# RESEARCH

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# Psychometric properties of the Turkish version of the child food rejection scale



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# Abstract

**Background** While some children are open to trying new foods, many exhibit dislike or refusal when encountering them for the first time. These behaviors can be broadly characterized as food neophobia and pickiness, which are believed to be the primary forms of food rejection among children. Because there are differences between countries in early feeding practices and culinary traditions, culturally adapted scales are needed to measure these behaviors. This study aimed to (1) test the reliability and validity of the Turkish adaptation of the Child Food Rejection Scale (CFRS), and (2) examine patterns of food rejection and the correlations between scale scores and sociodemographic characteristics among Turkish children.

**Methods** The validity of the CFRS translated into Turkish and cross-culturally adapted was assessed by content validity, construct validity, and convergent validity. Internal consistency was measured with Cronbach's alpha coefficient for the scale and its subdimensions. The scale reliability was also evaluated using test-retest reliability and several tests.

**Results** Three hundred seventy-five primary caregivers (mainly mothers) of children aged 2 to 7 years were recruited through an online questionnaire. The results confirmed the psychometric soundness of the Turkish CFRS. Construct validity was supported by factor analysis (KMO coefficient = 0.852; Bartlett's sphericity test  $\chi^2$ =1301.580, p < 0.01), with two factors explaining 53.47% of the variance. Internal consistency was high (Cronbach's  $\alpha$  = 0.838 for the total scale;  $\alpha$  = 0.845 for neophobia,  $\alpha$  = 0.600 for pickiness). Test-retest reliability (ICC = 0.770) indicated stability over time. Reliability was further supported by split-half reliability (Spearman-Brown coefficient = 0.746), and the scale demonstrated additivity (Tukey's test F = 35.543,  $p \le 0.001$ ) and absence of response bias (Hotelling T-square test F = 63.041,  $p \le 0.001$ ). Confirmatory factor analysis showed good model fit for the two-factor structure, supporting construct validity. Moreover, the rate of food rejection was 21.1%, and CFRS scores did not vary by gender, age, or other sociodemographic characteristics among Turkish children.

**Conclusions** Overall, these findings affirm that the adapted CFRS is a reliable and valid tool for assessing food rejection behaviors in Turkish children.

# **Plain english summary**

Some kids are willing to try new foods, but a lot of them do not like them or will not eat them at all the first time they see them. These actions, commonly referred to as food neophobia and pickiness, are believed to be the

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primary reasons why kids reject food. We need regionally appropriate scales to measure these behaviors because different countries have different ways of feeding babies and cooking. We conducted this study (1) to see if the Turkish version of the Child Food Rejection Scale (CFRS) was reliable and valid, and (2) to find out how common food rejection is among Turkish kids and if there are any links between scale results and sociodemographic factors. We used several tests to check the validity and reliability of the scale. We asked 375 primary caregivers of children ages 2 to 7 to fill out an online questionnaire. As a result, the Turkish CFRS had good psychometric properties. We also found that 21.1% of Turkish children show food rejection behavior, and CFRS results did not change based on gender, age, or other sociodemographic factors. We concluded that the adapted CFRS is a good and reliable way to measure food rejection behaviors in Turkish children.

Keywords Children, Eating behaviors, Food neophobia, Picky eating, Reliability, Validity

# Background

It is well known that children need a well-balanced and broad variety diet to develop physically and mentally and to meet their essential nutrient requirements [1]. In early childhood, it can be challenging to introduce children gradually to a broad range of previously unseen foods, each with its flavor, texture, and visual characteristics. While some children are open to trying new foods, many exhibit dislike or refusal when encountering them for the first time [1, 2]. These behaviors can be broadly characterized as food neophobia and pickiness, which are believed to be the primary forms of food rejection among children [2, 3].

First proposed by Pliner and Hobden (1992) [4], food neophobia is characterized by a reluctance or a fear of eating novel or unfamiliar foods. This behavior increases sharply as a child becomes more mobile and typically peaks between the ages of 2 and 6, predominantly affecting children in this age group [3, 5]. Pickiness, also referred to as "picky eating" or "fussy eating," is characterized by selective eating patterns that include both familiar and new foods. Unlike food neophobia, which is defined as the avoidance or rejection of unfamiliar foods, pickiness extends to rejecting certain familiar foods based on specific properties such as taste, texture, or presentation [3, 6]. Picky eaters may accept food on one occasion and refuse it on another, or they may consume only limited amounts of certain foods while completely avoiding others [3].

Neophobic children tend to avoid trying new foods and prefer familiar foods, focusing on food-specific details such as texture. This results in a limited intake of both familiar and new foods before and during the tasting step [2, 6]. Studies have shown that children who exhibit food neophobia and picky/fussy eating behavior generally consume fewer fruits and vegetables, which in turn influences their food intake and dietary diversity [7–9]. As food neophobia and pickiness can have adverse effects on health, investigating the factors associated with food rejection behaviors is essential to inform potential interventions [9]. Since food neophobia and pickiness are two distinct but interrelated aspects of food rejection, it is essential to detect both tendencies in children at an early stage [6]. The Food Neophobia Scale (FNS), the most widely used tool for evaluating food neophobia, was initially developed for adults but subsequently adapted to measure children's food neophobia [4, 10]. However, considering only food neophobia is not sufficient for a comprehensive evaluation of food rejection.

The "food fussiness" subscale of the Child Eating Behavior Questionnaire (CEBQ) also attempts to capture certain aspects of food rejection [11]. However, the CEBQ fails to adequately distinguish between food neophobia and pickiness, now recognized as distinct constructs [3, 6]. This distinction is critical, as neophobia typically pertains to the refusal of novel foods, while pickiness extends to selective eating patterns involving familiar foods as well. Addressing this gap, Rioux et al. (2017) [3] developed the Child Food Rejection Scale (CFRS), which evaluates neophobia and pickiness as distinct subscales, offering a more nuanced and comprehensive assessment of food rejection behaviors. Importantly, the CFRS was designed for children aged 2 to 7, a period during which food rejection tendencies are most pronounced and relatively stable [3, 6]. Although food rejection behaviors may persist beyond this age, the CFRS focuses on early childhood, where interventions may have the greatest impact.

The development of the original CFRS was rooted in the need to provide a psychometrically robust tool that addressed these dual dimensions of food rejection in young children. The scale was designed to address the limitations of existing measures by capturing both dimensions of food rejection behavior comprehensively. The development process involved generating items that captured key characteristics of food neophobia and pickiness, as informed by a thorough review of the existing literature. Specifically, six items were created to assess food neophobia (e.g., reluctance to try unfamiliar foods) and five items to measure pickiness (e.g., selective eating patterns related to familiar foods) [3, 6]. This two-factor structure of the CFRS was validated through exploratory and confirmatory factor analyses, confirming its reliability and applicability in diverse cultural contexts [6].

Given the importance of assessing and identifying factors that could effectively mitigate food rejection in children, validating the CFRS for Turkish children is crucial due to the unique cultural context of Turkey, which encompasses distinct food habits and culinary traditions. Turkey's unique food culture includes traditional practices such as the use of yogurt, tarhana (a fermented flour-yogurt mixture for soup), and grape molasses (pekmez) in early childhood diets [12, 13]. While these nutrient-dense foods can support dietary diversity, cultural norms, such as the frequent preparation of familiar dishes and encouraging children to finish their plates, may limit exposure to varied flavors and textures, potentially contributing to selective eating. These culturally specific factors highlight the importance of adapting the CFRS to the Turkish context to accurately assess food rejection behaviors in children.

Therefore, this study aimed to (1) test the reliability and validity of the Turkish adaptation of the CFRS, and (2) explore the patterns of food rejection and the correlations between scale scores and sociodemographic characteristics among Turkish children. By validating this scale in the Turkish context, this study also seeks to contribute to a more global and inclusive evaluation of child food rejection behaviors, enhancing the ability to develop targeted interventions and support strategies.

#### Methods

#### Participants and procedure

Primary caregivers (mainly mothers) of children aged 2 to 7 years were recruited through an online questionnaire. We included caregivers who self-reported familiarity with the children's daily dietary situation and feeding practices, as well as their ability to understand and respond to questions in Turkish. The study excluded parents of children diagnosed with food allergies, acute or chronic illnesses that could affect food intake, those requiring special dietary practices, and those with tastesmell disorders. Inclusion and exclusion criteria, including the caregiver's familiarity with the child's dietary habits, were determined based on caregiver self-report.

This study was approved by the Erciyes University Social and Humanities Science Ethics Committee. Parents provided online consent for their participation.

#### Materials

*Sociodemographic questionnaire* After reviewing the literature, the researcher's team designed the online questionnaire and asked participants to provide general demographic information such as the child's sex, age, body weight, height, birth length, birth weight, gestational week, and caregiver's age.

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The child food rejection scale The CFRS, originally developed by Rioux et al. (2017) [3], measures two main types of food rejection behaviors in children: pickiness and neophobia. The Turkish adaptation followed a rigorous process of cultural adaptation and validation. Primary caregivers rated 11 items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), producing three scores: a food neophobia subscore, a food pickiness subscore, and a total food rejection score. Higher scores indicate greater rejection dispositions [3, 6]. Items with low item-total score correlations (< 0.30) were excluded to ensure the scale's reliability and construct validity, as recommended in scale adaptation studies [14-19]. After exclusion of item CFRS9, the Turkish CFRS demonstrated high item reliability and construct validity, with two factors explaining 53.47% of the variance. Internal consistency was supported by a Cronbach's alpha coefficient of 0.838 for the whole scale, 0.845 for the neophobia subscale, and 0.600 for the pickiness subscale. These values indicate good reliability for the overall scale and the neophobia subscale, while the pickiness subscale showed moderate reliability.

*The food neophobia scale* The FNS, developed by Pliner and Hobden (1992) [4] assesses reluctance to try new foods and was validated in Turkish by Duman et al. (2020) [20]. The scale consists of 10 items with five food-neophobic and five food-neophilic items scored on a Likert scale (1=strongly disagree, 7=strongly agree), yielding scores between 10 and 70. Higher scores indicate higher levels of neophobia. The internal consistency of the FNS in the present sample was excellent, with a Cronbach's alpha coefficient of 0.865. This supports the reliability of the FNS for use in this study and its role in assessing the convergent validity of the CFRS food neophobia subscale.

#### Translation and cross-cultural adaptation

After contacting the original author of the CFRS and obtaining permission for its Turkish adaptation, a rigorous translation and back-translation process was conducted [21, 22], followed by expert consultation and a pilot test with parents to ensure the scale's cultural suitability and clarity. The adaptation process included the following steps:

- 1. *Forward translation.* Four bilingual translators independently translated the scale from English to Turkish. A bilingual expert synthesized the translations and resolved discrepancies to ensure linguistic and conceptual equivalence.
- 2. *Backward translation.* Three independent bilingual translators, blinded to the original scale, translated the synthesized Turkish version back into English. The back-translated versions were compared with

the original scale, and discrepancies were resolved through discussions to ensure semantic and conceptual alignment.

- Expert consultation. Eight experts (five pediatric dietitians, two pediatric clinicians, and one pediatric nurse) evaluated the Turkish version of the CFRS using a structured review form according to the Davis content validity index technique. They rated each item's clarity, cultural relevance, and content validity on a 4-point Likert scale (1- Appropriate, 2- Item should be slightly revised, 3- Item should be seriously revised and 4- Item is not appropriate) [23]. Items with scores below 4 were revised based on expert feedback. Their suggestions focused on improving linguistic clarity and cultural alignment. For instance:
  - *"My child is suspicious of new foods"* was revised to *"Çocuğum yeni besinlere karşı kuşku/şüphe duyar"* to better reflect Turkish linguistic nuances.
  - "Food" was consistently translated as "besin" instead of "yiyecek" for better alignment with professional terminology.
  - "My child separates the food on their plate" was modified to "Çocuğum tabağındaki besinleri (birbirine değmemesi için) ayırır" to reflect specific behaviors observed in Turkish children.

There were no unresolved disagreements among the experts, and all changes were mutually agreed upon.

4. *Parent feedback*. A pilot test was conducted with 20 parents who met the inclusion criteria (not included in the final datasheet) to evaluate the clarity and relevance of the revised Turkish CFRS. Most parents reported that the items were clear and culturally

relevant. However, based on their feedback, two items—"*My child can eat some foods in large amounts and others not at all*" and "*My child won't taste a new food if it's been in contact with another food they don't like*"—were identified for minor revisions to enhance clarity, such as simplifying sentence structures and improving phrasing. These adjustments helped ensure that the scale items were fully comprehensible for Turkish caregivers. The two versions are presented in Table 1.

5. *Final adjustments.* The Turkish version of the CFRS was finalized after integrating feedback from experts and parents. The final version retained all original conceptual domains of the scale, ensuring that it captured both food neophobia and pickiness behaviors effectively within the Turkish cultural context.

# **Data collection**

The sample size was determined according to the necessity of factor analysis. The number of participants is suggested to be between 5 and 20 times the number of items on the scale [18]. Therefore, 375 parents (no missing data) were included in this study to assess the scale's construct validity. Two weeks later, 40 randomly selected caregivers of children (20 boys and 20 girls) in the sample were asked to fill out the questionnaire again to measure the scale's test-retest reliability. No missing data was observed for any item, ensuring a complete dataset for analyses.

# Data analysis

The primary purpose of the CFRS in this study was to evaluate stable traits of food rejection behaviors, specifically food neophobia and pickiness, in children aged 2 to 7 years. These traits are conceptualized as relatively

Items	English	Turkish
	Neophobia subscale	Neofobi alt ölçeği
CFRS1 (N1)	My child always chooses familiar food.	Çocuğum her zaman alışkın olduğu besinleri seçer.
CFRS2 (N2)	My child is suspicious of new foods.	Çocuğum yeni besinlere karşı kuşku/şüphe duyar.
CFRS3 (N4)	My child likes the types of foods they know.	Çocuğum bildiği besin türlerini sever.
CFRS4 (N6)	My child rejects new foods without even tasting them.	Çocuğum yeni besinleri tadına bile bakmadan reddeder.
CFRS5 (N7)	My child gets anxious when they see new foods.	Çocuğum yeni besinler görünce huzursuz/rahatsız olur.
CFRS6 (N10)	My child won't taste a new food if it's been in contact with another food they don't like.	Yeni bir besin çocuğumun sevmediği başka bir besinle temas ederse, çocuğum yeni besinin tadına bakmayacaktır.
	Pickiness subscale	Seçicilik alt ölçeği
CFRS7 (P3)	My child refuses to eat some foods because of their texture.	Çocuğum dokusu/kıvamı nedeniyle bazı besinleri yemeyi reddeder.
CFRS8 (P4)	My child separates the food on their plate.	Çocuğum tabağındaki besinleri (birbirine değmemesi için) ayırır.
CFRS9 (P5)	My child rejects some foods after tasting them.	Çocuğum bazı besinleri, tadına baktıktan sonra reddeder.
CFRS10 (P6)	Sometimes, my child will eat a food one day and refuse it the next day.	Bazen, çocuğum bir gün yediği besini ertesi gün reddedecektir.
CFRS11 (P10)	My child can eat some foods in large amounts and others not at all.	Çocuğum bazı besinleri çok miktarda yiyebilirken, bazılarını hiç yiyemez.

Table 1 The english and Turkish items of the CFRS

stable characteristics of early childhood, rather than transient or situational behaviors. The scale is not designed as a measure of symptom severity or as an outcome measure sensitive to short-term change. Given this conceptual framework, the validation strategy focused on establishing the scale's content validity (to ensure items adequately represent the construct), construct validity (to confirm the scale's factor structure), and convergent validity (to confirm alignment with an existing measure of food neophobia). Reliability analyses, including internal consistency and test-retest reliability, were also conducted to assess the stability and consistency of the measurements.

Statistical analyses were performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, New York, USA) and Amos version 23.0. Data were presented as number (n) and percentage (%) for categorical variables and mean±standard deviation (SD) for continuous variables. Floor and ceiling effects were evaluated prior to data analysis, and no such effects were detected, ensuring the robustness of the scale's psychometric evaluation. Validity and reliability analyses included:

*Content validity.* The content validity of the Turkish CFRS was evaluated using the Content Validity Ratio (CVR) and Content Validity Index (CVI). Content validity assesses whether a measurement tool contains sufficient quality and quantity of items to accurately represent the construct being measured [24, 25].

- CVR: This statistic assesses expert agreement on whether an item is essential for measuring the construct. CVR values range from -1 to +1, with higher values indicating stronger agreement among experts. For this study, eight experts evaluated the items of the Turkish CFRS. Based on the minimum threshold for CVR values reported in the literature (>0.750 for eight experts), all items met or exceeded this value [24, 25].
- CVI: The CVI provides an overall measure of the relevance and clarity of all items in the scale. It is calculated as the mean of the CVR values for all items. The CVI of the Turkish CFRS was 0.933, indicating that the scale represents 93.3% of the conceptual framework it aims to measure. These results confirm that the Turkish CFRS adequately covers the intended construct of food rejection behaviors in children [24, 25].

# *Construct validity* Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) assessed the scale's factor structure:

• EFA: Identifies how items are grouped under specific factors. A Kaiser-Meyer-Olkin (KMO) coefficient

of 0.852 and Bartlett's sphericity test ( $\chi^2$ =1301.580, p < 0.01) confirmed the data's suitability for factor analysis. These outcomes indicated that the items were sufficiently correlated to form coherent factors [18, 26–28].

 CFA: Tests whether the 2-factor model proposed by the original CFRS fits the Turkish sample data. The CFA results, including CFI (≥0.90), GFI (≥0.90), and RMSEA (≤0.10), indicated a good model fit, supporting the structural validity of the scale [18, 26–28].

*Convergent validity* Correlations between the food neophobia subscale of the CFRS and the total FNS scores were calculated using Pearson correlation analysis. In this study, a significant positive correlation was observed between the CFRS food neophobia subscale and FNS scores (r = 0.800;  $p \le 0.001$ ), with a correlation coefficient indicating a large effect size. This confirms the strong conceptual alignment between the two scales in measuring food neophobia [14, 19].

*Reliability* To comprehensively assess the reliability of the Turkish CFRS, multiple tests were conducted:

- Internal consistency: Cronbach's alpha was calculated to evaluate how well the items in the scale measure the same construct. The values (0.838 for the whole scale, 0.845 for the neophobia subscale, and 0.600 for the pickiness subscale) indicated high reliability for the overall scale and the neophobia subscale, and moderate reliability for the pickiness subscale [15, 16, 18, 28].
- Test-retest reliability (ICC = 0.770): This measured the stability of the scale over time, ensuring that scores remain consistent when the same individuals are reassessed after a two-week interval.
- Split-half reliability (Spearman-Brown and Guttman Coefficients > 0.70): These analyses confirmed the consistency of the scale across two randomly split halves, providing further evidence of internal consistency.
- Tukey's test for nonadditivity: Ensured the additivity of the scale, meaning that the total score is meaningful and not influenced by interaction effects between items.
- Hotelling's T-square test: Verified the absence of response bias, ensuring that participants' responses were not systematically influenced by extraneous factors unrelated to the construct being measured.

Together, these tests provide robust evidence of the scale's reliability, addressing both its internal consistency and its temporal stability [15, 16, 18, 28].

Scores above the 75th percentile were used to define high food neophobia, pickiness, or overall food rejection. This threshold aligns with percentile-based grouping methods commonly employed in literature [5, 29]. Mean scores, ranging from 0 to 5, were used to calculate these thresholds, ensuring comparability across different versions of the scale. The independent sample t test was applied to compare the mean scale scores for children's genders, while the Pearson correlation coefficient was used to evaluate the correlations between scores and sociodemographic factors. An alpha level of 0.05 was used for all the statistical analyses.

# Results

#### Participant characteristics

This study included 375 children, half of whom were girls; the mean age was  $4.38 \pm 1.28$  years; the birth weight was 3327.97±410.36 g; and the gestational age was  $39.08 \pm 1.40$  weeks. The caregivers were  $32.56 \pm 5.85$  years old, and 98.7% and 96.8% were women and mothers, respectively. Table 2 also depicts the children's current height and body weight based on age group and gender.

#### Validity of the Turkish CFRS

Content validity Eight experts assessed the content validity of the scale. The calculated CVRs were >0.750 for all the items, meeting the threshold recommended for a panel of eight experts. The CVI for the whole scale was 0.933, indicating that the Turkish CFRS adequately cov-

Table 2 Participant ch	naracteristics
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ers the intended construct of food rejection behaviors in children.

Exploratory factor analysis The KMO coefficient was 0.852, and Bartlett's sphericity test result was  $\chi^2 = 1301.580$ , df = 45 (p < 0.01), confirming the suitability of the data for factor analysis. The scale items were grouped under two factors; the explained variance was 53.47%.

Confirmatory factor analysis The CFA results supported the two-factor structure of the Turkish CFRS. The calculated chi-square value was 128.827, with a degree of freedom of 33 ( $p \le 0.001$ ). The factor loads of the first subdimension of the scale ranged between 0.41 and 0.84, and those of the second subdimension ranged between 0.36 and 0.69 Fig. . 1). The fit indices were  $X^2/$ SD = 3.904, RMSEA = 0.088, CFI = 0.925, GFI = 0.936, and AGFI = 0.893, indicating a good model fit (Table 3).

Convergent validity A positive correlation was observed between the food neophobia subscale of the CFRS and the total FNS scores, with r = 0.800 ( $p \le 0.001$ ). This represents a large effect size, confirming strong conceptual alignment between the two scales in measuring food neophobia.

# **Reliability of the Turkish CFRS**

Internal consistency After excluding item CFRS9 ("My child rejects some foods after tasting them"), whose itemtotal score correlation was below 0.30, the item-total score correlations ranged between 0.325 and 0.630 (Table 4),

Table 2         Participant characteristics				
Variables	Mean ± SD			
Caregiver's characteristics				
Age (years)	$32.56 \pm 5.85$			
<b>Gender</b> , n <b>(%)</b>				
Female	370 (98.7)			
Male	5 (1.3)			
Closeness to the child, n (%)				
Mother	363 (96.8)			
Others (father, sister, aunt, grandmother)	12 (3.2)			
Child's characteristics				
Age (years)	$4.38 \pm 1.28$			
<b>Gender</b> , n <b>(%)</b>				
Girl	188 (50.1)			
Воу	187 (49.9)			
Birth weight (g)	3327.97±410.36			
Gestational age (weeks)	$39.08 \pm 1.40$			
	2–3 years	4–5 years		6–7 years
Current height (cm) for age	$94.06 \pm 11.74$	108.12±11.77		$117.91 \pm 9.14$
Current body weight (kg) for age	$14.59 \pm 2.74$	$19.09 \pm 4.01$		$22.89 \pm 5.92$
	Girl		Воу	
Current height (cm) for gender	$107.02 \pm 12.82$		107.05±13.68	
Current body weight (kg) for gender	$19.00 \pm 5.10$		$18.66 \pm 4.30$	



Fig. 1 Model of first-order multifactor confirmatory factor analysis of the CFRS

 Table 3
 The goodness-of-fit indices of the CFRS for the Turkish sample

Index	Values	Perfect fit <sup>*</sup>	Good fit <sup>*</sup>	Result
X <sup>2</sup> /SD	3.904	0-3	3–5	Good fit
RMSEA	0.088	$0.00 \le \text{RMSEA} \le 0.05$	$0.05 \le \text{RMSEA} \le 0.10$	Good fit
CFI	0.925	$0.95 \le CFI \le 1.00$	$0.90 \le CFI \le 0.95$	Good fit
GFI	0.936	$0.95 \leq \mathrm{GFl} \leq 1.00$	$0.90 \le \text{GFI} \le 0.95$	Good fit
AGFI	0.893	$0.95 \le AGFI \le 1.00$	$0.85 \le AGFI \le 0.90$	Good fit

Abbreviations: RMSEA, root mean square error of approximation; CFI, comparative fit index; GFI, goodness-of-fit index; AGFI, adjusted goodness-of-fit index

\*Field A. Discovering statistics using IBM SPSS statistics. Sage; 2024

and the Cronbach's alpha coefficient for the whole scale was 0.838 (Table 5). The Cronbach's alpha coefficients for the neophobia and pickiness subscales were 0.845 (high reliability) and 0.600 (moderate reliability), respectively (Table 4).

*Test-retest reliability* The scale's stability over time was assessed with a two-week interval between measurements. No significant differences were found between the first and second administrations of the scale (p > 0.05), and

Table 4	Item ana	lysis and	d Cron	bach	's alp	ha re	esults f	or t	he
subscale	of the Tu	rkish CF	RS						

Subscales	ltems	Cronbach's Alpha	Corrected Item Total Correlation	ltem Deleted Cronbach's Alpha
Neophobia	CFRS1	a=0.845	0.596	0.801
	CFRS2		0.630	0.797
	CFRS3		0.482	0.812
	CFRS4		0.625	0.796
	CFRS5		0.622	0.797
	CFRS6		0.610	0.798
Pickiness	CFRS7	$a = 0.600^{*}$	0.550	0.805
	CFRS8		0.442	0.816
	CFRS10		0.325	0.829
	CFRS11		0.474	0.812

\*The value after subtracting the CFRS9 is shown

the ICC for the whole scale was 0.770 ( $p \le 0.001$ ) (Table 5), indicating good reliability.

*Split-half reliability* The Spearman-Brown and Guttman split-half coefficients were 0.749 and 0.746, respectively

Cronbach's alpha		0.838			
Spearman-Brown	coefficient	0.749			
Guttman split-half	coefficient	0.746			
		F		р	
Tukey's test for no	nadditivity	35.543		≤ 0.001	
Hotelling's T-squar	ed test	63.041		≤ 0.001	
		r		р	
Intraclass Correlat	ion Coefficient	0.838		≤ 0.001	
		Food Ne	ophobia Scale		
		r		р	
CFRS Neophobia S	ubscale	0.800		≤ 0.001	
	First administration <i>Mean</i> ± SD	Second administration <i>Mean</i> ± SD	t*		p
Neophobia	3.52±0.82	3.64±0.73	1.006		0.320
Pickiness	3.52±0.73	$3.55 \pm 0.69$	1.034		0.308
CFRS**	$3.52 \pm 0.69$	3.60±0.67	1.115		0.272

\*Paired samples t test (df:39; p > 0.05)

\*\*Cohen's d values; 0.159 for Neophobia, 0.163 for Pickiness, 0.176 for CFRS

Table 6 Comparison and correlations of food neophobia, pickiness, and total food rejection scores with sociodemographic characteristics

	Neophobia subscores		Pickiness subscores		Total food rejection scores	
	Mean±SD		Mean ± SD		Mean±SD	
Mean score	$3.52 \pm 0.82$		$3.52 \pm 0.73$		$3.52 \pm 0.70$	
Child's age						
2–3 years	$3.55 \pm 0.89$		$3.49 \pm 0.87$		$3.53 \pm 0.79$	
4–5 years	$3.48 \pm 0.80$		$3.50 \pm 0.70$		$3.49 \pm 0.67$	
6–7 years	$3.65 \pm 0.81$		$3.65 \pm 0.68$		$3.65 \pm 0.67$	
	F*	p	F*	р	F*	р
Test <sup>*</sup>	0.673	0.511	0.639	0.528	0.746	0.475
Child's gender						
Girl	$3.50 \pm 0.83$		$3.51 \pm 0.75$		$3.50 \pm 0.72$	
Воу	$3.54 \pm 0.81$		$3.54 \pm 0.71$		$3.54 \pm 0.68$	
	<i>t</i> **	р	t**	р	<i>t</i> **	р
Test <sup>**</sup>	-0.420	0.675	-0.461	0.645	-0.490	0.625
	r***	p	r***	р	r***	р
Child's age	0.028	0.593	0.037	0.476	0.035	0.499
Birth weight	0.020	0.694	-0.017	0.749	0.007	0.885
Gestational age	0.005	0.923	-0.023	0.657	-0.006	0.906
Caregiver's age	0.043	0.407	0.037	0.472	0.046	0.375

\*One Way ANOVA (p > 0.05); \*\*Independent samples t test (p > 0.05); \*\*\*Pearson correlation coefficient

(Table 5), confirming consistent measurement across split halves of the scale.

# **Descriptive analysis**

Additivity and response bias Tukey's test for nonadditivity confirmed the scale's additivity (F = 35.543,  $p \le 0.001$ ), meaning the items collectively measure the construct of food rejection without overlapping effects. The Hotelling T-square test revealed no response bias (F = 63.041,  $p \le 0.001$ ) (Table 5).

Table 6 displays the children's food rejection scores on the 10-item Turkish scale. Since the CFRS scale does not have the same number of items in other countries (11 items in the French sample and 8 items in the UK sample), we averaged the scores for each question to enable direct cross-cultural comparison and obtained values ranging from 1 to 5. The mean ( $\pm$ SD) scores were  $3.52\pm0.82$ ,  $3.52\pm0.73$ , and  $3.52\pm0.70$  for the food neophobia, pickiness, and total food rejection scale, respectively. The visual binning feature in SPSS revealed that 71 children (18.9%) exhibited food neophobia ( $\geq$ 4.18), 70 (18.7%) displayed pickiness ( $\geq$ 4.01), and 79 (21.1%) had food rejection ( $\geq$ 4.01).

# Discussion

The present study aimed to adapt the CFRS, developed by Rioux et al. (2017) [3], to the Turkish context for children aged 2 to 7, addressing a gap in the existing research on food neophobia and pickiness in diverse cultural backgrounds. Previous studies have highlighted the complex interplay of cognitive (e.g., categorizing foods as familiar or unfamiliar), social (e.g., parental modeling and peer influence), and environmental (e.g., early exposure to diverse foods reducing neophobic tendencies) factors in children's food rejection behaviors [2, 8, 9], as well as the importance of examining these behaviors across different cultures [7, 20]. By demonstrating the validity and reliability of the CFRS in a Turkish sample, this study provides an initial step toward creating a tool that may facilitate cross-cultural comparisons and support the development of interventions tailored to Turkish children. However, further research is needed to confirm its applicability in broader contexts and refine its potential for guiding strategies to address food rejection behaviors.

# Adaptation of the CFRS to Turkish children

The validation of the Turkish CFRS provides a robust tool for assessing food neophobia and pickiness in children aged 2-7 years. For content validity, the number of experts is recommended to be between 5 and 40 [24, 25]. In this study, the opinions of eight experts were consulted, and in line with their opinions, the CVRs of the scale items and the CVI of the whole scale were calculated. Experts were specifically asked to evaluate whether the existing items fully captured the content domain of food neophobia and pickiness, identify any missing aspects, and assess the clarity and cultural relevance of the items. Their feedback confirmed that the existing items sufficiently represented the constructs, with no major omissions noted. Suggestions focused on linguistic adjustments to enhance clarity and cultural alignment, such as replacing "yiyecek" with "besin" for professional consistency. The high CVRs (>0.750) and CVI (0.933) affirm the scale's content validity, ensuring its cultural and linguistic appropriateness for this population [24, 25]. These findings underscore the critical role of expert input in adapting psychometric tools across cultures. In addition, feedback from the 20 parents who participated in the pilot study was invaluable. Their input led to minor revisions to two items, further improving clarity and comprehensibility. This iterative process highlights the importance of incorporating caregiver perspectives in ensuring the practical applicability of the scale.

The construct validity, supported by both EFA and CFA, aligns with the theoretical framework of the original CFRS, reinforcing its two-factor structure [30]. The moderate explained variance (53.47%) reflects the scale's capacity to capture meaningful variability in food rejection behaviors, while the fit indices (e.g., RMSEA = 0.088, CFI = 0.925) indicate that the adapted scale retains its structural integrity [18, 26–28]. These results provide confidence in the CFRS's ability to measure the distinct but related dimensions of food neophobia and pickiness.

The significant positive correlation (r = 0.800,  $p \le 0.001$ ) between the CFRS neophobia subscale and the FNS supports the scale's convergent validity, highlighting its ability to measure neophobia effectively [14, 19]. This robust alignment with an established measure of food neophobia validates the Turkish CFRS as a reliable tool for assessing rejection tendencies.

Reliability analyses indicate strong internal consistency and temporal stability for the Turkish CFRS. The Cronbach's alpha for the overall scale (0.838) and the neophobia subscale (0.845) suggests high reliability, demonstrating that the items measure their respective constructs consistently [16]. However, the moderate reliability of the pickiness subscale (Cronbach's alpha = 0.600) reflects areas for potential refinement. The test-retest reliability (ICC = 0.770) indicates that the CFRS reliably captures stable traits of food rejection over time [15, 31], making it a suitable tool for longitudinal and cross-sectional studies. This finding highlights that while the scale effectively measures neophobia, the pickiness subscale may benefit from additional development to improve its psychometric robustness.

The exclusion of item CFRS9, due to a low item-total score correlation (<0.30) [14–19], is consistent with standard practices in scale adaptation [2, 6]. Similar adjustments in the UK adaptation of the CFRS highlight the importance of tailoring psychometric tools to cultural contexts. This ensures that the scale remains conceptually sound while addressing cultural nuances that may influence responses.

Lastly, the scale's demonstrated additivity (Tukey's F = 35.543,  $p \le 0.001$ ) and lack of response bias (Hotelling T-square F = 63.041,  $p \le 0.001$ ) further validate its psychometric properties [15]. These findings suggest that the Turkish CFRS is not only a reliable and valid tool but also one that effectively measures the multifaceted construct of food rejection without interference from item overlap or external response patterns.

#### Food rejection in Turkish children

A preliminary analysis of 375 children revealed that patterns of food rejection in Turkish 2–7-year-old children showed a rate of 21.1%. In the literature, no prior studies have reported the patterns of food rejection in children as determined by the CFRS. However, in this study, the rate of food neophobia was 18.9%, which is comparable to the rate of 20.69% observed in Chinese preschoolers using the Child Food Neophobia Scale [5]. Moreover, the food neophobia, pickiness, and total food rejection scores obtained in the current study (3.5 for all three) are close to those in the French sample (2.9, 3.7, and 3.3, respectively) but higher than those in the UK sample (2.5, 1.6, and 2.1, respectively) [6]. There may be several explanations for the lower scores in the UK sample.

First, differences in social desirability bias might contribute to these variations. It has been suggested that caregivers in the UK may exhibit a tendency to present their children in a more favorable light, potentially underreporting behaviors perceived as undesirable, such as food rejection [6]. Future studies could address this possibility by incorporating behavioral assessments or indirect measures to better evaluate the extent of social desirability bias in caregiver-reported data. Second, it is plausible that the difference in food rejection scores is due to differences in weaning practices because it is well known that exposure to food early in life reduces food rejection behaviors [29, 32]. Evidence suggests that UK mothers tend to introduce solid foods earlier than their French counterparts [33], a practice associated with reduced pickiness and broader acceptance of food textures later in childhood [6]. Earlier exposure to diverse food textures during infancy might therefore contribute to the lower food rejection scores observed in the UK sample, particularly in the pickiness subscale. Furthermore, variations in scores could also be attributed to differences in the socioeconomic status of the caregivers in the samples, such as education or income levels. Nevertheless, the present study, like the French sample [3], did not collect this information. This limitation prevents us from being confident that the observed differences are not a result of sampling effects. However, previous studies reported null findings for the relationships between socioeconomic status and pickiness and neophobia [34].

Finally, we found that CFRS scores in early childhood did not vary by gender, age, or other sociodemographic characteristics. This result aligns with prior findings in French and UK samples [3, 6]. To explore the specific contributions of cognitive and social aspects to food rejection, future research could expand the sample to include children of both genders across a wider age range and incorporate more detailed sociodemographic data. Such studies could provide a more comprehensive framework for interpreting the factors influencing food rejection behaviors in diverse populations.

#### **Practice implications**

Food rejection, one of the most common eating behaviors in early childhood, can negatively affect children's growth, development, and nutritional status, so it is crucial to detect this behavior in children. In addition, negative eating behaviors acquired in childhood can also cause various health problems in adulthood. However, culturally adapted scales are necessary to measure these behaviors because there are different dietary habits and culinary traditions between countries. Therefore, this study provides a validated tool for assessing food rejection behaviors in Turkish children, addressing cultural differences that may influence eating patterns. While the findings offer valuable insights into the Turkish context, further research is needed to confirm the tool's applicability in other cultural settings and to refine interventions tailored to specific populations. Understanding cultural differences in food rejection could guide targeted strategies to improve children's healthy eating behaviors, and educating parents of children experiencing food neophobia or pickiness may support healthier developmental outcomes.

#### Limitations and future research

There are several limitations in the present study. First, this study was based on self-reported data from primary caregivers, which might be subject to bias. Additionally, due to the COVID-19 pandemic, the participants were recruited through an online questionnaire via a random sampling method. Although the sample is large, it is not representative of all regions in Turkey, potentially limiting the generalizability of the findings. Furthermore, this study only demonstrated convergent validity for the food neophobia subscale of the CFRS, as it did not include an independent measure specifically assessing picky eating. The absence of such a measure limits the evaluation of the picky eating construct within the scale.

Future research should include validated tools for assessing picky eating to strengthen the validity of this subscale, incorporate more diverse and representative samples to test the scale's applicability across different regions, and conduct multiregional and multicenter studies to examine patterns of food rejection in Turkish children. Additionally, efforts to improve the reliability of the pickiness subscale through the development or refinement of items may enhance its psychometric properties and applicability in diverse contexts. Moreover, examining how cognitive and social factors contribute to food rejection behaviors by including children across a broader age range and gathering detailed sociodemographic data could provide valuable insights. Longitudinal studies are also needed to assess changes in food rejection behaviors over time, explore their relationship with specific nutritional outcomes in early childhood, and develop interventions to prevent or reduce these behaviors. Finally, additional investigations should focus on determining the CFRS diagnostic threshold to enable comparable results across countries.

### Conclusions

The present study assessed the psychometric properties of the 10-item CFRS, demonstrating its good reliability and validity among Turkish children. This Turkish version is the second adaptation of the CFRS after the English version and provides a tool for assessing food rejection behaviors in different cultures. While these findings contribute to the evaluation of such behaviors, further research is needed to investigate how these behaviors can be addressed through specific interventions. This study highlights the importance of culturally tailored approaches to child nutrition and development, offering a foundation for future research and potential applications in diverse cultural settings.

#### Abbreviations

AGFI	Adjusted goodness-of-fit index
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CFRS	Child Food Rejection Scale
CVI	Content validity index
CVR	Content validity ratio
EFA	Exploratory factor analysis
FNS	Food Neophobia Scale
GFI	Goodness-of-fit index
ICC	Intraclass correlation coefficient
КМО	Kaiser–Meyer–Olkin
RMSEA	Root mean square error of approximation

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#### Author contributions

Z.C.A., B.A.G., and O.B. designed the research study. Z.C.A. and B.A.G. performed the research. O.B. analyzed the data. Z.C.A., B.A.G., and O.B. wrote the paper. All authors have read and approved the final manuscript.

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#### Data availability

No datasets were generated or analysed during the current study.

#### Declarations

#### Ethics approval and consent to participate

This study was approved by the Erciyes University Social and Humanities Science Ethics Committee, and parents provided online consent for their participation.

#### Consent for publication

All authors read and approved the final manuscript.

#### **Competing interests**

The authors declare no competing interests.

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