

# Male body dissatisfaction scale (MBDS): proposal for a reduced model

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## Abstract

**Aims** To evaluate the psychometric properties of the male body dissatisfaction scale (MBDS) in Brazilian and Portuguese university students; to present a reduced model of the scale; to compare two methods of computing global scores for participants' body dissatisfaction; and to estimate the prevalence of participants' body dissatisfaction. **Methods** A total of 932 male students participated in this study. A confirmatory factor analysis (CFA) was used to assess the scale's psychometric properties. Multi-group analysis was used to test transnational invariance and invariance in independent samples. The body dissatisfaction score was calculated using two methods (mean and matrix of weights in the CFA), which were compared.

Finally, individuals were classified according to level of body dissatisfaction, using the best method.

**Results** The MBDS model did not show adequate fit for the sample and was, therefore, refined. Thirteen items were excluded and two factors were combined. A reduced model of 12 items and 2 factors was proposed and shown to have adequate psychometric properties. There was a significant difference ( $p < 0.001$ ) between the methods for calculating the score for body dissatisfaction, since the mean overestimated the scores. Among student participants, the prevalence of body dissatisfaction with musculature and general appearance was 11.2 and 5.3%, respectively.

**Conclusions** The reduced bi-factorial model of the MBDS showed adequate validity, reliability, and transnational invariance and invariance in independent samples for Brazilian and Portuguese students. The new proposal for calculating the global score was able to more accurately show their body dissatisfaction.

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## Introduction

The concept of body image has been investigated in the literature through perception and/or attitude. Bearing in mind that the construction of an individual's body image involves evaluating a range of factors, it is the task of the researcher to evaluate which aspects and instruments should be used, according to their objectives and target population, to properly capture these aspects [1, 2]. Body dissatisfaction evaluates the individual's affect towards their own body and is one of the principal components

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evaluated within the attitudinal dimension of body image. Researching and assessing body dissatisfaction are important [3, 4], as it is strongly linked to the development of eating disorders [5, 6], body dysmorphic disorders [7], low self-esteem [5, 8, 9], binge eating [10], perfectionism [11], interpersonal difficulties [11, 12], social anxiety [4, 5], internalization of media ideals [13], drive for muscularity [4, 11, 13], body checking [11, 14], training frequency and muscle-building supplement consumption [13], and emotional dysregulation and insecure–anxious attachment [11]. Furthermore, the stigma associated with body dissatisfaction has been reported in some studies [7, 15].

For many years, body dissatisfaction research concentrated on the female population, principally in terms of weight, shape, and accumulation of body fat [6, 13]. These studies indicated that women, on average, are more concerned about their bodies and at higher risk of developing an eating disorder as compared to men. This view, however, has changed in recent decades with increasing research on the male population, a significant advance in the literature, showing that men also demonstrate significant concern about their bodies [13, 16]. Dakanalis et al. [4] reported a strong relationship among body dissatisfaction and eating disorder symptomatology in Italian men. Other studies have also shown an association between body dissatisfaction and binge-eating [17], laxative/diuretic misuse, fasting, and excessive exercise in men [18].

Recent literature [4, 5, 11] supports the contention that body dissatisfaction is a risk factor for eating disorders in both genders. It is, however, important to note that the body concerns of men differ substantially from those of women [19, 20]. In women, concerns are directed mainly at slimness [5, 6, 21, 22]. Whereas, among men, increased lean muscle mass prevailed [23]. Thus, when researching aspects related to body image, as is the case with body dissatisfaction, it is important to use instruments that can capture the specific concerns of each sex [24]. Beyond the difference found based on sex, the literature [21, 25–27] indicates that men and women in the 18-to-35 age group were most concerned with their bodily appearance. Sepulveda et al. [28] and Silva et al. [25] also report that university students are a population that is vulnerable to body dissatisfaction due to the social and academic pressures imposed which may affect their perceptions of their own bodies.

There exist a range of instruments for evaluating body dissatisfaction in women. However, instruments designed to assess body dissatisfaction in men are scarce and consist mainly of adaptations of pre-existing scales used for women. In 2009, Ochner et al. [29] constructed an instrument for the male population with the aim of evaluating the main body concerns in this population. The instrument developed was composed of 25 items and

known as the male body dissatisfaction scale (MBDS). The items of which the MBDS is made up included theoretical assumptions presented in the literature on body dissatisfaction in males as well as on experts' opinions on which areas of the body would be the most relevant for this population. The factors in the MBDS were obtained through exploratory factorial analysis which indicated three sets of items, namely, musculature, definition, and relative standing/external evaluation. This exploratory strategy of allocating items may have overlooked the role of theoretical formulation (content) of the items at the expense of distribution (statistics) of the responses given, considering the study sample ( $n = 95$  American university student). Marôco [30] emphasizes that the exploratory strategy produces a factorial solution among many statistical equivalents without any indication of the quality of the retained factorial structure or content of the items. This fact can be verified in other studies [31, 32] exploring the items of the MBDS for Brazilian and French men, and finding different structures. Thus, both in the construction of the items of a scale and in the definition of the associated factors, it is necessary to first formulate the technical framework involving both the content of the items and their allocation in the factors, and only then to verify whether the data collected confirm this structure. It is also recommended that the external validity of this proposal be evaluated in independent samples in order for the formulated model to be deemed adequate [30].

Regarding the psychometric properties of the MBDS, to date, no studies have been found that use confirmatory strategies confirming the three-factor structure recommended in the original study. The need to evaluate the psychometric properties, including estimates of validity, reliability, and invariance, is important in guaranteeing the adequacy of the instrument for the sample studied [30, 33]. The MBDS has previously been translated into Portuguese and French. Transnational studies using the same scale may provide some insight into how body dissatisfaction is perceived in different populations/cultures. Conducting transnational studies also allows for broader discussion of the variables studied and enables comparison of populations with different socio-cultural and economic characteristics [34–36].

Given the above, the objectives of this study were as follows:

1. to evaluate the psychometric properties of the MBDS when applied to Brazilian and Portuguese university students;
2. to present a reduced model of the MBDS;
3. to compare and discuss estimation methods for calculating the global score of MBDS factors;

4. to estimate the prevalence of body dissatisfaction in Brazilian and Portuguese university students.

## Method

### Participants

This is a cross-sectional study. The minimum sample size needed to evaluate the psychometric properties of the MBDS was calculated using the proposal by Kim [37] in which  $\alpha = 5\%$ ,  $\beta = 20\%$  and degree of freedom of the MBDS = 272, resulting in 95 subjects. Moreover, bearing in mind that losses are common in epidemiological studies, we added an attrition rate of 20% to the minimum sample size, which thus became 120 individuals. This estimate was maintained for each country (Brazil and Portugal), as well as in independent subsamples (test and validation). However, we were not confident that this sample size would be large enough to adequately capture population variability. As one of the aims of study was to assess the psychometric properties of the MBDS for Brazilian and Portuguese students, a representative sample of the population much larger than the usually recommended for performing statistical tests was used.

Study participants were recruited according to the following inclusion criteria: aged between 18 and 35 years, male, and enrolled in a Brazilian or Portuguese higher education institution. To collect the data, one university (Universidade Estadual Paulista—UNESP) in Brazil and five Portuguese institutions (Instituto Universitário de Ciências Psicológicas, Sociais e da Vida—ISPA, Instituto Superior de Ciências da Saúde Egas Moniz—ISCSEM, Escola Superior de Enfermagem de Lisboa—ESEL, Instituto Superior de Engenharia do Porto—ISEP, and Faculdade de Farmácia da Universidade de Coimbra—FFUC) agreed to participate and were included in the study. It is worth noting that the institutions were chosen in a non-probabilistic way, considering researchers' access. All academic institutions approved the conduction of the study with lecturers' previous agreement for data collection in the classroom. The students were informed about the aim of the study and they were invited to complete the questionnaire, which took an average of 10 min. Data were self-reported by students via paper-and-pencil measures, and they received no remuneration for participating in the study.

A total of 1047 students agreed to participate, although 115 did not complete all items of the MBDS and were, therefore, not included in the sample. Thus, 932 male students (513 Brazilian and 419 Portuguese) formed the total study sample.

### Sample characteristics

Data on age, area of study, working while studying, self-reported body type (thin, normal/average, overweight, or muscular), weight status, and socio-economic class were all collected to characterize the sample. Weight status was classified according to WHO recommendation [38, 39] using students' body mass index (BMI) calculated based on self-reported weight and height. Participants' socio-economic group was classified based on mean monthly income of the main breadwinner in number of minimum wages (monthly household income in minimum wages  $A \geq 5$ ,  $3 \leq B < 5$ ,  $1 \leq C < 3$ ,  $D < 1$ ). In Brazil, the Brazilian Economic Classification Criterion [40] was used to estimate monthly household income, whereas in Portugal, monthly household income was reported by the student.

### Study variables and instrument

Body dissatisfaction was estimated using the Portuguese version of the MBDS published by Carvalho et al. [41]. Ochner et al. [29] constructed the MBDS in English to evaluate body dissatisfaction in the male population. The instrument's 25 items were developed to assess the main concerns of the male population with regard to body dissatisfaction related to the literature and according to experts. These items were divided into three factors musculature (items 4, 6, 7, 9, 12, 13, 16, and 24), definition (items 1, 3, 10, 15, 17, 18, 20, 22, and 25), and relative standing/external evaluation (items 2, 5, 8, 11, 14, 19, 21, and 23). Aiming to control false responses, the authors formulated 13 MBDS items in the negative and proposed evaluation of body dissatisfaction considering a weighting between the importance attributed to the item ranging from 1 to 10 points and the response to the same item on a 5-point Likert-style scale. This weighting is obtained by dividing the value attributed to importance by 10, which is then multiplied by the participant's response on the Likert-style scale for that same item. Thus, the quantitative score produced for each item varied between 0.1 and 5.0 points.

### Procedures and ethical aspects

In class, the participants completed the questionnaire characterizing the sample and the Portuguese version of the MBDS. It should be noted that students participated voluntarily and only those who signed an informed consent form were included in the sample.

This study was approved in Brazil and Portugal by the Ethics Committees for Research Involving Human Beings (UNESP-CAAE 29896214.0.0000.5426, ESEL#1413).

## Psychometric properties

The psychometric properties of the original MBDS model including factorial, convergent, and discriminant validity and reliability were evaluated for the total sample, as well as for the subsamples (Brazil, Portugal, test, and validation). The test and validation subsamples were selected based on the total sample for each country which was randomly divided into two parts following Kapan and Saccuzzo's [42] recommendation. The randomization of the total sample into subsamples is a common strategy in the literature [9, 43, 44] and strengthens the results of the study as well as to allow the assessment of factorial invariance in independent samples (test and validation).

## Psychometric sensitivity

To verify distribution of participants' responses to the MBDS items, the mean, standard deviation, skewness, and kurtosis were calculated. Psychometric sensitivity was evaluated by measuring skewness and kurtosis and deemed adequate when distribution of frequencies of responses approximated a normal curve. Absolute values for skewness and kurtosis lower than 3 and 7, respectively, were used as parameters of adequacy [30].

## Factorial validity

To verify MBDS fit in the different samples, we used confirmatory factor analysis (CFA) with the estimation of maximum likelihood (ML). The Chi square per degree of freedom ratio ( $\chi^2/df$ ), root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis index (TLI) were used to evaluate the model's goodness of fit to the data. The model was deemed acceptable when  $\chi^2/df \leq 5.00$ ,  $RMSEA \leq 0.10$ ,  $CFI$ , and  $TLI \geq 0.90$  [30, 45]. The factorial weights ( $\lambda$ ) of each item were also analyzed and those which were  $\lambda < 0.40$  excluded. When the MBDS fit was not adequate, the content of each item was analyzed by the authors of this study to verify its fit to the proposed factor and modification indices above 11, estimated using Lagrange multipliers (LM) were also examined, seeking a better fit for the model. Moreover, when correlation of MBDS factors was  $\geq 0.90$ , the variance inflation factor (VIF) was calculated to verify multicollinearity, which was deemed important if  $VIF > 5$  [30]. Psychometric analyses were conducted using the MPLUS software (version 7.2 Muthén & Muthén, Los Angeles).

## Convergent and discriminant validity

To evaluate the convergent validity of the MBDS items for each proponent factor, the average variance extracted

(AVE) was calculated [46]. The set of items was considered to have adequate convergent validity when  $AVE \geq 0.50$  [30]. To evaluate the discriminant validity of the MBDS, squared correlations ( $r^2$ ) between factors was calculated. When the AVE values for each pair of correlated factors were  $\geq r^2$ , the scale showed adequate discriminant validity [46].

## Reliability

The reliability of the MBDS was evaluated in terms of its internal consistency ( $\alpha$  Cronbach's alpha coefficient) and composite reliability (CR). Composite reliability was calculated following the recommendations of Fornell and Larcker [46]. Values for  $\alpha$  and CR above 0.70 were deemed to show adequate reliability [30].

## Transnational invariance and invariance in independent samples

The invariance of the adjusted MBDS model was evaluated with multi-group analysis using the Chi-square difference statistical test ( $\Delta\chi^2$ ). After confirming the configurational invariance (same structure) for both countries in the CFA, transcultural invariance and invariance in independent samples were tested. To evaluate invariance, we used factorial weights ( $\lambda$ ), intercepts ( $i$ ), and residues' variance/covariance (cov). When  $p\Delta\chi^2_{\lambda}$  was  $>0.05$  a weak invariance (metric) was found, if  $p\Delta\chi^2_{\lambda}$  and  $p\Delta\chi^2_{i}$  were  $>0.05$ , strong invariance (metric and scalar) was found, and if  $p\Delta\chi^2_{\lambda}$ ,  $p\Delta\chi^2_{i}$ , and  $p\Delta\chi^2_{cov}$  were  $>0.05$ , a strict invariance (metric, scalar, and strict) was found. It is important to note that invariance in independent samples was conducted with the aim of evaluating external validity of the factorial solution obtained.

## Computing global score for body dissatisfaction

After evaluating the psychometric properties of the MBDS and defining the best model, each participant's level of body dissatisfaction was estimated. In the initial validation study, Ochner et al. [29] proposed that the higher the individual's score, obtained from summing the weight of each item, the higher the body dissatisfaction. However, altering the configuration of the scale by eliminating an item, for example, would invalidate this scoring approach. Therefore, this may not be the ideal method for obtaining the global score, as the instrument's configuration may undergo changes depending on the context/population in which it is applied. The mean is commonly used in the literature for computing the global score and can be preferable over summing. However, we must highlight that

calculation based on the mean assumes that all items making up the factor have the same weight, which is unrealistic. Thus, Marôco [30] recommends computing the global score using an algorithm calculated based on the matrix of weights for obtaining the factorial scores, obtained in the CFA, which considers the relations/contributions of each factor for the response observed in the item. Thus, in this study, the global score was computed using the arithmetic mean (method 1) and the algorithm (method 2). The estimates obtained based on the two methods were compared using the paired *t* test with level of significance of 5%. Next, a proposal was made for classifying the levels of individual’s body dissatisfaction using the percentiles of the response scale ( $\leq P25$  0.1–1.3 very low,  $P25$ – $P50$  1.3–2.6 low,  $P50$ – $P75$  2.6–3.8 moderate,  $>P75$  3.8–5.0 high). The classification was carried out for each factor and for each country, with a 95% confidence interval (CI 95%).

**Results**

The students’ mean age was 21.3 [standard deviation (SD) = 3.4] years [Brazilian 21.3 (SD = 3.2); Portuguese 21.5 (SD = 3.6)]. Table 1 shows the characterization of the sample studied separated according to country (some students did not report some information to characterize the sample, and therefore, the descriptive analysis in Table 1 did not include all students). It can be seen that the majority

**Table 1** Characterization of the university students

Characteristic	Sample <i>n</i> (%)		
	Brazil	Portugal	Total
Working and studying			
Yes	148 (28.9)	68 (16.2)	216 (23.2)
No	364 (71.1)	351 (83.8)	715 (76.8)
Self-reported body type			
Thin	126 (24.8)	54 (12.9)	180 (19.4)
Normal/average	257 (50.5)	270 (64.7)	527 (56.9)
Overweight	106 (20.8)	75 (18.0)	181 (19.5)
Muscular	20 (3.9)	18 (4.3)	38 (4.1)
Weight status			
Underweight	10 (2.0)	15 (3.6)	25 (2.7)
Normal weight	334 (65.4)	306 (73.9)	640 (69.2)
Overweight	127 (24.9)	78 (18.8)	205 (22.2)
Obesity	40 (7.8)	15 (3.6)	55 (5.9)
Socio-economic class			
A ( $\geq 5$ minimum wages)	159 (31.0)	42 (10.2)	201 (21.7)
B (3–5 minimum wages)	252 (49.1)	172 (41.6)	424 (45.8)
C (1–3 minimum wages)	100 (19.5)	167 (40.4)	267 (28.8)
D (<1 minimum wages)	2 (0.4)	32 (7.7)	34 (3.7)

of the students do not work while studying, selected the normal/average body type, were classified as in a condition of normal weight and in socio-economic class B.

Table 2 presents the distribution of students’ responses to each item of the MBDS for the total sample, Brazil and Portugal. As can be seen, only item 22 presented a discrepant value for kurtosis in the Portuguese sample.

Table 3 shows the indicators used for evaluating the MBDS psychometric properties for the samples in the study. It can be seen that the original MBDS model does not show adequate adjustments for any of the samples. Moreover, there is a lack of convergent and discriminant validity and poor reliability for some factors. Thus, the basic scale was refined based on adapting the modification indices and the content of each item considering, where the factor itself was placed according to the original proposal. In total, 13 items were excluded, twelve of which (3, 7, 10, 11, 13, 14, 17, 18, 20, 22, 24 and 25) were due to being strongly correlated with other items within the same factor. Moreover, the exclusion of items 5, 17, 20, and 25 was also supported by the low factorial weight shown. After exclusion of the above-mentioned items, factor definition was composed of only two items (1 and 15) and their strong correlation with the external evaluation factor ( $r = 0.93$ ;  $p < 0.001$ ) indicated multicollinearity ( $VIF = 7.14$ ). It was, therefore, decided to combine these factors into one single factor which was renamed “general body appearance”. In this way, a reduced version of the MBDS was created (cf. “Appendix”), with 12 items distributed between two factors (items musculature 4, 6, 9, 12, and 16; general body appearance 1, 2, 8, 15, 19, 21, and 23) which shows adequate validity and reliability for all of the samples in the study.

Table 3 also shows the results for the transnational (Brazil vs. Portugal) and independent sample (test vs. validation) invariance tests for the reduced version of the MBDS. Metric (weak) invariance can be seen between Brazil and Portugal and metric, scalar, and strict (strong) invariance in the independent samples.

Equations 1 and 2 show the algorithm obtained based on the matrix of weightings for estimating factorial scores in the CFA using the reduced model of the MBDS:

$$\begin{aligned} &\text{Dissatisfaction with musculature} \\ &= 0.164 \times \text{item4} + 0.191 \times \text{item6} + 0.099 \\ &\quad \times \text{item9} + 0.268 \times \text{item12} + 0.148 \times \text{item16}, \end{aligned} \tag{1}$$

$$\begin{aligned} &\text{Dissatisfaction with general body appearance} \\ &= 0.106 \times \text{item1} + 0.137 \times \text{item2} + 0.177 \times \text{item8} \\ &\quad + 0.127 \times \text{item15} + 0.075 \times \text{item19} + 0.095 \\ &\quad \times \text{item21} + 0.197 \times \text{item23}. \end{aligned} \tag{2}$$

These equations were used to compute the global score for body dissatisfaction (method 2). In comparing the two

**Table 2** Distribution of male university students' responses to the items of the male body dissatisfaction scale—MBDS

Items	Brazil				Portugal				Total			
	Me	SD	Sk	Ku	Me	SD	Sk	Ku	Me	SD	Sk	Ku
1	1.92	1.10	0.65	-0.13	1.74	0.96	1.02	1.27	1.84	1.04	0.81	0.36
2	1.61	0.92	0.75	0.62	1.41	0.87	1.15	2.35	1.52	0.90	0.91	1.22
3	1.93	1.15	0.90	0.32	1.79	1.02	0.95	0.60	1.86	1.10	0.94	0.48
4	2.41	1.45	0.22	-0.88	2.10	1.27	0.53	-0.32	2.27	1.38	0.37	-0.68
5	1.23	0.85	1.63	4.06	1.28	0.91	1.62	3.80	1.25	0.88	1.63	3.94
6	1.35	1.27	1.10	0.58	1.21	1.14	1.29	1.13	1.29	1.21	1.19	0.82
7	1.63	1.34	0.95	0.23	1.14	1.04	1.35	1.55	1.41	1.24	1.16	0.82
8	1.72	0.98	1.02	1.41	1.65	0.88	1.14	2.21	1.69	0.93	1.07	1.74
9	1.36	1.24	1.07	0.50	1.74	1.22	0.68	-0.14	1.53	1.24	0.86	0.08
10	1.23	0.59	0.84	2.51	1.27	0.67	1.15	3.41	1.24	0.62	1.02	3.12
11	1.40	0.93	0.94	0.85	1.41	0.88	1.16	2.43	1.41	0.91	1.03	1.47
12	1.54	1.32	0.92	0.20	1.43	1.15	1.09	0.82	1.49	1.25	1.00	0.47
13	2.01	1.39	0.51	-0.50	1.81	1.22	0.72	0.10	1.92	1.32	0.61	-0.26
14	1.66	1.04	0.93	0.81	1.54	0.98	1.38	2.64	1.61	1.01	1.12	1.49
15	1.84	1.19	0.70	-0.13	1.74	1.08	1.03	0.88	1.80	1.14	0.83	0.24
16	2.00	1.42	0.54	-0.59	1.70	1.18	0.71	0.02	1.87	1.32	0.65	-0.30
17	1.21	0.76	1.56	4.25	1.33	0.87	1.58	3.32	1.26	0.81	1.59	3.85
18	1.75	0.91	1.14	1.84	1.54	0.77	1.11	2.45	1.66	0.86	1.17	2.20
19	1.35	1.01	1.23	1.39	1.42	0.92	1.07	1.66	1.38	0.97	1.16	1.47
20	1.63	0.97	1.01	1.35	1.54	0.85	1.15	2.53	1.59	0.92	1.08	1.82
21	1.37	0.85	0.87	1.23	1.33	0.82	1.28	3.35	1.35	0.84	1.04	2.08
22	1.19	0.56	0.73	1.70	1.21	0.68	2.02	7.49*	1.20	0.62	1.52	5.75
23	1.66	0.97	1.01	1.48	1.54	0.86	1.01	1.86	1.61	0.93	1.03	1.69
24	1.84	1.39	0.67	-0.38	1.50	1.14	0.93	0.49	1.69	1.30	0.81	0.00
25	1.38	0.69	1.14	3.22	1.38	0.67	0.79	1.44	1.38	0.68	0.99	2.43

\* Discrepant values

Me mean, SD standard deviation, Sk skewness, Ku kurtosis

methods (mean and algorithm) for estimating global scores, a significant difference between the methods was found that for both musculature (mean =  $1.69 \pm 1.02$ , algorithm =  $1.45 \pm 0.90$ ,  $t = 44.68$ ,  $p < 0.001$ ) and for general body appearance (mean =  $1.60 \pm 0.70$ , algorithm =  $1.48 \pm 0.66$ ,  $t = 39.10$ ,  $p < 0.001$ ) with the mean appearing to overestimate score for body dissatisfaction. Thus, method 2 was chosen to calculate the prevalence of body dissatisfaction among the students.

Table 4 shows the prevalence of body dissatisfaction with musculature and general body appearance for the Brazilian and Portuguese university students. It was found that 11.2% of the students had a moderate-to-high level of dissatisfaction with musculature and 5.3% with general body appearance.

## Discussion

This study enabled, for the first time in the literature, the originally proposed three-factor model of the MBDS to be evaluated through a confirmatory strategy. Our results

indicate that the validity of the original model was not adequate for the samples studied, suggesting the need to restructure the scale. Thus, the reduced bi-factorial model was proposed and tested, indicating appropriate validity, reliability, and transnational invariance and invariance of independent samples. Moreover, we propose a superior method for obtaining global body dissatisfaction scores and for classifying the prevalence of dissatisfaction with musculature and with general body appearance when using the MBDS.

The psychometric properties of the original MBDS model were not adequate for the samples studied, indicating the need to restructure the scale, especially in terms of grouping items into factors. One possible explanation for the lack of fit of the original model may be the fact that it was defined through an exploratory strategy. Carvalho et al. [32] and Rousseau et al. [31] also explored the items of the MBDS and found different structures. The exploratory strategy meant that different sets of items were grouped together, possibly related to the characteristics of the study sample. These new groupings, for the most part,

**Table 3** Indicators for evaluating the psychometric properties of the original (tri-factorial) and reduced (bi-factorial) model of the male body dissatisfaction scale (MBDS) applied to Brazilian and Portuguese male university students

Sample	<i>n</i>	$\chi^2/df$	RMSEA (CI 90%)	CFI	TLI	$\lambda$	AVE	$r^2$	$\alpha$	CR
Original model (musculature, definition, relative standing/external evaluation)										
Total	932	8.57	0.09 (0.08–0.09)	0.81	0.79	0.22–0.82	0.51, 0.29, 0.41	0.41, 0.47, 0.96	0.99, 0.78, 0.84	0.89, 0.77, 0.84
Brazil	513	5.00	0.09 (0.08–0.09)	0.81	0.79	0.18–0.84	0.51, 0.27, 0.41	0.36, 0.45, 0.98	0.89, 0.76, 0.84	0.89, 0.75, 0.84
Brazil test	256	3.49	0.10 (0.09–0.11)	0.77	0.75	0.17–0.84	0.49, 0.29, 0.40	0.28, 0.36, 0.96	0.88, 0.77, 0.83	0.88, 0.76, 0.84
Brazil validation	257	2.93	0.09 (0.08–0.09)	0.82	0.80	0.18–0.86	0.53, 0.26, 0.41	0.42, 0.49, 1.00	0.90, 0.74, 0.84	0.90, 0.73, 0.85
Portugal	419	4.74	0.09 (0.09–0.10)	0.80	0.78	0.25–0.80	0.51, 0.32, 0.43	0.47, 0.56, 0.92	0.89, 0.80, 0.84	0.89, 0.80, 0.85
Portugal test	209	2.86	0.09 (0.09–0.10)	0.80	0.78	0.26–0.81	0.53, 0.32, 0.39	0.53, 0.64, 0.90	0.90, 0.77, 0.82	0.90, 0.80, 0.83
Portugal validation	210	3.26	0.10 (0.10–0.11)	0.77	0.75	0.20–0.80	0.50, 0.32, 0.47	0.43, 0.52, 0.92	0.89, 0.76, 0.86	0.89, 0.80, 0.87
Reduced model (musculature, general body appearance)										
Total	932	6.21	0.07 (0.07–0.08)	0.94	0.93	0.54–0.82	0.54, 0.50	0.42	0.85, 0.85	0.85, 0.85
Brazil	513	3.62	0.07 (0.06–0.08)	0.95	0.93	0.55–0.85	0.55, 0.45	0.37	0.86, 0.85	0.86, 0.85
Brazil test	256	2.93	0.08 (0.07–0.10)	0.92	0.90	0.54–0.84	0.53, 0.44	0.31	0.84, 0.87	0.85, 0.85
Brazil validation	257	2.38	0.07 (0.06–0.09)	0.95	0.93	0.53–0.86	0.58, 0.45	0.43	0.84, 0.85	0.87, 0.85
Portugal	419	3.81	0.08 (0.07–0.09)	0.93	0.92	0.54–0.80	0.54, 0.47	0.49	0.85, 0.85	0.86, 0.86
Portugal test	209	2.40	0.08 (0.06–0.10)	0.93	0.91	0.47–0.82	0.57, 0.42	0.59	0.87, 0.82	0.87, 0.83
Portugal validation	210	2.66	0.08 (0.07–0.10)	0.92	0.91	0.61–0.80	0.51, 0.52	0.41	0.84, 0.88	0.84, 0.88
Invariance										
Brazil × Portugal	$\Delta\chi^2_{\lambda}(10) = 16.02, p = 0.099, \Delta\chi^2_i(20) = 107.84, p < 0.001, \Delta\chi^2_{COV}(10) = 91.82, p < 0.001$									
Brazil (teste × validation)	$\Delta\chi^2_{\lambda}(10) = 11.47, p = 0.322, \Delta\chi^2_i(20) = 22.05, p = 0.337, \Delta\chi^2_{COV}(10) = 10.59, p = 0.391$									
Portugal (teste × validation)	$\Delta\chi^2_{\lambda}(10) = 4.61, p = 0.915, \Delta\chi^2_i(20) = 14.82, p = 0.787, \Delta\chi^2_{COV}(10) = 10.21, p = 0.423$									

$\lambda$  factorial weight,  $\chi^2/df$  Chi square by degrees of freedom ratio, *RMSEA* root mean square error of approximation, *CFI* comparative fit index, *TLI* Tucker–Lewis index, *AVE* average variance extracted,  $r^2$  squared correlation between factors (musculature vs. definition, musculature vs. relative standing/external evaluation, definition vs. relative standing/external evaluation, musculature vs. general body appearance),  $\alpha$  Cronbach’s alpha, *CR* composite reliability,  $\Delta\chi^2$  Chi-square difference, *i* intercept, *cov* residues’ covariance

did not fit other populations as they were defined exclusively using statistical strategy without considering the theory and/or content of the items. Thus, the restructuring of MBDS based on both items’ content and validity of scale is important, because it allows to show the literature an instrument with better psychometric indices and that can be used in other studies to assess more accurately (that is, considering the theory underlying of the evaluated concept) the body dissatisfaction of the male population.

The adjustments made to produce the reduced model of the MBDS were proposed in this study in as attempt to identify a more parsimonious structure with adequate validity and reliability that could be used with other populations. These modifications are described below and each factor is discussed. For the Musculature factor, the items are thought to be related to evaluating dissatisfaction with muscles, although the content of items 7 and 24, components of this factor, refers to thoughts of general body

**Table 4** Classification of the Brazilian and Portuguese university students according to the method used (mean and algorithm) to obtain body dissatisfaction (musculature and general appearance) from the male body dissatisfaction scale

	Classification	Brazil		Portugal		Total	
		n (%)	CI 95%	n (%)	CI 95%	n (%)	CI 95%
Method 1 (mean)							
Dissatisfaction with musculature	Very low	212 (41.3)	37.2–45.4	175 (41.8)	37.2–46.3	387 (41.5)	38.5–44.6
	Low	200 (39.0)	35.1–43.1	183 (43.7)	38.9–48.2	383 (41.1)	38.0–44.3
	Moderate	79 (15.4)	12.3–18.5	49 (11.7)	8.6–15.0	128 (13.6)	11.5–16.1
	High	22 (4.3)	2.7–6.0	12 (2.9)	1.2–4.5	34 (3.6)	2.5–4.9
Dissatisfaction with general body appearance	Very low	170 (33.1)	29.0–37.2	161 (38.4)	33.7–43.2	331 (35.5)	32.4–38.4
	Low	301 (58.7)	54.8–63.0	230 (54.9)	50.1–59.9	531 (57.0)	53.8–60.2
	Moderate	37 (7.2)	4.9–9.6	24 (5.7)	3.6–8.1	61 (6.5)	5.0–8.5
	High	5 (1.0)	0.2–1.9	4 (1.0)	0.2–2.1	9 (1.0)	0.4–1.7
Method 2 (algorithm)							
Dissatisfaction with musculature	Very low	244 (47.6)	42.9–51.9	231 (55.1)	50.4–60.1	475 (51.0)	47.6–54.0
	Low	201 (39.2)	34.9–43.5	152 (36.3)	31.5–40.8	353 (37.9)	34.9–41.1
	Moderate	58 (11.3)	8.8–14.0	33 (7.9)	5.5–10.7	91 (9.8)	7.9–11.8
	High	10 (1.9)	0.8–3.1	3 (0.7)	0.0–1.7	13 (1.4)	0.6–2.3
Dissatisfaction with general body appearance	Very low	214 (41.7)	37.2–45.6	208 (49.6)	44.9–54.4	422 (45.3)	42.2–48.3
	Low	267 (52.0)	48.1–56.3	194 (46.3)	41.5–51.3	461 (49.5)	46.4–52.6
	Moderate	28 (5.5)	3.5–7.6	13 (3.1)	1.4–4.8	41 (4.4)	3.1–5.7
	High	4 (0.8)	0.2–1.6	4 (1.0)	0.2–2.1	8 (0.9)	0.3–1.5

dissatisfaction, not clearly evaluating musculature. In addition, within this factor, items 4 and 13 contain similar content and both approach dissatisfaction with arm muscles, although 13 is directed specifically at biceps, restricting the estimate. Thus, the exclusion of items 7, 13, and 24 was initially based on their own representativeness for the factor. We should also report the strong correlations found (indicated by the modification indices) between items 7, 13, and 24 and other factors. In the Definition factor, items 3 (appropriate weight for height), 18 (appearing to have a health body), 20 (body shape as a positive point), and 25 (wishing to have a better body) did not appear to be specifically evaluating individuals' dissatisfaction with definition. Although items 10 (toning up muscles) and 22 (more defined muscles) include definition, they highlight muscles, giving them a strong correlation with the musculature factor. Moreover, items 17 and 25 have factorial weights below 0.30, reinforcing their lack of contribution to evaluating body dissatisfaction. In the relative standing/external evaluation factor, items 11 (comparing quantity of muscles with others of the same age) and 14 (well-developed pectoral muscles) are thought to be related to evaluating musculature, which is supported by the high modification indices found between these items and the musculature factor. Likewise, item 5 shows a factorial weight below 0.30, indicating the fact that removing the shirt in public does not appear to contribute to evaluating body dissatisfaction in men. It is also worth

discussing that the combination of the “definition” and “relative standing/external evaluation” factors was initially based on the strong correlation ( $r = 0.93$ ) between them. We believe that making the definition factor with only two items would limit the estimate of content. Thus, evaluating the content of the remaining items based on this combination, we chose to name the proposed new category “general body appearance”. Rousseau et al. [31] conducted exploratory analysis of the MBDS and verified that the more general items were grouped together into one factor, as with our proposal, and the authors deemed this set of items to evaluate general body appearance. All of the alterations made in constructing the reduced model of the MBDS, therefore, were justified when considering the theory/content of the items and the psychometric estimates obtained using a sample of Brazilian and Portuguese university students and independent samples (within each country).

As for the invariance tests, our study indicated that the MBDS showed weak transnational invariance between Brazil and Portugal. Silva et al. [44] conducted a study to verify the validity, reliability, and transnational invariance of the reduced model of the body shape questionnaire (BSQ-8B), which, like the MBDS, evaluates part of body image, in Brazilian and Portuguese female university students and identified a weak transnational invariance. Weak invariance indicates the adequacy of the model for the two samples, but we should also note the absence of the



intercept invariance ( $\Delta\chi^2_i p < 0.05$ ), indicating that the mean of the factors differs between Brazil and Portugal, revealing adequate validity of the proposed reduced model's discriminant criterion. As for the invariance test in the independent sample, our study indicates adequate external validity of the MBDS reduced model.

As for computing the global body dissatisfaction score, the two methods tested presented statistically different estimates and using the mean appears to overestimate individuals' body dissatisfaction. Campos et al. [47] compared global scores obtained by the mean and the algorithm using other psychometric instruments and also identified that the mean overestimates the scores for the concept evaluated. Thus, although the literature presents mean scores for body dissatisfaction using the sum or the mean, we recommend using the algorithm. This estimate is more accurate compared to the others as it weights the responses to each item considering the operationalization of the instrument for the sample to which the individuals belong, and will allow for more precise identification of those at risk of developing eating or body dysmorphic disorders. This method of computing the global score may appear difficult in the routine of professionals/researchers in this area. However, technology advances and new software that assist in this calculation are some strategies of interest, as weighted scores could be calculated automatically by entering the individual's responses. It is also worth noting that the weights presented in this study could be used for Brazilian and Portuguese samples with similar characteristics.

In addition to defining and demonstrating adequate psychometric properties of the MBDS reduced model, and using the algorithm for computing the global score, we would like to present a proposal for classifying the level of individuals' body dissatisfaction (for each factor) based on the percentiles of the response scale. The prevalence of individuals in our sample with moderate-to-high dissatisfaction with musculature and general body appearance was low compared to those presented in the literature [13, 32, 48, 49]. However, we must bear in mind that body dissatisfaction in this study was separated into levels. We suggest that this method may be more appropriate for identifying which individuals may be at greater risk for an eating disorder, and thus promote guidance and treatment strategies.

In this way, this study contributes to the scientific community in terms of using confirmatory strategy to identify that the original MBDS model did not adequately fit different samples and presenting an alternative, reduced, two-factor model with adequate validity and reliability for screening for male individuals' body dissatisfaction.

Moreover, using the algorithm to compute global body dissatisfaction scores should be encouraged, as the estimate appears more accurate. The use of classification bands could also be a useful strategy for determining, where interventions should be focused. We also encourage further studies using the reduced model MBDS with different samples to compare with our results and verify its psychometric properties in other populations in other countries/cultures or with specific groups such as, for example, weight lifters, athletes, and dancers.

There were some limitations to this study. The choice of institutions for collecting data was non-probabilistic and this may make it more difficult to generalize the results. The cross-sectional design may also be a limitation, as causality cannot be inferred. It is important to highlight that we did not investigate the discriminant criterion validity of the reduced model MBDS or the potential effects of some important concepts in this version as, for example, sexual orientation, self-esteem, eating disorder symptoms, muscle-building supplement consumption, and eating behavior. Thus, we suggest that future studies seek to assess the relationship among these concepts and body dissatisfaction evaluated by the MBDS reduced model.

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#### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved in Brazil and Portugal by the Ethics Committees for Research Involving Human Beings (UNESP-CAAE 29896214.0.0000.5426, ESEL#1413).

**Informed consent** Informed consent was obtained from all individual participants included in the study.

## Appendix

See Table 5.

**Table 5** Reduced version of the male body dissatisfaction scale (MBDS)

Item	Reduced version in English	Reduced version in Portuguese
1	I am happy with how much muscle I have compared to how much fat I have	Estou feliz com a quantidade de músculos que tenho em relação à quantidade de gordura do meu corpo
2	Other people think I have a good body	Outras pessoas acham que tenho um corpo bom
4*	I wish I had more muscular arms	Eu gostaria de ter braços mais musculosos
6*	I fantasize about having more muscle	Eu fantasio sobre ter mais músculos
8	I think I have a generally attractive body	No geral, acho que tenho um corpo atraente
9*	I wish I had more of a V-shaped torso (upper body)	Eu gostaria de ter o tronco mais em formato de “V” (triângulo invertido)
12*	I worry about being more muscular	Preocupo-me em ser mais musculoso
15	I have a “six-pack” or “washboard” stomach	Eu tenho barriga de “tanquinho”
16*	Others would find me more attractive if I had more muscle	Se eu fosse mais musculoso, os outros me achariam mais atraente
19	I like to show off my body	Eu gosto de exibir meu corpo
21	I look like I could lift more weight than the average male my age	Eu aparento conseguir levantar mais peso do que a média dos homens da minha idade
23	My body is sexually appealing to others	Para as outras pessoas, meu corpo é sexualmente atraente

\* Reverse items

MBDS English version was published by Ochner et al [29] and MBDS Portuguese version was published by Carvalho et al. [41]

Factors of MBDS reduced model musculature items 4, 6, 9, 12 and 16; general body appearance items 1, 2, 8, 15, 19, 21 and 23

Proposal for classifying the levels of individual’s body dissatisfaction (musculature and general body appearance) using the percentiles of the response scale 0.1–1.3 very low ( $\leq P25$ ), 1.3–2.6 low ( $P25$ – $P50$ ), 2.6–3.8 moderate ( $P50$ – $P75$ ), 3.8–5.0 high ( $>P75$ )

## References

- Gadermann AM, Guhn M, Zumbo BD (2012) Estimating ordinal reliability for Likert-type and ordinal item response data: a conceptual, empirical, and practical guide. *Prat Assess Res Eval* 17(3):1–13
- Thompson JK, Burke NL, Krawczyk R (2012) Measurement of Body Image in adolescence and adulthood. In: Cash T (ed) *Encyclopedia of body image and human appearance*. Elsevier, London, pp 512–520
- Cash TF, Smolak L (2011) *Body image: a handbook of science, practice, and prevention*, 2nd edn. Guilford Press, New York
- Dakanalis A, Zanetti AM, Riva G, Colmegna F, Volpato C, Madeddu F, Clerici M (2015) Male body dissatisfaction and eating disorder symptomatology: moderating variables among men. *J Health Psychol* 20(1):80–90. doi:10.1177/1359105313499198
- Dakanalis A, Zanetti MA, Riva G, Clerici M (2013) Psychosocial moderators of the relationship between body dissatisfaction and symptoms of eating disorders: a look at a sample of young Italian women. *Revue Europeene Psychol Appl* 63(5):323–334. doi:10.1016/j.erap.2013.08.001
- Dakanalis A, Timko A, Serino S, Riva G, Clerici M, Carra G (2016) Prospective psychosocial predictors of onset and cessation of eating pathology amongst college women. *Eur Eat Disord Rev* 24(3):251–256. doi:10.1002/erv.2433
- Mitchison D, Mond J (2015) Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: a narrative review. *J Eat Disord* 3:20. doi:10.1186/s40337-015-0058-y
- Yean C, Benau EM, Dakanalis A, Hormes JM, Perone J, Timko CA (2013) The relationship of sex and sexual orientation to self-esteem, body shape satisfaction, and eating disorder symptomatology. *Front Psychol* 4:887. doi:10.3389/fpsyg.2013.00887
- Dakanalis A, Timko AC, Clerici M, Riva G, Carra G (2017) Objectified body consciousness (OBC) in eating psychopathology. *Assessment* 24(2):252–274. doi:10.1177/1073191115602553
- Dakanalis A, Carra G, Clerici M, Riva G (2015) Efforts to make clearer the relationship between body dissatisfaction and binge eating. *Eat Weight Disord* 20(1):145–146. doi:10.1007/s40519-014-0152-1
- Dakanalis A, Favagrossa L, Clerici M, Prunas A, Colmegna F, Zanetti MA, Riva G (2015) Body dissatisfaction and eating disorder symptomatology: a latent structural equation modeling analysis of moderating variables in 18-to-28-year-old males. *J Psychol* 149(1–2):85–112. doi:10.1080/00223980.2013.842141
- Dakanalis A, Timko CA, Favagrossa L, Riva G, Zanetti MA, Clerici M (2014) Why do only a minority of men report severe levels of eating disorder symptomatology, when so many report substantial body dissatisfaction? Examination of exacerbating factors. *Eat Disord* 22(4):292–305. doi:10.1080/10640266.2014.898980
- Dakanalis A, Timko A, Madeddu F, Volpato C, Clerici M, Riva G, Zanetti AM (2015) Are the male body dissatisfaction and drive for muscularity scales reliable and valid instruments? *J Health Psychol* 20(1):45–59. doi:10.1177/1359105313498108
- Hildebrandt T, Walker DC, Alfano L, Delinsky S, Bannon K (2010) Development and validation of a male specific body checking questionnaire. *Int J Eat Disord* 43(1):77–87. doi:10.1002/eat.20669
- Caslini M, Crocamo C, Dakanalis A, Tremolada M, Clerici M, Carra G (2016) Stigmatizing attitudes and beliefs about anorexia and bulimia nervosa among Italian undergraduates. *J Nerv Ment Dis* 204(12):916–924. doi:10.1097/NMD.0000000000000606
- Raeuori A, Keski-Rahkonen A, Hoek HW (2014) A review of eating disorders in males. *Curr Opin Psychiatry* 27(6):426–430. doi:10.1097/YCO.000000000000113

17. Dakanalis A, Pla-Sanjuanelo J, Caslini M, Volpato C, Riva G, Clerici M, Carrà G (2016) Predicting onset and maintenance of men's eating disorders. *Int J Clin Health Psychol* 16(3):247–255. doi:10.1016/j.ijchp.2016.05.002
18. Dakanalis A, Clerici M, Caslini M, Gaudio S, Serino S, Riva G, Carra G (2016) Predictors of initiation and persistence of recurrent binge eating and inappropriate weight compensatory behaviors in college men. *Int J Eat Disord* 49(6):581–590. doi:10.1002/eat.22535
19. Rousseau A, Knotter A, Barbe P, Raich RM, Chabrol H (2005) Étude de validation de la version française du body shape questionnaire. *L'Encéphale* 31:162–173
20. Drewnowski A, Yee DK (1987) Men and body image: are males satisfied with their body weight? *Psychosom Med* 49:626–634. doi:10.1097/00006842-198711000-00008
21. Grogan S (2008) *Body image: understanding dissatisfaction in men, women, and children*. Routledge, New York
22. Holmes M, Fuller-Tyszkiewicz M, Skouteris H, Broadbent J (2015) Understanding the link between body image and binge eating: a model comparison approach. *Eat Weight Disord* 20(1):81–89. doi:10.1007/s40519-014-0141-4
23. Gray JJ, Ginsberg RL (2007) Muscle dissatisfaction an overview of psychological and cultural research and theory. In: Thompson J, Cafri G (eds) *The muscular ideal: psychological, social, and medical perspectives*. American Psychological Association, Washington DC, pp 15–39
24. Cash TF (2011) Crucial considerations in the assessment of body image. In: Cash T, Smolak L (eds) *Body image: a handbook of science, practice and prevention*. Body Image: a handbook of science, practice and prevention. The Guilford Press, Nova Iorque, pp 129–137
25. Silva WR, Dias JCR, Maroco J, Campos JADB (2015) Factors that contribute to the body image concern of female college students. *Rev Bras Epidemiol* 18(4):785–797. doi:10.1590/1980-5497201500040009
26. Banfield SS, McCabe MP (2002) An evaluation of the construct of the body image. *Adolescence* 37:373–393
27. Costa LCF, Vasconcelos FAG (2010) Influence of socioeconomic, behavioral and nutritional factors on dissatisfaction with body image among female university students in Florianopolis, SC. *Rev Bras Epidemiol* 13(4):665–676. doi:10.1590/S1415-790X2010000400011
28. Sepulveda AR, Carrobbles JA, Gandarilhas AM (2008) Gender, school and academic year differences among Spanish university students at high-risk for developing an eating disorder: an epidemiologic study. *BMC Public Health* 8:102. doi:10.1186/1471-2458-8-102
29. Ochner CN, Gray JG, Brickner K (2009) The development and initial validation of a new measure of male body dissatisfaction. *Eat Behav* 10:197–201. doi:10.1016/j.eatbeh.2009.06.002
30. Marôco J (2014) *Análise de equações estruturais*. 2a edn. Report number, Lisboa
31. Rousseau A, Denieula M, Lentillon V, Valls M (2014) French validation of the male body dissatisfaction scale in a sample of young men. *J Théor Comport Cogn* 24(3):122–129. doi:10.1016/j.jtcc.2014.07.001
32. Carvalho PHBd, Conti MA, Neves CM, Meireles JFF, Oliveira FC, Ferreira MEC (2015) Psychometric assessment of the Brazilian version of the male body dissatisfaction scale. *Rev Psiquiatr Clín* 42(4):90–94. doi:10.1590/0101-60830000000056
33. Hair JF, Black WC, Babin B, Anderson RE, Tatham RL (2005) *Multivariate data analysis*, 6th edn. Prentice Hall, New Jersey
34. Marôco J, Campos JADB, Vinagre MG, Pais-Ribeiro JL (2014) Brazil-Portugal transcultural adaptation of the social support satisfaction scale for college students. *Psychol Res Rev* 27(2):247–256. doi:10.1590/1678-7153.201427205
35. Warren CS, Cepeda-Benito A, Gleaves DH, Moreno S, Rodriguez S, Fernandez MC, Fingeret MC, Pearson CA (2008) English and Spanish versions of the body shape questionnaire: measurement equivalence across ethnicity and clinical status. *Int J Eat Disord* 41:265–272. doi:10.1002/eat.20492
36. Pope HG Jr, Gruber AJ, Mangweth B, Bureau B, deCol C, Jouvant R, Hudson JI (2000) Body image perception among men in three countries. *Am J Psychiatry* 157:1297–1301. doi:10.1176/appi.ajp.157.8.1297
37. Kim KH (2005) The relation among fit indexes, power and sample size in structural equation modeling. *Struct Equ Modeling* 12(3):368–390. doi:10.1207/s15328007sem1203\_2
38. WHO (2000) *Obesity: preventing and managing the global epidemic*. Technical Report Series, Geneva: World Health Organization WHO
39. Onis DM, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J (2007) Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 85(9):660–667. doi:10.1590/S0042-96862007000900010
40. ABEP (2015) *Brazilian economic classification criteria (Brazilian Criteria)*. <http://www.abep.org/criterio-brasil>. Accessed January 2017
41. Carvalho PHBd, Ferreira MEC, Kotait M, Teixeira PC, Hearst N, Cordás TA, Conti MA (2013) Equivalências conceitual, semântica e instrumental: análises preliminares da versão em português (Brasil) da male body dissatisfaction scale (MBDS). *Cadernos de Saúde Pública* 29(2):403–409. doi:10.1590/S0102-311X2013000200027
42. Kaplan RM, Saccuzzo DP (2012) *Psychological testing. Principles, applications and issues*, vol 8. Wadsworth Cengage Learning, CA
43. Dakanalis A, Zanetti MA, Clerici M, Madeddu F, Riva G, Caccialanza R (2013) Italian version of the Dutch eating behavior questionnaire. Psychometric proprieties and measurement invariance across sex, BMI-status and age. *Appetite* 71:187–195. doi:10.1016/j.appet.2013.08.010
44. Silva WR, Costa D, Pimenta F, Maroco J, Campos JADB (2016) Psychometric evaluation of a unified Portuguese-language version (Brazil and Portugal) of the body shape questionnaire in female university students. *Cadernos de Saúde Pública (Online)* 32(7):1–12. doi:10.1590/0102-311X00133715
45. Kline RB (1998) *Principles and practice of structural equation modeling*. The Guilford Press, New York
46. Fornell C, Larcker DF (1981) Evaluating structural equation models with unobservable variables and measurement error. *J Marketing Res* 18(1):39–50. doi:10.2307/3151312
47. Campos JADB, Zucoloto ML, Bonafé FSS, Maroco J (2017) General oral health assessment index: a new evaluation proposal. *Gerodontology* 1:1–9. doi:10.1111/ger.12270
48. Brown J, Bardoukas N (2013) Predictors of body dissatisfaction in asian and caucasian males: a preliminary test of a three factor model. *Int J Mens Health* 12(1):3. doi:10.3149/jmh.1201.3
49. Hallsworth L, Wade T, Tiggemann M (2005) Individual differences in male body-image: an examination of self-objectification in recreational body builders. *Br J Health Psychol* 10(1):453–465. doi:10.1348/135910705X26966