Psychological symptoms in young university students: analysis of physical activity and body composition

Síntomas psicológicos en jóvenes universitarios: análisis de la actividad física y la composición corporal

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Abstract

Introduction: Physical activity is recognized as a protective factor for mental health; however, evidence regarding its relationship with body composition and psychological symptoms remains inconsistent.
Objective: To analyze the relationship between symptoms of depression, anxiety, and stress and levels of physical activity and body composition (Body Mass Index and body fat percentage) in university students.
Methodology: A cross-sectional quantitative study was conducted with 115 university students (M = 20.4 years, SD = 3.5) from a private university in Colombia. Psychological symptoms were assessed using DASS-21, physical activity using IPAQ-SF, and body composition using body mass index and bioelectrical impedance analysis. One-way ANOVA and Pearson correlations were performed.
Results: No significant differences were found in depression, anxiety, and stress according to physical activity levels or body fat percentage. However, students with overweight or obesity presented lower levels of anxiety than those with normal weight. Descriptively, participants with underweight and with a "lean" body fat percentage reported higher symptoms of depression, anxiety, and stress than those with normal weight and overweight or obesity.
Discussion: The lack of significant associations may be explained by sample homogeneity and absence of mediating variables, suggesting that physical activity may influence mental health indirectly. Lower anxiety in overweight-obese students partially supports the "jolly fat" hypothesis.
Conclusions: Levels of depression, anxiety, and stress symptoms did not vary according to physical activity intensity. Students classified as overweight or obese based on body mass index showed fewer anxiety symptoms than those classified as normal.

Keywords

Bioelectrical impedance; body fat percentage; depression; anxiety; stress; exercise.

Resumen

Introducción: La actividad física se reconoce como un factor protector de la salud mental; sin embargo, la evidencia sobre su relación con la composición corporal y los síntomas psicológicos es inconsistente.
Objetivo: Analizar la relación entre síntomas de depresión, ansiedad y estrés con los niveles de actividad física y la composición corporal (Índice de Masa Corporal y porcentaje grasa corporal) en estudiantes universitarios.
Metodología: Se realizó un estudio cuantitativo transversal con 115 estudiantes universitarios (M = 20.4 años; DE = 3.5) de una universidad privada en Colombia. Los síntomas psicológicos se evaluaron con DASS-21, actividad física con IPAQ-SF y composición corporal mediante Índice de masa corporal y bioimpedancia eléctrica. Se aplicaron ANOVA y correlaciones de Pearson.
Resultados: No se encontraron diferencias significativas en depresión, ansiedad y estrés según niveles de actividad física, ni porcentaje de grasa corporal. Sin embargo, los estudiantes con sobrepeso-obesidad mostraron menor ansiedad que aquellos con peso normal. Descriptivamente, los participantes con bajo peso y con porcentaje de grasa «delgadez» puntuaron más síntomas que los de peso normal y sobrepeso-obesidad.
Discusión: La falta de asociaciones significativas puede explicarse por la homogeneidad de la muestra y ausencia de variables mediadoras, lo que sugiere un efecto indirecto de la actividad física en la salud mental. Los menores niveles de ansiedad en sobrepeso-obesidad respaldan parcialmente la hipótesis de la «*jolly fat*».
Conclusiones: Los síntomas de depresión, ansiedad y estrés no variaron según la intensidad de la actividad física. Los estudiantes con sobrepeso-obesidad presentaron menor ansiedad que aquellos con peso normal.

Palabras clave

Bioimpedancia eléctrica; porcentaje de grasa corporal; depresión; ansiedad; estrés; ejercicio.

Introduction

Physical Activity (PA) is defined as any bodily movement produced by skeletal muscles that results in energy expenditure above resting levels (World Health Organization [WHO], 2024). In recent years, PA has emerged as an adjunctive strategy of growing interest in psychotherapeutic programs, particularly within the fields of psychiatry and clinical psychology (Anger et al., 2023). Evidence suggests that PA not only has a positive impact on the management of non-communicable chronic diseases, which are frequently associated with mental disorders (WHO, 2021), but also contributes significantly to the reduction of symptoms of depression, anxiety, and stress (Bailey et al., 2018; Di Liegro et al., 2019; Gordon et al., 2017; Tristancho-Celis et al., 2025).

Considering PA as a promotional, preventive, and treatment strategy for mental illness—particularly symptoms of depression, anxiety, and stress—represents an important public health challenge. Globally, approximately one billion people were living with some form of mental disorder in 2019, including 14% of adolescents (WHO, 2022a), and recent estimates indicate that nearly one in seven people experience some form of mental health problem (WHO, 2025). In Colombia, the prevalence of affective and anxiety disorders was 2.1% and 2.4%, respectively, with major depression being the most frequent individual diagnosis (Ministerio de Salud y Protección Social [MinSalud], 2015). This concern became even more evident after the COVID-19 pandemic, when cases of anxiety and depression increased by approximately 25% worldwide (WHO, 2022b). In Colombia, 66.3% of the population reported having faced some form of mental health problem in 2023 (MinSalud, 2023). In this context, PA played an important role in mitigating the adverse effects of confinement on mental health (Aguirre-Loaiza et al., 2021; 2024b).

Considering the above, the youth age group between 18 and 24 years—coinciding with the university population—presents significant vulnerability in terms of mental health compared with other age groups (Auerbach et al., 2018). The transition to higher education involves academic, social, personal, and economic demands that may exceed students' psychological resources. This context may trigger dysfunctional responses with high levels of depression, anxiety, and stress symptomatology (Luthar et al., 2020; Nooijen et al., 2019; Villamar et al., 2026). Depression manifests through a marked decrease in mood, loss of interest, and reduced motivation (American Psychiatric Association [APA], 2022). Anxiety is characterized by excessive and persistent worry, as well as difficulties controlling anticipatory thoughts (APA, 2022). Stress, in turn, is understood as an emotional and physiological response to demands that exceed the individual's perceived resources (Lazarus & Folkman, 1984). These manifestations can interfere with daily functioning and with students' academic and social performance within the university context.

Although PA has shown favorable effects on mental health and is considered an evidence-based strategy for the promotion, prevention and treatment of mental health problems (Stubbs et al., 2018; Tristancho-Celis et al., 2025), important knowledge gaps remain (Bailly et al., 2022). Previous research in this field has largely focused on a psychopathological perspective, mainly addressing depression, anxiety, and stress (Aguirre-Loaiza et al., 2024b; Tristancho-Celis et al., 2025), and has been criticized for its reductionist nature, that prioritizes pharmacological interventions over more interdisciplinary approaches (Singh et al., 2022). The integration of additional variables could contribute to a more comprehensive understanding of this relationship. Among these variables, measures of physical fitness stand out, as they allow the evaluation of individuals' functional and athletic capacity, as well as anthropometric measures, which are considered key indicators of human cognition (Zapata et al., 2025).

Within this line of argument, body composition emerges as a relevant variable, not only because it is a biological marker of cardiometabolic risk in clinical and epidemiological contexts (Gadde et al., 2018), but also due to its influence on executive functioning variables (Favieri et al., 2019; Zapata et al., 2025). Some studies have found that excess weight and obesity may lead to cognitive deficits (Yang et al., 2018). For example, a high Body Mass Index (BMI) and higher body fat percentages have been associated with a greater prevalence of depressive symptoms and poorer health-related quality of life (Redondo-Flórez et al., 2021). However, this claim is not conclusive and requires further research.

Another line of findings has reported that individuals with overweight and obesity have reported fewer psychological symptoms (Revah-Levy et al., 2011). These results have provided support for the classical "jolly fat" hypothesis proposed in the seminal work of Crisp & MacGuiness (1976). The "jolly fat" hypothesis suggests that individuals with higher body weight—overweight and obesity—may present

lower levels of depressive or anxious symptomatology (Palinkas et al., 1995). Nevertheless, this perspective cannot be generalized, nor can it be entirely dismissed. Its analysis requires greater levels of complexity and the consideration of additional variables and more sensitive measures. For example, BMI has been widely used in the literature and clinical field due to its ease of evaluation and interpretation (body mass—in kilograms—divided by height—in meters—squared [kg/m^2]). At the same time, BMI presents limitations because it does not discriminate between components of body composition (Nuttall, 2015). This limitation has led to recommendations to use methods such as bioelectrical impedance analysis (BIA) for more precise evaluation (Bove et al., 2016; Catoira et al., 2016).

Despite the growing interest in understanding the relationship between PA and mental health, existing studies still present limitations. The body of knowledge reviewed in this work has analyzed the relationship between PA and mental health in isolation from other physical health indicators (e.g., body composition indicators or physical fitness capacities, and even modalities). Given this knowledge gap, few studies have integrated PA and body composition within the same study to examine their association with symptoms of anxiety, depression, and stress. This fragmented approach limits the understanding of whether psychological symptoms are associated not only with behavioral factors, such as PA level, but also with anthropometric indicators, such as BMI and body fat percentage. Therefore, the present study aimed to identify the possible relationship between depressive symptoms, anxiety, and stress, levels of PA (low, moderate, and vigorous), and body composition indicators (BMI, body fat percentage) in university students.

Two general hypotheses were proposed, each subdivided into sub-hypotheses for more detailed analysis:

H1: There are significant differences in the levels of depressive symptoms, anxiety, and stress as a function of PA levels and body composition.

H1.1: Moderate and vigorous levels of PA are expected to report lower psychological symptomatology compared with low levels of PA.

H1.2: A high BMI, corresponding to overweight and obesity categories, as well as a higher body fat percentage were expected to present higher levels of depressive symptoms, anxiety, and stress.

H2: Depressive symptoms, anxiety, and stress were expected to be significantly associated with the independent variables analyzed.

H2.1: PA variables were expected to be inversely associated with depressive symptoms, anxiety and stress.

H2.2: BMI values and body fat percentage were expected to be positively associated with depressive symptoms, anxiety, and stress.

Method

Participants

A non-experimental cross-sectional quantitative study was conducted. The sample was intentional and consisted of 115 university students (M_{age} = 20.4, *Mdn* = 20.0, *SD* = 3.5) from the Faculty of Social and Human Sciences at a private university in the city of Pereira, Colombia, who met the inclusion criteria and agreed to participate during the data collection period. Of the participants, 82.7% (n = 95) were women (M_{age} = 20.5, *Mdn* = 20.0, *SD* = 3.8, *Min* = 18, *Max* = 42) and 17.3% (n = 20) were men (M_{age} = 19.9, *Mdn* = 20.0, *SD* = 1.4, *Min* = 18, *Max* = 42).

The inclusion criteria were: (a) being older than 18 years, (b) having higher education enrollment, and (c) signing informed consent. Two exclusion criteria were established: (a) having metallic devices that could affect the BIA measurement, and (b) self-reporting psychiatric or physical impairment.

Procedure

Data collection was carried out in two phases. In the first phase, participants completed a self-administered online questionnaire via Google Forms®, which included Depression, Anxiety, and Stress Scale.

Prior to its final administration, three pilot tests were conducted to verify the clarity of the instrument, the proper capture of data, and the functionality of the platform.

In the second phase, participants were scheduled individually at previously assigned times. They were instructed to consume light meals, maintain adequate hydration, and refrain from wearing metallic objects for the BIA measurement. During the session, anthropometric measurements (weight and height) were first taken, followed by the assessment of body composition using BIA (Biody Xpert ZM®). To ensure the precision and reliability of the collected data, the double data entry technique described by Prokscha (2011) was employed. This process consisted of recording the information both digitally and in physical format. The implementation of this technique ensured consistency, accuracy, and control of the data throughout the study.

All participants were fully informed about the objectives and scope of the study, ensuring their understanding and voluntary consent. This study followed the ethical principles established in the Declaration of Helsinki (World Medical Association, 2013) and the Ethical and Deontological Code of the Colegio Colombiano de Psicólogos (2016). Additionally, the study is classified as minimal risk research, according to Act 20-09 of 2023 issued by the Ethics Committee of Catholic University of Pereira. Confidentiality of the data and respect for participants' rights were guaranteed throughout the research process.

Instrument

Depression, Anxiety and Stress Scale (DASS-21)

Symptoms of depression, anxiety, and stress were assessed using the Depression, Anxiety and Stress Scale – 21 (DASS-21), developed and validated by Antony et al. (1998) and adapted to Spanish by Daza et al. (2002). For this study, the version validated by Ruiz et al. (2017) in Colombian university samples was used. The DASS-21 has solid evidence of structural, criterion, and construct validity across different populations (Dwight et al., 2024; Lee et al., 2019; Antúnez & Vinet, 2017)

The factorial structure of the scale comprises three dimensions: Depression, Anxiety, and Stress, each consisting of seven items. Examples of statements include: «I found it difficult to breathe» and «I felt that life had no meaning». Responses are collected using a four-point Likert scale: 0 (Did not apply to me at all), 1 (Applied to me to some degree, or some of the time), 2 (Applied to me to a considerable degree, or a good part of the time), and 3 (Applied to me very much, or most of the time). The minimum score per factor is 0 and the maximum is 21, where higher scores indicate greater associated symptomatology. The cut-off points used to classify symptom severity were based on the raw scores proposed by Ruiz et al. (2017). For the Depression dimension, the ranges are: ≤4 (no symptoms), 5–6 (mild), 7–10 (moderate), 11–13 (severe), and ≥14 (extremely severe). For Anxiety: ≤3 (no symptoms), 4 (mild), 5–7 (moderate), 8–9 (severe), and ≥10 (extremely severe). Finally, for Stress: ≤7 (no symptoms), 8–9 (mild), 10–12 (moderate), 13–16 (severe), and ≥17 (extremely severe).

For the purposes of this study, specifically in the correlation analysis (see data analysis section), categories of psychological symptomatology were recategorized into two main levels: «no symptoms» (corresponding to the original category of «no symptoms») and «with symptoms», which includes mild, moderate, severe, and extremely severe levels. This grouping allows for a more general and operational interpretation when analyzing the relationship between the variables of interest in this study.

International Physical Activity Questionnaire - Short Form (IPAQ-SF)

PA was assessed using the International Physical Activity Questionnaire – Short Form (IPAQ-SF), a self-report instrument that collects the frequency and duration of physical activities performed during the previous seven days (Craig et al., 2003). This questionnaire has demonstrated robust evidence of validity and internal consistency across different populations (Dinger et al., 2006; Forsén et al., 2010; Sanda et al., 2017). Additionally, it aligns with the international PA recommendations of the WHO (2018). Responses are reported in hours/day and minutes/day, allowing the estimation of the MET unit (metabolic equivalent of task, minutes per week). Based on this estimation, three PA categories are established: (i) vigorous (three days accumulating ≥1500 MET-minutes/week or seven days with a total ≥3000 MET-minutes/week); (ii) moderate (moderate or vigorous PA accumulating a minimum total ≥600 MET-minutes/week, including vigorous activity at least 20 minutes/day for ≥3 days, or moderate PA and/or walking at least 30 minutes/day for ≥5 days); and (iii) light (includes records that do not meet the criteria for moderate or vigorous categories).

Bioelectrical Impedance Analysis (BIA)

Body composition was evaluated using bioelectrical impedance analysis (BIA), which measures the resistance of body tissues to the passage of low-intensity electrical currents. This method is widely recognized as painless, non-invasive, and portable (Aldobali & Pal, 2021).

In this study, the Biody Xpert ZM® device was used along with Biody Manager® software to record body fat percentage (% fat). These values were calculated considering each participant's sex, age, weight, and height. The body fat percentage was determined based on the estimation of constant body hydration, given that fat mass may vary depending on weight, which in turn depends on water intake. To minimize this effect, the device recalculates weight based on an "ideal" hydration level, thus reducing variations in the results.

Although there is no definitive consensus regarding optimal body fat percentage values related to health risk, ideal ranges are considered to be between 12%–23% for men and 17%–26% for women (Liguori et al., 2021). For this study, specific categories were established according to body fat percentage ranges (see Table 1).

Table 1. Classification of body fat percentage by sex

Men	Women	Classification
< 8.0%	<15%	Lean
8.1% – 15.9%	15.1% - 20.9%	Optimal
16.0 %– 24.9%	21.0% - 31.9%	Overweight
>25%	>32%	Obese

Note: Adapted from Cardozo et al. (2016).

Body Mass Index (BMI)

BMI was calculated using the standard formula: weight (kg) / height (m^2). The classification categories used were: underweight (≤18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obesity (≥30). For the present analysis, the overweight and obesity categories were grouped to simplify the statistical analysis. Participants' height was measured using a Seca 206® retractable tape stadiometer fixed to the wall, with a measurement range from 0 to 220 cm and an accuracy of ±5 mm. Body weight was determined using a Seca-876® digital scale with a capacity of up to 250 kg. Both measurements were conducted under standardized conditions to ensure the precision and reliability of the collected data.

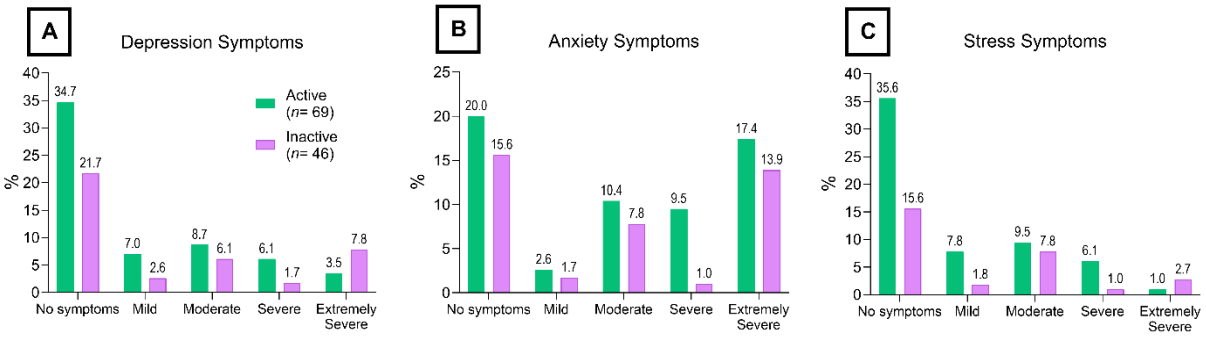
Data analysis

Data processing and analysis were conducted using JASP® 0.18.3 software (JASP Team, 2024). Microsoft Excel® was previously used to perform data cleaning, coding, and filtering. An initial exploratory and descriptive analysis was conducted. Extreme and atypical values (outliers) were inspected, a total of 12 atypical values were identified across the main study variables, these values were retained because they were within plausible ranges and did not correspond to data-entry errors, no imputations using the median were performed. No missing data was identified. The Shapiro–Wilk test was used to verify the normality of the dependent variables (symptoms of depression, anxiety, and stress) (Aguirre-Loaiza et al., 2024a), and homogeneity of variances was assessed using Levene's test. Subsequently, three one-way ANOVA models were applied, corresponding to the three dependent variables. These analyses were compared with the independent variables: PA, BMI, and body fat percentage. To estimate effect size, the eta squared statistic (η^2) was used. Post hoc analyses were performed using Bonferroni correction, and in the comparison of means the mean difference (M^{diff}) along with its 95% confidence interval (95% *CI*) was reported. Finally, correlation analyses were conducted by segmenting the data into two groups: with and without symptoms of the evaluated factors. The relationship analysis was performed using Pearson's correlation coefficient (r) to evaluate relationships between variables. For hypothesis testing, a significance level of $p < .05$ was assumed.

Results

Depressive, anxiety, and stress symptom scores were categorized as «no symptoms», «mild» «moderate», «severe» and «extremely severe» (see techniques and instruments for cut-off points). Figure 1 shows the descriptive percentage distribution of depressive, anxiety, and stress symptoms according to PA status, classified as active or inactive. Overall, physically active group represented a higher proportion of "no symptoms" category across the three factors: depression (34.7%, *n* = 40), anxiety (20.0%, *n* = 23), and stress (35.6%, *n* = 41). A similar descriptive pattern was observed in the remaining symptom categories (mild, moderate, and severe). Even in the "extremely severe" anxiety category, physically active participants also showed a higher proportion (17.4%, *n* = 20) than inactive individuals (13.9%, *n* = *16*). However, those who presented "extremely severe symptoms" in depression (7.8%, *n* = 13) and stress (2.7%, *n = 4*) were more frequent in the physically inactive group (see Figure 1A and 1C).

Figure 1. Depressive, anxiety, and stress symptoms according to PA (active or inactive).



Depressive symptoms

The descriptive scores and the factorial ANOVA model for depressive symptoms are presented in Table 2. Participants who reported engaging in vigorous PA showed, on average, lower depressive symptom scores compared with those reporting moderate or light activity levels; however, these differences were not statistically significant. No significant differences were found in depressive symptoms according to BMI or body fat percentage.

Table 2. ANOVA of depression symptoms according to PA, BMI, and fat mass

Depression symptoms	*n*	%	*M*	*SD*	*Mdn*	*IQR*	*MS*	*F*	*p*	η^2
Physical Activity Levels										
Light	46	40.0	6.34	5.9	4.00	5.93				
Moderate	35	30.4	5.37	5.1	4.00	5.19	24.0	0.85	.428	0.015
Vigorous	34	29.5	4.82	4.4	4.00	4.41				
BMI										
Underweight	16	13.9	6.87	5.4	7.00	9.50				
Normal Weight	62	53.9	6.16	5.5	4.50	8.00	63.9	2.33	.102	0.040
Overweight-Obese	37	32.1	4.10	6.6	3.00	4.00				
Body Fat %										
Lean	6	5.2	8.83	4.7	7.50	6.25				
Optimal	23	20.0	5.39	4.4	4.00	5.00	25.3	0.90	.442	0.024
Overweight	56	48.6	5.67	5.8	4.00	9.00				
Obese	30	26.0	4.96	4.8	4.00	5.50				

Note: *Mdn* = Median, *IQR* = Interquartile Range, *MS* = Mean Square, η^2 = Eta squared (effect size).

Anxiety symptoms

The descriptive scores for anxiety symptoms and the factorial ANOVA are presented in Table 3. Significant differences in anxiety symptoms were identified only between BMI categories, $F(2,112)= 3.68$, $p= .028$, $\eta^2= 0.062$. Bonferroni-adjusted post-hoc analyses revealed a significant difference between the normal-weight and overweight–obesity categories $M_{diff}= 2.50$, *CI* 95% [0.14, 5.54], p= .041). Specifically, participants classified as overweight–obesity reported, lower anxiety symptoms scores than normal

weight participants (see *Figure 2B*). No statistically significant differences in anxiety symptoms were found according to PA levels or body fat percentage categories.

Table 3. ANOVA of anxiety symptoms according to PA, BMI, and fat mass

Anxiety symptoms	*n*	%	*M*	*SD*	*Mdn*	*IQR*	*MS*	*F*	*p*	η^2
Physical Activity Levels										
Light	46	40.0	7.08	6.3	5.00	10.75				
Moderate	35	30.4	7.28	4.9	6.00	6.50	5.81	0.18	.834	0.003
Vigorous	34	29.5	6.50	5.2	5.50	7.75				
BMI										
Underweight	16	13.9	8.31	5.1	6.50	7.75				
Normal Weight	62	53.9	7.82	5.8	7.00	9.00	110.73	3.68	.028*	0.062
Overweight-Obese	37	32.1	4.97	4.8	3.00	7.00				
Body Fat %										
Lean	6	5.2	8.16	5.3	7.50	5.50				
Optimal	23	20.0	6.13	4.7	5.00	6.00	9.83	0.30	.820	.008
Overweight	56	48.6	7.25	6.2	6.00	10.25				
Obese	30	26.0	6.86	5.2	6.00	8.50				

Note: *Mdn* = Median, *IQR* = Interquartile Range, *MS* = Mean Square, η^2 = Eta squared (effect size). *$p < .05$

Stress symptoms

The descriptive data and factorial ANOVA for stress symptoms are presented in Table 4. None of the contrasts showed significant differences in stress symptoms according to PA levels, BMI, or body fat percentage.

Table 4. ANOVA of stress symptoms according to PA, BMI, and fat mass

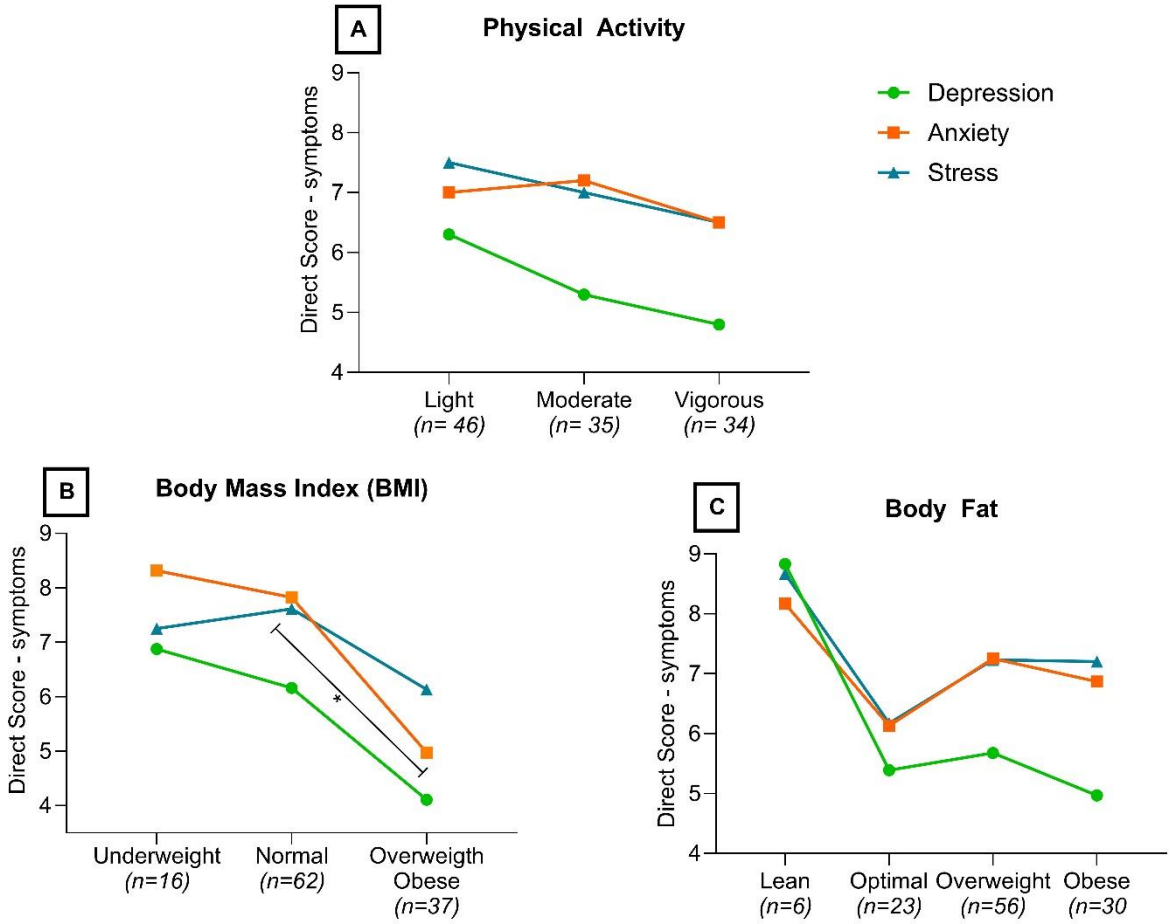
Stress symptoms	*n*	%	*M*	*SD*	*Mdn*	*IQR*	*MS*	*F*	*p*	η^2
Physical Activity Levels										
Light	46	40.0	7.52	5.40	7.50	9.00				
Moderate	35	30.4	7.08	3.86	6.00	6.00	10.20	0.429	0.65	0.008
Vigorous	34	29.5	6.50	5.05	6.00	9.75				
BMI										
Underweight	16	13.9	7.25	3.71	7.50	7.25				
Normal Weight	62	53.9	7.61	4.93	6.50	8.75	25.54	1.08	.341	0.019
Overweight-Obese	37	32.1	6.13	5.11	6.00	8.00				
Body Fat %										
Lean	6	5.2	8.66	4.84	9.50	7.00				
Optimal	23	20.0	6.17	3.89	5.00	6.00	9.83	0.30	.820	0.008
Overweight	56	48.6	7.23	5.10	6.00	8.25				
Obese	30	26.0	7.20	5.14	6.00	8.75				

Note: *Mdn* = Median, *IQR* = Interquartile Range, *MS* = Mean Square, η^2 = Eta squared (effect size).

Comparison of depression, anxiety and stress symptoms according to PA, BMI, and body fat percentage

Symptoms of depression, anxiety, and stress were compared according to PA levels, BMI, and body fat percentage, as shown in Figure 2. Regarding PA and body fat percentage, no significant differences were found between the different classifications. With respect to BMI, participants with normal weight were significantly more anxious than those classified as overweight–obese (see Figure 2B).

Figure 2. Symptoms of depression, anxiety, and stress according to PA levels (Fig. 2A), Body Mass Index (Fig. 2B), and body fat. percentage (Fig. 2C).



Note: *p < .05.

Relationship between symptoms of depression, anxiety and stress, PA, BMI, and body fat percentage

Table 5 presents the Pearson correlation coefficients (r) between symptoms of depression, anxiety, and stress and the independent variables: PA and body composition (BMI and fat mass). Symptoms of depression and stress did not show significant relationships with any independent variables.

Table 5. Correlation coefficients according to the presence of symptoms in relation to PA and body composition

Variable	Depression symptoms		Anxiety symptoms		Stress symptoms	
	without (*n* =65)	with (*n* =50)	without (*n* =41)	with (*n* =74)	without (*n* =64)	with (*n* =51)
Physical Activity						
MET's - IPAQ	-.14	-.12	-.13	-.02	-.07	.01
Body Composition						
BMI	-.01	-.06	-.16	-.13	-.08	.08
Body Fat (%)	-.03	-.08	.27	-.06	-.05	.19

Nota: *p< .01

Discussion

The present study aimed to identify the possible relationship between depressive symptoms, anxiety, and stress, levels of PA (light, moderate, and vigorous), and body composition (BMI and body fat percentage). Overall, the results suggest that psychological symptomatology did not vary significantly according to PA levels or body composition. These results did not support hypothesis H1, which proposed

that significant differences exist in levels of depressive symptoms, anxiety, and stress as a function of PA levels and body composition. However, unexpectedly, students classified as overweight–obese according to BMI reported significantly lower levels of anxiety compared with those classified as normal weight. Although differences were observed in the behavior of anxiety symptomatology, the data did not occur in the hypothesized direction, which suggested that a high BMI and higher body fat percentage would be associated with greater presence of depressive symptoms, anxiety, and stress (H1.2). Therefore, this finding should be interpreted cautiously and limited to anxiety symptoms according to BMI categories.

Additionally, the correlational analysis did not support H2, which proposed that there would be a significant relationship between depressive symptoms, anxiety, and stress and the independent variables analyzed. No inverse relationships were found between psychological symptoms and PA variables (H2.1), nor were direct relationships observed between psychological symptoms and BMI values or body fat percentage (H2.2).

The absence of significant differences in depression, anxiety, and stress symptoms according to PA level differs from studies that have reported inverse associations between these variables (Paricahua-Peralta et al., 2024; Singh et al., 2023). One possible explanation may lie in the relatively homogeneous characteristics of the sample, composed mostly of young individuals between 18 and 24 years old and with higher education levels, which may reduce the variability necessary to detect significant differences. Another possible reason is the lack of inclusion of mediating and moderating variables. It has been suggested that the impact of PA on mental health is often mediated by variables such as sex, with women being more affected (Luppino et al., 2010; Nameni et al., 2024), as well as psychosocial variables such as affect, self-esteem, self-efficacy, resilience, and social support (White et al., 2024). Therefore, although PA has been associated with better mental health outcomes in previous studies, the present results do not provide evidence of a direct protective effect of PA on depression, anxiety or stress symptoms.

It is worth highlighting that, descriptively, participants reporting light PA levels showed higher symptoms of depression, anxiety, and stress. However, these differences were not significant and should be interpreted only as exploratory observations. This parameter was related to a recent study (Botero-Arboleda & Aguirre-Loaiza, 2025) in which significant differences were found—although with small effect sizes—showing that students with light PA levels, regardless of sex, presented higher depressive symptoms compared with students with moderate and vigorous intensity levels. The same study also reported that when analyzing the sex variable, the effect disappeared but main effects were identified, indicating that men with vigorous PA levels experienced fewer depressive symptoms than women with light and moderate PA levels.

On the other hand, regarding body composition, the finding that students classified as overweight–obese reported lower levels of anxiety compared with those with normal weight contrasts with previous evidence suggesting positive associations between elevated BMI and anxiety symptomatology (Amiri & Behnezhad, 2019; Camargo et al., 2024). Contrary to our results, systematic reviews and meta-analyses have indicated a positive association between obesity and anxiety (Gariepy et al., 2010). Specifically, indices of visceral adiposity have been associated with generalized anxiety, with women showing higher adiposity indices having a greater probability of experiencing generalized anxiety disorder (Nameni et al., 2024).

However, the evidence is not uniform and suggests that the relationship between BMI–and other anthropometric and body indicators under study– and anxiety may be modulated by contextual and perceptual factors. Studies indicate that subjective perception of body weight and internalization of body stigma may play a more determinant role than BMI itself (Martínez & Sánchez, 2021; Pearl & Puhl, 2018). In environments where overweight is highly prevalent, social comparison and aesthetic pressure may vary, which could attenuate the association between adiposity and emotional distress. Nevertheless, these explanatory pathways were not directly assessed in the present study and should therefore be interpreted as possible directions for future research rather than as conclusions derived from the data.

In turn, our finding that students with greater overweight–obesity reported lower anxiety symptoms can be cautiously discussed in light of the "jolly fat" hypothesis, which suggests that individuals with

greater body weight may present lower levels of depressive or anxious symptomatology (Crisp & MacGuiness, 1976). Additional studies have also supported the "jolly fat" hypothesis (Palinkas et al., 1996). In a sample of 2245 participants of both sexes, depressive symptoms were inversely associated with body weight in men but not in women. However, another study found that adolescent girls with obesity showed lower depression than their peers with overweight (Revah-Levy et al., 2011).

The results of Revah-Levy et al. (2011) are consistent with our findings, given that 82.7% of our participants were women, which is relevant because obesity has been reported to be sex-dependent, affecting women more strongly (Magallares & Pais-Ribeiro, 2013). In this regard, a meta-analysis found that women with obesity reported poorer mental health—health-related quality of life—compared with women of normal weight, whereas men with obesity showed better mental health than men of normal weight (Magallares & Pais-Ribeiro, 2013).

Nevertheless, another body of studies rejects the "jolly fat" hypothesis and warns about the risks of overweight and obesity for mental health. This line of research indicates that obesity significantly increases the risk of developing depression, especially in women, and that there is a bidirectional relationship between obesity and depressive symptoms (Luppino et al., 2010; Nameni et al., 2024; Amiri & Behnezhad, 2019). In young populations, generally university students, factors such as body acceptance, belonging to social groups, and cultural norms may play a more determinant role than body weight. Consequently, it is possible that the normal-weight group experiences greater aesthetic pressure or greater body surveillance, which could explain higher levels of anxiety compared with their overweight peers in certain contexts. However, this interpretation remains hypothetical, as body image, weight stigma, and social comparison were not directly measured in the study.

Regarding both BMI and body fat percentage—assessed through BIA—it was found that underweight participants showed higher scores of depression, anxiety, and stress. Although statistically significant differences were not observed between groups, a descriptive pattern indicates that university students with low body weight or lean profiles tend to show greater symptomatology (see Figure 2B and 2C). This result coincides, at least with our analysis of body fat percentage (Figure 2C), with the study by Wit et al. (2009), who found in a sample of 45,535 participants (aged 18–90 years) a "U-shaped" association between BMI categories and depressive symptoms, with underweight participants presenting higher depressive symptomatology. Nevertheless, the present data do not allow confirmation of a "U-shaped" association, and future studies with larger samples are needed to examine this possibility.

In summary, our results contribute to the discussion regarding the relationship between psychological symptoms (depression, anxiety, and stress), PA and body composition, specifically BMI and body fat percentage. Although no statistical significance was observed, descriptive data suggest a trend in which moderate and vigorous PA levels appear to be protective against psychological symptoms. On the other hand, there is divergence in the literature regarding the understanding of psychological symptomatology in relation to overweight and obesity. Our findings provide partial support for the "jolly fat" hypothesis (Crisp & MacGuiness, 1976) and the "U-shaped" hypothesis (Wit et al., 2009) in relation to BMI and body fat percentage categories. First, individuals with overweight and obesity presented significantly lower anxiety than those with normal weight. Second, individuals with low weight (BMI) and lean body composition (fat percentage) showed higher anxiety scores, resembling a "U-shaped" pattern.

The discrepancy between these results and our hypotheses may be explained by methodological heterogeneity across the reviewed studies and by the characteristics of the analyzed samples. Consequently, there is a need to incorporate variables at different levels of analysis—biological, psychological, and social (Kandola et al., 2019).

Although this study is promising in exploring the relationship between mental health, body composition, and PA, as well as their potential clinical, educational, and social implications, several limitations should be acknowledged. The selection, size, and characteristics of the sample do not allow generalization of the results, and the study employed a non-experimental cross-sectional design. Furthermore, the sample was predominantly composed of women, limiting the interpretation of potential sex differences. PA was assessed through self-report, which may introduce recall bias or social desirability bias. Likewise, BMI assessment is often overvalued and may present interpretative limitations, since BMI categories can mask internal heterogeneity, for example, in physically active young individuals with greater muscle mass, which BMI cannot discriminate. Although this limitation is partially addressed by the use of BIA,

in this study emphasis was placed primarily on body fat percentage and BMI categories; therefore, it would be interesting to consider other components such as muscle mass. Additionally, mental health measures were restricted to a psychopathological perspective, which limits a broader understanding of the concept of mental health. Finally, potentially relevant variables such as sleep quality, habitual dietary intake, and psychological history were not assessed and should be considered in future research.

Despite these limitations, promising avenues for future research emerge. At the theoretical-conceptual level, it would be important to test hypotheses (e.g., «jolly fat», U-shaped hypothesis) regarding the directionality and causality of obesity and overweight in relation to mental health, incorporating variables of positive mental health (e.g., domains such as emotional well-being and health-related quality of life). Furthermore, categories such as "underweight" and "lean" should be considered potential risk categories for mental health, without neglecting the health risks associated with overweight and obesity. Similarly, other components such as muscle mass should be considered in relation to mental health.

Regarding the assessment of PA, the use of more objective techniques is recommended, as well as the study of the effects of physical exercise and variability in modalities such as coordination, aerobic endurance, speed, and flexibility, which have shown significant associations with mental health in previous research (Kandola et al., 2019; Lubans et al., 2016; Smith & Merwin, 2021). Methodologically, mediation and moderation analyses may help explore the role of sociodemographic and motivational variables. Likewise, the use of experimental and longitudinal studies may help clarify the complex relationships between mental health, PA, and body composition. In particular, it is recommended to investigate dose–response relationships in terms of the duration, intensity, and volume of PA.

In this sense, our study has both theoretical and applied implications. At the theoretical level, the results invite caution regarding strictly linear assumptions, namely, the assumption that higher BMI or body fat percentage necessarily implies greater depressive, anxiety, and stress symptomatology, and therefore poorer mental health. Similarly, the absence of significant differences according to PA levels suggests that the relationship between PA and mental health may depend on additional contextual, psychological, or biological variables. These results suggest the need for more complex approaches involving interactions among physical, biological, psychological, and social variables. Likewise, this study highlights that social perceptions regarding thinness and low body weight as indicators of health may pose risks for mental health.

At the applied level, the importance of interventions in university settings involving systematic monitoring is emphasized, particularly considering that this population shows high prevalence and incidence of psychological symptoms. Furthermore, comprehensive health promotion programs are required from early educational stages and across the life course, including adolescence and childhood. In clinical contexts, comprehensive assessments may also be considered to support complementary preventive and non-pharmacological interventions.

Conclusions

Our study concludes that symptoms of depression, anxiety, and stress do not vary according to the intensity levels of PA. The BMI categories of overweight–obesity showed fewer anxiety symptoms compared with students with normal BMI weight. Descriptively, it was observed that subjects with low weight and with a percentage of fat in the "lean" range scored higher for symptoms of depression, anxiety, and stress than those of normal weight and overweight-obesity.

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