ORIGINAL ARTICLE

Back pain occurred due to changes in routinary activities among Brazilian schoolteachers during the COVID-19 pandemic

Rose Elizabeth Cabral Barbosa[1] · Giovanni Campos Fonseca[2] · Nayra Suze Souza e Silva[1] ·
Rosângela Ramos Veloso Silva[3] · Ada Ávila Assunção[1,4] · Desirée Sant'Ana Haikal[1]

Abstract

Objective This study's main objective was to investigate the emergence of back pain as a consequence to changes in usual activities due to the COVID-19 pandemic among teachers in public schools in the state of Minas Gerais, Brazil.
Methods A cross-sectional study was conducted among 15,276 schoolteachers using an online questionnaire. The variables included sociodemographic and occupational data, health situation, habits and behaviors during the COVID-19 pandemic. Bivariate analyses using Pearson's chi-square test and multiple analyses using Poisson regression were performed to identify the associated factors.
Results About 58% of schoolteachers reported back pain due to changes in routine activities during the pandemic. The adjusted model showed a correlation between back pain and female sex, longer working hours, overwork, difficulties concerning distance working, negative changes in health status and quality of sleep; frequent feeling of sadness, depression, or anxiety; use of medications to relax, sleep or against stress/anxiety/depression; physical inactivity or negative changes in the practice of physical activities; increased body weight; reduction of leisure time; increased time of use of computer or tablet and overload of housework.
Conclusion During the COVID-19 pandemic, schoolteachers reported a high prevalence of emergence of back pain, which delineates a contradiction in terms: on the one hand, distance education allows social distancing that contributes to the preservation of teachers' health by reducing the risk of contamination by COVID-19. On the other hand, it imposes new demands that—in disagreement with working conditions—can threaten the health of these workers.

Keywords COVID-19 · Musculoskeletal disorders · Back pain · Schoolteachers · Brazil

Introduction

The COVID-19 pandemic imposed challenges on different sectors of society and social distancing proved to be an alternative to reduce the spread of the disease. In the educational sector, the adoption of social distancing has resulted in the closure of schools and as a consequence interruption of face-to-face classes. Across the country, public and private schools suspended their activities and teaching started to be carried out using digital resources, including the use of information and communication technologies (Souza et al. 2021).

Distance teaching emerged as the possibility of continuing school activities (Departamento Intersindical de Estatística e Estudos Socioeconômicos 2020). The change from face-to-face to distance education has reconfigured the routine of millions of people. In Brazil, in 2019, about 2.6 million teachers worked in basic education, and approximately 48 million students enrolled in more than 180 thousand public and private schools (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira 2020).

Teachers started to perform distance working, in a new teaching format, having to unexpectedly develop their

✉ Rose Elizabeth Cabral Barbosa
    rosebarbosa.moc@gmail.com

1 Graduate Program in Health Sciences, State University of Montes Claros, Montes Claros, Minas Gerais, Brazil

2 Federal University of Minas Gerais, Montes Claros Campus, Montes Claros, Minas Gerais, Brazil

3 Graduate Program in Primary Health Care, State University of Montes Claros, Montes Claros, Minas Gerais, Brazil

4 Faculty of Medicine, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

activities through digital education platforms, conventional media, and, also, social networks (Pontes and Rostas 2020; Souza et al. 2021). These workers often had no specific training nor appropriate facilities and resources to deal with such changes imposed by distance working (Souza et al. 2021), learning while teaching.

This new reality required teachers to develop skills, especially those related to the use of technologies, the need to adapt lesson plans for distance teaching, and a new daily routine, which included adapting the spaces of their homes, transforming them into classrooms. These transformations can generate improvised working conditions and strenuous hours (Souza et al. 2021), in addition to significant changes in habits and behaviors, with consequences for teachers' physical and mental health (Vu et al. 2020), including the appearance of musculoskeletal pain (Szwarcwald et al. 2021b).

Musculoskeletal pain represents one of the main health problems among teachers (Cardoso et al. 2009; Erick and Smith 2011). This fact reinforces the importance of examining the effect of adopting remote work during the pandemic. Did changes in teachers' work and other daily activities generate episodes of back pain? Thus, this study aimed to investigate the emergence of back pain (upper, mid and low) as a consequence to changes in usual activities due to the COVID-19 pandemic among teachers of basic education in public schools in the state of Minas Gerais, Brazil.

Methods

Study design and participants

This cross-sectional study analyzes data from a web survey called *Health and work conditions among teachers in the state education network of the state of Minas Gerais in the COVID-19 pandemic* (ProfSMoc Project-Minas COVID Stage). One of the authors helped in the coordination of this project. Together with the entire team, we participated in all phases of the investigation such as study design, data collection and results' analyses.

The study population included about 90,000 active teachers in 2020, working in basic education in public schools of Minas Gerais, Brazil. Basic education in Brazil includes elementary school, middle school and high school. The Minas Gerais State Department of Education has six regional centers subdivided into 47 Regional Teaching Superintendencies.

The calculation for the definition of the sample considered infinite populations, prevalence of the event of 50%, a confidence level of 95%, standard error of 3%, deff = 2, and an increase of 20% to compensate for possible losses. The sample was estimated at 2564 subjects to guarantee the

representativeness of the sample. After estimating the overall sample size, the composition of the sample was calculated according to the percentage share of teachers in each teaching superintendencies.

Instrumentation

The data collection questionnaire was organized into blocks composed of questions extracted or adapted from health surveys previously conducted in Brazil, applied to the general population (Fundação Oswaldo Cruz 2020; Szwarcwald et al. 2021a) or to teachers in particular (Assunção et al. 2019) (Table 1). For some topics, there were questions about situations before the pandemic and after its manifestation in Brazil. Thus, this study delineates changes in several aspects related to teaching work, health conditions, habits and behaviors.

The research form had 144 mandatory questions asked via Google Forms with an estimated time of 25 min to fully complete it. A pilot study was carried out on August 10th and 11th, 2020 and involved 20 public schools teachers from five cities of Minas Gerais. The participants of the pilot study were excluded from the definitive data collection.

Data gathering procedure

Data collection, using an online form sent to the teachers' institutional e-mail, took place between August 20 and September 11, 2020. Minas Gerais State Department of Education headquarters sent an access link for the form to all the teachers allotted in the 47 Regional Teaching Superintendencies of the state. Teachers were not identified, guaranteeing anonymity and to avoid automatic filling of the form, a resource was used to ensure that participants were human beings (reCAPTCHA). A total of 16,210 teachers replied to the online form: 569 declined the invitation to participate in the research, and 15,461 teachers agreed to participate and fully answered the proposed questions.

Outcome and covariates

The research excerpt presented in this study investigated the emergence of back pain as a consequence to changes in usual activities due to the COVID-19 pandemic by answering the question: *During the pandemic, with the changes in your usual activities, did you start to have any back pain (upper, mid or low)? (No | Yes, a little | Yes, a lot)*. The last two answer options were grouped under *Yes*.

The explanatory variables included in this study were organized in blocks as described below.

Sociodemographic characteristics Sex, age (21–43 years|44–77 years), schooling (With or without postgraduate education); marital situation and children (With or

Table 1 Thematic blocks, questions and reference sources of validated instruments included in the questionnaire of the ProfSMoc Project-Minas COVID Stage

Thematic blocks	Questions	Reference source
School characterization	School name; city name; location area (urban or rural)	School Census Brazil (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira 2021)
Demographic and socioeconomic characteristics	Sex; age; race; family income; schooling; marital status; number of children; household characteristics	ConVid Research on Behaviors (Fundação Oswaldo Cruz 2020; Szwarcwald et al. 2021a)
Work characteristics	Working time as a teacher; weekly working hours; teaching stage; subjects taught; employment relationship; other paid work; job satisfaction	Educatel Study (Assunção et al. 2019)
Remote teaching	Remote work; digital tools used to replace face-to-face classes; work overload during pandemic; difficulties faced during remote teaching; mastery of technologies; computer availability and quality of internet at home; participation in training courses for remote teaching; access to remote classes for students	Prepared for the ProfsMoc Project-Minas COVID Stage
Changes in daily activities due to the pandemic	COVID-19 risk group; presence of flu-like symptoms; taking the COVID-19 test; family or friends developed severe symptoms or died because of COVID-19; adherence to social isolation; changes in the amount or type of housework	ConVid Research on Behaviors (Fundação Oswaldo Cruz 2020; Szwarcwald et al. 2021a)
Fear of COVID	Aimed to assess fear of COVID-19 among individuals	Fear of COVID-19 Scale (Faro et al. 2020)
Health situation during the pandemic	Quality of life; self-rated health; presence of chronic back or spine problems; change in intensity or onset of back pain; search for health care; reason for seeking health care; satisfaction with the care received; changes in sleep; presence of feelings of sadness or anxiety; adherence to drug treatments; self-medication; use of medication to relax, sleep, or for stress/anxiety/depression; personal care	ConVid Research on Behaviors (Fundação Oswaldo Cruz 2020; Szwarcwald et al. 2021a)
Habits during the pandemic	Cigarette and alcohol consumption; dietary habits; weight gain; physical activities; leisure activities; time watching TV; time using a computer or tablet	ConVid Research on Behaviors (Fundação Oswaldo Cruz 2020; Szwarcwald et al. 2021a)
Family life during the pandemic	Time spent with family members; arguments; alcohol consumption and mental health issues among family members; domestic violence and sexual harassment	Prepared for the ProfsMoc Project-Minas COVID Stage

without partner and with or without children). We chose to exclude pregnant teachers from this analysis since pregnancy can trigger back pain related to issues not addressed in this study (Aragão 2019).

Characteristics of teaching work Working time (Up to 15 years|16 years or more), weekly working hours (up to 20 h|BETWEEN 21 and 40 h|41 h or more), number of teaching stages in which they operate (1, 2 or 3 stages) and another paid activity. Moreover, information about the overload of teaching work during the pandemic, number of digital tools used and number of difficulties faced in distance teaching.

The *overload of teaching work during the pandemic* was investigated from the answers to the question *During the pandemic: I have worked the same as I used to, I have worked less than I used to, I have worked more than I used to, I have worked much more than I used to*. The first two answer options were grouped under *No* and the last two grouped under *Yes*.

The variable *number of digital tools you use* was created based on the question *What digital tools have you used to replace classroom lessons?* The response options, in addition to *I do not use any*, were as follows: School Connection—a tool made available by the State Department of Education for teachers in Minas Gerais—, WhatsApp or Telegram, E-mail, Facebook, Instagram, Twitter, Moodle, Google Classroom, Zoom, Google Meet, Microsoft Teams and Skype.

The variable *difficulties faced in distance teaching work* refers to the lack of an adequate environment for classes, problems with connectivity or equipment, difficulties in preparing content for classes in digital media, difficulties in monitoring students' understanding, difficulties in terms of resistance/interest of students and/or their families and difficulties in controlling attendance.

Health situation, habits and behaviors during the pandemic Information about changes in quality of life, health status and sleep quality, frequent feeling of sadness, depression or anxiety and use of medications to relax, sleep or against stress/anxiety/depression. In addition, information about physical activity, increased body weight, reduction of leisure time, increased time watching television or using a computer or tablet and overload of domestic work. All questions were answerable by a Yes or No.

The variables *negative changes in quality of life* and *negative changes in health status* were created based on the questions: *Do you think the pandemic caused changes in your quality of life?* and *Do you think the pandemic has changed your health?*, respectively. The answer options *Stayed the same* and *Improved* were grouped under *No* and the *Worsened* and *Worsened a lot* were grouped under *Yes*.

The practice of physical activity was evaluated considering the answers to the questions about the number of days in the week and the time spent on each day to exercise before and during the pandemic. The categories elaborated were: same level of physical activity—for those who maintained, during the pandemic, the same level of activity they practiced before it (number of days in the week and time of exercise in each day); positive changes—those who started exercising or increased the level of physical activity during the pandemic; negative changes—those that reduced the level of physical activity or interrupted the practice; and sedentary—did not practice exercises before the pandemic and continued not practicing.

The variable *overload of domestic work* was obtained by answering the question *Has the pandemic affected/changed the amount and type of your domestic work?* The *Remained the same* and *Decreased* options were grouped under *No*, *Increased* and *Increased a lot* were grouped under *Yes*.

Data analysis

Statistical analysis was performed using the STATA version 13.0 statistical program. Initially, the descriptive analysis estimated absolute and relative frequencies and Pearson's chi-square test was used to assess crude correlations between the onset of back pain and the independent variables selected for the study. The significance level of 20% ($p \leq 0.20$) in Pearson's chi-square test was considered to insert the variables in the multiple model. The magnitude of the associations among variables was estimated using Poisson regression with robust variance, calculating the prevalence ratios (PR) and the respective 95% confidence intervals. The final adjusted model had variables associated with the outcome investigated at the level of $p \leq 0.05$.

Ethics

Minas Gerais State Department of Education authorized the development of the research project that was also approved by the Research Ethics Committee of the State University of Montes Claros-Unimontes (opinion number 4200389). Participants received the Informed Consent Form when accessing the survey form.

Results

For the purposes of this research, teachers who were not on distance working ($n = 121$) and pregnant women ($n = 244$) were excluded. Therefore, the responses of 15,276 teachers were analyzed. Among respondents, 81.7% were women (Table 2); with a mean age of 43.1 (± 9.4 years) and average teaching experience 14.9 (± 9.5 years). Table 2 shows the distribution of the investigated teachers according to

Table 2 Distribution of the study population according to the explanatory variables

Variables	n	%
Sociodemographic characteristics		
Sex		
Male	2788	18.3
Female	12,488	81.7
Age		
21–43 years	8040	52.6
44–77 years	7236	47.4
Schooling		
With post-graduate education	11,558	75.7
Without post-graduate education	3718	24.3
Marital situation and children		
Without partner and without children	2601	17.0
Without partner and with children	2505	16.4
With partner and without children	1578	10.3
With partner and with children	8592	56.3
Characteristics of teaching work		
Working time as a teacher		
Up to 15 years	8785	57.5
16 years or more	6491	42.5
Weekly working hours before the pandemic		
Up to 20 h	4293	28.1
Between 21 and 40 h	9539	62.4
41 h or more	1444	9.5
Number of teaching stages in which they operate		
1 stage	10,280	67.3
2 stages	4729	30.9
3 stages	267	1.8
Another paid activity		
No	10,023	65.6
Yes, other school	3744	24.5
Yes, other activity	1509	9.9
Overload of teaching work during the pandemic		
No	3075	20.1
Yes	12,201	79.9
Number of digital tools used		
Up to 3 tools	6419	42.0
4 or 5 tools	7037	46.1
6 or more tools	1820	11.9
Number of difficulties faced in distance teaching		
None	1322	8.7
Up to 2	6339	41.5
3 or more	7615	49.8
Health situation, habits and behaviors during the pandemic		
Negative changes in quality of life		
No	5038	33.0
Yes	10,238	67.0
Negative changes in health status		
No	8365	54.8
Yes	6911	45.2
Negative changes in sleep quality		
No	8328	54.5

Table 2 (continued)

Variables	n	%
Yes	6948	45,5
Frequent feeling of sadness, depression or anxiety		
No	8392	54.9
Yes	6884	45.1
Use of medications to relax, sleep or against stress/anxiety/depression		
No	10,598	69.4
Yes	4678	30.6
Physical activity		
Stayed active	2936	19.2
Positive changes	2700	17.7
Stayed inactive	5530	36.2
Negative changes	4110	26.9
Increased body weight		
No	6411	42.0
Yes	8865	58.0
Reduction of leisure time		
No	3806	24.9
Yes	11,470	75.1
Increased time watching television		
No	8016	52.5
Yes	7260	47.5
Increased time spent using a computer or tablet		
No	1388	8.8
Yes, within 5 h	7665	50.2
Sim, 6 h or more	6273	41.0
Overload of domestic work		
No	4717	30.9
Yes	10,559	69.1

sociodemographic characteristics, characteristics of the teaching work, health situation, habits and behaviors during the COVID-19 pandemic.

The appearance of back pain (upper, mid, and low) due to changes in usual activities was reported by 57.8% of the participants (Table 3). The prevalence was higher among women, those between 44 and 77 years, teachers with graduate degrees, without a partner and with children (Table 3). Regarding the characteristics of the work, the prevalence was higher among those who had been teaching for the longest time, those with more weekly hours, teachers who worked in more than 1 teaching stage, those who exercised other paid activity in another school, those who indicated an overload of teaching work during the pandemic, teachers who reported using more than 3 digital tools in an attempt to replace face-to-face classes, and teachers who indicated that they had difficulties with distance learning (Table 3).

Regarding health status, habits and behaviors during the pandemic, the prevalence of appearance of back pain was higher among teachers who indicated negative changes in quality of life, health status and sleep quality, and also among teachers who reported frequent feelings of sadness, depression or anxiety and use of medication to relax, sleep or against stress/anxiety/depression (Table 3). In addition, the prevalence of back pain was higher among sedentary teachers, those who increased body weight, reduced leisure time, increased time watching television and time spent on the computer or tablet, and teachers who reported overload of domestic work (Table 3).

Figure 1 shows the prevalence of back pain among teachers who worked in only one teaching level: elementary, middle or high school (n = 10,280). The prevalence of back pain was high at all levels of education, with percentage differences that do not support associating reports and characteristics of activities in each level. The other participating teachers (n = 4996) worked in two or three levels, not being possible to associate reports of back pain to a single level of education.

After launching the adjusted model (Table 4), a higher prevalence of back pain reporting was observed among female teachers (PR: 1.13; CI 95%: 1.09–1.18); those who have been in teaching for the longest time (PR: 1.06; CI

Table 3 Reports of back pain according to the explanatory variables

Variables	Presence of pain		p*
	n	%	
Appearance of back pain	8823	57.8	
Sociodemographic characteristics			
Sex			<0.001
Male	1326	47.6	
Female	7497	60.0	
Age			<0.001
21–43 years	4509	56.1	
44–77 years	4314	59.6	
Schooling			<0.001
With post-graduate education	6811	58.9	
Without post-graduate education	2012	54.1	
Marital situation and children			0.007
Without partner and without children	1425	54.8	
Without partner and with children	1480	59.1	
With partner and without children	918	58.2	
With partner and with children	5000	58.2	
Characteristics of teaching work			
Working time as a teacher			<0.001
Up to 15 years	4826	54.9	
16 years or more	3997	61.6	
Weekly working hours before the pandemic			<0.001
Up to 20 h	2301	53.6	
Between 21 and 40 h	5610	58.8	
41 h or more	912	63.2	
Number of teaching stages in which they operate			0.017
1 stage	5856	57.0	
2 stages	2809	59.4	
3 stages	158	59.2	
Another paid activity			0.076
No	5758	57.4	
Yes, other school	2217	59.2	
Yes, other activity	848	56.2	
Overload of teaching work during the pandemic			<0.001
No	1227	39.9	
Yes	7596	62.3	
Number of digital tools used			<0.001
Up to 3 tools	3572	55.6	
4 or 5 tools	4162	59.1	
6 or more tools	1089	59.8	
Number of difficulties faced in distance teaching			<0.001
None	557	42.1	
Up to 2	3297	52.0	
3 or more	4969	65.2	
Health situation, habits and behaviors during the pandemic			
Negative changes in quality of life			<0.001

Table 3 (continued)

Variables	Presence of pain		p*
	n	%	
No	2227	44.2	
Yes	6596	64.4	
Negative changes in health status			<0.001
No	3762	45.0	
Yes	5061	73.2	
Negative changes in sleep quality			<0.001
No	3832	46.0	
Yes	4991	71.8	
Frequent feeling of sadness, depression or anxiety			<0.001
No	3911	46.6	
Yes	4912	71.4	
Use of medications to relax, sleep or against stress/anxiety/depression			<0.001
No	5436	51.3	
Yes	3387	72.4	
Physical activity			<0.001
Stayed active	1361	46.4	
Positive changes	1403	52.0	
Stayed inactive	3576	64.7	
Negative changes	2483	60.4	
Increased body weight			<0.001
No	3163	49.3	
Yes	5660	63.8	
Reduction of leisure time			<0.001
No	1728	45.4	
Yes	7095	61.9	
Increased time watching television			<0.001
No	4530	56.5	
Yes	4293	59.1	
Increased time spent using a computer or tablet			<0.001
No	554	41.4	
Yes, within 5 h	4016	52.4	
Sim, 6 h or more	4253	67.8	
Overload of domestic work			<0.001
No	2093	44.4	
Yes	6730	63.7	

*Pearson's chi-square test ($p \leq 0.20$)

95%: 1.03–1.09); those who indicated overload of teaching work during the pandemic (PR: 1.23; CI 95%: 1.18–1.29), and teachers who indicated facing up to 2 (PR: 1.10; CI 95%: 1.03–1.17) ou 3 or more (PR: 1.19; CI 95%: 1.12–1.27) difficulties concerning distance teaching.

As for the health situation, habits and behaviors during the pandemic, higher prevalences occurred among teachers who reported negative changes in their health status (PR:
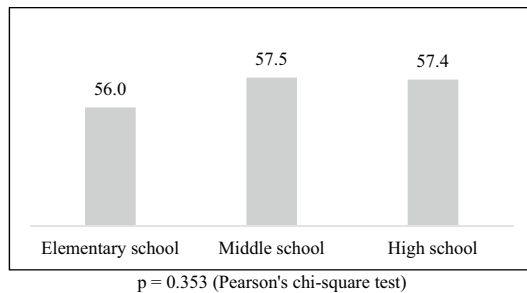
Fig. 1 Prevalence of back pain (%), according to the level of teaching. $p = 0.353$ (Pearson's chi-square test)

1.25; CI 95%: 1.12–1.29) and sleep quality (PR: 1.18; CI 95%: 1.14–1.21); frequent feeling of sadness, depression or anxiety (PR: 1.10; CI 95%: 1.07–1.14); use of medications to relax, sleep, or for stress/anxiety/depression (PR: 1.13; CI 95%: 1.10–1.16); physical inactivity (PR: 1.10; CI 95%: 1.06–1.15) or negative changes in the practice of physical activities (PR: 1.12; CI 95%: 1.07–1.17); increased body weight (PR: 1.10; CI 95%: 1.07–1.13); reduction of leisure time (PR: 1.08; CI 95%: 1.04–1.12); increased time of use of computer or tablet within 5 h (PR: 1.12; CI 95%: 1.05–1.19) or 6 h or more (PR: 1.27; CI 95%: 1.19–1.35) and overload of housework (PR: 1.14; CI 95%: 1.10–1.18).

The average time using a computer or tablet before the pandemic was similar among teachers who reported back pain during the pandemic compared to those without a report of back pain (2.8 ± 2.1 h and 2.8 ± 2.2 h, respectively). This use increased, on average, 4.3 h (± 3.3) among teachers without reports of pain and 5.7 h (± 3.6) among those who presented reports of back pain.

Regarding the changes in domestic work during the pandemic, 69.1% of teachers indicated an increase in the amount and type of work, with a disadvantage for women (Fig. 2).

Discussion

The results indicated a high prevalence of back pain as a consequence of changes in routine activities due to the COVID-19 pandemic among teachers of public basic education in Minas Gerais. The highest prevalence was associated with an increase in the teaching workload and the difficulties faced during distance working. The highest prevalence was also associated with sociodemographic characteristics, adoption of less healthy behaviors, worse physical and emotional health situations. In general, several negative conditions, arising or worsening during the pandemic, were associated with the outcome in a pulverized way (low PR), with no particularly central role of any variable being observed.

The emergence of back pain among teachers during the pandemic period covered by this study had 57.7% of prevalence. For the Brazilian population in general, 27.1% of adults interviewed reported that they started experiencing back pain during the COVID-19 pandemic (Szwarcwald et al. 2021b). Among Italian workers in the administrative sector, 50% reported the worsening of neck pain and 38.1% the worsening of low back pain since they started working remotely with the onset of the pandemic (Moretti et al. 2020).

The female teachers had a higher prevalence of back pain as a consequence of work reconfigurations compared to their usual activities. Studies carried out before the COVID-19 pandemic already showed a higher prevalence of musculoskeletal pain among female teachers (Cardoso et al. 2009; Erick and Smith 2011).

The present study also showed a higher prevalence of back pain among teachers who reported increased domestic work during the pandemic. The social distancing has made people stay longer in their homes, which results in increased demand for household cleaning and maintenance, in addition to having a greater number of meals at home (which previously could be eaten in a restaurant or at work). Added to this is the care for children, who were also under the regime of distance education, and guidelines for cleaning objects and surfaces to prevent infection with the new coronavirus (Araújo and Lua 2021). And, as is known, women assume the greatest responsibility for household chores (Araújo et al. 2019; Araújo and Lua 2021), which could explain the higher prevalence of back pain observed among female teachers.

Among teachers with longer experience in teaching, even after adjusting for age, a higher prevalence of back pain was observed due to work reconfigurations compared to their usual activities. The COVID-19 pandemic did not inaugurate the intensification and precariousness of teaching work but contributed to making these more evident (Pontes and Rostas 2020). For decades, teachers have lived with unfavorable conditions that represent a risk to their health and cause the occurrence of musculoskeletal pain (Araújo et al. 2019; Cardoso et al. 2009).

Teachers who indicated work overload during the pandemic and difficulties concerning distance education had a higher prevalence of back pain due to work reconfigurations compared to their usual activities. This reality required teachers to abruptly adapt to the new teaching format, with an extension of the workday, blurring the line between the time spent carrying out professional activities and that dedicated to personal and family activities (Souza et al. 2021).

Regarding the changes noted by teachers in their health status and quality of sleep, there was a higher prevalence of back pain among those who noticed deteriorations in both situations. These results are consistent with the literature that distinguishes self-rated health as an indicator of the individual's general health, including musculoskeletal aspects (Andrade et al. 2019; Pavão et al. 2013); and it

Table 4 Multiple regression for back pain as a dependent variable

Variables	Unadjusted PR (CI 95%)	Adjusted PR* (CI 95%)	p**
Sex			
Male	1.00	1.00	
Female	1.26 (1.21–1.31)	1.13 (1.09–1.18)	<0.001
Working time as a teacher			
Up to 15 years	1.00	1.00	
16 years or more	1.12 (1.09–1.15)	1.06 (1.03–1.09)	<0.001
Overload of teaching work during the pandemic			
No	1.00	1.00	
Yes	1.56 (1.49–1.63)	1.23 (1.18–1.29)	<0.001
Number of difficulties faced in distance teaching			
None	1.00	1.00	
Up to 2	1.23 (1.15–1.32)	1.10 (1.03–1.17)	0.003
3 or more	1.55 (1.45–1.65)	1.19 (1.12–1.27)	<0.001
Negative changes in health status			
No	1.00	1.00	
Yes	1.63 (1.58–1.67)	1.25 (1.21–1.29)	<0.001
Negative changes in sleep quality			
No	1.00	1.00	
Yes	1.56 (1.52–1.60)	1.18 (1.14–1.21)	<0.001
Frequent feeling of sadness, depression or anxiety			
No	1.00	1.00	
Yes	1.53 (1.49–1.57)	1.10 (1.07–1.14)	<0.001
Use of medications to relax, sleep or against stress/anxiety/depression			
No	1.00	1.00	
Yes	1.41 (1.37–1.45)	1.13 (1.10–1.16)	<0.001
Physical activity			
Stayed active	1.00	1.00	
Positive changes	1.12 (1.06–1.18)	1.02 (0.97–1.08)	0.351
Stayed inactive	1.39 (1.33–1.46)	1.10 (1.06–1.15)	<0.001
Negative changes	1.30 (1.24–1.36)	1.12 (1.07–1.17)	<0.001
Increased body weight			
No	1.00	1.00	
Yes	1.29 (1.26–1.33)	1.10 (1.07–1.13)	<0.001
Reduction of leisure time			
No	1.00	1.00	
Yes	1.36 (1.31–1.41)	1.08 (1.04–1.12)	<0.001
Increased time spent using a computer or tablet			
No	1.00	1.00	
Yes, within 5 h	1.27 (1.18–1.35)	1.12 (1.05–1.19)	<0.001
Sim, 6 h or more	1.64 (1.53–1.75)	1.27 (1.19–1.35)	<0.001
Overload of domestic work			
No	1.00	1.00	
Yes	1.43 (1.39–1.49)	1.14 (1.10–1.18)	<0.001

PR prevalence ratio, *CI* confidence interval

*Age-adjusted; $p \leq 0.05$.

also indicates sleep disorders as a risk factor for chronic musculoskeletal pain (Chun et al. 2018; Mork et al. 2013). A study that investigated factors that affected the self-rated health of Brazilians found an association between the worsening self-rated health and the emergence of back pain during the COVID-19 pandemic (Szwarcwald et al. 2021b).
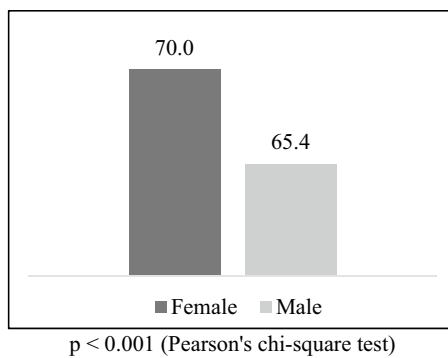
Fig. 2 Increasing of domestic work during the pandemic (%), according to the sex of the teachers. $p < 0.001$ (Pearson's chi-square test)

A higher prevalence of back pain was observed among teachers who indicated a frequent feeling of sadness, depression or anxiety; and among those who—under medical guidance—started taking or increased the dose of medication to relax, sleep or against stress/anxiety/depression during the pandemic. Studies show that social distancing due to the pandemic can have adverse psychological effects, including symptoms of post-traumatic stress, increased anxiety, fear of infection, frustration and loneliness (Barros et al. 2020; Brooks et al. 2020; Smith and Lim 2020). There is evidence of a correlation between musculoskeletal pain, presence and severity of symptoms of depression and anxiety (Hannerz et al. 2020; Heer et al. 2014). This correlation is explained by the reciprocal effect between such morbidities since they share the same pathophysiological pathways (Heer et al. 2014).

Teachers who did not practice physical activity before and continued not practicing during the pandemic registered a higher prevalence of back pain compared to those who maintained the same level of physical activity. Higher prevalence was also registered among schoolteachers who reduced the level of physical activity or interrupted the practice. These results are coherent with other studies, once the effects of physical activity on musculoskeletal health are broadly recognized (Luan et al. 2019).

The prevalence of back pain was higher among teachers who reported increased body weight during the pandemic. Weight gain can result in obesity, and the literature highlights a bidirectional relationship between obesity and complaints of musculoskeletal pain (Gabani et al. 2018; Walsh et al. 2018).

A higher prevalence of back pain emerged among teachers who reported a decrease in leisure time. Leisure activities, in times of face-to-face work, constitute a way to recover from the effects caused by occupational tasks. Reductions of time dedicated to leisure are associated with deleterious health effects, including episodes of musculoskeletal pain (Barbosa et al. 2013). The decrease in leisure

time was expected in times of social distancing due to the COVID-19 pandemic (Smith and Lim 2020).

Distance working unequivocally increased the use of electronic devices by teachers. These devices mediate the access to information and communication technologies used by teachers to deliver their classes and to keep in contact with their students. Thus, teachers increased their workload. The process of familiarization with digital tools, training courses, adaptation of teaching plans and adaptation of pedagogical actions for distance teaching contributed to increasing the teachers' workload (Pontes and Rostas 2020). Among the research participants, a higher prevalence of back pain was observed among those who reported an increase of up to 5 h spent using a computer or tablet. The prevalence was even higher among those who reported an increase of 6 h or higher, compared with those who answered that time dedicated to using the computer or tablet kept the same. It is worth mentioning that this variable registered the highest PR among the variables included in the study.

It is known that musculoskeletal pain etiology is multifactorial. Psychosocial work factors—such as psychological demand, control and social support—have been associated with the occurrence of pain (Erick and Smith 2011) and should be considered in future studies.

This study carries some methodological limitations. The questionnaire did not address the precise location of the back pain (upper, mid or low), its intensity or duration. In addition, different modalities of data collection can lead to different results, despite the coincidence of format and content of the questions. This "mode effect" is produced, among other factors, by the interference of the respondent's judgment on the social acceptance of their response, possibly stronger in a face-to-face situation than via the web (Zhang et al. 2017). In online data collection, the interviewee is less tolerant of a long interview. Futhermore, respondents are more likely to make mistakes and to withdraw or abandon a participation, if we compare an online survey to a face-to-face interview (Rocheleau et al. 2012). Online surveys are also limited due to selection bias. This approach is more attractive to the internet user profile: younger, better educated and more financially advantaged. These individuals probably are part of a group with better health status. However, the over-representation of healthy people might had been balanced by the attraction of less healthy internet users and more vulnerable to harmful lifestyles. An online survey was an opportunity for this group to answer the questionnaire and to declare their perception of health and work relationships (Rocheleau et al. 2012; Zhang et al. 2017).

Despite these limits, an online data collection demanded lower costs and enabled a higher speed in the processing of collected data (Moreira 2021). This modality also allowed access to participants located in remote areas, and it guaranteed social distancing during the pandemic. Additionally,

self-reported information has its relevance broadly recognized (Okura et al. 2004), due to low costs and appropriate operationalization in population samples (Assunção et al. 2019). Health surveys are common methods to support formulation and evaluation of public policies (Panniz et al. 2010). Since the 1970's, several countries have been carrying out periodic surveys through questionnaires on working conditions and health researches—both in national and transnational samples of workers—to identify exposure to occupational risk factors (Assunção et al. 2019).

The present study is cross-sectional and, thus, it is does not allow us to explain the mechanisms underlying the verified associations. However, the presented literature sustained the findings interpretation. The non-probabilistic sample and the volunteer respondent effect (Leening et al. 2014; Thomson et al. 2005) possibly biased the rates obtained by an over-representation of healthy individuals. In general, self-reports are susceptible to recall bias, and imply overestimation of effects or underestimation of exposure. In cross-sectional designs, overcoming such biases is unlikely. Finally, due to the anonymity guaranteed to participants, it was impossible to compare their characteristics to the characteristics of the population of interest.

Conclusion

The results showed a high prevalence of back pain during the COVID-19 pandemic among schoolteachers, which is higher than that observed in the general Brazilian adult population. Among teachers, the emergence of back pain adheres to changes resulting from the adoption of distance education. This modality of teaching increased workload, imposed additional difficulties on teachers' activities and demanded extra hours using electronic devices. In addition to the work-related characteristics, distance education worsened physical and emotional health of teachers, causing a decrease in physical activities and leisure practices. The high prevalence of back pain among schoolteachers delineates a contradiction in terms: on the one hand, distance education allows social distancing that contributes to the preservation of teachers' health by reducing the risk of contamination by COVID-19. On the other hand, it imposes new demands that—in disagreement with working conditions—can threaten the health of these workers.

There are many uncertainties about how this pandemic will evolve. In several countries, we observe attempts of the return to on-site education. Although, new peaks of COVID-19 cases end up creating new setbacks. The trend seems to be the adoption of hybrid systems that will make distance activities occur simultaneously with face-to-face teaching activities, which will result in a demand overlap for teachers. The recent history of epidemics and pandemics is also a sign

that new diseases may occur. The challenge is to reconcile the potential advantages of distance working with the protection of teachers' health, avoiding contamination, and preventing the emergence of occupational diseases. In this context, it is essential for unions and teachers' associations to make efforts to require public policies that guarantee better working conditions, necessary infrastructure and adequate training for teachers to carry out distance education.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. The Ethics Committee of the State University of Montes Claros-Unimontes granted approval (opinion number 4200389).

Consent to participate Informed consent was obtained from all individual participants included in the study.

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