Portuguese version of the Body Appreciation Scale-2 for Children (BAS-2C): Psychometric evaluation and measurement of invariance across sex

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ABSTRACT

Body appreciation, a central aspect of positive body image, recently started to capture the attention of the scientific community as a potential determinant of well-being. However, little is known about onset and early identification in both males and females, as studies on this subject in childhood are still scarce, due in part to a dearth of validated instruments. Therefore, the main purpose of this study is to examine the psychometric properties and sex invariance of a Portuguese version of the Body Appreciation Scale-2 for Children (BAS-2C; Halliwell et al., 2017). We also explored the relationship between the BAS-2C and body mass index z-scores (BMIz). Participants were 328 children, ages 9-to-11 years (50.9% girls). Confirmatory factor analysis indicated that the one-dimensional factor structure had adequate fit, but sex invariance was not supported. Differential item functioning analysis revealed that boys and girls respond differently to item #9, which assesses body comfort. BAS-2C scores evidenced internal consistency and convergent validity with quality of life, healthy eating habits, and body size dissatisfaction. BMIz showed a low ability to predict body appreciation. This study brings support for the use of the BAS-2C in Portuguese-speaking children, but caution is warranted in comparing BAS-2C scores across sexes.

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1. Introduction

The theoretical definition of positive body image (Tylka & Wood-Barcalow, 2015b) has enhanced the study of this construct over the last few years. Positive body image drew the attention of the scientific community for its multifaceted and holistic nature, which extends beyond body (dis)satisfaction. In addition, the emergence of this construct highlighted an important shift in the field of body image, shifting from a pathology-focused approach to a comprehensive, function-focused exploration of the concept (Halliwell, 2015).

Positive body image encompasses appreciation, love, respect, and acceptance for the body, even when one is not completely satisfied with all aspects of appearance (Tylka & Wood-Barcalow, 2015b). One key characteristic of this construct is the concept of body appreciation – the ability to relate with one's body in an accepting manner, and to appreciate its functionality and health, resisting the sociocultural pressures to internalize the stereotyped appearance ideals (Avalos et al., 2005; Tylka, 2019). Currently, the Body Appreciation Scale-2 (BAS-2; Tylka & Wood-Barcalow, 2015a) is considered the most precise measurement of the core construct of positive body image and is, possibly, the most-widely used tool for indexing this construct (Swami et al., 2020).

The BAS-2 has been validated in Western and non-Western countries (e.g., Aimé et al., 2020; Razmus et al., 2020; Todd & Swami, 2020) demonstrating to be a psychometrically sound measure to assess body appreciation. It has been found to have a consistent, unidimensional factor structure, adequate reliability, and convergent validity with body image satisfaction (e.g., Alleva et al., 2016; Swami et al., 2017), body-esteem (Torres et al., 2018), and other facets of

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positive body image, such as functionality satisfaction (Alleva et al., 2016; Soulliard & Vander Wal, 2019), and body image flexibility (Meneses et al., 2019; Soulliard & Vander Wal, 2019).

Body appreciation is also associated with various well-being indices, such as self-esteem (e.g., Lemoine et al., 2018; Swami et al., 2017), life satisfaction (e.g. Alcaraz-Ibáñez et al., 2017; Swami et al., 2017), positive affect (Razmus & Razmus, 2017), quality of life (Lemoine et al., 2018), and healthy behaviors (Andrew et al., 2016). In view of this, positive body image has been proposed as a key factor for preventing a spectrum of psychosocial and health problems (Baceviciene & Jankauskiene, 2020; Carrard et al., 2019). Fueled by this finding, there has been an explosion of research concerning body appreciation in recent years. The extant research, however, has remained largely focused on adolescent and adult populations. Although positive body image is purported to be an important facet of a child's well-being, very little is known about when and how positive body image develops in childhood, how can it be maintained, and its fluctuation over time (Halliwell, 2015; Webb et al., 2015). Developing this understanding, its developmental nature would assist the creation and implementation of prevention and early intervention programs to promote positive body image in youth (Carrard et al., 2019).

To facilitate research on positive body image in children there is a need for age-appropriate measures. The BAS-2 is available for use with adolescents (e.g., Góngora et al., 2020; Lemoine et al., 2018), young adults (Aimé et al., 2020), adults (Razmus et al., 2020; Todd & Swami, 2020), and older adults (Meneses et al., 2019). There is also a version for children - the BAS-2C (Halliwell et al., 2017) – but, to the best of our knowledge, it is only available for administration in English and Japanese. Both versions have demonstrated satisfactory psychometric properties, including a consistent single factor structure, adequate internal consistency and good test–retest reliability over four (Namatame et al., 2020) and six weeks (Halliwell et al., 2017). Convergent validity of the BAS-2C was supported in both language versions. The BAS-2C was significantly and positively correlated with body-esteem (Halliwell et al., 2017), self-esteem, and life satisfaction (Namatame et al., 2020), and negatively correlated with body surveillance, awareness of media influence, internalization of media influence, and media influence pressures (Halliwell et al., 2017). The original version of the BAS-2C made an incremental contribution to positive and negative affect above and beyond body-esteem, providing evidence for its incremental validity (Halliwell et al., 2017). The Japanese version was invariant across sex (Namatame et al., 2020). Sex differences were only seen in the English sample, with boys showing higher body appreciation than girls (Halliwell et al., 2017).

Overall, these studies suggest that this tool is suitable for the assessment of body appreciation in childhood and provide preliminary evidence for factorial equivalence in the BAS-2C across different linguistic and cultural groups. As a contribution to this literature, we aimed to investigate the psychometric properties of the BAS-2C within an additional, Portuguese, cultural context. Specifically, we sought to examine the factor structure, sex-based measurement invariance, reliability, and convergent validity of a Portuguese translation of the BAS-2C in native Portuguese-speaking children. Portugal represents a Western but non-English speaking cultural context, thus complementing the aforementioned BAS-2C research that has been conducted in England and Japan. In addition, we aim to explore the relationship between the BAS-2C and body mass index (BMI). Empirical evidence for a negative association between BMI and body appreciation is mixed (He et al., 2020) and, to our knowledge, no studies have investigated the link between these variables in childhood samples. Analyzing this research question will expand the knowledge about the factors related to body appreciation in early developmental stages, namely primary-school-aged children.

Predictions were made based on previous research with the BAS-2C, and incorporating findings from the BAS-2 in adolescents, whenever information regarding the children's version was unavailable. We hypothesized that the BAS-2C would yield a one-dimensional factor structure and its items would be internally consistent (Halliwell et al., 2017; Namatame et al., 2020). We expected that the BAS-2C would be invariant across sex (Namatame et al., 2020). Regarding convergent validity, we anticipated that BAS-2C scores would be positively correlated with quality of life (Namatame et al., 2020) and healthy eating habits (Lemoine et al., 2018), yet negatively correlated with body size dissatisfaction (Namatame et al., 2020). The association with body mass index is expected to be negative and weak, not significantly larger among girls (Alcaraz-Ibáñez et al., 2017; Góngora et al., 2020; He et al., 2020).

2. Method

2.1. Participants

Participants of this study were 328 children (50.9% girls) aged between 9 and 11 years (M = 9.20, SD = 0.45) who were recruited from Portuguese primary schools in the district of Porto and Madeira Island. Sample size estimates were based on the COSMIN guidelines for designing studies to evaluate measurement properties of health instruments (Mokkink et al., 2019), as well as on the recommendation for multi-group modeling of a minimum sample-size to parameters ratio of 10:1 (Kline, 2016). These parameters suggested a minimum of 100 boys and 100 girls for analysis with the current study. The age range was defined based on the study sample from Halliwell et al.'s (2017) as reference. Inclusion criteria were age between 9-11 years old and Portuguese mother tongue; exclusion criterion was the presence of cognitive impairment. These criteria were informed by the class teacher. A total of five participants were removed from the initial sample due to the presence of a teacher-reported cognitive impairment (n = 1) and multivariate outliers (i.e., maximum or minimum rates in all items on the assessment protocol; n = 4).

2.2. Measures

2.2.1. Demographics
Participants reported their age, sex, school, and school year.

2.2.2. Body mass index (BMI)
The BMI of children was calculated based on height and weight (kg/m^2) obtained by direct measurement with a stadiometer (Seca®) and a bio-impedance scale (Tanita Segmental Body Composition BC601®). Subsequently, BMI was converted into age and sex-specific z-scores (BMIz) based on WHO growth standards for children and adolescents ages 5–19 years. Children were also categorized as underweight, normal weight, overweight, and obese, according to the WHO growth reference data (de Onis et al., 2007).

2.2.3. Body appreciation
Body appreciation was measured by a Portuguese translation of the BAS-2C (Halliwell et al., 2017). The BAS-2C is composed of 10 items rated on a 5-point Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). Analyses have revealed a unidimensional factor structure, good internal consistency, test-retest reliability, and validity among British (Halliwell et al., 2017) and Japanese (Namatame et al., 2020) children.

The BAS-2C's translation process was based on the TRAPD method - an acronym for the five serial (but interrelated) phases of this method: Translation, Review, Adjudication, Pretesting, and Documentation (Harkness, 2003). Two translators (one postgraduate

student and one psychology professor) worked independently to translate the English version of the BAS-2C to Portuguese. As a further step, a reviewer (a second psychology professor) met together with the translators to reconcile translation differences. During the adjudication phase, final decisions were made by a fourth person - the adjudicator - who considered the reviewer's comments and applied their own expertize in body image research. The four individuals involved in this process were proficient in both Portuguese and English. No items were considered difficult to translate. A pilot of the adjudicated version of the BASC-2C scale was conducted with eight participants meeting target population age criteria (children between 9 and 11 years). For this step, we adapted the cognitive pretesting model for children (Woolley et al., 2004). Cognitive pretesting was carried out individually and took place in a private room at the University or in the homes of participants according to parents' requests. Prior to implementation, each child was instructed on how to answer the items of the BAS-2C and then they were asked to: 1) read the question aloud; 2) rephrase the question into their own words; 3) select the best answer to the question; and 4) explain their answer. Item #4 ("I take a positive attitude towards my body") and item #9 ("I am comfortable in my body") have proven to be more difficult for children to understand and, accordingly, minor modifications in item #4 were made to improve grammatical clarity and facilitate comprehension. All translation-related aspects were documented.

2.2.4. Body size dissatisfaction

The Children's Body Image Scale (CBIS; Truby & Paxton, 2002) is a pictorial scale that was employed to measure body perception and dissatisfaction in children. It consists of seven, sex-specific body pictures representing standard percentile curves for BMI. Children are asked to select the body picture that best matches their current figure (perceived body image) and one that matches the figure that they would like to have (ideal body image). The discrepancy between the perceived and ideal figures is used as a measure of body size dissatisfaction. Studies have shown that scores derived from the scale have good construct validity (Truby & Paxton, 2002) and test–retest reliability after 3 weeks (Truby & Paxton, 2008).

2.2.5. Quality of life

Quality of life was assessed using the KIDSCREEN-10 (Ravens-Sieberer et al., 2010) – a generic health-related quality of life (HRQoL) measure for children and adolescents. The KIDSCREEN-10 is a unidimensional index with 10 items rated on a 5-point Likert-type scale, ranging from 1 (*Never/ Not at all*) to 5 (*Always*). It covers well-being, mood and emotions, autonomy, family and friends, as well as school environment, with two items each. The KIDSCREEN-10 demonstrated construct and criterion validity (Ravens-Sieberer et al., 2010) when applied to a sample of participants from 13 European countries. The Portuguese version of the instrument showed a good internal consistency of .78 with children and adolescents between 10-and-16-years-old (Matos et al., 2012). In the present study, internal consistency coefficient was acceptable in the total sample (ω =.70, 95% CI =.63-.73; α =.69), as well as in the girls (ω =.73, 95% CI =.61-.80; α =.72) and boys (ω =.68, 95% CI =.55-.74; α =.65) subsamples.

2.2.6. Healthy eating habits

The Mediterranean Diet Quality Index (KIDMED; Serra-Majem et al., 2004) was administrated to evaluate adherence to the Mediterranean diet in children. The Mediterranean diet is part of the identity of the Portuguese gastronomy and is regarded as one of the healthiest dietary models currently existing (Sofi et al., 2010). Based on 16 questions, the KIDMED dietary adherence index ranges from 0 to 12 and is categorized into three levels of adherence to the Mediterranean diet: ≥ 8 indicates a high level of adherence; 4-7 indicates

an average level of adherence; ≤ 3 indicates a very low level of adherence and qualitatively to an unhealthy diet (Serra-Majem et al., 2004). For this study we only used the total score (index) of the Portuguese version adapted by Marques et al. (2020) to Portuguese.

2.3. Procedures

This study was carried out in the scope of the project "Por mais Saúde [For Better Health]" developed by the Escola Superior de Saúde de Santa Maria [Santa Maria School of Health]. The project was approved by the Ethics Committee of the Regional Health Administration and the National Data Protection Commission (Reference NDPC nº1704/2015). No aspects of the study were pre-registered. Permission for translation and validation of a Portuguese version of the BAS-2C was granted by the original authors (Tracy Tylka). Written informed consent was obtained by the child's legal representative. Participants completed the questionnaires in their classroom, in the presence of the teacher and two members of the research team. Before starting data collection, the researchers informed the children about the study and collect oral assent. The children were encouraged to ask the researchers questions if they did not understand the meaning of a sentence or a word. Questionnaires were presented in a random order to reduce order bias, and were completed using pen and paper. The participants did not receive monetary, or in-kind, reward for their participation. Data from the current study are available from the corresponding author (S.T.), upon reasonable request.

2.4. Data analyses

Item quality was assessed by examining missing data and frequency distributions. Missing data accounted for 0.9% of the main dataset. This low percentage (less than 10%) suggest that current analyses are not prone to bias (Bennett, 2001). Based on Little's MCAR analyses, χ^2 (775) = 628.93, *p* >.99, we assumed that these data were missing completely at random and, therefore, we used the mean imputation method (mean of the item according to the participant's sex) to replace missing values in the BAS-2C (*n* = 5) and KIDSCREEN-10 (*n* = 2). Four multivariate outliers were identified with the use of Mahalanobis distance, and were subsequently deleted. The psychometric sensitivity of the items was assessed according to Kline's (2016) criteria for skewness and kurtosis (i.e., absolute values below 3.0 and 8.0, respectively, were considered adequate and within acceptable limits for normal distribution).

Confirmatory factor analysis (CFA) was performed to examine the fit of a single-factor model, where all items loaded onto a single latent variable. The factor loadings were used as local indices of goodness-of-fit, as well as the ratio of Chi-square to degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Parsimony Comparative Fit Index (PCFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). The model's fit was considered to be good if χ^2/df values are < 3.00, CFI ≥.95, IFI > .90, PCFI > .60 or.80, RMSEA ≤.07, and SRMR < .08, whereas CFI values ≥.90 and RMSEA and SRMR values ≤.10 indicate an adequate fit (Byrne, 2016; Hair et al., 2010; Hu & Bentler, 1999; Steiger, 2007). The correlation among errors was established considering a conservative approach, modification indices (MI) higher than 11 ($\chi^2_{0.999;\ (1)}$ = 10.83), balancing model saturation, and goodness-of-fit measures. Factor loadings were interpreted using Tabachnick and Fidell's (2019) recommendations, with loadings ≥.32 considered acceptable.

In order to determine whether the BAS-2C was invariant among girls and boys, measurement invariance was examined at four different levels (Chen, 2007; Putnick & Bornstein, 2016): (a) configural invariance (i.e., the model configuration is the same for the different groups); (b) factor loading or metric invariance (i.e., the magnitude

of the factor loadings is equivalent for the different groups); (c) intercept or scalar invariance (i.e., the intercepts of the items are equivalent for the different groups); and (d) strict invariance (i.e., measurement errors are the same for the different groups). Given that $\Delta\chi2$ statistic is considered an excessively conservative standard for invariance (Meade et al., 2008), we additionally examined the ΔCFI, ΔRMSEA, and ΔSRMR to assess the significance of the different invariance levels. According to Chen (2007), changes < -.010 in CFI, < .015 in RMSEA, and < .030 (for factor loading invariance) or < .010 (for intercept invariance or strict invariance) in SRMR are supportive of measurement invariance.

Internal consistency of the BAS-2C was assessed using the McDonald's Omega (ω). This coefficient is a practical alternative to Cronbach's alpha in estimating measurement reliability of the total score, proving to be more sensitive and with a lower risk of overestimation or underestimation (Deng & Chan, 2017; Dunn et al., 2014). A value greater than .70 was considered satisfactory (Gadermann et al., 2012). Nevertheless, Cronbach's alpha (α) was also reported to facilitate comparison between studies.

Pearson correlation coefficients (r) between body appreciation and body size dissatisfaction, quality of life, and healthy eating habits were calculated to establish the convergent validity of the scale. Fisher's r-to-z transformation was used to evaluate the difference between correlation coefficients among boys and girls. The association between the BAS-2C and BMIz was analyzed by using curve fit sex-specific regression statistics. This method calculated linear and non-linear regression statistics, including quadratic (U-shaped) trends. The BMIz quadratic was tested based on a recent meta-analysis that hypothesized that the association between body appreciation and BMI might be better explained by a curvilinear relationship, in particular for males (He et al., 2020).

Lastly, weight status difference in body appreciation was examined through independent-samples t-test. The magnitude of the between-group difference was interpreted according to Cohen's (1988) benchmarks: small d =.2, moderate d =.5, and large d =.8.

Statistical analyses to examine validity were performed using SPSS version 26. CFA and tests for measurement invariance were conducted using AMOS version 26. JASP (Version 0.16.2) was used to calculate McDonald's Omega reliability. Fisher's r-to-z transformation was performed by using the online statistical computation website VassarStats (Lowry, 2001).

3. Results

3.1. Preliminary analyses

Descriptive statistics for BAS-2C items are presented in Table 1. With the exception of item #9 ("I am comfortable in my body"), which did not present a normal distribution and adequate sensitivity, all items showed skewness and kurtosis within normal parameters.

3.2. Confirmatory factor analysis

The 10 item, one-factor model revealed an acceptable fit to the data for the whole sample: $\chi2$ (35) = 63.08, p =.02; $\chi2$/df = 1.80; CFI =.92; IFI =.97; PCFI =.61; RMSEA =.050, 90% CI [.029,.069], p =.490; SRMR =.046. Factor loadings ranged from .31 (R^2 =.10; Item 7) to .56 (R^2 =.31; Item 2). An inspection of the modification indices suggested correlation of the error covariances between items #1 and #9 (MI = 11.44, $\chi2$ (1) = 13.44, p < .001), which resulted in significantly improved model fit $\chi2$ (34) = 49.64, p =.041, $\chi2$/df = 1.46; CFI =.96; IFI =.96; PCFI =.72; RMSEA =.04, 90% CI [.008,.059], P(RMSEA $\leq$.05) =.816; SRMR =.041. Factor loadings ranged from .32 (R^2 =.10; Item 7) to .55 (R^2 =.30; Item 2) and were then considered adequate (see Fig. 1).

3.3. Sex invariance

Despite the adequate fit of the model for the full sample, when exploring sex measurement invariance the configural model did not present a satisfactory fit, $\chi2$ (68) = 133.96, p < .001, $\chi2$/df = 1.97, CFI =.84, IFI =.85, PCFI =.64, RMSEA =.055 with CI 90% [.004,.068], P(RMSEA $\leq$.05) =.278, SRMR =.069. This indicated that the pattern of item loadings on the latent factors differs for the two sexes. In light of this finding, we investigated the extent of the impact of anomalous items on the lack of measurement invariance (Swami & Barron, 2019). Thus, we estimated differential item functioning (DIF), using the three-step procedure recommended by He and van de Vijver (2012). First, we computed the total score of the BAS-2C unidimensional scale, irrespective of sex. Next, we divided the BAS-2C total score into four levels, range cut-off of 1+/- SD. Finally, we computed an analysis of variance (ANOVA), with sex and BAS-2C score level as independent variables, and item scores as the dependent variable. A significant effect for sex and a significant interaction between sex and BAS-2C score level points to item bias. Only item #9 ("I am comfortable in my body") revealed statistically significant DIF. Compared to boys, girls had lower scores, $F(3,320)$ = 3.18, p =.024, η^2 =.029.

3.4. Internal consistency reliability

The internal consistency coefficient of BAS-2C scores was acceptable in girls (ω =.71, 95% CI =.62-.79; α =.71) and boys (ω =.70, 95% CI =.62-.77; α =.73).

3.5. Convergent validity

In both sexes, the BAS-2C was significantly and positively correlated with quality of life and healthy eating habits, and negatively correlated with body size dissatisfaction (Table 2). The magnitude of the relationship between BAS-2C scores and healthy eating habits was small. Fisher's r-to-z transformation indicated that the
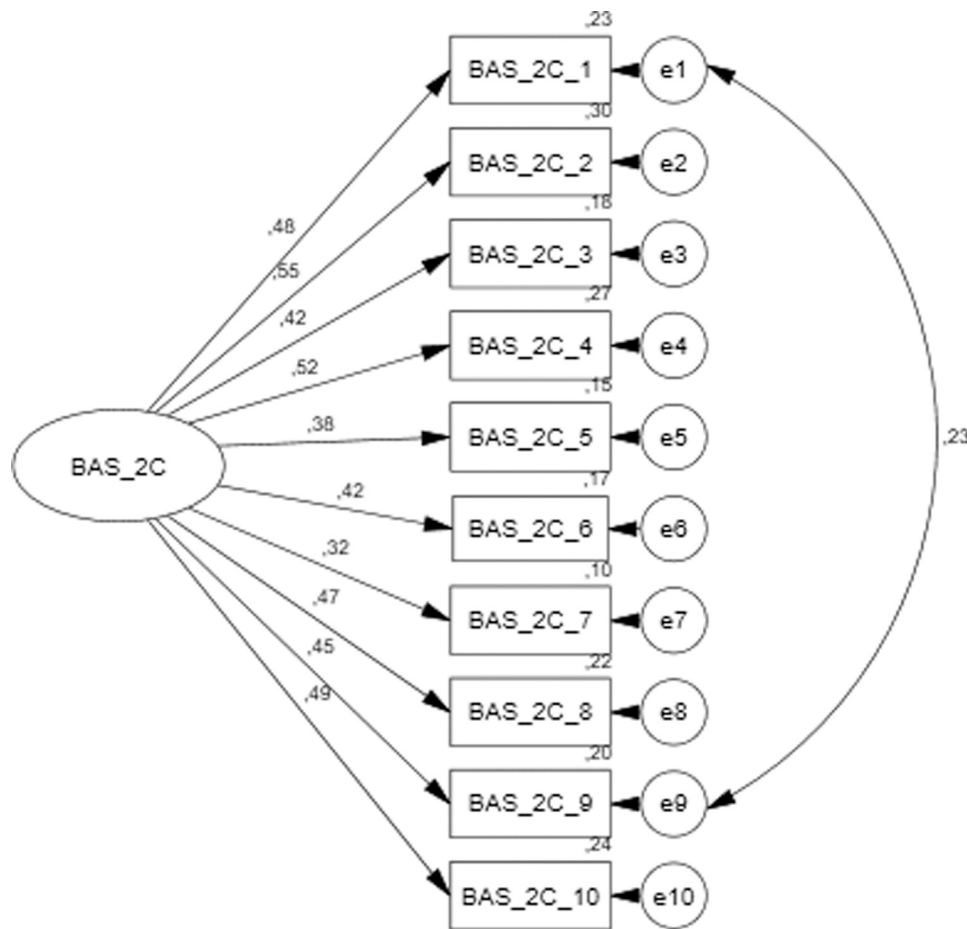
Table 1
Descriptive statistics for Body Appreciation Scale-2 for Children (BAS-2C) items.

BAS-2C items/ Portuguese translation	M	SD	Skewness	Kurtosis
1. I feel good about my body / *Sinto-me bem com o meu corpo*	4.582	0.733	-1.646	1.745
2. I respect my body / *Respeito o meu corpo*	4.750	0.557	-2.255	4.469
3. I feel that my body has at least some good qualities/ *Sinto que o meu corpo tem algumas qualidades*	4.137	1.113	-1.252	0.851
4. I take a positive attitude towards my body / *Tenho uma atitude positiva em relação ao meu corpo*	4.436	0.940	-1.795	2.830
5. I pay attention to what my body needs / *Estou atento(a) ao que o meu corpo precisa*	4.500	0.754	-1.377	1.290
6. I feel love for my body / *Sinto amor pelo meu corpo*	4.689	0.722	-2.647	7.425
7. I appreciate the different and unique things about my body / *Aprecio as características que são diferentes e únicas no meu corpo*	4.393	1.005	-1.724	2.252
8. You can tell I feel good about my body by the way I behave / *As pessoas conseguem perceber que eu me sinto bem com o meu corpo pela forma como me comporto*	4.290	0.960	-1.213	0.722
9. I am comfortable in my body / *Sinto-me confortável no meu corpo*	4.799	0.603	-3.680	15.688
10. I feel like I am beautiful even if I am different from pictures and videos of attractive people (e.g., models/actresses/actors) / *Sinto-me bonito(a), mesmo que seja diferente de fotos e vídeos de pessoas atraentes (por exemplo, modelos/ atrizes/ atores)*	4.616	0.804	-2.350	5.502

Fig. 1. Path diagram and estimates for the one-dimensional model of the Body Appreciation Scale-2 for Children (BAS-2C). *Note.* All parameter estimates are standardized and significant at $p < .001$.

Table 2
Associations between body appreciation and additional measures included in the study, reported for girls (bottom diagonal) and boys (upper diagonal) separately.

	1	2	3	4
1. Body appreciation	-	.339***	.177*	-.364***
2. Quality of life	.353***	-	.296***	-.147
3. Healthy eating habits	.189*	.224**	-	-.057
4. Body size dissatisfaction	-.276***	-.092	-.161*	-

*p < .05; **p < .01; ***p < .001.

correlation coefficients between the BAS-2C and quality of life ($z = 0.14$, $p = .888$), healthy eating habits ($z = 0.11$, $p = .912$), and body size dissatisfaction ($z = -0.89$, $p = .374$) were not significantly different between boys and girls.

3.6. Body appreciation and BMI

BMI ranged from 12.30 to 30.60 kg/m^2 ($M = 18.64$, $SD = 3.42$) and children's distribution for weight status category based on BMI percentile was as follows: underweight (Girls: $n = 9$, Boys: $n = 5$, Total: $n = 14$; 4.3%), normal weight (Girls: $n = 99$, Boys: $n = 105$, Total: $n = 204$; 62.2%), overweight (Girls: $n = 28$, Boys: $n = 27$, Total: $n = 55$; 16.8%) and obese (Girls: $n = 30$, Boys: $n = 24$, Total: $n = 54$; 16.5%).

The association between body appreciation and BMIz was negative and non-significant considering both the quadratic and linear functions. Despite that the BMIz-squared performed better, it only explained about 3% of the variance in the BAS-2C scores in girls, $F (2, 164) = 2.328$, $p = .101$, $R^2 = .028$, and boys, $F (2, 161) = 2.431$, $p = .091$, $R^2 = .029$. However, the comparison between weight statuses revealed

that girls with normal weight ($M = 4.60$, $SD = .40$) had significantly higher body appreciation than girls at both of the higher weight categories ($M = 4.41$, $SD = .51$), $t_{Welch} (98.5) = 2.42$, $p = .018$, $d = .43$. Conversely, in boys, there was no significant difference in BAS-2C scores for those with normal weight ($M = 4.54$, $SD = .41$) and at both of the higher weight categories ($M = 4.47$, $SD = .44$), $t (154) = 1.04$, $p = .299$, $d = .18$.

4. Discussion

This study investigated the Portuguese BAS-2C's reliability and validity among Portuguese children ages 9-to-11-years-old. Using CFA, the unidimensional factor structure was confirmed, as was the internal consistency reliability, which mirrored findings from studies carried out with the British and Japanese versions of the same scale (Halliwell et al., 2017; Namatame et al., 2020). Overall, this research gives added strength to the unidimensionality of the BAS-2 in school-aged children. Nevertheless, it should be noted that adequate fit was obtained following the freeing of error covariances between items #1 and #9. Although this procedure is consistent with some previous BAS-2 translational studies (e.g., Geller et al., 2020; Junqueira et al., 2019; León et al., 2021), it is suggestive of possible item-content overlap. When analyzing the semantic content of these items, we identified that, in the Portuguese language, the adjectives "good" and "comfortable" can have a similar interpretation. Other studies have also pointed out this problem (Junqueira et al., 2019; Swami et al., 2017), raising the hypothesis that, in some translational forms, these items might be closer in semantic meaning than they are in English.

In terms of measurement invariance, our results fail to support invariance across sex. This is in contrast to results reported by Japanese BAS-2C investigators (Namatame et al., 2020). A closer inspection of the items revealed that item #9 ("I am comfortable in my body") had differential functioning in girls and boys; in other words, this item does not measure body appreciation in the same manner for male and female children. Item bias may indicate linguistic translation issues, but also a lack of conceptual equivalence across groups (He & van de Vijver, 2012). We are inclined to argue that the non-literal nature of the concept of comfort in a body, underlying item #9, is abstract and may preclude full understanding by children, particularly in Portuguese culture and language. To be comfortable in one's own body can be translated into self-acceptance and body confidence, which are concepts that Portuguese children may be unfamiliar with. It should be noted that the topic of body image is not yet included in Portuguese educational curricula. As observed by Coelho et al. (2013), Portuguese girls between 7-to-10-years-old have a more accurate awareness of body shape than boys and, in this sense, we hypothesize that the body image satisfaction facet of the word "comfort" was more prominent in girls and the physical component in boys. In context of subjectivity, we believe that male and female participants may have used different conceptual frames of reference and attached different meanings to this item. It is also possible that non-invariance across sex in item #9 may not be specific to this age group and, in some cultural contexts, this item needs to be calibrated/revised to obtain comparable levels of body appreciation across male and female adults, as recently noted by Zarate et al. (2021). To conclude, in practical terms, the Portuguese BAS-2C is relatively unaffected by test bias when measuring body appreciation in boys and girls, which allows for its use in both the research and clinical spheres. Though caution should be had with direct comparison between sexes of latent BAS-2C scores, which cannot be conducted. Further scrutiny of the dimensionality of the construct across sex in this age group should be caried out with different samples, as it will clarify whether some BAS-2C items are less central to the meaning of body appreciation.

The convergent validity of the Portuguese BAS-2C was globally supported: body appreciation was negatively correlated with body size dissatisfaction, and positively correlated with quality of life and healthy eating habits, in both sexes. Previous studies with children (Namatame et al., 2020), adolescents (Góngora et al., 2020) and adults (e.g., Swami et al., 2019; Tylka & Wood-Barcalow, 2015a) have supported the notion that body appreciation and body dissatisfaction are distinct but negatively correlated factors of body image, as proposed by Tylka and Wood-Barcalow (2015b). The present study reinforces this finding in childhood and underscores that positive body image should not simply be represented as low levels of negative body image.

The observed positive association between body appreciation and quality of life in children also converged with previous research looking at older samples, suggesting that positive body image may contribute to a host of psychological and physical health benefits across the lifespan (Guest et al., 2019; Swami et al., 2018). Our study extends this evidence to childhood and lends credence to the view that body appreciation can bring a range of positive health-related outcomes beginning in early developmental stages.

Despite healthy eating habits being positive and significantly associated with the BAS-2C, it should be noted that its magnitude was weak. Theoretically, these variables were expected to be more closely linked, assuming that the adaptive investment in body care is a facet of positive body image (Tylka & Wood-Barcalow, 2015b). Moreover, empirical data documenting a moderate-to-strong association between body appreciation and intuitive eating in adults, also reinforced this expectation (Bruce & Ricciardelli, 2016; Lemoine et al., 2018). We posit that the observed low association between body appreciation and healthy eating habits has three prongs that

deserve consideration. Firstly, the construct of intuitive eating, despite being viewed as promoting a healthy relationship with food, seems to be distinct enough from healthy eating motivation (Román et al., 2021). Thus, it is possible that healthy eating does not employ both motivation and intuitive eating - particularly for children when the locus of control for food selection may be caregiver-based (Nowicka et al., 2014). Secondly, along the same vein, the assessment of eating decisions in childhood can be a complex process, because, at this age, the meals are mainly managed by parents. Thirdly, the instrument that was used to assess healthy eating habits (i.e., KIDMED index) may not be suitable to measure healthy eating practices out of the scope of the Mediterranean diet. Altogether, these arguments lead us to conclude that the concept of healthy eating habits may be limited when assessing the construct validity of this instrument in school-age children.

One additional aim of this study was to investigate the association between the BAS-2C and BMI, on the assumption that these two variables can interact differently over the life span (Meneses et al., 2019). In our sample, the BMIz showed a low ability to predict body appreciation in both sexes. The meta-analysis by He et al. (2020), based on adolescent and adult samples, also found a weak and negative association between these variables but, in contrast to our study, these authors noted that this relationship was slightly larger and close-to-moderate in females, probably as a result of cultural idealization of leanness. Thus, one possible explanation for our results is that body appreciation in late childhood does not seem to be influenced by societal thin-ideal standards. It is possible that children in this developmental phase have broader conceptualizations of beauty and value other facets of body image, such as outfits (e.g., clothing), physical capabilities (e.g., flexibility), and the ability to communicate with others (e.g., body language). If so, these findings reinforce the view that positive body image is a multifaceted construct (Tylka & Wood-Barcalow, 2015b), not fully dependent on body size. This does not exclude, however, that weight can impact body appreciation under extreme circumstances, such as obesity. The lower scores of body appreciation observed in girls at a higher weight suggest that weight stigma of obesity is perceived at an early age, particularly for females. There is evidence that a desire for a thinner body occurs in girls as young as 6 years of age (e.g., Dohnt & Tiggemann, 2005; Lowes & Tiggemann, 2003). Arguably, this shared peer norm for thinness makes it difficult for a girl to appreciate her body when it is devaluated and rejected by others. There is evidence that children with overweight or obese body types often experience weight-related bullying and teasing, and are more vulnerable to weight discrimination (Haqq et al., 2021). The internalization of negative social attitudes related to weight prejudice and discrimination can lead to poor self-regard, which limits the development of approval, love, and respect for one's body (He et al., 2020).

Despite the contribution this study makes to the assessment of positive body image in children, it has its limitations. The convenience sampling technique and the lack of control for demographic information other than age and sex, prevents the results from being treated as representative of the entire population. Future research could expand on our work by including a broader age range of participants, and a larger, more diverse sample of children in terms of weight categories, geographical regions, and urbanicity.

Our sample size did not allow for analysis of the factorial validity of the Portuguese BAS-2C using a two-step analytic strategy, consisting of Exploratory Factor Analysis (EFA) followed by CFA, which is regarded as the most robust approach for the validation of body image instruments (Swami & Barron, 2019). We used the CFA given its position as the most suitable approach to test a previously established model, and its solid support from theoretical and empirical research (Brown, 2006). The BAS-2 has been translated into a number of different languages and age groups and scores on the measure consistently retain a one-factor structure across all

samples. Though not all scholars recommend using both the EFA and CFA (e.g., Kline, 2016), doing so would have allowed for an in-depth exploration of item behavior with regard to multiple hypothesized models and, thus, clarify the source of non-invariance across sex. Future studies would benefit from using this analysis, sample-size providing.

Regarding the variables and instruments that were selected to determine the construct validity, and as mentioned above, self-care behaviors are difficult to assess at this age, due to the low autonomy and high involvement from parents. As such, the usefulness of healthy eating (and the KIDMED) for testing the BAS-2C's convergent validity is limited. It should also be noted that the nature of the association between body appreciation and body dissatisfaction cannot be entirely understood from our findings, as the CBIS only measures dissatisfaction with body size, not other body features. Despite the reduced availability of previously-validated measures in Portugal, there are still some variables of interest, such as self-esteem (e.g., Self-concept and Self-esteem Scale; Peixoto et al., 2017) and positive affect (e.g., Positive and Negative Affect Scale for Children; Ameixa, 2013), that can be used in future work to extend the evidence base of construct validity.

Finally, the reliability of the BAS-2C was only evaluated in terms of internal consistency. The design of our study did not allow for a second administration point and, therefore, the examination of temporal stability. Future research will profit from investigating test-retest reliability, as well as divergent and incremental validity that were not assessed in this study.

Despite these limitations, the present work makes an important contribution to the field of body image in school-age children. It enables the use of the BAS-2C in an additional linguistic group, facilitating further cross-cultural comparisons, and presents new insights on the association between BMI and body appreciation. As research on positive body image continues to grow, we expect that the availability of this instrument will assist with the identification of significant predictors of children's body appreciation trajectories over time.

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CRediT authorship contribution statement

Sandra Torres: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision. **Mariana Pereira:** Methodology, Formal analysis, Writing – original draft. **Maria Raquel Barbosa:** Formal analysis, Validation, Writing – original draft. **Tânia Barbosa:** Methodology, Investigation, Supervision. **Kylee M. Miller:** Conceptualization, Writing – original draft, Writing – review & editing. **Goreti Marques:** Investigation, Project administration, Funding acquisition.

Conflict of interest statement

None.

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