Objective: To assess the association of body image dissatisfaction with two anthropometric indicators (body mass index and sum of skinfolds) in female adolescents and to identify the best predictor of body image dissatisfaction in this population.

Method: The study included 329 female students aged 11–14 years from Santa Maria/RS. Body image was evaluated by the scale of body silhouettes of Stunkard et al. Body weight, height and skinfold thickness were measured to calculate body mass index and sum of skinfolds. The chi-square test and logistic regression analyses were used in the SPSS® 15.0 software, adopting a significance level of 5.0%.

Results: Body image dissatisfaction was associated with both anthropometric indicators; however, body mass index showed greater predictive power of this phenomenon, and overweight and obese students were three times more likely to be dissatisfied.

Conclusion: This study suggests the use of body mass index as an anthropometric indicator in studies on body image in this population due to its strong relationship with body image dissatisfaction.

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Introdução

O índice de massa corporal (IMC) é um indicador antropométrico que mede o peso corporal em relação à altura da pessoa. O IMC é usado em muitos países para avaliar o sobrepeso e a obesidade. No entanto, é importante lembrar que o IMC não é uma medida perfeita e pode não ser apropriada para todos os grupos de pessoas. Por exemplo, pessoas que têm uma grande quantidade de massa muscular podem ter um IMC alto, mas ainda assim serem saudáveis. Outros métodos de avaliação de saúde corporal incluem a medida de circunferência braço e a circunferência cintura, que podem ser usados para avaliar a proporção de gordura corporal.

Políticas e práticas de saúde corporal

As políticas e práticas de saúde corporal têm um papel importante na prevenção e tratamento de doenças relacionadas à obesidade. A promoção de uma vida saudável e a prevenção de doenças podem ser alcançadas por meio da educação e da promoção de atividades físicas e do esporte. Além disso, a criação de políticas que promove o uso de alimentos saudáveis e o controle de peso corporal pode ser uma forma de prevenção de doenças relacionadas à obesidade.

Conclusão

O IMC é um indicador antropométrico que pode ser usado para avaliar o sobrepeso e a obesidade. No entanto, é importante lembrar que o IMC não é uma medida perfeita e pode não ser apropriada para todos os grupos de pessoas. Outros métodos de avaliação de saúde corporal incluem a medida de circunferência braço e a circunferência cintura, que podem ser usados para avaliar a proporção de gordura corporal.

Palavras-chave:
Adolescentes
Composição corporal
Imagem corporal
Índice de massa corporal

Índice de massa corporal e somatório de dobrás cutâneas: qual é o melhor preditor da insatisfação com a imagem corporal em adolescentes?

RESUMO

Objetivo: avaliar a associação da insatisfação com a imagem corporal com dois indicadores antropométricos (índice de massa corporal e soma de dobrás cutâneas) em adolescentes do sexo feminino e identificar o melhor preditor da insatisfação com a imagem corporal nesta população.

Método: o estudo incluiu 329 estudantes do sexo feminino com idades entre 11–14 anos de Santa Maria/RS. A imagem corporal foi avaliada por meio da escala de silhuetas de Stunkard et al. Peso corporal, estatura e dobrás cutâneas foram mensuradas para calcular o índice de massa corporal e o somatório de dobrás cutâneas. O teste Qui-quadrado e análise de regressão logística foram utilizadas no software SPSS® 15.0, adotando um nível de significância de 5.0%.

Resultados: A insatisfação com a imagem corporal esteve associada com ambos os indicaadores antropométricos. No entanto, o índice de massa corporal mostrou maior poder de preditivo deste fenômeno e os estudantes com sobrepeso e obesidade apresentaram três vezes mais chance de estarem insatisfeitos.

Conclusão: Este estudo sugere o uso do índice de massa corporal como um indicador antropométrico em estudos sobre a imagem corporal nesta população devido a sua forte relação com a insatisfação com a imagem corporal.

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The study population consisted of 7273 adolescents. The sample was probabilistic, stratified by geographic region (considering the city of Santa Maria divided into three regions), school system (state and municipal) and age (11, 12, 13 and 14 years).

To calculate the sample, a tolerable relative error of five percentage points and a confidence interval of 95.0% were considered. Thus, sample size was estimated in 239 adolescents. Schools were randomly selected through simple drawing, totaling 15 educational institutions, six state schools and nine municipal schools. Data collection was performed by cluster of groups, and all adolescents at target age present in the classroom on the day of collection were invited to participate in the study. For this reason, 345 adolescents participated in this study. There was a sample loss of 16 students, who showed incomplete data regarding the studied variables. Thus, the final sample consisted of 329 female students.

This study was carried out with the approval from the Municipal and State Department of Education of the city of Santa Maria/RS, and was approved by the Ethics Committee on Human Research of the Federal University of Santa Maria (process No: 23081.013844/2007-48).

Procedures

Data collection was performed at school during class period. To participate in the study, the students delivered the Consent Term signed by parents.

BMI was assessed using the scale of silhouettes of Stunkard et al., which is composed of a set of human figures numbered from one to nine, representing a continuum from thinness (silhouette one) to severe obesity (silhouette nine). The figures were presented to adolescents and they answered the following questions: (1) Which silhouette best represents your current physical appearance? (Real silhouette), (2) Which silhouette would you like to have? (Ideal silhouette). The appraiser did not influence in the choice of silhouettes. BI dissatisfaction was identified by the difference between the value corresponding to the real silhouette and the value indicated as the ideal profile (real silhouette – ideal silhouette). Thus, adolescents who showed zero value were classified as “Satisfied” and those who had non-zero values (positive or negative) were considered “Unsatisfied”.

Body weight status was assessed by BMI (BMI = body weight (kg)/height (m²)). To measure body weight and height, standardized procedures were used. BMI values were classified using the cutoff points established by Conde et al., specifically for Brazilian children and adolescents. For the data analysis, the categories were grouped as follows: underweight/normal weight and overweight/obesity.

Triceps (TR) and subcapular (SE) skinfolds were measured according to standardized procedures, by a single evaluator, trained and experienced in carrying out those measures. Two non-consecutive measurements for each SF were carried out, and having 5.0% difference between these measurements, a third one was performed, using the average of the two closest measurements, as recommended Heyward et al. The sum of TR and SE skinfolds (SSF) was used as an indicator of the body fat level, using the National Children and Youth Fitness Classification, which establishes the following categories: Excellent (>percentile 70), Good (≥percentile 40 and <percentile 70), Fair (≥percentile 20 and <percentile 40) and Poor (<percentile 20). Three categories were considered in the data analysis: Ideal (Excellent + Good), High (Fair) and Very high (Poor).

Statistical analysis

Descriptive statistics was used, with mean, standard deviation, minimum and maximum values. To characterize the sample in relation to BMI and SSF, frequency distribution was used. The chi-square tests were used to examine the association between BI dissatisfaction and BMI and SSF. To identify the best predictor of BI dissatisfaction (study outcome), logistic regression analysis was used. Two models were tested, one simple and one multiple (adjusted by both anthropometric indicators). Data were analyzed using the SPSS 15.0 software, considering a significance level of 5.0% for all analyses.

Results

Table 1 shows the descriptive analysis of data concerning the age of adolescents, anthropometric measurements and BI. The prevalence of overweight and obesity, identified by BMI, were 22.5% (n = 74) and 6.7% (n = 22), respectively. Adolescents classified as underweight and normal weight accounted for 1.2% (n = 4) and 69.6% (n = 229) of the sample, respectively. According to SSF, the percentage of adolescents with ideal body fat level was only 25.5% (n = 84), while 22.2% (n = 73) and 52.3% (n = 172) were classified into categories high and very high, respectively.

BI dissatisfaction was significantly associated with both anthropometric indicators. Among overweight and obese adolescents, most were dissatisfied with BMI. The same behavior was observed in relation to students with body fat level above ideal. However, there was also a high prevalence of BI dissatisfaction among adolescents with underweight/normal weight and in those with body fat considered ideal (Table 2).

Table 3 shows the results of the crude and adjusted analyses for BI dissatisfaction related to logistic regression. In the crude analysis, both BMI and SSF were associated with the outcome. When the model was adjusted for all variables, only BMI remained associated with BI dissatisfaction, and Overweight/Obesity adolescents were 3.73 (CI 95%: 1.51–9.22, p = 0.004) times more likely to be dissatisfied compared with those underweight/normal weight.

Discussion

A previous literature review indicated lack of studies aimed at identifying the anthropometric indicator with the greatest power to predict BI dissatisfaction in female adolescents. Thus, this study contributes to literature by showing that body dissatisfaction is associated with BMI and SSF; however, the anthropometric indicator that best predicts BI dissatisfaction is BMI.

By analyzing the sample distribution into categories related to anthropometric indicators, it was observed that in considering overweight as the sum of overweight and obese categories, identified by BMI, this value (29.2%) is less than half the prevalence of adolescents with body fat levels above the ideal (74.5%), classified according to SSF. This difference in the results of anthropometric indicators was also observed in other national studies with this population. A study carried out in Três de Maio, Rio Grande do Sul, showed that while most adolescents was considered eutrophic by BMI (82.2%), only 46.1% of them showed the same fat percentage. Similar results were found in a sample of students from three cities in western Santa Catarina and one in northern Rio Grande do Sul. The study showed that only 49.0% of female adolescents were classified concurrently by BMI and sum of SF.

Thus, the data collected in the current study corroborate what has been observed in other studies, demonstrating that the SF method is the most appropriate to measure the amount of body fat in relation to BMI. In this sense, it is emphasized that the choice of the best anthropometric indicator to be used both for research purposes and clinical practice should be done with caution.

Although BMI is an indirect measure of adiposity that makes no distinction between body components (fat, bones, muscles and...
Moreover, it is recommended by the World Health Organization for screening overweight children and adolescents because it is easy to obtain, inexpensive and well accepted.26 Moreover, overweight and obesity prevalence estimates in epidemiologic studies are based on BMI, which facilitates comparisons with national and international prevalences. Another positive aspect of using BMI in Brazilian children and adolescents is that this indicator has criteria for classifying body weight status, which were developed especially for this population.27

The skinfold method has been widely used in clinical and epidemiological assessments. The main advantage of using this technique is that it allows a more detailed assessment of body composition, with body weight fractionation into lean and fat mass. Additionally, it is easy to use and has relatively low cost compared to other methods such as hydrostatic weighing and dual energy X-ray absorptiometry.27 Among the limitations of using SF measures, it is worth mentioning that this technique requires trained raters and there are no Brazilian criteria for the interpretation of values of both SF and fat percentage, requiring the use of international benchmarks for classification.

The present study showed that BMI and SF anthropometric indicators were both associated with BI dissatisfaction among adolescents. Similar results were found in other studies using scales of silhouettes for the assessment of BI dissatisfaction in students.14,15 Thus, it was found that inadequate BMI and SF values generate BI dissatisfaction among female adolescents. Therefore, it could be inferred that the higher the values of anthropometric indicators, the more distant adolescents are from BI considered ideal, therefore, the greater the BI dissatisfaction. Thus, schools should propose interventions programs aimed at overweight and obesity students, through actions including nutritional and psychological counseling, as well as physical activities in order to generate greater body image satisfaction.

However, the number of students showing adequate BMI and SF values and dissatisfied with their BI calls attention. The results showed that 69.1% of adolescents classified as underweight/normal weight and 67.9% of those who had SF considered ideal were dissatisfied with their BI. These findings demonstrate a constant desire of female adolescents to achieve the current beauty standard, characterized by thinness, even showing adequate anthropometric indicators. Thus, this is a concerning condition, since, in order to reduce body weight, these adolescents are likely to engage in unhealthy behaviors such as poor diet, fasting, self-induction of vomiting and use of laxatives and diuretics, which may result in the development of eating disorders such as anorexia and bulimia.11

In this context, cases of adolescents with adequate BMI and body fat levels with excessive concern with body image should also be taken with care in order to prevent abnormal eating behaviors that could trigger severe cases of anorexia and bulimia. Thus, it is suggested that strategies and actions to be implemented in the school environment should include not only guidelines for a healthy eating behavior and practice of physical activities, but also be aimed at

### Table 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12.5</td>
<td>1.1</td>
<td>11.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>49.2</td>
<td>10.9</td>
<td>24.6</td>
<td>101.3</td>
</tr>
<tr>
<td>Stature (cm)</td>
<td>156.0</td>
<td>7.6</td>
<td>127.0</td>
<td>178.0</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>20.0</td>
<td>3.6</td>
<td>13.6</td>
<td>40.6</td>
</tr>
<tr>
<td>Triceps skin fold (mm)</td>
<td>19.7</td>
<td>7.7</td>
<td>4.2</td>
<td>48.8</td>
</tr>
<tr>
<td>Subscapular skin fold (mm)</td>
<td>17.7</td>
<td>9.8</td>
<td>5.0</td>
<td>61.0</td>
</tr>
<tr>
<td>Sum of triceps and subscapular skinfolds (mm)</td>
<td>37.4</td>
<td>16.8</td>
<td>9.2</td>
<td>101.5</td>
</tr>
<tr>
<td>Ideal silhouette</td>
<td>3.7</td>
<td>1.2</td>
<td>1.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Real silhouette</td>
<td>2.9</td>
<td>0.8</td>
<td>1.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Body image % (n)</th>
<th>Satisfied</th>
<th>Unsatisfied</th>
<th>Test value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body mass index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight/normal weight</td>
<td>30.9 (72)</td>
<td>69.1 (161)</td>
<td>χ² = 20.77</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>7.3 (7)</td>
<td>92.7 (89)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sum of triceps and subscapular skinfolds (mm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideal</td>
<td>32.1 (27)</td>
<td>67.9 (57)</td>
<td>χ² = 20.81</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>High</td>
<td>38.4 (28)</td>
<td>61.6 (45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very high</td>
<td>14.0 (24)</td>
<td>86.0 (148)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

χ²: Chi-square test.

### Table 3

<table>
<thead>
<tr>
<th>Anthropometric indicators</th>
<th>Crude analysis</th>
<th>Adjusted analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (CI 95%)</td>
<td>p value</td>
</tr>
<tr>
<td><strong>Body mass index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight/normal weight</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td><strong>5.68 (2.50–12.88)</strong></td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td><strong>Sum of triceps and subscapular skinfolds (mm)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideal</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0.76 (0.39–1.46)</td>
<td>0.046</td>
</tr>
<tr>
<td>Very high</td>
<td><strong>2.92 (1.55–5.47)</strong></td>
<td><strong>0.001</strong></td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval.
In bold, p-value <0.05.
promoting better body acceptance among female adolescence and higher awareness of social pressures related to thickness overvaluation.

Logistic regression analysis showed that for the sample of this study, BMI was the indicator with best predictive power of BI dissatisfaction compared to ŜSF. Analyzing the body fat levels by measuring the TR SF, Robinson et al.16 found similar results in female American adolescents and identified BMI as the strongest predictor of this outcome. However, among Brazilian college students, the sum of five SF was the best predictor of body dissatisfaction compared to BMI.17 Thus, it could be suggested that female adolescents are mainly based on BMI to define feelings about their body image. Moreover, the perceived amount of subcutaneous fat seems to be less accurate at the age group investigated. This can be explained by the fact that, at that stage, changes in body composition resulting from maturational process are more clearly visible through monitoring body weight, and identifying which body component is changing, whether fat mass or muscle mass, is more difficult. In college students, it is believed that there is a better perception of the amount of body fat, as evidenced by Coqueiro et al.17

Limitations of this study are: (1) the use of the scale of body silhouettes to assess BI. Silhouettes are two-dimensional; thus, they do not allow the representation of the individual as a whole, the distribution of subcutaneous fat mass, important in the formation of body image; (2) the cross-sectional design of the study. Due to the fact that exposure and outcome are identified in a single moment, it could not be considered that the relationship between events is causal. However, this design was selected due to its low cost, easy implementation, speed with which it is used and objectivity in data collection. Despite these limitations, it is noteworthy that the study was carried out in a representative sample of students aged 11–14 years, so the results can be extrapolated to adolescents with similar characteristics.

Thus, it could be concluded that BI dissatisfaction is associated with BMI and ŜSF in female adolescents, and the higher the values of these anthropometric indicators, the greater the BI dissatisfaction. However, the anthropometric indicator that best predicts body image dissatisfaction among students is BMI. Thus, it is suggested that studies use BMI to investigate BI dissatisfaction in female adolescents because it shows a stronger relationship with this outcome in relation to the body fat level indicator. Additionally, studies aimed at determining the effect of dietary interventions and the practice of physical activities on body image should be carried out in order to promote advancement of knowledge on this subject.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Conflict of interest

The authors have no conflict of interest to declare.

References


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