

## Association between body dissatisfaction, physical activity and mental health indicators in Brazilian adolescents

### Asociación entre insatisfacción corporal, actividad física e indicadores de salud mental en adolescentes brasileños

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**Abstract.** This study aimed to verify the association between body dissatisfaction, physical activity and mental health indicators in Brazilian adolescents. This is a cross-sectional study, where the information that characterized and composed the variables was obtained from the education database of the National School Health Survey - Brazil - 2019. The sample consisted of 124,898 adolescents aged between 13 and 17 from public and private schools in all regions of Brazil. The data was analyzed using descriptive statistics and binary logistic regression, with a significance level of 0.05. All the analyses were carried out using the Jamovi® for Windows software, version 2.3. An association was found between body dissatisfaction and insufficient physical activity (OR = 1.17; 95%CI = 1.44; 1.21) and in all the indicators of the variables related to mental health that adolescents answered "most of the time, always": miscellaneous worries (OR = 1.43; 95%CI = 1.39; 1.48), feelings of sadness (OR = 1.97; 95%CI = 1.89; 2.04), perceived indifference (OR = 1.42; 95%CI = 1.37; 1.47), feelings of irritation (OR = 1.39; 95%CI = 1.35; 1.44), suicidal ideation (OR = 1.49; 95%CI = 1.43; 1.56), and adolescents who reported having "no close friends" (OR = 1.38; 95%CI = 1.27; 1.50). We conclude that there is a direct association between body dissatisfaction, insufficient physical activity and fragile mental health indicators in Brazilian adolescents.

**Keywords:** Body Image; Body Dissatisfaction; Physical Activity; Mental Health, Adolescence.

**Resumen.** Este estudio tuvo como objetivo verificar la asociación entre la insatisfacción corporal, la actividad física y los indicadores de salud mental en adolescentes brasileños. Se trata de un estudio transversal en que las informaciones que caracterizaron y compusieron las variables fueron obtenidas de la base de datos de educación de la Encuesta Nacional de Salud Escolar - Brasil - 2019. La muestra fue constituida por 124.898 adolescentes de 13 a 17 años, de escuelas públicas y particulares de todas las regiones de Brasil. Los datos se analizaron mediante estadística descriptiva y regresión logística binaria, con un nivel de significación de 0,05. Todos los análisis se realizaron con el software Jamovi® para Windows, versión 2.3. Se encontró una asociación entre la insatisfacción corporal y la actividad física insuficiente (OR = 1,17; IC 95% = 1,44; 1,21) y en todos los indicadores de las variables relacionadas con la salud mental que los adolescentes respondieron "la mayoría de las veces, siempre": preocupaciones varias (OR = 1,43; IC95% = 1,39; 1,48), sentimientos de tristeza (OR = 1,97; IC95% = 1,89; 2,04), indiferencia percibida (OR = 1,42; IC95% = 1,37; 1,47), sentimientos de irritación (OR = 1,39; IC 95% = 1,35; 1,44), ideación suicida (OR = 1,49; IC 95% = 1,43; 1,56) y adolescentes que declararon "no tener amigos íntimos" (OR = 1,38; IC 95% = 1,27; 1,50). Concluimos que existe una asociación directa entre la insatisfacción corporal, la actividad física insuficiente y los indicadores de salud mental frágil en adolescentes brasileños.

**Palabras clave:** Imagen Corporal; Insatisfacción Corporal; Actividad Física; Salud Mental; Adolescencia.

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### Introduction

Body dissatisfaction is considered a mental health symptom present in adolescents (Baker et al., 2019) and can lead to the following consequences: extreme behavior such as vigorous diets, self-induced vomiting, aesthetic procedures, exacerbated physical exercise and disorders such as anxiety (Biolcati et al., 2017). In addition, for adolescents, striving to fit the ideal body standard can lead to low self-esteem, unhealthy behaviors, affective instability, obsessive, impulsive, and perfectionist disorders, which can result in depression and, in more serious cases, suicide (Cruz-Bojorquez et al., 2019).

Worldwide, it is estimated that one in seven people (14%) between the ages of 10 and 19 have mental health problems. Adolescence is the stage most vulnerable to situations that can affect and exacerbate these problems (Campos et al., 2014; WHO, 2022). The suffering generated by dissatisfaction with body image can be a trigger for extreme psychological suffering (Antunes et al., 2022). In

a simplified way, body image is a mental representation that each individual builds about their body, but in a comprehensive way, it is a multidimensional construct, as it involves thoughts, beliefs, self-perceptions, feelings and actions in relation to the body, thus encompassing perceptual, cognitive, emotional and attitudinal aspects, which influence psychological changes such as distortion, dissatisfaction, body pressure and even the practice of acts that are harmful to health (Castro-Lemus, 2016; Valverde-Sánchez et al., 2024). In this context, identifying the associations that expose and harm the psychological and physical health of adolescents becomes an important public health strategy (Matias et al., 2020).

A study of Brazilian adolescents showed low self-esteem and body dissatisfaction in both sexes, and that females were more likely to express body dissatisfaction (Uchôa et al., 2020). However, the authors did not assess whether age, physical activity levels, sedentary behavior, physical activity or sports in Physical Education and mental health influenced the chances of increased body dissatisfaction. Furthermore,

there is still no consensus in the scientific literature regarding the effects of physical activity on body dissatisfaction. In males, one study showed that greater participation in physical activity was associated with a more positive body image, but another study did not find sufficient evidence to suggest that physical activity or sports interventions improve body dissatisfaction in females (Bassett-Gunter et al., 2017; McIntosh-Dalmedo et al., 2018).

Furthermore, another cross-sectional study, with a sample of 125,123 Brazilian adolescents aged 13 to 17, of both sexes, from the 2019 National School Health Survey (PeNSE), described the prevalence of mental health indicators; however, the study did not associate mental health with body dissatisfaction, level of physical activity and other factors (Antunes et al., 2022). Thus, given that the process of forming adolescent's self-image and acceptance of their bodies is impacted in various ways, and that adolescence is a phase of life with implications in multiple areas - physical, emotional, attitudinal, behavioral, and health-related (Hao et al., 2022) it is important to elucidate these issues. This will help better understand whether the level of physical activity, sedentary behavior, participation in physical activities or sports in Physical Education, health, and, above all, mental health indicators are associated with body dissatisfaction.

In the scientific literature, studies with Brazilian adolescents that seek to investigate body dissatisfaction and associated factors through PeNSE 2019 are scarce, which justifies this study. Therefore, the main objective of this study is to verify the association between body dissatisfaction, physical activity and mental health indicators in Brazilian adolescents.

## Material and Methods

### Study design

A cross-sectional study was carried out using secondary data from the fourth edition of the National School Health Survey (PeNSE), and the microdata has been available for public use since 2022 (Brasil, 2022). The PeNSE sample was sized to estimate population parameters (proportions or prevalence) from public and private schools in all regions of Brazil. PeNSE was organized by the Brazilian Institute of Geography and Statistics (IBGE), in collaboration with the Ministry of Health and with the support of the Brazilian Ministry of Education, submitted to the National Research Ethics Commission (CONEP), managed by the National Health Council (CNS) and issued its approval through CONEP opinion no. 3.249.268, dated 08.04.2019, and its results are available for consultation (Brasil, 2021).

The inclusion and exclusion of topics or questions investigated in the PeNSE were derived from the demands of the Brazilian Ministry of Health's Risk Factor Surveillance System for Chronic Non-Communicable Diseases. The sample considered by the IBGE was based on a two-stage conglomerate procedure, with schools corresponding to the first stage of selection and the second stage consisting of classes

of enrolled students (Brasil, 2021).

The data obtained from the IBGE databases for this survey was collected using a Mobile Collection Device, which corresponds to a smartphone into which the information from the self-administered questionnaire was entered. The definition of the final version of the data collection instruments was preceded by its structuring and testing, which has been improved since the first PeNSE in 2009. The preliminary version of the most recent PeNSE questionnaire underwent two stages of testing in the second half of 2018 and was evaluated by the Health Surveillance Secretariat of the Brazilian Ministry of Health. The time taken by the selected students to answer the questionnaire and their understanding of what was being asked were analyzed. The final collection, carried out by trained IBGE technicians, took place between April and September 2019, covering 1,288 Brazilian municipalities. More information on the sampling plan, the data collection procedures and the instruments used by the IBGE can be found in the survey report (Brasil, 2021).

### Participants

The adolescent participants selected by the IBGE were enrolled and regularly attending the 7th to 9th grades of elementary school and the 1st to 3rd grades of secondary school, across morning, afternoon, and evening shifts, in both public and private schools. Schools with fewer than 20 students enrolled were excluded by the IBGE. The total sample of PeNSE 2019 was 189,857 enrolled students. A total of 159,245 participants with regular attendance were validated from the general sample (Brasil, 2021).

For this study, as an exclusion criterion, adolescents between 13 and 17 years of age, of both sexes and from all Brazilian states participated in the final sample, leaving a total of 124,898 adolescents (78.04%). The sample cut-off was made to focus only on those who are characterized as "adolescents", according to Brazilian legislation (Brasil, 2022a), excluding children and adults.

### Procedures and Instruments

The dependent variable that characterized "body dissatisfaction" in the study was derived from the question: "How do you feel about your body?" (question code: B11007). This question was dichotomized into "Satisfied" and "Dissatisfied", with the first group consisting of those who self-reported as: "very satisfied, satisfied", while the second group included those who marked the option "indifferent, dissatisfied and very dissatisfied". Dichotomization model adopted following another study based on PeNSE (Gomes et al., 2021). Table 1 presents and characterizes all the variables used in this study.

For the variable "sex" (question code: B01001a) in this study, the biological criterion used by the IBGE in the PeNSE (Brasil, 2021) was maintained. The question that characterized the "level of physical activity" (question code: B03006b) was classified based on the World Health Organization (WHO) guidelines of incorporating at least 3 days a

week of moderate or vigorous intensity aerobic physical activity for adolescents (WHO, 2020).

The question on "practices in Physical Education or sport at school" (question code: B03005b) was classified according to the recommendation of 60 minutes of practical physical activity that should be spent in Physical Education classes, given that the daily average is 15 minutes of low to vigorous intensity physical activity for adolescents, which represents 25% of the recommendation (Bull et al., 2020; Hollis et al., 2016). The question that characterized "sedentary behavior" (question code: B03010b) was dichotomized into acceptable sedentary behavior  $\leq 4$  h/day and excessive sedentary behavior  $> 4$  h/day, following the model

of another study that used the PeNSE (Gomes et al., 2021).

Within the questions on mental health presented in the PeNSE, in order to produce a more objective classification, the question on "adolescents with close friends" (question code: B12003) was dichotomized into: "no close friends" and "one or more close friends". The other questions on mental health were classified and dichotomized according to another study using the same indicators of variables present in the topic "mental health" set out in PeNSE 2019 (Antunes et al., 2022). More detailed information on the study's variables, including their dichotomization and categorization, can be found in the analytical matrix presented in Frame 1.

Frame 1.

Analytical matrix of the questions used in the study

Dependent Variable		
Indicator	Code – Question	Categorized groups
Body dissatisfaction	B11007 - How do you feel about your body?	1 - Satisfied: Very satisfied; Satisfied; 2 - Dissatisfied: Indifferent; Dissatisfied; Very dissatisfied.
Independent variables		
Model 1 – Sociodemographic		
Indicator	Code – Question	Categorized groups
Sex	B01001a - What is your sex?	1 - Male: Man; 2 - Female: Woman.
Age Group	B01003 - How old are you?	1 - Younger teenagers: 13 to 15 years old; 2 - Older teenagers: 16 or 17 years old.
Model 2 - Physical activity, sedentary behavior and health perception		
Indicator	Code – Question	Categorized groups
Physical Activity	B03006b - IN THE LAST 7 DAYS, excluding school physical education classes, on how many days did you do any physical activity?	1 - Below recommended: No days in the last 7 days; 1 day; 2 days. 2 - Within the recommended range: 3 days; 4 days; 5 days; 5 days plus Saturday; 5 days plus Saturday and Sunday.
Physical activity or sport in Physical Education	B03005b - How much time a day did you DO physical activity or play sport during physical education lessons at school? Do not take into account the time spent on theoretical activities in the classroom.	1 - Below recommended: No physical activity in physical education class at school in the last 7 days; Less than 10 minutes a day; 10 to 19 minutes a day; 20 to 29 minutes a day; 30 to 39 minutes a day; 40 to 49 minutes a day; 50 to 59 minutes a day; 2 - Within the recommended range: 1 hour to 1 hour 19 minutes per day; 1 hour and 20 minutes or more per day.
Sedentary Behavior	B03010b - How many hours a day do you usually spend sitting, watching television, playing video games, using a computer, cell phone, tablet or doing other activities while sitting? (do not count Saturdays, Sundays, holidays or time spent sitting at school).	1 - Acceptable sedentary behavior: Up to 1 hour per day; More than 1 hour up to 2 hours per day; More than 2 hours up to 3 hours a day; More than 3 hours up to 4 hours a day. 2 - Excessive sedentary behavior: More than 4 hours up to 5 hours a day; More than 5 to 6 hours a day; More than 6 hours to 7 hours a day; More than 7 hours to 8 hours a day; More than 8 hours a day.
Perception of Health	B13005 - How would you rate your state of health?	1 - Positive perception: Very good; Good. 2 - Negative perception: Fair; Bad; Very bad.
Model 3 - Mental Health Indicator		
Indicator	Code – Question	Categorized groups
Having friends	B12003- How many close friends do you have?	1 - No close friends: No friends. 2 - One or more close friends: 1 friend; 2 friends; 3 or more friends.
Various concerns	B12004 - IN THE LAST 30 DAYS, how often have you felt very worried about the ordinary things in your day-to-day life such as school activities, competitions, sports, homework, etc.?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.

Feelings of sadness	B12005 - IN THE LAST 30 DAYS, how often have you felt sad?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Perceived indifference	B12006 - IN THE LAST 30 DAYS, how often have you felt that no one cares about you?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Feeling of irritation	B12007 - IN THE LAST 30 DAYS, how often have you felt irritable, nervous or moody because of something?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Suicidal ideation indicator	B12008 - IN THE LAST 30 DAYS, how often have you felt that life is not worth living?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.

### Statistical Analysis

Data analysis procedures used descriptive statistics and verification of the chances of occurrence through binary logistic regression and their respective confidence intervals. The model used to analyze associations was adjusted and divided into three explanatory blocks: model 1 - sociodemographic (variables gender and age group); model 2 - physical activity, sedentary behavior and health perception (variables physical activity; practices in Physical Education or sport at school; sedentary behavior and health perception), plus the significant variables from model 1; model 3 - mental health indicators (variables adolescents with close friends; adolescents with worries about common everyday things; adolescents with feelings of sadness; adolescents with feelings that nobody cared about them; irritable, nervous and moody adolescents and adolescents with feelings that life is not worth living), plus the significant variables grouped together from model 2.

Variables with statistical significance  $p < 0.05$  remained in the models. All the analyses were carried out using Jamovi software for Windows, version 2.3.

### Results

This study consisted of a sample of 124,898 adolescents. The largest proportion was "female", 63,148 (50.68%) and they were in the "age group" between 13 and 15 years old, 82,389 (65.97%). Table 1 shows the general characteristics of the sample and their categorizations based on the responses obtained through the data collection instrument applied by the IBGE. Other variables chosen for possible associations with "body dissatisfaction", according to the objectives of this study, can be consulted in Table 1.

The descriptive results presented in Table 1, with their respective 95% Confidence Intervals, showed that the highest proportions of adolescents were: "female" 50.68% (CI = 50.40; 50.95) and "younger adolescents" 65.97% (CI = 65.70; 66.23). In addition, the descriptive data showed that: 59.14% (CI = 58.86; 50.47) of the adolescents had a level of physical activity "below recommended"; 75.75% (CI = 75.48; 76.02) practiced physical activity or sports "within recommended"; 56.66% (CI = 56.38; 56.94) had "acceptable sedentary behavior" and 67.66% (CI = 67.40; 67.93) had a "positive perception" regarding health.

Finally, the results showed higher proportions: 96.63%

(CI = 96.52; 96.73) adolescents with "one or more close friends"; 57.17% (CI = 56.90; 57.45) with worries about common everyday things "most of the time, always"; 68.35% (CI = 68.09; 68.61) with feelings of sadness "never, rarely, sometimes"; 70.93% (CI = 70.68; 71.18), who felt that no one cared about them "never, rarely, sometimes"; 58.22% (CI = 57.94; 58.49) who felt irritable, nervous or moody, "never, rarely, sometimes"; and 79.76% (CI = 79.53; 70.98) had feelings that life was not worth living "never, rarely, sometimes". In addition, the descriptive data showed that 62.36% (CI = 62.09; 63.63) of the adolescents were "satisfied".

Table 1. General characteristics of the sample

Variables considered	n*	%	Confidence Interval 95%	
			Lower limit	Upper limit
Sex				
Male	61.462	49.32	49.05	49.60
Female	63.148	50.68	50.40	50.95
Age group				
Younger adolescents	82.309	65.97	65.70	66.23
Older adolescents	42.509	34.03	33.77	34.30
Physical Activity				
Within the recommended range	50.913	40.86	40.59	41.14
Below recommended	73.686	59.14	58.86	50.47
Time spent practicing physical education or sport				
Within the recommended range	12.360	12.99	12.78	13.21
Below recommended	82.766	87.01	86.79	87.22
Sedentary Behavior				
Acceptable sedentary behavior	69.718	56.66	56.38	56.94
Excessive sedentary behavior	53.327	43.34	43.06	43.62
Perception of health				
Positive perception	83.845	67.66	67.40	67.93
Negative perception	40.067	32.34	32.07	32.60
Teenagers with close friends				
One or more close friends	120.280	96.63	96.52	96.73
No close friends	4.199	3.37	3.27	3.48
Teenagers with worries about everyday things				
Never, rarely, sometimes	53.214	42.83	42.55	43.10
Most of the time, always	71.038	57.17	56.90	57.45
Teenagers with feelings of sadness				
Never, rarely, sometimes	84.973	68.35	68.09	68.61
Most of the time, always	39.344	31.65	31.39	31.91
Teenagers with feelings that nobody cared about him				
Never, rarely, sometimes	84.144	70.93	70.68	71.18
Most of the time, always	36.126	29.07	28.82	20.32
Teenagers irritable, nervous and moody				
Never, rarely, sometimes	72.353	58.22	57.94	58.49
Most of the time, always	51.932	41.78	41.51	42.06
Teenagers with feelings that life is not worth living				
Never, rarely, sometimes	99.022	79.76	79.53	79.98
Most of the time, always	25.130	20.24	20.02	20.47
Body Dissatisfaction				
Satisfied	77.082	62.36	62.09	63.63
Dissatisfied	45.530	37.64	37.37	37.91

\*n: Total number.

Table 2 shows the associations between the dependent variable "body dissatisfaction" and the independent variables considered, inserted hierarchically within the model.

The results of the analysis in this study are presented for discussion starting with model 3, after all the groupings and adjustments included in the models.

Table 2  
Associations between the dependent variable "body dissatisfaction" and the variables considered adjusted within the model

Variables considered	Reference of the Model	Model 1			Model 2			Model 3		
		Sociodemographic			Physical activity, sedentary behavior and health perception			Mental health indicators		
		OR*	CI** 95 %	p***	OR	CI 95%	p	OR	CI 95%	p
Sex	Female	2.35	2.29 2.42	< .001	1.97	1.91 2.02	<.001	1.39	1.35 1.43	<.001
Age Group	Older	1.18	1.15 1.22	<.001	1.10	1.07 1.14	<.001	1.04	1.01 1.08	0,013
Physical Activity	Below recommended				1.15	1.12 1.19	<.001	1.17	1.14 1.21	<.001
Practices in Physical Education or sport at school	Below recommended				1.07	1.03 1.12	0,002	1.08	1.03 1.13	<.001
Sedentary Behavior	Excessive sedentary behavior				1.57	1.53 1.62	<.001	1.41	1.37 1.46	<.001
Perception of health	Negative perception				2.98	1.17 1.23	<.001	2.24	2.17 2.32	<.001
Teenagers with close friends	No close friends							1.38	1.27 1.50	<.001
Teenagers worried about common everyday things	Most of the time, always							1.43	1.39 1.48	<.001
Teenagers with feelings of sadness	Most of the time, always							1.97	1.89 2.04	<.001
Teenagers with feelings that nobody cared with him	Most of the time, always							1.42	1.37 1.47	<.001
Teenagers angry, nervous and moody	Most of the time, always							1.39	1.35 1.44	<.001
Teenagers with feelings that life is not worth be lived	Most of the time, always							1.49	1.43 1.56	<.001

\*OR: Odds Ratio; \*\*CI: Confidence Interval 95%; \*\*\*p: Probability.

All the variables analyzed in this study indicated significant associations in relation to "body dissatisfaction". In block 1 "sociodemographic", included in model 1, female adolescents (OR = 1.39; 95% CI = 1.35;1.43) and older adolescents (OR = 1.04; 95% CI = 1.01;1.08) had increased odds of "body dissatisfaction".

In block 2 "physical activity, sedentary behavior and perception of health", included in model 2, adolescents who had a level of physical activity "below recommended" (OR = 1.17; 95% CI = 1.14;1.21), who had time spent in physical activity or sports at school "below recommended" (OR = 1.08; 95% CI = 1.03;1.13), who showed "excessive sedentary behavior" (OR = 1.41; 95% CI = 1.37;1.46) and who had a "negative" perception of health (OR = 2.24; 95% CI = 2.17;2.32) showed increased chances of "body dissatisfaction".

Finally, in line with the main objectives of this study, the final adjusted block within model 3: "mental health indicators", showed that school-aged adolescents who answered that they had "no close friends" (OR = 1.38; 95% CI = 1.27;1.50), who showed worries about common everyday things "most of the time, always" (OR = 1.43; 95% CI = 1.39;1.48), who showed feelings of sadness "most of the time, always" (OR = 1.97; 95% CI = 1.89;2.04), who felt that no one cared about them "most of the time, always" (OR = 1.42; 95% CI = 1.37;1.47), who felt irritable, nervous or grumpy "most of the time, always" (OR = 1.39; 95% CI = 1.35;1.44) and school-aged adolescents who felt that life was not worth living "most of the time, all of the time" (OR = 1.49; 95% CI = 1.43;1.56) were also more likely

to be dissatisfied with their bodies.

## Discussion

The main objective of the study was to verify the associations between the dependent variable "body dissatisfaction" and the independent variables "physical activity" and "mental health indicators." The main findings indicate that increased chances of body dissatisfaction correlate with insufficient physical activity and various mental health indicators, such as loneliness, anxiety, sadness, and situations that can lead to stress, depression, and suicide.

The associations also revealed that females, older adolescents, those who practiced physical activity or sports at school below what is recommended, those who showed excessive sedentary behavior and a negative perception of health in general, also showed greater chances of body dissatisfaction.

In the sociodemographic variables analyzed in this study, females had a 39% increased chance of body dissatisfaction compared to the opposite sex. The pattern of greater body dissatisfaction in female adolescents compared to males is evidenced in other studies (Gualdi-russo et al., 2022; Miranda et al., 2018).

Social and biological reasons can explain this data: social - internalization of an early aesthetic model, which exposes the slim and athletic body as the key to female attractiveness; in addition to cultural and media pressure and the "bombardment" of social networks with ideals of the "perfect" body (Fernández-Bustos et al., 2019); biological - in natural female physiology, during puberty, there

is a favorable deposition of adipose tissue, increasing body fat, which makes this period more critical for adolescents (Pereira et al., 2020). During this period, there are gender-specific physiological differences, in which there is an increase in body fat (mainly in the central region of the body) and a decrease in lean mass in females compared to males, which implies changes in body shape and size, which can lead to body dissatisfaction, especially in females (Gualdi-russo et al., 2022).

In the "age group" variable, "older adolescents" showed a 4% increased chance of body dissatisfaction. This result may indicate, as one study suggests, that all the years leading up to adolescence have indicated concerns about body image (Van Den Berg et al., 2010). These differences in body dissatisfaction between the age groups can be explained by the body transformations that take place in early adolescence, during the maturation process, in which the adolescent's body identity is still being formed. The period of sexual and biological maturation, causing hormonal and bodily changes, which comprises the period of early adolescence, increases body adiposity and consequently the development of negative feelings towards the body (Lima Borges et al., 2021). Thus, it is inferred that, by the age of 17, the final formation of the adolescent's body is already close to that of an adult, thus generating less dissatisfaction with body image (Pimentel et al., 2017).

In this study, a level of physical activity below the recommended level was associated with a 17% increased chance of body dissatisfaction. The WHO points out that doing some physical activity is better than none, and the more the better (WHO, 2020). Scientific studies have been divergent in relation to the association between levels of physical activity and body dissatisfaction, however, low levels of physical activity, or the lack of it, was reported in a Brazilian study as a possible aggravating factor for body dissatisfaction in adolescents (Fantineli et al., 2020). Corroborating the results of this study, another finding with adolescents points out that the greater the participation in physical activity, the lower the body dissatisfaction (Hao et al., 2022).

In this study, physical activity was measured in days per week, not in minutes per week, as is usually the case in other studies. The WHO recommends that children and adolescents should do at least an average of 60 minutes a day of moderate to vigorous intensity physical activity throughout the week, but that these activities should be incorporated into at least 3 days a week (WHO, 2020). Another study based on the PeNSE showed that adolescents who were physically active for five or more days a week were less likely to have body dissatisfaction (Tebar, et al., 2021).

On the other hand, participation in practical classes in school Physical Education can be important for stimulating changes in out-of-class behavior in adolescents, influencing them to adopt a more physically active behavior and spend less time in sedentary behavior (Matias et al., 2018; Miguel-Berges et al., 2018). This stimulus of regular physical activity or sport results in notable physical changes (in weight

and body composition), improving self-esteem and self-confidence, which can result in a more positive perception of body image (Sabiston et al., 2019). A study showed that the lack of pedagogical resources of the Physical Education teacher at school and an insufficient capacity for positive perception of the body image of adolescents generate a lower participation in classes (Lagos Hernández et al., 2022).

In this study, adolescents with less time spent in physical activity or sports in Physical Education showed an 8% increased chance of body dissatisfaction. School Physical Education contributes to students' understanding of their bodies, encourages the practice of physical activity and the adoption of a healthier lifestyle, and its practical interventions can considerably increase the amount of physical activity adolescents do during the week (da Silva et al., 2022; Errisuriz et al., 2018). Studies conducted with adolescents in various countries have found that physical education classes are important for encouraging students to get involved in physical and sporting activities at school and outside of school, and that an increase in weekly physical education classes results in adolescents who are more physically active, which can lead to a more positive body image (Calahorra-Cañada et al., 2017; Loprinzi et al., 2018; Møller et al., 2014).

Another important fact to consider is that in adolescence there is an increase in sedentary behavior, while the level of physical activity tends to decrease significantly. This trend in behavior contributes to the expansion of excess weight in adolescence, and consequently, there is an exponential increase in concerns about body image during this period (Kemp et al., 2020).

In this study, adolescents with excessive sedentary behavior had a 41% increased chance of body dissatisfaction. In other studies, sedentary behavior was also strongly associated with body image dissatisfaction in adolescents (Fernández-Bustos et al., 2019; Miranda et al., 2018). Corroborating this study, another finding showed that spending > 4 h/day in sedentary behavior showed greater chances of body image dissatisfaction in adolescents of both sexes (Gomes et al., 2021).

This study also investigated the association between body dissatisfaction and "perceived health". The result was that adolescents who reported a "negative perception of health" were more than twice as likely to be dissatisfied with their bodies as the opposite group. Excess body weight is one of the main indicators of body dissatisfaction and longitudinal studies have shown that this association between body weight and body dissatisfaction is related to a decrease in general health status (Eisenberg et al., 2006; Neumark-Sztainer et al., 2006). In addition, adolescents form their perception of health according to their physical health. In this way, an unfavorable view of health, which can be influenced by excessive alcohol consumption, lack of regular exercise and chronic diseases, can have an impact on body dissatisfaction (Nogueira et al., 2023). In the final model adjusted in this study, the six indicators of mental health variables in PeNSE

2019 showed negative associations with body dissatisfaction. In this study, adolescents who reported not having "any close friends" were 38% more likely to be dissatisfied with their bodies. This variable refers to loneliness, and this association between body dissatisfaction and social isolation/loneliness can be explained by the shame of something that involves physical appearance, especially obesity (Tran et al., 2019). Having friends in adolescence is an important factor for socialization and mental health and one study revealed that students with body dissatisfaction are more likely to feel lonely (De Camargo et al., 2023; Wroblewski et al., 2022).

In this study, adolescents who reported common worries about everyday things "most of the time, always" had a 43% increased chance of body dissatisfaction. This variable refers to anxiety, where the individual's psychosocial state can increase the risk of body dissatisfaction, since in adolescence there is a process of mental reorganization, being a vulnerable period for the appearance of symptoms that are consistent with anxiety (Duchesne et al., 2017; Grolli et al., 2017).

Furthermore, this study showed that adolescents who reported feeling sad "most of the time, all of the time" were 97% more likely to be dissatisfied with their bodies. This feeling of sadness can be indicative of a depressive state and, as adolescents approach adulthood, they experience depressive emotions, perceptions of unhappiness and helplessness as a result of this life stage transition (Agathão et al., 2018). Studies have shown that depression has a bidirectional association with body dissatisfaction (Bornioli et al., 2021; El Ansari & Berg-Beckhoff, 2019).

Adolescents in this study who felt that nobody cared about them had a 42% increased chance of body dissatisfaction, which could also be related to depression. It is understood that the formation of a coherent and secure personality in adolescence requires a good relationship with self-image and self-esteem and the possible justifications found suggest that adolescents may have negative perceptions of their body image because they want to achieve unattainable standards of beauty. This can lead to unsuccessful efforts to change their bodies, resulting in frustration and depression (Chen et al., 2015).

This study also found that irritable, nervous and moody adolescents had a 39% increased chance of body dissatisfaction. This variable is closely related to stress and it is known that this is implicated in the onset of internalizing and externalizing symptoms in adolescence (Grant et al., 2006), however, it is also understood that its link with body dissatisfaction has received little attention in scientific studies, so one study suggests that the approach to stress, self-esteem and body importance should be included in programs that seek to improve body dissatisfaction (Murray et al., 2013).

Finally, adolescents who reported feeling that life was not worth living "most of the time, all of the time" had a 49% increased chance of body dissatisfaction. This variable has a strong relationship with a tendency to suicide and this

sadness about life is an important sign of psychological distress that requires a rigorous, multi-professional support network. It is known that body dissatisfaction is related to feelings of social rejection, loneliness, sadness, difficulty sleeping and ideals of suicide, which is the path adopted to solve these problems, especially by women (Simões et al., 2022).

This study has some limitations: the cross-sectional nature of the work, making it impossible to determine causality and recall bias, and possible confusion related to the interpretation of the self-administered structured questionnaire, which could lead to inaccurate responses from school-age adolescents. In addition, PeNSE only investigates students who are regularly enrolled and attending school, excluding adolescents who may be more vulnerable because they are further away from school. A strong point is the significant size of the sample of participating adolescents, from public and private schools in all regions of Brazil, which improves the validity of the results.

## Conclusion

This study showed an increased likelihood of a direct association between body dissatisfaction, insufficient physical activity and mental health indicators in Brazilian school-age adolescents. All the independent variables included in the study pointed to chances of greater exposure to body dissatisfaction. Based on the findings, it is concluded that formulating and implementing public policies is crucial to promote increased physical activity both during and outside of school hours, thereby reducing sedentary behavior. This approach can positively impact the overall health of adolescents and contribute to improving their body image perception. Additionally, it is essential to promote actions aimed at reducing and preventing mental health challenges among adolescents.

## Data Availability Statement

The data from this research can be obtained at <https://www.ibge.gov.br/estatisticas/downloads-estatisticas.html?caminho=pense/2019/microdados/> (accessed on September 30, 2023).

## Conflicts of interest

The authors declare no conflicts of interest.

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