

Body image, nutritional status, abdominal strength, and cardiorespiratory fitness in children and adolescents practicing sports

Imagem corporal, estado nutricional, força de resistência abdominal e aptidão cardiorrespiratória de crianças e adolescentes praticantes de esportes

Imagen corporal, estado nutricional, fuerza de resistencia abdominal y aptitud cardiorrespiratoria de niños y adolescentes practicantes de deportes

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ABSTRACT

Objective: To verify the association between nutritional status, physical fitness, and body image in children and adolescents.

Methods: This cross-sectional study included 401 students (236 boys and 165 girls) aged between 8 and 16 years that were regularly enrolled in sports in the local clubs. The nutritional status was evaluated by the body mass index. Students were assessed for satisfaction with body image, abdominal strength resistance, and cardiorespiratory fitness. The variables were assessed on the same day following a standardized order. In order to verify relationships between variables, the chi-square test was used. Afterwards, the binary logistic regression was applied to identify the magnitude of the associations, considering $p < 0.05$ as significant.

Results: Association was found between body image and body mass index ($p = 0.001$), abdominal strength resistance ($p = 0.005$) and cardiorespiratory fitness ($p = 0.001$). The Odds Ratio for presenting the body image dissatisfaction for those who have not achieved the expected values for the health criteria in abdominal strength resistance and cardiorespiratory fitness were 2.14 and 2.42 times respectively, and for those with overweight and obesity, 2.87 times.

Conclusions: Dissatisfaction with body image is associated with body mass index and also with physical fitness, abdominal strength resistance, and cardiorespiratory fitness variables.

Key-words: physical fitness; body mass index; body image, children; adolescents.

RESUMO

Objetivo: Verificar se há associação entre estado nutricional, nível de aptidão física e imagem corporal em crianças e adolescentes.

Métodos: Participaram deste estudo transversal 401 estudantes (236 meninos e 165 meninas) com idades entre 8 e 16 anos, praticantes de esportes nos clubes locais. Para o estado nutricional calculou-se o índice de massa corpórea. Foram avaliadas a satisfação com a imagem corporal, a força de resistência abdominal e a aptidão cardiorrespiratória. As variáveis foram analisadas no mesmo dia, seguindo ordem padronizada. Para verificar as associações entre as variáveis foi utilizado o teste do qui-quadrado. Posteriormente, a regressão logística binária foi aplicada para identificar a magnitude das associações, considerando-se significante $p < 0,05$.

Resultados: Foi constatada associação entre imagem corporal e índice de massa corpórea ($p = 0,001$), força de resistência abdominal ($p = 0,005$) e aptidão cardiorrespiratória ($p = 0,001$). A razão de chances para os participantes que não atingiram os valores esperados para os critérios de saúde na força de resistência abdominal e na aptidão cardiorrespiratória de apresentarem insatisfação com a imagem corporal foi

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de 2,14 e 2,42 vezes, respectivamente, e para aqueles com sobrepeso e obesidade, de 2,87 vezes.

Conclusões: A insatisfação com a imagem corporal está associada ao índice de massa corpórea e também às variáveis de aptidão física, força de resistência abdominal e aptidão cardiorrespiratória.

Palavras-chave: aptidão física; índice de massa corporal; imagem corporal; crianças; adolescentes.

RESUMEN

Objetivo: Verificar si hay asociación entre estado nutricional, nivel de aptitud física e imagen corporal en niños y adolescentes.

Métodos: Participaron de este estudio transversal 401 estudiantes (236 muchachos y 156 muchachas) con edades entre 8 y 16 años. Para el estado nutricional se calculó el índice de masa corporal. Se evaluaron la satisfacción con la imagen corporal, la fuerza de resistencia abdominal y la aptitud cardiorrespiratoria. Las variables fueron analizadas en el mismo día, siguiendo orden estandarizado. Para verificar las asociaciones entre las variables se utilizó la prueba del chi-cuadrado. Posteriormente, se aplicó la regresión logística binaria para identificar la magnitud de las asociaciones, considerando como significativa $p < 0,05$.

Resultados: Se constató asociación entre imagen corporal e índice de masa corporal ($p=0,001$), fuerza de resistencia abdominal ($p=0,005$) y aptitud cardiorrespiratoria ($p=0,001$). La razón de chances para los participantes que no alcanzaron los valores esperados para los criterios de salud en la fuerza de resistencia abdominal y en la aptitud cardiorrespiratoria de presentar insatisfacción con la imagen corporal fue de 2,14 y 2,42 veces, respectivamente, y para aquellos con sobrepeso y obesidad, de 2,87 veces.

Conclusiones: La insatisfacción con la imagen corporal está asociada al índice de masa corporal y también a las variables de aptitud física, fuerza de resistencia abdominal y aptitud cardiorrespiratoria.

Palabras clave: aptitud física; índice de masa corporal; imagen corporal; niños; adolescentes.

Introduction

Several studies have been shown that obesity has reached epidemic proportions in the last decades in most developed

and developing countries⁽¹⁻³⁾. Additionally, it is well documented in literature that its effects reach all ages indistinctively⁽⁴⁻¹⁰⁾, so that the prevalence of overweight and obesity has been growing in children and adolescents and is directly associated with higher risks for morbidity and mortality in adulthood⁽¹¹⁾. In this sense, the significant increase in body mass combined with a sedentary lifestyle is associated with decreased physical fitness, leading to impairments in cardiorespiratory function and muscle resistance. Conversely, although obesity is a highly prevalent disease, its psychosocial determinants have not been totally understood yet⁽¹²⁾.

Studies approaching the psychological effects of obesity in adults have been widely explored; however, the findings are not consistent in children and adolescents, possibly because these periods are marked by development and by significant physical and psychological changes. Alterations in morphology and physical appearance seem to be the most evident concerns among the population in question and, for this reason, obesity may predispose to dissatisfaction with body image⁽¹³⁾.

Moreover, studies that examined the association between body image and physical fitness are still inconsistent, and those aiming to associate body image dissatisfaction and low physical fitness in children are scarce. Thus, the aim of this study was to identify the possible association between body image, nutritional status, abdominal strength/resistance (ABD) and cardiorespiratory fitness (CF) in children and adolescents practicing sports.

Method

A descriptive exploratory research with cross-sectional design was conducted, whose study population was selected by convenience sampling at the main sports clubs in the city of Londrina, state of Paraná, Brazil. The sample was selected using a table of random numbers and included 401 children and adolescents of both genders (236 boys and 165 girls) aged between 8 and 16 years and who had participated in schools of individual and team sports for at least one year and had Physical Education classes at school two or three times a week.

This study was submitted to and approved by the Research Ethics Committee of Universidade Estadual de Maringá, according to the regulations of resolution 196/96 of the Brazilian National Health Council on research involving human beings, under opinion number 129/2010. After being properly informed about the purpose of the research and

its procedures, legal guardians of the subjects investigated signed a free and informed consent form.

Data from each individual were collected on the same day, according to the following sequence: firstly, the tests related to subjects' anthropometric data, i.e., body mass and height. Then body image was assessed and finally the field tests were performed in the following order: ABD and CF tests.

Body mass was measured by a Filizola digital platform scale (S.A Pesagem e Automação, São Paulo, Brazil), model ID110, and height was determined by a wooden stadiometer accurate to 0.1 cm. Nutritional status was evaluated by the body mass index (BMI), calculated as the ratio between body mass and height squared. An international nutritional status chart widely used in national studies was adopted as a reference⁽¹⁴⁾. After BMI was assessed, subjects were stratified into two groups, one comprising eutrophic individuals and the other comprising overweight and obese individuals.

The battery of tests and the classification criteria proposed by *Projeto Esporte Brasil* (PROESP) were used as indicators of health-related physical fitness (HRPF)⁽¹⁵⁾. Subjects were divided into two groups: those who had met health indicators and those who had not. Individuals classified as having very poor, poor and fair physical fitness⁽¹⁵⁾ were reclassified as not meeting health indicators, and those classified as having good, very good and excellent physical fitness, according

to the same authors, were reclassified as meeting health indicators. The tests used to evaluate HRPF were: ABD and nine-minute walk test for CF.

Body image satisfaction was identified as the agreement between self-reported current and ideal silhouettes, both of them selected by the participants from a scale showing different silhouettes of human figures⁽¹⁶⁾.

The sample was characterized using descriptive statistics. In parallel, data were dichotomously categorized and then the chi-square test⁽¹⁷⁾ was used to identify possible associations. Secondly, the binary logistic regression was applied to identify the magnitude of the associations⁽¹⁸⁾. Univariate analysis were performed and subsequently the adjusted model was applied to those variables that remained significant ($p < 0.05$). Afterwards, the binary logistic regression was used again, adjusted for BMI, considering body image as a dependent variable. The significance level was set at $p < 0.05$. Data were calculated with Statistical Package for the Social Sciences (SPSS) software, version 17.0.

Results

Boys represented 59% of the total sample (401 children and adolescents), and girls, 41%. Table 1 shows the general characteristics of the sample. There was significant difference

Table 1 - General characteristics of the sample, described as mean±standard deviation

	Boys (n=236)	Girls (n=165)	p-value
Age (years)	11.95±2.34	12.20±2.06	<0.001
Height (cm)	1.56±0.16	1.53±0.12	<0.001
Body mass (kg)	52.45±18.51	48.02±14.51	<0.001
BMI (kg/m ²)	20.76±4.1	19.90±3.97	<0.001

BMI: body mass index

Table 2 - Prevalence and association of body image with nutritional status, abdominal strength/resistance, and cardiorespiratory resistance

	Body image		p-value
	Satisfied n (%)	Dissatisfied n (%)	
Eutrophy	151 (64)	85 (36)	<0.001
Excess weight	63 (38.2)	102 (61.8)	
Met ABD criteria	185 (56.9)	140 (43.1)	0.005
Did not meet ABD criteria	29 (38.2)	47 (61.8)	
Met CF criteria	140 (63.1)	82 (36.9)	<0.001
Did not meet CF criteria	74 (41.3)	105 (56.1)	

ABD: abdominal strength/resistance; CF: cardiorespiratory fitness

among sexes for age, height, body mass and BMI, with boys presenting the highest values for height, body mass and BMI. Girls had a higher mean age.

Table 2 displays the values for the chi-square test, identifying an association between nutritional status and body image, in the sense that those individuals classified as having excess weight reported dissatisfaction with body image. Low performance in the motor test, which is an indicator of muscle strength/resistance, was also associated with body image disorders. A similar association was found for motor capacity and cardiorespiratory resistance.

The univariate model for association between anthropometric variables and body image (Table 3) presents odds ratio values and their respective confidence intervals. Subjects with excess weight had a 187% higher chance of developing body weight dissatisfaction compared to eutrophic subjects. As for the association with the abdominal strength/resistance variable, subject who did not meet the health criteria for this motor capacity had a 114% higher chance of presenting body image dissatisfaction compared to those who met the criterion. Likewise, subjects with low CF showed a 142% higher chance of body image dissatisfaction compared to those who had met health criteria for this motor capacity.

In the values presented using the adjusted model (Table 4), the association between abdominal strength/resistance and

body image disorder loses statistical significance. Conversely, the associations of BMI and CF with body image dissatisfaction remained statistically significant.

Discussion

The present study investigated the existence of possible associations between body image, nutritional status, ABD and CF in children and adolescents of both sexes participating in schools of individual and team sports in the main sports clubs from the city of Londrina, Brazil.

It was observed that there was a greater proportion of children and adolescents classified as eutrophic by BMI, and a significant difference was found between boys and girls. Nutritional status showed to be associated with body image, since overweight and obese subjects had a 2.87 times higher chance of being dissatisfied with their body image. This dissatisfaction is part of a subcomponent of the attitudinal dimension of body image, and concerns to how subjects depreciate their own physical appearance^(19,20). Petroski *et al*⁽²⁰⁾, in a study involving a sample of schoolchildren, showed that individuals with excess weight, according to BMI, have a 8.45 times higher chance of being dissatisfied with their body image, a value much higher than that of the present study.

Table 3 - Univariate model for association between physical activity variables and body image

	Body image		OR (95%CI)	p-value
	Physical activity variables			
BMI	Eutrophic	Reference		
	Excess body		2.87 (1.90–4.34)	<0.001
ABD	Met criteria	Reference		
	Did not meet criteria		2.14 (1.28–3.57)	0.004
CF	Met criteria	Reference		
	Did not meet criteria		2.42 (1.61–3.62)	<0.001

BMI: body mass index; ABD: abdominal strength/resistance; CF: cardiorespiratory fitness; OR: Odds Ratio

Table 4 - Adjusted model for association between physical activity variables and body image

	Body image		OR (95%CI)	p-value
	Physical activity variables			
BMI	Eutrophic	Reference		
	Excess body		2.32 (1.51–3.58)	<0.001
ABD	Met criteria	Reference		
	Did not meet criteria		1.38 (0.79–2.42)	0.248
CF	Met criteria	Reference		
	Did not meet criteria		1.80 (1.16–2.79)	0.008

BMI: body mass index; ABD: abdominal strength/resistance; CF: cardiorespiratory fitness, OR: Odds Ratio

However, although the results from the present investigation were lower than those of the above mentioned study, they are still worrying, because the most common practices of weight control among dissatisfied adolescents are usually associated with strenuous physical exercises and inappropriate eating behavior, suggesting the presence of eating disorders⁽²¹⁾. Additionally, it was observed that the majority of eutrophic subjects (64%) were satisfied with their body image. However, in the case of overweight or obese subjects, only 38.2% of them reported to be satisfied with their body image. Likewise, other authors⁽²²⁾ found that most overweight and obese adolescents were more dissatisfied with their body image than eutrophic adolescents. Conversely, in another study⁽²³⁾, 82% of the sample of schoolchildren aged between 8 and 12 years-old reported to be dissatisfied with their body image, regardless of BMI classification, which shows that, in this case, body image dissatisfaction was not associated with nutritional status.

Although obese children were more dissatisfied with their body image than their eutrophic counterparts, their concept on their bodies is not totally negative. It means, although they agree that they are bothered by their physical appearance, some positive features about certain parts of their body, such as eyes and a pretty face, can mitigate dissatisfaction⁽²⁴⁾. Others authors who also analyzed schoolchildren⁽²⁵⁾ showed that most eutrophic children evaluated (58.2%) were dissatisfied with their body image, results that differ from those presented herein.

Thus, some studies point out that BMI is one of the main determinants of body satisfaction^(26,27), while other studies argue that this indicator is little important compared to the psychological characteristics that influence dissatisfaction with body image^(21,28). In this sense, it is observed that body dissatisfaction rates diverge considerably among the studies. However, it is consensus in literature that body dissatisfaction is highly prevalent during adolescence, especially among girls⁽²⁹⁾.

As for the association between physical fitness and body image, it was observed that there was a greater proportion of subjects satisfied with their body image among those who had met the established criteria for HRPF, both for ABD and CF, 56.9 and 63.1%, respectively. However, when physical fitness levels had not met these criteria, there was a greater proportion of subject dissatisfied with their body image for the same capacities (61.8 and 56.1%). In a study with older adults⁽³⁰⁾, it was found that physical activity

improves not only physiological but also psychological aspects, such as body image satisfaction.

The literature presents univariate models of boys and girls who find themselves "very fat", being remarkably influenced by a high risk for physical inactivity. Thus, the association between body image dissatisfaction and low physical activity levels is well established in both sexes⁽³¹⁾; however, no study on the association between physical fitness and body image was found for any age.

As for the physical fitness components, it was observed that the greater proportion of individuals satisfied with their body image was found among those who had met the health criteria for ABD and CF, 56.9 and 63.1% respectively. In turn, the greater proportion of dissatisfied individuals had not met these criteria for both variables. This finding is emphasized by the observation that the Odds Ratios for presenting body image dissatisfaction for those who had not met the health criteria for ABD and CF were 2.14 and 2.42 times, respectively.

A study⁽³²⁾ with college students found that they reported better body image after undergoing a strength training program for six weeks. These results are similar to those from another study⁽³³⁾, which also showed that there was an improvement in the body image of female college students after a 12-week strength training program. Therefore, evidence shows that the practice of physical exercises and the improvement in some physical fitness components can influence the improvement in body image. Conversely, a longitudinal analysis has not revealed any association between changes in body perception and alteration in physical activity level over 12 months⁽³⁴⁾. In addition, other authors⁽³⁵⁾, when analyzing female athletes, observed that 33% of them presented body image distortion even though having body fat compatible for age and sex.

As for the values shown in the adjusted model, it is possible to observe that abdominal resistance loses its association with body image. However, the opposite occurs with BMI and CF, which remained associated with body image, although with a decrease in magnitude. Therefore, it seems reasonable to assume that body image is associated with some physical fitness variables, such as ABD and CF. However, the causes leading to this association have not been clarified yet. One of the factors that could justify such association may be the relationship between physical fitness variables and BMI, considering that individuals with low cardiorespiratory resistance and limited ABD are more likely to present high BMI values.

It is also important to highlight that a possible limitation of this study was the fact that it did not control for physical activity levels at leisure times, which could have influenced the results found, depending on the activity. Another factor to be considered is that the research did not examine the activities proposed during Physical Education classes, which

may also have had an influence on the results from this study. Anyway, these results point out the existence of an association between body image and nutritional status and between body image and physical fitness variables, such as ABD and cardiorespiratory resistance, in children and adolescents participating in schools of individual and team sports.

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