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Physical activity and mental health in Brazilian university students: An analysis in different sexes during the COVID-19 pandemic

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Abstract

Study aim: To identify symptoms of depression, anxiety, and stress in Brazilian university students of both sexes and the association of physical activity parameters during the COVID-19 pandemic.
Material and methods: An online cross-sectional study was conducted from March to April 2021. Data on occupational and social variables and mental health symptoms were investigated using the Beck Anxiety Inventory, Hamilton depression rating scale, and Perceived Stress Scale questionnaires. Physical activity levels were assessed using the International Physical Activity Questionnaire.
Results: In total, 277 college students over eighteen years old participated in the study (66% female; 46.7% brown race). Higher scores and symptoms of anxiety and depression were observed in women ($p < 0.0001$). Anxiety symptoms were negatively associated with physical activity levels in women. Sedentary time, including sitting correlated with depression scores in women ($r = 0.171$; $p < 0.05$).
Conclusions: University students are a risk group for the appearance of symptoms related to mental health. In addition, these disorders occur more frequently in females, and sedentary habits, such as more time sitting, were related to higher scores in depression and anxiety.

Key words: Physical activity – Pandemic – Mental health

Introduction

Cases of infections caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus had their first cases emerged in November 2019 in Wuhan, China [1]. Then the contamination quickly spread across the world causing a global pandemic. More than 386.548.962 cases were estimated to have been confirmed, in addition to 5.705.754 deaths [37]. To contain the advance and spread of the virus, social isolation policies were adopted [27]. In this way, several places in the world have adopted the lockdown as a form of prevention. In a global analysis, it was possible to identify that the lockdown was able to promote a reduction in the incidence of COVID-19 cases [2]. However, because of the isolation and closure of places for physical activity, there was an increase in cases of a sedentary lifestyle [3, 9].

The reduction in the practice of physical activity during the coronavirus disease (COVID-19) pandemic period brought several health repercussions [10]. The pandemic was associated with an increase in BMI and with it, greater chances of developing cardiometabolic diseases, which can worsen the chances of mortality from COVID-19 [7]. In addition, problems related to sleep and well-being were observed in individuals who showed reduced levels of weekly physical activity during the pandemic [24]. Changes in the pattern of sleep and physical activity in the context of health were raised as factors that contribute to an increase in the occurrence of psychological diseases, such as depression, anxiety, and stress [30]. During the pandemic, there was a significant increase in the diagnosis of mental

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illnesses. Among these disorders, there was an increase of 26.3% in cases of anxiety and 27.8% in depression when compared before and after the pandemic period [12]. These data were more expressive in individuals who live alone, which may have been accentuated by social isolation [13]. In addition, the practices of studying and working from home contributed to the increase in stress [31]. Within this context, students and women are the groups most affected by mental fatigue during the period of isolation [16]. These changes on health in general seem to compromise specific groups. Among these groups, university students present themselves as a vulnerable group, due to the psychological conditions and workload to which they are exposed [17]. In addition, they are a critical group that goes through a transition between adolescence and adulthood. Among the most common mental health problems among students, depression, anxiety, and stress stand out, which can be aggravated by sedentary behavior [38].

In this sense, evidence demonstrates the importance of establishing changes linked to lifestyle to promote mental well-being in young people, including the practice of physical activity [18]. Biddle et al. conducted a scope review study to summarize the main effects of physical activity on mental health and cognitive function in children and adolescents. The authors observed that the absence of regular practice of a physical activity is associated with impairments in mental health, including increased levels of anxiety as well as worsening in cognitive functions including academic performance [18]. Corroborating the findings, Vankim and Nelson, 2013 point out that university students who do not meet the recommendations for aerobic physical activities or resistance at vigorous intensity are more likely to develop harm to mental health, increasing, for example, perceived stress. In this sense, it is evident from highly reliable evidence that establishing higher levels of physical activity can prevent the onset of mental and cognitive disorders, leading to an improvement in quality of life, health, and academic performance in these subjects [19]. Given this scenario, the objective of the present study was to identify symptoms of depression, anxiety, and stress in Brazilian university students of both sexes and the association of physical activity parameters during the COVID-19 pandemic period.

Materials and methods

Sample characteristics

In total, 277 university students participated in the study. Only 257 answered all questions, and the questions asked for a sample composition. In its composition, a sample consisted of 66% female participants, with a median age of 22 years (17–27 years) and a predominance of brown race (46.7%). Regarding occupation, 64.1% of the studies study and work, with most studies in the health area (78%) and a median of 30 hours of work per week (4–97 hours). The description of the social and occupational variables of university students during the COVID-19 pandemic period can be found in Table 1.

Study type

This study is a cross-sectional and descriptive.

Data collection and sample

Data were collected from March 2021 to April 2021 using convenience sampling, and data collection carried out through an online questionnaire made available through the Google forms platform. Data extracted from the electronic questionnaire was imported into an Excel spreadsheet for further data analysis. University students, aged over eighteen and of both sexes, were recruited voluntarily from public and private universities in the state of Pernambuco. Healthy university students who do not have diagnosed neurological disorders or who are under continuous use of medication for psychosomatic illnesses were included in the present study. During the development period of the present study, all participants are negatively diagnosed for SARS-CoV2. Subjects who did not respond to the questionnaires requested the appropriate variables of the present study be excluded. A priori sample calculation was performed using the G Power 3.1 software, with the following coefficient values: Effect size f = 0.45, $\alpha = 0.05$ (5%), power $(1 - \beta) = 0.95$, numerator, number of groups = 2, Critical t: 1,969, Denominator df = 257, reaching a final sample size calculation of 272 subjects.

Variables

Social and occupational variables

Participants were asked about gender, date of birth, race, area of the undergraduate course, hours of work per week, type of occupation (study or study and work).

Mental health symptoms

Beck Anxiety Inventory. To measure the state of anxiety, the Beck Anxiety Inventory (BAI) was used [5]. This scale has been validated for the study population [14] and consists of a self-report scale that measures the intensity of anxiety symptoms, consisting of 21 items, which are descriptive statements of anxiety symptoms and that should be evaluated by the subject with reference to himself, on a 4-point scale that reflects levels of increasing severity of each symptom: 1. Not; 2. Slightly: it didn't bother me much; 3. Moderately: It was very unpleasant, but I could bear it; 4. Severely: I could hardly bear it. The total score is the result of the sum of the scores of the individual items.

Table 1. Description of social and occupational variables of university students during the period of the COVID-19 pandemic

Variables	
Sex % (n)	
Female	66 (171)
Male	33.2 (86)
Age, median (maximum – minimum values)	22 (17–27)
Race	
Brown	46.7 (121)
Black	16.2 (42)
White	29.3 (76)
Yellow	5.8 (15)
Indigenous	1.2 (3)
Occupation % (n)	
Only study	35.1 (91)
Study and work	64.1 (166)
Undergraduate course area % (n)	
Health sciences	78 (202)
Exact sciences	10.8 (28)
Human sciences	9.3 (24)
Hours of work per week, median (maximum-minimum values)	30 (4–97)

Hamilton depression rating scale (HAM-D). This scale investigates the presence of symptoms of depression in the last seven days, including the day of application [15]. The translated and adapted version for the Brazilian population was used [19]. This scale is composed of 17 items to 24 items, whose score varies according to the number of items: 0 to 9 = normal; 8 to 18 = mild depression; 14 to 26 = moderate; 20 to 34 = severe depression; ≥ 26 = very severe depression.

Perceived Stress Scale (EPS-10). EPS-10 assesses the expression of feelings and thoughts during the last 30 days (last month). It consists of 10 questions that consider four score ranges: 0, Never; 1, Almost Never; 2, Sometimes; 3, Infrequent; 4, Very Frequent [11].

Self-reported physical activity. Physical activity parameters were assessed using the International Physical Activity Questionnaire (IPAQ). This instrument was validated and has reproducibility for the Brazilian population [28]. The short version containing eight questions was used. This questionnaire considers activities of daily living, stratifying them according to frequency (days/week), duration (minutes), and moderate or vigorous intensity.

Ethics statement

To participate in the present study, the participants authorized their participation through the free and informed consent form provided at the beginning of the digital questionnaire. Only those who agreed to carry out the study proceeded with the next steps. All personal data were kept confidential. The present study was approved by the ethics committee in studies using humans with registration number 40277620.4.0000.8727 and followed the Declaration of Helsinki.

Statistical analysis

Initially, an exploratory analysis of the data was performed, followed by the Komolgorov Smirnov normality test ($n > 50$). Then, data was expressed as mean and standard deviation. For comparison between means, we used the Mann-Whitney test. For significance, $p < 0.05$ were established. All analyses were performed using Graph-

Pad Prism version 9 software (GraphPad Software Inc, La Jolla, CA, USA).

Results

Mental health outcomes

Females had higher anxiety scores than males ($p < 0.0001$). In addition, there was a higher prevalence of anxiety symptoms in women when compared to men, except for symptoms of feeling hot. The data are described in table 2. Regarding the total score and symptoms of depression, it was observed that there was a higher score in women compared to men ($p < 0.0001$). In addition, symptoms such as depressed mood, guilt, suicide, initial insomnia, work and activity, psychic anxiety, somatic anxiety, gastrointestinal symptoms, diurnal variation, paranoid, and obsessive symptoms were more prevalent in female subjects (Table 3).

Correlation between anxiety, depression, and stress scores and IPAQ categories

Correlation analyses are described in table 4. Beck's inventory score was negatively correlated with the frequency of moderate activity per week and walking time in females. In both sexes, there were weak correlations between sitting time (hours per week and weekend). There were no correlations between both sexes between the IPAQ categories and EPS-10 score. Hamilton Depression Score showed weak correlations with sitting time hours per week and weekend in females.

Table 2. Comparison between the sexes of university students by score and anxiety symptoms assessed by the Beck inventory during the COVID-19 pandemic

Tool	Female	Male	p
Beck Inventory Score	19.94 ± 13.93	9.32 ± 7.43	<0.0001
Symptoms			
Numbness/Tingling	0.888 ± 0.97	0.325 ± 0.64	0.001
Heat Sensation	1.158 ± 0.88	1.000 ± 0.93	0.149
Legs tremor	0.584 ± 0.90	0.174 ± 0.46	0.0001
Unable to relax	1.433 ± 1.06	0.767 ± 0.82	<0.0001
Bad events	1.731 ± 0.96	1.140 ± 0.94	<0.0001
Confused or Delusional	0.748 ± 1.08	0.290 ± 0.63	0.001
Accelerated Beats	1.234 ± 1.03	0.546 ± 0.79	<0.0001
Insecure	1.784 ± 1.02	0.872 ± 0.87	<0.0001
Terrified	0.918 ± 1.09	0.348 ± 0.73	<0.0001
Nervous	1.474 ± 1.01	0.976 ± 0.88	0.0002
Suffocation	0.777 ± 1.01	0.255 ± 0.61	<0.0001
Hands tremor	0.725 ± 0.96	0.337 ± 0.71	0.0008
Trembling	0.578 ± 0.18	0.186 ± 0.58	<0.0001
Lose control	1.251 ± 1.174	0.569 ± 0.93	<0.0001
Difficulty Breathing	0.924 ± 0.964	0.255 ± 0.61	<0.0001
Fear to die	0.947 ± 1.06	0.500 ± 0.74	0.001
Scared	0.918 ± 0.95	0.395 ± 0.74	<0.0001
Abdominal Discomfort	0.953 ± 1.02	0.255 ± 0.55	<0.0001
Fainting	0.146 ± 0.46	0.000 ± 0.00	0.001
Facial Flushing	0.426 ± 0.83	0.023 ± 0.15	<0.0001
Sweating	0.573 ± 0.88	0.104 ± 0.34	<0.0001

Table 3. Comparison between the sexes of university students by score and symptoms of depression assessed by the Hamilton scale during the COVID-19 pandemic

Tool	Female	Male	p
Hamilton Depression Scale	10.25 ± 5.35	6.98 ± 4.23	<0.0001
Symptoms			
Depressed mood	1.865 ± 1.23	0.848 ± 1.13	<0.0001
Guilt feeling	1.035 ± 0.95	0.604 ± 0.89	0.0003
Suicide	0.257 ± 0.69	0.069 ± 0.39	0.008
Initial Insomnia	0.918 ± 0.74	0.837 ± 0.76	<0.0001
Intermediate insomnia	0.672 ± 0.57	0.639 ± 0.57	0.678
Late Insomnia	0.157 ± 0.43	0.006 ± 0.29	0.088
Jobs and Activities	0.497 ± 0.73	0.337 ± 0.72	0.023
Delay	0.046 ± 0.23	0.000 ± 0.00	0.099
Agitation	0.128 ± 0.42	0.186 ± 0.54	0.549
Psychic Anxiety	0.245 ± 0.73	0.069 ± 0.39	0.002
Somatic Anxiety	1.053 ± 0.67	0.802 ± 0.54	0.003
Gastrointestinal Symptoms	0.064 ± 0.24	0.000 ± 0.00	0.017
Somatic Symptoms	0.140 ± 0.36	0.069 ± 0.25	0.135
Genital Symptoms	0.011 ± 0.10	0.000 ± 0.00	0.553
Hypochondria	0.070 ± 0.35	0.081 ± 0.38	0.931
Weight loss	0.000 ± 0.00	0.000 ± 0.00	0.304
Disease Awareness	1.322 ± 0.87	1.419 ± 0.86	0.373
Diurnal Variation	0.491 ± 0.59	0.220 ± 0.47	0.0002
Depersonalization and Derealization	0.386 ± 0.73	0.314 ± 0.63	0.628
Paranoid Symptoms	0.514 ± 0.73	0.279 ± 0.52	0.010
Obsessive Symptoms	0.333 ± 0.55	0.139 ± 0.34	0.005

Table 4. Correlation between IPAQ categories and Beck Inventory, Hamilton Depression scores in both sexes during the COVID-19 pandemic

IPAQ Categories	Beck Inventory Score		EPS-10 Score		Hamilton Depression Score	
	Female	Male	Female	Male	Female	Male
Frequency of Moderate per week	–0.154 **(0.045)**	–0.025 (0.842)	–0.008 (0.907)	0.060 (0.581)	–0.141 (0.065)	–0.006 (0.953)
Moderate Physical Activity (minutes)	–0.102 (0.182)	0.104 (0.363)	0.042 (0.583)	0.084 (0.437)	–0.118 (0.122)	0.065 (0.547)
Walk time	–0.167 **(0.031)**	–0.011 (0.920)	–0.013 (0.864)	–0.058 (0.606)	–0.061 (0.428)	–0.091 (0.414)
Sitting time (hours per week)	0.188 **(0.017)**	0.275 **(0.012)**	0.117 (0.137)	–0.098 (0.402)	0.157 **(0.048)**	–0.102 (0.387)
Sitting time (weekend)	0.186 **(0.026)**	0.216 **(0.045)**	0.138 (0.100)	–0.159 (0.191)	0.171 **(0.041)**	–0.101 (0.407)
Vigorous physical activity per day	0.013 (0.863)	–0.072 (0.515)	–0.034 (0.657)	–0.126 (0.247)	–0.054 (0.483)	–0.184 (0.089)

IPAQ – International Physical Activity Questionnaire.

Discussion

The present study sought to identify symptoms of depression, anxiety, and stress in Brazilian university students of both sexes and the association of physical activity parameters during the COVID-19 pandemic. University students present themselves as a risk group for the development of sedentary behavior and psychological disorders [22, 35]. In university students, a reduction in the level of physical activity is related to a reduction in quality of life, as well as a relationship with age and gender [30]. The reduction in physical activity levels often occurs in students in the health area, which was the predominant sample in the present study [29]. The sedentary behavior common in university students was accentuated after the installation of the COVID-19 pandemic. During the installation of restrictions such as the lockdown, an increase in sedentary behaviors was observed, such as increased daily sitting time [31, 33] and a reduction of minutes spent per week of moderate to vigorous physical activity [6]. Along the same lines as the increase in sedentary behavior, changes in mental health parameters have been observed [34].

On the other hand, evidence demonstrates that intervention with physical activity in university students can act positively on different health parameters. Herbert et al., 2020 evaluated 185 German university students of both sexes and the effects of aerobic physical exercise for six weeks on parameters of mental health and well-being. At the end of the intervention, it was observed that physical activity was negatively related to self-reported depression, anxiety, and perception of psychosomatic stress. The authors conclude that the applicability of even acute physical activity/exercise strategies can bring better mental health and well-being in this type of population [17]. In another recent review study, Herbert 2022 summarizes the main impacts of programs based on physical activity and exercises on the physiological and psychological health of university students, suggest that exercise interventions that include low to moderate-intensity aerobic exercise may help improve mental health (alleviate depressive symptoms and perceived stress) among college students. Furthermore, acute bouts of exercise including yoga seem effective in the modifying perception of body signals, cardiac activity, and processing of emotions after exercise. The scientific literature emphasizes the importance of integrated investigations between psychological and physiological factors that promote an active lifestyle and strengthen mental health and well-being in university students [18].

During the COVID-19 pandemic, greater reporting of problems associated with mental health can be identified. An increase in cases of depression, anxiety and stress was observed in different populations and in different age groups [32]. As in the present study, Lelisho et al. [2022] found that 39.5% of college students from Ethiopia had symptoms of depression. This prevalence is positively associated with the female sex, use of alcohol, smoking, and problems with sleep quality [25]. These symptoms can be even more expressive in low- and middle-income regions, such as Brazil [4].

In the present study, the results showed that the female audience was found to be more vulnerable to psychiatric problems. Similarly, Lee et al. [2022] observed that women were at greater risk of developing anxiety and stress than men during the COVID-19 pandemic period [23]. In an animal model, pregnant rats exposed to stress due to mobility restriction showed disorders in lipid metabolism linked to depression, being more expressive in females when compared to males [20]. In humans, studies indicate that variations in the levels of chemokines, such as MIP-1α/CCL3, MIP-1β/CCL4, MCP-1/CCL2, MIP-3α/CCL20, RANTES/CCL5 may be higher in women with anxiety and depression [8]. Furthermore, changes in LPS-stimulated cytokine levels were greater in women with depressive symptoms, perceived stress, and rumination disorder. Therefore, gender may be a key factor in the development of mental health problems, due to changes in inflammatory responses [21].

The presence of symptoms of anxiety and depression related to the time of activity of sedentary activity. In a recent review, it was observed that increased physical activity was associated with reduced symptoms of anxiety, anxiety, and stress during the first year of the COVID-19 pandemic (July 2021). In agreement with the present study, women were also more vulnerable to mental problems [26]. In Chinese university students, it was also observed that higher activity levels were associated with a reduction in anxiety and depression. In addition, activities such as stretching, and resistance training were negatively correlated with increased symptoms of anxiety and depression [36].

The present study showed that during the COVID-19 pandemic period, university students are a risk group for the appearance of symptoms related to mental health, such as depression, stress, and anxiety. In addition, these disorders occur more frequently in females. It was also possible to observe that sedentary habits, such as more time sitting, were related to higher scores in depression and anxiety. Furthermore, the mental and physiological health of university students deserves to receive fundamental attention from public and private entities linked to education and health. Among these strategies, we can mention the construction and expansion of places linked to the practice of physical activities, aiming to significantly increase their regular levels, mainly in moderate and vigorous intensity, frequently three times a week at least, to promote psychophysiological adaptations in these students. Linked

to these recommendations, attention and care should also be applied to mental health, valuing the performance of the psychology professional in the prevention, treatment, and rehabilitation of different psychosomatic disorders, including stress, anxiety, and depression. The use of these strategies in an integrated way guarantees a better quality of health and longevity

Conflict of interest: Authors state no conflict of interest.

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