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Relationship between body mass index and self-perception among university students

ABSTRACT

OBJECTIVE: To assess the relationship between body mass index and self-perception of body image.

METHODS: A study was carried out in a sample comprising 106 female and male university students aged 18 years or more in Ribeirão Preto, Southeastern Brazil, in 2003. The Contour Drawing Rating Scale and Visual Analogue Scale were used to evaluate body image perception; the former was applied using two different psychometric methods. A body image questionnaire was used to assess the subjective component of body image. Subjects were classified according to body mass index. Statistical analyses were performed through variance analysis and Newman-Keuls *post-hoc* test.

RESULTS: Most normal weight or overweight women (87%) overestimated their body size while obese women and all men (73%), regardless of their BMI, underestimated their body size. The differences of body image perception between men and women were statistically significant as well as the overall dissatisfaction with their perceived body size, revealed by a desired lower body mass index. Overweight women were more concerned and uncomfortable with their own body.

CONCLUSIONS: Both men and women had a distorted self-perception of body image, underestimating or overestimating it. The study results suggest dissatisfaction of subjects with their body image as they desire to have leaner bodies.

KEYWORDS: Body image. Self-concept. Body contitution. Body mass index. Adult.

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INTRODUCTION

The relationship between eating disorders and body image self-perception is well documented in the literature.[17,19] However, Leonhard & Barry[16] notes that studies on body image distortion and dissatisfaction have mostly focused on subjects with specific eating disorders (bulimia, anorexia nervosa and morbid obesity). It has recently been described a similar body image distortion in normal weight individuals without any specific eating disorders.

Body image is an important element of the intricate mechanism of one's own identity. Gardner[11] defines it as "the mental picture we have of our body's measures, contours and shape; and our feelings related to these characteristics and to our body parts". The subjective component of body image refers to one's satisfaction with their own body size or specific body parts.

Sociocultural theories on body image disorders focus on influences of a body social and culturally established as ideal, expectations and experiences, as well as the etiology and prevalence of body image disorders. Thus, it is important to highlight the negative impact of mass media. Research has evidenced a conflict between the ideal beauty set by modern societies and the general somatotype and the burden created by such model.[14] The sociocultural environment seems to be an important variable in the development of distortions and subjective body image disorders.

Nutritional status reflects the level at which physiological nutrient requirements are reached. Routine evaluation of nutritional status should be carried out in primary care settings for it allows to prevent several conditions besides being an important indicator of the need for education activities and interventions.[8] The body mass index (BMI), or Quetelet index [body weight (kg)/height^2 (m)], is the most common measure used in population-based studies for primarily categorizing nutritional status.[4] Likewise, research assessing body image self-perception has used BMI as an indicator of nutritional status associated with determinants of body weight-related behaviors.[10,15]

As environmental and socio-cultural changes seen in the last decades have an important role in increasing obesity rates,[3,20] it is crucial to know the determinants of nutritional status, i.e., the symbolic universe and subjective elements pervading people's life style and eating behaviors. Identifying and measuring the magnitude of body image self-perception distortions would be relevant for the clinical evaluation of those individuals at risk of developing obesity.

In that regard, the contour drawings scale is a highly effective instrument for assessing people's level of dissatisfaction with their body weight and body size while evaluating the perceptual component of body image.[12,13,17] It is a helpful instrument for exploring ideal body image and objective image, particularly among overweight and obese individuals or those struggling to maintain their weight and control their eating behaviors.

For preventing and reducing excess weight, the efficiency and efficacy of strategies to be designed and applied in the clinical practice and for disseminating information to the general population rely on one's realistic perception and self-awareness of their own body based on a real body size. This can be a valuable instrument in outpatient settings as an additional tool for clinically evaluating those seeking professional help due to body weight concerns.

However, most studies published have focused on the relationship between body image and BMI in subjects diagnosed as having eating disorders,[1,2,5,16,18] mental disorders[24] or even those engaged in physical activities.[9] Besides, most Brazilian studies on body image have used contour drawing scales developed and validated elsewhere for assessing individuals with different biotypes from Brazilian ones.[2,9]

The present study aimed at evaluating the relationship between BMI and body image self-perception in both female and male university students.

METHODS

Given the standard psychophysical method widely validated for the evaluation of perception, the results were quite consistent among subjects allowing to study a relatively small sample. Statistical estimates based on the prevalence of normal weight, overweight and obese adults in the Brazilian population yielded a sample size of at least 100 subjects. To ensure the inclusion of subjects from all socioeconomic strata there were selected one public and one private university in Ribeirão Preto, Southern Brazil. Data was first collected from 116 university students (51 males and 65 females) aged over 18 years, following an even distribution of at least five subjects in each of the nine BMI intervals corresponding to each drawing of the rating scale.

Subjects were randomly recruited to voluntarily participate in the study. There were no refusals during data collection. Ten subjects were excluded as their BMIs fell either below 18.5 kg/m^2 or above 40 kg/m^2.

While the inclusion criterion was 18.5 kg/m^2 <BMI <40.0 kg/m^2, the study contour drawing rating scale showed BMIs ranging between 17.5 and 37.5 kg/m^2. This allowed to assess body image distortion, since the literature shows that people tend to report a lower BMI than their actual one. Therefore, even those subjects with BMI of 18.5 kg/m^2 could select contour drawings corresponding to BMI lower that their actual one.

After excluding the 10 cases mentioned above, the study sample comprised 106 subjects, 49 males and 57 females, based on the distribution of prevalence of normal weight, overweight and obese individuals among Brazilian adults.

Data collection was carried out in classrooms provided by the universities and comprised the application of contour drawing tests using three different psychometric methods, weight and height measures and self-administration of a questionnaire on body image (Body Shape Questionnaire, BSQ). All data were collected in 2003 by one investigator, trained in the use of the study instruments.

The contour drawing scale comprises a set of nine contour drawings of each gender presented in separate cards showing escalating measures, from leaner to wider drawings, and mean BMI ranging between 17.5 and 37.5 kg/m^2. This scale was especially conceived for this study using computer graphics based on real human models of corresponding BMIs that had their picture taken by a professional photographer. Gardner's et al[12] (1998) methodological recommendations on contour drawing composition were followed (Figure A).

The first psychometric method ("choice") applied consisted in asking subjects to pick one card, from a set of cards displayed in ascending order, which would better describe their own body contour at that time. Then subjects were asked to point out the card with their desired body contour.

The second method applied ("absolute threshold") was constant stimuli[23] when cards were displayed in five random series, and the same sequence was preset and similar to all subjects. They were asked to "select the drawing corresponding to their current contour" and "select a drawing that would correspond to their desired contour".

The third method applied (visual analogue scale, VAS) comprises a visual analogue scale with two contour drawings and was developed by taking the upper and lower limit drawings (one for each gender) from the nine contour drawing scale, linked by a 12-cm continuous line, as proposed and validated by Gardner[11] and Gardner et al[12] (Figure B). Subjects were asked to make a vertical mark on the scale point that would feel most closely to their body size. As BMIs of both drawings displayed were known, the BMI of the subject's mark on the continuous line could be estimated.

Weight was measured using an electronic calibrated scale (Kratos-Cas, Brazil) and subjects were weighed wearing light clothes, barefoot and carrying no heavy objects. Height was measured using a portable anthropometer (Kratos-Cas, Brazil) set against the wall, ensuring their accurate posture before reading the fixed marker.

Subjects were then asked to carefully read and answer the BSQ. The BSQ was developed by Cooper et al[6] and translated into Portuguese by Cordás,[7] and evaluates people's concerns about their body shape, self-depreciation of one's appearance and feeling of being "fat". The BSQ was also validated by Di Pietro* (2001) in a population of Brazilian university students. The BSQ

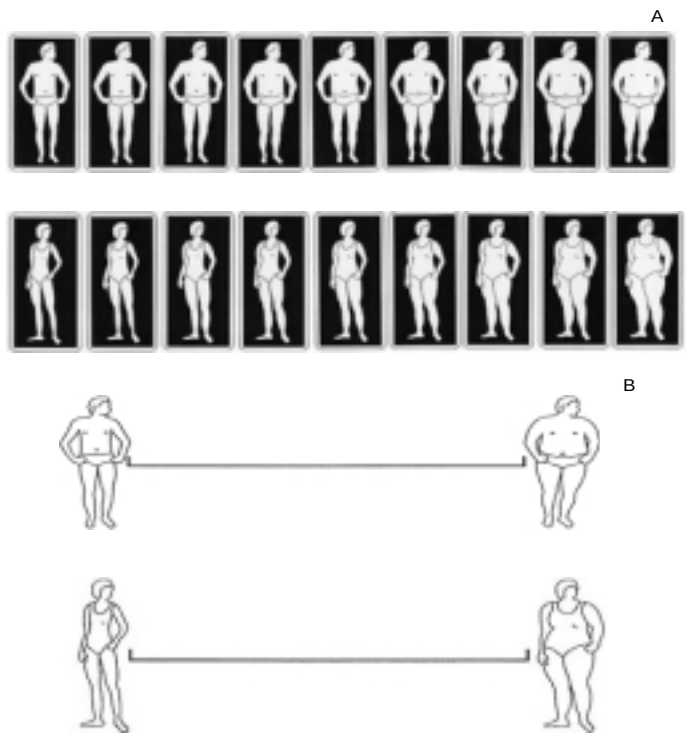

Figure - Contour drawing scale (A) and visual analogue scale (B).

*Di Pietro MC. Validade interna, dimensionalidade e desempenho da escala BSQ - "Body Shape Questionnaire" em uma população de estudantes universitários [dissertação de Mestrado]. São Paulo: Escola Paulista de Medicina da Universidade Federal de São Paulo; 2002.

is a self-administered questionnaire with 34 questions. Each question has 6 possible answers: 1) Never, 2) Rarely, 3) Sometimes, 4) Often, 5) Very often and 6) Always. Body image distortion can be mild (70 to 90), moderate (90 to 110), or severe (>110).

BMI categories for both female and male subjects were based on actual weight and height data collected as well as the World Health Organization (WHO) parameters,[25] as follows: Class 1 - Subjects with BMI between 18.5 and 24.9 kg/m^2 were categorized as normal weight; Class 2 - Subjects with BMI between 25 and 29.9 kg/m^2 were categorized as overweight; and Class 3 - Subjects with BMI >30 kg/m^2 were categorized as obese.

Test-retest reliability of contour drawing scale measures was conducted in 73 female and male adult subjects from different socioeconomic strata and educational backgrounds. Subjects were asked to select a contour drawing in a first step (test) and then, in a second step, they were asked to do the same again, one month later (retest).

Statistical analysis was carried out using SPSS 12.0 software. Data measures were described as median and 95% confidence intervals (95% CI). Cronbach's alpha was used for estimating test-retest reliability. Kolmogorov-Smirnov (Lilliefors) goodness-of-fit test showed 0.084 with 106 degrees of freedom at $p>0.05$, indicating normal distribution. Based on these results, the study data were then analyzed using one factorial variance analysis (ANOVA) (BMI classes) for each method used and a two factorial ANOVA (BMI class and gender) for BSQ data and differences between current and actual BMI and between current and desired BMI. Hence, not only the main effects of class and gender but also interactions between class and gender were obtained. When applicable, the Newman-Keuls post-hoc test was used for multiple comparisons. A 5% significance level was set.

The study was approved by the Research Ethics Committee of Ribeirão Preto School of Philosophy, Social Sciences and Languages, University of São Paulo, and subjects were previously communicated.

RESULTS

The test-retest reliability results showed high correlation between test and retest performed a month later, Cronbach's alpha was 0.93 and the correlation coefficient was 0.87(95% CI: 0.79-0.91).

Table shows the overall results by gender. All measures of perception scales are in kg/m^2. Subjects were grouped regardless of age as statistical analysis showed no effect of their age.

Among women, the results of the selection of a drawing corresponding to their current contour were statistically significant for BMI class in the choice method (CM) [$F(2.54)=38.76$; $p<0.001$], VAS [$F(2.54=10.63$; $p<0.001$] and absolute threshold (AT) [$F(2.54)=24.99$; $p<0.001$] method. The post-hoc analysis showed that, regardless of the method used, women in Class 1 had lower means compared to those in Class 2 and 3, and those in Class 2 had lower means compared to those in Class 3 ($p<0.05$), suggesting a relationship between actual BMI and their perception of current BMI (Table).

The deviation between desired BMI (target) and actual BMI showed significant effect of BMI class in CM [$F(2.54)=51.44$; $p<0.001$] and AT [$F(2.54)=57.57$; $p<0.001$]. The post-hoc analysis showed that, in both CM and AT, women's dissatisfaction with their body image proportionally increased as their BMI class increased (Table). Thus women's dissatisfaction in Class 1 is lower than that of those women in Class 2 and 3 ($p<0.05$).

The deviation between current BMI and actual BMI (Table) in women showed statistically significant effects of BMI class in CM [$F(2.54)=15.16$; $p<0.01$], VAS [$F(2.54)=10.63$; $p<0.01$] and AT [$F(2.54)=17.84$; $p<0.01$]. In CM, the post-hoc analysis showed greater deviation in Class 1 compared to Class 2 and 3 ($p<0.05$). In VAS, the post-hoc analysis showed a smaller deviation in Class 3 compared to Class 1 and 2 ($p<0.05$). Lastly, in AT, the post-hoc analysis revealed greater deviation in Class 1 compared to Class 2 and 3 ($p<0.05$). These results showed that both normal weight (Class 1) and overweight women (Class 2) overestimated their body size, contrasting with obese women (Class 3) who underestimated their body size.

Among men, the effect of BMI class for current body image self-perception was also significant in CM [$F(2.46)=58.32$; $p<0.001$]; VAS [$F(2.46)=45.07$; $p<0.001$] and AT [$F(2.46)=36.69$; $p<0.001$]. The post-hoc analysis showed that, regardless the method used, men in Class 1 had lower means compared to those in Class 2 and 3 ($p<0.05$), suggesting an association between actual BMI and perception of current BMI (Table).

The deviation between desired BMI (target) and actual BMI (Table) showed significant effect of BMI class in CM [$F(2.46)=52.85$; $p<0.001$] and AT [$F(2.46)=76.89$; $p<0.001$]. The post-hoc analysis showed that in both CM and AT men's dissatisfaction

with their body image (or body image distortion) proportionally increased as BMI classes increased. Similar to that seen among women, dissatisfaction in Class 1 was lower than in Classes 2 and 3 ($p<0.05$).

The deviation between actual BMI and current BMI showed statistically significant effect of BMI class in AT only [$F(2.46)=7.29$; $p<0.01$]. The post-hoc analysis indicated a significant effect in Class 3 compared to Class 1 and 2, i.e., differentiating obese men only (Table).

The two factorial ANOVA (class and gender) showed significant effect of class [$F(2.100)=98.27$; $p<0.001$] and gender [$F(1.100)=25.34$; $p<0.001$] as well as an interaction between class and gender [$F(2.100)=4.34$; $p<0.01$] for current perception of body image in CM. The post-hoc analysis showed that both in Class 1 and Class 2 women chose contour drawings with BMI significantly higher than men ($p<0.05$) but this gender difference was not seen in Class 3 (Table).

The two factorial ANOVA (class and gender) showed significant effect of class [$F(2.100)=9.11$; $p<0.01$] and gender [$F(1.100)=34.67$; $p<0.001$] as well as an interaction between class and gender [$F(2.100)=3.27$; $p<0.01$] for the difference between current perception of body image and actual BMI in CM. The post-hoc analysis showed that both in Class 1 and Class 2 the deviations were significantly higher among women when compared to men ($p<0.05$). This gender difference was not seen in Class 3 (Table).

In regard to dissatisfaction with one's body image, expressed as the deviation between the desired BMI (target) and current BMI in CM, ANOVA showed significant effect of class [$F(2.100)=57.63$; $p<0.001$] and gender [$F(1.100)=6.44$; $p<0.01$] as well as an interaction between class and gender [$F(2.100)=5.07$; $p<0.01$]. The post-hoc analysis showed a significant deviation between women and men in Class 1 ($p<0.05$) and no difference in Classes 2 and 3 (Table).

The results of the questionnaire on body image showed significant effects of gender [$F(1.100)=23.79$; $p<0.001$] and class [$F(2.100)=7.75$; $p<0.001$] but no interaction between these two factors (Table). The post-hoc analysis showed that women had higher scores compared to men ($p<0.05$) and among men only these scores increased as BMI class increased

Table - Sample description by medians and 95% confidence interval (95% CI) of age, weight, height, BMI class, actual BMI, BSQ scores and BMIs for each method used. Ribeirão Preto, Brazil, 2003.

Gender	Age	Weight	Height	Class	Actual BMI	BSQ	Method	Current BMI	BMI(D-A)	BMI (C-A)
Female	27	69.2	1.62	1	21.9	88.0	CM	25.0	-0.31	3.4
(n=57)	(18; 55)	(44.7; 109.2)	(1.49; 1.75)		(21.1; 22.5)	(79.9; 107.4)		(24.2; 26.5)	(-0.9; 0.9)	(2.7; 4.3)
							VAS	23.3	NA	2.2
								(23.1; 25.1)		(1.2; 3.2)
							AT	24.1	-0.7	2.6
								(23.6; 26.1)	(-1.6; 0.2)	(1.7; 4.1)
				2	27.8	120.0	CM	28.6	-3.1	1.9
					(26.7; 28.3)	(89.3; 136.9)		(26.1; 31.0)	(-5.7; -1.0)	(-1.2; 3.3)
							VAS	30.6	NA	2.4
								(27.5; 31.7)		(-0.1; 4.2)
							AT	28.7	-5.5	1.1
								(25.4; 29.8)	(-6.7; -3.04)	(-2.0; 2.2)
				3	33.6	103.0	CM	32.5	-9.3	-0.7
					(32.7; 24.9)	(89.3; 123.4)		(32.1; 34.5)	(-10.3; -7.3)	(-1.4; 0.4)
							VAS	32.3	NA	-1.2
								(31.2; 33.8)		(-2.3; -0.3)
							AT	30.9	-10.2	-1.8
								(30.0; 32.6)	(-11.6; -8.3)	(-3.8; -1.1)
Male	23	83.5	1.75	1	21.7	52.0	CM	20.0	-1.2	-1.2
(n=49)	(18; 48)	(53.3; 135.3)	(1.63; 1.94)		(20.2; 22.3)	(44.0; 65.5)		(18.8; 21.2)	(-2.4; -0.1)	(-2.2; -0.3)
							VAS	20.0	NA	-1.0
								(19.2; 22.0)		(-1.9; 0.6)
							AT	19.1	-2.0	-1.5
								(18.4; 21.5)	(-4.2; -1.3)	(-2.5; -0.1)
				2	27.3	69.0	CM	27.5	-5.2	-1.5
					(26.7; 28.1)	(62.8; 86.0)		(23.9; 28.2)	(-6.8; -4.2)	(-3.1; 0.4)
							VAS	25.8	NA	-2.6
								(23.7; 27.9)		(-3.3; 0.1)
							AT	24.1	-7.7	-3.6
								(22.8; 26.6)	(-8.4; -6.4)	(-4.3; -1.1)
				3	34.0	87.0	CM	32.5	-11.0	-2.2
					(32.8; 35.9)	(80.5; 109.9)		(30.6; 33.4)	(-12.2; -8.9)	(-3.8; -0.9)
							VAS	31.3	NA	-2.4
								(30.2; 33.1)		(-4.1; -1.3)
							AT	29.1	-12.7	-4.1
								(28.0; 30.8)	(-14.3; -11.9)	(-6.4; -3.5)

CM: Choice method
VAS: Visual analogue scale
AT: Absolute threshold method
BMI (D-A): Desired minus actual BMI; BMI (C-A): Current minus actual BMI; NA: Not available

($p<0.05$). Among men, scores of Class 1 were lower than those in Class 2 and 3 ($p<0.05$) and scores in Class 2 were lower than scores in Class 3 ($p<0.05$).

DISCUSSION

Both contour drawing scale and visual analogue scale were previously validated in the literature.[13] The study results also showed high test-retest reliability for contour drawings indicating that measures remained unchanged in the retest a month later, which corroborates other literature findings.[13] Based on that, the present study confirmed the instrument's internal validity since the controlled methodology resulted in quite consistent, and therefore reliable and trustworthy data. This was additionally evidenced by high correlation between test-retest measures. Thus, the contour drawing scale developed is valid for quantitative studies on body image self-perception in both female and male adults. While the study results were based on a particular sample (Brazilian university adults), the adapted version had preserved the original scale's features developed for other countries' populations, cultures, ages, and socioeconomic status. Preserving the instrument's original features allows for reasonably safe generalizations of findings in other samples, which provides the instrument external validity.

Madrigal et al[17] (2000) point out the relationship between body weight and body image self-perception is well-documented in the literature,[19] which was corroborated in the present study. Normal weight and overweight women tended to overestimate their weight but as BMI increased this relationship was inverted and in that case obese women tended to underestimate their weight. These findings could also explain the fact that among men overall actual BMI mean was above the desired one (normal weight) as men tend to underestimate their body size, regardless of their BMI. Moreover, these same authors[17,19] suggest a possible reason for underestimating could be a denial of their own nutritional status.

These findings indicate men pay less attention to the required management of their nutritional status, which would make it difficult to establish prevention actions against chronic degenerative diseases associated to excess weight. Among women, overestimating could reflect environmental factors associated to the development of eating disorders such as anorexia nervosa and bulimia. But other studies found disagreeing findings and reported overestimation of body size by obese people in general.[21,22]

The fact that those drawings reported as desired were largely within lower ranges of BMI compared to those reported as current BMI is suggestive of body image dissatisfaction, showing that both men and women praise thinness ideals. The appreciation of thinness in modern societies, of bodies so lank unattainable for most people, creates a condition of everlasting dissatisfaction. This dissatisfaction could be an important environmental factor contributing to the characteristic stress of modern life, a condition also strongly associated with the current morbimortality.[3,14,20]

The fact that even women having an adequate weight-to-height ratio desire to have lower weight is of concern. This body image distortion is indeed originated by the mass media that privilege beauty models that have weight-to-height ratios close, or even parallel, to those of people suffering from eating disorders such as anorexia nervosa and bulimia. These beauty models disseminated through the media affect people's behavior and determine eating behaviors among female adolescents. These effects need to be further explored for better understanding environmental factors that predispose the onset of eating disorders.

On the other hand, overweight women are likely to be subject to greater psychological distress when compared to normal weight or even obese women as evidenced in the body image questionnaire. The significantly higher mean scores among overweight women may indicate greater body concern and discomfort.[6] In the same way, they are emotionally more vulnerable, since one's emotional condition could affect the construction and constant reconstruction of one's own image. They could be considered a borderline group more susceptible to intervention and advice for improving their nutritional status.

Finally, these findings showed the methods applied in the study were suitable for studying body image self-perception and also their value in identifying differences in perception associated to BMIs reported by the study subjects. The contour drawing scale was developed from real pictures of Brazilian subjects, illustrating these subjects' biotype. The use of these scales is an advance as Brazilian investigators are not required anymore to use contour drawings available in the literature based on biotypes that may not be fitting to the Brazilian ones. These findings suggest that other aspects of body image self-perception should be explored as significant subjective elements for attitudes and behaviors establishing eating behaviors and nutritional status. Further knowledge on this field will help to improve clinical and nutritional evaluation and obesity prevention and consequently to reducing chronic degenerative conditions known to be associated to nutritional status.

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