Original Article

Association between anxiety symptoms and preference for exercise intensity: a cross-sectional study

Associação entre sintomas de ansiedade e preferência de intensidade de exercício: um estudo transversal

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ABSTRACT

Introduction: The literature highlights the benefits of regular physical exercise in the treatment of anxiety; however, the preference for exercise intensity has been little explored. Objective: To investigate the association between anxiety symptoms and exercise intensity preference in physically active adults. Methods: A cross-sectional study recruited 639 participants classified as active or very active between August 2022 and October 2023. Of these, 108 presented anxiety symptoms (~16.9%) and 531 did not (~83.1%). Exercise intensity preference and anxiety symptoms were assessed using the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) and Generalized Anxiety Disorder-7 (GAD-7), respectivel. Associations were analyzed using crude and adjusted logistic regression models. Results: Of the 108 symptomatic participants, 39 were male (36.1%; 44.1 ± 10.6 yrs; 1.75 ± 0.07 m; 86.2 ± 14.1 kg; GAD = 11.9 ± 3.4) and 69 were female (63.9%; 42.5 ± 8.8 yrs; 1.63 ± 0.06 m; 68.9 ± 13.4 kg; GAD = 13.0 ± 3.7). Among the 531 non-symptomatic participants, 324 were men (61.1%; 47.3 ± 11.1 yrs; 1.75 ± 0.06 m; 85.2 ± 14.9 kg; GAD = 2.7 ± 2.4) and 207 were women (38.9%; 44.9 ± 9.6 yrs; 1.63 ± 0.06 m; 67.9 ± 12.3 kg; GAD = 3.5 ± 2.3). No association was observed between anxiety symptoms and exercise intensity preference, in either the crude model (p = 0.44) or the adjusted model (p = 0.79). Conclusion: Anxiety symptoms were not associated with exercise intensity preference in physically active adults.

Keywords: Mental health; Physical activity levels; Anxiety disorder; Generalized anxiety disorders; Cross-sectional study.

RESUMO

Introdução: A literatura aponta para benefícios da prática regular de exercícios físicos no tratamento da ansiedade, entretanto a preferência pela intensidade foi pouco explorada. Objetivo: Investigar a associação entre sintomas de ansiedade e preferência por intensidade de exercício em adultos fisicamente ativos. Métodos: Estudo transversal que recrutou 639 participantes classificados como ativos ou muito ativos entre agosto de 2022 e outubro de 2023. A preferência pela intensidade de exercício e os sintomas de ansiedade foram avaliados, respectivamente, pelo Questionário de Preferência e Tolerância à Intensidade do Exercício (PRETIE-Q) e pela escala de Transtorno de Ansiedade Generalizada-7 (GAD-7). As associações foram analisadas utilizando modelos de regressão logística bruta e ajustada. Resultados: Dos 108 participantes sintomáticos, 39 eram homens (36,1%; 44,1 ± 10,6 anos; 1,75 ± 0,07 m; 86,2 ± 14,1 kg; GAD = 11,9 ± 3,4) e 69 eram mulheres (63,9%; 42,5 ± 8,8 anos; 1,63 ± 0,06 m; 68,9 ± 13,4 kg; GAD = 13,0 ± 3,7). Entre os 531 participantes não sintomáticos, 324 eram homens (61,1%; 47,3 ± 11,1 anos; 1,75 ± 0,06 m; 85,2 ± 14,9 kg; GAD = 2,7 ± 2,4) e 207 eram mulheres (38,9%; 44,9 ± 9,6 anos; 1,63 ± 0,06 m; 67,9 ± 12,3 kg; GAD = 3,5 ± 2,3). Nenhuma associação foi observada entre sintomas de ansiedade e preferência por intensidade de exercício, tanto no modelo bruto (p = 0,44) quanto no ajustado (p = 0,79). Conclusão: Os sintomas de ansiedade não apresentaram associação com a preferência pela intensidade do exercício em adultos fisicamente ativos.

Palavras-chave: Saúde mental; Níveis de atividade física; Transtorno de ansiedade; Transtornos de ansiedade generalizada; Estudo transversal.

Introduction

Generalized anxiety disorder (GAD) is characterized by persistent and excessive anxiety and worry about various events or activities, occurring on most days over a period of at least six months[1]. The global lifetime prevalence of GAD is estimated at 6.2%, with women being affected approximately twice as often as men[2]. GAD imposes a substantial economic burden and significantly reduces lifetime work productivity[3,4]. As such, developing effective strategies for appropriate

treatment is critically important.

While effective treatments for GAD include antidepressants and quetiapine[5], exercise has also emerged as a potentially beneficial intervention[6-9]. Current evidence suggests that higher levels of physical activity (PA) are associated with fewer anxiety symptoms and a reduced risk of developing anxiety disorders[8]. Furthermore, exercise interventions may alleviate disorder-specific symptoms in adults diagnosed with clinical anxiety disorders[8]. Despite these benefits, individuals with GAD tend to engage in low levels of physical activity[10].

However, limited evidence exists regarding the factors that influence PA engagement in individuals with GAD. Herring et al.[11] proposed that habitual expectations regarding psychological or perceptual responses to exercise may significantly impact PA participation, particularly in relation to symptoms commonly experienced by individuals with GAD. Nevertheless, only exercise-related expectations concerning anxious mood accounted for a small portion of the variance in PA behavior, contributing just 1.5%[11]. Among the various factors that may influence PA engagement, exercise intensity preference has received little attention.

Exercise intensity preference refers to an individual's tendency to self-select a particular level of exertion during PA[12]. This preference may be especially relevant for individuals with anxiety symptoms, as higher-intensity exercise can elicit interoceptive cues (e.g., increased heart rate, breathlessness) that may resemble or exacerbate anxiety symptoms, potentially reducing exercise adherence or psychological benefit[13,14]. Conversely, allowing individuals to exercise at their preferred intensity has been linked to greater affective responses and long-term adherence[15], which could be particularly advantageous in managing anxiety.

To our knowledge, no study has specifically examined the relationship between anxiety symptoms and exercise intensity preference in individuals with GAD. Moreover, previous research has not addressed this relationship in physically active adults—a population that, despite meeting activity guidelines, may still experience psychological distress. Understanding how anxiety symptoms influence intensity preference among active individuals is important for refining exercise prescriptions aimed at mental health benefits. Thus, the objective of this study was to investigate the association of anxiety symptoms with preference for exercise intensity in physically active adults.

Methods

The study was designed and reported in accordance with the 2007 guidelines of the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE)[16].

Study Design and Setting

This cross-sectional study was conducted using baseline data from the Longitudinal Study of Physical Activity Determinants (ELDAF), which investigates the influence of psychosocial and environmental factors on PA among workers[17]. Data collection took place between August 2022 and December 2023. Participants were recruited from a population of non-faculty civil servants at a public university located in Baixada Fluminense, a low-lying region within the Rio de Janeiro Metropolitan Area, Brazil. Baixada Fluminense covers approximately 2,512 km² and is home to about 2.4 million people, representing 40% of the total population of the metropolitan region.

Participants

The ELDAF study successfully recruited 1,160 participants. However, 639 participants met the eligibility criteria and comprised the study sample. The eligibility criteria were as follows: (a) participants must be classified as either "active" or "very active" according to the International Physical Activity Questionnaire (IPAQ)[18]; and (b) participants must complete the GAD-7 scale[19], with scores ranging from 0 to 21, although no specific cut-off was used for exclusion. In addition, the following exclusion criteria were used: (a) assigned to another institution, (b) on leave, or (c) lacking the cognitive potential to respond to the data collection instruments. The study followed the guidelines established in the Declaration of Helsinki for human subjects. All subjects signed informed consent, and the experiment gained approval from the Research Ethics Committee of the Salgado Oliveira University (protocol number: 4.082.122).

Measurement of physical activity level

Participants' PA levels were assessed using the long version of the IPAQ, which has acceptable measurement properties for monitoring population levels of PA among 18- to 65-yr-old adults in diverse settings[18]. Based on their PA levels, participants were categorized into one of four groups: (a) very active, (b) active, (c) irregularly active, and (d) sedentary. For this study, only

individuals classified as very active or active were included.

Variables

Symptoms of anxiety were used as the exposure variable and defined using the GAD-7 scale. The GAD-7 is a self-administered instrument consisting of seven items that assess symptoms in accordance with the criteria for GAD outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)[19]. Using a 4-point Likert scale ranging from 'not at all' to 'nearly every day,' patients are asked to report how frequently they have been bothered by each of the seven symptoms. For the exposure group, participants were required to score ≥ 8 on the GAD-7 scale, as this threshold is considered indicative of significant anxiety symptoms[20].

The study outcome measure (i.e., preference for exercise intensity) was assessed by the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q)[12]. The PRETIE-Q consists of two 8-item scales, called Preference and Tolerance, with each item accompanied by a 5-point Likert scale from 1 to 5, corresponding to the answers "I totally disagree", "I disagree", "I neither agree nor disagree", "I agree", and "I totally agree". Of the eight scale items in the "Preference" domain, 4 denoting preference for high intensity and 4 for low intensity. It is important to highlight that the PRETIE-Q has already been translated and validated in Brazilian adults[21]. Considering that the PRETIE-Q was developed with no cut-off points, we established the middle value of the scale. In this sense, we adopted the score of 24 (the possible scores of the scale range from eight to 40) to define higher and lower preferences for high-intensity exercise. Participants who scored eight to 23 were considered to prefer low-to-moderate intensity, while participants who scored 24 to 40 were considered to prefer moderate-to-high intensity.

Study size

GAD has a worldwide prevalence of approximately 6.2% in the general adult population[2]. In this study, the sample consisted specifically of individuals classified as physically active or very active according to the IPAQ criteria, representing a distinct subgroup. From the 1,160 physically active participants recruited, 108 were identified with GAD, corresponding to 9.3% of the sample. Thus, although specific prevalence data for

GAD within physically active adults are limited, our sample suggests that anxiety symptoms remain prevalent in this population, as 108 out of 639 participants classified as active or very active exhibited anxiety symptoms (~16.9% of the sample).

Statistical analysis

Continuous variables are expressed as means and standard deviations, and categorical variables are expressed as frequencies and percentages. After confirming the residual normality of the data using the Kolmogorov-Smirnov test, a logistic regression analysis was performed to examine the association between anxiety symptoms and preference for exercise intensity (low-to-moderate and moderate-to-high intensities, respectively). Age and gender were considered confounding variables and included in the adjusted model. Additionally, logistic regression analyses stratified by gender were conducted to investigate the association between anxiety symptoms and preference for exercise intensity (i.e., low-to-moderate vs. moderate-to-high). Age was treated as a potential confounding variable and was included in the adjusted models accordingly. Odds ratios (OR) and their respective 95% confidence intervals (95% CI) were estimated for crude and adjusted models. The level of significance was set at $p < 0.05$. Analyses were conducted using R, version 4.2.2.

Results

Participants

In the first phase of the ELDAF study, a total of 2,264 participants were initially invited. After applying the exclusion criteria at each stage, the final sample consisted of 1,160 individuals. Of these, 639 participants were classified as active or very active (~55%). Among the active or very active group, 108 exhibited anxiety symptoms (~ 16.9%), while 531 did not (~ 83.1%) (Figure 1). The participants' characteristics are shown in Table 1.

Logistic regression analyses indicated no statistically significant association between anxiety symptoms and preference for exercise intensity (p = 0.44). In the crude model, although participants with anxiety symptoms showed 17% higher odds of preferring higher-intensity exercise (OR = 1.17; 95% CI: 0.77–1.78), this result was not statistically significant (p = 0.44). Similarly, after adjusting for age categories and gender, individuals with anxiety symptoms observed 6% lower odds of preferring higher-intensity exercise (OR =
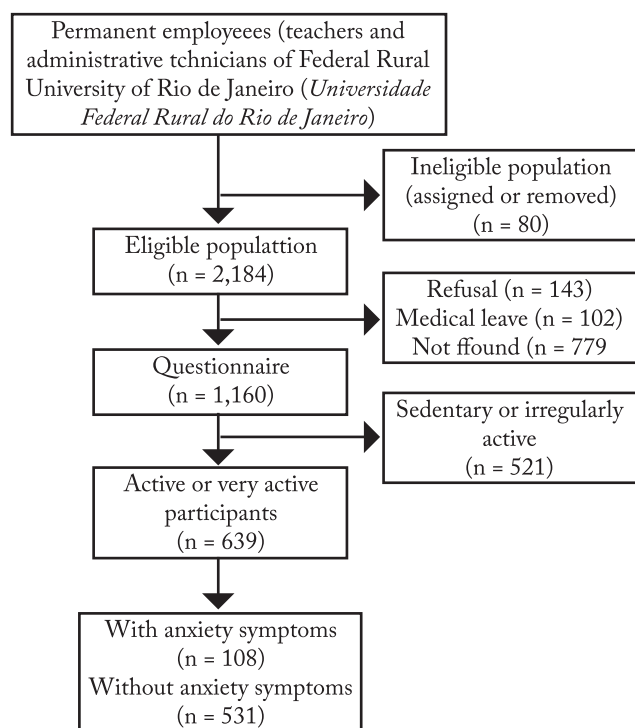
Figure 1 – Flow diagram for the numbers of individuals at each stage of the study.

Table 1 – Characteristics of participants.

Variables	With anxiety symptoms (n = 108)	Without anxiety symptoms (n = 531)
Gender (n; %)		
Male	39 (36.1)	324 (61.1)
Female	69 (63.9)	207 (38.9)
Age (years)		
Male	44.1 ± 10.6	47.3 ± 11.1
Female	42.5 ± 8.8	44.9 ± 9.6
Stature (meters)		
Male	1.75 ± 0.07	1.75 ± 0.06
Female	1.63 ± 0.06	1.63 ± 0.06
Body mass (kilogram)		
Male	86.2 ± 14.1	85.2 ± 14.9
Female	68.9 ± 13.4	67.9 ± 12.3
Generalized Anxiety Disorder-7 (score)		
Male	11.9 ± 3.4	2.7 ± 2.4
Female	13.0 ± 3.7	3.5 ± 2.3
Preference (n; %)		
Low-to-moderate intensity (Male)	23 (59.0)	183 (56.5)
Moderate-to-high intensity (Male)	16 (41.0)	141 (43.5)
Low-to-moderate intensity (Female)	31 (44.9)	103 (50.0)
Moderate-to-high intensity (Female)	38 (55.1)	103 (50.0)

n = number of participants; % = percentage of the total number of participants.

0.94; 95% CI: 0.61–1.46), which was also not statistically significant (p = 0.79). These findings suggest that anxiety symptoms were not meaningfully associated with preference for exercise intensity. Full results are presented in Table 2.

Table 2 – Odds ratios and their respective confidence intervals for the association between anxiety symptoms and exercise intensity preference.

Anxiety symptoms	*n (%)	Preference for exercise intensity	
		Crude model	Adjusted model
		OR (CI 95%)	OR (CI 95%)
No	531 (45.8)	1	1
Yes	108 (50.0)	1.17 (0.77 - 1.78)	0.94 (0.61 - 1.46)

OR (95% CI), odds ratio and their respective 95% confidence intervals for the logistic regression models adjusted for the preference of exercise intensity (lower: the outcome reference, moderate or higher). References for the analysis: exposure, active people without depressive symptoms; adjusted model, adjusted for gender and age. *n, numbers of observations (percentage of those in the higher preference level).

When stratified by gender, logistic regression analyses once again indicated no statistically significant association between anxiety symptoms and preference for exercise intensity in either males (p = 0.76) or females (p = 0.43) in the crude model. Conversely, logistic regression analyses revealed a statistically significant association between anxiety symptoms and preference for exercise intensity (p = 0.001) in males, after adjusting for age. However, males with anxiety symptoms showed 7% lower odds of preferring higher-intensity exercise (OR = 0.93), which was also not statistically significant (95% CI: 0.91–1.95). Notably, after adjusting for age, a statistically significant association between anxiety symptoms and preference for exercise intensity was observed in females (p = 0.001), as indicated by the logistic regression analyses. However, females with anxiety symptoms showed 5% lower odds of preferring higher-intensity exercise (OR = 0.95), although this result was not statistically significant (95% CI: 0.92–1.98). Full results are presented in Table 3.

Discussion

The study examined the relationship between anxiety symptoms and the preference for exercise intensity among physically active adults. The findings of this study indicate that there was no significant association between anxiety symptoms and exercise intensity preference among physically active adults. This finding contrasts with the limited but growing literature sug-

Table 3 – Odds ratios and their respective confidence intervals for the association between anxiety symptoms and exercise intensity preference according to gender.

Anxiety symptoms	Male			Female		
	n (%)	Preference of exercise intensity		n (%)	Preference of exercise intensity	
		Crude model	Adjusted model		Crude model	Adjusted model
		OR (CI 95%)	OR (CI 95%)		OR (CI 95%)	OR (CI 95%)
No	321 (89.2)	1	1	204 (74.7)	1	1
Yes	39 (10.8)	0.89 (0.45 - 1.76)	0.93 (0.91 - 1.95)	69 (25.3)	1.25 (0.72 - 2.16)	0.95 (0.92 - 1.98)

Legend: OR (95% CI), odds ratio and their respective 95% confidence intervals for the logistic regression models adjusted for the preference of exercise (lower: the outcome reference). References for the analysis: exposure, active people without anxiety symptoms; adjusted model, adjusted for age. n, number of observations (percentage of those in the higher preference level).

gesting that psychological traits, including anxiety, may influence exercise behavior and preferences.

For example, Ekkekakis et al.[22] proposed that individuals with higher anxiety sensitivity tend to avoid high-intensity exercise due to its similarity to physiological symptoms of anxiety. However, most existing evidence is either theoretical or based on clinical populations rather than physically active adults. In contrast, our findings support the notion that, within an active population, preferences for exercise intensity may be shaped more by prior experiences, physical conditioning, and motivational factors than by anxiety symptoms alone.

Our findings align with those of Box and Petruzzello[23], who found that in non-clinical populations, psychological factors such as perceived competence, enjoyment, and past experience were more predictive of exercise preference than trait anxiety alone. Furthermore, the absence of association in our study might reflect the complexity and multidimensionality of anxiety, which encompasses both somatic and cognitive symptoms. It is possible that certain dimensions of anxiety (e.g., somatic anxiety) may influence exercise behavior differently than others—a nuance not fully captured by our use of the GAD-7, which emphasizes generalized worry over physical symptoms.

These results suggest that exercise preferences can be influenced by various factors, such as personal fitness levels, prior experience with physical activity, and individual goals[12], rather than solely by psychological conditions like anxiety. In turn, the findings of this study have important practical implications, particularly in prescription exercise programs for individuals with anxiety symptoms. Despite the considerable uncertainty regarding the effectiveness of exercise in reducing anxiety symptoms[24], particularly among individuals with anxiety, numerous studies have demonstrated that promoting PA can be an effective strategy for preventing or treating anxiety disorders[7,8,25-27]. Al-

though the evidence to date suggests that higher levels of PA are associated with fewer anxiety symptoms, and exercise appears to reduce disorder-specific symptoms of anxiety in adults with an anxiety disorder[8], the implementation of exercise into clinical practice has been slow. In this context, choosing the appropriate exercise intensity can represent a major challenge for patients with anxiety disorders.

Among physically active adults in our study, no significant association between anxiety symptoms and exercise intensity preference. Based on this, we suggest that the prescription of aerobic exercise intensity for physically active patients with anxiety disorders be individualized and tailored to their preferences. This is because an increase in anxiety symptoms, induced by exercise, is associated with reduced engagement in PA among patients with anxiety disorders. For instance, one study showed that patients with high somatic anxiety had a significantly higher prevalence of low PA levels compared to those with low somatic anxiety (62.5% versus 34.3%), and somatic symptoms of anxiety were the only significant predictors of low PA levels[28]. Moreover, exercise intensity preference may influence the psychological benefits of PA[13,14] and impact long-term adherence[15].

This study has several limitations in interpreting its results. First, due to its cross-sectional design, it is not possible to establish a cause-and-effect relationship between anxiety symptoms and preference for exercise intensity. Second, variables measured using questionnaires should be interpreted with caution, as limitations may exist despite their utility for epidemiological purposes. Notably, the IPAQ, PRETIE-Q, and GAD-7 are considered valid instruments[12,18,19]. Third, the broad spectrum of anxiety disorders limits the interpretation of these results to a specific anxiety disorder[1]. Fourth, a limitation of this study is the use of an arbitrary cut-off point on the PRETIE-Q to classify exercise intensity

preference, since the instrument lacks validated thresholds. Although the midpoint (24 points) has been used in prior studies[29], this approach requires cautious interpretation. Fifth, a limitation of this study is the lack of assessment of potential confounders, such as physical fitness level and PA history[12]. These factors may influence exercise intensity preference and affect the associations observed. Future studies should include objective or self-reported measures to better control for these variables. Finally, the limited sample size of active participants with anxiety symptoms (n = 108) may increase the risk of a false null result, although our sample suggests that anxiety symptoms remain prevalent in this population (~16.9%).

In conclusion, no significant association was found between anxiety symptoms and preference for exercise intensity among physically active adults. Future research should explore other potential factors influencing exercise intensity preference, such as perceived exertion, mood responses, or social support, which could provide a more comprehensive understanding of the barriers and motivators to exercise in individuals with anxiety.

Conflict of interest

The authors declare no conflict of interest.

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Author's contributions

Lattari E: Conceptualization; Methodology; Software; Validation; Formal analysis; Investigation; Resources; Data curation; Supervision; Project administration; Visualization; Funding acquisition; Writing – original draft; Writing – review & editing; Approval of the final version. Oliveira FFS: Formal analysis; Data curation; Visualization; Writing – review & editing; Approval of the final version. Souza ES: Investigation; Writing – review & editing; Approval of the final version. Oliveira AJ: Methodology; Validation; Formal analysis; Supervision; Writing – review & editing; Approval of the final version.

Declaration regarding the use of artificial intelligence tools in the article writing process

To prepare this manuscript, the ChatGPT 5 artificial intelligence tool was used to perform the following activity: Proofreading of the text in English. The authors declare that all material derived from this process has been reviewed and they assume full responsibility for the entire content of the manuscript.

Availability of research data and other materials

The contents underlying the research text are contained in the manuscript.

Acknowledgments

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