

Agreement of adolescents' self-perception of their body image with the analysis on the three-dimensional body image

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Abstract

Objectives: to verify the agreement among adolescents' perception of their own body image and the health professionals' analysis based on three-dimensional body image and the inter-rater agreement.

Methods: a cross-sectional study was carried out with 1,662 adolescents, aged 18 to 19 years old, from the 1997/98 birth cohort in São Luís, Maranhão. Self-perception of body image was assessed using the Stunkard's body image scale. Three nutritionists evaluated the three-dimensional body image obtained by the Photonic Scanner (3D Body Scanner) and classified according to the Stunkard's scale. The agreement between raters was verified by using weighted Kappa.

Results: the analysis of agreement between raters in the general group and when stratified by sex was considered moderate to good by Kappa. Regarding the intraclass correlation (ICC), good and excellent correlation values were observed both in the general group, males and females. There was a greater perception of overweight by all raters, when compared with the adolescents' self-assessments. When stratified by sex, examiner 1 had the same perception as male self-assessments, as for females the perception of overweight was more frequent, as well as raters 2 and 3, for both sexes.

Conclusion: agreement between raters and self-assessments was considered weak/moderate in Kappa and good/excellent in ICC.

Key words Adolescent, Body image, Body dissatisfaction



Introduction

Body image is the mental image that an individual has of the size, shape and parts of their own body, perceptions, feelings, attitudes and experiences associated with that image.^{1,2} It is built since childhood based on a dynamic process^{3,4} which becomes even more complex in adolescence due to the biopsychosocial changes inherent to this phase and the greater vulnerability to influences from society, family, friends and media regarding the ideal body.⁵

Self-assessment of body image can be influenced by factors such as sex, age, media, and how the body is seen in different beliefs, values and attitudes inserted in a culture. An inaccurate perception of a body image can lead to inappropriate behaviors, causing nutritional changes.⁶ Individuals dissatisfied with their body image may present depressive symptoms,⁷ eating disorders,⁸ suicidal behavior,⁹ in addition to problems with social acceptance, job opportunities, self-esteem, well-being and socioeconomic status.¹⁰

High prevalence of distortion and dissatisfaction with body image have been observed, especially in female^{3,8} overweight adolescents.^{2,11} Usually, girls want to be thin, and boys want a muscular/athletic body.¹²

Body image is measured by using questionnaires, interviews, drawings and image distortion techniques. Epidemiological studies both in Brazil and in other countries generally use silhouette scales.^{5,6,8,10} These scales use images that vary from a very thin to an obese subject¹³ where the individual must choose the figure that represents his or her current, ideal or desired body. The Silhouettes scale of Stunkard *et al.*,¹⁴ validated for the Brazilian population presents nine silhouettes for men and women, separately.¹⁵

Some criticisms have been made regarding the use of silhouette scales, such as the low reliability of the human body, the use of few figures and the biotypes used, which can lead to discrepancies between the real perceived or idealized image.^{1,13}

Three-dimensional scanners are a validated method for use in children and adolescents that provide automated, quick and easy evaluations of bodies measurements, providing reproducible, reliable and accurate data.¹⁶

Studies show that parents of children and adolescents have the perception of their children's body image that corresponds to the classification of the nutritional status of these children/adolescents.^{17,18} In this sense, other individuals can perceive the actual nutritional status and even identify possible dissatisfactions and distortions in the adolescents' body image. Considering that body image distortion can lead to physical and mental health problems in adolescents, the comparison between the body image

that individuals in this age group have of themselves and the perceived image of this self-assessment by health professionals can provide information about the real level of this dissatisfaction and distortion.

We did not find studies comparing the self-perception of body image in adolescents and the image obtained by three-dimensional scanners, nor studies that used a silhouette scale to analyze the agreement between self-perceived body image in adolescents and the assessment carried out by health professionals through three-dimensional body image. Thus, in this study, we sought to verify the agreement of self-perception of body image in adolescents with the analysis of health professionals based on a three-dimensional body image and to analyze possible inter-rater agreement.

Methods

A cross-sectional study, conducted with individuals aged 18 to 19, participants of the third phase of the 1997/1998 São Luís Birth Cohort. In the first phase of the study, a systematic sample of 1/7 of births residing in São Luís in 10 maternity hospitals in the city was selected. The sample was stratified by the maternity hospitals, with shared proportional to the number of births in each unit, in 1997, totaling 2,493 live births. The first follow-up was carried out in 2005/2006, with 673 children aged 7 to 9 years old, and the second follow-up was carried out in 2016, with adolescents aged 18 to 19 years old (n=654). Due to the small number of individuals who agreed to participate in the study in the previous phases, we decided to increase the sample size, including other individuals born in São Luís in 1997, who were not initially drawn to be part of the birth cohort. Thus, 1,861 individuals identified through school or university registration and military enlistment were included in the second segment of the cohort, totaling 2,515 individuals participating in this phase.¹⁹

Data were collected between January and November, 2016. Individual interviews were carried out to collect demographic, socioeconomic and behavioral information, obtaining a three-dimensional body image and assess of self-perception of the body image. The analytical sample of this study was 1,662 individuals. These individuals were the ones who performed the assessment of the three-dimensional body image and had valid images for analysis.

Self-perception of the body image was assessed through the individual's perception of their body image among the nine silhouettes proposed by Stunkard *et al.*¹⁴ (Figure 1a). The individual was asked to choose a silhouette that would consider their current appearance or image that identified themselves (*Percepção da Imagem Corporal Real* – PICR) (Perception of Real Body Image).

The three-dimensional body image of the human body (Figure 1b) was obtained using a Photonic Scanner (3D Body Scanner). This equipment extracts several anthropometric measurements in a short time, without using radiation or causing any discomfort to the individual, as well as complementing body composition measurements. For such purpose, the individual remains in a darkroom receiving light beams, which generate the three-dimensional body image on the computer.

Three nutritionists were asked to assess the adolescents' three-dimensional images. Nutritionists who belonged to the research team of the study, with experience in research in the field of nutritional assessment, were selected. The raters were instructed to classify each three-dimensional body image according to one of the nine silhouettes established by Stunkard *et al.*¹⁴ The classification was listed in a Microsoft Excel® *software* spreadsheet with the identification code of each participant referring to the evaluated image. The procedure was performed by the observers with the same images, independently, in order to verify inter-examiner variability. After performing the evaluation and classification of the images, the raters discussed and scored the main obstacles and difficulties observed during this phase of the study.

Agreement analyses and comparison of the ratings of the raters among themselves and between the adolescents and the raters were carried out to assess the perception of overweight or thinness. The comparison was performed by subtracting the number referring to the silhouette indicated by the raters by the number equivalent to the silhouette with which the adolescents classified themselves. The difference ranges from -8 to +8 and was considered the same perception when the variation was equal to zero, thinness perception when the difference was negative and overweight perception when the difference was positive.

The variables used to describe the study sample were: age (18 to 19 years old), sex (male, female), schooling (illiterate to 11 years, 12 years or more), self-reported skin color (white, black, mixed race) – according to the options provided by the *Instituto Brasileiro de Geografia e Estatística* (IBGE),²⁰ (Brazilian Institute of Geography and Statistics) marital status (no partner, consensual union), total physical activity (insufficiently active, physically active),²¹ alcohol consumption (yes, no), smoking (yes, no) and socioeconomic classification according to the *Critério de Classificação Econômica do Brasil 2016*²² (Brazilian Economic Classification Criteria) grouped in A-B, C and D-E.

Statistical analyses were performed using Stata software version 14. Descriptive analysis was applied to characterize the sample. The analysis of the distribution of the participants between the groups that carried out the assessment of the three-dimensional body image and

the ones that did not was carried out to verify sample similarity. Agreement analysis was carried out regarding the ability to measure identical results, applied to the same subject/phenomenon, by different raters, and between raters and adolescents using weighted *Kappa*,²³ in the general sample and by sex. Stratification by sex was performed considering that previous studies have shown differences in questions related to body image between male and female adolescents.^{5,24} *Kappa* agreement was classified as poor (<0.20), weak (0.21 to 0.40), moderate (0.41 to 0.60), good (0.61 to 0.80) and excellent (0.81 to 1.00).²⁵ An intraclass correlation coefficient (ICC) analysis was performed, classified as poor (<0.40), fair (0.4 to <0.6), good (0.6 to <0.75) and excellent (0.75 to 1.00).²⁶ The research was approved by the Research Ethics Committee – Zip Code - HUUFMA (CAAE No 49096315.2.0000.5086) in all of its stages. The participants signed an informed consent form.

Results

In total, 4,333 three-dimensional images were obtained from the image bank extracted from *Photonic*. Repeated images whose quality did not allow for body analysis were excluded, resulting in 1,662 individuals with valid images.

To carry out the analysis of the distribution of the participants, they were divided into two groups: those who carried out the three-dimensional body image assessment and those who did not. Significant differences were observed regarding age ($p < 0.001$), sex ($p = 0.046$), schooling ($p < 0.001$), skin color ($p = 0.007$) and economic class ($p < 0.001$) (Table 1).

Most participants were female (51.0% *versus* 49.0%), aged 18 years old (87.4% *versus* 12.6%), mixed race (65.2% *versus* 18.1% white, and 16.7% black), with 0 to 11 years of schooling (53.1% *versus* 46.9%), economic class C (50.3% *versus* 27.2% Class A/B and 22.5% Class D/E), without a partner (96.6% *versus* 3.4%), did not smoke (96.8% *versus* 3.2%), consumed alcoholic beverages (53.3% *versus* 46.7%) and was physically active (58.7% *versus* 41.3%) (data not shown in Table).

The analysis of agreement between raters in the general group and when stratified by sex was considered moderate to good. The agreement between the raters and the adolescents' self-assessments in the general group and stratified by sex was considered weak for raters 1 and 3 and moderate for rater 2. We observed a greater perception of overweight by all raters when compared with the adolescents' self-assessments. When stratified by sex, rater 1 had the same perception as the males' self-assessments, while for females the perception of overweight was more frequent, as well as the raters 2 and 3, for both sexes.

Table 1

Percentage distribution of adolescents who participated and did not participate in the study, according to sociodemographic, socioeconomic and behavioral characteristics. São Luís, Maranhão, Brazil, 2016/2017.

Variable	Three-dimensional body image				<i>p</i> *
	No		Yes		
	n	%	n	%	
Age (years) (N=2,515)					<0.001
18	290	34.00	1,452	87.36	
19	563	66.00	210	12.64	
Sex (N=2,515)					0.046
Male	382	44.78	814	48.98	
Female	471	55.22	848	51.02	
Schooling (years) (N=2,500)					<0.001
0 - 11	270	32.18	882	53.10	
≥12	569	67.82	779	46.90	
Skin Color (N=2,502)					0.007
White	198	23.35	299	18.08	
Black	140	16.51	276	16.69	
Mixed race	510	60.14	1,079	65.24	
Economy class (N=2,226)					<0.001
A-B	262	34.43	398	27.17	
C	379	49.80	737	50.31	
D-E	120	15.77	330	22.53	
Marital status (N=2,515)					0.320
No partner	817	95.78	1,605	96.57	
Consensual union	36	4.22	57	3.43	
Total physical activity (N=2,384)					0.926
Insufficiently active	334	41.49	652	41.29	
Physically active	471	58.51	927	58.71	
Alcohol consumption (N=2,488)					0.202
No	370	44.00	769	46.69	
Yes	471	56.00	878	53.31	
Smoking (N=2,515)					0.185
No	817	95.78	1,609	96.81	
Yes	36	4.22	53	3.19	

*Pearson's Chi-Square Test.

In the general group, it was observed that the agreement was moderate between raters 1 and 2, with the percentage of agreement between the measures beyond what was expected by chance and the weighted $k=Kappa$ of 58.80% ($p < 0.001$). Between raters 1 and 3, the percentage of agreement between measurements beyond what was expected by chance and the weighted $Kappa$ was 69.43% ($p < 0.001$), which was considered good agreement. The percentage of agreement between the measures beyond what was expected by chance and the weighted $Kappa$ was moderate, being 55.36% between raters 2 and 3 (Table 2).

When analyzing the agreement between raters 1 and 2 by sex, we observed that the percentage was 47.27% for males ($p < 0.001$), considered moderate. For females, the percentage was 68.54% ($p < 0.001$), being classified as good. Between raters 1 and 3, the percentage of agreement

was 68.00% ($p < 0.001$) for males and 69.79% ($p < 0.001$) for females, which was considered good. Between raters 2 and 3, agreement was moderate, being 48.88% ($p < 0.001$) for males and 58.44% ($p < 0.001$) for females (Table 2).

The agreement between rater 1 and the self-assessments carried out by the adolescents was considered weak, with the percentage of agreement between the measures beyond what was expected by chance and the weighted $Kappa$ of 32.91% ($p < 0.001$). When stratified by sex, agreement was weak for both sexes, a percentage of 33.81% ($p < 0.001$) and 32.27% ($p < 0.001$), for females and males, respectively (Table 2).

The agreement between rater 2 and the adolescents' self-assessments was considered moderate and the percentage of agreement between the measures was higher than that expected by chance and the weighted $Kappa$ was 43.07% ($p < 0.001$). When stratified by sex, the agreement

Table 2

Weighted *Kappa* values and intraclass correlation coefficient for the sample in general and stratified by sex. São Luís, Maranhão, Brazil, 2016/2017.

Agreement	Agreement	Expected Agreement	<i>Kappa</i> weighted	<i>p</i>	ICC*	<i>p</i>
General						
Raters 1 and 2	91.97%	80.51%	0.588	<0.001	0.890	<0.001
Raters 1 and 3	94.41%	81.72%	0.694	<0.001	0.926	<0.001
Raters 2 and 3	91.58%	81.15%	0.554	<0.001	0.875	<0.001
Rater 1 and self-assessments	85.53%	78.43%	0.329	<0.001	0.721	<0.001
Rater 2 and self-assessments	89.11%	80.87%	0.431	<0.001	0.785	<0.001
Rater 3 and self-assessments	85.10%	78.92%	0.293	<0.001	0.693	<0.001
Male						
Raters 1 and 2	89.99%	81.01%	0.473	<0.001	0.844	<0.001
Raters 1 and 3	94.63%	83.21%	0.680	<0.001	0.920	<0.001
Raters 2 and 3	90.85%	82.10%	0.489	<0.001	0.848	<0.001
Rater 1 and self-assessments	86.79%	80.04%	0.338	<0.001	0.718	<0.001
Rater 2 and self-assessments	90.61%	82.13%	0.474	<0.001	0.806	<0.001
Rater 3 and self-assessments	88.07%	81.00%	0.372	<0.001	0.748	<0.001
Female						
Raters 1 and 2	93.87%	80.51%	0.685	<0.001	0.924	<0.001
Raters 1 and 3	94.21%	80.82%	0.698	<0.001	0.928	<0.001
Raters 2 and 3	92.29%	81.45%	0.584	<0.001	0.884	<0.001
Rater 1 and self-assessments	84.32%	76.84%	0.323	<0.001	0.724	<0.001
Rater 2 and self-assessments	87.68%	79.54%	0.398	<0.001	0.772	<0.001
Rater 3 and self-assessments	82.24%	76.85%	0.233	<0.001	0.657	<0.001

*Average intraclass correlation coefficient (ICC) measures.

of rater 2 with the self-assessments of males remained moderate, a percentage of 47.44% ($p < 0.001$), but was weak in females, 39.78% ($p < 0.001$) (Table 2).

The agreement between rater 3 and the self-assessments carried out by the adolescents was considered weak, and the percentage of agreement between the measures was higher than that expected by chance and the weighted *Kappa* of 29.29% ($p < 0.001$). When stratified by sex, the rater 3 agreement with male self-assessments remained weak, a percentage of 37.22% ($p < 0.001$); however, it was weak for females, 23.29% ($p < 0.001$) (Table 2).

Regarding intraclass correlation (ICC), good values were observed for the correlation between rater 1 and self-assessments, and rater 3 and self-assessments both in the general group, in males and females. The other correlations were considered excellent.

When analyzing the frequency of the raters' perception of thinness or overweight compared to the adolescents' self-assessments, a greater perception of overweight was observed by all the raters. However, raters 2 and 3 noticed more overweight individuals (69.27% and 71.02%, respectively) when compared with rater 1 (48.58%) (Figure 2). When considering sex, rater 1 had the same perception as male self-assessments in 40.30% of cases, whereas the perception of overweight was more frequent (65.88%) for females. For raters 2 and 3, the

perception of overweight was more frequent for both males (61.31% and 57.60%, respectively) and females (76.90% and 83.89%, respectively) (Figure 3).

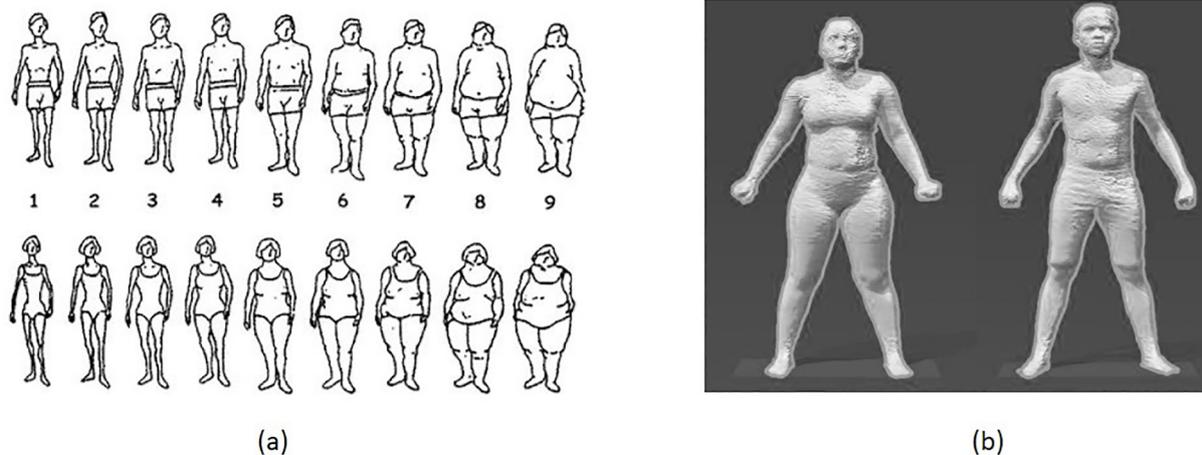
Discussion

To the best of our knowledge, this was the first study to use three-dimensional imaging to assess the body image of Brazilian adolescents. The main results of this study showed moderate to good agreement between raters. The analysis of agreement between raters and the adolescents' self-assessments was considered weak to moderate, with a greater perception of overweight by all the raters, except rater 1 for males.

To date, no studies were identified that investigated the concordance of self-perceived body image in adolescents with the analysis of health professionals based on three-dimensional body image and inter-rater agreement. However, some studies have assessed the perception of parents or guardians regarding their children's body image and the self-perception of the body image of children and adolescents regarding their nutritional status. The study by Battisti *et al.*,¹⁷ with 122 children and adolescents aged 6 to 19 years old and their parents from a city in the state of Rio Grande do Sul, observed that their parents' perception of body image was significantly associated with the children's self-perception of body image and classification

Figure 1

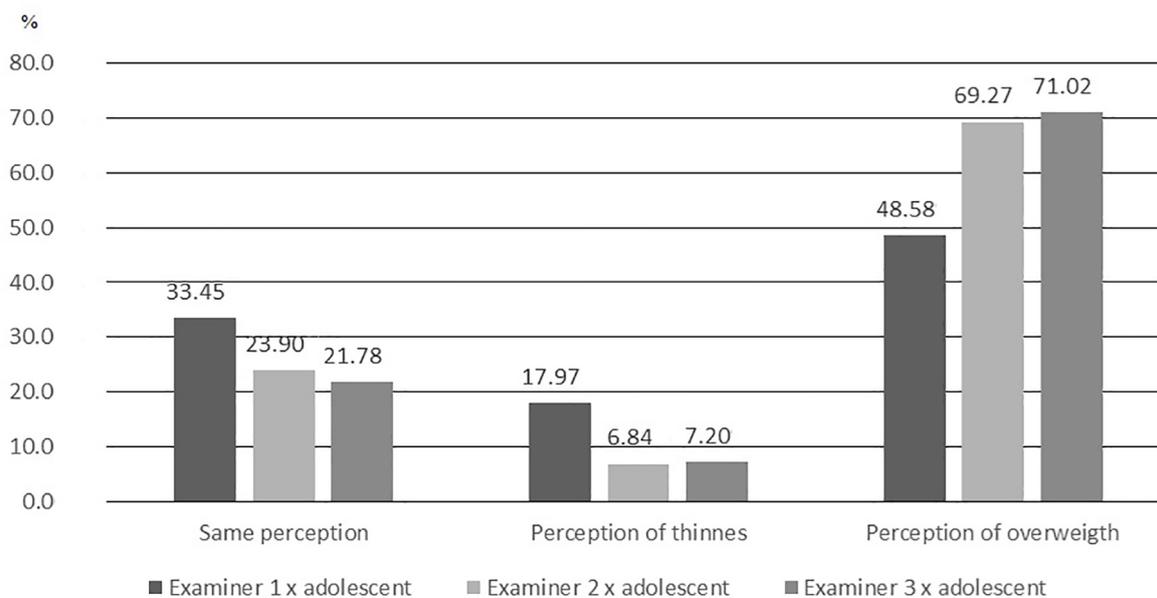
Set of silhouettes and models for assessing body image.



(a) Set of silhouettes proposed for body image assessment. Stunkard's scale.¹⁴
 (b) Example of a three-dimensional body image model of volunteers from the 1997/1998 Birth Cohort. Source: Fonseca et al.²⁰

Figure 2

Distribution of perception of the same weight, thinness or overweight by raters 1, 2 and 3 in relation to the adolescents' self-assessments. São Luís, Maranhão, Brazil, 2016/2017.



of their nutritional status. Moreover, self-perception of the body image in children and adolescents was associated with their nutritional status. The study by Vieira *et al.*,¹⁸ carried out with 914 parents and adolescents aged 10 to 19 years old from two cities in Vale do Taquari, Rio Grande do Sul, observed a direct and significant correlation between the body mass index with the adolescents' self-perception and the parents' perception of the body image, showing that adolescents and their parents have a real perception of their body image.

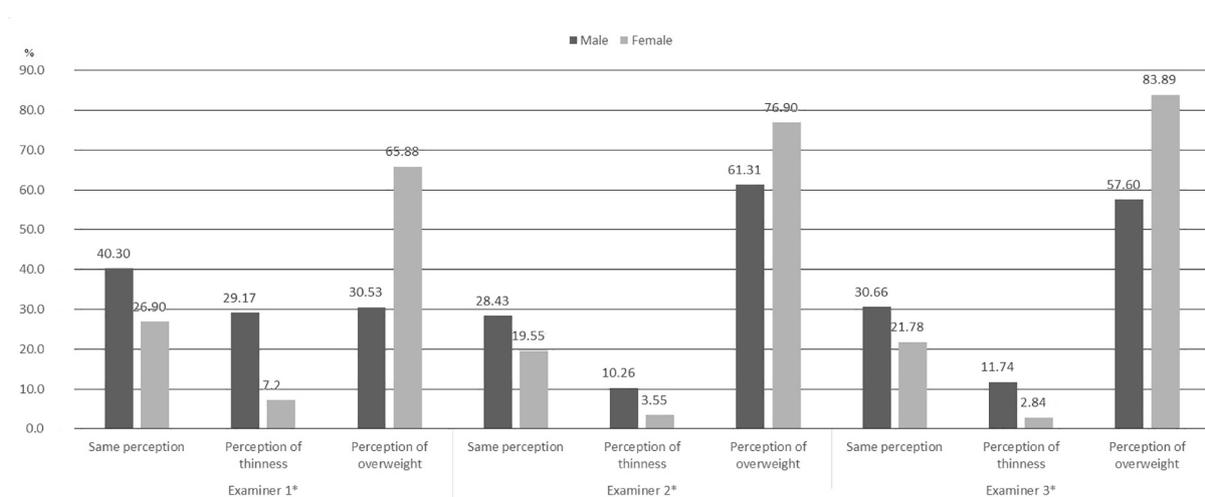
The modest agreement observed between the raters may be the result of difficulties inherent to the scale used. Among the obstacles reported by the raters, the difficulty in classifying the images of some individuals stands out,

since they did not fit into any of the silhouettes presented, which constitutes one of the criticisms of the instrument reported in the literature. Studies suggest that scales with a greater number of silhouettes could reduce the problem of loss of information resulting from the use of Likert-type scales to assess a continuous variable such as body size.^{1,13} However, some authors report that a larger number of silhouettes would not solve this issue since, in addition to confuse the individual,^{1,27} only two to three central figures tend to be chosen by the participants when using scales with many silhouettes.^{1,13}

Another difficulty reported by the raters was related to the body shape, which often differs from the images presented. The same individual could fit into two

Figure 3

Distribution of perceptions by raters 1, 2 and 3 compared the adolescents' self-assessments, by sex.

* $p < 0.001$ on Pearson's Chi-Square Test.

silhouettes according to their body characteristics, such as adolescents who had thinner upper limbs and larger lower limbs. In this case, the upper body could be classified into one silhouette and the lower one into another. According to the literature, this can be explained by the fact that those responsible for illustrating the figures built most scales, including the one used in this study, to correspond to what they subjectively believe represent a variety of weights rather than known anthropometric body dimensions for varying weights.²⁸

When comparing the raters' perception to self-assessments, it is clear that the three assessed adolescents had more perception of overweight than the adolescents themselves. The way individuals see themselves continually changes over time and with the culture in which they are inserted,²⁹ which may have made the raters' perceptions of the body different from those of the adolescents.

This study has some limitations. The use of scales that are two-dimensional figures, which do not represent the human body accurately. Another limitation refers to the losses related to the participants who performed the three-dimensional body image, which can lead to selection bias, since the adolescents with better health were more likely to be those that attended the test or these had their own characteristics that interfered with their self-perception of body image, for example. Furthermore, the subjectivity of the raters and adolescents can interfere with the classification of individuals on the scale, which may contribute to the disagreements observed. The fact that instruments are highly subject to individual subjectivity made it impossible to obtain a standardization for the study raters, which could reduce the differences in classifications. Furthermore, the differences were important to respond to one of the objectives of the study, which was to assess the inter-rater agreement of the three-dimensional images compared to the Stunkard's scale.

The findings in this study show that the agreement between the raters was acceptable, being considered weak or moderate in *Kappa* and good and excellent in ICC. However, when compared with the adolescents' self-assessment, a greater perception of overweight by the raters were found. These results may be related to both the subjectivity of the individuals and the inherent limitations of the scale used.

The greater perception of overweight by the raters may reflect the training of the nutritionist when dealing with nutritional assessments, since this professional is qualified to detect health situations that require nutritional interventions. In this sense, the greater detection of overweight individuals may reflect the concern of this professional the damage that overweight can bring to health. Furthermore, although silhouette scales are widely used in epidemiological studies, the need to develop and validate a scale with figures that are more realistic to the characteristics of Brazilian adolescents is highlighted, using, for example, technological tools such as three-dimensional images.

We conclude that, although subjectivity is a fundamental factor when considering agreement in the perception of others and self-perception of the body image, health professionals, especially nutritionists, tend to have a sensitive eye for detecting overweight situations, even when this is not self-perceived by adolescents, directing and guiding these individuals at nutritional risk for health promotion actions.

Author's contribution

Confortin SC, Souza CM, Oliveira BR, Marques KDS, Rudakoff LCS, EIS Magalhães, AAM Silva collaborated in the design, analysis and interpretation of data and the elaboration of the manuscript. All authors substantially

contributed to the critical review and approved the final version of the article. The authors declare no conflict of interest.

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Received on January 28, 2021

Final version presented on November 25, 2021

Approved on December 14, 2021