Applied nutritional investigation

Turkish validity and reliability of the Four Facet Mindful Eating Scale (FFaMES-TR) in adolescence

Neslihan Sürmeli Akçadağ M.D. [a],[*], Saniye Bilici Ph.D. [b]

[a] Department of Nutrition and Dietetics, Faculty of Health Sciences, Yüzüncü Yıl University, Van, Tuşba, Türkiye
[b] Department of Nutrition and Dietetics, Faculty of Health Sciences, Gazi University, Emek, Ankara, Türkiye

ARTICLE INFO

ABSTRACT

Objectives: The aim of this study was to evaluate the validity and reliability of the Four Facet Mindful Eating Scale by Carrière et al. in a Turkish adolescent group.
Methods: The study included 591 participants between 14 and 17 years old. The Cronbach's alpha (CA) coefficient was used to evaluate the internal consistency reliability and the test-retest method was applied. Exploratory factor analysis (EFA) was performed to determine the factor structure. The model obtained with EFA was evaluated with confirmatory factor analysis.
Results: The total CA of the scale was 0.893, non-reactance CA 0.898, external awareness 0.808, non-judgment 0.862, internal awareness 0.772. The relationships between the total score and subscales in the first test and retest were found to be significant ($P < 0.001$). The Kaiser−Meyer−Olkin value was 0.903. Bartlett's test of sphericity, the correlation level between the items was found to be sufficient for factor analysis ($\chi^2 = 5326.27$, standard deviation = 231, $P = 0.001$; $P < 0.05$). The factor loadings of the items were between 0.511 and 0.885, and the factors explained 61.8% of the variance. It was observed that the model had an acceptable fit (χ^2/standard deviation 3.035, comparative fit index 0.933, Tucker−Lewis index 0.904, standardized root mean square error 0.057, and root mean square error of approximation 0.058. Because of applying EFA to the 29 questions in the scale, it was decided to remove 8 items from the final scale.
Conclusions: The Turkish version of the Four Facet Mindful Eating Scale is valid and reliable for assessing mindful eating behaviors among adolescents.

Introduction

Mindfulness is defined as a present-centered awareness with an attitude of non-judgment [1]. Mindfulness is a set of practices or processes rather than a construct [2]. In general, current literature has defined two fundamental elements; attention and attitude. These two facets are described as the what and how of mindfulness and play a significant role in the therapeutic benefits of mindfulness training on health outcomes [3]. Mindful eating fundamentally applies mindfulness to eating-related thoughts, bodily sensations, emotions, and behaviors. A key component of mindful decision-making is decentering from food-related thoughts, taking a non-judgmental stance toward food-related thoughts, and viewing them as transient mental events that are separate from oneself. Mindful eating might be a promising approach to enrich the current treatment of eating and weight disorders and aid in expanding our understanding of the underlying mechanisms of its application in the field [4].

Adolescence is marked by some of the most dramatic and significant changes occurring throughout the human lifespan, particularly in terms of brain development. Research has confirmed the importance of supporting adolescents during this transitional period as they develop the physical and cognitive competencies that will shape their adult lives [5]. Mindfulness practice has the potential to support healthy development during adolescence and beyond by reducing stress, promoting well-being, and providing tools for emotional balance. Specifically for young individuals, the cultivation of these cognitive abilities is directly linked to enhanced self-awareness, self-regulation, fully engaged learning, and overall well-being [6]. Although research on adolescents remains more limited compared to adults, several studies have

documented improvements in attentional skills, social skills among students with learning difficulties, sleep quality, overall well-being, as well as reductions in anxiety and depression [6–8]. Programs such as Learning to Breathe (L2B) have been designed to assess the effects of mindfulness-based approaches among adolescents, particularly those that can be integrated into high school curricula as universal prevention strategies [6].

The interactions between eating behaviors, cognitive development, and mindfulness capacity during adolescence play a crucial role in shaping individuals' overall health and psychological well-being. Research has highlighted the significant influence of gender, family dynamics, socio-cultural factors, biological predispositions, and psychological characteristics on the development of adolescents' eating behaviors. The current studies have found that mindfulness-based interventions improve eating behaviors in adolescents [4,9,10].

Mindfulness and mindful eating have been increasingly used as an adjunct treatment for adolescents with a range of physical and mental health problems. Recently, there has been increased interest in investigating the effectiveness of mindfulness-based programs for the treatment of obesity and this age group represents an important turning point for the future [11–13]. Obesity during adolescence is the best predictor of adult obesity and following health complications, including heart disease and Type 2 diabetes mellitus [14,15]. Thus, adolescence is a critical period for obesity prevention and treatment. Furthermore, adolescents who are obese or overweight are more likely to experience weight-related stigma from their peers [16]. Mindful eating programs represent a promising approach to youth obesity given that they seek to provide a balanced, integrated approach to the prevention of weight-related problems in youth [17]. Eating disorders are psychiatric illnesses with a high prevalence of onset during adolescence. Mindfulness and mindful eating interventions have been among the most effective approaches in reducing binge eating behaviors, regardless of weight status during adolescence. Additionally, these interventions have been shown to decrease emotional eating and eating in response to external cues, both of which are key behaviors associated with obesity in adolescence [18]. Studies have reported that mindfulness-based interventions provide 30% to 40% remission in adolescents diagnosed with eating disorders [19,20]. In a study conducted with 198 adolescents between the ages of 13 to 18; mindfulness, emotional eating, and weight control self-efficacy in adolescents had a facilitating effect on the management of obesity [21]. Two weeks of mindful eating intervention with 5 min of training per day revealed not only short-term effects in decreasing maladaptive eating behaviors that foster the development and maintenance of eating and weight-related disorders but also its effects 3 months after the short training period [4]. More research is required to assess the effects of mindfulness eating on eating behaviors among adolescents. There is still much lack of knowledge about mindful eating, especially about its effects on behavior and the related mechanisms due to the difficulty of measuring the direct effects as it refers to internal processes rather than physical behavior [13,22]. Mindfulness-based interventions could address specific facets of mindfulness to maximize improvements in the targeted outcomes and optimize positive effects in specific risk groups. To investigate the mechanism by which the overall facets of mindfulness may produce benefits, there has been a growing interest in the assessment of mindfulness using validated self-reported questionnaires [23].

Mindful eating has been proposed as a potential mechanism for enhancing awareness of cognitive, emotional, and physiological experiences related to food consumption and eating environments [24–27]. This practice fosters an attitude of curiosity, openness, and acceptance toward present-moment experiences, enabling individuals to approach their eating-related thoughts, emotions, and bodily sensations with non-judgmental awareness [28]. By cultivating the ability to observe and accept one's immediate experiences without engaging in reactive behaviors, individuals may reduce their reliance on automatic and maladaptive eating patterns, such as emotional eating, as a means of regulating negative emotions [29,30]. All of this literature highlights the importance of both the attentional and attitudinal components of eating awareness. Therefore, a valid measure of mindful eating is necessary to determine whether mindful eating interventions effectively target the attentional and attitudinal components of awareness and whether these components produce the desired changes over time. In other words, a valid mindful eating measure is required to examine whether individuals practicing mindful eating experience an increase in specific aspects of awareness over time and whether these aspects lead to meaningful and positive changes in eating behaviors.

Among the commonly accepted self-reported measures, the Four Facet Mindful Eating Scale (FFaMES) was developed to assess both fundamental facets of attention and attitude in the context of mindful eating behaviors. Previous measurement scales predominantly emphasized the attentional aspects of mindful eating while neglecting the attitudinal dimensions of the construct. Merely increasing attentional awareness (eg, recognizing hunger and satiety signals) may not be sufficient to bring about positive changes in eating behaviors. Instead, how individuals respond to this awareness and their approach toward themselves also play a crucial role. Therefore, fostering healthy eating habits requires not only enhancing awareness but also adopting a more non-judgmental and non-reactive attitude toward the eating experience. These four factors are critical for understanding how mindful eating enhances eating awareness and promotes positive changes in eating behaviors. When all dimensions are considered together, they provide a more comprehensive and valid assessment of the effectiveness of mindful eating interventions. In individualized treatments using FFaMES, the subscale scores can serve as an indicator of which aspect of mindful eating needs to be developed, thereby facilitating the targeting of personalized interventions [3]. FFaMES consists of four separate subscales. These subscales are internal awareness, external awareness, non-judgment, and non-reactance. Non-reactance refers to an individual's ability to maintain mental distance from impulsive reactions to eat. Non-judgment is an individual's ability to avoid negative self-judgment and respond with acceptance toward their eating behaviors [3]. External awareness reflects an individual's ability to observe or examine the effects of external factors, while internal awareness refers to an individual's ability to observe or examine the effects of their mental and emotional processes. While the external and internal awareness aspects belong to the attention domain of the mindful eating construct, the non-reactance and non-judgment subscales belong to the attitude domain Assessing the distinct components of mindful eating will provide a more comprehensive understanding of the independent effects and underlying mechanisms that contribute to the efficacy of mindful eating programs in improving health-related outcomes [3]. Due to the absence of a comprehensive scale that evaluates the distinct components of mindful eating in detail and specifically investigates mindful eating in adolescents, it was decided to assess the validity and reliability of the FFaMES in an adolescent population. Therefore, this study aimed to evaluate the validity and reliability of the FFaMES [3] in a Turkish adolescent group.

Materials and methods

Participants

This study was conducted in two public schools in Mersin, Turkey, between October 2023 and April 2024, with participants aged between 14 and 17 years (15.42 ∓ 0.86). Individuals who were excluded from the study if they had any eating disorders and/or chronic diseases requiring the following specific diet.

Procedure

In the process of adapting the scale to Turkish, studies were conducted to ensure language validity. The original scale was independently translated from English to Turkish by an expert with a good command of English. In the language adaptation, the standard translation−back translation method was used to minimize distinctions in expression. The scale was reviewed by 10 researchers to ensure that each item was appropriate for the adolescent age group and that it was sufficiently clear and comprehensible, with written feedback provided accordingly. The researchers examined the items in terms of their meaning, considering age- and culture-specific characteristics, and a Turkish text was derived using the most appropriate expressions. Since most of the questions were universal in nature, no major modifications were made to account for cultural differences. The original and translated versions of the scale were administered to a group of 20 bilingual individuals. The consistency between the responses to the original scale and the Turkish translation was analyzed using Pearson's correlation coefficient.

For the cultural adaptation of the scale and to test its validity and reliability in Turkish, a pilot study was conducted with a small group of adolescents using the version of FFaMES adapted by Carrière et al. [3]. It is recommended that a pilot study be conducted with 30 to 50 individuals representing the target population [31]. The linguistic validity of the scale was evaluated in 43 participants who met the inclusion criteria. These preliminary data were not used in the subsequent stages of the study. After all the statements of the scale were corrected by the researchers, the study was completed in 591 adolescents. This number was reached based on the recommendation that the number of individuals should be at least 5 to 10 times the number of items in the scale when determining the sample size in studies developed in different languages and/or cultures [32]. To evaluate the reliability of the scale, the scale was re-applied to 100 students participating in the study 14 days later using the test-retest method. For the validity and reliability analysis of the scale, permission was obtained from the authors of the original scale via email.

Measures

The FFaMES was developed by Carrière et al. [3] as a multifaceted mindful eating scale that assesses several domains of mindfulness directed at the eating experience. The FFaMES is a 29-item scale designed to assess eating-related mindfulness. Specifically, FFaMES is designed to assess attentional and attitudinal components of mindful eating. The FFaMES can be used to measure four separate domains of mindful eating: non-reactance (9 items), non-judgment (8 items), external awareness (6 items), and internal awareness (6 items). Participants were asked to score each item as "never," "rarely," "sometimes," "often," and "very often." The subscale scores were calculated by calculating the mean of the subscale item responses. Higher facet scores indicate higher levels of eating-specific mindfulness.

Data analyses

The data obtained from the 591 participants were evaluated using the appropriate statistical methods in IBM SPSS Statistics 22.0 (SPSS Inc., Chicago, IL) and the AMOS 21.0 package program. Item scores from the scale are presented as mean (X) and standard deviation (SD) values.

Reliability analysis was performed for the scale using Cronbach's α coefficient. While the α coefficient should be at least 0.70, values of 0.80 and above are considered very good, and values of 0.90 and above are considered highly reliable [33]. In the exploratory factor analysis (EFA) phase, items included in two or more factors and the factor load of 0.30 and below were excluded from the analysis. EFA and confirmatory factor analysis (CFA) were performed to assess the validity of the adapted scale. The Varimax vertical rotation method was used in the EFA. The Bartlett and Kaiser−Meyer−Olkin (KMO) tests were used for the suitability of the data for factor analysis. In the KMO value measurement, values close to 1 indicate that the sample is eligible for factor analysis [34]. Analyses with KMO values between 0.5 and 0.7 are considered average, 0.7 to 0.8 are considered good, 0.8 to 0.9 are considered very good, and values above 0.9 are considered excellent [35]. The skewness and kurtosis values of the subscale scores and the total score between ∓1.5 were considered normal distributions [36]. The test-retest method was used to assess the reliability of the scale. The intraclass correlation coefficient was obtained by re-administering the scale to 100 people 14 days later.

Results

To determine the reliability of the scale, 591 individuals were included. The mean age of these individuals was 15.42 ∓ 0.86 years and 61.53% of the students were female and 38.47% were male.

The factor structure of the FFaMES was examined using EFA. As a result of the EFA applied to the 29 questions in the scale at the first stage, items that were distributed to multiple factors with a similar factor load were excluded from the scale. For this reason, we decided to exclude 8 items from the scale (3, 13, 26, 2, 15, 18, 24, 29). Item 2 from the Non-reactivity subscale was removed due to loading on an incorrect factor. Item 15 from the Non-judging subscale was excluded as it loaded on multiple factors simultaneously and on an incorrect factor. İtems loading on multiple factors with a loading of 0.40 or higher should be removed if the difference between the factor loadings is 0.10 or less [37]. Similarly, item 3 from the external awareness subscale was eliminated due to incorrect factor loading. Additionally, items 13, 24, 26, and 29 from the internal awareness subscale were removed due to incorrect factor loadings, while item 18 was excluded as it was distributed across multiple factors. The remaining items were numbered from 1 to 21. In the final version of the scale, items 4, 8, 13, 17, 18, and 21 are in the non-reactance subscale, 3, 5, 10, 15 are in the non-judgment subscale, 1, 2, 7, 12, 14, 20 are in the external awareness subscale, and 6, 9, 11, 16, 19 are in the internal awareness subscale. It has been reported that a minimum factor load of 0.30 and above should be taken for the number of samples 350 and above [38]. A factor loading level between 0.30 and 0.40 is considered low, while a loading of 0.50 or higher indicates practical significance. Loadings of 0.70 or above suggest a strong structural explanation. Although factor loadings between 0.30 and 0.45 are acceptable, a loading of 0.45 or higher is generally expected [37,39]. It is observed that the factor loads of all substances are above 0.50 (Table 1).

X^2 As a result of the EFA, the KMO value was found to be 0.903, and this value was adequate for factor analysis of the sample size [40]. As a result of Bartlett's test of sphericity, the correlation level between the items was found to be sufficient for factor analysis (=5326.27, SD = 231, P = 0.001; P < 0.05). When the eigenvalues and explained variances of the scale were examined, the first factor explained 33.22% of the variance, the second factor explained 13.26%, the third factor explained 8.147%, and the fourth factor explained 7.205% (Table 1).

Descriptive statistics (mean, SD, minimum, maximum, skewness, and kurtosis) regarding FFaMES-TR subfactors and total scores are shown in Table 2. Since the skewness and kurtosis values of the subscale scores and the total score were between ∓1.5, the distribution complied with the assumption of normality [41] (Table 2).

Table 3 shows Pearson correlation analysis to examine the relationship between FFaMES-TR subfactors and the total score. A significant, positive relationship was found between the non-reactance factor and external awareness, non-judgment, and internal awareness scores (P < 0.001). It was determined that there was a relationship between the non-reaction factor and the external awareness and internal awareness factors moderately, and a relationship with the non-judgmental factor weakly. There is a significant and positive relationship between the FFaMES total score and the non-reactance, external and internal awareness factors strongly. There is a significant, positive, and moderate relationship between the non-judgment factor and the FFaMES-TR total score (Table 3). The correlation matrix of the items of the FFaMES-TR was examined and it was concluded that all of the items were significant with each other (P < 0.001).

Table 1
Factor structure of the Four Facet Mindful Eating Scale

Item	Factor loadings				Eigenvalue	Explain variance
	Non-reactance	External awareness	Non-judgment	Internal awareness		
10. I use food to numb my emotions	0.856				6.978	33.227%
28. I escape uncomfortable emotions	0.846					
23. I push uncomfortable feelings away by eating.	0.836					
17. I distract myself with food when I have uncomfortable thoughts.	0.791					
6. I eat to make myself feel better.	0.675					
22. My emotions control how much I eat.	0.540				2.785	13.26%
9. I notice when the sight of food makes me want to eat.		0.774				
16. I notice how my desires to eat change when I see or smell something delicious.		0.751				
4. I notice when the smell of food makes me want to eat.		0.736				
1. I notice how my desires to eat change when I'm surrounded by my favorite foods.		0.685				
27. I notice how talking about food affects my desires to eat.		0.608				
19. I notice that I tend to eat more when others are also eating.		0.526				
20. I feel guilty when I eat too much.			0.885		1.711	8.147%
5. I get mad at myself for overeating.			0.851			
12. I feel like a bad person when I give into a craving to eat.			0.822			
7. I get mad at myself for eating unhealthy foods.			0.733			
8. I pay attention to my mood while I eat.				0.775	1.513	7.205%
21. I pay attention to my thoughts while I eat.				0.763		
14. I pay attention to how my food affects my mood.				0.695		
25. I notice my mood after I eat.				0.546		
11. I notice my thoughts after I eat.				0.511		
	KMO value: 0.904 Barlett's test of sphericity Chi-square: 5323.767 SD = 210 P = 0.001					

KMO, Kaiser−Meyer−Olkin; SD, standard deviation.

When the reliability analysis results for the FFaMES-TR were evaluated; it was found that FFaMES-TR total Cronbach's alpha (CA): 0.893, non-reactance CA: 0.898, external awareness CA: 0.808, non-judgment CA: 0.862, internal awareness CA: 0.772. When the item total correlation column was examined, it was observed that the total correlation of no item was below 0.20. In addition, when the CA coefficients were evaluated, it was found that no item needed to be removed because the CA of the scale would not rise much if any item was removed. Therefore, no items were removed from the reliability analysis.

In Figure 1, the FFaMES-TR factor distribution, latent items, and relationships between the factors were examined by primary-level factor analysis. The goodness of fit indices obtained as a result of primary-level factor analysis are presented in Table 4. According to the fit values of $\chi^2/df = 3.035 < 5$, confirmatory factor index (CFI) = $0.933 < 0.95$, normed fit index = $0.903 < 0.95$, Tucker−Lewis Index = $0.904 < 0.95$, standardized root mean square error = $0.057 < 0.10$, root mean square error of approximation = $0.058 < 0.06$, it is seen that the model's χ^2/df, normed fit index, Tucker−Lewis Index, standardized root mean square error values were among the acceptable fit index values. The CFI values were close to the acceptable goodness of fit index values. Since the model obtained an optimal result, no modification was required (Table 4).

In the model in which primary-level factor analysis was performed previously, the total scores obtained from the factors were evaluated separately. When obtaining the total score from the scale, a secondary-level factor analysis should be performed. Secondary-level factor analysis was conducted to test whether four independent factors can be collected under a dimension that can represent all of them, and that they can be collected as total points. To test this, an upper latent variable was defined in the CFA model, and its relationship with FFaMES-TR factors was examined. As shown in Figure 2, the regression coefficients between the FFaMES-TR latent variable and the factors are excellent. Therefore, the results show that these four factors can be collected under the FFaMES-TR latent variable, which represents itself. The analysis results confirm that the total score can be obtained from the scale. Another important indicator of CFA is the significance of regression coefficients. Table 5 shows the standardized regression coefficients for the expressions in the subscale of FFaMES-TR. The regression coefficients of all items are 0.50 and above, which is quite high. In addition, the effect of the factors on the FFaMES-TR latent variable was significant and excellent (Table 5).

To examine the invariance of students' FFaMES-TR scores over time, the relationship between the scores of 100 students in the first application and the scores in the retest was examined. It was determined that there was a significant and positive relationship between the students' non-reactance, non-judgment, internal awareness, external awareness factor, and total FFaMES score in the first application and their re-test scores ($P < 0.001$).

Discussion

As disordered eating behaviors may increase and unhealthy eating behaviors may develop during adolescence, we aimed to test the validity and reliability of the multi-faceted mindful eating scale in Turkish, which assesses several domains of mindfulness directed at the eating experience in an adolescent group. The

Table 2
Descriptive statistics for FFaMES-TR scores

Subscales and total points	Mean	SD	Min	Max	Skewness	Kurtosis
FFaMES non-reactance	12.51	6.02	6	30	0.991	0.354
FFaMES external awareness	18.2	5.17	6	30	−0.013	−0.422
FFaMES non-judgment	8.42	4.50	4	20	0.967	−0.112
FFaMES internal awareness	10.62	4.38	5	25	0.723	0.070
FFaMES total points	49.79	14.58	21	99	0.505	0.021

Table 3
The relationship between FFaMES-TR subscales and total scores (*n* = 591)

Subscales and total points		Non-reactance	External awareness	Non-judgment	Internal awareness	FFaME total points
Non-reactance	*r*	1	0.479[**]	0.312[**]	0.532[**]	0.840[**]
	P		0.001	0.001	0.001	0.001
External awareness	*r*	0.479[**]	1	0.076	0.387[**]	0.693[**]
	P	0.001		0.063	0.001	0.001
Non-judgment	*r*	0.312[**]	0.076	1	0.354[**]	0.571[**]
	P	0.001	0.063		0.001	0.001
Internal awareness	*r*	0.532[**]	0.387[**]	0.354[**]	1	0.767[**]
	P	0.001	0.001	0.001		0.001
FFaME total points	*r*	0.840[**]	0.693[**]	0.571[**]	0.767[**]	1
	P	0.001	0.001	0.001	0.001	

[**] indicates that the relationship between the FFaMES-TR subscales and the total score is significant as a result of the Pearson correlation analysis.
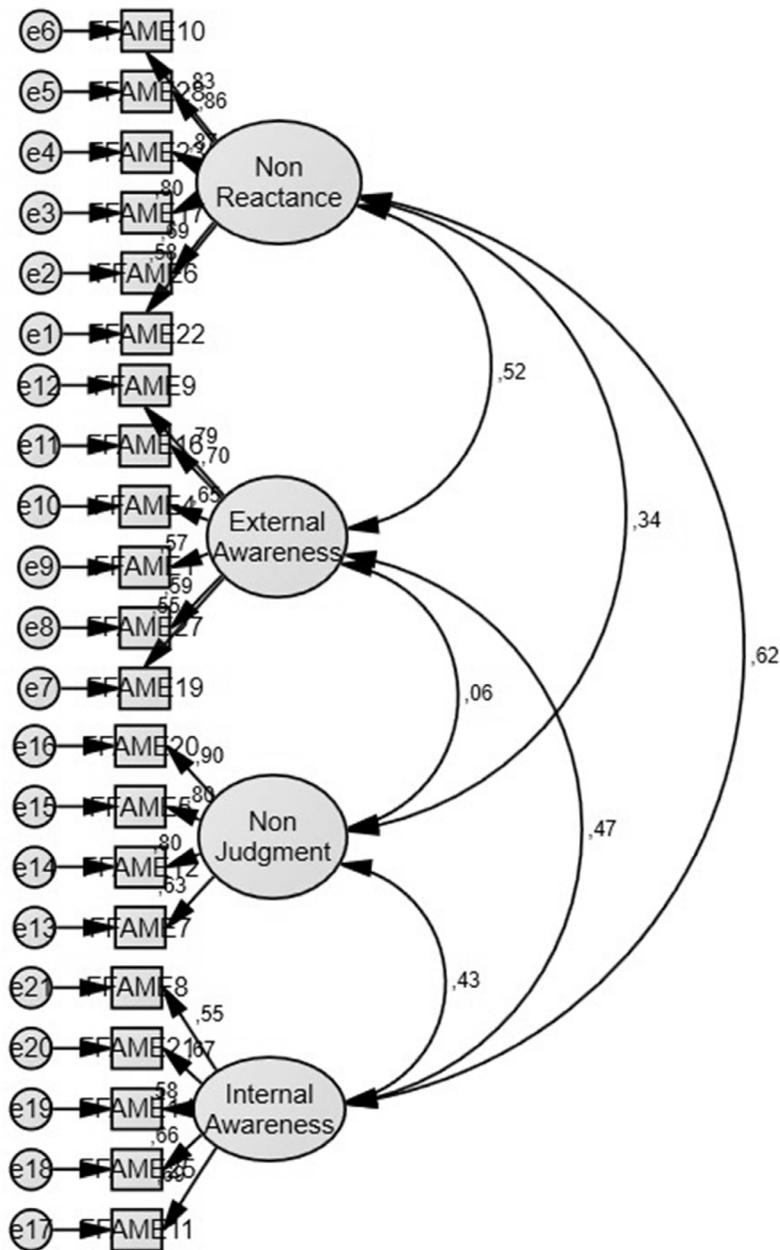

Fig. 1. Four Facet Mindful Eating Scale (FFaMES-TR) primary-level factor analysis diagram.

Table 4
The goodness of fit indices of FFaMES-TR primary-level factor analysis

Good fit	Acceptable fit	Values
CMIN/DF < 3	CMIN/DF < 5	3.035
$0.97 \leq CFI \leq 1$	$0.95 \leq CFI \leq 0.97$	0.933
$0.95 \leq NFI \leq 1$	$0.90 \leq NFI \leq 0.95$	0.903
$0.95 \leq TLI \leq 1$	$0.90 \leq TLI \leq 0.95$	0.904
$0.00 \leq SRMR \leq 0.05$	$0.05 \leq SRMR \leq 0.10$	0.057
$0 < RMSEA < 0.05$	$0.06 < RMSEA < 0.08$	0.058

original scale contains four specific subscales and 29 items are found to be valid and reliable with high CAs for all subscales and 21 items for the Turkish version. As a result of the EFA applied to the 29 questions in the scale at the first stage, items that were distributed to multiple factors with a similar factor load were excluded from the scale. It was decided to exclude 8 items from the scale (M3, M13, M26, M2, M15, M18, M24, M29). It is observed that the factor loads of all substances are above 0.50. The removed items were excluded because they did not distribute as expected in the original scale. We believe that these items were unclear in the scale format and could lead to misinterpretation, which resulted in a lack of alignment with the original scale. We hypothesize that a reduced number of items may enhance the quality of responses, particularly among adolescent participants. As a result of EFA (61.8%) higher total variance was explained than in the original study (54%). The Cronbach's α internal reliability coefficients of this study ranged from 0.772 to 0.898, similar to those of the original scale (0.82–0.92). The observed Cronbach's α values align closely with the original version. Similar to the original study, χ^2/SD, CFI, and root mean square error of approximation values were evaluated in this study and the desired high values were
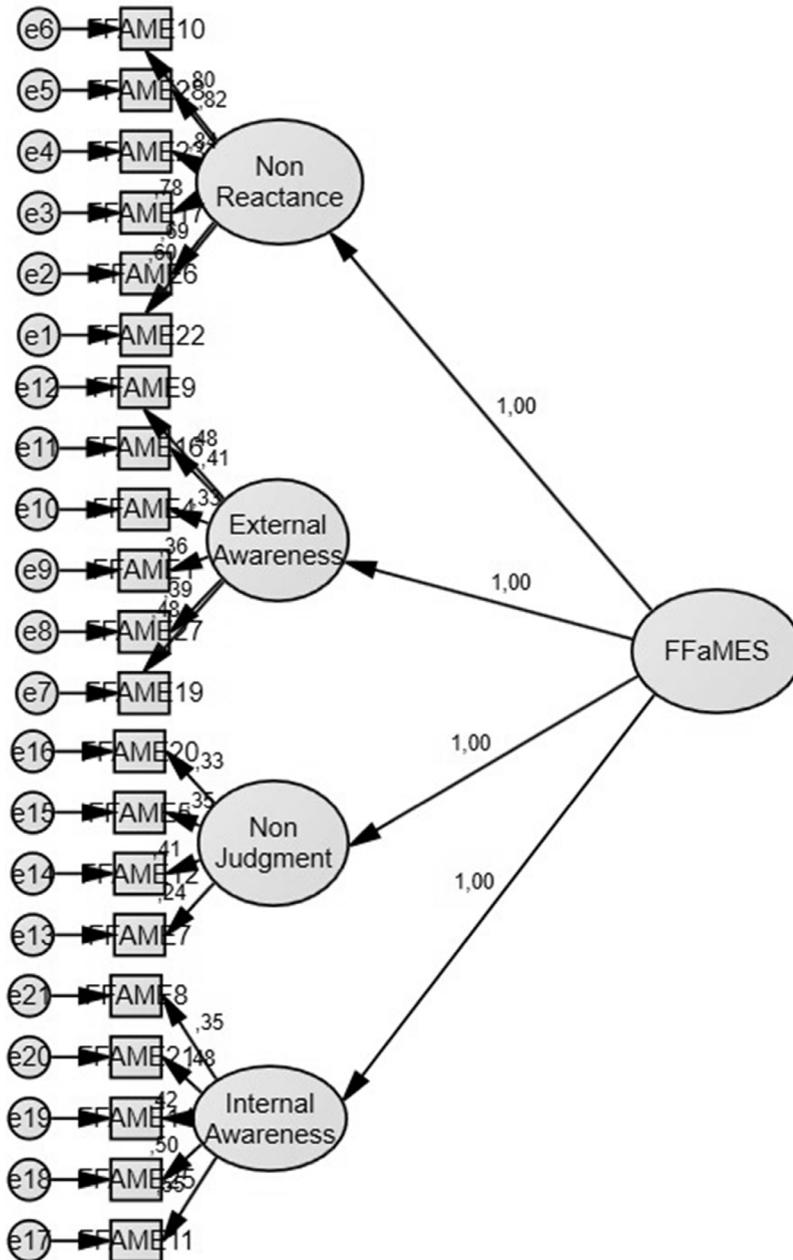

Fig. 2. Four Facet Mindful Eating Scale (FFaMES-TR) secondary level factor analysis.

Table 5
Regression coefficients of the model obtained as a result of the FFaMES-TR secondary level factor analysis

Item		Factor	Regression Coefficient	p
Non-Reactance	◄—	FFaMES	1.000	0.001*
ExternalAwareness	◄—	FFaMES	1.000	0.001*
Non-Judgement	◄—	FFaMES	1.000	0.001*
InternalAwareness	◄—	FFaMES	1.000	0.001*
M22	◄—	Non-Reactance	0.579	0.001*
M6	◄—	Non-Reactance	0.687	0.001*
M17	◄—	Non-Reactance	0.803	0.001*
M23	◄—	Non-Reactance	0.866	0.001*
M28	◄—	Non-Reactance	0.862	0.001*
M10	◄—	Non-Reactance	0.827	0.001*
M19	◄—	ExternalAwareness	0.552	0.001*
M27	◄—	ExternalAwareness	0.586	0.001*
M1	◄—	ExternalAwareness	0.571	0.001*
M4	◄—	ExternalAwareness	0.653	0.001*
M16	◄—	ExternalAwareness	0.702	0.001*
M9	◄—	ExternalAwareness	0.788	0.001*
M7	◄—	Non-Judgement	0.625	0.001*
M12	◄—	Non-Judgement	0.798	0.001*
M5	◄—	Non-Judgement	0.799	0.001*
M20	◄—	Non-Judgement	0.896	0.001*
M11	◄—	InternalAwareness	0.689	0.001*
M25	◄—	InternalAwareness	0.655	0.001*
M14	◄—	InternalAwareness	0.575	0.001*
M21	◄—	InternalAwareness	0.670	0.001*
M8	◄—	InternalAwareness	0.552	0.001*

*$P < 0.001$.

obtained. In this study, these fit indices were found to have eligible values, as in the original.

In the present study, when the mean values of the subscales of the scale were examined, the external awareness factor, which includes the ability to examine the effects of external factors on eating behaviors, was found to have the highest value. The results of this study allude to the potentially significant role of the attitudinal facets of eating-related mindfulness in adolescence. The mean value of the non-judgment factor in the scale was found to be the lowest at 8.42 ∓ 4.50. Although adolescents may be aware of the thoughts, emotions, or physical sensations accompanying their urges to eat, they may be unable to successfully decenter from habitual patterns of reaction and negative self-judgment. Individuals who cannot tolerate increasing stress may resort to old coping strategies such as emotional eating to alleviate their discomfort. This may result from increased levels of shame and self-judgment, which can trigger an urge to eat more. These results may be due to the increased frequency and variability of negative emotions during the developmental stages of individuals. Fluctuations in daily stress levels have a significant impact, especially on

emotional eating behaviors. A systematic review by Favieri et al. [42] shows that adolescents may turn to overeating behaviors when emotional regulation is inadequate. This situation is seen as a coping mechanism for negative emotions and increases the risk of obesity.

In the original version of the scale, the interfactor correlations of the FFaMES subscales ranged between weak to moderate, the non-reactance and non-judgment subscales demonstrated weak to moderate negative correlations with the external and internal awareness subscales. However, in this study, a significant and weak to moderate positive correlation was found between the non-reactance and external awareness, non-judgment, and internal awareness scores ($P < 0.001$). The original scale was conducted on an adult population, and the variability of emotions during a developmental stage such as adolescence may explain these differences in findings. Additionally, students in this age group may not have fully understood and answered the scale questions. The FFaMES subscales of non-reactance and non-judgment belong to the attitude domain of the mindful eating construct, while the facets of external and internal awareness belong to the attentional

domain of the mindful eating construct. This shows that adolescents may notice and pay attention to their internal and external processes (eg, feelings of hunger or external triggers for eating), while at the same time maintaining mental distance from these processes without judgment. It is difficult to maintain mental distance from internal and external processes, it may cause impulsive reactions to food, especially during a stressful period such as adolescence. Thus, it is integral to develop both an awareness of one's internal and external experiences and an ability to relate to these experiences in a way that is non-reactive and non-judgment.

It was determined that there was a significant, positive, and very high-level correlation between the students' FFaMES-TR total scores in the first application and the retest FFaMES-TR total score ($P < 0.001$). This result shows that the scale scores did not change according to time and the scale questions show the same attitude in the students at different times.

Limitations and future research

This study was conducted with adolescents and high school students 14 to 17 years old in two schools in Mersin, Turkey. This may limit the generalizability of the findings, as the results may not be applicable to a larger population or different conditions. Studies conducted at different centers may increase the diversity of results and provide a more comprehensive perspective. Future research should continue to confirm the validity and reliability of this scale in different racial and ethnic groups.

Practical use of FFaMES in clinics and education can help adolescents manage their eating behavior more consciously. By better understanding the emotional triggers behind their eating behaviors, they can identify emotional eating habits and help them make conscious decisions about choosing healthy foods and avoiding unhealthy habits. Understanding eating habits can also help them to be more comfortable in social situations and to engage in healthier interactions within groups. The assessment of the separate factors of mindful eating will further assist in determining the independent effects and underlying processes that contribute to the effectiveness of mindful eating programs on health-related outcomes in adolescents. Considering that Türkiye ranks first in obesity in Europe, the use of FFaMES in adolescents could be a beneficial tool in combating obesity. As a result of EFA applied to 29 questions in the scale, we decided to remove 8 items from the final scale. The Turkish version of the FFaMES was found to be valid and reliable, with 21 items for determining mindful eating behaviors of adolescents.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

CRediT authorship contribution statement

Neslihan Sürmeli Akçadağ: Writing – review & editing, Writing – original draft, Validation, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Saniye Bilici:** Writing – review & editing, Methodology, Investigation, Conceptualization.

Ethical statement

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Gazi University (dated 20.06.2023 and numbered 12).

Consent to participate

Parents were informed about the content of the study and written informed consent was obtained.

Funding

References

[1] Kabat-Zinn J. Mindfulness-based interventions in context: past, present, and future. Clin Psychol Sci Pract 2003;10(2):144–56. https://doi.org/10.1093/clipsy.bpg016.

[2] Van Dam NT, Van Vugt MK, Vago DR, Schmalzl L, Saron CD, Olendzki A, et al. Mind the hype. A critical evaluation and prescriptive agenda for research on mindfulness and meditation. Perspect Psychol Sci 2018;13(1):36–61. https://doi.org/10.1177/1745691617709589.

[3] Carrière K, Shireen SH, Siemers N, Preißner CE, Starr J, Falk C, et al. Development and validation of the four facet mindful eating scale (FFaMES). Appetite 2022;168:105689. https://doi.org/10.1016/j.appet.2021.105689.

[4] Peitz D, Warschburger P. What are you hungry for? The 9 hunger mindful eating online randomized controlled trial. Mindfulness 2023;14:2868–79. https://doi.org/10.1007/s12671-023-02263-9.

[5] Steinberg L. A dual systems model of adolescent risk-taking. Dev Psychobiol 2010;52(3):216–24.

[6] Broderick PC, Jennings PA. Mindfulness for adolescents: a promising approach to supporting emotion regulation and preventing risky behavior. New Dir Youth Dev 2012;136:111–26.

[7] Napoli M, Krech PR, Holley LC. Mindfulness training for elementary school students: the attention academy. J Appl Sch Psychol 2005;21(1):99–125.

[8] Zylowska L, Ackerman DL, Yang MH, Futrell JL, Horton NL, Hale TS, et al. Mindfulness meditation training in adults and adolescents with ADHD: a feasibility study. J Atten Disord 2008;11(6):737–46.

[9] Hendrickson KL, Rasmussen EB. Mindful eating reduces impulsive food choice in adolescents and adults. Health Psychol 2017;36:226. https://doi.org/10.1037/hea0000436.

[10] Pivarunas B, Kelly NR, Pickworth CK, Cassidy O, Radin RM, Shank LM, et al. Mindfulness and eating behavior in adolescent girls at risk for type 2 diabetes. Int J Eat Disord 2015;48:563–9. https://doi.org/10.1002/eat.22435.

[11] Johnson C, Taylor A, Dray J, Dunning D. You can lead an adolescent to mindfulness, but you can't make them mindful. Mindfulness 2024;15:1861–9. https://doi.org/10.1007/s12671-024-02154-9.

[12] Pickerell LE, Pennington K, Cartledge C, Miller KA, Curtis F. The effectiveness of school-based mindfulness and cognitive behavioural programmes to improve emotional regulation in 7–12-year-olds: a systematic review and meta-analysis. Mindfulness 2023;14:1068–87. https://doi.org/10.1007/s12671-023-02131-6.

[13] Tapper K. Mindful eating: what we know so far. NFI Bull 2022;47:168–85. https://doi.org/10.1111/nbu.12559.

[14] Freedman DS, Khan LK, Dietz WH, Srinivasan SR, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. Pediatrics 2001;108:712–8. https://doi.org/10.1542/peds.108.3.712.

[15] Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report (No. 98). New York: National Institutes of Health, National Heart, Lung, and Blood Institute; 1998.

[16] Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: current perspectives. Adolesc Health Med Ther 2015;6:149–58.

[17] Kumar S, Croghan IT, Biggs BK, Croghan K, Prissel R, Fuehrer D, et al. Family-based mindful eating intervention in adolescents with obesity: a pilot randomized clinical trial. Children 2018;5:93. https://doi.org/10.3390/children5070093.

[18] Lawrence NS, O'Sullivan J, Parslow D, Javaid M, Adams RC, Chambers CD, et al. Training response inhibition to food is associated with weight loss and reduced energy intake. Appetite 2015;95:17–28.

[19] Lock J, Agras WS, Le Grange D, Couturier J, Safer D, Bryson SW. Do end of treatment assessments predict outcome at follow-up in eating disorders? Int J Eat Disord 2013;46:771–8. https://doi.org/10.1002/eat.22175.

[20] Omiwole M, Richardson C, Huniewicz P, Dettmer E, Paslakis G. Review of mindfulness-related interventions to modify eating behaviors in adolescents. Nutrients 2019;11:2917. https://doi.org/10.3390/nu11122917.

[21] Bektas I, Gürkan KP. Investigation of the relationships between mindfulness, emotional eating, weight control self-efficacy, and obesity in adolescents. J Pediatr Nurs 2023;73:e381–7.

[22] Grossman P. Defining mindfulness by how poorly I think I pay attention during everyday awareness and other intractable problems for psychology's (re) invention of mindfulness: comment on Brown et al. (2011). Psychol Assess 2011;23(4):1034–40. https://doi.org/10.1037/a0022713.

[23] Chien WT, Chow KM, Chong YY, Bressington D, Choi KC, Chan CWH. The role of five facets of mindfulness in a mindfulness-based psychoeducation intervention for people with recent-onset psychosis on mental and psychosocial health outcomes. Front Psychiatry 2020;11:177. https://doi.org/10.3389/fpsyt.2020.00177.

[24] Baer RA, Fischer S, Huss DB. Mindfulness and acceptance in the treatment of disordered eating. J Rat-Emo Cognitive-Behav Ther 2005;23:281–300. https://doi.org/10.1007/s10942-005-0015-9.

[25] Bays JC. In: Sharek TS, editor. Mindful eating: rediscovering a joyful relationship with food, Boston, MA: Shambhala. Behrend; 2009.

[26] Clementi C, Casu G, Gremigni P. An abbreviated version of the mindful eating questionnaire. JNEB 2017;49(4):352–6. https://doi.org/10.1016/j.jneb.2017.01.016.

[27] Kristeller JL, Epel E. Mindful eating and mindless eating: the science and the practice. In: Le A, Ngnoumen CT, Langer EJ, editors. The Wiley Blackwell handbook of mindfulness, Hoboken, NJ: Wiley Blackwell; 2014. p. 913–33.

[28] Mantzios M, Wilson JC. Exploring mindfulness and mindfulness with self-compassion-centered interventions to assist weight loss: theoretical considerations and preliminary results of a randomized pilot study. Mindfulness 2015;6(4):824–35. https://doi.org/10.1007/s12671-014-0325-z.

[29] Brewer JA, Ruf A, Beccia AL, Essien GI, Finn LM, Lutterveld RV, et al. Can mindfulness address maladaptive eating behaviors? Why traditional diet plans fail and how new mechanistic insights may lead to novel interventions. Front psychol 2018;9:e1418. https://doi.org/10.3389/fpsyg.2018.01418.

[30] Kristeller JL. Mindfulness, eating disorders, and food intake regulation. In: Ostafin B, Robinson M, Meier B, editors. Handbook of mindfulness and self-regulation, New York, NY: Springer; 2015. p. 199–215.

[31] Seçer İ. Psikolojik test geliştirme ve uyarlama süreci: SPSS ve LISREL uygulamaları. Ankara: Anı yayıncılık; 2018.

[32] Osborne JW, Costello AB. Sample size and subject to item ratio in principal components analysis. Pract Assess Res Eval 2019;9:11.

[33] Büyüköztürk Ş. Sosyal bilimler için veri analizi el kitabı, 018. Ankara: Pegem Atıf İndeksi; 2015. p. 001–214.

[34] Alpar C. Uygulamalı çok değişkenli istatistiksel yöntemler. Ankara: Detay Yayıncılık; 2017.

[35] Field A. Discovering statistics using IBM SPSS statistics. London: Sage Publications; 2013.

[36] Fidell LS. Using multivariate statistics. Boston, MA: Allyn and Bacon; 2001.

[37] Alpar R. Uygulamalı çok değişkenli istatistiksel yöntemler. Ankara: Detay Yayıncılık; 2013. p. 277.

[38] Hair JF, Anderson, RE/Tatham, RL/Black, WC. Multivariate data analysis, 2005. Upper Saddle River, NJ: Prentice Hall; 1998.

[39] Can A. SPSS ile bilimsel araştırma sürecinde nicel veri analizi. Ankara: Pegem Yayıncılık 2018:317.

[40] Kaiser HF. A computational starting point for Rao's canonical factor analysis: implications or computerized procedures. Educ Psychol Meas 1974;34:691–2. https://doi.org/10.1177/001316447403400322.

[41] Tabachnick BG, Fidell LS, Ullman JB. Using multivariate statistics, 013. Boston, MA: Pearson; 2015.

[42] Favieri F, Marini A, Casagrande M. Emotional regulation and overeating behaviors in children and adolescents: a systematic review. Behav Sci 2021;11:11. https://doi.org/10.3390/bs11010011.