

Originales

Physical activity level, depression and anxiety of physical education student

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ABSTRACT

Aim: To investigate the association of physical activity levels (PA) with the presence of anxiety and depression symptoms among undergraduate students in a higher education program. **Method:** This correlational, quantitative study was conducted with 180 undergraduate students in Physical Education. The Hospital Anxiety and Depression Scale (HAD) and the International Physical Activity Questionnaire - Short Form (IPAQ-SF) were used. Descriptive analyses, network analysis, and ordinal logistic regression were applied to estimate associations between PA levels and symptoms of anxiety and depression. **Results:** The mean age was 21.84 (± 3.48) years, and 51.1% were male. The 49.4% of the students presented anxiety symptoms, and 30% reported depressive symptoms. Vigorous PA showed a negative association with five of the seven HAD-D items and with one item of the HAD-A. In logistic regression, PA showed no statistically significant association with anxiety or depression, although moderate (OR=0.94; $p=0.096$) and vigorous PA (OR=0.93; $p=0.071$) showed a protective tendency for depressive symptoms. Male gender was a significant predictor of a lower risk for anxiety (OR=0.31; $p<0.001$). **Conclusion:** The prevalence of mild to severe anxiety and depressive symptoms is relevant among university students. Although PA did not show a significant association, a protective tendency was observed for moderate and vigorous PA, especially for depressive symptoms. The gender factor was consistent, reinforcing the importance of differentiated and multidimensional approaches.

Keywords: depressive disorder; anxiety disorders; physical exercise.

Nivel de actividad física, depresión y ansiedad en estudiantes de Educación Física

RESUMEN

Objetivo: Investigar la asociación de los niveles de actividad física con la presencia de síntomas de ansiedad y depresión en estudiantes de pregrado en un programa de educación superior. **Método:** Este estudio cuantitativo correlacional se realizó con 180 estudiantes de pregrado de Educación Física. Se utilizaron la Escala de Ansiedad y Depresión Hospitalaria (HAD) y el Cuestionario Internacional de Actividad Física - Forma Corta (IPAQ-SF). Se aplicaron análisis descriptivos, análisis de red y regresión logística ordinal para estimar asociaciones entre los niveles de actividad física y los síntomas de ansiedad y depresión. **Resultados:** La edad media fue de 21,84 ($\pm 3,48$) años y el 51,1% eran varones. El 49,4% de los estudiantes presentó síntomas de ansiedad y el 30% presentó síntomas depresivos. La actividad física vigorosa se asoció negativamente con cinco de los siete ítems de la HAD-D y con un ítem de la HAD-A. En la regresión logística, la actividad física no mostró una asociación estadísticamente significativa con la ansiedad o la depresión, aunque la actividad física moderada (OR=0,94; $p=0,096$) y vigorosa (OR=0,93; $p=0,071$) mostró una tendencia protectora para los síntomas depresivos. El género masculino fue un predictor significativo de un menor riesgo de ansiedad (OR=0,31; $p<0,001$). **Conclusión:** La prevalencia de síntomas de ansiedad y síntomas depresivos de moderados a severos es relevante entre los estudiantes universitarios. Aunque la actividad física no mostró una asociación significativa, se observó una tendencia protectora para la actividad física moderada y vigorosa, especialmente para los síntomas depresivos. El factor género fue consistente, lo que refuerza la importancia de los enfoques diferenciados y multidimensionales.

Palabras clave: trastorno depresivo; trastornos de ansiedad; ejercicio físico.

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Nível de atividade física, depressão e ansiedade em estudantes de Educação Física

RESUMO

Objetivo: Investigar a associação entre os níveis de atividade física e a presença de sintomas de ansiedade e depressão em estudantes de graduação de um programa de ensino superior. **Método:** Este estudo quantitativo correlacional foi realizado com 180 estudantes de graduação em Educação Física. Utilizaram-se a Escala Hospitalar de Ansiedade e Depressão (HAD) e o Questionário Internacional de Atividade Física – Versão Curta (IPAQ-SF). Foram aplicadas análises descritivas, análise de rede e regressão logística ordinal para estimar associações entre os níveis de atividade física e os sintomas de ansiedade e depressão. **Resultados:** A idade média foi de 21,84 ($\pm 3,48$) anos e 51,1% eram homens. Observou-se que 49,4% dos estudantes apresentaram sintomas de ansiedade e 30% apresentaram sintomas depressivos. A atividade física vigorosa associou-se negativamente a cinco dos sete itens da HAD-D e a um item da HAD-A. Na regressão logística, a atividade física não apresentou associação estatisticamente significativa com ansiedade ou depressão, embora a atividade física moderada (OR=0,94; $p=0,096$) e vigorosa (OR=0,93; $p=0,071$) tenha mostrado uma tendência protetora para os sintomas depressivos. O gênero masculino foi um preditor significativo de menor risco de ansiedade (OR=0,31; $p<0,001$). **Conclusão:** A prevalência de sintomas de ansiedade e de sintomas depressivos moderados a graves é relevante entre estudantes universitários. Embora a atividade física não tenha apresentado associação significativa, observou-se uma tendência protetora da atividade física moderada e vigorosa, especialmente para os sintomas depressivos. O fator gênero mostrou-se consistente, reforçando a importância de abordagens diferenciadas e multidimensionais.

Palavras-chave: transtorno depressivo; transtornos de ansiedade; exercício físico.

INTRODUCTION

Depressive disorders are characterized by a sad, empty, or irritable mood, often accompanied by somatic and cognitive changes that significantly interfere with the individual's functional capacity. Anxiety disorders, on the other hand, share characteristics of excessive fear and anxiety, as well as associated behavioral changes, such as avoidant behavior. Both are classified as common mental disorders due to their high prevalence in the global population^{1,2}. In both cases, the symptoms are excessive and persistent, distinguishing them from transient emotional manifestations, such as sadness or fear, which are part of everyday human experience^{1,2}.

Physical exercise has been widely studied as a relevant factor in the prevention and treatment of common mental disorders, especially depression. The scientific literature highlights that its beneficial effects are related to several biological mechanisms, including increased serotonin release, increased expression of neuronal growth factors, beta-endorphin release, and stimulation of the hypothalamic-pituitary-adrenal axis. These processes result in direct effects on mood regulation and may also act indirectly by promoting neurogenesis in the hippocampus. Additionally, changes in parasympathetic vagal activity have been observed, contributing to physiological changes such as resting bradycardia. Psychosocial aspects, such as improved self-esteem and strengthened social support, are also identified as relevant mediators of these effects³.

Despite the methodological diversity and dose-response variability of the antidepressant effects of physical activity (PA), recent evidence reinforces its therapeutic efficacy. A systematic review with meta-analysis, involving 41 studies and 2,264 participants, concluded that physical exercise is effective in treating depression, recommending supervised moderate-intensity activities, preferably aerobics⁴. In addition to its effects on depression, there is consistent evidence that PA has a positive impact on anxiety symptoms in different adult populations. Studies suggest that exercise acts as an adjunctive treatment for anxiety disorders, including generalized anxiety disorder, although its efficacy is lower than that of traditional pharmacological treatment. Nevertheless, the literature emphasizes the need for methodologically robust investigations to define optimal PA dosage parameters aimed at preventing and managing these symptoms^{5,6}. The use of supervised exercise has even been incorporated into international clinical guidelines, such as those of the World Health Organization (WHO) and the Canadian Network for Mood and Anxiety Treatments (CANMAT) and is recommended

as first-line monotherapy for mild depression and as second-line adjunct treatment for moderate cases. These recommendations reflect the recognition of PA as a safe and effective therapeutic alternative, especially for individuals who cannot tolerate the adverse effects of medications or who prefer non-pharmacological approaches^{2,4,7}.

The WHO² highlights that the number of people with common mental disorders is growing globally, particularly in low- and middle-income countries, where the consequences in terms of morbidity and loss of quality of life are significant. In this context, investigating the relationship between PA and mental health in university students becomes relevant, considering the academic and psychosocial demands that can contribute to the emergence of anxiety and depression symptoms. Thus, the present study aimed to describe the prevalence of anxiety and depression symptoms and analyze their association with the level of PA and sociodemographic characteristics of Physical Education (PE) students.

METHODS

This is a cross-sectional and correlational study with a quantitative approach⁸. The project was registered (CAAE: 83169524.5.0000.5055) and approved by the Research Ethics Committee of the Regional University of Cariri, Brazil (approval number 7315821). All participants provided written informed consent.

Participants

The convenience sample included Physical Education (PE) students from the Regional University of Cariri (Brasil) in December 2024. Inclusion criteria were being regularly enrolled in the course, being over 18 years old, and agreeing to participate voluntarily. The final sample consisted of 180 participants, resulting in a 60% response rate. The mean age was 21.84 ± 3.48 years, 51.1% identified as male, and 54% reported receiving assistance from social programs.

Measures

Anxiety and depressive symptoms were assessed using the Hospital Anxiety and Depression Scale (HAD)^{9,10}. The instrument comprises 14 items divided equally between anxiety (HAD-A) and depression (HAD-D) subscales, scored from 0 to 21. Scores of 0–7 indicate the absence of symptoms, 8–10 mild, 11–14 moderate, and ≥ 15 severe symptoms. The scale has good sensitivity and specificity

(≈0.80) and is validated for the Brazilian population⁹. The PA level was assessed using the International PA Questionnaire – Short Form (IPAQ-SF), validated for the Brazilian population^{11,12}. The instrument estimates weekly time spent walking and performing moderate and vigorous physical activities, calculated by multiplying frequency (days per week) and duration (minutes per day).

STATISTICAL PROCEDURES

Descriptive statistics were used to characterize the sample (means and standard deviations for continuous variables; absolute and relative frequencies for categorical variables). Network Analysis was applied to explore relationships between PA, anxiety, and depression variables, using a Markov Random Fields model with L1 penalty (LASSO). The regularization parameter (Lambda) was selected via the Extended Bayesian Information Criterion (EBIC = 0.25). Network visualization followed the Fruchterman–Reingold algorithm¹³, and centrality measures (betweenness, closeness, and strength) were used to identify the most influential variables. Additionally, Ordinal Logistic Regression (Proportional Odds Model) was applied using SPSS v27 to assess associations between PA levels and anxiety or depression symptoms. Dependent variables were the ordinal HAD categories (“unlikely,” “possible,” and “probable”), and PA was entered as a continuous variable (weekly hours of light, moderate, and vigorous PA). Results are presented as coefficients (β), p-values, and odds ratios (ORs), with significance set at p<0.05.

RESULTS

The two questionnaires (HAD and IPAQ-SF) were distributed to students from the first to eighth semesters of the PE course who were present in the classroom during the survey visit, totaling a sample of 180 participants. Only one student was excluded due to inadequate completion of the HAD, while four students were excluded due to inadequate completion of the IPAQ-SF. Therefore, the data from these five participants were not considered in the calculation of the results. Completing the questionnaires took approximately 10 to 15 minutes in each classroom. The sociodemographic results and responses to the HAD questionnaire indicated that the participants were, on average, 21.84 ± 3.48 years old, and 92 (51.1%) identified as male. When applying HAD, it was observed that 91 (50.6%) students did not report anxiety symptoms, 69 (38.4%) had mild symptoms, and 20 (11.1%) reported moderate to severe symptoms. Regarding depressive symptoms, 126 (70%) students had no symptoms, 49 (27.2%) had mild symptoms, and only 5 (2.8%) reported moderate to severe symptoms. Next, the results of the IPAQ questionnaire, which assessed days and minutes of PA per day, as well as time spent sitting per week showed that approximately 87.6% of the students reported light PA, 84.4% reported moderate PA, and 77.4% vigorous PA. The average time spent on light PA was 77.54 minutes, on moderate activity was 99.46 minutes, and on vigorous activity was 91.36 minutes total.

Figure 1 presents the correlations between the component variables anxiety, depression, PA, and sedentary behavior from a network perspective. The analysis showed that the set of items in each questionnaire was connected and related to each other, as were the items in the HAD-A and HAD-D subscales that make up a single

questionnaire. The sedentary behavior variables, on the other hand, had fewer connections with the other nodes in the network. Variable 1 (semester) was the node with the least relevance in the network, having the lowest centrality values (Betweenness: -0.89356230; Closeness: -2.38925470; Strength: -2.40132539). It can also be observed that variable 2 (gender) was less strongly connected to the items on anxiety symptoms and did not present a significant relationship with depressive symptoms. The variable with the greatest proximity and expected influence in the model was node 23 (vigorous PA), which showed a negative association with five of the seven HAD-D items and the same association with one HAD-A variable, identified by node 7 - "I have a bad feeling of fear, like butterflies in my stomach or a tight feeling in my stomach." The relationship between the other six items on this subscale was not significant.

Furthermore, the findings infer that higher score on the individual items "I (often or almost always) have a bad feeling of fear, like butterflies in my stomach or a tight feeling in my stomach" from the HAD-A and "I (never or rarely) feel happy" from the HAD-D, as well as vigorous PA, interfere with and modify the other variables present in the network. Thus, they proved to be sensitive to the effect of future interventions, being the variables that would spread their effect most rapidly throughout the network.

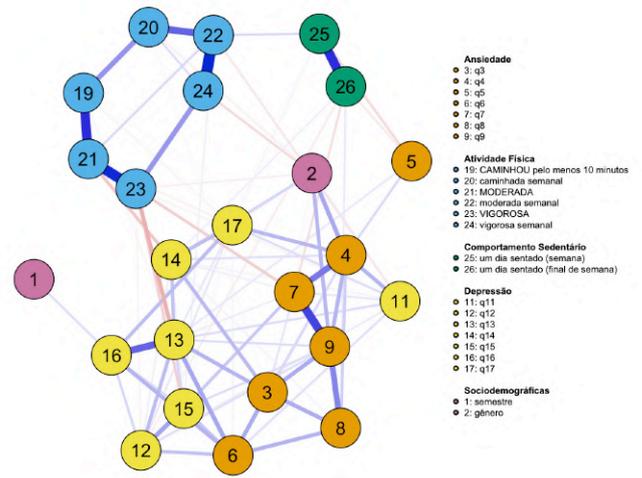


Figure 1. Associations between anxiety, depression, PA, and sedentary behavior variables from a network perspective. Q question.

The results in Table 1 show that the PA variables (light, moderate, and vigorous) were not significantly associated with anxiety levels. The only significant predictor was gender: males were approximately 69% less likely (OR=0.31; p<0,001) to be in higher anxiety categories compared to females. This suggests that gender is a more significant factor than PA in explaining anxiety in this sample.

For depression, Table 2 shows that the PA variables showed protective tendencies, especially moderate and vigorous PA, which indicated a lower chance of depressive symptoms, although without reaching conventional statistical significance (p<0.05). Male gender also showed a protective effect (OR=0.51), but marginally (p=0.060).

Table 1. Ordinal logistic regression between PA and anxiety.

Variable	Coefficient β	p	OR
Light PA (h)	-0,004	0,827	0,996
Moderate PA (h)	0,004	0,846	1,004
Vigorous PA (h)	-0,011	0,639	0,989
Male	-1,170	<0,001	0,310

P significance level; OR odds ratio; H hours.

Table 2. Ordinal logistic regression between PA and depression.

Variable	Coefficient β	<i>p</i>	OR
Light PA (h)	0.012	0.582	1,012
Moderate PA (h)	-0.063	0096	0,939
Vigorous PA (h)	-0.077	0.071	0,926
Male	-0.669	0.060	0,512

P significance level; OR odds ratio; H hours.

DISCUSSION

The main findings of the current status showed, among university students, the prevalence of mild-moderate and severe anxiety and depressive symptoms ranged from 30 to 50%, approximately. Moreover, PA did not show a significant association, but a protective tendency was observed for moderate and vigorous PA, especially for depressive symptoms. Males were less likely to be in higher anxiety and depression categories compared to females.

Ghrouz et al.¹⁴ conducted a cross-sectional study to examine the effects of PA on the mental health of 617 Indian university students, using the HAD and IPAQ-SF scales, as in our study. Some similar results were found, such as a mean age of 23.4 years, 314 of whom were male (51%), a higher prevalence of anxiety (30%) than depressive symptoms (18%), and a higher prevalence of light-intensity PA (51%). The main differences were found in the prevalence rates of the variables studied. Our results showed a higher prevalence of PA intensity, compared to the Indian study.

There are several studies in the literature that have proposed evaluating the relationship between depressive and/or anxiety symptoms and PA in a variety of populations. Regarding anxiety disorders, exercise appears to be effective as an adjunctive treatment, but it is less effective compared to pharmacological treatment. Meta-analyses of studies on depressive symptoms show that usual and increasing levels of moderate to vigorous PA are inversely associated with the incidence of depression regardless of global region, sex, age, or follow-up period^{4,15}.

Network analysis has been used in studies of complex and multidimensional associations as a statistical alternative to better describe the relationships between multiple variables. It offers the advantage of providing a graphical representation of how these interactions occur, enabling practical interventions after analyzing the results^{16,17}. In our study, the network analysis approach allowed us to assess the relationships between depressive and anxiety symptoms and PA based on the items on each scale. This type of analysis demonstrates how individual items on the scale can contribute differently to each association, as assessed by van Wanrooij et al.¹⁸, who, in a study of 3,526 older adults, verified the relationship between items on the Geriatric Depression Scale and functional loss and risk of dementia in these patients.

Our results showed that the variable with the greatest proximity and the greatest expected influence on the network was vigorous PA. Strategies and actions that encourage this practice would have a direct impact on the variables "I (no longer) feel like I like the same things as before", "I (can no longer) laugh and have fun when I see funny things", "I (never or rarely) feel happy", "I have lost interest in taking care of my appearance" and "I (almost never or rarely) feel pleasure when I watch a good television or radio program or when I read something" identified as depressive symptoms in the HAD-D items and on the variable "I (often or almost always) have a bad feeling of fear, like butterflies in my stomach or a tightness in my stomach" identified as an anxious symptom in the HAD-A items.

Given that the seven items that comprise the depression subscale were largely centered on the notion of anhedonia^{9,10}, our results relate to a recent study by Hird et al.¹⁹ which proposes that physical exercise initially specifically improves symptoms of the "activity of interest" axis of depression (anhedonia, fatigue,

and subjective cognitive impairment) by decreasing systemic inflammation and consequently increasing dopamine transmission, increasing the propensity to exert effort. These considerations may be important in the development of new intervention strategies, particularly by encouraging personalized interventions for patients.

CONCLUSION

This study found a relevant prevalence of mild to severe anxiety and depressive symptoms among PE students. Although total PA was not significantly associated with symptoms, a protective trend of moderate and vigorous PA was observed, especially against depression. Network analysis revealed the distinct contribution of specific scale items, highlighting the need for multidimensional interventions. Gender emerged as a consistent factor, with males being less likely to experience both symptoms than females. These findings reinforce the importance of gender analysis but also PA that requires of longitudinal studies to better determine the protective role of PA on the mental health of this population.

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