Original Article

TEXTO & CONTEXTO ENFERMAGEM
TEXT & CONTEXT NURSING TEXTO & CONTEXTO ENFERMERÍA

PERCEIVED STRESS AND MUSCULOSKELETAL PAIN AMONG UNDERGRADUATE HEALTH STUDENTS

Bruna Xavier Morais[1]
Graziele de Lima Dalmolin[1]
Cecília Mariane Pinheiro Pedro[2,3]
Julia Zancan Bresolin[3]
Rafaela Andolhe[1]
Tânia Solange Bosi de Souza Magnago[1]

[1]Universidade Federal de Santa Maria, Programa de Pós-graduação em Enfermagem. Santa Maria, Rio Grande do Sul, Brasil.
[2]Faculdade Integrada de Santa Maria, Departamento de Enfermagem. Santa Maria, Rio Grande do Sul, Brasil.
[3]Prefeitura Municipal de Santa Maria, Secretaria Municipal de Saúde. Santa Maria, Rio Grande do Sul, Brasil.

ABSTRACT

Objective: to assess the association between the presence of perceived stress and reports of musculoskeletal pain among undergraduate health students.
Method: a cross-sectional study carried out with undergraduate health students (Nursing, Pharmacy, Physiotherapy, Speech Therapy, Medicine, Occupational Therapy, and Dentistry) in a public university of southern Brazil. Data collection took place in the period from April to June 2017. An instrument with sociodemographic, habits, health profile, and academic variables was used; as well as the Brazilian version of the Standardized Nordic Questionnaire and the Perceived Stress Scale. Descriptive and inferential statistics were employed for the analysis.
Results: a total of 792 students took part in the study. The students with a high stress level presented more chances for the occurrence of musculoskeletal pain in the vertebral column region (OR=2.92; 95% CI=1.30-6.55), upper limbs (OR=3.27; 95% CI=1.80-5.92) and lower limbs (OR=3.10; 95% CI=1.81-5.29). The variables “not having time for leisure” and “sometimes having time for leisure” presented higher chances of pain in the vertebral column region (OR=2.92; 95% CI=1.30-6.55), upper limbs (OR=3.27; 95% CI=1.80-5.92) and lower limbs (OR=3.10; 95% CI=1.81-5.29). The variables “not having time for leisure” and “sometimes having time for leisure” presented higher chances of pain in the vertebral (OR=3.11; 95% CI=1.84-5.25), Occupational Therapy (OR=2.57; IC95%=1,51-4,38) and Physiotherapy (OR=1.82; 95% CI=1.00-3.31) and being overweight (OR=1.59; 95% CI=1.09-2.31) presented higher chances of pain in the lower limbs.
Conclusion: the association between perceived stress and the occurrence of musculoskeletal pain among the students was evidenced, revealing the importance of implementing programs aiming at the students’ health.

DESCRIPTORS: Students. Health sciences students. Psychological stress. Musculoskeletal pain. Cumulative traumatic disorders. Nursing.

HOW CITED: Morais BX, Dalmolin GL, Pedro CMP, Bresolin JZ, Andolhe R, Magnago TSBS. Perceived stress and musculoskeletal pain among undergraduate health students. Texto Contexto Enferm [Internet]. 2021 [cited YEAR MONTH DAY]; 30:e20200076. Available from: https://doi.org/10.1590/1980-265X-TCE-2020-0076

ESTRESSE PERCEBIDO E DOR MUSCULOESQUELÉTICA ENTRE ESTUDANTES DE GRADUAÇÃO DA ÁREA DA SAÚDE

RESUMO

Objetivo: avaliar a associação entre a presença de estresse percebido e relatos de dor musculoesquelética entre estudantes de graduação da área da saúde.
Método: estudo transversal, realizado com estudantes de graduação da área da saúde (Enfermagem, Farmácia, Fisioterapia, Fonoaudiologia, Medicina, Terapia Ocupacional e Odontologia) em uma universidade pública do Sul do Brasil. A coleta de dados ocorreu no período de abril a junho de 2017. Utilizaram-se um instrumento com variáveis sociodemográficas, de hábitos e perfil de saúde, e acadêmicas; a versão brasileira do *Standardized Nordic Questionnaire* e a Escala de Estresse Percebido. Para análise empregou-se estatística descritiva e inferencial.
Resultados: participaram 792 estudantes. Os estudantes com alto nível de estresse apresentaram mais chances para ocorrência de dor musculoesquelética na região da coluna vertebral (OR=2,92; IC95%=1,30-6,55), membros superiores (OR=3,27; IC95%=1,80-5,92) e inferiores (OR=3,10; IC95%=1,81-5,29). As variáveis "não ter tempo para o lazer" e "ter às vezes tempo para o lazer" apresentaram maiores chances de dor na coluna vertebral (OR=3,03; IC95%=1,42-6,47; OR=2,35; IC95%=1,67-3,30, respectivamente) e nos membros superiores (OR=2,34; IC95%=1,28-4,25; OR=1,49; IC95%=1,10-2,02, respectivamente), e as variáveis cursar Fonoaudiologia (OR=2,37; IC95%=1,25-4,49), Enfermagem (OR=3,11; IC95%=1,84-5,25), Terapia Ocupacional (OR=2,57; IC95%=1,51-4,38) e Fisioterapia (OR=1,82; IC95%=1,00-3,31), e estar com sobrepeso (OR=1,59; IC95%=1,09-2,31) apresentaram maiores chances de dor musculoesquelética nos membros inferiores.
Conclusão: evidenciou-se associação entre estresse percebido e a ocorrência de dor musculoesquelética entre os estudantes, revelando a importância de instituir programas que visem à saúde dos estudantes.

DESCRITORES: Estudantes. Estudantes de ciências da saúde. Estresse psicológico.
Dor musculoesquelética. Transtornos traumáticos cumulativos. Enfermagem.

ESTRÉS PERCIBIDO Y DOLOR MUSCULOESQUELÉTICO ENTRE ESTUDIANTES DE GRADO EN EL ÁREA DE SALUD

RESUMEN

Objetivo: evaluar la asociación entre la presencia de estrés percibido y reportes de dolor musculoesquelético entre estudiantes de grado en el área de salud.
Método: estudio transversal, realizado con estudiantes de grado en el área de salud (Enfermería, Farmacia, Fisioterapia, Fonoaudiología, Medicina, Terapia Ocupacional y Odontología) en una universidad pública del sur de Brasil. La recolección de datos tuvo lugar entre abril y junio de 2017. Se utilizó un instrumento con variables sociodemográficas, de hábitos y perfil de salud, además de académicas; la versión brasileña del *Standardized Nordic Questionnaire* y la Escala de Estrés Percibido. Para el análisis, se empleó estadística descriptiva e inferencial.
Resultados: participaron 792 estudiantes. Los estudiantes con alto nivel de estrés presentaron más probabilidades de sufrir dolor musculoesquelético en la región de la columna vertebral (OR=2,92; IC95%=1,30-6,55), y en los miembros superiores (OR=3,27; IC95%=1,80-5,92) e inferiores (OR=3,10; IC95%=1,81-5,29). Las variables "no tener tiempo para el ocio" y "a veces tener tiempo para el ocio" presentaron mayores probabilidades de dolor en la columna vertebral (OR=3,03; IC95%=1,42-6,47; OR=2,35; IC95%=1,67-3,30, respectivamente) y en los miembros superiores (OR=2,34; IC95%=1,28-4,25; OR=1,49; IC95%=1,10-2,02, respectivamente), y las variables relacionadas con cursar Fonoaudiología (OR=2,37; IC95%=1,25-4,49), Enfermería (OR=3,11; IC95%=1,84-5,25), Terapia Ocupacional (OR=2,57; IC95%=1,51-4,38) y Fisioterapia (OR=1,82; IC95%=1,00-3,31), y tener sobrepeso (OR=1,59; IC95%=1,09-2,31) presentaron mayores probabilidades de dolor musculoesquelético en los miembros inferiores.
Conclusión: se hizo evidente una asociación entre estrés percibido y la manifestación de dolor musculoesquelético entre los estudiantes, lo que revela la importancia de instituir programas destinados a la salud de los estudiantes.

DESCRIPTORES: Estudiantes. Estudiantes de ciencias de la salud. Estrés psicológico.
Dolor musculoesquelético. Trastornos Traumáticos acumulativos. Enfermería.

INTRODUCTION

The current way of life establishes various pressures and instabilities in people's daily lives, requiring from them adaptations to daily situations that can result in transformations, which can lead to the development of stress[1]. Stress is considered a manifestation that happens when an event goes beyond the adaptation sources of the individuals' physiological or psychological, whether in the cognitive, emotional, or behavioral aspects, exposing them to risk situations for impairment in their health[2].

In this perspective, the academic training of future professionals has shown to be stressful, especially among the health students[3–4]. Although they are not considered workers, the activities they perform can be considered as pre-professional[4]. Insertion in the work environment for the performance of academic activities occurs in a context with high emotional demand,[4] and may be a stressor for the students.

Entrance into higher education is characterized by a transition that must be well grounded, as it requires several adaptations. Among them, the following stand out: distance from family, home, and friends, changes in the daily routine, assuming financial responsibilities, need for organizations, adjusting to a new teaching methodology, high hour loads of curricular activities, demands and new professional perspectives, among others[3].

Exposure to these stressors can trigger biological, emotional, or behavioral changes[1,5]. Among the biological changes, there are physical symptoms, such as the musculoskeletal aspects[5]. Musculoskeletal disorders affect muscles, bones, articulations, tendons, nerves, and ligaments. Musculoskeletal Pain (MP) results from repetitive efforts, static postures and excessive use of the musculoskeletal system[6]. The scientific literature has demonstrated a high prevalence of MP among health students, ranging from 58.8% to 96%[6–7].

International studies show that stress is related to the occurrence of MP[6,8–10]. This can happen due to stress-related neurophysiological, psychological or cognitive-behavioral aspects. The manifestation of the stressors in a person relates to the individual characteristics, to their evaluation the face of the stressor, and to the available resources and the strategies to face it[8,10].

In addition to that, coping with the stressor can cause physiological reactions in the individual, including biochemical processes, which can result in muscle tension or MP. These reactions increase pain perception through the processing of sensory information in the Central Nervous System, increasing muscle tone and favoring the increase of the biomechanical load of muscles and tendons, contributing to the emergence of musculoskeletal symptoms[8,10].

Because of this, an online search was conducted in November 2019 in the SciVerse Scopus (Scopus), Medline (via the National Library of Medicine – PUBMED) and Latin American and Caribbean Health Sciences Literature (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*, LILACS) databases to identify scientific productions regarding the association of stress with MP in undergraduate health students. The following association was used as search strategy: ("*stress*" OR "*stress, psychological*") AND ("*musculoskeletal pain*" OR "*cumulative trauma disorders*") AND (*"students, health occupations"* OR *"undergraduate student"* OR *"students"*).

A total of 60 studies were found in the Scopus database, 27 studies in Medline, and 14 in LILACS. Of these, only four international articles addressed the association between MP and psychological aspects among university health students,[6,9,11–12] developed in Pakistan,[9] Bosnia,[12] and Jordan,[6,11], evidencing a lack of studies developed on this theme.

In this regard, it is important to research MP and stress among undergraduate health students, since they provide care to patients in addition to their academic activities. Thus, a previous situational diagnosis and possible strategies for health promotion will contribute to the maintenance

of the physical and mental health of these future professionals, as well as to quality assistance to the patient.

In view of the above, the following question guided the study: Is there an association between the presence of perceived stress and the reports of musculoskeletal pain among undergraduate health students? As a study hypothesis, it is listed that there is an association between the presence of perceived stress and the reports of musculoskeletal pain. Thus, the objective was to assess the association between the presence of perceived stress and reports of musculoskeletal pain among undergraduate health students.

METHOD

A cross-sectional study carried out with undergraduate health students of a public university of southern Brazil. The students were attending the Nursing, Pharmacy, Physiotherapy, Speech Therapy, Medicine, Occupational Therapy, and Dentistry courses.

For the development of the study, probabilistic cluster sampling was used, in which the semesters of the courses were divided into beginning, middle and end. To define a minimum sample, a sample calculation was performed for finite populations considering a 95% confidence level, sampling error of 0.3 points, standard deviation of 3.08[7] and the total population of 2,334 students. The result was 346 students, number to which 20% was added for possible losses, resulting in a minimum sample of 416 participants. Based on that, the minimum number of students per course was as follows: 125 (Medicine), 79 (Pharmacy), 62 (Dentistry), 37 (Physiotherapy), 55 (Occupational Therapy), 37 (Nursing) and 21 (Speech Therapy).

The selection criteria of the participants were as follows: being enrolled and regularly attending the undergraduate course and being 18 years old or older. Those who were away from the course for any reason or who were not in the classroom during data collection were excluded.

Data collection took place in the period from April to June 2017, conducted by the authors of the study and by members of the research group, previously trained. It took place in the classrooms, after previous authorization from the professors responsible for the academic subjects. The students were informed about the research objective and about their voluntary participation in the study. After acceptance, they signed the Free and Informed Consent Form in two copies, keeping one for themselves.

A questionnaire was used to characterize the students with sociodemographic (gender, age), habits and health profile (use of alcohol and tobacco, physical activity, time for leisure), and academic (course, semester and whether they were in practical classes during the data collection period) variables. To assess MP, the Brazilian version of the Standardized Nordic Questionnaire[13–14] was used, which enables the verification of the reports of MP in ten anatomical regions, by means of three questions, which had two answers options: yes or no. In this study, only the question “Have you had this pain/discomfort in the last seven days?” was considered, and the anatomical regions were divided into vertebral column (cervical, thoracic and lumbar), upper limbs (shoulder, elbow and wrist or hand) and lower limbs (thighs, knees, legs and ankles). The presence of MP in each region was assessed by the students’ affirmative answer in at least one of the subregions described.

To measure stress, the Perceived Stress Scale (PSS) adapted for university students was used[15–16]. The PSS is composed of 14 items, seven with positive meaning (items 4,5,6,7,9, 10 and 13) and seven with negative meaning (items 1,2,3,8,11, 12 and 14). Each item has answers ranging from zero to 4 (0=never; 1=almost never; 2=sometimes; 3=almost always; 4=always).

The data were inserted in an electronic spreadsheet in the Microsoft Excel format, version 2010, with double independent typing. After checking errors and inconsistencies in typing, the data

were analyzed in the *PASW Statistics*® program (*Predictive Analytics Software*, SPSS Inc., Chicago, USA), version 18.0 for Windows.

A descriptive analysis was performed for the sociodemographic, habits and health profile and academic variables. The qualitative variables were described by means of absolute and relative frequencies, and the quantitative variables by measures of position (mean) and dispersion (standard deviation) due to data symmetry, identified by the Kolmogorov-Smirnov test. Pearson's Variation Coefficient was calculated observing the representativeness of the data for the use of mean and standard deviation in the analysis of the PSS.

MP was analyzed in a dichotomous manner, present or absent, in each anatomic region, presenting the absolute and relative frequencies. Stress was measured by the sum of the scores of the 14 questions. The questions with a positive connotation had their score reversed as follows: 0=4, 1=3, 2=2, 3=1 and 4=0. The remaining questions were negative and were directly added up. The PSS score can range from zero to 56, and values above the 75 percentile (42 points) are considered indicative of high stress level[16].

For the analysis of the differences of means between perceived stress and MP, the t-test was used to compare the means, and, for the association of the other independent variables and MP, the Chi-Square or Fisher's Exact tests were used, considering a 95% confidence interval with a statistical significance level of $p<0.05$. For the binary logistic regression, the variables that obtained $p<0.15$ in the bivariate analysis entered adjusted model 1. In adjusted model 2, the variables that remained associated (p 0.05) in adjusted model 1 were included.

The research respected the ethical aspects set forth in Resolution 466/12 and was approved by the Research Ethics Committee of the Institution.

RESULTS

A total of 792 students participated in the study, namely: 192 (24.2%) from the Medicine course, 143 (18.1%) from Dentistry, 117 (14.8%) from Nursing, 105 (13.3%) from Pharmacy, 102 (12.9%) from Occupational Therapy, 70 (8.8%) from Physiotherapy, and 63 (8%) from Speech Therapy. There was predominance of female students (74.6%) with a median age of 21 years old, who were in the intermediate period of the course, between the 3rd and 6th semesters (41.3%), and in practical classes (88.5%). Most of the students drank alcoholic beverages occasionally (63.1%), did not make use of tobacco (88.6%) and sometimes had time for leisure activities (55.4%). 35.9% stated performing some physical activity.

Regarding perceived stress, the questions "Have you felt nervous or 'stressed out'?" (2.72±1.01) and "Have you caught yourself thinking about the things you had to do?" (3.22±0.88) were the ones that presented the highest prevalence of affirmative answers, 34.1% and 46.2%, respectively. The questions "Have you felt on top of everything (in control of things)?" (1.56 ±1.01) and "Were you capable of controlling how you spend your time?" (1.96±1.03) obtained more negative answers: 27.7% and 30.3%, respectively.

Regarding stress among the undergraduate health students, a mean of 30.22 (±8.47) was observed, with a minimum score of 6 points and maximum of 54. Of the students, 9.5% (n=75) were classified with high stress level, and a higher prevalence of this high perception of stress was verified among the Speech Therapy (30.2%) and Medicine (10.4%) students.

Regarding the presence of MP in the last seven days among the students, a higher prevalence of pain in the vertebral column region (74.9%) was observed, followed by the upper (54.1%) and lower (43.6%) limbs.

In Table 1, the difference between the means of perceived stress and the reports of MP among the students is verified.

According to Table 1, the reports of MP distributed in three anatomic regions presented a significant difference (p<0.001) among the means of perceived stress of the undergraduate students.

A statistically significant difference was observed between perceived stress and MP in the vertebral column among the Nursing (p=0.002), Medicine (p=0.005), and Dentistry (p=0.044) students; between perceived stress and MP in upper limbs in Nursing (p=0.002), Speech Therapy (p=0.009) and Medicine (p=0.006) students; and between perceived stress and MP in lower limbs in Physiotherapy (p=0.044) and Medicine (p=0.032) students.

Table 1 – Difference between the means of perceived stress and musculoskeletal pain among undergraduate health students. Santa Maria, RS, Brazil, 2017. (n=792)

Musculoskeletal pain		Perceived Stress			
		N	Mean	SD	p*
Vertebral column	Yes	593	31.30	8.28	<0.001
	No	199	27.02	8.25	
Upper limbs	Yes	428	31.69	8.51	<0.001
	No	364	28.49	8.10	
Lower limbs	Yes	345	32.31	8.42	<0.001
	No	447	28.61	8.16	

*t Test

In Table 2, the adjusted analysis between the prevalence of MP in the vertebral column region with perceived stress and the sociodemographic, habits and health, and academic variables evidence that the students with high level of perceived stress (OR=2.92; 95% CI=1.30-6.550), who did not have time for leisure (OR=3.03; 95% CI=1.42-6.47), and who sometimes had time for leisure (OR=2.35; 95% CI=1.67-3.30) presented higher chances for the occurrence of MP in that region.

Table 2 – Gross and adjusted associations between musculoskeletal pain in the vertebral column region and perceived stress, sociodemographic, habits and health, and academic variables of the undergraduate health students. Santa Maria, RS, Brazil, 2017. (n=792)

Variables	MP in the Vertebral Column		
	Gross	Adjusted 1	Adjusted 2*
	OR (CI)	OR (CI)	OR (CI)
Stress			
High	3.55 (1.60-7.87)	2.74 (1.21-6.22)	2.92 (1.30-6.55)†
Low	1.00	1.00	1.00
Leisure			
No	3.74 (1.78-7.85)	2.78 (1.28-6.03)	3.03 (1.42-6.47)†
Sometimes	2.42 (1.72-3.39)	2.25 (1.58-3.21)	2.35 (1.67-3.30)†
Yes	1.00	1.00	1.00
Course			
Nursing	1.00	1.00	
Speech Therapy	3.28 (1.36-7.91)	2.08 (0.84-5.16)	
Pharmacy	1.02 (0.57-1.83)	1.07 (0.58-1.97)	
Medicine	1.07 (0.65-1.79)	1.18 (0.68-2.06)	
Occupational Therapy	1.58 (0.85-2.95)	1.61 (0.85-3.08)	
Physiotherapy	1.80 (0.87-3.70)	2.05 (0.97-4.31)	

Table 2 – Cont.

Variables	MP in the Vertebral Column		
	Gross	Adjusted 1	Adjusted 2*
	OR (CI)	OR (CI)	OR (CI)
Dentistry	1.02 (0.59-1.75)	1.41 (0.79-2.54)	
Transportation			
Bus	1.34 (0.97-184)	1.18 (0.83-1.69)	
Others	1.00	1.00	
Marital status			
No partner	2.02 (1.03-3.95)	1.74 (0.86-3.54)	
Has a partner	1.00	1.00	
Physical activity			
No	1.40 (1.00-1.94)	1.13 (0.79-1.61)	
Yes	1.00	1.00	

*Hosmer-Lemeshow test Model 2 = 0.975; †p<0.05.

In Table 3, the adjusted analysis between the prevalence of MP in the upper limbs region with perceived stress and the sociodemographic, habits and health, and academic variables evidence that the students with high level of perceived stress (OR=3.27; IC95%=1.80-5.92), who did not have time for leisure (OR=2.34; IC95%=1.28-4.25) and who sometimes had time for leisure (OR=1.49; 95% CI=1.10-2.02) presented higher chances for the occurrence of MP in that region.

Table 3 – Gross and adjusted associations between musculoskeletal pain in the upper limbs region and perceived stress, sociodemographic, habits and health, and academic variables of the undergraduate students in the area of health. Santa Maria, RS, Brazil, 2017. (n=792)

Variables	MP in the Upper Limbs		
	Gross	Adjusted 1	Adjusted 2*
	OR (CI)	OR (CI)	OR (CI)
Stress			
High	3.79 (2.12-6.81)	3.17 (1.74-5.75)	3.27 (1.80-5.92)†
Low	1.00	1.00	1.00
Leisure			
No	2.99 (1.67-5.34)	2.22 (1.21-4.07)	2.34 (1.28-4.25)†
Sometimes	1.55 (1.15-2.09)	1.43 (1.05-1.94)	1.49 (1.10-2.02)†
Yes	1.00	1.00	1.00
Transportation			
Bus	1.30 (0.98-1.72)	1.21 (0.91-1.62)	
Others	1.00	1.00	
Physical activity			
No	1.44 (1.08-1.93)	1.25 (0.92-1.69)	
Yes	1.00	1.00	

*Hosmer-Lemeshow test Model 2 = 0.920; †p<0.05.

In Table 4, the adjusted analysis between the prevalence of MP in the lower limbs region with perceived stress and sociodemographic, habits and health, and academic variables evidence that the students with high level of perceived stress (OR=3.10; 95% CI=1.81-5.29), who studied Speech Therapy (OR=2.37; 95% CI=1.25-4.49), Nursing (OR=3.11; 95% CI=1.84-5.25), Occupational Therapy (OR=2.57; 95% CI=1.51-4.38), and Physiotherapy (OR=1.82; 95% CI=1.00-3.31), and who were classified as overweight (OR=1.59; 95% CI=1.09-2.31) presented higher chances for the occurrence of MP in that region.

Table 4 – Gross and adjusted associations between musculoskeletal pain in the lower limbs region and perceived stress, sociodemographic, habits and health, and academic variables of the undergraduate health students. Santa Maria, RS, Brazil, 2017. (n=792)

Variables	MP in Lower Limbs		
	Gross	Adjusted 1	Adjusted 2*
	OR (CI)	OR (CI)	OR (CI)
Stress			
High	3.27 (1.96-5.46)	2.86 (1.66-4.95)	3.10 (1.81-5.29)†
Low	1.00	1.00	1.00
Smokes			
Yes	2.40 (0.70-8.28)	2.32 (0.62-8.69)	
Sometimes	1.45 (0.90-2.32)	1.49 (0.90-2.46)	
No	1.00	1.00	
Leisure			
No	2.13 (1.24-3.66)	1.35 (0.74-2.47)	
Sometimes	1.20 (0.89-1.63)	0.99 (0.71-1.37)	
Yes	1.00	1.00	
Course			
Speech Therapy	3.00 (1.63-5.54)	2.33 (1.18-4.61)	2.37 (1.25-4.49)†
Nursing	3.35 (2.00-5.60)	3.18 (1.85-5.48)	3.11 (1.84-5.25)†
Pharmacy	1.28 (0.75-2.18)	1.28 (0.73-2.23)	1.27 (0.74-2.19)
Medicine	1.35 (0.85-2.14)	1.31 (0.81-2.11)	1.27 (0.80-2.03)
Occupational Therapy	2.53 (1.50-4.29)	2.47 (1.42-4.33)	2.57 (1.51-4.38)†
Physiotherapy	1.79 (0.99-3.23)	1.86 (1.01-3.43)	1.82 (1.00-3.31)†
Dentistry	1.00	1.00	1.00
Time using a computer			
3 hours or more	1.27 (0.96-1.68)	1.18 (0.87-1.59)	
Up to 2 hours	1.00	1.00	
BMI			
Obesity	1.24 (0.73-2.11)	1.12 (0.63-1.97)	1.06 (0.61-1.86)
Overweight	1.66 (1.16-2.38)	1.54 (1.05-2.25)	1.59 (1.09-2.31)†
Low weight	1.07 (0.58-1.97)	0.93 (0.49-1.78)	0.89 (0.46-1.69)
Adequate weight	1.00	1.00	1.00
Physical activity			
No	1.30 (0.97-1.75)	0.95 (0.69-1.32)	
Yes	1.00	1.00	

*Hosmer-Lemeshow test Model 2 = 0.951; †p<0.05.

DISCUSSION

The findings evidence a significant relation between stress and the occurrence of MP in the vertebral column and upper and lower limbs of the undergraduate health students of a public university of southern Brazil, confirming the study hypothesis. Physiologically, there is evidence that stress releases hormones like cortisol and adrenocorticotrophic,[8] which increase the pain perception and cause muscle tension[17]. The occurrence of this tension causes a reduction in the blood flow among the tissues, reducing the exchange of oxygen and nutrients between them[18]. For this reason, there is an accumulation of acid residues in the tissues, resulting in fatigue and muscle pain[18].

In this regard, due to the high number of stressors and physical overload to which the students are exposed, the development of muscle fatigue can occur. Characterized by reduced strength and by compromised refined movements, it manifests itself after muscle stress or work for a long period of time[19–20]. Among the effects of fatigue, there is also a reduction in muscle speed, contraction and power[19–20]. In these situations, the muscle energy reserve, consisting of glucose and phosphorus, is depleted and the products of muscle metabolism (lactic acid and carbon dioxide) rise and make the muscle acid[19,21]. Therefore, fatigue acts as a protective process against mechanical overload, preventing the loss of adenosine triphosphate (ATP), preventing other reactions from happening in the muscle. However, it results in reduced muscle performance[19,21].

In the academic universe of the health area, insertion in the assistance services occurs by means of practical classes and internships. The students are exposed to stressors as they witness critical situations, such as suffering and death of the patients. Generally, they perform assistance activities in high pressure environments, activities that must often be developed quickly and objectively[22]. With this, the development of muscle tension secondary to stress can occur due to the relationship between psychosocial aspects and musculoskeletal disorders and can intensify due to several factors of the academic environment[23].

The scientific literature shows physical manifestations related to stress among health professionals, such as the presence of cephalea, tachycardia, fatigue and pain in the legs[24]. When they develop the activities inherent to their daily work, they experience physical and emotional stress, caused by the presence of anxiety, the feeling of loss and the patients' fragility[24].

The following are also part of this context; overload of activities, repetitive movements and postural vices adopted during assistance to the patients, which contribute to the presence of MP[6]. Aspects such as load lifting and muscle strength, height of the furniture in the work stations and/or at the bedside, adoption of standing postures, and walking most of the shift stand out, favoring uncomfortable positions that can promote the development of MP[25–26].

In this perspective, postural aspects, and those implying repetition of movements and emotional stress, as well as fatigue and muscle ischemia, can be related to the occurrence of myofascial pain syndrome[19]. This syndrome is one of the frequent causes of MP, affecting muscles, connective tissues and fascias[20]. Thus, it is characterized by the presence of pain and trigger points in the tension bands of the affected muscle[19].

Burning, weight or pain sensations are common in the affected individuals, sometimes in stings, with reduced muscle strength and limited range of motion[20]. Trigger points are most often associated with mechanical muscle overload, which results in muscle tension and shortening. Pain intensity and the affected region will depend on the degree of irritability of these trigger points[19].

Regarding health habits, not having or sometimes having time for leisure were associated with the occurrence of MP in the vertebral column and upper limbs among the students. The academic requirements added to the lack of time to rest, to spend time with the family and/or friends and to develop leisure activities favor stress overload and, consequently, physical wear out in the students[5].

Thus, the development of leisure activities causes affective and emotional satisfaction among the individuals, since the time set aside for this is not related to obligations or goals to be met[27].

In this context, leisure activities are fundamental for health promotion, as they favor relaxation and relief of tensions resulting from the students' academic daily life,[28] which helps in the prevention of MP. Thus, it becomes important to provide spaces for the students in the academic environment that favor the relief of tensions by means of leisure activities, such as conversation circles, promotion of physical activities and cultural spaces, among others.

It was observed that, among the students of the courses assessed, attending Speech Therapy, Nursing, Occupational Therapy or Physiotherapy was considered a factor associated with the occurrence of MP in the lower limbs. In particular, the Physiotherapy and Occupational Therapy students stand out, who presented, respectively, 82 and 57 times more chances for the occurrence of MP when compared to the others. Considering the competence activities of each of these professions, it is highlighted that both perform activities, most of the times, to contemplate the physical rehabilitation of the individuals, facing tasks that favor physical overload in the student, such as aid in walking, in movement and in the transportation of dependent patients; as well as the development of manual therapeutic techniques that require muscle strength and static contraction[29]. These aspects can exert an influence on the development of MP.

In addition, the students witness the limit between disease and death, suffering and emotional weaknesses of patients and/or family members, and need to develop autonomy in decision-making, confidence to perform activities of clinical competence and in urgency and emergency situations. Associated with this we find the intense pace in academic life, with a high load of activities, evaluations and work[3,30].

Consequently, health students experience challenges inherent to the training process, which is shown to be a challenging period, permeated by complex demands related to the paces of study and learning, new relationship patterns and the construction of a vocational identity[31]. Such aspects constitute undergraduation and make it a period vulnerable to the presence of stress[31]. In this regard, it is highlighted that the high stress level, added to the use of different regions of the body during the practices, the deconditioning of the cardiovascular and locomotor system and sexual characteristics constitute factors that exert an influence in the presence of the MP symptoms[32].

It is worth noting that the students remain seated for a long period of time during the theoretical classes. This posture is related to the development of several changes in the musculoskeletal system, such as the increase in the internal pressure of the intervertebral disc nucleus, which causes the stretching of musculoskeletal structures (ligaments, joints and nerves) of the vertebral column and the reduction of blood circulation between the students' limbs[33]. From this, it promotes the occurrence of inflammatory processes that will be responsible for the painful processes in these regions,[33] with emphasis on the lower limbs region. Therefore, these aspects must be taken into account for the development of strategies that can mitigate possible changes in the musculoskeletal system. One of them is to provide short breaks during the classes so that the students can get up for a few minutes, temporarily changing their body posture.

Regarding BMI, it was observed that being overweight contributes to the presence of MP in the lower limbs. This is due to the fact that, with weight gain, muscle overload can occur and, thus, it triggers inflammatory processes in the musculoskeletal system, favoring painful symptoms[34].

As a strategy for the prevention of stress and MP, the students performing physical activity on a regular basis stands out. It can be offered through spaces provided by the educational institutions in partnership with Physical Education courses in order to promote students' health. Practicing physical activity contributes to the energy balance, keeps the muscles active, irrigated and oxygenated, and

provides the release of endorphins that helps in the reduction of MP,[35] as well as it contributes to the cardiovascular and respiratory functions, which can be stimulated and provided to the students.

As limitations, the study design stands out, since cross-sectional studies do not enable the inference of causality. The difficult access to the medical students from the last semesters due to the performance of internships is also highlighted, sometimes in places outside the researched institution. The memory bias may have been minimized, in view of the reports of MP in the last seven days.

CONCLUSION

The study evidenced an association between perceived stress and the occurrence of MP among undergraduate students in the area of health, confirming the study hypothesis. In addition to that, the following were shown to be factors associated with the occurrence of MP in the vertebral column and lower limbs regions: “not having time” and “sometimes having time for leisure” and, in the lower limbs region, studying Speech Therapy, Nursing, Occupational Therapy and Physiotherapy, and being overweight.

The findings point out that the prevention of musculoskeletal symptoms also involves the students’ psychological aspects. In this regard, it is important to address physical and psychological health during undergraduation, by means of student care programs, contributing to a better adaptation to the challenges proposed by higher education and preventing the triggering of feelings such as stress, which can cause the development of MP.

REFERENCES

1. Hirsch CD, Barlem ELD, Tomaschewski-Barlem JG, Lunardi VL, Oliveira ACC. Predictors of stress and coping strategies adopted by nursing students. Acta Paul Enferm [Internet]. 2015 [cited 2020 Mar 03];28(3):224-9. Available from: https://doi.org/10.1590/1982-0194201500038
2. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. JAMA [Internet]. 2007 [cited 2020 Mar 03];298(14):1685-7. Available from: https://doi.org/10.1001/jama.298.14.1685
3. Ribeiro RM, Bragiola JVB, Eid LP, Pompeo DA. Impact of self-esteem and of the sociodemographic factors on the self-efficacy of udergraduate nursing students. Texto Contexto Enferm [Internet]. 2020 [cited 2020 Apr 06];29:e20180429. Available from: https://doi.org/10.1590/1980-265X-TCE-2018-0429
4. Souza MR, Caldas TCG, De Antoni C. Fatores de adoecimento dos estudantes da área da saúde: uma revisão sistemática. Psicol Saúde Debate [Internet]. 2017 [cited 2020 Mar 03];3(1):99-126. Available from: https://doi.org/10.22289/2446-922X.V3N1A8
5. Hirsch CD, Barlem ELD, Almeida LK, Tomaschewski-Barlem JG, Lunardi VL, Ramos AM. Stress triggers in the educational environment from the perspective of nursing students. Texto Contexto Enferm [Internet]. 2018 [cited 2020 June 05];27(1):e0370014. Available from: https://doi.org/10.1590/0104-07072018000370014
6. Almhdawi KA, Mathiowetz V, Al-Hourani Z, Khader Y, Kanaan SF, Alhasan M. Musculoskeletal pain symptoms among allied health professions’ students: Prevalence rates and associated factors. J Back Musculoskelet Rehabil [Internet]. 2017 [cited 2020 Mar 03];30(6):1291-301. Available from: https://doi.org/10.3233/BMR-169669
7. Gomes-Neto M, Sampaio GS, Santos PS. Frequência e fatores associados a dores musculoesqueléticas em estudantes universitários. Rev Pesqui Fisioter [Internet]. 2016 [cited 2020 Mar 03];6(1):26-34. Available from: https://www5.bahiana.edu.br/index.php/fisioterapia/article/view/790/566
8. Osteras B, Sigmundsson H, Haga M. Perceived stress and musculoskeletal pain are prevalent and significantly associated in adolescents: an epidemiological crosssectional study. BMC Public Health [Internet]. 2015 [cited 2020 Mar 03];15:1081. Available from: https://doi.org/10.1186/s12889-015-2414-x

9. Haroon H, Mehmood S, Imtiaz F, Ali SA, Sarfraz M. Musculoskeletal pain and its associated risk factors among medical students of a public sector University in Karachi, Pakistan. J Pak Med Assoc [Internet]. 2018 [cited 2020 Mar 03];68(4):682-88. Available from: https://www.jpma.org.pk/article-details/8671

10. Arias ARB, García AM. Asociación entre la exposición laboral a factores psicosociales y la existencia de trastornos musculoesqueléticos en personal de enfermería: revisión sistemática y meta-análisis. Rev Esp Salud Pública [Internet]. 2017 [cited 2020 June 06];91:e201704028. Available from: https://www.mscbs.gob.es/bibliopublic/publicaciones/recursos_propios/resp/revista_cdrom/vol91/revisiones/rs91c_201704028.pdf

11. Almhdawi KA, Kanaan SF, Khader Y, Al-Hourani Z, Almomani F, Nazzal M. Study-related mental health symptoms and their correlates among allied health professions students. Work [Internet]. 2018 [cited 2020 Mar 03];61(3):391-401. Available from: https://doi.org/10.3233/wor-182815

12. Bozovic D, Ivkovic N, Racic M, Ristic S. Salivary cortisol responses to acute stress in students with myofascial pain. Srp Arh Celok Lek [Internet]. 2018 [cited 2020 Mar 03];146(1-2):20-25. Available from: https://doi.org/10.2298/SARH161221172B

13. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987;18(3):233-7.

14. Barros E, Alexandre NMC. Cross-cultural adaptation of the Nordic musculoskeletal questionnaire. Int Nurs Rev [Internet]. 2003 [cited 2020 Mar 03];50(2):101-8. Available from: https://doi.org/10.1046/j.1466-7657.2003.00188.x

15. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983;24(4):385-96.

16. Dias JCR, Silva WR, Maroco J, Campos JADB. Escala de Estresse Percebido aplicada a estudantes universitários: estudo de validação. Psychology, Community & Health [Internet]. 2015 [cited 2020 Mar 03];4(1):1-13. Available from: https://doi.org/10.5964/pch.v4i1.90

17. Bonzini M, Bertu' L, Veronesi G, Conti M, Coggon D, Ferrario MM. Is musculoskeletal pain a consequence or a cause of occupational stress? A longitudinal study. Int Arch Occup Environ Health [Internet]. 2015 [cited 2020 Mar 03];88(5):607-12. Available from: https://doi.org/10.1007/s00420-014-0982-1

18. Aptel MO, Cnockaert JM. Stress and work related musculoskeletal disorders of the upper extremities. Tutb Newletter. 2002;(19-20):50-6.

19. Teixeira MJ, Yeng LT, Kaziyama HHS, Ramos CA. Fisiopatologia da dor músculo-esquelética. Rev Med [Internet]. 2001 [cited 2021 Mar 20];80:63-77. Available from: https://www.revistas.usp.br/revistadc/article/view/63153

20. Batista JS, Borges AM, Wibelinger. Physical therapy to treat miofascial pain syndrome and fibromyalgia. Rev dor [Internet]. 2012 [cited 2020 June 07];13(2):170-4. Available from: https://doi.org/10.1590/S1806-00132012000200014

21. Santos RF, Freitas Junior WM, Araújo RO. Avaliação do índice de fadiga muscular de flexores e extensores de joelho em indivíduos ativos e sedentários. Rev Bras Ciênc Esporte [Internet]. 2018 [cited 2020 June 07];42: e2008. Available from: https://doi.org/10.1016/j.rbce.2018.10.002

22. Santos RR, Greco PBT, Prestes FC, Kirchhof RS, Magnago TSBS, Oliveira MA. Sintomas de distúrbios psíquicos menores em estudantes de enfermagem. Rev Baiana Enferm [Internet]. 2016 [cited 2020 Mar 03];30(3):1-14. Available from: https://doi.org/10.18471/rbe.v30i3.16060

23. Freitas-Swerts FCT, Robazzi MLCC. The effects of compensatory workplace exercises to reduce work-related stress and musculoskeletal pain. Rev Lat Am Enfermagem [Internet]. 2014 [cited 2020 Mar 03];22(4):629-36. Available from: https://doi.org/10.1590/0104-1169.3222.2461

24. Farias SMC, Teixeira OLC, Moreira W, Oliveira MAF, Pereira MO. Characterization of the physical symptoms of stress in the emergency health care team. Rev Esc Enferm USP [Internet]. 2011 [cited 2020 Mar 03];45(3):722-9. Available from: https://doi.org/10.1590/S0080-62342011000300025

25. Oliveira VC, Almeida RJ. Aspectos que determinam as doenças osteomusculares em profissionais de enfermagem e seus impactos psicossociais. J Health Sci [Internet]. 2017 [cited 2020 Mar 03];19(2):130-5. Available from: https://doi.org/10.17921/2447-8938.2017v19n2p130-135

26. Sanchez HM, Sanchez EGM, Filgueira NP, Barbosa MA, Porto CC. Dor musculoesquelética em acadêmicos de odontologia. Rev Bras Med Trab [Internet]. 2015 [cited 2020 Mar 03];13(1):23-30. Available from: https://www.rbmt.org.br/details/22/pt-br/dor-musculoesqueletica-em-academicos-de-odontologia

27. Maciel RH, Martins JCO, Pimental FHP, Pinheiro AAG. Experiência do ócio como possibilidade de prevenção à Síndrome de Burnout. Psic Rev [Internet]. 2015 [cited 2020 Mar 03];24(2):311-26. Available from: https://revistas.pucsp.br/psicorevista/article/view/27803/19631

28. Morais BX, Magnago TSBS, Cauduro GMC, Dalmolin GL, Pedro CMP, Gonçalves NGC. Fatores associados à dor musculoesquelética em estudantes de enfermagem. Rev Enferm UFSM [Internet]. 2017 [cited 2020 Mar 03];7(2):206-21. Available from: https://doi.org/10.5902/2179769226442

29. Vieira WHB, Santos EP, Trede Filho RG, Abreu BJGA. Prevalência de desconforto musculoesquelético em fisioterapeutas da rede pública hospitalar de Natal/RN. Fisioterapia Brasil [Internet]. 2015 [cited 2020 June 05];16(2):107-12. Available from: http://www.portalatlanticaeditora.com.br/index.php/fisioterapiabrasil/article/view/276/469

30. Silva JOM, Pereira Junior GA, Coelho ICMM, Picharski GL, Zagonel IPS. Engajamento entre estudantes do ensino superior nas ciências da saúde (Validação do Questionário Ultrecht Work Engagement Scale (UWES-S) com Estudantes do Ensino Superior nas Ciências da Saúde). Rev Bras Educ Med [Internet]. 2018 [cited 2020 Mar 03];42(2):15-25. Available from: https://doi.org/10.1590/1981-52712015v42n2rb20170112

31. Bardagi MP, Hutz CS. Eventos estressores no contexto académico: uma breve revisão da literatura brasileira. Interaçao Psicol [Internet]. 2011 [cited 2020 Mar 03];15(1):111-9. Available from: https://doi.org/10.5380/psi.v15i1.17085

32. Paixão MS, Tassitano RM, Siqueira GR. Prevalence of musculoskeletal discomfort and associated factors in college students. Rev Bras Promoç Saúde [Internet]. 2013 [cited 2020 Mar 03];26(2):242-50. Available from: https://doi.org/10.5020/18061230.2013.p242

33. Vitta A, Canonici AA, Conti MHS, Simeão SFAP. Prevalência e fatores associados à dor musculoesquelética em profissionais de atividades sedentárias. Fisioter Mov [Internet]. 2012 [cited 2020 Mar 03];25(2):273-80. Available from: https://doi.org/10.1590/S0103-51502012000200004

34. Malta DC, Oliveira MM, Andrade SSCA, Caiaffa WT, Souza MFM, Bernal RTI. Factors associated with chronic back pain in adults in Brazil. Rev Saude Publica [Internet]. 2017 [cited 2020 Mar 03];51(Suppl 1):9s. Available from: https://doi.org/10.1590/s1518-8787.2017051000052

35. Paglioto J, Martins J, Souza CS, Oliveira AS. Estilo de vida e nível de atividade física de indivíduos com dor no ombro atendidos em um serviço público. Rev Bras Ativ Fís Saúde [Internet]. 2017 [cited 2020 Mar 03];22(2):176-85. Available from: https://doi.org/10.12820/rbafs.v.22n2p176-185

NOTES

ORIGIN OF THE ARTICLE

Extracted from the dissertation - Musculoskeletal pain and stress in undergraduate health students, presented to the Graduate Program in Nursing of the *Universidade Federal de Santa Maria*, in 2018.

CONTRIBUTION OF AUTHORITY

Study design: Morais BX, Dalmolin GL.
Data collection: Morais BX, Pedro CMP, Bresolin JZ.
Data analysis and interpretation: Morais BX, Dalmolin GL, Magnago TSBS.
Discussion of the results: Morais BX.
Writing and/or critical review of the content: Morais BX, Dalmolin GL, Pedro CMP, Bresolin JZ, Andolhe R, Magnago TSBS.
Review and final approval of the final version: Dalmolin GL.

FUNDING INFORMATION

This study was financed by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* - Brazil (CAPES) - Finance Code 001.

APPROVAL OF ETHICS COMMITTEE IN RESEARCH

Approved by the Ethics Committee in Research with Human Beings of the *Universidade Federal de Santa Maria*, opinion No.1,888,749; Certificate of Presentation for Ethical Appreciation No. 63473317.1.0000.5346.

CONFLICT OF INTEREST

There is no conflict of interests.

EDITORS

Associated Editors: Selma Regina de Andrade, Gisele Cristina Manfrini, Natália Gonçalves, Ana Izabel Jatobá de Souza.
Editor-in-chief: Roberta Costa.

HISTORICAL

Received: April 08, 2020.
Approved: July 09, 2020.

CORRESPONDING AUTHOR

Graziele de Lima Dalmolin
grazi.dalmolin@gmail.com