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ORIGINAL ARTICLE

Cross-validation of the body appreciation scale-2: invariance across sex, body mass index, and age in Mexican adolescents

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Abstract

Cross-validation is a useful strategy to address problems associated with the post hoc model fitting. The aim of this study was to cross-validate the BAS-2, in two samples (Calibration and Validation Samples), using an invariance testing strategy. 1127 Mexican adolescents (508 males and 619 females), aged 11–19 years ($M = 15.41$, $SD = 2.30$), allocated in two samples ($n_1 = 672$; $n_2 = 455$) completed the Mexican version of the BAS-2, along with other body image-related instruments. The cross-validation supported the generalizability of the one-factor respecified model of the BAS-2. The measure was invariant across body mass index and age, but not across sex. Internal consistency and test–retest reliability (a three-week period between each test) was excellent. In support of the validity of the BAS-2, it was positively associated with scores on body esteem, but negatively with body mass index, drive for thinness, and body dissatisfaction. Normal-weight and young adolescents groups showed higher body appreciation than excess-weight and late adolescents groups, respectively. Considering these findings, it is reasonable to conclude that the BAS-2 is a reliable and valid instrument to assess body appreciation in Mexican adolescents.

Level of Evidence Level V, cross-sectional, descriptive study.

Keywords Reliability · Positive body image · Mexico · Measurement invariance · Factorial validity · Psychometrics

Introduction

Body appreciation (BA) is a characteristic of positive body image and reflects gratitude for the function, health, and features of the body [1]. The most used questionnaire to understand this characteristic is the Body Appreciation Scale (BAS) [2]. Tylka and Wood-Barcalow [3] revised this instrument; some items were discarded, others added, and some others edited, to ultimately create a new version of 10 items (BAS-2).

The BAS-2 has been adapted to be applied in adolescents, college students, community samples, and sexual minorities from different world regions: Middle-East [4, 5], Asia [6–11], Europe [12–23], North-America [3, 24, 25], and Latin-America [26–28].

Some researchers have found that the BAS-2 is invariant across sex [21, 28], nationality [9, 18, 27], and sample type (college vs. community) [3]. Only one study examined the invariance by Body Mass Index (BMI) [26], and no study has examined the invariance by age, despite the documented association between BMI and age, and positive body image.

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The internal consistency of the BAS-2 (generally using the Cronbach alpha coefficient) ranged from 0.87 to 0.97 in women, and from 0.79 to 0.97 in men. Also, temporal stability was excellent ($r = 0.82–0.98$). Finally, the scores obtained in the BAS-2 were positively related to self-esteem [3] and optimism [12, 21], while negatively related to body dissatisfaction [20], body anxiety [8, 20], BMI [3, 21], and drive for thinness [29].

Using Exploratory Factor Analysis, researchers consistently identified a one-factor solution for the items of the BAS-2. However, when using CFA, several authors [6, 9, 11, 17, 19, 21–23, 26, 28] allowed measurement errors to correlate between two or more pairs of items, to improve the fit of the original model [3]. The analysis is no longer purely confirmatory and becomes exploratory [30, 31]. Therefore, further studies are necessary to evaluate how well a respecified model for a sample fits an independent sample, extracted from the same population (cross validation). Cross-validation would ensure that findings are not sample specific, and would improve the external validity of the BAS-2 [30].

As a contribution to the literature, we cross-validated the BAS-2 in two samples (calibration and validation samples) drawn from the same population, using an invariance testing strategy [32]. For sample 1, we hypothesized that the a priori model identified by a latent variable and ten indicators for the BAS-2 [3] would require freed error covariances between items, to obtain good fit indexes. Also, we expected to find support for invariance across sex, BMI, and age. We hypothesized that scores on the BAS-2 would be significantly and positively associated with scores on the body esteem scale, and negatively associated with BMI, drive for thinness, and body dissatisfaction. Finally, we hypothesized that the items of the BAS-2 would have a high internal consistency.

Methods

Participants

Participants were 1,127 Mexican adolescents between the ages of 11 and 19 years ($M = 15.41$, $SD = 2.30$) who attended an English language course at the Autonomous University of the State of Mexico, Campus Ecatepec, located in a low-income area.

Sample 1 included 672 participants (285 males, 387 females), with a mean age of 15.89 years ($SD = 2.45$); their BMI ranged from 13.50 to 37.12 ($M = 22.66$, $SD = 4.26$).

Sample 2 (validation Sample) included 455 participants (223 males, and 232 females) with a mean age of 14.70 years old ($SD = 1.85$). Participants in Sample 1 differed from participants in Sample 2 by sex, $X^2(1) = 4.77$, $p = 0.03$, and age, $t\ (1,112) = 9.27$, $p = 0.0001$, $d = 0.5$. Finally, a sub-sample of 193 participants, extracted from both initial samples (Sample 1, $n = 31$; Sample 2, $n = 162$) answered the BAS-2, 3 weeks later.

Measures

All participants anonymously provided information about their sex and age. Then, they completed the new Mexican translation (see supplementary materials) of the BAS-2 [3]. The instrument comprises 10 items rated on a 5-point scale (1 = *never*; 5 = *always*). Participants in Sample 2 answered the BAS-2, only. Their height was measured using a standard height bar. The body analyzer InBody-230-Biospace was used to obtain their BMI. To assess discriminant validity, we used the Body Dissatisfaction subscale (BD-EDI-2) and the Drive for Thinness subscale (DT-EDI-2) of Eating Disorders Inventory-2 [33]. These subscales assess attitudes and behaviors related to eating and body shape, on a 6-point Likert-type response scale. For the Mexican population, the Cronbach's alpha coefficients were over 0.85 for the two subscales [34]. For this study, Omega coefficients for BD-EDI-2 and DT-EDI-2 subscales were 0.88 and 0.89 for females, and 0.78 and 0.87 for males, respectively.

Convergent validity was examined with the Body Esteem Scale (BES) [35], which assesses feelings about different parts and functions of the body with 35 Likert-type items. In Mexico, authors identified two factors [36]: Physical Condition and Weight Concern (PHWC-BES), and Physical and Sexual Attractiveness (PSA-BES), with adequate internal consistency (Alpha = 0.86–0.91), and temporal stability ($r = 0.62–0.68$), for men and women, adolescents and adults. BES correlated with self-esteem, BMI, and fat mass. In this study, Omega coefficients for both subscales were 0.92 and 0.91 for females, and 0.93 and 0.92 for males, respectively.

Procedure

While there already exists a version for Latin-American adolescents [27], that version was not pre-tested, as suggested (37), with participants from the target audience, to check for comprehension and readability. Therefore, in this study, the BAS-2 was translated and adapted into a new version. To achieve conceptual equivalence, four bilingual researchers, specialized in the field of body image, translated the BAS-2 [3]. After reaching consensus, this new version was analyzed in terms of semantic, cultural, operational, conceptual equivalence and vocabulary [38] by three experts in the field of body image. The suggestions of all these experts were compiled into a single version which, in turn, was translated to English. Then, T. Tylka (personal communication, September 5, 2019) revised it and approved it. We pre-tested the final version in a sample of 30 participants, extracted from the target audience, to check for comprehension and readability [37].

When compared to its previous version [27], we found differences in five of the items, in terms of redundancies, grammar, idiomatic expressions, and word choice. For example, item 3 was redundant, as qualities are a positive (good) aspect, so in the present investigation, the item was proposed as *siento que mi cuerpo tiene cualidades* (I feel that my body has qualities). The expressions in items 8 and 9, were also adapted, according to the specific convention for the Mexican culture: *voy con la frente en alto y sonrío* (I go with my head up high and smile), and *estoy a gusto con mi cuerpo* (I am comfortable with my body). So, this new 10-item BAS-2 was adopted (see supplementary material).

Parents were informed about the study and gave written consent. Also, participants provided assent after receiving general information about the study. They completed the measures using the online survey platform Google forms, in a computer laboratory, during school hours, in the presence of two researchers, a parent, and an English language teacher. The Research Department of the Autonomous University of the State of Mexico approved this study. Participation was voluntary, and respondents did not receive any kind of compensation or academic credits.

Data analysis

All CFAs were conducted using MPLUS-8.0 software [39], with a maximum likelihood robust (MLM) estimator. To assess how well the data fit those of the hypothesized factor structure, we used two indices of absolute fit: (a) the Satorra–Bentler scaled Chi-square (S-Bχ^2), a test of overall model fit [40]; relative to the ratio between S-Bχ^2 and degrees of freedom (S-Bχ^2/df), where values lower than 3 indicated a good fit [41], and values lower than five indicated an acceptable fit [42], and (b) the Standardized Root Mean Square Residual (SRMR) [41], where values from 0.05 to 0.10 indicated an acceptable fit [43], and values lower than 0.05 indicated a good fit [44]. Additionally, we used two indices of comparative fit: Comparative Fit Index (CFI) [45] and Tucker Lewis Index (TLI); the cutoff considered for the CFI and TLI were values close to 0.95 [42]. Finally, we examined a parsimony corrected fit index: the Root Mean Square Error of Approximation (RMSEA) [44], for which we used the upper confidence interval of 0.08 or lower [46].

Invariance analyses were conducted via multigroup confirmatory factor analysis (CFA). For all MG-CFA analyses, we first checked the model for each group, separately. The invariance of the BAS-2 across sex, BMI, and age, was evaluated using multi-group CFAs (MG-CFA), being women, normal-weight, and late adolescents the reference groups.

The progressive invariance estimation started when metric invariance was tested based on the results of the configural invariance, with constraints on equivalencies in factor loading. Scalar invariance was based on the result of the last step, where we constrained the intercept of equal variables. Values $\Delta CFI \leq 0.01$, and $\Delta RMSEA \leq 0.015$ were considered as signs of invariance [47]. For each constrained step where it was not possible to admit full invariance, we consulted the Modification Indices (MI) and the Standardized Expected Parameter Change (EPC).

Using R software, we evaluated bivariate correlations between the BAS-2 and EDI-2-BD, EDI-2-DT, BMI, and with the BES. Finally, we used *t* tests from independent samples to examine differences in body appreciation by BMI and by age.

The internal consistency of the BAS-2 was evaluated with McDonald's Omega coefficient [48], using R software.

We used the Intra-class correlation coefficient (ICC) and Pearson's correlation to obtain the temporal stability, using R software. Values over 0.81 were considered almost perfect for the ICC [49].

Results

Preliminary analysis

There were no missing data for scales. The data violated the assumptions of normality. Specifically, for male and female, values of Mardia's normalized skewness (17.23) and kurtosis (166.07) were statistically significant ($p < 0.00001$) for Sample 1, as well as for Sample 2 (Mardia's normalized skewness = 16.95 and kurtosis = 160.16; $p < 0.00001$), so we used an MLM algorithm [51], based on the raw data matrix. Horn's Parallel analysis [50] revealed the existence of one factor, only.

Confirmatory factor analyses

For Sample 1 (Table 1), the model revealed an acceptable fit to the data (S-Bχ^2/df = 4.105). An inspection of the observed and estimated parameters, and the Modification Index (55.791) and its related EPC (0.484) suggested to correlate the error covariance of items #2 and #9. The semantic content of these items was very similar, so the correlation was included in the model. The indices of the model's fit reached ideal values. Item-total correlations ranged between 0.59 and 80. The loads of the items loaded on the latent factor were significant ($p < 0.0001$) and ranged from 0.50 (item 10) to 0.81 (item 9). Subsequent analyses were performed with the respecified model.

Cross-validation

The model fit was satisfactory for the two samples (Table 1). Using Sample 1 as a calibration group, configural and metric invariance were supported by a good fit. In general, changes

Table 1 Goodness-of-fit indices for the different models in Sample 1 and Sample 2

Models	S-Bχ^2	df	S-Bχ^2 /df	*p*	RMSEA (CI)	SRMR	CFI	TLI	Δ				
									S-Bχ^2	df	RMSEA	CFI	TLI
S_1-CFA ($n=672$)	143.679	35	4.11	0.00001	0.068 0.057–0.080)	0.037	0.951	0.937					
CFA respecified	92.902	34	2.73	0.00001	0.051 (0.039–0.063)	0.032	0.973	0.965					
Cross-Validation ($n=1127$)													
S_2-CFA ($n=455$)	69.339	34	2.04	0.0003	0.048 (0.031–0.064)	0.035	0.975	0.967					
Configural invariance	162.505	68	2.39	0.00001	0.050 (0.040–0.060)	0.033	0.974	0.965					
Metric invariance	178.247	77	2.62	0.00001	0.048 (0.039–0.058)	0.041	0.972	0.967	−15.742	−9	0.002	0.002	−0.002
Scalar invariance	229.949	86	2.67	0.00001	0.055 (0.046–0.063)	0.048	0.962	0.958	−57.702	−9	−0.007	0.010	0.009
MG-CFA													
By sex ($n=672$)													
Females ($n=387$)	54.212	34	1.59	0.0153	0.039 (0.017–0.058)	0.029	0.985	0.980					
Males ($n=285$)	73.247	34	2.15	0.00001	0.064 (0.044–0.084)	0.046	0.952	0.936					
Configural invariance	126.916	68	1.87	0.00001	0.051 (0.037–0.064)	0.037	0.973	0.964					
Metric invariance	134.173	77	1.74	0.0001	0.047 (0.033–0.060)	0.041	0.974	0.969	−7.257	−9	0.004	−0.001	−0.005
Scalar invariance	180.162	86	2.09	0.00001	0.057 (0.045–0.069)	0.052	0.956	0.954	−45.989	−9	−0.010	0.018	0.015
Partial scalar invariance (item 8)	168.859	85	1.99	0.00001	0.054 (0.042–0.066)	0.050	0.961	0.959	−34.686	−8	−0.007	0.013	0.010
By BMI ($n=656$)													
Normal weight ($n=405$)	69.208	34	2.04	0.0003	0.051 (0.033–0.068)	0.038	0.969	0.959					
Excess weight ($n=251$)	45.992	34	1.35	0.0822	0.037 (0.000–0.063)	0.031	0.988	0.984					
Configural invariance	115.530	68	1.70	0.0003	0.046 (0.031–0.060)	0.035	0.978	0.970					
Metric invariance	123.369	77	1.60	0.0006	0.043 (0.028–0.057)	0.039	0.978	0.974	−7.839	−9	0.003	−0.0001	−0.004
Scalar invariance	146.908	86	1.71	0.00001	0.046(0.033–0.059)	0.044	0.971	0.970	−23.539	−9	−0.003	0.007	0.004
By age ($n=672$)													
Young adolescents ($n=301$)	56.891	34	1.67	0.0082	0.047 (0.024–0.068)	0.044	0.972	0.963					
Late adolescents ($n=371$)	79.943	34	2.35	0.00001	0.060 (0.043–0.078)	0.035	0.971	0.961					
Configural invariance	134.209	68	1.97	0.00001	0.054 (0.040–0.067)	0.039	0.971	0.962					
Metric invariance	156.052	77	2.03	0.00001	0.055 (0.043–0.068)	0.055	0.966	0.960	−21.843	−9	−0.001	0.005	0.002
Scalar invariance	183.260	86	2.13	0.00001	0.058 (0.046–0.070)	0.059	0.958	0.956	−27.208	−9	−0.003	0.008	0.004

S-Bχ^2 Satorra–Bentler' Chi-square; *df* degrees freedom; *p* significance; *RMSEA* Root Mean Square Error of Approximation; *CI* confidence interval; *SRMR* Root Mean Square Residual; *CFI* Comparative Fit Index; *TLI* Tucker Lewis Index; *Δ* incremental value; S_1 sample one; S_2 sample two; *CFA* Confirmatory Factor Analysis, *MG-CFA* Multi-group Confirmatory Factor Analysis

in CFI, RMSEA, and TLI were lower than the cut-points established for metric and scalar invariance, indicating that all items on the BAS-2 operate equivalently across the two samples. Based on these findings, the one-factor structure of the BAS-2 is supported across calibration and validation samples.

Invariance across sex

In Sample 1, we assessed invariance across sex. The configural invariance model showed a good fit to the data across sex. A metric invariance was held for the model, indicating that all items operate equivalently across the two groups (males and females).

Regarding scalar invariance, all items, except #8, were also equivalent across sex. The ΔCFI for the scalar invariance was higher than 0.01, so MI and EPC indices led us to free the intercept for item #8, resulting again in an ΔCFI higher than the critical value of 0.01, which indicates that the BAS-2 was non-invariant across sex (Table 1). The unstandardized intercept for item #8 was 4.214 for males and 4.427 for females.

Invariance across BMI

To evaluate invariance based on BMI, we split our sample into two groups: normal weight and excess weight (including overweight, and obesity). Underweight participants ($n = 16$) were excluded. The model fit was good for the groups, separately. Moreover, the changes between the configural and the constrained models (metric and scalar) were good, indicating that the BAS-2 was invariant across BMI (Table 1).

Invariance across age

To evaluate invariance based on age, we divided our sample into two groups: young adolescents (including early and middle adolescents; 11–16 years old, $n = 301$) and late adolescents (17–19 years old, $n = 371$). The model fit was good for the groups, separately. Also, the changes between the configural and the metric invariances, as well as the one between the scalar invariance and the metric one, indicated that the BAS-2 was invariant across groups (Table 1).

Discriminant validity

The BAS-2 scores were slightly negatively associated ($p = 0.001$) with BMI ($r = -0.21$, and -0.19 for females and males, respectively), and with Drive for Thinness ($r = -0.42$, and -0.31, respectively), while moderately associated with Body Dissatisfaction ($r = -0.61$, and -0.51, respectively).

Convergent validity

For both, females and males, the BAS-2 scores were moderately positively associated ($p = 0.0001$) with Body Physical Condition and Weight Concern ($r = 0.61$, and 0.54, respectively), Physical and Sexual Attractiveness ($r = 0.50$, and 0.44, respectively), and with total scores in the BES ($r = 0.58$, and 0.52, respectively). Additionally, the average variance extracted (AVE) was 0.67.

BMI and age differences

Since the BAS-2 revealed to be invariant across BMI and age groups, we estimated t-tests comparing mean scores by BMI and age. There was a difference in body appreciation ($t\ (457) = 3.83$, $p = 0.0001$) between the normal-weight group ($M = 4.39$, $SD = 0.53$) and the excess-weight group ($M = 4.21$, $SD = 0.63$). The magnitude of such difference (0.18, 95% CI = 0.09–0.28) was small ($d = 0.31$).

Body appreciation was different [$t\ (670) = 3.51$, $p = 0.0001$] between young adolescents group ($M = 4.41$, $SD = 0.55$), and late adolescents group ($M = 4.25$, $SD = 0.58$). Also, the magnitude of the difference (0.15, 95% CI = 0.07–0.24) was small ($d = 0.28$).

Internal consistency

Omega coefficients showed that the 10-item BAS-2 test, displayed good internal consistency for Sample 1 ($\omega = 0.92$, 0.89, and 0.91, for females, males, and total, respectively), Sample 2 ($\omega = 0.92$, 0.88, and 0.90, for females, males, and total, respectively; and for the full sample ($\omega = 0.91$, 0.89, and 0.90, for females, males, and total, respectively).

Temporal stability

The temporal stability analysis showed a Pearson's correlation of 0.82 (0.79 for males and 0.84 for females); ICC values of 0.90 for the total sample ($n = 193$, 95%, CI = 0.86–0.92, $p = 0.0001$), 0.88 for males (95%, CI = 0.82–0.92, $p = 0.0001$), and 0.91 for females (95%, CI = 0.87–0.94, $p = 0.0001$).

Discussion

The aim of the present study was to cross-validate the BAS-2 using an invariance testing strategy. The BAS-2 was translated to Spanish and administered to Mexican adolescents. This new version eliminated issues with item

redundancy, grammar, and idiomatic expressions that the previous translation presented [27].

The BAS-2 had previously been administered in an adolescent population in only a few studies [18, 26, 27], so the present research represents a contribution to understanding the aspects of positive body image in Spanish speaking adolescents. This lack of studies is surprising, considering that adolescence is a critical period in the development of a healthy body image [26].

As we hypothesized, to get a good model fit for the calibration sample, it was necessary to free error covariances between items #2 (I feel good about my body) and #9 (I am comfortable in my body). When analyzing the semantic content of these items, we identified that in the Spanish language, the adjectives good and comfortable have similarities in meaning. Other authors have also pointed out this problem [23, 28]. It is possible that when translating the BAS-2 into different languages, items 2 and 9 have a very similar semantic meaning. Another cause of this covariance may be the presence of an exogenous variable (e.g., internalization of thinness ideal), which could influence our latent variable. In this sense, several authors released the error covariances between item #2 and other items [6, 11, 21–23, 26, 28]. In future studies, the structure of the BAS-2 could be tested by eliminating or rewriting item #2. A third explanation is based on social desirability; however, in our study, the instruments were applied online, thus reducing this effect.

When making post hoc adjustments to a model, based on purely statistical criteria, the risk of bias increases due to random factors. The modification of the model may be due to the specific characteristics of the particular sample, in which the model was tested, thus increasing the risk of making Type I or Type II errors. To address the problems associated with the post hoc fit of the model, the final model was tested on a second independent sample extracted from the same population [30], using an invariance test strategy [32]. The results supported the generalization of the respecified model, which contributes to increasing knowledge about the performance of the scale [31].

We hypothesized that the BAS-2 would be invariant by sex. However, our results did not support this hypothesis, and differ from the findings of previous studies [3, 17, 21, 27, 28]. The partial invariance test indicated differences in the intercepts of item #8, which indicates that the latent variable is not measured by sex in the same way. Tylka and Wood-Barcalow [3] pointed out that this item might be perceived by some cultures as arrogance, and not necessarily as a component of positive body image.

Consistent with our hypothesis, the results supported invariance by BMI, which is consistent with the findings of the only previous study that examined such invariance [26]. This contribution supports the comparison of body appreciation by BMI because the structure of the BAS-2 was similar for both groups in this study.

We found that the BAS-2 was invariant across age, indicating that comparisons across young adolescents and late adolescents groups are both meaningful and valid. For the first time, these results provide evidence of measurement invariance for the BAS-2 by age, indicating that the BAS-2 items are understandable, and that participants had a similar interpretation of the items.

In congruence with our hypothesis, our results provided support for the convergent and divergent validity of the BAS-2. Moreover, the negative correlation between the BAS-2 and body dissatisfaction is in line with the previous studies [10, 11]. The extent of this relationship supports the statement that body appreciation is not merely an issue contrary to body dissatisfaction. In fact, despite being negatively correlated, both could be considered as different concepts. Despite the evidence of convergent validity, we suggest further exploration, by evaluating the relationship between body appreciation and other constructs such as body-related emotions, life satisfaction, and mood in adolescents.

As in previous studies [20], the internal consistency of the scale, measured with the McDonald's Omega coefficient, was excellent for the full sample, and for both men and women. It is important to note that most studies used the Cronbach's Alpha coefficient to assess internal consistency despite the criticism it has received. The McDonald's Omega coefficient does not depend on the number of items and works despite the fact that the equivalence principle is not met, since the factor solution has very different values. Moreover, the Omega coefficient can be estimated with discontinuous variables and utilizes the factorial weight of each item, that is, the sum of the standardized variables, a transformation that makes the calculations more stable, and reflects the right level of reliability.

Comparisons indicated that normal-weight, and young adolescent groups had higher body appreciation than excess-weight [26] and late adolescents groups. Previous studies found similar results [3].

This study has some limitations. First, the sample only represents a sub-group of the population of Mexico, which affects the generalization of results. However, the participants who attend an English class come from different neighboring municipalities in the Campus Ecatepec in México, which probably generated a heterogeneous sample. Future research should aim to recruit participants of different age, gender orientation, as well as different clinical samples and geographic locations to provide further evidence of construct validity. Second, there is a risk in freeing constrains to achieve better fit model. By releasing error covariances between items #2 and #9, and the intercept of item #8 (invariance by sex), the risk of capitalization on chance factors increased [31]. These modifications could derive from the

characteristics of the sample, on which the model was tested. Although, the modification indices, both, for the calibration sample and for the validation sample, suggested us to release error covariances between item #2 and item #9, the risk of making either a Type I or Type II error persists. To address this problem, we evaluated the fitted model, on an independent sample extracted from the same population, using an invariance-testing strategy.

The availability of a validated and cross-validated Mexican version of the BAS-2 for adolescents will promote positive body image study. It could assist researchers in studying psychosocial protective factors associated with positive body image or in working in health promotion programs, with a validated version of an instrument that is the gold standard in the body appreciation field.

What is already known on this subject?

The BAS-2 is a one-dimensional measure of the body appreciation construct, and has been translated and validated in different languages and countries. The scale has convergent and divergent validity, adequate internal consistency (Cronbach's alpha coefficient being frequently used), and temporal stability, in addition to being invariant by sex. The BAS-2 has been translated and validated in Spain with adults and in Latin America with adolescents. Many previous studies have respecified the model initially proposed by Tylka, freeing covariance errors between pairs of items; however, none had cross validated the model. Finally, only one previous study had evaluated invariance by BMI.

What does this study add?

This study provides a translation of the BAS-2, addressing problems with redundant items, grammar, and idiomatic expressions, from two previous translations of the BAS-2 in Spanish. Furthermore, the scale was adapted for Mexican adolescents.

With MG-CFA, we evaluated the model and found that it is generalizable to a new sample of Mexican adolescents. In addition, we found invariance by sample, BMI, and age, which provides new evidence of construct validity for the BAS-2.

Compliance with ethical standards

Conflict of interest The authors declare that there are no conflicts of interest.

Ethical approval The Research Department of the Autonomous University of the State of Mexico approved this study.

Informed consent Informed consent was provided by all participants in the study.

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