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Turkish validity and reliability study of the psychological food involvement scale: PFIS-TR

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Abstract

Background This study aimed to adapt the Psychological Food Involvement Scale (PFIS) to Turkish culture and test its validity and reliability. The PFIS measures individuals' psychological, emotional, and social relationships with food, which significantly impact eating behaviors and health.

Methods The study was conducted with 478 participants aged 18–65. The PFIS underwent a six-stage translation and cultural adaptation process. Data collection was carried out via Google Forms, with participants completing a general information form, PFIS, and the Addiction-like Eating Behavior Scale (ALEBS). Reliability was assessed using the test-retest method. SPSS 24 was used for statistical evaluation, including internal consistency coefficient calculations, factor analysis, and correlation tests.

Results The Kaiser-Meyer-Olkin value was 0.94, indicating an adequate sample size, and Bartlett's test of sphericity was significant ($p < 0.05$). Exploratory factor analysis revealed a four-factor structure explaining 79% of the variance, with factor loadings > 0.40 and eigenvalues > 1 . Confirmatory factor analysis showed good fit indices: $\chi^2 / sd = 2.28$, GFI = 0.95, AGFI = 0.93, CFI = 0.98, NFI = 0.94, RMSEA = 0.05, SRMR = 0.04. Internal consistency analysis showed high reliability, with Cronbach's Alpha coefficients ranging from 0.86 to 0.94 across subscales.

Conclusion The Turkish version of the PFIS was found to be a valid and reliable tool for assessing psychological food involvement in the studied sample of the Turkish adult population.

Keywords Food involvement, Psychological food involvement scale, Food addiction, Validation, Turkish population

Introduction

In recent years, the role of food in people's lives has become increasingly differentiated. Although eating is a physiological necessity, it has become more symbolic and has moved away from its nutritional function. It has become linked to meanings and values that are strongly connected to the inner world of individuals [1, 2]. In the light of research, food is recognized as people's identities and images [3].

Food engagement is a personal characteristic that affects individuals' attitudes and behaviors toward food and eating habits. It also includes the individual's interest in food, meticulousness in food choices, the meaning attributed to food, and the impact of this meaning on

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daily life [4]. This psychological relationship with food can profoundly affect individuals' overall health, lifestyle, and dietary habits [1, 2, 5]. Psychological food involvement is significant for understanding the role of food in individuals' lives and its emotional, social, and personality-related dimensions [2].

Food involvement is a construct that describes the interaction between the consumer and the food product at the point of purchase [6–8]. A previous study demonstrated how commitment to organic food positively influences its attributed utilitarian and hedonic value, positively affecting consumption frequency [9]. Another study implied that a strong commitment to dietary supplements positively impacts the intention to seek information about these products and their consumption frequency [8]. The consumption of cow's milk and non-dairy beverages is strongly influenced by emotional, identity-related, and psychological aspects, as well as the need for self-affirmation rather than rational and conscious processes [10]. Food involvement is a multifaceted phenomenon that touches on social, cognitive, emotional, and identity-related psychological dimensions, engaging the consumer on a 360-degree level [11].

Psychological food involvement has become an increasingly important area of research, especially in modern societies. The psychological and emotional values that individuals attribute to food are important factors affecting their eating behaviors and overall health [12]. In this context, understanding individuals' relationships with food and assessing the psychological basis of these relationships has become an important research topic in health and nutrition [2, 5].

Like many cultures, Turkish culture provides a context where food holds symbolic meanings in individuals' lives, shaped by its distinct social and emotional dynamics [13]. In Turkey, eating is seen as more than a necessity; it is a significant cultural phenomenon that strengthens social bonds, facilitates the transfer of traditions, and reinforces individuals' sense of belonging [14]. Therefore, understanding factors like psychological food attachment that influence eating behaviors in Turkish culture is crucial for examining cultural dynamics and their health implications.

The question arises whether the measurement tools validated in Turkey adequately address this need Bayraktar et al. (2012) developed the Yale Food Addiction Scale, targeting only university students [15]. Similarly, Sevinçer et al. (2016) adapted the Yale Food Addiction Scale to measure food addiction in bariatric surgery patients [16]. Müftüoğlu et al. (2016) developed a food addiction scale aimed at assessing overeating urges in patients with major depression [17]. Lastly, Tok et al. (2017) created a Modified Yale Food Addiction Scale designed to evaluate food addiction using the DSM-5 substance use disorder

criteria [18]. However, while these scales focus on DSM-5-defined food addiction, this study seeks to measure the psychological and social dimensions of food attachment, making it unique in this respect.

While existing measurement tools address various aspects of eating and food addiction, they fall short in comprehensively and deeply examining individuals' relationships with food. The Psychological Food Involvement Scale (PFIS), developed to address this gap, is an innovative tool that evaluates individuals' psychological relationships with food and its various dimensions. This relationship encompasses emotional, social, and self-perception aspects, reflecting how food can influence an individual's identity and interactions with others [19]. The PFIS measures this engagement through four subscales: Emotional Balance, Self-Realization, Social Approval, and Social Bonding. These subscales each highlight unique psychological ties that influence individuals' attitudes toward food, reflecting how food contributes to one's identity, emotional well-being, and social relationships.

The Turkish adaptation of the Psychological Food Involvement Scale (PFIS) is a critical tool for evaluating individuals' relationships with food, uncovering the specific meanings of these relationships within Turkey's cultural context, and preventing potential health issues from emerging in this framework. Additionally, the age range of 18–65 encompasses adulthood, a period of active physical development where eating behaviors are increasingly influenced by various health and lifestyle factors [20]. The literature emphasizes the importance of applying such scales to different age groups to identify age-specific risk factors and facilitate cultural comparisons, especially in psychological studies [21].

This study aims to evaluate the psychometric properties of the Turkish version of the Psychological Food Involvement Scale (PFIS), including its validity, reliability, factor structure, and cultural relevance within Turkish society. Additionally, the study seeks to examine the scale's applicability across different demographic groups, its association with related constructs, and its potential contribution to understanding food behaviors in a Turkish cultural context.

Method

Participants

The population of this study consists of adult individuals between the ages of 18–65. On validity and reliability studies, it is stated in the literature that the sample size should be 5–10 times the number of scale items [22]. Accordingly, in this study, a scale consisting of 19 items was used, and the aim was to reach at least 95–190 participants. The questionnaire, which was prepared using Google Forms as a data collection tool, was sent to individuals via e-mail and WhatsApp, and participants

were determined by snowball sampling method. After approving the consent form, participants who agreed to complete the survey completed it online. Participants consisted of Turkish citizens who live in Turkey and can speak Turkish.

The sample size was determined by considering the minimum calculated values; however, the final sample size was completed with 478 participants. The participants consisted of 66% females and 34% males. The mean age of the female participants was 30.37 ± 11.08 years, while the mean age of the male participants was 35.97 ± 13.51 years. The inclusion criteria were voluntary participation, being 18 years or older, and not having any health problems that prevented them from completing the questionnaire. Individuals with a psychiatric diagnosis or eating disorder were excluded from the study. This was determined through a self-reported screening question in the demographic information form, which asked participants whether they had ever been diagnosed with a psychiatric condition or an eating disorder by a health-care professional. Participants who responded affirmatively were excluded from the analysis.

Study design

The authors obtained permission to evaluate the psychometric properties of the PFIS in Turkish via e-mail from the responsible author of the scale [19]. In this study, the translation and cultural adaptation process of the scale to be adapted into Turkish was carried out. Cross-cultural adaptation of the scale was carried out following the guidelines provided by Beaton et al. [23]. The translation of the scale into Turkish was completed in six

steps. These steps are translation, synthesis, back translation, expert committee review, pre-test, and final version. After language validity was ensured, a pre-test was administered to a similar sample group. After the pre-test, the questionnaire form, which did not receive any negative feedback, was delivered to the participants. The scale's reliability was then evaluated using the test-retest method on the same participants (49 people). The procedures followed for the adaptation of the scale are presented in Fig. 1.

The data collection process was carried out between May and July 2024. The questionnaire form administered to the participants included information form including demographic information (age, gender, educational status, and disease information), the PFIS-TR, and the Addictive Like Eating Behaviors Scale (ALEBS).

"Ethics Committee Approval" dated 09.05.2024 and numbered E-10840098-202.3.02-3020 was obtained from Istanbul Medipol University Non-Interventional Research Ethics Committee for the study. This study was conducted using the principles of the Declaration of Helsinki and the rules of "research and publication ethics." Informed consent to participate was obtained from all of the participants in the study.

Language validity and cultural adaptation process

The cultural adaptation of the Psychological Food Involvement Scale (PFIS) to Turkish was conducted following the six-step framework outlined by Beaton et al. [23]. This comprehensive methodology is widely recognized for its rigor in ensuring both linguistic and cultural equivalence in the adaptation of self-report instruments.

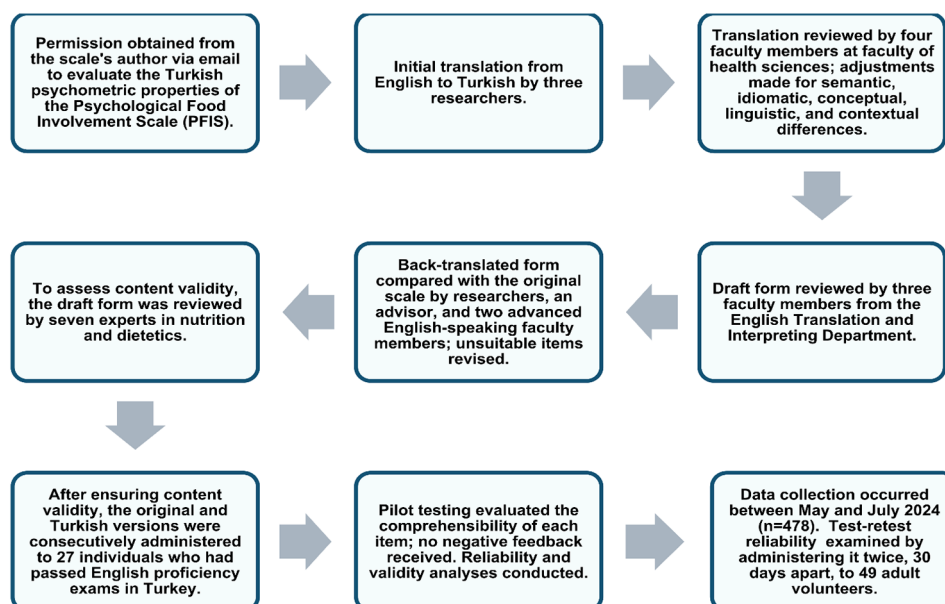


Fig. 1 Design of study

The process includes the following steps: Forward translation, the scale was independently translated into Turkish by three bilingual experts, ensuring linguistic and conceptual consistency. Synthesis, a single reconciled Turkish version was created by synthesizing the three forward translations and reviewed by four faculty members at Istanbul Beykent University, who evaluated semantic, idiomatic, conceptual, linguistic, and contextual differences. Back translation, to ensure semantic fidelity, the reconciled Turkish version was back-translated into English by an independent translator, and its language validity was assessed by CELTA-certified linguistics experts with doctoral degrees, who evaluated semantic, idiomatic, and conceptual consistency between the original and Turkish versions. Expert committee review, An expert committee comprising professionals in nutrition, dietetics, and linguistics evaluated the synthesized translation for semantic, idiomatic, experiential, and conceptual equivalence, while nutrition and psychology experts, with advanced degrees and specializations in food addiction and behavioral studies, reviewed the finalized version for contextual relevance and accuracy of psychological constructs. The preliminary version was pre-tested to a bilingual sample to test its comprehensibility and cultural appropriateness. Finalization: feedback from the pre-test was used to adjust, ensuring the final version was culturally and linguistically equivalent to the original scale.

During the expert committee review and pre-testing, particular attention was paid to adapting culturally sensitive elements of the scale. Language complexity was reviewed to ensure accessibility for participants with diverse educational backgrounds, simplifying terminology while preserving the original meaning.

Content validity

The Content Validity Index (CVI) is a quantitative metric used to evaluate the content validity of a scale or instrument. Content validity refers to the degree to which the items of a scale are relevant, transparent, and representative of the construct they are designed to measure. The CVI provides a systematic way to assess this validity based on expert feedback and helps ensure that the scale comprehensively and accurately captures the targeted concept. There are two primary levels of CVI:

Item Content Validity Index (I-CVI): This metric evaluates the content validity of individual items within a scale. It reflects the proportion of experts who rate an item as highly relevant or appropriate. Experts typically rate items on a Likert-type scale (e.g., 1 = not relevant to 4 = very relevant). The scale items were evaluated using a 4-point Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = highly relevant), which is widely recommended for Content Validity Index (CVI) calculations

as it encourages definitive expert judgments without a neutral option [24–26]. An I-CVI value of 0.78 or higher is acceptable for panels with fewer than ten experts [25, 26]. Items with low I-CVI values are usually revised or removed to improve the overall quality of the scale. The I-CVI is calculated as: $I-CVI = (\text{Number of experts giving a score of 3 or 4}) / (\text{Total number of experts})$.

Scale content validity index (S-CVI) This index measures the overall content validity of the scale, providing an aggregated view of expert consensus on all items. It can be calculated in two ways.

- S-CVI/UA (Universal Agreement): This measures the proportion of items that all experts agree are relevant (e.g., receive a score of 3 or 4):

$$S-CVI/UA = (\text{Number of items universally agreed upon}) / (\text{Total number of items})$$

- S-CVI/Ave (Average): This is the average of the I-CVI values across all items:

$$S-CVI/Ave = (\text{Sum of I-CVI values}) / (\text{Total number of items})$$

In this study, the content validity of the PFIS-TR was assessed based on the recommendations of Polit and Beck (2006), who suggest that panels of 5–10 experts are generally adequate for reliable evaluations of scale content validity [25, 26]. Similarly, Lynn (1986) argues that consulting at least six experts is sufficient if the panel members are selected for their expertise in the scale's target construct [24]. In our methodology, seven experts participated in the content validity assessment, aligning with these established guidelines [24]. The panel was carefully composed to include experts with diverse specialties in nutrition, food addiction, and psychology, ensuring a multidisciplinary perspective.

Experts were asked to evaluate the Turkish translated scale and the original version. Content validity index (CVI) was used to analyze the expert opinions, and each scale item was scored between 1 and 4. The evaluation criteria were defined as 1 point as “not appropriate,” 2 points as “somewhat appropriate, needs modification,” 3 points as “quite appropriate, minor modifications needed,” and 4 points as “very appropriate.” The scale items were finalized by making necessary adjustments per the experts' feedback. Experts evaluated each item as “appropriate,” “can remain,” or “not appropriate.” S-CVI and I-CVI were calculated separately for each item of the scale. Scores of 1 and 2 in the scale items were changed according to expert recommendation. The I-CVI ranged

between 0.87 and 0.99, and the S-CVI was 0.92 and consistent.

The reliability of our content validity findings is further supported by the high scores obtained for the Scale Content Validity Index (S-CVI=0.92) and Item Content Validity Indices (I-CVI=0.87–0.99), which exceeded the thresholds recommended for panels smaller than 10 [25, 26]. These results demonstrate the adequacy of our panel size and the robustness of the content evaluation process.

Pilot study

In scale validity and reliability studies, the scale should be applied to 20 to 30 participants who are like the sample but not included in the study sample [27]. After ensuring the scale's content validity, both the original English version and the Turkish translation were consecutively administered to 27 individuals with verified English proficiency. The scale was applied once to this group, and their feedback on item clarity and cultural appropriateness was collected. English proficiency was defined as achieving a score of 80 or above on the Foreign Language Proficiency Exam (YDS), which corresponds to an IELTS score of 6.5–7.0 or a TOEFL iBT score of 94–101 or graduating from an undergraduate program where English was the medium of instruction. This process was designed to assess the equivalence and clarity of the two versions of the scale, ensuring that the translation accurately conveyed the meaning and intent of the original items. These results were not included in the current study. Following the pilot application, the comprehensibility of each item was assessed. Participants were invited to provide qualitative feedback through open-ended questions regarding items they found unclear, culturally inappropriate, or requiring modification. Based on their responses, minor adjustments were made to enhance the accessibility of specific terms, ensuring the scale was comprehensible for individuals with diverse educational backgrounds. This iterative feedback process ensured that the Turkish adaptation of the scale retained the validity and reliability of the original version.

When the obtained data were analyzed, it was found that the KMO value, an indicator of the adequacy of the data structure for factor analysis [28, 29], was 0.94, and the Bartlett's test of sphericity (BS) was statistically significant at $p < 0.05$. A KMO value of 0.70 or higher indicates that the data are suitable for Exploratory Factor Analysis (EFA) [30]. The results of the pilot study are given in Supplementary T2.

Test-retest

After the language validity of the scale was ensured and finalized, its reliability was tested through test-retest and internal consistency analyses. The final version of the

Turkish PFIS was administered to 49 adult volunteers twice, 30 days apart, to examine test-retest reliability.

Data collection tools

Psychological food involvement scale (PFIS)

The Psychological Food Involvement Scale is a scale that expresses the social bond between consumers and food. Based on previous qualitative studies [2] and a review of the scientific literature, the PFIS was first developed as 21 items to test the PFIS and the number of items was reduced to 19 due to structural analysis. This scale developed by Castellini et al. consists of 4 subscales. The subscales of the scale are Emotional Balance, Self-Actualization, Social Approval, and Social Bonding. Emotional Balance reflects the extent to which food contributes to emotional regulation and psychological well-being. Self-realization assesses how individuals use food as a means of personal expression and identity construction. Social Affirmation evaluates the role of food in seeking social approval and adhering to social norms. Social Bonding Measures how food facilitates interpersonal connections and strengthens social relationships.

Responses to each item were evaluated on a 7-point Likert scale with the following options: 1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4 = Neither Agree nor Disagree, 5 = Somewhat Agree, 6 = Agree, 7 = Strongly Agree. There are no cut-off points and no reverse-scored items. A higher score indicates greater psychological food engagement. The scale's subscales were designed to address individual and social dimensions of food involvement, ensuring that the emotional and psychological effects are captured comprehensively.

Addictive-like eating behaviors scale (ALEBS)

The Turkish validity and reliability study of the scale developed by Ruddock and colleagues [31] was conducted by Demir and Bektaş [32]. The scale consists of 15 items and two subscales named appetite drive and low diet control (sample item: I keep eating even though I feel full; I feel I cannot control my weight). The internal consistency of the ALEBS was assessed using Cronbach's Alpha, demonstrating high reliability. The Cronbach's Alpha values were as follows: Appetite Impulse Subscale: 0.89, Low Eating Control Subscale: 0.87, and overall scale: 0.91. These findings confirm that the ALEBS is a reliable instrument for evaluating appetite control and eating behaviors, alongside the Psychological Food Involvement Scale (PFIS), which assesses food involvement's psychological and emotional dimensions. The scale has a five-point Likert format and is assessed with a total score. Items 6, 11, 12, 13, and 14 are reverse-scored items. There is no cut-off point on the scale, with higher scores indicating more addiction-like eating behaviors.

Statistical analysis

Descriptive statistics for categorical variables were reported as frequencies and percentages, while numerical variables were summarized using mean \pm standard deviation ($\bar{X} \pm SD$), minimum, and maximum values. The Shapiro-Wilk test was applied to assess the normality of numerical variables. Construct validity was evaluated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The suitability of the data for EFA was determined by the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. A KMO value of 0.70 and above indicates that the data suits EFA [30]. For the factorizability of the data, a KMO value higher than 0.60 is expected [31]. In addition, the Bartlett test value should also be significant [27].

Exploratory factor analysis (EFA) was conducted to identify the underlying factor structure using eigenvalues, the scree plot method, and the cumulative variance explained, with a threshold of $\geq 50\%$ deemed acceptable [33]. A rotation method was applied to enhance the clarity and interpretability of the factor loadings. Items with low factor loadings (< 0.30) or cross-loadings that

negatively impacted model fit were removed iteratively to achieve an optimal factor solution. CFA was subsequently conducted to validate the factor structure suggested by EFA. The model's fit was assessed using several standard indices, including the chi-square to degrees of freedom ratio (χ^2/df), root mean square error of approximation (RMSEA), goodness-of-fit index (GFI), comparative fit index (CFI), and standardized root mean square residual (SRMR).

Reliability was assessed using Cronbach's Alpha and Spearman-Brown coefficients to evaluate internal consistency. The consistency definition was used to calculate the Intraclass Correlation Coefficient (ICC). A two-way mixed-effects model, where measurement effects are fixed, was preferred. Since the interaction effect could not be estimated, the calculation was performed under the assumption that there was no interaction effect. Correlation analyses were conducted using the Pearson correlation coefficient to test the relationships between subscales and addictive-like eating behavior. All statistical analyses, including ICC, t-tests, ANOVA, and descriptive statistics, were performed using SPSS (Statistical Package for the Social Sciences, version 22.0), while confirmatory factor analysis (CFA) was conducted using AMOS (Analysis of Moment Structures, version 22.0).

Table 1 Demographic characteristics of the participants

Characteristic		n	%
Gender	Male	163	34.1
	Female	315	65.9
Marital Status	Single	253	52.9
	Married	225	47.1
Education Level	Primary School	57	11.9
	High School	123	25.7
	University	282	59.0
	Postgraduate	16	3.3
Incoming Status	My income is lower than my expenses	87	18.2
	My income is higher than my expenses	127	26.6
	My income equals my expenses	264	55.2
Smoking Status	I used to smoke but don't anymore	79	16.5
	I have never smoke and don't smoke	244	51.0
	I smoke	155	32.4
Alcohol Consumption Status	I used to drink but don't anymore	68	14.2
	I have never drunk and don't drink	258	54.0
	I drink	152	31.8
Health Problem	Yes	84	17.6
	No	394	82.4
Have you been trained in nutrition by a professional?	Yes	72	15.1
	No	406	84.9
BMI	Underweight (> 18.5)	21	4.4
	Normal ($18.5-24.9$)	201	42.1
	Overweight ($25.0-29.9$)	103	21.5
	Obese (< 30)	153	32.0
	Total	478	100.0

†BMI: Body Mass Index

Results

The Turkish adaptation of the PFIS and its validity and reliability study were conducted in this study. The scale was applied to 478 people. Demographic characteristics of the participants are presented in Table 1. The gender distribution of the participants was 66% female and 34% male. Regarding educational status, 59% of the participants were university graduates, and 25.7% were high school graduates. Regarding body mass index (BMI), 42.1% of the participants were normal weight, 21.5% were overweight and 32% were obese.

For the data to be factorable, the KMO value is expected to exceed 0.60 [34]. Additionally, the Bartlett's test value must also be statistically significant [27]. The exploratory factor analysis (EFA) results confirmed that the dataset was appropriate for factor analysis (KMO = 0.94, Bartlett's test $p < 0.05$). Based on the Exploratory Factor Analysis (EFA) results, the scale demonstrated an appropriate distribution across subscales, with factor loadings ranging from 0.55 to 0.87 (Table 2). Additionally, the four-factor structure explained 79% of the variance. In this study, the internal consistency of the Psychological Food Involvement Scale (PFIS) was assessed using Cronbach's Alpha. The Turkish adaptation of the scale demonstrated high reliability across its subscales, with the following Cronbach's Alpha values: Emotional Balance: 0.94, Self-Realization: 0.92, Social Affirmation: 0.86, Social Bonding: 0.93. The overall Cronbach's Alpha value

Table 2 EFA results for the psychological food involvement scale

Subscales	Items / English	Items / Turkish	1	2	3	4	Cronbach alpha	Cronbach alpha when item deleted	Cronbach alpha for Subscales
Emotional Balance	1. Food gives me pleasure	Besinler bana zevk verir.	0.793				0.901	0.923	0.94
	2. Food allows me to achieve psycho-physical well-being	Besinler psikolojik ve fiziksel açıdan iyi olmamı sağlar.	0.814				0.845	0.932	
	3. Food allows me to relax	Besinler beni rahatlatır.	0.843				0.870	0.929	
	4. Food is an important part of my life	Besinler hayatımın önemli bir parçasıdır.	0.804				0.767	0.948	
	5. Food has an impact on my emotions	Besinler, duygularım üzerinde etkilidir.	0.727				0.882	0.925	
Self-Realization	6. Choosing what to eat is a way to express my creativity	Yemek seçimlerim yaratıcılığımı ifade etmemin bir yoludur.		0.562			0.752	0.911	0.92
	7. Choosing what to eat tells something about me	Yemek seçimlerim, benim hakkımda fikir verir.		0.765			0.778	0.904	
	8. Choosing what to eat reflects the kind of person I am	Yemek seçimlerim nasıl bir insan olduğumu yansıtır.		0.864			0.871	0.885	
	9. Choosing what to eat allows me to express who I am	Yemek seçimlerim kim olduğumu ifade etmemi sağlar.		0.866			0.885	0.882	
	10. Through my food choices people can understand something about me	Besin seçimlerim sayesinde insanlar benim hakkımda fikir edinebilir.		0.784			0.686	0.921	
Social Approval	11. Choosing what to eat allows me to be considered by others as I would like them to consider me	Yemek seçimlerim, başkalarının beni istediğim şekilde düşünmelerini sağlar.			0.550		0.679	0.832	0.86
	12. Choosing what to eat is a way for others to recognize me for who I am	Yemek seçimlerim, başkalarının beni olduğum gibi tanınmasının bir yoludur.			0.573		0.813	0.793	
	13. Choosing what to eat is a way for others to accept me for who I am	Yemek seçimlerim başkalarının beni olduğum gibi kabul etmesinin bir yoludur.			0.615		0.775	0.803	
	14. My food choices are determined by how I want to appear to others	Besin seçimlerim, başkalarına nasıl görünmek istediğime göre belirlenir.			0.773		0.798	0.800	
	15. My food choices are determined by a dietary pattern to which I want to adhere	Besin seçimlerim, uymak istediğim bir beslenme düzeyine göre belirlenir.			0.643		0.380	0.907	
Social Bonding	16. Dining with loved ones allows me to strengthen my bond with them	Sevdiklerimle birlikte yemek yemek, onlarla olan bağımı güçlendirmemi sağlar.				0.799	0.840	0.919	0.93
	17. Dining with loved ones is an important time to share experiences	Sevdiklerimle birlikte yemek yemek, deneyimlerimizi paylaşmak için önemli bir zamandır.				0.798	0.862	0.911	
	18. Preparing lunches/dinners for my loved ones is a way to take care of them	Sevdiklerim için yemek hazırlamak onları önemsemiğimi göstermenin bir yoludur.				0.851	0.864	0.911	
	19. Preparing lunches/dinners for my loved ones is a way to express my affection	Sevdiklerim için yemek hazırlamak ilgimi ifade etmenin bir yoludur.				0.814	0.826	0.923	

for the entire scale was calculated as 0.94, confirming the scale's high internal consistency. These results support the reliability of the PFIS as an instrument for measuring the psychological and emotional effects of food within the Turkish adult sample of this study, although its

applicability to the broader Turkish population requires further investigation.

Upon examining the Exploratory Factor Analysis (EFA) results, items that negatively affected model fit indices were removed, and the analyses were repeated. Based on the findings, items 5, 6, 10, 11, and 15 were excluded from

Table 3 Goodness-of-fit values for the CFA Measurement Model

	χ^2 /sd	GFI	AGFI	CFI	NFI	RMSEA	SRMR
Normal Value	< 2	> 0.95	> 0.90	> 0.95	> 0.95	< 0.05	< 0.05
Acceptable Value	< 5	> 0.90	> 0.85	> 0.90	> 0.90	< 0.10	< 0.08
CFA Measurement Model	2.28	0.95	0.93	0.98	0.94	0.05	0.03

† χ^2 /sd : Chi-Square, GFI: Goodness-of-Fit Index, AGFI: Adjusted Goodness-of-Fit Index, CFI: Comparative Fit Index, NFI: Normed Fit Index, RMSEA: Root Mean Square Error of Approximation, SRMR: Standardized Root Mean Square

the analysis. This indicated that these items adversely impacted the model's fit indices and did not have sufficient factor loadings. During the factor analysis process, the decision to exclude items is typically based on low factor loadings (< 0.30) or cross-loadings, which can disrupt the overall fit statistics of the model [35].

In this study, the removed items were observed to either not contribute sufficiently to their respective factor structures or to exhibit high correlations with other factors. Specifically, item 5 failed to meet the expected loading in the "Emotional Balance" subscale, items 6 and 10 reduced model fit the "Self-Realization" subscale, items 11 and 15 did not contribute to the "Social Affirmation" subscale. Based on upper-lower group comparisons, the 27th percentile cut-off value for the scale was determined to be 55.6.

Based on the analysis of the findings, the Confirmatory Factor Analysis (CFA) results for the variables of the Psychological Food Involvement Scale indicated that the measurement model was validated and demonstrated a good fit for the sample in this study. The goodness-of-fit indices were as follows: $\chi^2/df = 2.28$, GFI = 0.95, AGFI = 0.93, CFI = 0.98, NFI = 0.94, RMSEA = 0.05, and SRMR = 0.04.

CFA was used to confirm the factor structure suggested by EFA and to evaluate the construct validity of the model. The schematic representation of the CFA, performed using the AMOS software, is presented in Fig. 2.

To evaluate discriminant validity, independent samples *t*-tests and one-way ANOVA tests were conducted to explore group differences based on gender, marital status, education level, and other demographic factors (Table 4). The results indicated no statistically significant difference between male and female participants in the overall scale scores ($t = -0.098$, $p = 0.922$). Similarly, no significant differences were observed across marital status ($t = 1.568$, $p = 0.118$), education levels ($F = 2.779$, $p = 0.063$), or other variables such as income, smoking, alcohol consumption, health problems, and nutrition education (all $p > 0.05$). These findings suggest that the scale performs consistently across various demographic groups, supporting its generalizability and discriminant validity.

Test-retest reliability

The test-retest reliability analysis results demonstrate that the measurement tool is reliable. The Cronbach's

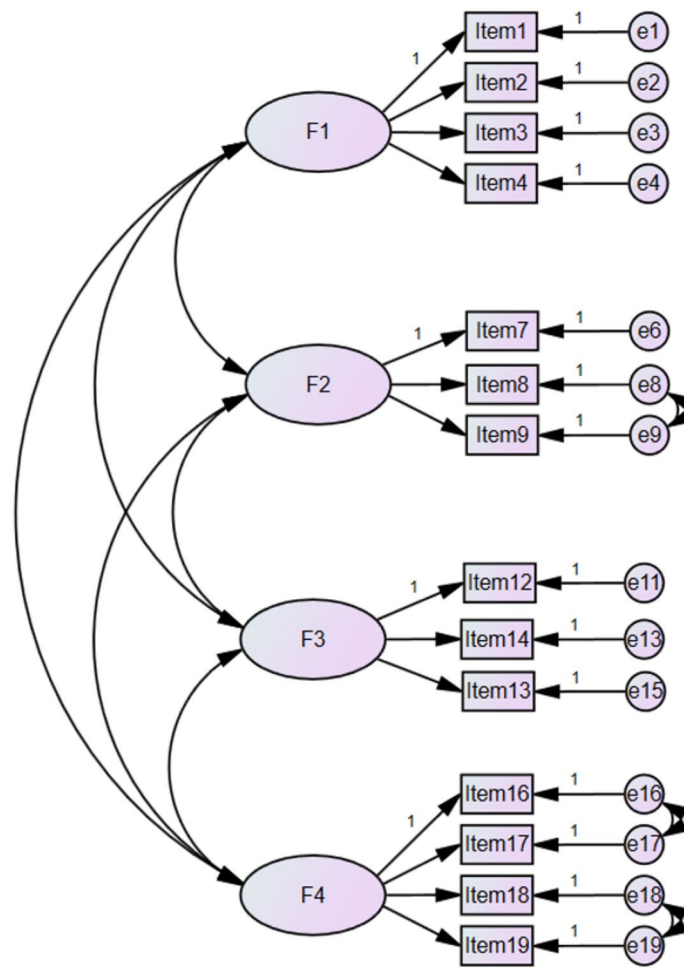
Alpha coefficient was calculated as $\alpha = 0.957$, indicating a high level of internal consistency between the two measurements. Additionally, the Intraclass Correlation Coefficient (ICC) for single measurements was 0.917 (Confidence Interval [CI]: 0.856–0.953), and for average measurements, it was 0.957 (CI: 0.922–0.976). These findings suggest that the scale provides consistent results over time and is highly reliable. The *F*-test results were significant at $F(45, 45) = 23.239$, $p < 0.001$, supporting that the measurements exhibit non-random consistency. The method employed was identified as a two-way mixed-effects model, where individual effects are random, and measurement effects are fixed.

Correlation results

According to the correlation findings in Table 5, emotional balance subscale was positively and significantly correlated with the total score ($r = 0.38$; $p < 0.01$), appetite drive subscale ($r = 0.34$; $p < 0.01$) and low eating control ($r = 0.28$; $p < 0.01$). The self-realization subscale was positively and significantly correlated with the total score ($r = 0.28$; $p < 0.01$), appetite drive subscale ($r = 0.24$; $p < 0.01$), and low eating control ($r = 0.25$; $p < 0.01$). The social affirmation subscale was positively and significantly associated with ALEBS total score ($r = 0.22$; $p < 0.01$), appetite drive subscale ($r = 0.18$; $p < 0.01$), and low eating control ($r = 0.19$; $p < 0.01$). The social bonding subscale was found to be positively and significantly associated with ALEBS total score ($r = 0.29$; $p < 0.01$), appetite drive subscale ($r = 0.21$; $p < 0.01$), and low eating control ($r = 0.30$; $p < 0.01$). PFIS-TR total score was found to be positively and significantly associated with ALEBS total score ($r = 0.35$; $p < 0.01$), appetite drive subscale ($r = 0.29$; $p < 0.01$), and low eating control ($r = 0.30$; $p < 0.01$).

Discussion

Today, psychological food involvement is recognized as an essential factor affecting people's eating behaviors and general health status, and research on this subject is increasing [36, 37]. In studies, scales developed by experts in the field are used to assess food engagement. The PFIS was developed by Castellini et al. (2023) to assess psychological food engagement [19]. The need to develop the PFIS stemmed from the necessity to address the relationship with food from emotional, social, and psychological aspects beyond the behavioral dimension.



CMIN=155,612; DF=91; p=000; CMIN/DF = 2,288; RMSEA = ,052; GFI = ,955; CFI = ,987; IFI=,987; TLI = ,982

Fig. 2 CFA Results of the Psychological Food Involvement Scale. Factor structure of the PFIS scale. Standardized parameter estimates for the final model (N=478). Note: F1 = Emotional Balance; F2 = Self-Realization; F3 = Social-Affirmation; F4 = Social Bonding

This scale was developed to understand food’s more profound psychological effects on an individual by measuring how food affects a person’s identity, social acceptance, and emotional balance.

This study was conducted to determine the reliability and validity of the Turkish version of the PFIS. In the study, the relationship between the PFIS and the ALEBS examined, and the structure of the scale was evaluated using EFA and CFA. In addition, correlations between related variables were analyzed. The findings revealed that the Turkish version of the PFIS provided high validity and reliability. In particular, it was found that the PFIS-TR was significantly correlated with the “appetite drive” and “low eating control” subscales of the ALEBS. These results support the idea that the Turkish PFIS is an effective tool for assessing individuals’ relationships with food. In the literature, there is no evidence of validity and reliability in studies of PFIS in different countries. This emphasizes the study’s originality and points to the

importance of conducting new research to test the PFIS in other cultures.

In the original study of PFIS, the scale consisted of 19 items and four subscales. These are Emotional Balance, Self-Realization, Social Approval, and Social Bonding factors. In the original study, these scales’ Cronbach’s Alpha values were reported as 0.916, 0.943, 0.891, and 0.928, respectively [19]. However, based on the Exploratory Factor Analysis (EFA) results conducted during the Turkish adaptation process, items 5, 6, 10, 11, and 15 were removed from the scale as they negatively affected model fit and lacked sufficient factor loadings. After these revisions, the scale was reduced to 14 items with a 4-factor structure. In the Turkish version, each subscale’s Cronbach’s Alpha values were calculated as 0.94, 0.92, 0.86, and 0.93, respectively. These values are generally consistent with the original study’s findings, demonstrating that the Turkish version is a reliable measurement tool with high internal consistency. These results confirm that

Table 4 Participants’ characteristics and PFIS mean scores

Variables		N	Mean ± SD	t	df	p
Gender	Male	163	63.04 ± 18.70	-0.098	476	0.922
	Female	315	63.22 ± 19.11			
Marital Status	Single	253	64.43 ± 17.63	1.568	476	0.118
	Married	225	61.72 ± 20.28			
Education Level	Primary School	57	59.09 ± 21.86	2.779	2.475	0.063
	High School	123	61.41 ± 20.16			
	University	298	64.65 ± 17.70			
Incoming Status	Postgraduate	87	64.98 ± 20.08	0.603	2.475	0.548
	My income is lower than my expenses	127	62.09 ± 19.30			
	My income is higher than my expenses	264	63.06 ± 18.43			
Smoking Status	My income equals my expenses	79	64.44 ± 17.40	0.932	2.475	0.394
	I used to smoke but don't anymore	244	62.00 ± 19.49			
	I have never smoke and don't smoke	155	64.32 ± 18.86			
Alcohol Consumption Status	I smoke	68	65.59 ± 21.13	0.770	2.475	0.464
	I used to drink but don't anymore	258	62.40 ± 18.73			
	I have never drunk and don't drink	152	63.34 ± 18.33			
Health Problem	I drink	84	65.42 ± 19.57	1.205	476	0.229
	Yes	394	62.67 ± 18.81			
Have you been trained in nutrition by a professional?	No	72	61.65 ± 19.29	-0.729	476	0.466
	Yes	406	63.42 ± 18.91			

Table 5 Correlation findings related to Construct Validity

	1	2	3	4	5	6	7	8
1. Emotional Balance	1							
2. Self-Realization	0.615**	1						
3. Social Affirmation	0.455**	0.763**	1					
4. Social Bonding	0.705**	0.535**	0.402**	1				
5. PFIS-TR Total	0.838**	0.891**	0.800**	0.777**	1			
6. ALEBS	0.377**	0.278**	0.216**	0.291**	0.351**	1		
7. Appetitive drive	0.339**	0.238**	0.181**	0.214**	0.295**	0.896**	1	
8. Dietary control	0.278**	0.247**	0.190**	0.296**	0.303**	0.724**	0.369**	1

†ALEBS = Addiction-like Eating Behavior Scale

the scale exhibits high internal consistency and reliability [30]. Positive and statistically significant relationships were found between the subscales, showing that the subscales of the scale are mutually supportive and reinforce the overall structural integrity of the scale. Based on the results, the PFIS-TR was evaluated as “highly reliable.”

Various scales have been developed to assess eating behaviors and emotional states in this context. Among these, the Emotional Eating Scale (EES), Three-Factor Eating Questionnaire (TFEQ), Addictive-like Eating Behavior Scale (ALEBS), and Yale Food Addiction Scale stand out [31, 38–40]. The Emotional Eating Scale measures eating behavior to cope with negative emotions [38], while the emotional eating subscale of TFEQ assesses how emotional states trigger eating behavior [40]. The Addictive-like Eating Behavior Scale and Yale Food Addiction Scale are used to measure addiction-like behaviors towards food [31, 39]. Although these scales are essential in examining the relationship between individuals’ emotional states and eating behaviors, their focus

is generally on negative emotions and behaviors. In contrast, the Emotional Balance subscale of PFIS includes positive and negative emotional responses evoked by food [19]. With this feature, PFIS can be considered a comprehensive tool for measuring emotional and psychophysical balance, as it considers the entire emotional spectrum, not just negative emotions. The Emotional Balance subscale of PFIS differs from other scales in this field by evaluating food’s psychological and emotional effects on individuals from a broad perspective. Therefore, it stands out as an essential measurement tool that can be used to examine the effects of food on emotional responses.

Food can be used as a means of expression, reflecting individuals’ personalities, values, and lifestyles [41, 42]. While food is an essential tool of expression, there is no specific measurement tool to assess how significant food choices are in individuals’ lives. In this context, the Power of Food Scale could be considered; however, it only evaluates the influence and impact of food on individuals

and does not fully encompass the use of food as a tool for personal expression [43]. At this point, PFIS emerges as an essential tool for evaluating whether individuals use their food choices as a means of personal expression. By addressing the relationship between individuals and food from a physiological need and a psychosocial and cultural perspective, PFIS offers a valuable framework for examining the role of food in the process of self-realization.

Individuals may modify their general behaviors and preferences to gain acceptance and approval in their social environments. Similarly, they may alter their food choices to conform to societal expectations or be accepted by certain groups [44]. To assess the impact of social and environmental factors on individuals' eating behaviors, the Dutch Eating Behavior Questionnaire (DEBQ) - External Eating Subscale can be used [45]. This subscale analyzes how social environments influence eating behaviors but does not directly address changes in food choices made to gain social approval [45]. In this context, PFIS can assess how individuals shape their food choices to gain approval from their social environments or align with societal norms.

The Food Involvement Scale (FIS) can assess individuals' general interest in food and their connection with it [1]. However, this scale does not directly evaluate the effectiveness of food as a tool for social bonding. Therefore, PFIS provides a comprehensive perspective by examining food's role in developing social bonds, going beyond its impact.

An exploratory factor analysis (EFA) was conducted to assess the data's suitability and the scale's structural validity to test the PFIS-TR's validity. In exploratory factor analysis, the suitability of the data is generally evaluated using Bartlett's test of sphericity and the KMO coefficient. In this study, based on the results of the Bartlett test and KMO coefficient, the data and sample size were deemed adequate for EFA [30]. Previous research has indicated that a 50% or more explained variance is sufficient for multi-factor scales [30, 46]. In the original study of the scale, the results of Bartlett's test and the KMO coefficient ($KMO = 0.916$, $X^2 = 4236.022$, $p < 0.001$) confirmed the suitability of the data for factor analysis. The EFA identified four factors with factor loadings > 0.40 and eigenvalues > 1 , with factor loadings ranging from 0.56 to 0.97, explaining 79.17% of the total variance [19]. Regarding factor loadings, values below 0.30 are considered weak, while those above 0.40 are deemed suitable [33]. In this study, the KMO value was found to be 0.94, indicating that the data were highly suitable for factor analysis. The EFA results showed factor loadings ranging from 0.55 to 0.87, with a four-factor structure explaining 79% of the total variance. The high KMO value of 0.94 demonstrates that the sample was sufficient for factor analysis. In contrast, the distribution of factor loadings within

this range indicates that the scale has solid structural validity. Despite the cultural differences between the two countries, the similarity in total variance and EFA results suggests that the PFIS-TR structure is comparable to the original scale, showing valid and robust structural validity for our sample.

Ensuring structural validity is crucial in cross-cultural adaptation studies. As recommended by field experts, CFA should be applied to evaluate the validity of culturally adapted scales [27, 30, 46]. In this study, CFA was conducted to assess the structural validity of the Turkish version of PFIS, revealing a factor structure consistent with the original form of the scale. In the original study, the CFA model fit indices indicated that the model fit well to the data [19]. For the Turkish version of the scale, the CFA model fit indices confirmed the measurement model for this sample and were found to be within an acceptable range. The CFA results validated the four-factor structure of the scale, demonstrating that the items within each subscale adequately defined their respective factors. Findings indicating that the items sufficiently represented the intended constructs further strengthen the structural validity of the scale [27, 30, 46]. These confirmations demonstrate that the PFIS-TR is mainly consistent with the original scale and provides a valid structure in this study's sample context.

Analyzing group differences based on demographic variables provides essential insights into the applicability of the Psychological Food Involvement Scale (PFIS) across diverse populations. The absence of statistically significant differences in the overall scores across gender, marital status, and other demographic factors such as smoking, alcohol consumption, and nutrition education supports the generalizability of the scale. Additionally, the slight variations observed in education level and BMI categories, while not statistically significant ($p > 0.05$), suggest potential trends that could be further explored in future research. For example, individuals with higher education levels or within specific BMI categories may perceive food involvement differently, which aligns with previous findings in the literature. These results emphasize the PFIS's robustness as a reliable instrument that is not heavily influenced by demographic variability. However, future studies could focus on larger and more diverse samples to investigate subtle group differences in greater detail and examine how these factors interact with specific subscales of the scale.

In this study, the structural validity of the Turkish version of the scale was tested using the ALEBS, and the positive and significant relationships between the two scales provided a deeper understanding of the psychological mechanisms underlying eating behaviors. ALEBS is a tool that measures individuals' addiction-like eating behaviors toward specific foods and evaluates both the physical and

psychological effects of these behaviors [32]. Emotional eating behaviors often arise from negative emotional states and lead to a loss of control over food consumption, especially in individuals with low eating control [47]. Findings in the literature show that emotional eating is strongly associated with negative emotional states such as stress, depression, loneliness, and boredom, which can lead to overeating tendencies (appetite impulses) and a reduction in eating control [48]. These emotional responses can prompt individuals to develop addiction-like reactions to food, seeking psychological relief through eating. While ALEBS assesses these addiction-like eating responses, PFIS-TR stands out as an essential scale measuring the psychological motivations behind eating behaviors. The study found positive and significant correlations between the subscales of PFIS-TR and ALEBS. This finding demonstrates that both scales evaluate similar psychological processes related to individuals' eating behaviors. In particular, the strong relationship between the emotional eating subscale of PFIS-TR and the food addiction subscale of ALEBS supports the idea that emotional eating behaviors are triggered by psychological processes such as stress and depression, which can lead to addiction-like eating responses in individuals [19]. In conclusion, the positive correlations between ALEBS and PFIS-TR show that both scales are complementary in understanding individuals' eating behaviors. These findings provide significant evidence of the structural validity of the scales based on the sample used in this study.

This study has several limitations. First, the use of self-report methods for data collection poses a risk of participant bias. Self-reported physical data such as height and weight may compromise accuracy in BMI calculations. Future studies are advised to validate such data through clinical measurements. The sample included individuals from a wide age range, which may impact the homogeneity of findings due to the inclusion of participants from different life stages. For instance, the psychological relationships with food may differ between young adults, middle-aged individuals, and older adults. This study was conducted with a sample of adults from a single region in Turkey. As such, the validation findings are specific to this population, and further studies are needed to confirm the applicability of the scale across more diverse and representative samples from different regions of Turkey.

Additionally, 66% of the sample comprised women, limiting the findings' generalizability to male participants. More balanced gender distributions in future samples could enable a more comprehensive evaluation of psychological factors related to food for both genders. Another limitation is that the study focused solely on individuals from a specific demographic and geographical group in Turkey. This limits the generalizability of the findings to other cultures. Future research should test the

validity and reliability of the PFIS-TR in diverse cultural groups.

Moreover, scales like the PFIS rely on participants' subjective evaluations and are susceptible to social desirability bias, where participants may provide socially acceptable responses, potentially affecting data accuracy. To minimize such biases, future studies could adopt mixed-method approaches. Finally, individuals with a diagnosis of eating disorders were excluded from this study. As a result, the applicability of the PFIS-TR in clinical populations remains unexamined. Future research on this group would help evaluate the scale's validity across a broader population.

Conclusion

As food engagement has become a research topic of increasing interest, understanding how food plays an essential role in emotional and social processes beyond just being a means of nutrition has necessitated using valid and reliable scales. The present study successfully demonstrated the validity and reliability of the PFIS-TR developed for this purpose. The results revealed that the Turkish-adapted version of the four-subscale structure of the scale was valid and showed significant positive relationships with the PFIS. These relationships provide essential clues to better understand the psychological dimensions of individuals' eating behaviors. Reliability analyses revealed high internal consistency and item reliability, thus proving that the PFIS is a reliable instrument that can be used in the Turkish population. The PFIS-TR will be particularly useful for epidemiologic research and large-scale survey studies to assess food adherence, investigate risk factors, and examine the psychological and physical consequences of eating disorders in the Turkish population.

Abbreviations

PFIS	Psychological Food Involvement Scale
ALEBS	Addiction-like Eating Behavior Scale
SPSS	Statistical Package for the Social Sciences
KMO	Kaiser-Meyer-Olkin
BS	Bartlett's Test of Sphericity
RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index
SRMR	Standardized Root Mean Square Residual
TLI	Tucker-Lewis Index
Cmin/df	Chi-Square Minimum/degree of freedom
S-CVI	Scale-Level Content Validity Index
I-CVI	Item-Level Content Validity Index
GFI	Goodness-of-Fit Index
AGFI	Adjusted Goodness-of-Fit Index
NFI	Normed Fit Index
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
SS	Standard Deviation
\bar{X}	Mean (Arithmetic Mean)
BMI	Body Mass Index

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40359-025-02413-9>.

Supplementary Material 1

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Author contributions

All authors contributed to the design and implementation of the research. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval

"Ethics Committee Approval" dated 09.05.2024 and numbered E-10840098-202.3.02-3020 was obtained from Istanbul Medipol University Non-Interventional Research Ethics Committee for the study. This study was conducted using the principles of the Declaration of Helsinki and the rules of "research and publication ethics." Informed consent to participate was obtained from all of the participants in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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