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Consequences of social distancing during the COVID-19 pandemic on the increase in perceived pain of students and professors from higher education institutions: A cross-sectional study

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Abstract.
BACKGROUND: Social distancing was implemented worldwide due to the coronavirus (COVID-19) pandemic. This impacted physical activity levels and increased the time spent in sedentary behaviors which may contributed to the emergence of increased musculoskeletal complaints.
OBJECTIVE: To assess the consequences of social distancing for the increase in perceived pain of students and professors from higher education institutions.
METHODS: One thousand two hundred and fifty-four participants responded to an online survey containing sociodemographic information and questions related to daily habits, physical activity profile, and musculoskeletal pain before and during the pandemic. Levels of concentration, nervousness, productivity, and visual fatigue were also assessed. The primary outcome was presence of perceived pain before and during the pandemic, dichotomized between those with and without increased pain during the pandemic.
RESULTS: Perceived pain increased during the pandemic ($p < 0.001$) and was associated with females ($p = 0.023$; PR = 1.16; 95%CI = 1.02–1.32), income up to one minimum wage ($p = 0.039$; PR = 1.20; 95%CI = 1.01–1.42), no physical activity practice ($p = 0.006$; PR = 1.22; 95%CI = 1.06–1.40), long time in sedentary behavior ($p = 0.013$; PR = 3.07; 95%CI = 1.27–7.43), and electronic device usage for > 6 hours ($p = 0.041$; PR = 1.44; 95%CI = 1.02–2.06). Nervousness ($p = 0.001$) and visual fatigue ($p = 0.001$) increased, whereas concentration ($p = 0.001$) and productivity ($p = 0.001$) reduced during the pandemic.
CONCLUSIONS: Reduced physical activity practice and increased time in sedentary behavior and electronic device usage during the pandemic were associated with increased musculoskeletal pain in students and professors from higher education institutions. Decreased concentration and productivity and increased nervousness and visual fatigue were also observed during the pandemic.

Keywords: Coronavirus, pandemic, COVID-19, education, universities, musculoskeletal pain, cross-sectional survey

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1. Introduction

The novel coronavirus (SARS-CoV-2) causing the COVID-19 disease was first detected at the end of 2019 in Wuhan, China. A pandemic was declared on March 11, 2020, by the World Health Organization [1], and the first case registered in Brazil was observed on February 25, 2020, in São Paulo [2, 3]. Direct or indirect repercussions of the disease were observed on health and will probably impact the population in the long-term [4, 5].

Person-to-person transmission stimulated non-pharmacological preventive measures as the most important preventive resource to cope with the virus [1, 6]. Among these, social distancing was implemented worldwide and effectively reduced the contamination curve [7, 8]. Several establishments (e.g., public places, gyms, businesses, restaurants, schools, colleges, and universities) were temporarily closed or reduced working hours to facilitate implementation and adherence to social distancing [9]. This reduced social interaction and limited physical space, impacting physical activity levels and increasing the time spent in sedentary behaviors, such as using cell phones, computers, and online games [10–12].

In this context, higher education institutions had to continue all activities remotely; some maintained current academic classes, and others performed only extracurricular academic and administrative activities. Thus, telework, which is also considered a home office modality [13], has suddenly been practiced by professors, and students strived to accompany remote activities. These activities may contribute to the emergence of increased screen time, musculoskeletal complaints, fatigue, and other health-related conditions.

Accordingly, this study aimed to assess the consequences of social distancing for the increase in perceived pain of students and professors from higher education institutions. It is hypothesized that students and professors from higher education institutions, who changed work and study routines due to social distancing, would present more physical inactivity and musculoskeletal pain than their usual routine before the COVID-19 pandemic.

2. Methods

This cross-sectional study was approved by the research ethics committee of the local university (number 4.101.008) and conducted following the Declaration of Helsinki. Data were collected between June 25 and September 30, 2020. All volunteers were electronically informed about study objectives and signed the consent form.

E-mails and disclosures on social media were used to recruit professors and students aged >18 years and regularly enrolled in higher education courses throughout the Brazilian territory. Exclusion criterion was the incompleteness of the survey.

The assessment was performed using an online survey developed on Google® Forms platform. Authors LBM and CGS (physiotherapists, doctors, and experts in musculoskeletal physiotherapy) elaborated a survey with 27 questions related to the topic investigated. The first version of this survey was analyzed by a third author (ROC), who suggested some changes. Then, a modified version was sent back to the first and second authors, who adjusted and performed a pilot test with five pre-defined volunteers. The final version of the survey was elaborated after the pilot test and comprised short and self-explanatory objective questions structured in four sub-items: personal data, daily habits, physical activity, and musculoskeletal pain. The survey was sent via e-mail and disclosed on social media.

The online survey was available for participants after accepting to participate in the study. Questions regarding type of institution (private or public), country region, sex, age, profession, family income, type of residence, number of people living in the same residence, COVID-19 symptoms, and previous diagnosis of COVID-19 were included. Items related to daily habits, physical activity, and musculoskeletal complaints were directed to the period before and during social distancing. Daily habits sub-item was composed of questions regarding mean time spent sitting/lying (sedentary behavior) and using electronic devices, social distancing measures, and work/study at home. Physical activity items comprised questions related to practice, level (sedentary or active), and time spent in physical activity. Presence of pain [14], region, and level [15] (the latter using the numerical rating pain scale [0–10]) composed the musculoskeletal pain sub-item. Level of concentration, nervousness, productivity, and visual fatigue was also assessed using a seven-point Likert scale. Primary outcome was perceived pain before and during the pandemic, which was dichotomized between those with and without increased pain during the pandemic.

Sample size was calculated (Open Epi® program version 3.01) using the number of professors

(397,893) and students (6,934,244) registered in Brazilian higher education institutions until 2018, according to the *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP)*. Given an expected frequency of 60%, significance level of 95%, and sampling error of 5%, an optimal number of 1024 participants was estimated. Considering a non-response ratio of 20%, total sample size of 1,229 individuals was obtained.

Statistical analysis was performed using the Statistical Package for the Social Sciences version 20.0 (IBM Corp, USA). Descriptive analysis was performed using mean and standard deviation for continuous variables and absolute and relative frequencies for categorical variables. Associations between increased perceived pain during the pandemic and independent variables were performed using Chi-squared test. Prevalence ratio (PR) and 95% confidence intervals (95%CI) were also calculated in the unadjusted model. Independent variables presenting $p \leq 0.20$ in the Chi-squared test were included in the multivariate regression model. Adjusted PR and 95%CI were obtained using Poisson regression model. Wilcoxon test compared continuous variables before and during social distancing. A significance level of 5% ($\alpha < 0.05$) was adopted.

3. Results

One thousand two hundred and sixty-one individuals accessed the online survey, and 1,254 met inclusion criteria. From these, 76.6% ($n = 961$) were students and 23.4% ($n = 293$) professors. The greatest number of individuals were from Northeast (80.4%), followed by Southeast (10.8%), Midwest (3.8%), South (3.0%), and North regions (2.1%). Musculoskeletal pain increased during the pandemic ($z = 15.112$; $p < 0.001$), with prevalence of 49.7% ($n = 623$) of respondents. Spine (62.78%) was the most painful body region indicated by participants, followed by lower (21.96%) and upper limbs (24.15%). Table 1 shows absolute and relative frequencies for each independent variable analyzed.

Most participants were female (71.1%) aged between 18 and 29 years (62.9%). A prevalence of 8.9% of individuals was infected by the SARS-CoV-2, and most (57.0%) reported no physical activity practice during the pandemic (Table 1).

Associations were observed between increased perceived pain during the pandemic and females ($p = 0.023$; PR = 1.16; 95%CI 1.02–1.32), income up to one minimum wage ($p = 0.039$; PR = 1.20; 95%CI 1.01–1.42), no physical activity practice ($p = 0.006$; PR = 1.22; 95%CI 1.06–1.40), long time spent in sedentary behavior ($p = 0.013$; PR = 3.07; 95%CI

Table 1
Descriptive analysis of participants

Variable	n (%)
Sex	
Male	362 (28.9)
Female	892 (71.1)
Age	
18 to 29 years	789 (62.9)
30 to 39 years	286 (22.8)
Over 39 years	179 (14.3)
Occupation	
Student	961 (76.6)
Professor	293 (23.4)
Institution	
Public	799 (63.7)
Private	455 (36.3)
Income	
Over R$ 5.196	448 (35.7)
Between R$ 3.118 – 5.195	230 (18.3)
Between R$ 1.040 – 3.117	424 (33.8)
Up to R$ 1.039	152 (12.1)
Obeyed quarantine	
Yes	837 (66.7)
No	417 (33.3)
COVID-19 diagnosis	
Yes	111 (8.9)
No	1143 (91.1)
Physical activity level	
Active	279 (22.2)
Sedentary	975 (77.8)
Physical activity before the pandemic	
Yes	873 (69.6)
No	381 (30.4)
Physical activity during the pandemic	
Yes	539 (43.0)
No	715 (57.0)
Sedentary behavior before the pandemic	
Less than 1 hour	121 (9.6)
Between 1 – 3 hours	338 (27.0
Between > 3 – ≤ 6 hours	442 (35.2)
Between > 6 – < 9 hours	284 (22.6)
Over 10 hours	69 (5.5)
Sedentary behavior during the pandemic	
Less than 1 hour	26 (2.1)
Between 1 – 3 hours	103 (8.2)
Between > 3 – ≤ 6 hours	263 (21.0)
Between > 6 – < 9 hours	394 (31.4)
Over 10 hours	468 (37.3)
Electronic device usage before the pandemic	
Up to 3 hours	401 (32.0)
Between > 3 – 6 hours	510 (40.7)
Over 6 hours	343 (27.4)
Electronic device usage during the pandemic	
Up to 3 hours	68 (5.4)
Between > 3 – 6 hours	237 (18.9)
Over 6 hours	949 (75.7)

Table 2
Multiple analysis between "increased perceived pain during the pandemic" and independent variables of the study

	Increased perceived pain during the pandemic		Unadjusted		Adjusted	
	No n (%)	Yes n (%)	*p*-value	PR (95CI%)	*p*-value	PR (95CI%)
Sex						
Male	199 (55.0)	163 (45.0)		1		1
Female	432 (48.4)	460 (51.6)	0.042	1.14 (1.01–1.30)	0.023	1.16 (1.02–1.32)
Age						
18 to 29 years	397 (50.3)	392 (49.7)		1	–	–
30 to 39 years	148 (51.7)	138 (48.3)	0.680	0.97 (0.84–1.17)	–	–
Over 39 years	86 (48.0)	93 (52.0)	0.578	1.05 (0.89–1.22)	–	–
Occupation						
Student	486 (50.6)	475 (49.4)		1	–	–
Professor	145 (49.5)	148 (50.5)	0.744	1.02 (0.90–1.16)	–	–
Income						
Over R$ 5.196	238 (53.1)	46.9 (210)		1		1
Between R$ 3.118 – 5.195	115 (50.0)	115 (50.0)	0.437	1.07 (0.91–1.25)	0.371	1.07 (0.92–1.26)
Between R$ 1.040 – 3.117	212 (50.0)	212 (50.0)	0.356	1.07 (0.93–1.22)	0.486	1.05 (0.92–1.20)
Up to R$ 1.039	66 (43.4)	86 (56.6)	0.031	1.21 (1.02–1.43	0.039	1.20 (1.01–1.42)
Obeyed quarantine						
Yes	415 (49.6)	422 (50.4)		1	–	–
No	216 (51.8)	201 (48.2)	0.463	0.96 (0.85–1.08)	–	–
COVID-19 diagnosis						
Yes	58 (52.3)	53 (47.7)		1	–	–
No	573 (50.1)	570 (49.9)	0.675	0.96 (0.78–1.17)	–	–
Physical activity level						
Active	172 (61.6)	107 (38.4)		1		1
Sedentary	459 (47.1)	516 (52.9)	<0.001	1.38 (1.18–1.62)	0.073	1.19 (0.98–1.44)
Physical activity before the pandemic						
Yes	412 (47.2)	461(52.8)		1		1
No	219 (57.5)	162 (42.5)	0.001	0.80 (0.70–0.92)	<0.001	0.74 (0.65–0.84)
Physical activity during the pandemic						
Yes	311 (57.7)	228 (42.3)		1		1
No	320 (44.8)	395 (55.2)	<0.001	1.31 (1.16–1.47)	0.006	1.22 (1.06–1.40)
Sedentary behavior before the pandemic						
Less than 1 hour	58 (47.9)	63 (52.1)		1	–	–
Between 1 – 3 hours	173 (51.2)	165 (48.8)	0.534	0.94 (0.76–1.15)	–	–
Between > 3 – ≤ 6 hours	221 (50.0)	221 (50.0)	0.684	0.96 (0.79–1.17)	–	–
Between > 6 – < 9 hours	144 (50.7)	140 (49.3)	0.606	0.95 (0.77–1.16)	–	–
Over 10 hours	35 (50.7)	34 (49.3)	0.714	0.95 (0.70–1.27)	–	–
Sedentary behavior during the pandemic						
Less than 1 hour	22 (84.6)	4 (15.4)		1		1
Between 1 – 3 hours	63 (61.2)	40 (38.8)	0.052	2.52 (0.99–6.42)	0.056	2.41 (0.98–5.93)
Between > 3 – ≤ 6 hours	143 (54.4)	120(45.6)	0.019	2.97 (1.19–7.38)	0.033	2.61 (1.08–6.30)
Between > 6 – < 9 hours	198 (50.3)	196(49.7)	0.011	3.23 (1.30–8.01)	0.028	2.68 (1.11–6.49)
Over 10 hours	205 (43.8)	263 (56.2)	0.005	3.65 (1.48–9.03)	0.013	3.07 (1.27–7.43)
Electronic device usage before the pandemic						
Up to 3 hours	195 (48.6)	206 (51.4)		1		1
Between > 3 – 6 hours	248 (48.6)	262 (51.4)	1.00	1.00 (0.88–1.14)	0.090	0.89 (0.78–1.02)
Over 6 hours	188 (54.8)	155 (45.2)	0.095	0.88 (0.76–1.02)	<0.001	0.75 (0.65–0.88)
Electronic device usage during the pandemic						
Up to 3 hours	45 (66.2)	23 (33.8)		1		1
Between > 3 – 6 hours	139 (58.6)	98 (41.4)	0.281	1.22 (0.85–1.76)	0.406	1.16 (0.81–1.67)
Over 6 hours	447 (47.1)	502 (52.9)	0.010	1.56 (1.11–2.19)	0.041	1.44 (1.02–2.06)

PR: Prevalence Ratio; CI: Confidence Interval.

1.27–7.43), and electronic device usage for > 6 hours ($p = 0.041$; PR = 1.44; 95%CI 1.02– 2.06) (Table 2).

The amount of physical activity ($z = 17.186$; $p < 0.05$), concentration ($z = 21.653$; $p < 0.05$), and productivity ($z = 22.367$; $p < 0.05$) were reduced, whereas nervousness ($z = 14.958$; $p < 0.05$) and visual fatigue ($z = 16.302$; $p < 0.05$) increased during the pandemic (Table 3).

Table 3
Comparison of variables before and during COVID-19 pandemic

Variable	n	Before the pandemic mean	Before the pandemic SD	During the pandemic mean	During the pandemic SD	Z-score	*p*-value
Physical activity practice (min/week)	1254	155.03	166.28	76.43	108.14	17.186	0.001
Level of nervousness (1 to 7)	1254	3.64	1.55	4.66	1.76	14.958	0.001
Level of visual fatigue (1 to 7)	1254	3.75	1.80	5.11	1.90	16.302	0.001
Concentration difficulty (1 to 7)	1254	3.18	1.66	5.12	1.83	21.653	0.001
Commitment to productivity (1 to 7)	1254	2.80	1.64	4.90	1.87	22.367	0.001

4. Discussion

The present study investigated the consequences of social distancing on the increase in perceived pain of students and professors from higher education institutions. Increased musculoskeletal pain was associated with females, low family income, reduced physical activity practice, and greater time spent in sedentary behavior and using electronic devices. The pandemic also affected productivity, concentration, visual fatigue, nervousness, and time spent practicing physical activity.

The need to implement non-pharmacological interventions to suppress COVID-19 transmission [7] may have impacted physical and mental health of the population [16, 17]. Increased musculoskeletal pain is common in studies investigating the effects of social distancing and isolation [18, 19], and pain may be attributed to incorrect and sustained postures during electronic device usage since this behavior was intensified in the pandemic during work, study, or leisure activities [16]. Home environment was probably not ergonomically adequate to allow work and study for several hours, increasing musculoskeletal complaints, especially in the spine [20]. Although pain in the spine was the greatest complaint, it was not associated with seated posture [21, 22]. This condition, especially chronic, is multifactorial and may be influenced by physical, environmental, and psychosocial factors, which have been strongly affected in this pandemic [23, 24].

Simultaneously, the effects of social restriction also reduced physical activity practice [25–27]. This was probably related to the temporary closing of gyms and sports centers and restricted use of community environments for physical practice. In a multicenter study, Ammar et al. [26] observed a reduced number of physical activity practice, corroborating with findings of the present study since weekly physical activity practice decreased from 155 to 76 minutes. These values are below recommended by the WHO [28] and the American College of Sports Medicine [29] and are associated with increased risk of cardiovascular disease and diabetes mellitus [30].

Participants also increased the time spent in sedentary behavior (i.e., 68.7% of individuals remained seated/lying down for > 6 hours daily), which agrees with Ammar et al. [26], who found a 28.6% increase in sitting time during the pandemic. Studies show that sitting time greater than 6–8 h/day increases mortality risk for several diseases [31], while 3–6 hours of continuous sitting is sufficient to deteriorate vascular function [32].

Inactivity and sedentary behavior are considered risk factors for several diseases, such as cardiovascular [33–35], cancer, diabetes [36, 37], metabolic syndrome [38], depression, and anxiety. For this reason, two pandemics are probably taking place: coronavirus and inactivity; the latter probably persisting after the end of the COVID-19 pandemic, leading to health and economic consequences [39]. Also, reduced time spent in physical activity and increased time in sedentary behavior are associated with increased musculoskeletal pain. A study conducted by Steffandottir and Gudmundsdottir [40] revealed that individuals with extended periods of sedentary behavior are more likely to develop musculoskeletal pain. In a prospective study, Nilsen et al. [41] observed that weekly physical activity was inversely associated with risk of chronic low back and neck/shoulder pain, especially if performed for at least 1 hour per week.

Musculoskeletal pain was greater in females, corroborating with findings of other studies [42–44]. Restrictive measures implemented to mitigate the risk of infection may expose females to a “double or triple shift” (i.e., dividing themselves between children, domestic chores, and work) and lead to greater exposure to risk factors, such as movement repetition, increased physical load, non-ergonomic postures, and short physical recovery time. Moreover, anatomo-physiological characteristics (e.g., short stature, high body mass index, different musculoskeletal composition, and joint fragility) may cause mental and physical overload and increase pain [45–48].

Musculoskeletal pain was also high in individuals with low family income. High socioeconomic levels are associated with better lifestyle habits, emotional stability, and greater access to healthy habits, reducing pain. Another hypothesis would be related to exposure to precarious and unhealthy work environments, increasing the risk of developing body pain [46, 47].

Severe mental health problems, high prevalence of anxiety, depressive symptoms, and poor sleep quality were also observed during the COVID-19 pandemic, probably due to the constant concern of becoming infected [49].

Changes in study and work routines brought new challenges to professors and students. Majumdar et al. [16] conducted an online survey to investigate the impact of lockdown on mental and physical health, depressive status, sleep quality, somatic complaints, and digital use in individuals from the corporate sector and university undergraduate or post-graduate students. They found sleep disturbance and depressive symptoms were present during the lockdown. Although home office may lead to several benefits to the worker (e.g., flexible working hours, increased productivity, creation of own rules, and family environment) [50–52], changes during the pandemic occurred quickly and without prior planning or training. Thus, students and professors had to completely change behaviors, despite feelings of fear, insecurity, and concern.

Aspects related to interconnection between work and family domains, logistics to separate personal and professional schedules [53], and inadequate environment [20] may impair health while working and studying at home. Kaushik and Guleria [52] emphasized that unpredictable interruptions, detachment from colleagues and bosses, lack of community feeling and attachment to the company, reduced productivity, and need for commitment, dedication, and self-motivation were negative aspects of home office. Furthermore, increased visual fatigue caused by extensive exposure to screens may lead to digital eye strain [54]. Therefore, participants of this study presented reduced productivity, increased nervousness, and difficulty concentrating.

Strengths of the study are related to the fact that it was conducted in a period of social distancing measures, facilitating the analysis of factors generating musculoskeletal complaints during extended sedentary activity. Despite this, it is prudent to analyze some limitations, including the cross-sectional design that did not infer reverse causality. However, it is challenging to conduct longitudinal studies due to the COVID-19 pandemic. Memory bias can also be pointed out since some variables were analyzed retrospectively. Nevertheless, this was minimized because questions were related to short-term memory and an unusual condition. Results should also not be extrapolated to other populations since data was restricted to young university students and professors. We recommend future studies with different populations and analysis of specific pain regions to better characterize the complaints generated during the pandemic.

5. Conclusions

Musculoskeletal pain increased significantly during social distancing, mainly in individuals with low income and females. This condition was associated with reduced physical activity practice, increased sedentary behavior, and greater use of electronic devices. Moreover, restrictive measures reduced concentration and productivity and increased nervousness and visual fatigue of professors and students from higher education institutions.

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Conflict of interest

None to report.

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