Mental stress and musculoskeletal symptoms in physical therapy students during the COVID-19 pandemic

Estresse mental e sintomas osteomusculares em acadêmicos de fisioterapia durante a pandemia de COVID-19

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Abstract

Introduction: The shift to remote learning during the COVID-19 pandemic changed the lives of students and affected their physical and mental health. There is no clear consensus regarding the relationship between mental stress and musculoskeletal symptoms in physical therapy students. **Objective:** To investigate the correlation between mental stress and musculoskeletal symptoms in physical therapy students in Brazil during the COVID-19 pandemic. **Methods:** This was an analytical cross-sectional study conducted virtually with 116 undergraduate physical therapy students from various regions of Brazil who were engaged in remote academic activities. A sociodemographic and academic profile questionnaire, the Nordic Musculoskeletal Questionnaire (NMQ), and Perceived Stress Scale (PSS-10) were applied. Pearson's correlation was used to assess the relationship between the number of body regions with musculoskeletal symptoms and perceived stress. **Results:** Most participants were females (83.6%), with a mean age of 23.17 ± 5.37 years. Nearly all the students (94.0%) reported musculoskeletal symptoms in at least one body region, the most affected areas being the neck (69.0%), upper back (62.1%), and shoulders (59.9%). On the NMQ, participants reported a mean of 3.99 ± 2.23 body regions with musculoskeletal symptoms, and 24.47 ± 6.79 on the PSS-10. There was a weak positive correlation between the number of musculoskeletal symptoms and stress ($r = 0.35$; $p < 0.001$). **Conclusion:** There was a high prevalence of musculoskeletal symptoms in physical therapy students during the COVID-19 pandemic and a relationship was observed between the number of musculoskeletal symptoms and mental stress.

Keywords: Students. COVID-19. Musculoskeletal pain. Mental health.

Resumo

Introdução: *A migração para o regime remoto devido à pandemia da COVID-19 trouxe modificações na vida dos estudantes, afetando sua saúde física e mental. Não há consenso sobre a relação entre o estresse mental e os sintomas osteomusculares em estudantes de fisioterapia.* ***Objetivo:*** *Correlacionar o estresse mental com os sintomas osteomusculares em acadêmicos de fisioterapia do Brasil durante a pandemia de COVID-19.* ***Métodos:*** *Trata-se de um estudo transversal analítico, realizado em ambiente virtual com 116 graduandos em fisioterapia, de qualquer região do Brasil, em atividades acadêmicas remotas. Aplicou-se questionário de perfil sociodemográfico e acadêmico, o Questionário Nórdico de Sintomas Osteomusculares (QNSO) e a Escala de Estresse Percebido (PSS-10). A correlação de Pearson foi aplicada a fim de avaliar a relação entre o número de regiões corporais com sintomas osteomusculares com o estresse percebido.* ***Resultados:*** *A maioria dos estudantes era do sexo feminino (83,6%), com média de idade de 23,17 ± 5,37 anos. Quase todos (94,0%) referiram sintomas osteomusculares em pelo menos uma região do corpo e os locais mais acometidos foram pescoço (69,0%), parte superior das costas (62,1%) e ombros (59,9%). Os acadêmicos apresentaram uma pontuação média de 3,99 ± 2,23 regiões corporais com sintomas osteomusculares no QNSO, e de 24,47 ± 6,79 na PSS-10. Houve fraca correlação positiva entre o número de sintomas osteomusculares e o estresse (r = 0,35; p < 0,001).* ***Conclusão:*** *Houve alta prevalência de sintomas osteomusculares nos estudantes de fisioterapia durante a pandemia de COVID-19 e foi encontrada relação entre o número de sintomas osteomusculares e o estresse mental.*

Palavras-chave: *Estudantes. COVID-19. Dor musculoesquelética. Saúde mental.*

Introduction

In December 2019, the first cases of coronavirus disease 2019 (COVID-19) were detected in Wuhan, China. Caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the disease spread rapidly and reached pandemic proportions.[1] In March 2020, the Brazilian Ministry of Health declared community transmission of COVID-19 in the country.[2] Several measures were implemented to reduce contact with the virus and prevent its spread, including the use of face masks, handwashing, suspension of nonessential activities,[1,3,4] and social distancing and isolation, which, over extended periods, can be detrimental to both physical and mental well-being.[5]

The suspension of in-person teaching activities during the pandemic prompted a shift to remote learning,[6,7] transitioning from face-to-face classes to online platforms using digital information and communication technologies.[6] This led to a lifestyle change for some students, increasing the prevalence of musculoskeletal symptoms during the pandemic.[8] Musculoskeletal symptoms are described as feelings of pain, heaviness, shock, numbness, and fatigue.[9] These conditions may be related to negative self-rated health,[10] can interfere with learning, and prevent physical therapy students from performing practical academic activities.[11] A study conducted in Poland during the COVID-19 pandemic identified an increase in cervical pain among physical therapy students, associated with low physical activity levels.[12]

The social isolation caused by the pandemic also affected students' mental health, increasing levels of stress,[13,14] anxiety, panic, and anger.[13] Stress is a physiological response to difficult situations and may manifest in physical and/or psychological symptoms.[15] Research carried out during the pandemic with students at a Brazilian university, including those in the physical therapy course, found that stress was a common problem in this population.[16]

Few studies have explored the relationship between stress and the emergence of musculoskeletal symptoms.[16,17] A study conducted with health sciences students before the pandemic indicated an association between perceived stress levels and reports of musculoskeletal pain. Among physical therapy students, this relationship was statistically significant specifically in relation to lower limb symptoms.[17] This can be explained by the fact that any pain stimulus can trigger the sympathetic nervous system and hypothalamic-pituitary-adrenal axis, which regulate the stress response.[18]

Conversely, a study carried out with university students during the pandemic, including those in the physical therapy program, found no relationship between perceived stress and musculoskeletal symptoms.[16] Thus, there is no consensus regarding this relationship and no studies were found that focused exclusively on physical therapy students and reflected the specific context of Brazil during the pandemic.

In light of the above, further research is needed to better understand the topic and enable higher education institutions to implement preventive measures and health promotion initiatives aimed at reducing the impact of social isolation on these students and supporting improved academic performance. Therefore, the objective of this study was to investigate the correlation between mental stress and musculoskeletal symptoms in physical therapy students in Brazil during the COVID-19 pandemic.

Methods

This was an analytical cross-sectional study with students from any region of Brazil, enrolled in a physical therapy undergraduate program. The study was approved by the Research Ethics Committee of the Pontifical Catholic University of Goiás (CAAE 47117221.8.0000.0 037).

Sample

The sample consisted of undergraduate physical therapy students. Inclusion criteria were age 18 years or older, attendance at any type of higher education institution (public or private), and participation in exclusively remote academic activities. Students pursuing another undergraduate degree concurrently or enrolled in graduate specialization programs were excluded.

The effect size (f2) was calculated using G.Power® software, version 3.1. This a posteriori calculation was based on the Pearson correlation coefficient obtained between the total score on the Perceived Stress Scale (PSS-10) and total number of regions with musculoskeletal symptoms reported in the Nordic Musculoskeletal Questionnaire (NMQ). A significance level of 0.05, 95% confidence interval, and statistical power of 0.95 were adopted, resulting in a minimum estimated sample size of 102 students.

Instruments

The instruments used for data collection were a sociodemographic and academic profile questionnaire, the NMQ, and PSS-10. The sociodemographic and academic profile questionnaire, developed by the researchers, addressed socioeconomic aspects, lifestyle habits, and academic routine. The NMQ is a standardized screening tool used in occupational health and ergonomics to assess musculoskeletal symptoms. The questions address symptoms most commonly found in occupational settings and may be self-administered or conducted through interviews.[19]

Participants respond to binary-choice items, indicating "yes" if they have experienced pain or discomfort in any of the nine most common anatomical regions of the body, and "no" when no symptoms were present in the region assessed.[20] To ensure a better understanding of the anatomical regions, the questionnaire includes a posterior view of the human body divided into nine areas (neck, shoulders, upper and lower back, elbows, wrists/hands, hips/thighs, knees, and ankles/feet).[19] Interviewees report the occurrence of symptoms over the past 12 months and in the seven days prior to data collection. They are also asked whether the symptoms led to time away from routine activities in the past year or prompted them to seek healthcare services.

The NMQ is translated[21] and validated in Portuguese. The data are reported as the frequency of "yes" responses for each of the anatomical regions and can also be analyzed based on the total number of regions with musculoskeletal symptoms (ranging from zero to nine).[22]

The PSS-10 is used to assess perceived stress and how individuals view stressful situations and evaluate their lives as overloaded, unpredictable, and uncontrollable over the past month. It originally contained 14 items (PSS-14),[23] but the 10-item version validated for use in Brazil[24] was applied in the present study. The scale includes six negative (1,2,3,6,9,10) and four positive items (4,5,7,8), each rated on a five-point Likert scale (0 = never to 4 = very often), with respondents instructed to answer based on their experiences during the previous month.[23,25] The total score ranges from 0 to 40 and is calculated by reversing the scores for the four positive items and then summing all the items.[25]

Procedures

Data were collected virtually from June to December 2021. The instruments were distributed via an online form using the snowball sampling method, whereby key groups or individuals selected as the original study participants (seeds) help recruit future participants via a referral chain.[26] The study objectives were presented to the original group, whose data were recorded, and the seeds were then asked to recommend potentially eligible groups from the same target population[27] or to share the link containing the data collection materials.

The instruments were distributed through social media platforms such as Instagram, Facebook and Whats App. The selected seeds included profiles of student athletic associations, academic centers, and physical therapy student societies, as well as WhatsApp and groups frequented by this population.

An informed consent form, which aimed to provide information about the study, such as possible risks and benefits, accompanied the instruments and was available for download. Students who declined to participate were redirected to a thank-you page.

Those who agreed to take part selected the appropriate option indicating consent and were directed to the questionnaire pages. The final page of the survey, available to participants on completion, included a message of appreciation and a request to share the link provided. The researcher's contact information was provided on both the consent form and the final page of the questionnaire for participants to ask questions or follow up on the study results. The data collection form was distributed via the Google Forms platform, and the estimated completion time was approximately ten minutes.

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26, at a significance level of 5% ($p < 0.05$). The sociodemographic and academic profile were characterized using descriptive statistics: mean, standard deviation, minimum and maximum for continuous variables; and absolute and relative frequencies for categorical variables.

Stress levels among physical therapy students were described using the mean and standard deviation, along with the relative frequency of each item on the PSS-10 according to the response categories (never, almost never, sometimes, fairly often, very often).

Musculoskeletal symptoms were reported as absolute and relative frequencies for each of the nine anatomical regions on the NMQ in which participants answered "yes". Additionally, the mean and standard deviation of the number of body regions with musculoskeletal symptoms in the past 12 months were calculated using a numerical interpretation based on the sum of the anatomical regions in which participants reported symptoms (i.e., answered "yes"), ranging from zero to nine.[22]

The decision to use parametric or nonparametric tests was made following application of Kolmogorov-Smirnov test. Pearson's correlation was used to assess the relationship between the total PSS-10 score and total number of anatomical regions with musculoskeletal symptoms (i.e., "yes" responses on the NMQ) over the past 12 months.

Results

The sample consisted of 116 undergraduate physical therapy students, including 97 women (83.6%) and 19 men (16.4%), with a minimum age of 18 years, maximum of 58, and mean age of 23.17 ± 5.37 years. A higher proportion of students were single (91.4%), in social isolation (73.3%), not working (77.6%), not engaging in physical activity (50.9%), and not diagnosed with an orthopedic disorder (81.9%) (Table 1).

Table 1 - Sociodemographic characteristics of the students (n = 116)

Characteristics	n (%)
Marital and parental status	
Married/Living with partner	10 (8.6)
Single	106 (91.4)
Have children	6 (5.2)
Education	
Holds a second degree	10 (8.6)
Holds a postgraduate specialization	6 (5.2)
Living arrangement	
Friend/Roommate	4 (3.4)
Family	98 (84.5)
Partner	6 (5.2)
Alone	8 (6.9)
Region	
Central-West	28 (24.1)
Northeast	22 (19.0)
North	5 (4.3)
Southeast	59 (50.9)
South	2 (1.7)
Situation	
Isolation	85 (73.3)
Currently employed	26 (22.4)

Table 1 - Sociodemographic characteristics of the students (n = 116) (continued)

Characteristics	n (%)
Type of transport	
Private	55 (47.4)
Public	61 (52.6)
Fear of COVID-19	
Extremely	41 (35.3)
Very much	16 (13.8)
Somewhat	46 (39.7)
Very little	10 (8.6)
None	3 (2.6)
Sleep duration (hours)	
≤ 5	18 (15.5)
6 to 7	60 (51.7)
≥ 8	38 (32.8)
Sleep quality	
Good	55 (47.4)
Very good	5 (4.3)
Very bad	9 (7.8)
Neither good nor poor	32 (27.6)
Poor	15 (12.9)
Engaging in physical activity	57 (49.1)
Orthopedic disorder diagnosis	21 (18.1)

There was a higher prevalence of students enrolled at public institutions (56.9%), those who used a cell phone and/or computer as their primary study device (76.7%), and who remained seated during classes (79.3%) and study sessions (93.1%) (Table 2).

The mean number of body regions with musculoskeletal symptoms in the past 12 months was 3.99 ± 2.23. Symptoms in at least one region were reported by 94.0% of students. The most frequently affected regions in the past 12 months were the neck (69.0%), upper back (62.1%), and shoulders (59.9%). The lower back (16.4%) and neck (14.7%) were the regions that most frequently prevented participants from performing normal activities due to symptoms, and the lower back was cited most often (12.1%) as the region that prompted students to seek health care due to musculoskeletal problems. Over the past seven days, symptoms were most prevalent in the neck (44.0%) and lower back (31.0%) (Table 3).

Table 2 - Academic profile of the students (n = 116)

Characteristics	n (%)
Type of institution	
Private	50 (43.1)
Public	66 (56.9)
Scholarship	
No	72 (62.1)
Yes	44 (37.9)
Semester in the program	
1st to 3rd	27 (23.3)
4th to 6th	30 (25.9)
7th to 10th	59 (50.9)
Type of course content	
Practical	21 (18.1)
Theoretical	56 (48.3)
Theoretical/practical	39 (33.6)
Devices used for study	
Cell phone	7 (6.0)
Cell phone/Computer	89 (76.7)
Cell phone/Computer/Others	9 (7.8)
Computer	11 (9.5)
Academic performance	
Below average	2 (1.7)
Average	51 (44.0)
Above average	63 (54.3)
Posture during class	
Lying down	3 (2.6)
Standing	21 (18.1)
Sitting	92 (79.3)
Class duration (hours)	
1-2	7 (6.0)
2-3	24 (20.7)
3-4	31 (26.7)
More than 4	54 (46.6)
Posture during study	
Lying down	5 (4.3)
Standing	3 (2.6)
Sitting	108 (93.1)
Daily study time (hours)	
1-2	49 (42.2)
2-3	32 (27.6)
3-4	12 (10.3)
More than 4	23 (19.8)

Table 3 - Distribution of musculoskeletal symptoms among physical therapy students (n = 116) – n (%)

Body region	Symptoms in the past 12 months	Activity limitation in the past 12 months	Sought health care	Symptoms in the past 7 days
Neck	80 (69.0)	17 (14.7)	9 (7.8)	51 (44.0)
Shoulders	69 (59.5)	12 (10.3)	11 (9.5)	33 (28.4)
Upper back	72 (62.1)	11 (9.5)	10 (8.6)	33 (28.4)
Elbows	13 (11.2)	1 (0.9)	1 (0.9)	7 (6.0)
Wrists/Hands	54 (46.6)	16 (13.8)	3 (2.6)	27 (23.3)
Lower back	65 (56.0)	19 (16.4)	14 (12.1)	36 (31.0)
Hips/Thighs	28 (24.1)	7 (6.0)	5 (4.3)	9 (7.8)
Knees	50 (43.1)	15 (12.9)	8 (6.9)	23 (19.8)
Ankles/Feet	32 (27.6)	12 (10.3)	7 (6.0)	16 (13.8)
Overall prevalence	109 (94.0)	49 (42.2)	37 (31.9)	86 (74.1)

The mean score on the PSS-10 was 24.47 ± 6.79, and the item with the highest mean score (3.05 ± 1.14), indicating the highest level of stress, referred to the frequency of feeling nervous or stressed. The largest number of responses of "sometimes" and "very often" were for items related to participants feeling upset because of an unexpected event, being unable to control important things in their life, feeling nervous or stressed, being unable to cope with all the things they had to do, being angered by things outside their control, and feeling that problems had piled up to the point of being unmanageable. On the other hand, items regarding confidence dealing with personal problems, feeling that things were going as expected, being able to control irritations in life, and feeling on top of things were more frequently marked as "sometimes" (Table 4).

There was a statistically significant but weak positive correlation between the number of body regions with musculoskeletal symptoms and the total PSS-10 score ($r = 0.35$, $p < 0.001$) (Figure 1).

Table 4 - Distribution of perceived stress responses among physical therapy students (n =116)

Question	Never	Almost never	Sometimes	Fairly often	Very often
	0	1	2	3	4
1. How often have you been upset because something unexpected happened?	0.9	11.2	38.8	11.2	37.9
2. How often have you felt unable to control important things in your life?	2.6	8.6	33.6	13.8	41.4
3. How often have you felt nervous or stressed?	2.6	7.8	23.3	14.7	51.7
4. How often have you felt confident about your ability to handle personal problems?	4.3	13.8	47.4	19.0	15.5
5. How often have you felt that things were going your way?	4.3	18.1	41.4	25.9	10.3
6. How often have you felt that you could not cope with all the things you had to do?	2.6	7.8	34.5	11.2	44.0
7. How often have you been able to control irritations in your life?	4.3	12.9	42.2	24.1	16.4
8. How often have you felt that you were on top of things?	12.1	31.0	37.9	12.1	6.9
9. How often have you been angered because of things that were outside your control?	2.6	11.2	28.4	20.7	37.1
10. How often have you felt that problems were piling up to the point of being unmanageable?	3.4	12.1	28.4	19.0	37.1

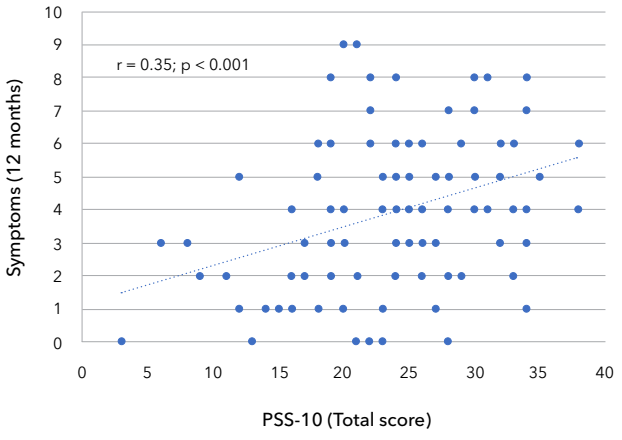

Figure 1 - Correlation between the number of body regions with musculoskeletal symptoms in the past 12 months and the total score on the Perceived Stress Scale (PSS-10).

There was a statistically significant positive but weak correlation between the number of musculoskeletal symptoms in the past 12 months and the PSS-10 score for the questions about feeling upset because something unexpected happened ($r = 0.23$; $p = 0.010$), being unable to control important things in life ($r = 0.28$; $p < 0.001$), feeling nervous or stressed ($r = 0.24$; $p = 0.010$), feeling confident about handling personal problems ($r = 0.20$; $p = 0.030$), being unable to cope with everything that needed to be done ($r = 0.26$; $p < 0.001$), feeling on top of things ($r = 0.20$; $p = 0.030$), feeling angered by things that could not be controlled ($r = 0.22$; $p = 0.020$), and feeling that things had piled up to the point of being unmanageable ($r = 0.27$; $p < 0.001$).

Discussion

The presence of musculoskeletal symptoms in at least one body region in the past 12 months was reported by 94% of participants, slightly higher than the reported percentage (90.5%) among 116 students, including those in the physical therapy program, at a Brazilian university during the pandemic.[16] A lower percentage was found in a pre-pandemic study conducted with physical therapy students in Croatia, where the prevalence of pain was 86.8%.[11]

The present study identified a weak correlation between the number of regions with musculoskeletal symptoms and perceived stress. The mean number of affected regions in the past 12 months was 3.99 ± 2.23, the most affected being the neck (69.0%), upper back (62.1%), shoulders (59.9%) and lower back (56.0%). During the pandemic, other researchers also reported high percentages for the lower (61.2%) and upper back (61.2%).[16] Another study conducted with physical therapy students in Poland, using the Oswestry Disability Index and Neck Disability Index (NDI) to evaluate spinal pain, also found a high prevalence of neck pain.[12]

In the present study, the neck (44.0%), lower (31.0%) and upper back (28.4%) were the most frequently cited regions with musculoskeletal symptoms in the past seven days. Higher percentages in the last two regions were also reported in another pandemic-era study, with 35.3% and 34.5%, respectively.[16]

The presence of musculoskeletal symptoms may be due to changes in students' daily routine during the pandemic, particularly the shift to remote activities.[6,7] This resulted in extended periods spent on electronic devices used for both leisure and academic purposes,[7,28] sitting for prolonged periods, use of non-ergonomic seating and workstations,[7,29,30] and reduced levels of physical activity,[7,31] which are predisposing factors for the development of musculoskeletal symptoms.[7,29,30]

The high prevalence of neck pain may be related to the substantial increase in electronic device use during the COVID-19 pandemic. A study carried out in Palestine found that pain intensity increased with length of use.[28] Additionally, forward head posture and neck flexion while using these devices are contributing factors to pain,[12,28] since neck flexion causes muscular imbalances and prolonged neck muscle contraction, increasing muscle fatigue in the region.[32]

In this study, students obtained a mean PSS-10 score of 24.47 ± 6.79. Similar results were reported in two other studies: one conducted during the pandemic with university students, including those from the physical therapy program (mean = 23.90 ± 7.02),[16] and another prior to the pandemic, also with physical therapy students (mean 23.53 ± 6.63).[33]

University students are often exposed to stressful situations, especially those in health-related fields. A heavy academic workload and limited leisure activities contribute to overload and stress onset.[33] These factors were reflected in the responses of participants in the present study, who frequently reported feeling stressed or nervous, being unable to cope with all the things they had to do, and feeling incapable of controlling important things in their lives.

A significant albeit weak correlation was found between the number of body regions with musculoskeletal symptoms and mental stress in the physical therapy students ($r = 0.35$; $p < 0.001$). A pre-pandemic study conducted with health sciences undergraduates, which used the PSS-14 and musculoskeletal complaints over the past seven days assessed by the NMQ, found a significant association between stress levels and lower limb musculoskeletal pain in physical therapy students ($p = 0.044$).[17] A pandemic-era study of university students, including those from the physical therapy program, observed no significant difference in mean PSS-10 scores between participants with and without musculoskeletal complaints.[16] It is important to note that the present study correlated stress with the number of body regions affected by symptoms, while the previous investigation considered only the presence or absence of symptoms.[16]

The literature indicates a relationship between stress and musculoskeletal symptoms in almost all body regions, whereby higher stress levels are associated with an increased prevalence of symptoms.[34] Dysregulated cortisol levels, the body's primary stress hormone, disrupt the homeostatic system and can negatively affect health.[35]

The findings of this study may support higher education institutions in developing strategies to promote health and prevent exposure to stressors and the onset of musculoskeletal symptoms. It is suggested that courses on ergonomic risks be included in the curriculum, particularly in relation to practical activities, during which poor posture may contribute to the development of these symtpoms.[36] Additionally, the implementation of exercise programs during class breaks is recommended as a strategy to combat sedentary behavior.[37] Psychological support may also help students manage stress and could include screening initiatives, group workshops, and individual psychotherapy when needed.[38]

The present study has several limitations that should be acknowledged. The sample size may limit the generalizability of the results to the broader population of physical therapy students in Brazil. The fact that the study was conducted in a virtual environment is another limitation. However, this allowed for the inclusion of participants from across the country and ensured compliance with social distancing guidelines in place during the COVID-19 pandemic. Finally, although data collection did not take place at the height of the pandemic, the study still provides a representative picture of the present reality.

The lack of research on this topic and the weak correlation between the number of body regions with musculoskeletal symptoms and perceived stress highlight the need for further investigation. It is recommended that longitudinal studies be conducted to examine the relationship between stress and musculoskeletal symptoms, along with experimental studies to evaluate the effects of interventions aimed at preventing or mitigating these conditions in physical therapy students.

Conclusion

Musculoskeletal symptoms in at least one body region were prevalent in 94% of the physical therapy students in this study. The most frequently affected areas were the neck, upper back, and shoulders. A weak correlation was found between the number of body regions with musculoskeletal symptoms and perceived mental stress. The feelings most strongly correlated with musculoskeletal symptoms were nervousness, being upset by unexpected events, feeling unable to control personal matters, difficulty managing responsibilities, and feeling overwhelmed by accumulated problems.

This study offers insights to support the development of preventive measures and intervention strategies to promote the overall health of physical therapy students.

Authors' contributions

LMS, LAG, COMP contributed equally to the study conception and design. LAG was responsible for data collection and LMS and COMP for data analysis and interpretation. LMS drafted the article, and LAG and COMP revised it. All the authors approved the final version.

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