

Validation of the Family Health Behavior Scale for the Brazilian Population

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Abstract

Background: It is well known that the family environment is associated with child health behavior and outcomes. However, there is a lack of available instruments to measure family health behaviors, even more so in languages other than English. The aim of the present study was to adapt and validate the Family Health Behavior Scale (FHBS) for Brazilian families.

Methods: The FHBS was translated and culturally adapted for the Brazilian families. Psychometric properties (content validity, construct validity, and concurrent validity) and reliability (internal consistency, ceiling-floor effect, and test-retest) were evaluated in a sample of healthy community-dwelling children who were between 5 to 12 years old, of both sexes. Caregivers responded to the FHBS. Concurrent validity was assessed by comparing the FHBS scale with Body Mass Index (BMI) percentile, percent body fat, and physical activity level.

Results: 272 children (54% girls) with a mean age of 7.9 years ($SD = 2.0$) and their caregivers were tested. Confirmatory analysis of the initial 4-factor structure (as proposed in the original English version of the questionnaire) suggested its performance was below acceptable. Exploratory factor analysis showed however an acceptable fit (Kaiser-Meyer-Olkin index = 0.79), and the factor loadings suggested a 7-factor model. Children who were considered obese ($BMI \text{ percentile} \geq 97$) had lower mean total FHBS scores than children who had a healthy weight or were overweight. Children who were classified as having a healthy fat percentage had higher FHBS scores than children classified as having an excessively high fat percentage. Children who were physically active had significantly higher total FHBS scores than children who were physically inactive. Cronbach's alpha was 0.81 and we noted acceptable values of the ceiling-floor effect. Test-retest analyses showed lower agreement and intraclass correlation coefficients than expected 0.63 (95% CI 0.41 to 0.78).

Conclusion: The adapted Family Health Behavior Scale for the Brazilian population showed adequate psychometric properties.

Background

The prevalence of childhood obesity has increased considerably in recent years and has become a public health problem worldwide (1–3). The main cause of obesity is the result of a positive energy balance (4) with social, behavioral, and environmental determinants (5, 6). In children and adolescents, obesity is associated with high blood pressure and abnormal fasting glucose, dyslipidemia, obstructive sleep apnea, depression, and low quality of life in general. (7–9). In addition to chronic health diseases, obesity can result in increased mortality among adults (10, 11).

Environmental factors contribute considerably to an obesogenic lifestyle such as the ingestion of high-energy-density foods and a sedentary lifestyle. One of the foundations of childhood obesity prevention is considering the contribution of family behavior to development of obesity. Parents who have healthy lifestyles help to facilitate their children's adoption of healthy habits by encouraging family mealtime

routines, creating access to a healthy food environment, and supporting healthy physical activity and screen time habits (12). On the other hand, parents with fewer routines and more sedentary lifestyles may negatively influence their children's healthy habits, thereby contributing to the development of an unhealthy weight status (5, 13, 14).

Although a number of instruments have been developed to assess family health behavior, available instruments often focus on family health and wellbeing (15–18). Other relevant instruments measure dietary quality by assessing the frequency of consumption of certain food groups (19–21); or focus on child physical activity habits (22). Comprehensive questionnaires targeting all the preceding domains are limited.

The Family Health Behavior Scale (FHBS) is one of the very few comprehensive scales available and that addresses concomitantly children's dietary habits, physical activity and parenting practices. Development of the Family Health Behavior Scale (FHBS) was guided by Social Learning Theory which proposes that the development of eating and physical activity habits in children results from observing others (e.g., parents) and the reinforcement of those behaviors through interactions with their environment (e.g., parenting practices) (23, 24). Parenting practices are specific strategies or behaviors through which parents influence the health behaviors of their children and includes practices such as modeling of behavior, providing access to food, facilitating physical activity, and development of meal patterns and acceptable meal time behavior (25). Child factors such as temperament and genetics may influence the reinforcement of these behaviors, highlighting the bidirectional nature of the relationship, such that both the child and the parent influence the development of the child's eating and physical activity habits (26). However, few measures have been developed to simultaneously measure both child and parent behaviors related to children's obesity prevention.

The FHBS consists of 27 items and includes the subscales to assess parental behavior, meal routines, physical activity, and children's behavior. The measure was originally created and validated in English in the United States (US) (14) and later translated to Spanish and validated in Spain (27). The English and Spanish version of the questionnaire have good psychometric properties. The aim of the present study is to validate the Family Health Behavior Scale in Portuguese for use in Brazil.

Methods

Study design and population

This is a cross-sectional study. Caregivers and their healthy community-dwelling children aged 5 to 12 years, of both sexes, were invited to participate in the study. Children were considered healthy if they had not been diagnosed with any chronic disease and were not on continuous medication. This study took place in public and private schools and sports centers in cities in southern Brazil. Participants were recruited via an invitation with an attached consent form, sent home to parents of students attending local schools and sports centers or by face-to-face verbal invitation. This study was approved by the

ethics committee of the Pontifícia Universidade Católica do Rio Grande do Sul – PUC/RS (CAAE: 81021317.9.0000.5336) and all children and their parents formally agreed to participate in the study. All parents provided informed consent and children assent form.

Sample size

The sample size was calculated *a-priori* using a 10:1 ratio (i.e., 10 participants for each item on the scale ($n = 27$), resulting in a sample of 270 participants (28).

Data Measures

Family Health Behavior Scale (FHBS)

Caregivers were interviewed by trained professionals. The original version of the FHBS includes 27 items covering four domains: assess parental behavior, meal routines, physical activity, and children's behavior. The answer categories range from 0 to 4, with 0 = almost never and 4 = almost always. Seven items on the scale (3, 5, 7, 10, 14, 16, 17) had their response categories reversed so that all items to measure the latent trait were in the same direction. The latent trait estimator is the Total Score, which consists of the sum of the responses of each respondent to all 27 items on the scale. The Total Score has a minimum score of zero and a maximum score of 108 points (14). A higher score reflects more healthy behaviors in the family.

Sociodemographic variables

Sociodemographic variables were obtained by structured interviews and included age (years), sex (male and female), and self-reported skin color (categorized into white, black, and others – brown and yellow). Brown and yellow were grouped together to homogenize the size of the categories.

Physical activity

To assess the children's level of physical activity, caregivers answered a question regarding time spent daily on moderate- to vigorous-intensity physical activity. Participants were classified as inactive or active according to the level of physical activity. The cut-off point to be considered active was 60 minutes per daily or 420 min of moderate to vigorous physical activity (MVPA) per week, as suggested by the World Health Organization (29).

Children's anthropometric and Bioelectrical impedance analysis (BIA) measurements

Body mass was measured with the participant in the standing position, with light clothing and no shoes, using a calibrated digital scale (Charder MS6121). Height was measured with the participant standing barefoot with parallel feet and heels together, arms along the body, and head in the Frankfurt plane, using a Sanny compact stadiometer and a tape measure to the nearest 0.1 cm (American Medical do Brasil Ltda, São Bernardo do Campo, SP, Brazil). BMI was calculated by dividing weight (kg) per height square

(m²), with the percentiles classified as underweight (< 5), healthy weight (> 5 and < 85), overweight (> 85 < 97), and obesity (≥ 97) according to the WHO BMI classification for children (30). Bioelectrical impedance analysis Multi-Frequency InBodyS10 (Ottoboni, Rio de Janeiro, RJ, Brazil) was used to assess fat percentage. The hand electrodes were attached to the thumb and middle finger of each hand, while the foot electrodes were positioned between the ankle bone and the heel, covering as much area as possible. BIA was performed with the participant in a standing position on a nonconductive surface, with legs apart and arms held away from the body and with light clothing, and no metal jewelry. Standard guidelines were followed for participants' instructions before bioimpedance (31) All measurements were performed by one of four experienced researchers according to the manufacturer's instructions using a trained standardized technique. The percentage of body fat was classified with the percentiles and following cut-off points: low with the percentiles classified as low (< 5), healthy (≥ 5 and < 85), high (≥ 85 < 97), and excessively high (≥ 97) (32).

Validation

The validation of the FHBS into Brazilian Portuguese was carried out in two phases, following the criteria proposed by the International Test Commission (33).

Phase 1 - Translation

This phase was done in the following steps: (i) translation by two English – Brazilian Portuguese translators; (ii) harmonization between both Portuguese versions, resulting in a single version in Portuguese; (iii) back-translation of the harmonized version by two Brazilian Portuguese-English translators; (iv) harmonization between both translators, resulting in a single English version; and (v) general harmonization, where the versions resulting from the first and second harmonization were discussed by the four translators, to obtain a consensus version (33).

Phase 2 - Field validation (testing psychometric properties)

Content validity

After the scale was translated, the process of cultural adaptation began. To this end, the consensus version (see phase 1) of the scale was evaluated in relation to content by judges with clinical experience in the studied latent trait. Twenty professionals participated in this stage, with five professionals from each of the following areas: psychology, medicine, nutrition, and physical education. The procedure to determine content validity was as follows: First, to improve cultural adaptation of the translated terms, a qualitative evaluation was performed. Next, the Content Validity Index (CVI) was determined by evaluating the following characteristics of the translated scale: language clarity, practical relevance, and theoretical dimension (34–36). A 5-point Likert-type scale was used to perform the quantitative evaluation varying from 1 = strongly disagree; 2 = partially disagree; 3 = Indifferent 4 = partially agree; and 5 = totally agree.

Each item received a score by summing ratings with a score of 3 or higher and dividing by the total number of ratings (37, 38). Ratings of “1” or “2” were reviewed or eliminated. Individual items had to obtain a score greater than 0.78 in order to be retained (39, 40). The scale was also evaluated in relation to its content by means of a pilot study conducted in 10 families.

Construct validity

Construct validity was determined using exploratory factor and confirmatory factor analyses.

Confirmatory factor analysis (CFA) was used to confirm the initial four domains as determined in the original FHBS version (14). We complemented the CFA with an exploratory factor analyses to further examine the structure of our FHBS version.

CFA. The quality of the 4-factor structure determined by CFA was verified through the following measures: χ^2 (Model Chi-Square), Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Squared Residual (SRMR), Normed-Fit Index (NFI), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and Bollen Non-normed Index (IFI). The following cutoff points for an acceptable scale adjustment were used: χ^2 $p > 0.05$, GFI > 0.90 , RMSEA < 0.08 , SRMSR: < 0.10 , NFI ≥ 0.90 , CFI > 0.90 , TLI > 0.95 , IFI $s > 0.90$ (34–37, 41–43).

Exploratory factor analyses

The Promax rotation method and the Kaiser measure were used to assess the adequacy of the sample to a latent factorial structure.

Concurrent validity

Concurrent validity was assessed by comparing the FHBS scale with the following variables: percentile classification of the BMI, the percentage of body fat measured using bioimpedance, and the level of physical activity. Concurrent validity for the comparison between the means of the FHBS score and BMI, percentage of body fat, and physical activity classification were tested using ANOVA's with Tukey's post-hoc tests. According to the theoretical reference, it was expected that the means of the total FHBS score would be highest among individuals who were classified as having a healthy BMI and body fat percentage, and who were classified as physically active according to their physical activity level.

Reliability

Reliability was assessed with Cronbach's α coefficient (α -C), the Spearman-Brown coefficient, the ceiling-floor effect, and test-retest reliability analysis. The Spearman-Brown coefficient was analyzed by the split-half method. For this method, we took the following strategies: First, the items were randomly divided into two equal halves. A scale mean was computed for each half, and then the two sets of scale means were correlated to estimate a split-half correlation. The split-half correlation was adjusted by the Spearman-Brown prophecy formula to create a split-half reliability. This procedure was repeated 1000 times and the

mean of the split-half correlations was returned as the best estimate of the reliability of a single item. Meanwhile, the mean of the split-half reliabilities was returned as the best estimate of the reliability of the composite of all items (44, 45). The floor effect was determined by the percentage of the population that had the lowest score, and the ceiling effect would be the margin of the population that with highest score. Test-retest was assessed by the intraclass correlation (ICC) and the graphical approach of Bland–Altman to verify the agreement between the test-retest. We considered a deviation of up to 20% in the 95% Limits of Agreement (LOA) clinically acceptable (relative bias within $1.96 \times$ standard deviation).

Cut-offs for Cronbach's α coefficient, intraclass correlation, the ceiling-floor effect, and the Spearman-Brown coefficient were, respectively: ≥ 0.7 (46), 25% (47), $ICC \geq 0.7$ (48), and 0.3 (49)

Continuous variables were described by means and standard deviations, or medians and interquartile ranges, according to the symmetry of the variables and categorical variables, by the absolute and relative frequency. Means of the total score of the questionnaire and the specific domains was calculated.

The data were analyzed using the statistical software SAS, version 9.4, Lavann packages, version 0.6-5, and Multicon, version 1.6 of R. p was set at 0.05 as statistical threshold for significance.

Results

In total, 295 children were eligible to participate in the study. However, 23 of the caregivers did not answer the questionnaire. Thus, our sample consisted of 272 children, with a mean age of 7.9 ± 2.0 years, with 147 (54%) girls. Regarding skin color, 203 individuals (76%) reported to be white, 26 individuals indicated to be (10%) black, and 39 (14%) indicated another skin color. The median monthly household income was US\$800 (IQR25-75 400–2000). The total mean FHBS score was 72.3 ($SD = 12.6$). According to BMI percentiles, most of the children were classified as having a healthy weight, 143 children (55%) were classified as having a healthy body fat percentage and 68 children (25%) had an excessively high percentage of body fat. Regarding physical activity, 156 children (57%) were considered inactive (Table 1). Table 1 also presents the characteristics of the participants included in the validation studies carried out in the United States and Spain.

Table 1
Characteristics of the American, Spanish, and Brazilian sample.

	US	Spain	Brazil
Sample size	310	360	272
Age, years, mean (SD)	8.7 (2.3)		7.9 (2.0)
Sex, girls, n (%)	158 (51)	160 (44)	147 (54)
Skin color, n (%)			
White			203 (76)
Black			26 (10)
Others (brown and yellow)			39 (14)
Household income US\$, median (IR 25–75)			800 (400–2000)
Weight classification n (%)			
Underweight	23(7.3)	32(8.9)	
Healthy weight	167(54.0)	231(64.3)	143(55)
Overweight	57(18.3)	47(13.0)	63 (24)
Obese	63(20.3)	50(13.8)	54 (21)
Percentage of fat (BIA) n (%)			
Low			23 (8)
Healthy			123(45)
High			26(10)
Excessively high			68(25)
Physical Activity n (%)			
Inactive			156 (57)
IR25-75: Interquartile range, SD: standard deviation			
BIA = Bioelectrical impedance analysis, US = United States			

Content validity

Regarding content validity, our study indicated that CVI values were adequate (0.98). Analyzing each item on the scale separately, the twenty professionals indicated that they totally agreed with the clarity of language, 15/20 (75%); the practical relevance, 16/20 (80%); the theoretical relevance, 19/20 (95%); and the theoretical dimension, 17/20 (85%).

Construct validity

For the CFA, results for the verification of the theoretical factorial structure (four factors) were: χ^2 : $p < 0.0001$, RMSEA = 0.084 (90% CI 0.077 to 0.091), SRMR = 0.101, GFI = 0.781, NFI = 0.591, CFI = 0.696, TLI = 0.664, and IFI = 0.702. According to the RMSEA (0.084, 95% CI 0.075 to 0.092) and SRMR (0.100) adjustment indexes, the factorial structure had a marginally acceptable fit in the present study.

The exploratory factor analysis with seven items showed a good fit of the sample to a latent factorial structure according to the resulting value for the Kaiser measure ($KMO = 0.788$). The items that we did not consider appropriate for factorial load, or that had a similar factorial load on multiple factors were moved to a factor that made most theoretical and clinical sense. The factorial loadings of the latent factor structure are shown in Table 2.

Table 2
Exploratory Factor analysis with ProMax rotation factor loading for the FHBS.

Items	Factors						
	I	II	III	IV	V	VI	VII
I. Parent Feeding Practices							
4. My child is assisted with making health food choices	0.352						
18. I make low calorie, low fat foods when cooking for my family.	0.802						
19. I offer my child a healthy alternative when he/she asks for junk food	0.707						
20. I eat low calorie, low fat foods.	0.694						
21. I keep unhealthy food out of sight of my child.	0.269						
22. I choose low calorie healthy options at fast food or at restaurants.	0.302						
26. I teach my child about healthy food choices	0.647						
II. Parental Modeling of Physical Activity							
6. My child participates in physical activities with parents/caregivers.	0.84						
24. I workout, exercise, or participate in physical activity	0.532						
27. I participate in physical activity with my child.	0.803						
III. Mealtime routines- at table							
9. My child eats meals at the table.	0.704						
12. My child eats meals at a routine time.	0.203						
13. My child stays seated at the table.	0.781						
IV. Child- Eating Patterns							
1. My child eats breakfast daily.	0.427						

Items	Factors
5. My child eats frequently throughout the day.	-0.38
15. My child eats three meals a day.	0.620
16. My child eats when he/she feels sad, mad, or nervous.	0.223
V. Child Access to Food	
7. My child frequently asks for unhealthy snacks.	0.499
10. My child is offered unhealthy foods by other family members.	0.599
14. My child sneaks food.	0.329
17. My child is influenced to eat unhealthy foods by other kids.	0.539
VI. Child Physical Activity Behaviors	
2. My child participates in sports (swimming, football, gymnastics, dance, etc.)	0.452
3. My child prefers indoor activities over outdoor activities.	0.538
8. My child is physically active for at least 30 minutes daily.	0.433
11. My child plays outside.	0.589
VII. Fruit and Vegetable Parenting Practices	
23. I eat vegetable.	0.437
25. I serve fresh fruits and vegetables.	0.557
Eigenvalue	5.66 1.66 1.28 0.89 0.74 0.66 0.55
Proportion	0.51 0.15 0.11 0.08 0.06 0.06 0.05

The factor structure suggested in the exploratory factorial analysis was composed of a seven-factor model, as described below. In accordance with the new factor structure which resulted in more nuanced factors, the subscales were renamed to better represent the latent constructs.

Parent Feeding Practices Factor (I): initially composed of nine of the following items: 2, 4, 12, 18, 19, 20, 21, 22, 26. With item 2, "My child participates in sports (swimming, football, gymnastics, dance, etc.)," the

factorial load was similar to that of factor 6. However, from the theoretical point of view, this item is considered to be more appropriate for inclusion in factor 6. Similarly, item 12, "My child eats meals at a routine time," loaded similarly on factor I and III, but from a theoretical perspective, this item is however more appropriate for factor III.

Parental Modeling of Physical Activity Factor (II): initially composed of items 6, 24, and 27.

Mealtimes Routines at the Table Factor (III): composed of items 9 and 13.

Child-Meal Patterns Factor (IV): composed of items 1, 5, 14, and 15. For item 14, "My child sneaks had food," the factorial loading was equal to the loading on factor V and was more suitable for inclusion in factor 5 from the theoretical point of view.

Child Access to Food Factor (V): composed of items 7, 10, and 17.

Child Physical Activity Behaviors Factor (VI): composed of items 3, 8, and 11.

Fruit and Vegetable Parenting Practices Factor (VII): initially composed of items 16, 23, 25, and 1. Item 16, "My child eats when he feels bored, sad, angry or nervous," had the second-highest load on factor IV, becoming more adequate on this factor according to the theoretical point of view. The final 7-factor structure yielded accounting for 100% of the explained variance (Table 2)

Concurrent validity

The comparison of means of the FHBS Total Score in relation to the BMI percentile categories revealed a significant difference for at least one of the three means ($p = 0.01$, $F = 4.64$, $DF = 2$, effect size (Partial Eta-Square) = 0.0417). The follow-up Tukey test identified that the mean Total Score of individuals that were classified as obese (67.0 ± 15.9 SD) had significantly lower FHBS scores than individuals who were in the healthy weight (73.6 ± 10.9 SD) and overweight categories (73.6 ± 12.4 SD).

The results of the comparison of the mean FHBS scores between fat percentage categories revealed a main effect of category ($p = 0.02$, $F = 3.23$, $df = 3$, effect size (Partial Eta-Square) = 0.0478). Follow-up Tukey tests revealed that children categorized as having normal percentage of body fat group had higher FHBS scores than children who were in the excessively high body fat percentage group (74.18 ± 11.4 SD vs. 68.3 ± 14.1 SD).

The mean total FHBS score of the group classified as physically active (75.2 ± 11.4 SD) was significantly higher than the mean total score of the group classified as inactive (70.7 ± 13.7 SD) ($p = 0.003$, $F = 8.57$, $df = 1$, effect size (Partial Eta-Square) = 0.0388)

Reliability

The Cronbach's alpha coefficients showed adequate internal consistency for the FHBS total scale ($\alpha = 0.80$) and values per domain range from 0.45 for the domain Child Behaviors to 0.80 for the domain

parents Behaviors (Table 3). Table 3 also presents Cronbach's alpha coefficients of US and Spain validation study.

However, the 7-factor structure, values per domain range from 0.008 for the domain child- eating patterns to 0.756 for the parent feeding practices domain.

When the item "My child eats frequently throughout the day" was excluded, the value of the Cronbach's alpha coefficients increased to $\alpha = 0.820$. None of the domains showed > 25% floor and ceiling effects.

The best estimate of the Spearman-Brown coefficient was 0.8105 (0.09 SD).

Forty-eight caregivers (19%) completed the questionnaire for a second time two weeks after initial administration. The test-retest reliability intraclass correlation coefficient was 0.626 (95% CI: 0.406–0.777).

Table 3

Cronbach's alpha US, Spain and Brazil

Scale Domain	US	Spain	Brazil
Parent Behaviors	0.85	0.76	0.80
Physical Activity	0.75	0.61	0.68
Mealtimes Routines	0.77	0.45	0.64
Child Behaviors	0.74	0.68	0.45
Total	0.83	0.74	0.80

Figure 1 showed the Bland-Altman graph of agreement with the mean difference and the 95% agreement limits of the test and retest. The average bias was -0.840, with the lower and upper limits of -22.76 to 21.07, respectively.

Discussion

The Family Health Behavior Scale, adapted for the Brazilian population, showed adequate psychometric properties when examining the factorial structure with seven factors.

The good psychometric performance of our version may stem from that the questions were easily understood. Also, the adjustments suggested by professionals working in areas related to family health behavior in the same way and by the following target audience could have contributed positively to the

quality of the measure. The CVI analysis suggested that the professionals considered the final version of the scale adequate for the evaluation of family behavior and health.

The validation processes performed in the US (original scale) (14) and Spain (27) suggested that the scale was composed of the following factors: parental behavior, physical activity, meal routine, and childhood behaviors. However, in our study, we proposed seven factors: Parent Feeding Practices; Parental Modeling of Physical Activity; Mealtime routines- at table; Child- Eating Patterns; Child Access to Food; Child Physical Activity Behaviors; Fruit and Vegetable Parenting Practices. The original scale also initially considered the factorial inclusion of five and six factors, but according to the authors' report, the structure with only four was forced (14).

Most items remained in the factors as in the original study. The items for which the analysis suggested different domains were as follows: Item 12, "My child follows a feeding routine," which had to be replaced by another factor, perhaps due to a lack of understanding of what "routine" meant, i.e., if there was a routine in terms of the children's mealtimes. Likewise, Item 14, "My son hides food," for which a possible reason could be, as above, the lack of understanding of this question among the participants who answered the scale, and Item 16, "My child eats when he/she feels bored, sad, angry or nervous," suggesting that this issue may not be relevant or well understood in our population. In addition, it is worth noting that this validity is subjective and that it is up to each professional to evaluate the content of each item (34, 39, 50).

With regard to concurrent validity, higher total scores on the questionnaire were associated having a BMI classified as healthy weight, having a healthy body fat percentage, and with meeting physical activity guidelines for 60 minute of physical activity per day. These results suggest that the scale score in the evaluation of family health behaviors is associated with factors related to nutritional status and expected physical activity. In the validation studies of the scale in the USA (14) and Spain (27), the concurrent validity with regard to BMI was similar as in our study. Additionally, the current study provided complementary evidence for good concurrent validity by showing additional associations between FHBS scores and body fat percentage and physical activity level.

Regarding reliability, Cronbach's alpha values of the total score of our study were considered adequate (46), as they were in the original (14) and Spanish (27) versions. The domains of mealtime routines and child behaviors had insufficient internal consistency, as they did in the validation study in Spain, suggesting the need to evaluate some items in these domains. (27) Cronbach's alpha increased in the total score when we excluded the question "My child eats frequently throughout the day". The preceding may be due to parents having difficulty conceptualizing the frequency of meals. The domain child-eating patterns had low Cronbach's alpha suggesting that this subscale or some of its items could be excluded. The ceiling-floor effect was also adequate, showing that there was no such effect in the scales answered. In relation to the test-retest reliability, our results showed reasonable performance, but test-retest reliability for some scales was lower than expected. In the literature, there is a divergence between the time that should be allotted between the applications of questionnaires between different authors (50, 51). A

correlation between the test and the retest progressively decreases as the interval between applications increases (52). On the other hand, if the interval between the test-retest is very short, the result may be influenced by a learning effect, that is, the participant's performance on the scale may benefit in the retest due to his memory, as the test had been very recent (52).

The present study is not without limitations. Due to sample size, we did not evaluate the theory of response to the item. However, even if the scale demonstrated a good performance overall, after the evaluation of the psychometric properties was performed it was possible to identify limitations of some items. Another limitation is that all participants were recruited in Rio Grande do Sul and we do not include participants from other regions of Brazil. However, we included individuals of different socioeconomic levels to obtain a greater representation of the Brazilian population.

A strength of the study is that we followed the suggestions of the study of Spanish validation (27) and employed previously trained health professionals to collect anthropometric data. In addition to measures of weight and height, and unlike previous validation studies, our study used the bioimpedance test to evaluate body fat percentage.

Conclusion

The Family Health Behavior Scale adapted for the Brazilian population showed evidence of adequate psychometric performance. the FHBS seems to be a promising tool to evaluate family health behaviors related to the prevention of child obesity. Replication in independent samples is needed to further test the generalizability of the seven factors.

Declarations

Ethics approval and consent to participate:

The study was approved by the Ethics Committee of the Pontifícia Universidade Católica do Rio Grande do Sul, Brazil, under approval number 2.476.056.

Consent for publication:

For child participants, consent was obtained from their parents or guardians. An assent form was read and explained to the children/adolescents, and their signature was then collected.

Availability of data and materials:

none

Competing interests:

None declared.

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Authors' contributions:

LTP: study design, acquisition, interpretation of data, drafting and critical revision of manuscript; CHS: acquisition of data, drafting and critical revision of manuscript; LLGL: acquisition of data, drafting and critical revision of manuscript; CS: acquisition of data, drafting and critical revision of manuscript; PM: acquisition of data, drafting and critical revision of manuscript; SMJC: analysis of data, drafting and critical revision of manuscript; MRS: drafting and critical revision of manuscript; JPM: drafting and critical revision of manuscript; LB: drafting and critical revision of manuscript; RM: study conception and design, acquisition, analysis, and interpretation of data, drafting and critical revision of manuscript.

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Figures

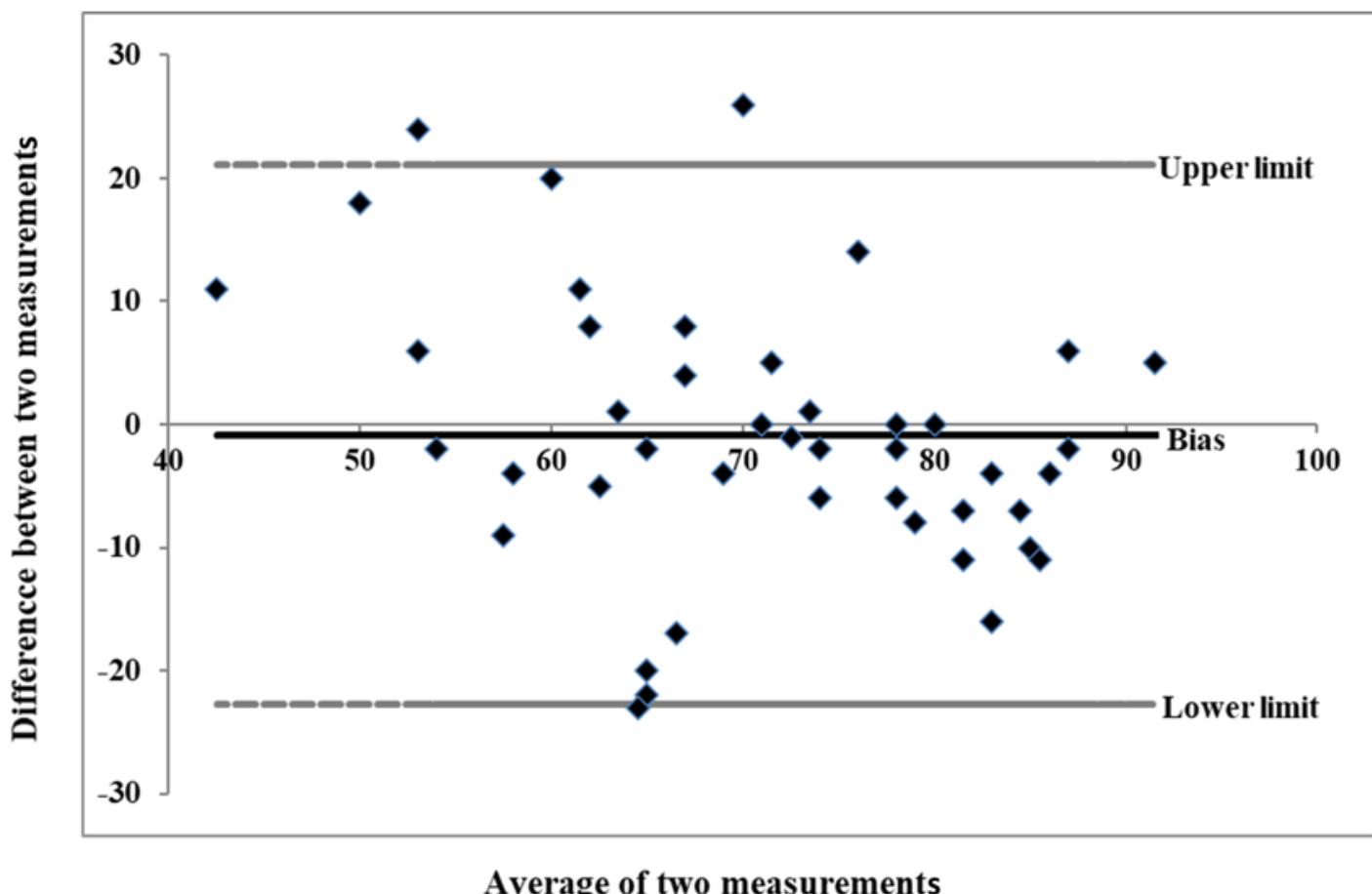


Figure 1

Bland-Altman plot of agreement with the mean difference and the 95% agreement limits of the test and retest.