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Reliability and validity of the Turkish version of the Salzburg emotional eating scale: a psychometric study

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Abstract

Background The Salzburg Emotional Eating Scale (SEES) measures emotional eating by evaluating responses to both positive and negative emotions. This study aimed to establish the reliability and validity of the Turkish version of the SEES (SEES-TR).

Method The SEES was translated into Turkish and back-translated into English. The translated version was reviewed by experts and pretested on a preliminary sample. The final version was administered to 303 participants from Namık Kemal University (mean age: 22.1 ± 4.8 years, 89.1% female). The data collected included demographic information and responses to the SEES and the Emotional Eating Subscale of the Dutch Eating Behavior Questionnaire (DEBQ). Reliability was assessed using Cronbach's alpha, McDonald's omega, and test-retest analyses. Validity was evaluated using exploratory and confirmatory factor analyses, along with content and face validity and convergent validity.

Results The SEES-TR demonstrated high internal consistency, with Cronbach's alpha values for the subscales ranged from 0.913 to 0.942, indicating excellent reliability. McDonald's omega values supported these findings. Test-retest reliability indicated stability over time. Exploratory factor analysis confirmed a four-factor structure consistent with the original SEES, corresponding to happiness, sadness, anger, and anxiety, further supported by confirmatory factor analysis. Content and face validity were established through expert reviews and pretesting. Significant positive correlations ($r = 0.425–0.522$, $p < 0.01$) between the SEES-TR subscales and the DEBQ Emotional Eating Subscale indicate strong convergent validity.

Conclusion The Turkish version of the Salzburg Emotional Eating Scale showed reliability and validity for assessing emotional eating behaviors in the Turkish population. This tool can be useful in both clinical and research settings to evaluate emotional eating in response to various emotional states.

Plain English summary

Emotional eating refers to eating in response to emotions rather than hunger. This study aimed to validate the Turkish version of the Salzburg Emotional Eating Scale (SEES), which measures changes in emotional eating behavior. The scale was translated, reviewed by experts, and tested on a sample from Namık Kemal University. The Turkish version was shown to be consistent and accurate in assessing emotional eating, confirming its effectiveness

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in assessing emotional eating behaviors in the Turkish population. This validated tool can help researchers and clinicians better understand and address emotionaleating in Turkiye.

Keywords Salzburg emotional eating scale, Validation, Reliability, Factor analysis, Psychometrics, Turkiye, Emotional eating

Background

Emotional eating is characterized by a compulsion to consume food in response to emotional states rather than physiological hunger [1, 2]. This behavior is often associated with managing negative emotions, such as anxiety, anger, and depression, though research also suggests that positive emotional states can trigger emotional eating in certain individuals [2–4]. Emotional eating has been closely linked to obesity, as it often involves overeating in response to emotional states [4–7], highlighting the need for effective tools to assess and address these behaviors.

Several theories explain the connection between emotions and eating behavior. The psychosomatic theory suggests that individuals with obesity may struggle to recognize internal hunger and satiety cues, leading to emotional eating [5–7]. Restraint theory posits that emotional eating occurs when individuals restricting their food intake lose control during emotional distress [8, 9]. Schachter's internal/external theory emphasizes the role of external cues in guiding eating behaviors, particularly in people with obesity [10]. These theories illustrate the complex interplay between emotional regulation and eating behaviors, suggesting that addressing emotional regulation could reduce emotional eating and related disorders [11, 12].

Emotional eating is a key factor in several eating disorders, including binge eating disorder, bulimia nervosa, anorexia nervosa, and night eating syndrome [5, 13–18]. Its prevalence across conditions makes assessing emotional eating essential for effective treatment strategies [5, 19]. While tools like the Dutch Eating Behavior Questionnaire (DEBQ) [20] and Three-Factor Eating Questionnaire (TFEQ) [1] assess emotional eating, the Salzburg Emotional Eating Scale (SEES) [21] offers a more nuanced evaluation. By distinguishing between overeating and undereating in response to specific emotions, the SEES provides a comprehensive tool for research and clinical applications.

Cultural factors significantly influence emotional eating patterns, as food consumption and emotional expression are deeply shaped by cultural norms [22]. In Turkish culture, food plays a central role in emotional expression and social bonding [23], which may predispose individuals to emotional eating in response to both positive and negative emotions. This study aimed to validate the Turkish version of the SEES (SEES-TR) and ensure its reliability and applicability for assessing emotional eating behaviors in the Turkish population.

Methods

Study design

The Turkish adaptation of the Salzburg Emotional Eating Scale (SEES) consists of two main phases: cross-cultural adaption and validation.

Translation and language validity

Permission was obtained from the responsible researcher who developed the SEES for the scale's Turkish validation and reliability. In the subsequent stage of the study, six experts proficient in English translated the scale from English to Turkish. Following the necessary evaluations, the scale was then back-translated from Turkish to English by four experts proficient in the English language. After the back-translation stage, the scale was evaluated by 6 experts who were proficient in both languages and knowledgeable about the construct to be measured and who were not involved in the translation and back-translation phases. Following the review conducted after both translations, the Turkish version of the scale that emerged was administered to a preliminary sample group consisting of 38 individuals meeting the sample criteria. Feedback regarding the appropriateness and comprehensibility of the scale items was gathered from the participants. In the subsequent step, the Turkish version of the scale was conveyed to the responsible researcher who developed the scale, and their opinions were obtained. Following necessary adjustments, the Turkish version of the scale to be used in the research was finalized.

Content validity and face validity

After the back-translation phase, six independent academics, each with expertise in both languages and in psychometrics, evaluated the scale to ensure its linguistic and conceptual accuracy. Importantly, these experts were not involved in the initial translation phases to maintain objectivity. Both the original English version and the back-translated Turkish version were presented side-by-side for comparison. Using the Davis Technique, we gathered expert ratings on each item's relevance to the construct and calculated a Content Validity Ratio (CVR) for each item, with ≥ 0.80 deemed acceptable for content validity [24].

Face validity assesses whether the measurement tool appears to measure the intended trait from a user perspective [25]. This was evaluated by gathering feedback from 38 non-expert individuals who represented the sample group in a pilot/pretest study. Participants were

asked to read each scale item aloud, describe the meaning it conveyed, and complete the scale to confirm item clarity and relevance. Additional feedback was solicited from the original scale developer via email to further validate item interpretations. Based on these insights, minor revisions were made to improve clarity, resulting in the final version of the scale.

Reliability analysis

The reliability of the SEES was evaluated using methods including internal consistency and test-retest reliability. Internal consistency reliability was assessed to determine if items consistently measured the same conceptual construct. The Intraclass Correlation Coefficient (ICC), paired samples *t*-test, and correlation analysis were used to calculate stability [26, 27]. Cronbach's alpha and McDonald's Omega were employed as reliability indices suitable for multidimensional scales [28, 29]. Test-retest reliability, a measure of stability over time, was assessed by re-administering the scale to the same sample group at specific intervals.

Factor analysis

In addition to content and face validity, construct validity analysis methods, including exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), were used. Factor analysis reduces a large number of variables into smaller groups (factors) and establishes dimensions between measured variables and latent structures [30]. Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) value were used to assess the suitability of the data for factor analysis. The KMO value must be 0.5 or higher, and factor loadings of 0.30 or higher are considered acceptable [31, 32]. The factor structure was determined by employing the Kaiser criterion (eigenvalues > 1) and visual analysis of the scree plot, with four factors explaining approximately 79% of variance, consistent with the original SEES structure [32, 33]. For assessing convergent validity, we administered the SEES alongside the DEBQ Emotional Eating Subscale (DEBQ-EES), using correlation analysis [30].

Participants

The population of the research consisted of students, academicians, and administrative staff of Namık Kemal University in Tekirdağ. The inclusion criteria were age between 18 and 65 years and not having received a diagnosis of any illness. The exclusion criteria were a diagnosis of any chronic/psychological/psychiatric illness by a doctor, regular use of medication/vitamin supplements, and pregnancy or lactation. The study received ethical approval for its appropriateness from the Namık Kemal University Scientific Research and Publication Ethics Board (2021-02-24/T2021-585).

Data collection was conducted between March and May of the 2020–2021 academic year. The scale was transferred to an online platform using Google Forms and sent via email to Namık Kemal University students, academicians, and administrative staff. Both EFA and CFA require adequate sample sizes to ensure reliable results. Traditional guidelines for EFA have recommended minimum sample sizes, with Boomsma (1982) advocating for at least 200 participants to avoid improper solutions, with sample sizes below 100 being identified as problematic, while Comrey (1973) classified sample sizes of 50 as "very poor" and 1,000 as "excellent" [34, 35]. Nevertheless, smaller samples can still be used for CFA when factor loadings are high, though larger samples are generally preferred to ensure stability and minimize errors. Based on these considerations, we aimed to reach a sample size of at least 200 for the present study. Initially, 416 individuals completed the survey. However, 113 participants were excluded for not meeting the inclusion criteria or for completing the survey multiple times. Therefore, the data from 303 individuals were utilized for the initial phase of the study. Subsequently, to assess the test-retest reliability of the scale, a follow-up data collection was conducted with a sample of 30 individuals who had participated in the initial phase. These individuals were randomly assigned to be re-tested at 2-to-3 weeks. This timeframe was chosen to ensure reliability without introducing undue memory effects [36]. At the beginning of the study, participants were asked to create a username using the first letters of their names-surnames and the last 4 digits of their phone numbers to determine duplications and whether the same individuals were reached in both phases of data collection. To reduce self-selection bias, the study employed several strategies, including reminders to participate and assurances of anonymity to enhance response rates. Furthermore, data quality was monitored by assessing response patterns and excluding inconsistent entries.

Data collection

The study utilized a demographic information form created by the researcher to obtain sociodemographic data from the students, academicians, and administrative staff involved. Additionally, participants were administered the Salzburg Emotional Eating Scale and the Emotional Eating subscale of the Dutch Eating Behavior Scale.

Demographic questionnaire form

The information form prepared by the researcher was used to assess the sociodemographic characteristics of the participants. This section inquired about the participants' sex, age, marital status, education level, occupation, monthly income, health status, medication usage,

smoking habits, sleep duration, regular exercise habits, body weight, and height.

Salzburg emotional eating scale (SEES)

The 'Salzburg Emotional Eating Scale,' developed by Meule, Reichenberger, and Blecher [21] in the Salzburg region of Austria, is intended to measure changes in the amount of eating in response to positive and negative emotions. The scale consists of 20 items indicating how emotional expressions influence eating behavior and comprises four subscales: happiness, sadness, anger, and anxiety. Each item begins with the stem "When I am/feel." followed by an adjective describing an emotional state. The response options ranged from 1 to 5, indicating "much less than usual" to "much more than usual" eating behaviors. Scores above three represent increased food intake, a score of three indicates unchanged food intake, and scores below three indicate decreased food intake [21].

Emotional eating subscale of the Dutch eating behavior questionnaire (DEBQ)

The DEBQ was developed in 1986 by Van Strien and colleagues [20], and its Turkish validation was conducted by Bozan [37]. The scale evaluates three subscales of eating behavior—external eating, restrained eating, and emotional eating—comprising 33 items. In this study, the emotional eating subscale, which consists of 13 items, was utilized to assess emotional eating behavior using a 5-point Likert scale [20]. In the present study, the emotional eating subscale of the DEBQ had Cronbach's alpha of 0.950.

Table 1 The demographic characteristics of the participants ($n = 303$)

Gender	*n*	%	Regularly exercise habit	*n*	%
Female	270	89	Yes	99	33
Male	33	11	No	204	67
Marital status			**Smoking**		
Single	287	95	Yes	42	14
Married	16	5	No	261	86
Occupation			**Sleep duration**		
Student	291	96	< 6 h	21	7
Academic	6	2	6–8 h	217	72
Administrative staff	6	2	8 h <	65	21
Monthly income			**BMI (kg/m^2)**		
0-2800 TL	244	81	< 18.5	42	14
2801–5000 TL	33	11	18.5–24.9	204	67
5001–7500 TL	16	5	25-29.9	48	16
7500 TL<	10	3	30 ≤	9	3

TL: Turkish liras, BMI: Body mass index

Data analysis

The data were analyzed using IBM SPSS 22 and AMOS 24 software to evaluate the psychometric properties of the SEES-TR. Missing data were handled using listwise deletion to ensure robust analysis. Reliability was assessed using Cronbach's alpha and McDonald's omega coefficients. Cronbach's alpha values were assessed, with thresholds of ≥ 0.70 indicating acceptable reliability and ≥ 0.90 reflecting excellent reliability. Similarly, omega coefficients above 0.75 are deemed reliable [26, 28]. Test-retest reliability was assessed using ICC and Pearson/Spearman correlation analyses, with ICC values ≥ 0.75 considered indicative of good reliability [27]. Paired sample t-tests or Wilcoxon tests were applied to assess scale stability over time, depending on the normality of data distribution.

Convergent validity was assessed using Spearman correlation coefficients between the SEES-TR subscales and the DEBQ Emotional Eating Subscale (DEBQ-EES). Correlation coefficients were interpreted as strong for values above 0.50, moderate for values between 0.30 and 0.50, and weak for values below 0.30 [31]. The factor structure of the SEES-TR was analyzed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), supported by the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. Model fit indices, including χ^2/df, CFI, RMSEA, GFI, AGFI, NFI, TLI, and IFI, were used to evaluate structural validity. Thresholds for fit indices followed Hu and Bentler's (1999) criteria, with CFI/TLI ≥ 0.90 indicating good fit and RMSEA ≤ 0.08 considered acceptable [38].

The dataset was split into two independent subsamples to ensure distinct groups for EFA and CFA. A random selection procedure in SPSS was employed to ensure that the structural model derived from EFA was independently validated through CFA [31, 32].

The Bollen-Stine bootstrap method was applied to address nonnormality in the data, ensuring robust estimates through resampling. Given the influence of sample size and model complexity on fit indices, their interpretation was guided by contextual considerations [39–41]. Statistical significance was set at $p < 0.05$ for all analyses.

Results

Demographic characteristics

The average age of the individuals in the research group was 22.1 ± 4.8 years (within the range of 18–50 years). A total of 89.1% of the participants were female, while 10.9% were male. The participants consisted of 96% students, 2% academics, and 2% administrative staff (Table 1). Similarly, 4% of the respondents had completed high school, 93% had completed undergraduate studies, and 3% had completed postgraduate studies.

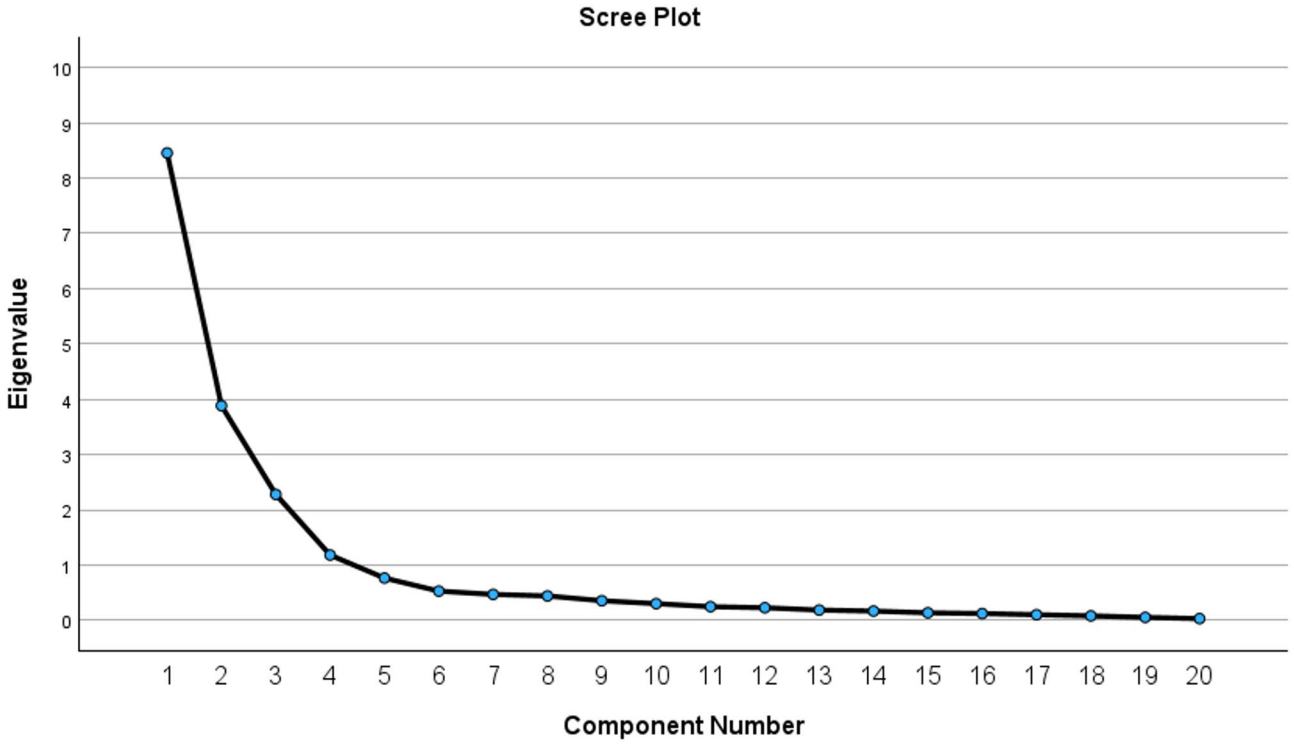

Fig. 1 Scree plot for the SEES-TR

Table 2 EFA factor loadings for SEES-TR subscales

Scale Items	Factor 1	Factor 2	Factor 3	Factor 4
SEES 1.		0.892		
SEES 2.		0.900		
SEES 3.		0.930		
SEES 4.		0.838		
SEES 5.		0.874		
SEES 6.			0.850	
SEES 7.			0.855	
SEES 8.			0.860	
SEES 9.			0.712	
SEES 10.			0.519	
SEES 11.				0.880
SEES 12.				0.862
SEES 13.	0.318			0.835
SEES 14.	0.413			0.640
SEES 15.	0.427			0.433
SEES 16.	0.765			
SEES 17.	0.928			
SEES 18.	0.932			
SEES 19.	0.822			
SEES 20.	0.703			
Eigenvalue	4.32	4.02	3.80	3.64
% Varying	21.636	20.114	19.028	18.236
Cumulative Variance %	21.636	41.749	60.778	**79.013**

Results of factor analyses

In the validation analysis of the SEES, confirmatory and exploratory factor analysis methods were employed. First, the KMO test was conducted to determine the adequacy of the sample size for factor analysis, and Bartlett's sphericity test was performed to determine the correlations between variables necessary for factor analysis. The KMO coefficient was 0.875, the Bartlett's sphericity test X^2 value was 3005.275 ($p = 0.000$) (Supplemental Table 1).

The structural validity of the SEES was assessed using EFA methods, including principal component analysis and the scree plot technique. The number of factors for the SEES, according to the EFA, was determined by examining the scree plot shown in Fig. 1, selecting factors with eigenvalues greater than 1. In the EFA performed to establish the factor structure of the SEES, it was observed that the scale consists of 4 subscales.

The EFA identified a four-factor structure corresponding to the subscales: Happiness (items 1–5, loadings 0.838–0.930), Sadness (items 6–10, loadings 0.519–0.860), Anger (items 11–15, loadings 0.433–0.880), and Anxiety (items 16–20, loadings 0.703–0.932) (Table 2).

The critical value calculated as 36.794 for the study data with AMOS indicated that the assumption of multivariate normality was not met, as it exceeded 8. As the data did not exhibit a normal distribution, the 'Bollen-Stine Bootstrap' method was applied for CFA. The bootstrap

Table 3 Internal consistency reliability coefficients for SEES-TR subscales

	SEES-TR	
Subscales	**Cronbach's α**	**McDonald's ω**
Happiness	0.942	0.943
Sadness	0.913	0.917
Anger	0.913	0.917
Anxiety	0.922	0.921
Total	0.924	0.932

Table 4 SEES-TR subscales Test-Retest reliability ($n = 30$)

SEES-TR Subscales	Mean	SD	z/t	*p*
Test of Happiness	2.83	0.15	0.37	0.71[a]
Retest of Happiness	2.95	0.13		
Test of Sadness	2.56	0.19	0.21	0.83[b]
Retest of Sadness	2.58	0.18		
Test of Anger	2.44	0.17	0.41	0.68[b]
Retest of Anger	2.48	0.19		
Test of Anxiety	2.24	1.09	-1.33	0.19[b]
Retest of Anxiety	2.04	0.91		

[a] Wilcoxon test, [b] paired sample t test, $p < 0.05$

method is used in AMOS to generate approximate standard errors for many statistics calculated without needing to fulfil the assumption of multivariate normality [41]. Consequently, the bootstrap results were compared with the original ML estimation method outputs for the scale. The bootstrap method, which provides approximate standard errors without requiring the assumption of normality for the data, demonstrated that the confirmatory factor analysis was suitable for parametric statistics. The CFA diagram has been presented in Supplementary Fig. 1.

In the context of bootstrapping for the SEES, the ML model fit indices were examined, yielding $\chi^2/df = 3.78$ and RMSEA = 0.071. The CFI, TLI, and IFI values were 0.909, 0.901, and 0.911, respectively, all falling within acceptable reference ranges [21, 38].

Results of the reliability analysis

The Salzburg Emotional Eating Scale was subjected to reliability analysis using internal consistency.

Internal consistency

Internal consistency analyses were conducted using Cronbach's α and McDonald's Omega coefficient (ω) for the SEES-TR. The reliability coefficients for the happiness, sadness, anger, and anxiety subscales were determined to be 0.942, 0.913, 0.913, 0.913, and 0.922, respectively, for Cronbach's α. McDonald's omega coefficient (ω) for the Happiness, Sadness, Anger, and Anxiety subscales were determined to be 0.943, 0.917, 0.917, and 0.921, respectively (Table 3).

Table 5 Test-Retest consistency and agreement for SEES-TR subscales ($n = 30$)

	Correlation		ICC	
SEES-TR subscales	***r***	***p***	**ICC (95% CI)**	***p*[c]**
Sadness x Sadness	0.777	**> 0.001**[a]	0.88 (0.74–0.94)	**> 0.001**
Anger x Anger	0.825	**> 0.001**[a]	0.90 (0.79–0.95)	**> 0.001**
Anxiety x Anxiety	0.698	**> 0.001**[a]	0.81 (0.61–0.91)	**> 0.001**
Happiness x Happiness	0.490	**0.006**[b]	0.65 (0.57–0.84)	**0.003**

[a] Pearson correlation, [b] Spearman correlation, [c] Intraclass correlation coefficients (ICC) using an absolute agreement definition. CI: confidence interval. $p < 0.01$

Test-retest reliability

Invariance was examined using a t test to investigate the relationship between the happiness, sadness, anger, and anxiety subscales of the scale administered at two different time points. The analysis revealed no significant difference among the responses given within the subdimensions of the SEES-TR.

The test-retest analysis results for the SEES-TR subscales are presented in Table 4.

The Table 5 detailed test-retest reliability metrics for each SEES-TR subscale, including correlation coefficients (r) and ICC with 95% confidence intervals (CI). Correlation values measure consistency between test and retest, while ICC values evaluate absolute agreement across time. The high ICC values (ranging from 0.65 to 0.90) and significant correlations for most subscales suggest that the SEES-TR exhibits reliable temporal stability and agreement.

Results of validity analysis

Content validity and face validity

Translation, back-translation, expert evaluation, and pilot/pretest studies were conducted under the headings of linguistic, content, and face validity. For content validity, expert opinions were obtained using the Davis technique [24]. The content CVR was obtained by comparing the original and Turkish translations of the scale items. A CVR value of ≥ 0.80 was expected, and according to expert evaluations, it was determined that the CVR values of the scale items were ≥ 0.80 (Supplemental Table 2).

For face validity, a pilot/pretest study was conducted by collecting opinions from individuals who were not experts in the researched field but were consistent with the determined sampling [25]. The scale was administered to 38 individuals. Participants were asked to read each scale item aloud, express the meaning evoked by each scale item, and fill out the scale appropriately. Additionally, the scale was sent to the scale owner via email, and their opinions were obtained. Based on the feedback received and appropriate changes, the final version of the scale was established (Supplemental Table 3).

Convergent validity

To assess convergent validity, the DEBQ-EES was employed as a reference measure. Moderate to strong correlations were observed between specific SEES-TR subscales (Sadness, Anger, Anxiety) and the DEBQ-EES, indicating that the SEES-TR subscales are consistent with an established measure of emotional eating. The significant positive correlations ($p < 0.01$) confirm that the SEES-TR subscales accurately capture emotional responses influencing eating behaviors, thereby supporting the SEES-TR's validity as a tool for assessing emotional eating (Table 6).

Table 6 Spearman's correlation between SEES-TR subscales and DEBQ-EES

	1	2	3	4	5
1. Happiness	-				
2. Sadness	0.006	-			
3. Anger	−0.001	0.698**	-		
4. Anxiety	0.053	0.511**	0.653**	-	
5. DEBQ-EES	−0.111	0.522**	0.425**	0.308**	-

Spearman's correlation **$p < 0.01$

Discussion

The Salzburg Emotional Eating Scale (SEES) was developed by Meule et al. [21] to measure emotional eating behaviors by examining food responses to both positive and negative emotional states. Several scales have been developed to assess emotional eating, including the Emotional Eating Subscale by Van Strien et al. [20], the Emotional Eating Scale by Arnow et al. [3], and the Emotional Overeating Scale by Masheb and Grilo [15]. However, these scales primarily focus on negative emotions. In contrast, the Positive and Negative Emotional Eating Scale captures both positive and negative emotions but has demonstrated reliability and validity only for female participants [41]. Another tool, the Emotional Appetite Questionnaire, measures both positive and negative emotional states and evaluates increased and decreased eating tendencies; however, it was not developed based on experimental data during its creation phase [42].

The SEES stands out for its detailed delineation of specific emotions and its ability to differentiate between overeating and undereating based on emotional triggers, making it an expanded and versatile version of previous scales [21].

In Turkiye, tools for assessing emotional eating, such as the Emotional Appetite Questionnaire, also cover positive and negative emotions. However, Turkish validation studies for these scales remain incomplete [41, 43]. Adapting the SEES to the Turkish population is believed to provide a more comprehensive perspective for research on emotional eating.

In scale adaptation studies, sample sizes of 100 participants are considered weak for validity and reliability analyses, 200 are sufficient, and 300 are considered good [44, 45]. The present study included data from 303 participants, comprising students, academics, and staff at Namık Kemal University. Women represented 89.1% of the sample. Similarly, in Meule's [21] and Ghafouri et al.'s [46] studies, women constituted the majority (89.1%, 82.9%, 74.4%, and 90%, respectively), indicating a comparable gender distribution. This disproportionate representation of women may influence the study results, as observed in the original research.

For the validity analysis of the SEES, structural validity was assessed through content, face, and convergent validity methods. During the translation phase, as recommended by Coster [47] and Bayık [48], translation was conducted by two commissions of six and four expert individuals, respectively. The Davis method was then applied to analyze content validity. According to Davis [24], an assessment by at least two and up to 20 experts is required; in this study, six experts evaluated the items, yielding KMO values (>0.80) that confirmed content validity.

Convergent validity was assessed by examining the relationship between the SEES-TR subscales and the DEBQ-EES. The DEBQ-EES was selected as a reference measure due to its established use in assessing emotional eating behaviors. Significant positive correlations were observed between the sadness, anger, and anxiety subscales of the SEES-TR and the DEBQ-EES, indicating that these subscales are consistent with an established measure of emotional eating. While the happiness subscale of the SEES-TR showed a negative correlation with the DEBQ-EES, this relationship was not statistically significant, reflecting the nuanced role of positive emotions in emotional eating behavior as previously suggested by the original study [21].

For factorial validity, both exploratory and confirmatory factor analyses were employed. As Suhr [49] emphasized, the objective of EFA is to uncover the factor structure underlying scale items, while CFA verifies the adequacy of the original factor structure. These methods are frequently preferred for validating models [49, 50].

In this study, the KMO value (0.88) indicated an excellent sample size for factor analysis, while Bartlett's sphericity test ($p < 0.001$) confirmed adequate relationships among variables. Principal component analysis and scree plot methods were used in exploratory factor analysis to evaluate the 'number of factors or components' and 'factor loading of variables' to determine the structural characteristics of the variables [51]. The EFA revealed that 20 items with factor loading values ranging from 0.433 to 0.932 formed four subscales. This structure aligns with the original scale and confirms its compatibility [21]. A

criterion value of > 0.30 was used for factor loadings, consistent with prior studies [52–54], with all items exceeding this threshold.

CFA was also conducted to assess construct validity. When ML and GLS methods are applied to nonnormally distributed data, they may inflate fit indices and reduce standard error rates [55]. Therefore, selecting an appropriate method for nonnormal data is critical [15]. While the ADF method can handle nonnormal distributions, it requires a minimum sample size of 200 for simple models and > 5000 for complex ones [56]. Additionally, ADF is prone to weak estimations when models are misspecified [57]. As an alternative, the Bollen–Stine Bootstrap method, which provides robust solutions for multivariate nonnormal data, was utilized in this study [38].

In evaluations of fit indices derived from Bollen–Stine Bootstrap analysis, it has been stated that Bollen–Stine Bootstrap analysis can provide strong evidence by avoiding biases in estimation values [40, 56]. In the present study, ML fit indices were assessed within the Bollen–Stine bootstrap framework. Examination of model fit indices revealed that the CFI value of 0.909 suggests the model demonstrates a marginally good fit. Additional indices, including χ^2/df at 3.78, RMSEA at 0.071, TLI at 0.901, and IFI at 0.911, fall within acceptable ranges, indicating the scale fits well into the model. Meule et al. reported that for confirmatory factor analysis, acceptable ranges for model fit indices include CFI = 0.917–0.932 and RMSEA = 0.051–0.073 [21]. Similarly, Ghafouri et al.'s study reported fit indices of CMIND/DF = 7.58, GFI = 0.91, CFI = 0.90, TLI = 0.89, and RMSEA = 0.061 [46]. Consistent with these findings, the current study demonstrated that fit indices were within acceptable ranges.

Reliability analyses revealed that the Cronbach's α coefficients of the SEES-TR subscales of happiness, sadness, anger, and anxiety ranged from 0.913 to 0.942. In scale adaptation studies, a Cronbach's α reliability coefficient > 0.80 indicates good reliability, while a value > 0.90 indicates excellent reliability. The subdimensions > 0.90 suggest that the SEES-TR has excellent reliability. According to McDonald's ω coefficient, which is a more general form of Cronbach's α, there is no optimal reliability measure, and it has been reported that the omega (ω) coefficient should be indicated for reliability estimation instead of α [29, 58]. Therefore, both reliability analysis methods were used in the current study. The omega coefficients of the happiness, sadness, anger, and anxiety subscales were found to be 0.917–0.943. Watkins et al. mentioned that the omega coefficient should be above 0.75 [59], indicating that the current study's omega reliability coefficient is reliable. In the study by Meule et al., the Cronbach's α coefficient for the subdimensions of the scale ranged from α = 0.732–0.871. In the present study, the reliability coefficients of the subdimensions indicate that the reliability is consistent with that of the original scale [21].

Another reliability analysis, the stability of the scale over time, involved readministering the scale to a subset of participants after 2-to-3 weeks. There was no statistically significant difference, and the reliability coefficient between the two test results was calculated. For the sadness and anger subscales of the study, the reliability coefficients were found to be 0.777 and 0.825, respectively, which are above the reported sufficient reliability coefficient [59]. The reliability coefficient for the anxiety subscale was 0.698, which is very close to the 0.70 adequacy level, while the reliability coefficient for the happiness subscale was 0.490. Ghafouri et al. noted that the lack of a retest analysis was a limitation of their study and emphasized the need for this analysis to be conducted in the future for scale [46]. In the current study, the term 'reliable scale' was reinforced through the stability method.

Limitations

The SEES-TR provides a detailed analysis of the emotional effects on eating behavior but has some limitations. Its reliance on self-reports may introduce bias due to variability in participants' self-awareness of emotional fluctuations and their impact on food intake. The sample primarily included individuals with higher education levels and was skewed toward female participants, which may limit generalizability. Future research should include more diverse educational and demographic groups, with a focus on balanced gender representation, to enhance the scale's applicability across different populations.

While the dataset was appropriately split into subsamples of 158 participants for CFA and 145 participants for EFA to adhere to best practices, the relatively small size of each subsample may have limited the statistical power and generalizability of the findings. Future studies with larger, independent samples are recommended to further validate the SEES-TR's factor structure.

Conclusion

The SEES-TR is positioned as a valuable tool for a comprehensive assessment of emotional eating, extending beyond psychometric domains to encompass experimental research. This instrument holds promise for exploring new avenues in the investigation of mechanisms underlying emotional eating and in clinical research. As an enhanced iteration of preceding scales, the SEES-TR allows for a nuanced examination of specific emotions and a differentiation between overeating and undereating based on emotional triggers, thereby establishing its significance. This study concluded that the SEES can be considered a valid and reliable instrument in the Turkish language. It is anticipated that its application will

contribute meaningfully to research areas associated with emotional eating in Turkiye.

Abbreviations

AGFI	Adjusted Goodness-of-Fit Index
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CVR	Content Validity Ratio
DEBQ	Dutch Eating Behavior Questionnaire
EFA	Exploratory Factor Analysis
GFI	Goodness-of-Fit Index
ICC	Intraclass Correlation Coefficient
IFI	Incremental Fit Index
KMO	Kaiser–Meyer–Olkin
NFI	Normed Fit Index
RMSEA	Root Mean Square Error of Approximation
SEES	Salzburg Emotional Eating Scale
SEES-TR	Salzburg Emotional Eating Scale-Turkish version
TLI	Tucker-Lewis Index

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40337-025-01359-y.

Supplementary Material 1

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Author contributions
AG and CB designed the study. CB directed and supervised the project. AG collected the data. AG and CB conducted the data analysis. AG drafted the manuscript, with CB providing critical revisions. All authors have read and approved the final version of the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Ethical approval
(2021-02-24/T2021-585) was obtained from the Tekirdag Namık Kemal University Research Ethics Committee. The study was performed in accordance with the ethical standards of the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Online informed consent was obtained from all participants.

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