Strategies for eating and body change among Brazilian women and men

Wanderson R. **da Silva**,[1] Joao **Marôco**,[2] Juliana A. D. B. **Campos**[1]

Abstract

Objectives: Our study was conducted to adapt the Body Image and Body Change Inventory (BIBCI) for Portuguese; to evaluate the BIBCI's psychometric properties in samples of university students; to calculate the prevalence of strategies for eating and body change among students; and to evaluate the impact of demographic, social, and anthropometric characteristics on the BIBCI subscales.

Methods: 798 students (women = 63%) answered the Portuguese translation of the BIBCI and answered a demographic questionnaire. All analyses were performed separately for women and men. The BIBCI's psychometric properties were estimated using confirmatory factor analysis. Mean scores were calculated for each BIBCI subscale. A multivariate regression model was tested to evaluate the impact of demographic, social, and anthropometric characteristics on mean BIBCI subscale scores.

Results: The psychometric properties of the BIBCI were adequate in the samples analyzed. The BIBCI subscales scores did not differ according to sex. According to the cut-off points adopted, most of the students were classified in the very low category of the BIBCI subscales. For women, characteristics such as self-reported eating assessment, economic class, physical activity level, and work were significant. For men, only physical activity level was significant.

Conclusion: The Portuguese translation of the BIBCI was presented and its psychometric properties were found to be adequate in the samples analyzed. The models identified significant characteristics that can be used in intervention protocols for preventing inappropriate behaviors in relation to body image and eating.

Keywords: Eating, body image, women, men.

Introduction

Physical fitness has become one of the main reasons people effect changes in eating habits and physical activities. These changes are generally made for aesthetic reasons, without concern for physical and mental health. Researchers have sought to understand individuals' relationships with their bodies in order to develop health promotion actions.[1,2] To investigate these relationships, it is relevant to identify the mental representation that individuals construct in relation to their bodies, which has been conceptualized by Cash and Smolak[3] as body image.

Body image is a multidimensional concept that has been widely investigated using different measures. Most studies investigate the perceptual and attitudinal dimensions of body image.[3] Satisfaction with and the importance of body image and eating and body change strategies are inherent aspects of the attitudinal dimension of body image. These refer to individuals'

feelings and behaviors in relation to the desire to change their bodies. One of the instruments cited in the literature for evaluation of these aspects is the Body Image and Body Change Inventory (BIBCI). This instrument was developed in two parts, the first (BI) referring to body image[4] and the second (BCI), to eating and body change.[5] McCabe and Ricciardelli[5] presented the composition of both parts (BI and BCI) with different subscales for each.

The BIBCI was originally developed in the English language to evaluate satisfaction with body image, importance of body image and eating and body change strategies in adolescents. The items were developed for application in girls and boys, and the subscales have been widely used in international contexts,[6-11] but not in Portuguese-speaking countries.[12,13] In Brazil, Conti et al.[12] has presented a Portuguese version of the BIBCI, but only the second part of the instrument (BCI) was translated. Although the BIBCI was developed using a sample of adolescents, the items do not appear to be exclusive to this population. Another point that merits highlighting is related to evaluation of the psychometric properties of BIBCI, which is rarely reported in the literature, and the related lack of consensus among researchers on the analytical strategy for estimating BIBCI subscale scores (i.e., some studies use means, and others use sums). The authors of the BIBCI did not propose cut-off points for classification of individuals, which has impeded use of the instrument in clinical settings. Therefore, the present study highlights the relevance of evaluating the validity of the BIBCI and of developing and presenting methodological strategies for its use in different contexts.

Meanwhile, researches have encouraged identification of characteristics that can be included in intervention protocols, such as demographic, social, and anthropometric data. Such information can be important in preventative and follow-up protocols aimed at ensuring the best clinical management of individuals. In previous studies,[11,14-17] these characteristics have been reported to impact individuals' satisfaction with their body image and its importance to them and also their eating and body change strategies. Thus, these relationships merit investigation, especially in vulnerable populations such as adolescents and university students. It is against this background that the present study was conducted to achieve the following aims:

1. To translate and culturally adapt the BIBCI for use in Portuguese.
2. To evaluate the psychometric properties of the BIBCI when administered to a sample of university students of both sexes.
3. To propose an analytical strategy for calculating the scores of each BIBCI subscale and to establish cut-off points for defining the degree of satisfaction with and importance of body image and strategies for eating and body change.
4. To calculate the prevalence of the aspects assessed by each BIBCI subscale among students.
5. To verify the impact of demographic, social, and anthropometric characteristics on BIBCI subscales.

Method

Participants

This study adopted a cross-sectional design. A recommendation made by Hair Jr. et al.[18] that at least five respondents should be recruited per instrument item was followed when calculating the minimum sample size. Since the BIBCI comprises 53 items, the minimum sample size was estimated at 265 participants. This estimate was respected for each sex, because analyses were performed separately for women and men.

The sample was composed of university students enrolled in undergraduate courses in the pharmaceutical sciences, sciences, and languages faculties at the Universidade Estadual Paulista (UNESP, Araraquara, SP, Brazil). The inclusion criteria adopted were as follows: aged 18 years or older, not pregnant, and no visual impairment. A total of 798 students participated (women = 63.0%, men = 37.0%). The mean age was 21.2 (standard deviation [SD] = 2.8) years for women and 21.3 (SD = 3.3) years for men. The mean body mass index (BMI) was 22.9 (SD = 4.5) kg/m^2 for women and 24.0 (SD = 4.4) kg/m^2 for men.

Information on participants was collected, such as age, sex, course title and year, work, and internships. Further, participants also answered a self-report eating assessment item (bad, regular, normal, good, or excellent) and a question on use of medication or dietary supplements to change the body (never, once in a lifetime, sometimes, or frequently) and provided self-reported body weight and height. the Brazilian Criteria for social class distribution were used to estimated participants' economic class.[19] Participants' BMI was calculated and their anthropometric weight status was obtained.[20] The short form of the International Physical Activity Questionnaire (IPAQ) was used to estimate participants' physical activity levels. The BIBCI was used to estimate satisfaction with body image, importance of body image, and eating and body change strategies.[8]

Measure

The BIBCI was initially developed in an Australian context from existing scales containing items exclusively for women. For this reason, interviews were conducted with men to develop new items. The resulting BIBCI items were formulated for both women and men, considering theoretical aspects (i.e., body image, eating, and body change strategies). There are a number of different combinations of BIBCI subscales in the literature. The present study used a model composed of 53 items with a five-point Likert type response scale grouped into seven subscales (body image satisfaction, body image importance, body change strategies to decrease body size, body change strategies to increase body size, strategies to increase muscle tone, binge eating, and intake of food supplements). The material, including this model, was acquired from a commercial site (http://store.ets.org) and is described in McCabe and Ricciardelli.[8] It is important to note that the authors of the BIBCI gave permission for their instrument to be used in the present study. With regard to translation of BIBCI into Portuguese, Conti et al.[12] presented a version entitled Questionário de Mudança Corporal. That version does not include the subscales covering body image satisfaction or body image importance. Moreover, the theoretical content of most of the items differs from that observed in the version used in the present study. Therefore, a cross-cultural adaptation of the English version of the BIBCI (i.e., including all seven subscales) to Portuguese was performed.

This study prepared a Brazilian Portuguese translation of the BIBCI, taking care to verify idiomatic, semantic, conceptual, and cultural equivalence.[21,22] Idiomatic and semantic equivalence were ensured via translation and back-translation. The forward translation (from English to Portuguese) was performed by three native Brazilian Portuguese speakers proficient in English. The back-translation (from Portuguese to English) was conducted by three native English speakers proficient in Portuguese. Next, a neutral judge (a bilingual English-Portuguese translator) evaluated the agreement of words and expressions between the back-translations and original version of BIBCI. The back-translation most faithful to the original was chosen as the BIBCI Portuguese version to be used in the subsequent stages.

The conceptual and cultural equivalence of the Portuguese version was evaluated by two experts in body image and eating and one Portuguese language expert, to explore whether BIBCI items and subscales were appropriate for Brazilian settings. The experts in body image and eating suggested changes to improve comprehension of some items. In items 21 and 26, the expression "lose weight" was changed to "decrease body size", to make it fit the body change strategies to decrease body size subscale. In items 49 and 52, on the food supplement intake subscale, the word "Sustagen" was changed to "nutritional supplements" to improve cultural understanding, because Sustagen is a brand. In the satisfaction with body image and importance of body image subscales, the description "leg (between the knee and the ankle)" was added to items 9 and 19, to clearly specify the part of the body being considered. The Portuguese language expert suggested using the spelling reform rules implemented in Portuguese-speaking countries in 2009. Therefore, two synonymous words were used in items 4 and 14 (hip [quadril/anca]), 6 and 16 (breast [peitoral/seios]), and 7 and 17 (abdominal [região abdominal/estômago]) to facilitate understanding in other Portuguese-speaking countries. It should be clarified that these changes did not compromise the original content of the items.

After modification, the Portuguese version of the BIBCI was pre-tested in a pilot study with 30 students. These participants requested inclusion of a reference period to guide answers to the questions. The authors of the BIBCI did not specify any such period, but we believe it is important to include this information. Thus, we investigated the literature and identified "the last 12 months" as an appropriate reference period. After this reference period had been added, participants still reported difficulty in completing items that only differed in one part of the question (e.g., How often do you CHANGE your eating to increase your body size?; How often do you THINK ABOUT CHANGING your eating to increase your body size?; and How often do you WORRY ABOUT CHANGING your eating to increase your body size?). We therefore used uppercase letters and underlining to highlight the change strategy element of interest in each item. The modified Portuguese version of the BIBCI was tested once more with 30 students, who did not report any difficulty in completing the items. Table 1 presents both the English and Portuguese versions of BIBCI.

Procedures

The Portuguese BIBCI and a questionnaire on participants' characteristics were completed as paper-and-pencil surveys by the participants during class hours. The instructor responsible for class at the time of data collection agreed to allocate 15 minutes for the students to participate. Students received information about the study, such as the aims and purpose of the research and those who agreed to take part signed informed consent forms. Ethics approval was granted by the Human Research Ethics Committee at the Faculdade de Ciências Farmacêuticas, São Paulo, Brazil (C.A.A.E.: 46774015.5.0000.5426).

Table 1 - English and Portuguese versions of the Body Image and Body Change Inventory (BIBCI)

English version	Portuguese version
Body Image and Body Change Inventory	**Inventário de Imagem e Mudança Corporal**

Instructions:

Your answers are completely anonymous. No-one will know what answers you provide. There are no right or wrong answers. We just want to know how you feel and what you do. It is important not to take too long to answer each question. Simply circle the response that best applies to you. Extremely satisfied means very happy, extremely dissatisfied means very unhappy.

Instruções:

Suas respostas são completamente anônimas. Ninguém saberá qual resposta você forneceu. Não existem respostas certas ou erradas. Apenas queremos saber como você se sente e o que costuma fazer. É importante não demorar muito para responder cada questão. Simplesmente circule a resposta que melhor se adequa a você. Extremamente satisfeito significa muito feliz, extremamente insatisfeito significa muito infeliz. Responda as questões/itens abaixo de acordo com os ÚLTIMOS 12 MESES.

Body image satisfaction

Response options: 1 = Extremely dissatisfied, 2 = Fairly dissatisfied, 3 = Neutral, 4 = Fairly satisfied, 5 = Extremely satisfied.

1. How satisfied are you with your weight?
2. How satisfied are you with your body shape?
3. How satisfied are you with your muscle?

The remainder of the questions in this section ask about your level of satisfaction with particular body parts.

    4. Hips
    5. Thighs
    6. Chest
    7. Abdominal region/stomach
    8. Shoulders
    9. Legs
    10. Arms

Satisfação com a imagem corporal

Opções de respostas: 1 = Extremamente insatisfeito, 2 = Razoavelmente insatisfeito, 3 = Neutro, 4 = Razoavelmente satisfeito, 5 = Extremamente satisfeito.

1. Quão satisfeito você está com o seu peso?
2. Quão satisfeito você está com a forma do seu corpo?
3. Quão satisfeito você está com os seus músculos?

O restante das questões nesta seção são sobre quão satisfeito você está com diferentes partes do seu corpo.

    4. Quadril/Anca
    5. Coxas
    6. Peitoral/Seios
    7. Região abdominal/estômago
    8. Ombros
    9. Pernas (região entre joelho e o tornozelo)
    10. Braços

Body image importance

Response options: 1 = Extremely important, 2 = Fairly important, 3 = Neutral, 4 = Fairly unimportant, 5 = Not important at all.

11. How important to you is what you weigh compared to other things in your life?
12. How important is the shape of your body compared to other things in your life?
13. How important is the size and strength of your muscles compared to other things in your life?

The remainder of the questions in this section ask about the importance of the appearance of different parts of your body.

    14. Hips
    15. Thighs
    16. Chest
    17. Abdominal region/stomach
    18. Shoulders
    19. Legs
    20. Arms

Importância com a imagem corporal

Opções de respostas: 1 = Sem importância alguma, 2 = Razoavelmente sem importância, 3 = Neutro, 4 = Razoavelmente importante, 5 = Extremamente importante.

11. Quão importante é para você o seu peso, comparado com outras coisas da sua vida?
12. Quão importante é para você a forma do seu corpo, comparado com outras coisas da sua vida?
13. Quão importante é o tamanho e a força dos seus músculos, comparado com outras coisas da sua vida?

O restante das questões nesta seção são sobre quão importante é para você a aparência de diferentes partes do seu corpo.

    14. Quadril/Anca
    15. Coxas
    16. Peitoral/Seios
    17. Região abdominal/estômago
    18. Ombros
    19. Pernas (região entre joelho e o tornozelo)
    20. Braços

Strategies to decrease body size

Response options: 1 = Never, 2 = Sometimes, 3 = Frequently, 4 = Almost always, 5=Always.

21. How often do you feel like changing the types of foods you eat so that you can lose weight?
22. How often do you change your eating to decrease your body size?
23. How often do you change your levels of exercise to decrease your body size?
24. How often do you think about changing your levels of exercise to decrease your body size?

Estratégias para reduzir o tamanho do corpo

Opções de respostas: 1 = Nunca, 2 = Algumas vezes, 3 = Frequentemente, 4 = Quase sempre, 5 = Sempre.

21. Com que frequência você TEM VONTADE DE ALTERAR os tipos de alimentos que consome para diminuir o tamanho do seu corpo?
22. Com que frequência você ALTERA sua alimentação para diminuir o tamanho do seu corpo?
23. Com que frequência você ALTERA seus níveis de exercício para diminuir o tamanho do seu corpo?
24. Com que frequência você PENSA EM ALTERAR seus níveis de exercício para diminuir o tamanho do seu corpo?

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Table 1 (cont.)

English version	Portuguese version
Body Image and Body Change Inventory	**Inventário de Imagem e Mudança Corporal**
25. How often do you worry about changing your eating to decrease your body size?	25. Com que frequência você SE PREOCUPA EM ALTERAR sua alimentação para diminuir o tamanho do seu corpo?
26. How often do you think about exercising to lose weight?	26. Com que frequência você PENSA EM se exercitar para diminuir o tamanho do seu corpo?
Strategies to increase body size	**Estratégias para aumentar o tamanho do corpo**
27. How often do you change your eating to increase your body size?	27. Com que frequência você ALTERA sua alimentação para aumentar o tamanho do seu corpo?
28. How often do you change your levels of exercise to increase your body size?	28. Com que frequência você ALTERA seus níveis de exercício para aumentar o tamanho do seu corpo?
29. How often do you think about changing your eating to increase your body size?	29. Com que frequência você PENSA EM ALTERAR sua alimentação para aumentar o tamanho do seu corpo?
30. How often do you think about changing your levels of exercise to increase your body size?	30. Com que frequência você PENSA EM ALTERAR seus níveis de exercício para aumentar o tamanho do seu corpo?
31. How often do you worry about changing your eating to increase your body size?	31. Com que frequência você SE PREOCUPA EM ALTERAR sua alimentação para aumentar o tamanho do seu corpo?
32. How often do you worry about changing your levels of exercise to increase your body size?	32. Com que frequência você SE PREOCUPA EM ALTERAR seus níveis de exercício para aumentar o tamanho do seu corpo?
Strategies to increase muscle tone	**Estratégias para aumentar o tônus muscular**
33. How often do you change your levels of exercise to increase the size of your muscles?	33. Com que frequência você ALTERA seus níveis de exercício para aumentar o tamanho dos seus músculos?
34. How often do you change your food supplements to increase the size of your muscles?	34. Com que frequência você ALTERA seus suplementos alimentares para aumentar o tamanho dos seus músculos?
35. How often do you think about changing your eating to increase the size of your muscles?	35. Com que frequência você PENSA EM ALTERAR sua alimentação para aumentar o tamanho dos seus músculos?
36. How often do you think about changing your levels of exercise to increase the size of your muscles?	36. Com que frequência você PENSA EM ALTERAR os níveis de exercício para aumentar o tamanho dos seus músculos?
37. How often do you worry about changing your eating to increase the size of your muscles?	37. Com que frequência você SE PREOCUPA EM ALTERAR sua alimentação para aumentar o tamanho dos seus músculos?
38. How often do you worry about changing your levels of exercise to increase the size of your muscles?	38. Com que frequência você SE PREOCUPA EM ALTERAR seus níveis de exercício para aumentar o tamanho dos seus músculos?
Binge eating	**Compulsão alimentar**
39. How often do you quickly eat a large amount of food?	39. Com que frequência você COME rapidamente uma grande quantidade de alimentos?
40. How often do you eat to the point of stuffing yourself?	40. Com que frequência você COME até sentir-se completamente cheio?
41. How often do you eat a lot of food when you're not even hungry?	41. Com que frequência você COME uma grande quantidade de alimentos mesmo sem estar com fome?
42. How often do you experience urges to eat and eat?	42. Com que frequência você TEM UMA VONTADE incontrolável de comer?
43. How often do you find that all you can think about is food?	43. Com que frequência você ACHA QUE só consegue pensar em comer?
44. How often do you think about eating a large amount of food?	44. Com que frequência você PENSA EM comer uma grande quantidade de alimentos?
45. How often do you think about food when you're not even hungry?	45. Com que frequência você PENSA EM comida quando você não está com fome?
46. How often do you feel like stuffing yourself with food?	46. Com que frequência você TEM VONTADE de comer até sentir-se completamente cheio?
47. How often do you eat a lot when feeling anxious?	47. Com que frequência você COME muito quando está ansioso?
Food supplements	**Suplementos alimentares**
48. How often do you take vitamins to change your body weight?	48. Com que frequência você TOMA vitaminas para alterar o seu peso?
49. How often do you take food supplements (for example, diet pills, sustagens) to change your body weight?	49. Com que frequência você TOMA suplementos alimentares (por exemplo, comprimidos para dietas, suplementos nutricionais) para alterar o seu peso.

English version	Portuguese version
Body Image and Body Change Inventory	**Inventário de Imagem e Mudança Corporal**
50. If you could take steroids without them causing any harm to you, how frequently would you think about taking them?	50. Se você pudesse TOMAR esteroides sem que estes lhe causassem danos, com que frequência você pensaria em tomá-los?
51. How often do you think about taking vitamins?	51. Com que frequência você PENSA EM TOMAR vitaminas?
52. How often do you feel like taking food supplements? (for example, diet pills, sustagen)	52. Com que frequência você SENTE VONTADE DE TOMAR suplementos alimentares (por exemplo, comprimidos para dietas, suplementos nutricionais)?
53. How often do you feel like taking steroids?	53. Com que frequência você TEM VONTADE DE TOMAR esteroides?

Data analyses

The BIBCI factorial model composed of 53 items and 7 correlated subscales was evaluated. The analyses were performed separately for each sex, because the BIBCI assesses distinct aspects of body image that can be perceived differently by women and men.

Construct validity was examined in terms of factorial, convergent, and discriminant validity. Factorial validity was assessed by confirmatory factor analysis using the weighted least squares estimator with mean and variance adjusted. We used the following fit indices to evaluate the model: chi-square by degrees of freedom ratio (χ^2/df), root mean square error of approximation (RMSEA) with 90% confidence interval (CI), Tucker-Lewis index (TLI), and comparative fit index (CFI).[23] Values were considered acceptable at the following cutoffs: χ^2/df ≤ 3.0, RMSEA ≤ 0.08, TLI ≥ 0.90, and CFI ≥ 0.90.[24] The factorial weight (λ) of each item of BIBCI was assessed; values ≥ 0.40 were considered adequate. Analyses were carried out using MPLUS (v.7.2). Average variance extracted (AVE) was calculated to evaluate convergent validity.[25] The coefficient of determination (r^2) was calculated to evaluate discriminant validity.[25] For each pair of correlated subscales, AVE ≥ 0.50 and r^2 ≤ AVE indicated adequate convergent and discriminant validity, respectively.[24,25] Composite reliability (CR), the ordinal alpha coefficient (α), and the omega coefficient (ω) were calculated to evaluate the reliability of BIBCI subscales. Values were considered adequate for CR, α, and ω at ≥ 0.70.[24,26,27]

Previous studies were consulted with regard to estimation of the final scores of each BIBCI subscale. Most of these studies calculated scores using sums, which can be problematic (for example, if items are excluded, the classification ranges will be prejudiced). In this scenario, the mean was used to calculate BIBCI scores for women and men. The mean scores of the subscales were compared between men and women using analysis of variance (ANOVA) and a 5% level of significance. We used response scale percentiles (P25, P50, and P75) for classification of individuals according to their scores on the BIBCI subscales. The classification used for each BIBCI subscale was as follows: 1.0 ⊢ 2.0 (P ≤ 25) = very low; 2.0 ⊢ 3.0 (P25 ⊢ P50) = low; 3.0 ⊢ 4.0 (P50 ⊢ 75) = moderate; and 4.0 ⊢ 5.0 (P > 75) = high. The prevalence of individuals classified in each of categories described above was estimated for women and men with a 95%CI for each of the BIBCI subscales.

The final analytical stage consisted of evaluating the impact of characteristics of interest (work, self-report eating assessment, BMI, physical activity level, and economic class) on the mean scores of BIBCI subscales. This was performed by constructing a multivariate multiple regression model using structural equations modeling. The model was tested for women and men separately. Recommendations published by Marôco[24] were implemented to evaluate the model, using the maximum likelihood estimator. Next, the significance of hypothetical causal paths (β) was evaluated using a 5% level of significance, calculated by the z-test at the critical ratios. Models were refined using the stepwise method to identify significant characteristics. These analyses were conducted using MPLUS (v.7.2).

Results

Table 2 presents the participants' characteristics in detail.

Most of the participants were in their first year of undergraduate study, were not working or in internships, had never taken medication nor used dietary supplements to achieve body change, were classified as healthy weight according to BMI, had a high level of physical activity, and belonged to category B economic class. Most of the women were on the Education course and self-reported their eating as regular or normal. Most men were on the Economics course and self-reported their eating as normal or good.

Table 2 - Characterization of the sample of Brazilian university students

Characteristic	Sample, n (%)	
	Women	Men
Course		
Pharmacy	125 (25.1)	35 (11.9)
Business Administration	82 (16.5)	84 (28.5)
Language and Literature	3 (0.6)	2 (0.7)
Education	139 (27.9)	3 (1.0)
Economics	62 (12.4)	99 (33.6)
Social Sciences	47 (9.4)	53 (18.0)
Bioprocess Engineering	40 (8.1)	19 (6.3)
Course year		
First	164 (32.8)	121 (41.0)
Second	112 (22.4)	62 (21.0)
Third	63 (12.6)	53 (18.0)
Fourth	131 (26.2)	35 (11.9)
≥ Fifth	30 (6.0)	24 (8.1)
Work		
No	396 (79.2)	239 (81.6)
Yes	104 (20.8)	54 (18.4)
Internship		
No	356 (71.6)	247 (84.6)
Yes	141 (28.4)	45 (15.4)
Use of medication to achieve body change		
Never	413 (83.6)	252 (86.9)
Once in a lifetime	40 (8.1)	14 (4.8)
Sometimes	36 (7.3)	21 (7.2)
Frequently	5 (1.0)	3 (1.1)
Use of dietary supplements to achieve body change		
Never	383 (78.0)	181 (62.2)
Once in a lifetime	39 (7.9)	37 (12.7)
Sometimes	47 (9.6)	53 (18.2)
Frequently	22 (4.5)	20 (6.9)
Self-report eating assessment		
Bad	45 (9.3)	41 (14.0)
Regular	168 (34.6)	69 (23.6)
Normal	161 (33.1)	82 (28.1)
Good	102 (21.0)	86 (29.5)
Excellent	10 (2.1)	14 (4.8)
Anthropometric weight status		
Underweight	25 (5.1)	13 (4.5)
Healthy weight	351 (70.6)	184 (63.4)
Overweight	87 (17.5)	68 (23.4)
Obesity	34 (6.8)	25 (8.7)
Physical activity level		
Low	56 (12.0)	20 (7.0)
Moderate	158 (34.0)	72 (25.4)
High	251 (54.0)	192 (67.6)
Economic class (by average household income)		
D and E ($ 188.89)	1 (0.2)	1 (0.4)
C ($ 451.15 / $ 791.02)	109 (22.5)	38 (13.5)
B ($ 1,430.49 / $ 2,770.33)	246 (50.7)	151 (53.7)
A ($ 6,226.69)	129 (26.6)	91 (32.4)

The economic class was obtained using Brazilian Criteria. Values in Brazilian Reais (BRL) were converted into American dollars (at the exchange rate prevailing in Nov 2018).

The factorial validity of the BIBCI was adequate for both women (CFA: χ^2/df = 2.71, RMSEA = 0.06 [90%CI: 0.05-0.06], CFI = 0.95, TLI = 0.95, λ = 0.43-0.98) and men (CFA: χ^2/df = 2.29, RMSEA = 0.07 [90%CI: 0.06-0.07], CFI = 0.96, TLI = 0.95, λ = 0.60-0.97). Both convergent and discriminant validity were adequate for both samples (women: AVE = 0.53-0.85, r^2 = 0.00-0.38; men: AVE = 0.55-0.88, r^2 = 0.00-0.67). With regard to reliability, all CR and α values were adequate for both samples (women: CR = 0.92-0.97, α = 0.84-0.96; men: CR = 0.92-0.98, α = 0.91-0.96). An estimation discrepancy for the omega coefficient was only observed for women, for the body change strategies to decrease body size subscale (women: ω = 0.65-0.94, men: ω = 0.90-0.96).

Table 3 shows correlations among the BIBCI subscales for each sex.

Most correlations were significant except for two pairs in women (strategies to increase body size vs. binge eating, strategies to increase muscle tone vs. binge eating), one pair in men (body image satisfaction vs. body image importance), and one pair in both samples (body image satisfaction vs. strategies to increase body size).

The mean scores for the following subscales did not differ between women and men: body image satisfaction (women = 2.97 [SD] = 0.84; men = 2.95 [SD] 0.85, p = 0.846), body image importance (women = 3.19 [SD] 0.77; men = 3.25 [SD] 0.74, p = 0.230), body change strategies to decrease body size (women = 2.31 [SD] 1.10; men = 2.33 [SD] 1.05, p = 0.837), body change strategies to increase body size (women = 1.79 [SD] 0.96; men = 1.75 [SD] 0.97, p = 0.679), body change strategies to increase muscle tone (women = 1.80 [SD] 0.91; men = 1.72 [SD] 0.83, p = 0.251), binge eating (women = 2.47 [SD] 0.87, men = 2.45 [SD] 0.93, p = 0.682), and food supplements use for body change (women = 1.39 [SD] 0.66; men = 1.37 [SD] 0.60, p = 0.752).

Table 4 presents the prevalence of participants classified in each category according to their mean scores on each BIBCI subscale.

The majority of women and men were classified as follows: low to moderate for body image satisfaction, moderate for body image importance, very low for body change strategies to decrease body size, very low for body change strategies to increase body size, very low for body change strategies to increase muscle tone, very low to low for binge eating, and very low for use of dietary supplements for body change. The only difference identified between women and men was in the prevalence rates for the body image importance subscale.

Table 5 presents the estimates of the regression models.

Significant characteristics for women were self-report eating assessment, economic class, physical activity level, and work (p < 0.05). The results showed that women with better self-report eating assessment, greater body image importance, and in a higher economic class tended to have a higher category for strategies to reduce body size and increase muscle

Table 3 - Correlation matrix for the subscales of the Body Image and Body Change Inventory (BIBCI), in Brazilian university students

	A	B	C	D	E	F	G
Women							
A. Body image satisfaction	1.00	-0.18[†]	-0.56[†]	0.05	-0.12[†]	-0.35[†]	-0.25[†]
B. Body image importance	-	1.00	0.33[†]	0.11*	0.32[†]	0.09*	0.27[†]
C. Body change strategies to decrease body size	-	-	1.00	-0.11*	0.28[†]	0.23[†]	0.19[†]
D. Body change strategies to increase body size	-	-	-	1.00	0.62[†]	0.01	0.45[†]
E. Strategies to increase muscle tone	-	-	-	-	1.00	0.02	0.51[†]
F. Binge eating	-	-	-	-	-	1.00	0.14[†]
G. Intake of food supplements	-	-	-	-	-	-	1.00
Men							
A. Body image satisfaction	1.00	-0.03	-0.32[†]	-0.10	-0.17[†]	-0.26[†]	-0.16[†]
B. Body image importance	-	1.00	0.39[†]	0.43[†]	0.48[†]	0.22[†]	0.51[†]
C. Body change strategies to decrease body size	-	-	1.00	0.31[†]	0.37[†]	0.33[†]	0.34[†]
D. Body change strategies to increase body size	-	-	-	1.00	0.82[†]	0.17[†]	0.64[†]
E. Strategies to increase muscle tone	-	-	-	-	1.00	0.12*	0.77[†]
F. Binge eating	-	-	-	-	-	1.00	0.13*
G. Intake of food supplements	-	-	-	-	-	-	1.00

* p < 0.05; [†] p < 0.01.

tone. Women with a higher physical activity level had higher categories for strategies to decrease body size and for binge eating behavior. Moreover, women with a lower physical activity level had higher categories for strategies for food supplements use, for increasing body size, and for increasing muscle tone. Women who did not work presented a higher category for strategies for increasing muscle tone, whereas women who did work presented a higher category for binge eating behavior. For men, only physical activity level was significant, and male students with a higher physical activity level were more satisfied with their body image and had a higher category for strategies for decreasing body size. Men with a lower physical activity level had higher categories for strategies for increasing body size and muscle tone.

Table 4 - Classification of university students according to their mean scores on subscales of the Body Image and Body Change Inventory (BIBCI)

Subscale/classification	Women		Men	
	n (%)	95%CI	n (%)	95%CI
Body image satisfaction				
Very low	70 (13.9)	11.1-16.9	39 (13.2)	9.5-16.9
Low	208 (41.4)	37.0-45.3	132 (44.7)	39.0-50.5
Moderate	173 (34.4)	30.4-38.6	93 (31.5)	26.1-36.9
High	52 (10.3)	7.8-13.1	31 (10.5)	7.5-13.9
Body image importance				
Very low	43 (8.5)	6.4-11.1	26 (8.8)	5.8-12.2
Low	159 (31.6)	27.4-35.8	68 (23.1)	18.3-27.5
Moderate	249 (49.5)	45.1-53.9	178 (60.3)	55.3-66.1
High	52 (10.3)	7.8-13.1	23 (7.8)	4.4-11.2
Body change strategies to decrease body size				
Very low	238 (47.3)	42.7-51.5	137 (46.4)	40.7-51.9
Low	146 (29.0)	25.2-33.2	81 (27.5)	22.0-32.5
Moderate	79 (15.7)	12.7-19.1	60 (20.3)	16.3-25.4
High	40 (8.0)	5.8-10.5	17 (5.8)	3.1-8.5
Body change strategies to increase body size				
Very low	370 (73.6)	69.4-77.1	223 (75.6)	70.8-80.7
Low	83 (16.5)	13.1-19.7	41 (13.9)	10.2-18.0
Moderate	35 (7.0)	4.8-9.1	19 (6.4)	3.7-9.2
High	15 (3.0)	1.6-4.6	12 (4.1)	2.0-6.4
Strategies to increase muscle tone				
Very low	378 (75.1)	71.4-78.7	227 (72.2)	72.2-81.7
Low	76 (15.1)	12.1-18.5	50 (12.9)	12.9-21.4
Moderate	34 (6.8)	4.6-8.9	12 (2.0)	2.0-6.4
High	15 (3.0)	1.6-4.6	6 (0.7)	0.7-3.7
Binge eating				
Very low	186 (37.0)	32.8-41.2	126 (42.7)	37.3-48.1
Low	204 (40.6)	36.0-44.9	104 (35.3)	30.2-41.0
Moderate	80 (15.9)	12.7-19.3	43 (14.6)	10.5-19.0
High	33 (6.6)	4.4-8.7	22 (7.5)	4.7-10.5
Intake of food supplements				
Very low	450 (89.5)	86.9-92.0	265 (89.8)	86.4-93.2
Low	37 (7.4)	5.0-9.7	21 (7.1)	4.4-9.8
Moderate	9 (1.8)	0.8-3.0	8 (2.7)	1.0-4.4
High	7 (1.4)	0.4-2.4	1 (0.3)	0.0-1.0

95%CI = 95% confidence interval.

Table 5 - Multivariate multiple regression models tested in Brazilian university students

Independent/dependent variable (BIBCI subscales)	Complete			Refined		
	B	SE	p	β	SE	p
Women						
Work						
Body image satisfaction	0.001	0.050	0.980	-	-	-
Body image importance	-0.022	0.049	0.651	-	-	-
Body change strategies to decrease body size	0.039	0.049	0.422	-	-	-
Body change strategies to increase body size	-0.057	0.048	0.229	-	-	-
Strategies to increase muscle tone	-0.133	0.047	0.005*	-0.188	0.073	0.010*
Binge eating	0.109	0.048	0.023*	0.210	0.095	0.027*
Intake of food supplements	-0.065	0.049	0.182	-	-	-
Self-reported eating assessment						
Body image satisfaction	-0.029	0.051	0.563	-	-	-
Body image importance	0.153	0.049	0.002*	0.133	0.035	0.001*
Body change strategies to decrease body size	0.031	0.050	0.536	-	-	-
Body change strategies to increase body size	-0.050	0.048	0.303	-	-	-
Strategies to increase muscle tone	0.016	0.048	0.737	-	-	-
Binge eating	0.000	0.049	0.993	-	-	-
Intake of food supplements	-0.024	0.050	0.624	-	-	-
Body mass index						
Body image satisfaction	0.020	0.050	0.687	-	-	-
Body image importance	0.042	0.049	0.390	-	-	-
Body change strategies to decrease body size	0.018	0.049	0.717	-	-	-
Body change strategies to increase body size	-0.030	0.048	0.528	-	-	-
Strategies to increase muscle tone	0.046	0.048	0.335	-	-	-
Binge eating	-0.012	0.048	0.803	-	-	-
Intake of food supplements	-0.016	0.049	-0.749	-	-	-
Physical activity level						
Body image satisfaction	0.034	0.050	0.501	-	-	-
Body image importance	-0.005	0.050	0.927	-	-	-
Body change strategies to decrease body size	0.144	0.049	0.003*	0.234	0.072	0.001*
Body change strategies to increase body size	-0.242	0.047	0.001*	-0.359	0.063	< 0.001*
Strategies to increase muscle tone	-0.208	0.047	< 0.001*	-0.279	0.058	0.001*
Binge eating	0.234	0.048	0.001*	0.288	0.058	0.001*
Intake of food supplements	-0.129	0.049	0.009*	-0.137	0.044	0.002*
Economic class						
Body image satisfaction	0.007	0.050	0.886			
Body image importance	0.058	0.049	0.240	-	-	-
Body change strategies to decrease body size	0.157	0.048	0.001*	0.212	0.071	0.003*
Body change strategies to increase body size	0.091	0.047	0.055	-	-	-
Strategies to increase muscle tone	0.166	0.047	< 0.001*	0.111	0.045	0.013*
Binge eating	-0.009	0.048	0.854	-	-	-
Intake of food supplements	0.122	0.048	0.011*	-	-	-
Men						
Work						
Body image satisfaction	-0.052	0.062	0.405	-	-	-
Body image importance	0.022	0.062	0.724	-	-	-
Body change strategies to decrease body size	-0.008	0.061	0.902	-	-	-
Body change strategies to increase body size	-0.050	0.062	0.420	-	-	-
Strategies to increase muscle tone	0.048	0.061	0.435	-	-	-

Table 5 (cont.)

Independent/dependent variable (BIBCI subscales)	Complete			Refined		
	B	SE	p	β	SE	p
Binge eating	-0.028	0.063	0.654	-	-	-
Intake of food supplements	0.071	0.062	0.255	-	-	-
Self-reported eating assessment						
Body image satisfaction	-0.139	0.064	0.029	-	-	-
Body image importance	-0.015	0.065	0.820	-	-	-
Body change strategies to decrease body size	-0.056	0.064	0.382	-	-	-
Body change strategies to increase body size	0.018	0.065	0.784	-	-	-
Strategies to increase muscle tone	-0.091	0.064	0.151	-	-	-
Binge eating	-0.068	0.065	0.297	-	-	-
Intake of food supplements	-0.126	0.064	0.048*	-	-	-
Body mass index						
Body image satisfaction	-0.042	0.062	0.496	-	-	-
Body image importance	0.073	0.063	0.244	-	-	-
Body change strategies to decrease body size	-0.012	0.062	0.844	-	-	-
Body change strategies to increase body size	-0.006	0.063	0.919	-	-	-
Strategies to increase muscle tone	-0.018	0.062	0.772	-	-	-
Binge eating	0.006	0.063	0.928	-	-	-
Intake of food supplements	0.030	0.063	0.631	-	-	-
Physical activity level						
Body image satisfaction	0.169	0.064	0.008*	0.128	0.061	0.037*
Body image importance	0.131	0.064	0.041*	-	-	-
Body change strategies to decrease body size	0.217	0.062	0.001*	0.183	0.060	0.002*
Body change strategies to increase body size	-0.166	0.064	0.009*	-0.161	0.061	0.008*
Strategies to increase muscle tone	-0.126	0.063	0.048*	-0.168	0.061	0.006*
Binge eating	0.133	0.064	0.039*	-	-	-
Intake of food supplements	0.005	0.064	0.938	-	-	-
Economic class						
Body image satisfaction	0.014	0.062	0.229	-	-	-
Body image importance	0.092	0.062	0.142	-	-	-
Body change strategies to decrease body size	0.141	0.061	0.021*	-	-	-
Body change strategies to increase body size	0.005	0.063	0.934	-	-	-
Strategies to increase muscle tone	0.106	0.062	0.085	-	-	-
Binge eating	-0.009	0.063	0.880	-	-	-
Intake of food supplements	0.096	0.062	0.124	-	-	-

β = standardized estimate; BIBCI = Body Image and Body Change Inventory; SE = standard error.
* p < 0.05.

Discussion

The BIBCI is widely used in English-speaking countries. This study developed and presented a Portuguese version of the BIBCI to promote its use in Portuguese-speaking countries. This Portuguese version of the BIBCI will enable inter-cultural comparisons in cross-cultural studies with BIBCI. The validity and reliability of the BIBCI was confirmed in the sample of Brazilian university students. Additionally, cut-off points were proposed for classifying individuals according to

mean BIBCI scores, which should facilitate use of the instrument in clinical and epidemiological contexts. Furthermore, significant characteristics were identified and can be included in preventive or intervention protocols designed to reduce individuals' inappropriate behaviors in relation to body image and eating. This study has therefore contributed to both scientific knowledge and clinical practice.

The process of translation and adaptation of BIBCI to the Portuguese language included the important step of verifying the instrument's idiomatic, semantic,

conceptual, and cultural equivalence.[21,22] Cultural adaptations were needed to apply the BIBCI to the Brazilian context, but these did not compromise the original concept. The Portuguese BIBCI was well understood by both females and males and can be tested in other Portuguese-speaking countries. There are sex-specific instruments in the literature for evaluating body image in women and men,[28] whereas the BIBCI was developed for both sexes. In our sample, the BIBCI was adequate for both women and men and it can therefore be considered an appropriate instrument for investigation of individuals body image in epidemiological and clinical applications.

The psychometric properties of an instrument for a sample are validity and reliability and so the second aim of this study was to evaluate the adequacy of the BIBCI for administration to Brazilian university students. The BIBCI factorial model (53 items and 7 subscales) was adequate for both women and men. No prior study has used CFA to evaluate the validity of this model. Some studies[6,8-11,13] have presented satisfactory alpha values for the BIBCI subscales, which corroborate our results showing adequate reliability. Some studies have constructed different BIBCI subscales,[6,7,9,11,29-32] but we followed the original proposal, with its seven correlated subscales.[4,8,33] With regard to the correlations between the BIBCI subscales, the majority were significant, corroborating results presented by McCabe and Ricciardelli.[4] These results support use of the instrument in terms of the relationships between its subscales. Both samples demonstrated the adequacy of all BIBCI subscales in terms of their convergent and discriminant validities. Granero-Gallegosa et al.[6] also reported adequate convergent validity of two BIBCI subscales, corroborating our results. The present study is the first in the literature to present evidence regarding the psychometric properties of BIBCI using CFA. Additionally, we highlighted the good fit of the BIBCI to young adults, specifically university students, which indicates the instrument's suitability beyond adolescence.

After showing the good psychometric properties of the BIBCI factorial model for the samples, we proposed cut-off points for the instrument's subscales (aim 3). This aim was intended to help professionals/researchers to classify individuals within ranges defined by mean scores. By defining these rating ranges, we hope to contribute to use of the BIBCI in clinical contexts and in future studies that compare scores/prevalence rates between groups. The next step was to calculate the prevalence rates of eating and body change strategies among the students. A majority of the students presented low body image satisfaction and moderate

body image importance, corroborating recent studies[34,35] and revealing that this population strongly values the body. Moreover, most of the students presented very low use of strategies for body change. This result was to be expected, since this was a normative sample, i.e., recruited from among individuals without a clinical diagnosis of a body disorder that could directly influence body change strategies. However, some students were classified in the higher ranges, which could be associated with development of body image disorders. It would therefore be interesting to develop awareness regarding body image among these individuals, aiming to promote preventative health.

Regarding the multivariate models, the significant paths detected merit discussion. For women, self-reported eating assessment and body image importance were significant, corroborating previous results.[36,37] This finding highlights the relevant role that eating can play in an individuals' body appearance. The significant paths between economic class and body image have been reported in previous studies,[17] illustrating how individuals with greater economic power are more dissatisfied with their body and may engage more often in strategies to seek body change.[38] No prior study has reported results similar to ours in relation to the significant paths found between work and strategies for body change. However, we believe that the increased availability of spare time for students who do not work may have influenced the greater frequency of use of strategies to increase muscle tone. Meanwhile, the significant path between work and binge eating has been discussed in recent studies[39] that reported work as an activity that has relevance for people's eating patterns; students who work may have little time to prepare a more balanced diet, resulting in changes in food intake. Moreover, physical activity level was significant for BIBCI subscales in women and men, and this relationship is commonly reported in previous studies.[2,40] According to those studies, individuals who practice physical activities have a different perception of body image and often change their activities according to their interpretations with relation to the body. The results highlight the importance that these characteristics can have for eating and body change strategies. There is therefore a need to develop protocols that include these characteristics for preventive, educational, and/or curative treatments.

In general, we hope to have increased the possibilities for use of the BIBCI in both scientific and clinical contexts by producing the Portuguese version and defining the rating ranges. This instrument showed satisfactory psychometric properties in women and men, revealing its suitability for university students, who comprise a population considered vulnerable to issues

related to body image. The characteristics found to be significant can be used in protocols for intervention or prevention of problems related to eating disorders and body dissatisfaction.

Some limitations should be mentioned. The non-probabilistic sample selection means that the results cannot be generalized to all Brazilian university students, but may help better target future studies and clinical protocols. We also highlight as a limitation the cross-sectional design, which does not allow inference of cause-and-effect relationships between the characteristics evaluated in the regression models. However, the results found may help future studies in terms of the choice of characteristics to include in protocols. Therefore, to overcome the limitations of our study, we suggest that further studies be carried out with the BIBCI in different samples and contexts.

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Correspondence:
Juliana Alvares Duarte Bonini Campos
Departamento de Alimentos e Nutrição, Faculdade de Ciências Farmacêuticas, Universidade Estadual Paulista (UNESP)
Rodovia Araraquara-Jaú, km 01
14800-903 - Araraquara, SP - Brazil
Tel.: +55 (16) 33016935
E-mail: juliana.campos@unesp.br