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Psychometric properties of the Brazilian version of the Food Choice Questionnaire for Adolescents (FCQ-A-BR)

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Abstract

Background

Understanding the determinants of food choices in adolescence is essential for developing effective public health strategies. The Food Choice Questionnaire for Adolescents (FCQ-A) has been adapted in Spain, for different cultural contexts; however, evidence for its use in Brazil remains limited. This study aimed to evaluate the psychometric properties of the Brazilian version of the FCQ-A (FCQ-A-BR).

Methods

A psychometric study was conducted with 504 adolescents aged 14–19 years enrolled in public schools in a Brazilian city. Confirmatory Factor Analysis (CFA) was performed to assess structural validity. Convergent and discriminant validity were evaluated using Average Variance Extracted (AVE) and the Fornell–Larcker criterion. Internal consistency was assessed using Cronbach's alpha and composite reliability. Test–retest reliability was examined in a subsample (n = 51) using the Intraclass Correlation Coefficient (ICC), Wilcoxon signed-rank test, and Bland–Altman analysis.

Results

The six-factor model demonstrated excellent fit (CFI = 0.97; TLI = 0.96; RMSEA = 0.04; $\chi^2/df = 1.74$). Factor loadings were satisfactory across all items (> 0.50). AVE values exceeded 0.50, and discriminant validity was supported. Internal consistency ranged from 0.75 to 0.83. Test–retest reliability showed good to excellent stability (ICC = 0.73–0.85), with no significant differences between measurements ($p > 0.05$). Bland–Altman analysis indicated good agreement with no evidence of systematic bias.

Conclusions

The FCQ-A-BR demonstrated satisfactory validity and reliability, supporting its use in epidemiological and public health studies involving Brazilian adolescents. The instrument may contribute to a better understanding of food choice determinants and inform interventions targeting adolescent nutrition.

BACKGROUND

Dietary patterns among Brazilian adolescents have been increasingly characterized by a high consumption of ultra-processed foods, which are typically rich in sugars, saturated fats, and additives, and low in essential nutrients such as fiber, vitamins, and minerals [1–3]. This shift has been accompanied by insufficient intake of fruits and vegetables and a decline in overall diet quality over time [3]. Such patterns represent a major public health concern due to their association with obesity and the early onset of noncommunicable diseases (NCDs) [4].

Food choice is a multidimensional process shaped by the interaction of biological, psychological, and social factors [5]. During adolescence, this process becomes particularly dynamic, as individuals experience increasing autonomy, identity formation, and greater exposure to diverse food environments [6]. These changes are accompanied by behavioral characteristics such as preference for convenience, sensitivity to sensory attributes, and susceptibility to social influences, all of which may contribute to unhealthy dietary patterns [7, 8]. Understanding the determinants underlying food choices in this population is therefore essential for informing effective public health strategies.

The assessment of food choice motives requires valid and reliable instruments capable of capturing the multidimensional nature of this behavior. The Food Choice Questionnaire (FCQ), originally developed for adults [9], has been adapted for adolescents to better reflect age-specific characteristics [10]. Previous study have supported its applicability; however, evidence from low- and middle-income countries remains scarce. In Brazil, although a cross-cultural adaptation of the FCQ-A has been conducted [11], its psychometric properties have not yet been comprehensively evaluated in adolescent populations.

Given the importance of culturally appropriate and psychometrically robust tools, this study aimed to evaluate the structural validity and reliability of the Brazilian version of the Food Choice Questionnaire for Adolescents (FCQ-A-BR).

METHODS

Study design

This psychometric study evaluated the measurement properties of the FCQ-A-BR in accordance with COSMIN guidelines [12].

Participants and data collection

Participants were adolescents aged 14–19 years enrolled in public schools in Juiz de Fora, Brazil. Public schools were deliberately selected to ensure inclusion of a population highly exposed to the nutrition transition and obesogenic environments in Brazil, representing a key demographic for public health interventions. Data were collected using a self-administered questionnaire in the school setting. Further methodological details have been described elsewhere [13].

The sample size (n = 504) followed recommended criteria for factor analysis (≥ 10 participants per item).

Instrument

The FCQ-A-BR includes 22 items distributed across six factors: natural and healthy, price, sensory characteristics, weight control, ethical concern, and familiarity. Responses are rated on a 4-point Likert scale ranging from 1 (“not important”) to 4 (“very important”).

Statistical analysis

Structural validity

CFA was conducted to test the six-factor model. Model fit was evaluated using χ^2/df, CFI, TLI, and RMSEA. Acceptable thresholds were: $\chi^2/df < 3.0$, CFI and TLI ≥ 0.90, and RMSEA ≤ 0.05 [14, 15].

Maximum Likelihood estimation was used, supported by the large sample size and approximate normality of the data [14, 16]. Skewness (± 2) and kurtosis (± 7) were used to assess univariate normality [16].

Although Maximum Likelihood (ML) estimation was employed due to its robustness in large samples [14, 16], a sensitivity analysis was conducted using the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimator. The WLSMV is specifically designed for categorical and ordinal data, such as Likert scales, as it does not assume multivariate normality [14]. Given the ordinal nature of the 4-point Likert scale, consistency between estimators was examined to ensure the stability of the factor structure.

Convergent and discriminant validity

Convergent validity was assessed using AVE (≥ 0.50) and factor loadings (≥ 0.50). Discriminant validity was evaluated using the Fornell–Larcker criterion [17].

Reliability

Internal consistency was assessed using Cronbach's alpha and composite reliability (≥ 0.70) [15]. Test–retest reliability was evaluated in a subsample (n = 51) after 14 days using ICC (≥ 0.70) [15]. Agreement was assessed using the Wilcoxon signed-rank test and Bland–Altman analysis [18].

Ethical considerations

The study was approved by the Research Ethics Committee (CAEE: 68601617.1.0000.5147). Written informed consent and adolescent assent were obtained.

RESULTS

Factor structure analysis

The sample comprised 504 adolescents (56.5% female; mean age 16.16 ± 1.24 years).

The Confirmatory Factor Analysis (CFA) demonstrated an excellent fit of the proposed six-factor model (CFI = 0.97; TLI = 0.96; RMSEA = 0.04), supporting the structural validity of the FCQ-A-BR. All items

showed satisfactory factor loadings (> 0.50), indicating that they are adequate indicators of their respective latent constructs.

Convergent validity was supported, as all factors showed AVE values above the recommended threshold, while discriminant validity was confirmed, indicating that the constructs are empirically distinct. Correlations between factors ranged from negligible to moderate levels, suggesting conceptual relatedness without compromising discriminant validity.

Skewness and kurtosis values were within acceptable limits, indicating no severe deviations from normality.

Detailed results of the factor structure, including standardized loadings and validity indicators, are presented in Tables 1 and 2.

Table 1
Factor loadings and model fit indexes of the Food Choice Questionnaire for Brazilian Adolescents (FCQ-A-BR) (n = 504).

Items		
Portuguese	**English**	**λ**
Factor 1		
1. Seja nutritiva.	1. Be nutritious.	0.79
2. Contenha muitas vitaminas e minerais.	2. Contain many vitamins and minerals.	0.81
3. Tenha um alto conteúdo de proteínas.	3. Have high protein content.	0.79
4. Seja saudável.	4. Be healthy.	0.72
5. Tenha um alto conteúdo de fibras.	5. Have high fiber content.	0.78
6. Contenha ingredientes naturais.	6. Contain natural ingredients.	0.68
7. Não contenha ingredientes artificiais.	7. Not contain artificial ingredients.	0.54
Factor 2		
8. Seja barata.	8. Be cheap.	0.81
9. Não seja cara.	9. Not be expensive.	0.86
10. Tenha uma boa relação qualidade-preço.	10. Have a good value for money.	0.85
Factor 3		
11. Tenha um sabor agradável.	11. Have a pleasant taste.	0.68
12. Tenha uma textura agradável na boca.	12. Have a pleasant texture in the mouth.	0.81
13. Tenha um cheiro agradável.	13. Have a pleasant smell.	0.88
14. Tenha uma aparência agradável.	14. Have a pleasant appearance.	0.77
Factor 4		
15. Tenha pouca gordura.	15. Be low in fat.	0.82
16. Tenha poucas calorias.	16. Be low in calories.	0.88
17. Ajude a controlar o meu peso.	17. Help to control my weight.	0.83
Factor 5		
18. Informe na sua embalagem o país onde foi fabricada.	18. Inform country of production on its packaging.	0.86

Items		
Portuguese	**English**	**λ**
Factor 1		
19. Esteja embalada respeitando o meio ambiente.	19. Be in environmentally friendly packaging.	0.84
Factor 6		
20. Seja como eu comia quando era criança.	20. Be similar to what I ate as a child.	0.75
21. Seja o que eu como normalmente.	21. Be what I usually eat.	0.81
22. Seja conhecida.	22. Be known.	0.75
CFI		0.97
TLI		0.96
χ^2/df		1.74
RMSEA (CI 95%)		0.04 (0.03–0.05)
CFA: Confirmatory Factor Analysis		
λ: factor loading		
CFI: *Comparative Fit Index*		
TLI: *Tucker-Lewis Index*		
χ^2/df: ratio of chi-square to degrees of freedom		
RMSEA: Root Mean Square Error of Approximation		
CI: Confidence Interval		
The English version is the result of a free translation from the translated version and cross-culturally adapted for use in Brazil.		

Table 2
Convergent validity and composite reliability of the FCQ-A-BR factors.

Factors/items		**Final model - original**	
Portuguese	English	AVE	CR
Fator 1 - Natural e saudável	Factor 1 - Natural and healthy	0.54	0.89
Fator 2 - Preço	Factor 2 - Price	0.71	0.88
Fator 3 - Característica sensorial	Factor 3 – Sensory characteristics	0.62	0.87
Fator 4 - Controle de peso	Factor 4 – Weight control	0.71	0.88
Fator 5 - Preocupação ética	Factor 5 – Ethical concern	0.72	0.84
Fator 6 - Familiaridade	Factor 6 - Familiarity	0.59	0.81
AVE: average variance extracted			
CR: composite reliability			

Internal consistency and test–retest reliability

The test–retest subsample included 51 adolescents after exclusion of incomplete responses. Participants were predominantly female (53.7%) with a mean age of 15.98 ± 1.11 years.

Internal consistency was adequate across all factors, with Cronbach's alpha ranging from 0.75 to 0.83 (Table 3).

Table 3
Internal consistency and test–retest reliability of the FCQ-A-BR factors.

Factors/items	**N. of items**	**ICC (95% CI)**	**p-value**	**Cronbach's α**
Factor 1 - Natural and healthy	7	0.85 (0.78–0.90)	< 0.001	0.80
Factor 2 - Price	3	0.79 (0.68–0.86)	< 0.001	0.83
Factor 3 – Sensory characteristics	4	0.83 (0.76–0.89)	< 0.001	0.83
Factor 4 – Weight control	3	0.74 (0.61–0.83)	< 0.001	0.77
Factor 5 – Ethical concern	2	0.73 (0.58–0.83)	< 0.001	0.75
Factor 6 - Familiarity	3	0.77 (0.66–0.85)	< 0.001	0.75
Total	22	0.79 (0.70–0.87)	< 0.001	0.81
ICC – Intraclass Correlation Coefficient				
CI – Confidence Interval				

Test–retest reliability indicated good to excellent temporal stability (ICC = 0.73–0.85). No significant differences were observed between test and retest scores ($p > 0.05$), supporting the temporal stability of the instrument (Table 4).

Table 4
Test–retest comparison of FCQ-A-BR factor scores (n = 51).

Factors	N. of items	Test Median (IQR)	Retest Median (IQR)	p-value *
Factor 1 - Natural and healthy	7	3.00 (2.64–3.29)	2.71 (2.00-3.36)	0.88
Factor 2 - Price	3	3.00 (2.33–3.33)	2.67 (2.33–2.75)	0.90
Factor 3 – Sensory characteristics	4	3.50 (3.00–4.00)	3.50 (3.00-3.88)	0.21
Factor 4 – Weight control	3	2.67 (2.33–3.33)	3.00 (2.33–3.33)	0.75
Factor 5 – Ethical concern	2	2.50 (2.00–3.00)	2.50 (2.00-2.50)	0.75
Factor 6 - Familiarity	3	2.30 (1.66–2.75)	2.33 (2.00-2.67)	0.73
Total	22	2.81 (2.66–3.03)	2.82 (2.52–3.18)	0.96
IQR: Interquartile Range				
**Wilcoxon signed-rank* test				

Bland–Altman analysis (Fig. 1) demonstrated no evidence of systematic bias, with most observations within the limits of agreement. The mean difference was close to zero, and the limits of agreement were narrow, indicating good agreement and low measurement error between test and retest scores.

DISCUSSION

This study provides robust evidence supporting the validity and reliability of the FCQ-A-BR in a sample of Brazilian adolescents. Confirmatory factor analysis demonstrated an excellent fit for the six-factor model, consistent with the theoretical structure reported in previous adaptations of the instrument [9, 10]. These findings suggest that the core dimensions underlying food choice motives are relatively stable across cultural contexts, supporting the cross-cultural applicability of the FCQ-A framework.

The observed multidimensional structure reinforces the conceptualization of food choice as a complex behavior influenced by multiple interrelated domains, including health concerns, sensory appeal, economic considerations, ethical issues, and familiarity [5–8]. Moderate correlations between factors

indicate that, although these domains are conceptually distinct, they may operate simultaneously in shaping decisions. This pattern reflects the dynamic nature of dietary behaviors during adolescence, a life stage marked by increasing autonomy and evolving preferences, and aligns with previous validation studies in Brazilian populations [19, 20].

Reliability analyses demonstrated satisfactory internal consistency and temporal stability, consistent with established quality criteria for measurement instruments [21]. Internal consistency and temporal stability were comparable to those reported in previous FCQ-A study [10], suggesting consistent measurements over time. The absence of significant differences between test and retest scores, supported by the agreement in Bland–Altman analyses, further supports the stability of the construct being measured.

From a public health perspective, the availability of this validated instrument represents an important contribution to addressing gaps in adolescent nutrition research in low- and middle-income countries. While previous findings from the EVA-JF study have focused primarily on dietary consumption patterns [22–26], the FCQ-A-BR complements this body of evidence by allowing a more comprehensive understanding of the psychological and motivational drivers behind such behaviors. Identifying specific domains, such as price sensitivity and sensory appeal is crucial for developing strategies that promote food autonomy and health equity.

A major strength of this study is the focus on students from public schools. Adolescents in these settings are often exposed to food marketing and environmental pressures that favor unhealthy dietary patterns [1–3]. The FCQ-A-BR therefore provides a robust tool to inform public health policies, such as the Brazilian National School Feeding Program (PNAE). By understanding student motivations, managers can tailor school menus and educational interventions to better resonate with adolescents, potentially increasing the acceptance of healthy meals and preventing diet-related noncommunicable diseases (NCDs).

Despite these strengths, some limitations should be acknowledged. The sample was restricted to public schools in a single urban area, which may limit generalizability. Additionally, the relatively small test–retest sample may affect the precision of reliability estimates, and self-reported data may be subject to response bias.

Furthermore, the absence of measurement invariance testing limits conclusions regarding the equivalence of the instrument across demographic subgroups. Future studies should specifically test invariance between genders, as food choice motives are known to vary significantly between boys and girls during adolescence due to distinct social pressures. Future research could also explore the performance of the FCQ-A-BR using WLSMV estimation to enhance parameter precision across diverse socio-economic contexts [14].

CONCLUSIONS

The FCQ-A-BR demonstrated satisfactory psychometric properties, supporting its use as a valid and reliable tool for assessing food choice determinants among Brazilian adolescents. These findings provide a solid foundation for future research aimed at exploring the interplay between motivational drivers and dietary outcomes, ultimately informing more effective and culturally appropriate public health strategies in the Brazilian context.

Declarations

Ethics approval and consent to participate

The study was approved by the Research Ethics Committee of the Federal University of Juiz de Fora – UFJF (CAEE: 68601617.1.0000.5147). Written informed consent was obtained from the parents or legal guardians of all participants, and written assent was obtained from the adolescents, in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

VSF and FSN conceived and designed the study. VSF performed the data collection, data analysis, and drafted the manuscript. RMSO, ERF, MPN, and APCC participated in the study design and manuscript revision. VSF, FSN, RMSO, ERF, MPN, and APCC provided study supervision and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Data Availability

The EVA study that support the findings of this study are available from Public Health Nutriton Group, but restrictions apply to the availability of these data, which were used under licence for the current study and so are not publicly available. The data are, however, available upon request and with the permission of Public Health Nutriton Group.

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Figures

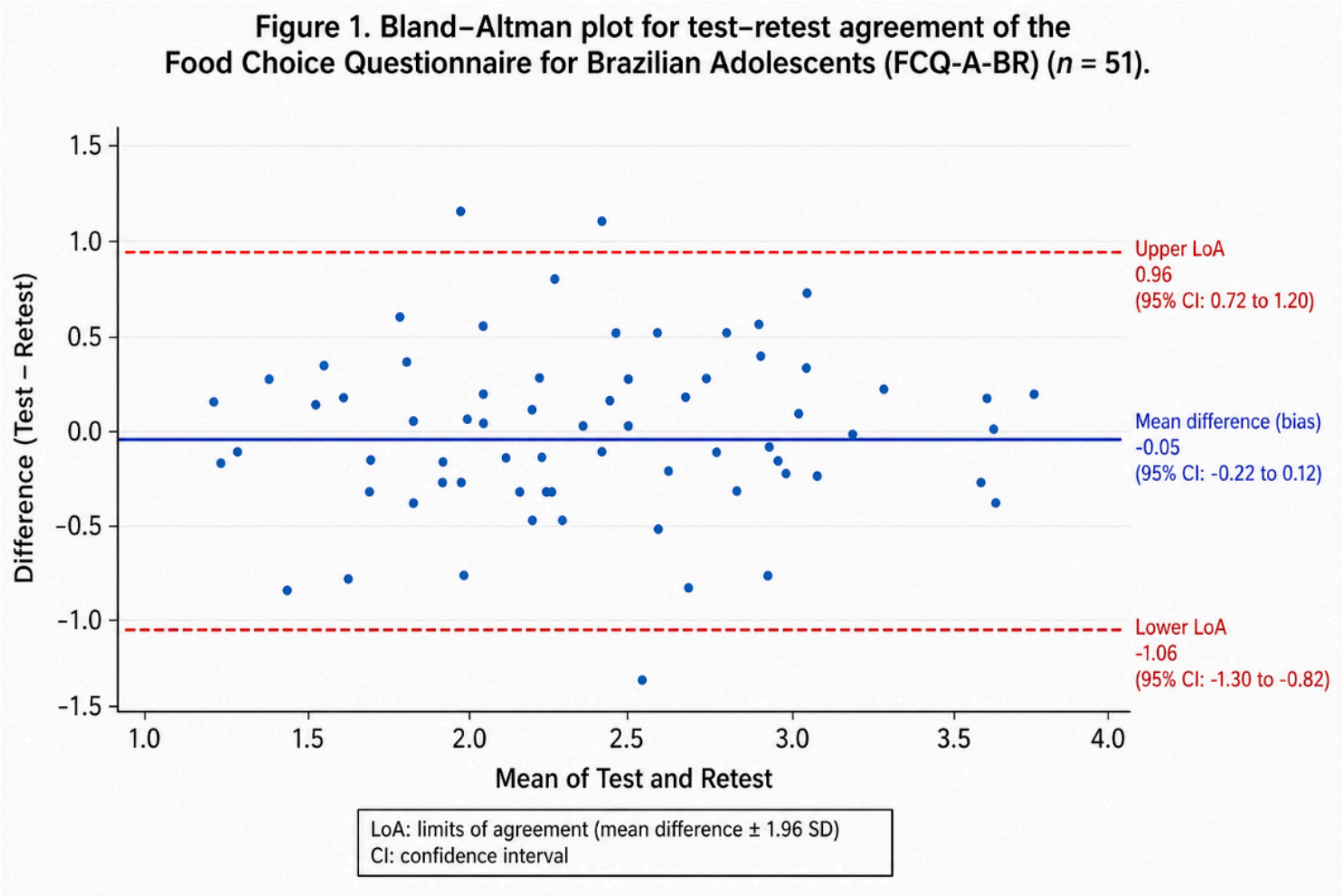


Figure 1

Bland–Altman plot for test–retest agreement of the FCQ-A-BR (n = 51). The solid line represents the mean difference (bias), and the dashed lines represent the limits of agreement (mean difference ± 1.96 standard deviations). The x-axis shows the mean of test and retest scores, and the y-axis shows the difference between measurements.