} and teachers^{23,24} during the COVID-19 pandemic? However, the influence of these aspects on MSP and stress was not analyzed here, and should be further investigated.

The findings of this study on MSP and stress showed that the teachers with MSP obtained higher occupational stress scores than their pain-free counterparts. The same was observed for pain intensity in the shoulder, wrists, hands, thoracic spine, hip, ankles and feet. The pandemic worsened the musculoskeletal health of

workers in different areas who worked from home.²⁵ Workers with MSP are more prone to developing post-stress perceptions, since pain makes these people less tolerant to work-related psychological demands.²⁶ This may justify the findings of the present study regarding the correlation between MSP and its intensity and occupational stress in the teachers assessed.

Furthermore, individuals with pain may be more at risk of developing psychological disorders caused by the COVID-19 pandemic. Symptoms such as pain and stress demonstrate the negative impact of the pandemic on teachers and reaffirm the need to devise interdisciplinary interventions that include psychologists in order to preserve the physical and mental health of these professionals.^{27,28} The focus now should be on investing in adequate working conditions to preserve the health of workers, especially during pandemics.²⁹

As reported in other studies, the teachers analyzed here obtained scores related to the initial burnout syndrome phase during the remote teaching period.^{30,31} It is important, however, to mention other work factors that may have contributed to compromising the physical and mental health of these professionals during this period. The teachers described numerous meetings, unpaid overtime, the lack of technological devices and training for their use, excessive demands, short deadlines to hand in results and messages sent to chat apps on the teachers' personal phones, nearly always after working hours and on weekends.

Also mentioned were societal pressure, especially from parents and politicians, to return to in-person classes, and their fear of contamination or death in light of the high number of deaths in Brazil. These aspects were also cited in other studies on the issue,³²⁻³⁴ demonstrating the extent to which the COVID-19 pandemic hindered the teachers' ability to perform their duties and how much it negatively impacted their physical and mental health.

Burnout syndrome is the chronic result of stress and originates in the workplace. This syndrome affects a worker's physical and mental health, compromising their quality of life, leading to work-related disorders and is considered a public health problem,³⁵ making the results of this investigation relevant, since the scores of teachers with MSP suggest that these professionals are in the initial burnout phase. Given that teachers may exhibit high risk of developing burnout syndrome during the remote teaching period, it is important to develop measures to improve the physical and mental health of teachers now and in future pandemics.

This study found a positive correlation between the presence and intensity of MSP with high levels of occupational stress in the teachers. These data may prompt state and/or municipal departments of education to support MSP and occupational stress prevention strategies, given the importance of these professionals to society. One suggestion would be to provide periodic physiotherapy training,³⁶ in order to increase teachers' knowledge about the ergonomic and occupational risks of their work environment. Implementing workplace exercise may be another valid alternative, since some studies observed good body posture after relaxation techniques during class breaks, before or after work, thereby preventing injury and pain.³⁷ Exercises with music, relaxation, physiotherapy, massage³⁸ and pompage³⁹ also proved to be effective in reducing anxiety, stress and MSP. These measures can be adopted by municipal and state departments of education to prevent MSP and high stress levels, by providing better working conditions for teachers, especially during critical periods, to enable them to perform their duties under better conditions and with lower occupational risk.

A limitation of this study was the convenience sample. However, the study was conducted during the COVID-19 pandemic, a period with substantial contamination in Brazil, which resulted in many teachers refusing to participate, thereby reducing the sample size. Another point is the fact that the participants were not asked if they had engaged in domestic activities, which also could contribute to MSP.

Conclusion

We observed a high prevalence of MSP in the teachers who took part in this study. The cervical, thoracic and lumbar spine, wrists and hands exhibited the highest prevalence of pain. Teachers with MSP showed a higher stress levels and there was a positive correlation between MSP intensity and high stress levels in teachers during the remote teaching period.

Authors' contributions

All the authors contributed substantially to the conception of this article. NMSM, SEAN and PGSF were responsible for all stages of the article, namely study

conception and design, literature review, data collection and writing of the article. MCFR contributed to the study conception, data interpretation and analysis and reviewed the article. LAB and RSM guided all the stages of the study and were responsible for study conception and design, statistical and critical analyses of the manuscript. All the authors approved the final version.

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