



## RESEARCH ARTICLE

# Psychometric properties of the Turkish version of the Binge Eating Scale in detecting binge eating disorder among people seeking treatment for obesity

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### ABSTRACT

**Objective:** Binge eating is a common behavior among individuals with obesity. The Binge Eating Scale (BES) is a widely utilized tool to assess binge eating behavior. Originally created in English, it has been validated in various languages. The aim of this study is to present psychometric evidence supporting the Turkish version of the BES in diagnosing Binge Eating Disorder (BED) in individuals with obesity.

**Method:** The Turkish version was developed through translation and back translation from the original English version. The binge eating behavior of 188 obese adult patients, who sought treatment at an obesity outpatient clinic, was assessed using the BES and a psychiatric assessment with the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) - Clinician Version. Metrics such as internal consistency, test-retest reliability, predictive validity, factor analysis, and diagnostic measures were calculated.

**Results:** The Turkish version of the BES demonstrated a one-factor structure with high internal consistency (Cronbach alpha: 0.843). At a cut-off point of 18, the BES showed a sensitivity of 72.09%, specificity of 79.31%, a positive predictive value of 50.80%, and a negative predictive value of 66.7%. The test-retest reliability indicated significant agreement between the BES scores (Intraclass Correlation Coefficient (ICC)=0.875 p<0.001).

**Conclusion:** These results suggest that the Turkish version of the BES is a valid and reliable screening instrument for BED in adults with obesity.

**Keywords:** Binge eating, Binge Eating Scale, obesity, Turkiye

## INTRODUCTION

Binge Eating Disorder (BED) is characterized by recurrent episodes of binge eating ( $\geq 1$  per week for three consecutive months), involving the consumption of an objectively large amount of food within a discrete

period of time (typically within two hours), without inappropriate compensatory behaviors to prevent weight gain. These episodes are marked by feelings of loss of control, shame, anxiety, depression, and disgust. During a binge-eating episode, individuals might consume large amounts of food even when not

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hungry, eat more rapidly than normal, and continue eating until physically uncomfortable. They often feel embarrassed by their eating habits and tend to eat in secrecy (1,2). Although binge eating is seen in bulimia nervosa and can occur in anorexia nervosa, with the release of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) in 2013, BED was recognized as a distinct eating disorder category. It presented a lower diagnostic threshold regarding the duration and frequency of binge episodes compared to its previous categorization as an example of an Eating Disorder Not Otherwise Specified (EDNOS) in DSM-4 (3). The DSM-5 criteria reduced the frequency and duration requirement for binge eating episodes from two or more days per week for six or more months to once a week for three months, allowing individuals who did not previously meet the DSM-4 criteria to now be diagnosed under DSM-5.

BED is the most common eating disorder, with a prevalence of 2-5% among adults (4,5). A study by Kessler spanning 14 countries on four continents found a lifetime prevalence rate of BED to be 1.4%. BED significantly impacts the quality of life, leading to increased socioeconomic burdens due to various medical and psychiatric comorbidities (6-9).

Binge-eating disorder is more common in women (3.5%) than in men (2.0%) and is notably more common among the obese population (5% to 30%), with no marked gender difference (10,11). This prevalence is particularly high among those who are severely obese and those seeking treatment for obesity (12,13). However, BED is often an undiagnosed and undertreated condition, as patients may be embarrassed to self-disclose their symptoms, and clinicians may focus on obesity without exploring underlying psychopathology.

Although clinical examination is the gold standard for assessing any psychopathology, it is not always feasible due to time constraints and the requirement for a trained professional. In contrast, self-report tools, while potentially overinclusive by nature, are useful alternatives for evaluating the presence of BED, particularly for research and screening purposes (14,15). The BES is one of the most commonly used instruments in studies on BED.

The BES is a 16-item self-report questionnaire measuring behavioral, cognitive, and affective symptoms associated with binge episodes. Each item contains 3-4 differently weighted statements, resulting in a total score range of 0-46, with higher scores indicating more severe bingeing symptoms.

Subjects select the statement that best describes their feelings and/or behavior regarding eating. In the original study, scores of 17 and below were considered to indicate no or minimal bingeing, 18-26 indicated mild-moderate binge-eating, and 27 or more indicated severe binge eating (16). The BES is used to identify binge eaters, assess the severity of binge eating, and monitor treatment response. There are studies employing the BES as a screening tool to diagnose BED (14,17,18).

Initially designed and tested in an English-speaking population, the BES was later translated and validated in other languages across multiple international samples (15,17,19,20). To our knowledge, no other instruments are available in Türkiye for assessing binge eating behavior.

The aim of the present study is to evaluate the psychometric properties of the Turkish version of the BES in a clinical sample of individuals seeking outpatient treatment for obesity at the Family Medicine department of a university hospital in Türkiye.

## METHOD

This was a cross-sectional study conducted at the obesity outpatient clinic of the Department of Family Medicine at a university hospital in Istanbul, in collaboration with the Departments of Family Medicine and Psychiatry, between February 2019 and January 2020.

Participants were recruited consecutively as they presented to the obesity outpatient clinic. Inclusion criteria included being literate, aged between 18 and 65 years, able to give informed consent, and seeking medical treatment for obesity (body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup>, confirmed by measurements in the Department of Family Medicine). Exclusion criteria were the presence of major or uncontrolled medical/psychiatric problems (e.g., active psychosis, diabetes mellitus, dementia) that could influence eating patterns or the ability to complete the assessment. None of the participants were candidates for bariatric surgery. Informed consent was obtained, and participation was voluntary, with no payment for contribution.

Comrey and Lee have suggested that a minimum of ten observations per item is necessary to avoid computational difficulties (21,22). Since the BES questionnaire contains 16 items, a minimum sample size of 160 patients was deemed necessary for conducting an exploratory factor analysis.

## Procedure and Measures

Permission to use the BES was obtained from Elsevier, the publisher of the original English scale (16). The Turkish version of the BES was developed through a meticulous process of translation and back translation. This was carried out by one of the researchers (AG) and an independent translator, both fluent in English. It was initially tested on a sample of ten patients with obesity and subsequently revised by the study authors before finalization.

In addition to the BES, which is a self-report tool as described above, a semi-structured sociodemographic data collection form was designed and completed by the researchers. This form was used to record data on age, gender, marital status, educational and employment status, BMI of the participants, and details of their past medical and psychiatric histories.

Patients presenting to the obesity outpatient clinic were initially assessed by a family physician for their physical health status, including BMI. The family physician collected data on socio-demographic and medical clinical variables using the semi-structured form. Subsequently, patients were asked to fill out the BES in the same setting. Following this, all patients were directed to the psychiatry department where they underwent comprehensive psychiatric assessments by researchers (AG, HTK, RYE) using the Structured Clinical Interview for DSM-5-Disorders - Clinician Version (SCID-5-CV). These interviews lasted approximately 45 minutes, and the psychiatrists were blinded to the BES scores. The BES scores were then compared to the SCID-5-CV assessment, which was considered the gold standard for the diagnosis of BED in this study (23). The Structured Clinical Interview for DSM Disorders, Clinician Version (SCID-5-CV) is the current version of the SCID and reflects the diagnostic categories of the DSM-5. The adaptation and reliability of the Structured Clinical Interview for DSM-5-Disorders - Clinician Version (SCID-5-CV) to the Turkish language was carried out by Elbir et al. (23).

Among the participants, the first 30 were invited for a retest after two weeks. Of these, 26 completed the BES twice.

## Statistical Analysis

Descriptive analyses were conducted using counts and percentages for categorical variables, and means and standard deviations (SD) for continuous measures. The internal consistency was evaluated using Cronbach's alpha coefficient and McDonald's omega value for the total score and for each item. Test-retest reliability was assessed using the intraclass correlation coefficient (ICC). Construct validity was examined through

**Table 1: Sociodemographic variables**

|                       | n   | %    |
|-----------------------|-----|------|
| Gender                |     |      |
| Female                | 144 | 76.5 |
| Male                  | 44  | 22   |
| Marital status        |     |      |
| Single                | 70  | 37.2 |
| Married               | 112 | 59.5 |
| Divorced              | 6   | 3.1  |
| Employment status     |     |      |
| Employed              | 50  | 26.5 |
| Unemployed            | 16  | 8.5  |
| Housewife             | 86  | 45.7 |
| Student               | 19  | 10.1 |
| Retired               | 17  | 9.0  |
| Education status      |     |      |
| Illiterate            | 2   | 1.0  |
| Primary school        | 82  | 43.6 |
| Secondary-high school | 73  | 38.8 |
| University            | 31  | 16.4 |

exploratory factor analysis. After confirming sample adequacy with the Kaiser-Meyer-Olkin (KMO) index and Bartlett's Chi-square test of sphericity, varimax rotation was used for factor determination. Two structures found in the literature were tested using confirmatory factor analysis (CFA): a one-factor model for binge eating (BE) and a model with two correlated factors (behavioral and emotional/cognitive BE). Model fit was assessed using the chi-square statistic, the Comparative Fit Index (CFI), with values above 0.90 indicating a good fit, and the Root Mean Square Error of Approximation (RMSEA), with values of 0.08 or less indicating an excellent fit (24).

Predictive validity was assessed in terms of sensitivity, specificity, and predictive values. For these analyses, the BES was compared to the SCID-5-CV using the Receiver Operator Characteristic curve. The statistical significance level was set at 0.05. Data analysis was conducted using JAMOVI software (version 1.6.18.0) and the Statistical Package for the Social Sciences (SPSS) (version 23).

## RESULTS

### Participants

Out of 209 assessed individuals, 188 met the inclusion criteria and had no missing data. Participant details are presented in Table 1. The mean age of participants was  $45.9 \pm 11.9$ , and the mean BMI was  $36.3 \pm 4.8$ . There

**Table 2: Item reliability statistics**

|       | Mean  | SD    | If item dropped       |                     |                     |
|-------|-------|-------|-----------------------|---------------------|---------------------|
|       |       |       | Item-Rest Correlation | Cronbach's $\alpha$ | McDonald's $\omega$ |
| Bes1  | 0.622 | 0.768 | 0.312                 | 0.839               | 0.849               |
| Bes2  | 1.319 | 1.144 | 0.384                 | 0.837               | 0.846               |
| Bes3  | 1.176 | 1.222 | 0.617                 | 0.822               | 0.832               |
| Bes4  | 0.617 | 0.943 | 0.502                 | 0.830               | 0.839               |
| Bes5  | 0.782 | 0.896 | 0.411                 | 0.834               | 0.844               |
| Bes6  | 1.495 | 1.042 | 0.161                 | 0.849               | 0.855               |
| Bes7  | 1.080 | 1.324 | 0.541                 | 0.828               | 0.837               |
| Bes8  | 1.064 | 0.962 | 0.564                 | 0.826               | 0.835               |
| Bes9  | 1.106 | 0.889 | 0.504                 | 0.830               | 0.839               |
| Bes10 | 0.899 | 0.951 | 0.620                 | 0.823               | 0.832               |
| Bes11 | 0.596 | 0.683 | 0.517                 | 0.831               | 0.838               |
| Bes12 | 0.410 | 0.779 | 0.393                 | 0.835               | 0.845               |
| Bes13 | 0.793 | 1.121 | 0.379                 | 0.837               | 0.845               |
| Bes14 | 0.910 | 1.007 | 0.519                 | 0.828               | 0.837               |
| Bes15 | 0.899 | 0.805 | 0.522                 | 0.829               | 0.837               |
| Bes16 | 0.739 | 0.815 | 0.456                 | 0.832               | 0.841               |

SD: Standart deviation.

was a significant correlation between BMI and BES scores (Pearson correlation: 0.194,  $p < 0.044$ ).

### Internal Consistency

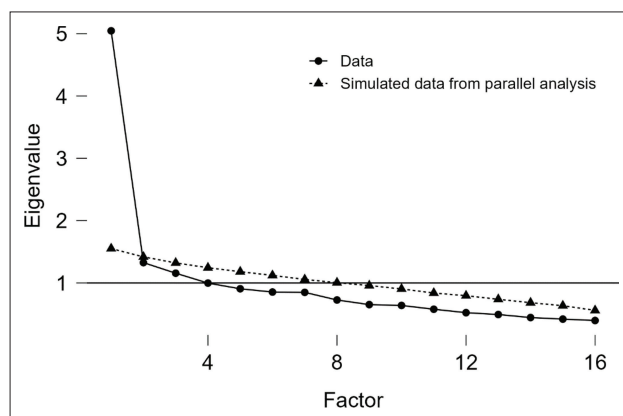
The overall internal consistency of the Turkish version of the BES, as measured by Cronbach's alpha coefficient, was 0.843, and McDonald's  $\omega$  was 0.849. Cronbach's Alpha for each item ranged from 0.825 to 0.851. The corrected item-total correlation values for each item were greater than 0.3, indicating that each item correlates well with the total score (Table 2).

### Test-Retest Reliability

To assess temporal stability, 26 participants completed the BES again two weeks later. Test-retest reliability was calculated with an ICC=0.875 for the total BES score ( $p < 0.001$ ), indicating significant agreement between the BES scores.

### Factor Analysis

For factor analysis of scale data, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value must be 0.6 or above, and Bartlett's Test of Sphericity should be significant (i.e., the significance value should be 0.05 or smaller) (25). In our study, the KMO value was 0.888, and Bartlett's Test of Sphericity statistic was  $\chi^2=740$  ([120df],  $p < 0.001$ ), indicating the data were appropriate for factor analysis.



**Figure 1.** Scree plot indicating one factor with an Eigenvalue above 1.

The factor structure of the BES was explored using exploratory factor analysis, adhering to the condition of selecting factors with Eigenvalues greater than 1. The results indicated that a one-factor solution provided a strong fit. We identified one factor with an Eigenvalue greater than 1 (Eigenvalue=4.374). This one-factor construct was also supported by the Scree plot (Fig. 1).

In CFA, the validity of the models can be evaluated using several fit indices, including the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA),

**Table 3: Confirmatory factor analyses for BES for one factor solution**

|                  | Fit Measures |       |       |             | Test for Exact Fit |     |       |
|------------------|--------------|-------|-------|-------------|--------------------|-----|-------|
|                  | CFI          | TLI   | RMSEA | RMSEA CI    | X <sup>2</sup>     | df  | p     |
| One-Factor Model | 0.935        | 0.925 | 0.046 | 0.027-0.063 | 146                | 104 | 0.004 |

BES: Binge Eating Scale; CFI: Comparative Fit Index; TLI: Tucker Lewis Index; RMSEA: Root Mean Square Error of Approximation.

**Table 4: BES score at a cut-off point of 18 and SCID-5-CV diagnoses**

| Predicted     | SCID-5-CV |      |         |      |       |       |
|---------------|-----------|------|---------|------|-------|-------|
|               | BED       |      | Non-BED |      | Total |       |
|               | n         | %    | n       | %    | n     | %     |
| BES Score     |           |      |         |      |       |       |
| ≥18 (BED)     | 31        | 50.9 | 30      | 49.1 | 61    | 100   |
| <18 (Non-BED) | 12        | 09.5 | 115     | 90.5 | 127   | 100.0 |
| Total         | 43        | 22.8 | 145     | 77.2 | 188   | 100.0 |

BES: Binge Eating Scale; BED: Binge Eating Disorder; SCID-5-CV: Structured Clinical Interview for DSM-5-Disorders - Clinician Version.

**Table 5: The predictive validity analysis**

| Cutpoint | Youden's Index | AUC±SD      | Sensitivity (%) | Specificity (%) | PPV (%) | NPV (%) |
|----------|----------------|-------------|-----------------|-----------------|---------|---------|
| 18       | 0.514          | 0.788±0.039 | 72.09           | 79.31           | 50.80   | 90.55   |

SD: Standard deviation; AUC: Area under the curve; NPV: Negative predictive value; PPV: Positive predictive value.

along with the 90% confidence interval for RMSEA. A satisfactory fit is generally indicated by CFI>0.9, TLI>0.9, and RMSEA of about 0.05 to 0.08 (26). Our CFA analysis is presented in Table 3 (Fig. 2).

### Predictive Validity

The predictive validity of the Turkish version of the BES was compared to the diagnosis of BED according to the SCID-5-CV, which is accepted as the gold standard. Table 4 shows the frequencies of BED diagnoses according to the BES and the SCID-5-CV.

The results of the predictive validity analysis are summarized in Table 5 below, including the recommended cut-off score for the Turkish version of the BES.

The relationship between sensitivity and specificity is represented by the Receiver Operator Characteristic (ROC) curve in Figure 3.

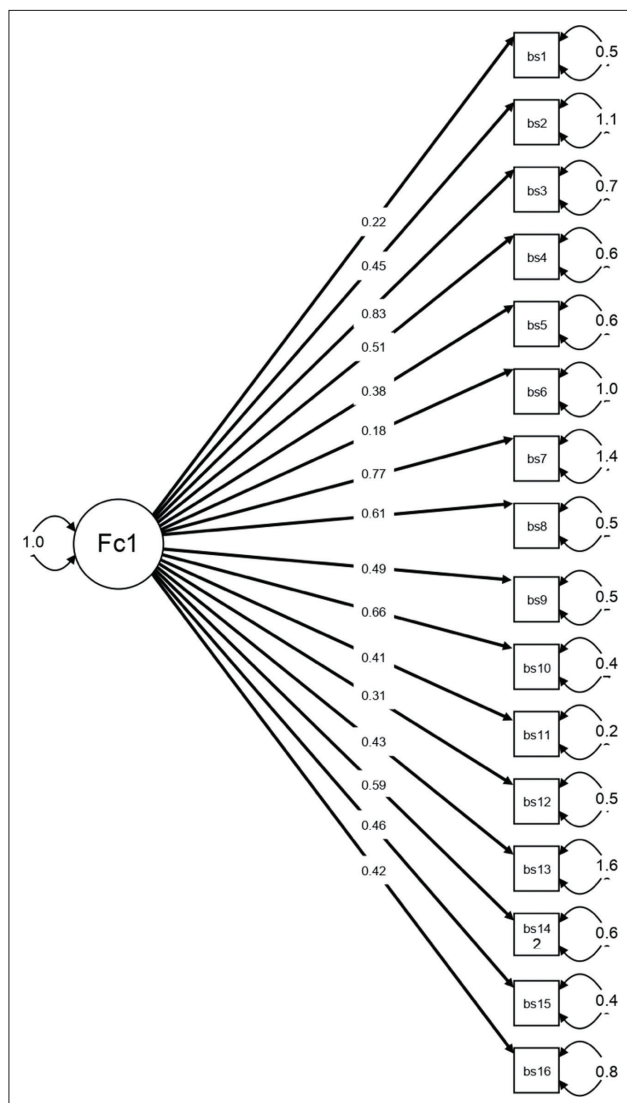
When evaluating the diagnostic success of the total BES score through ROC analysis, the Area Under the Curve (AUC) was found to be 0.788±0.039 ( $p<0.001$ ). An AUC between 0.7 and 0.8 is considered "acceptable" in distinguishing the measurement capability of a scale, according to literature standards (27). When the AUC value determined in our study is considered, it can be concluded that the Turkish version of the BES has acceptable discriminating power. Youden's index (YI) was employed to determine the appropriate cut-off value (28).

Among the potential cut-off values, the largest YI (0.514) value corresponded to 18 (Table 4). At this cut-off, the sensitivity of the scale was 72.1%, specificity was 79.3%, positive predictive value (PPV) was 50.8%, and negative predictive value (NPV) was 90.5%. Considering these values, a cut-off score of 18 seems appropriate for the Turkish version of the BES.

## DISCUSSION

The purpose of this study was to examine the psychometric properties of the Turkish version of the Binge Eating Scale. To the best of our knowledge, this is the first study to assess the psychometric properties of the Turkish version of the BES in a population with obesity in Türkiye. Currently, no other instrument is available in the country to measure binge eating behavior.

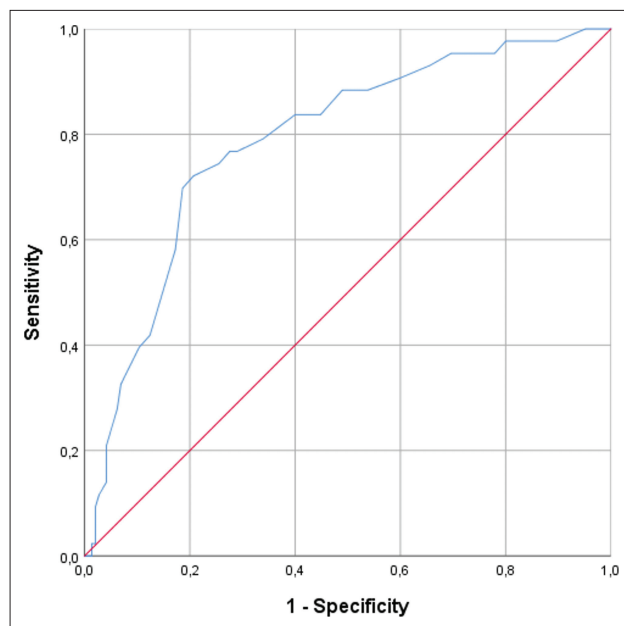
We evaluated the concordance between the BES and the diagnosis of BED in individuals with obesity seeking weight loss at an obesity clinic. The BES proved to be a useful instrument in our sample, demonstrating good sensitivity and specificity. Using a cut-off score of 18, 72.9% of individuals with BED (sensitivity) and 79.31% of those without BED (specificity) were correctly identified. Studies in different cultures and populations have reported similar cut-off values (17 and 18) for the BES (15,17,18). For instance, a study conducted in France with people



**Figure 2.** Confirmatory factor analysis (CFAs) model of the BES (Binge Eating Scale).

with obesity reported a validity profile comparable to ours (sensitivity 75%, specificity 88%), finding the BES useful in assessing BED in patients with obesity (15). Our results support the cross-cultural validity of the BES in this context.

In the factor analysis, both the one-dimensional and two-dimensional structures of the BES, as suggested by the original study and some previous validation studies, were tested. Our results supported the unidimensionality of the scale, with the one-factor model showing the best fit and simplest structure. A one-factor model was supported by several previous studies: the Portuguese version tested in general population by Duarte et al. (29), the Italian version by Imperatori et al. (19) in obese and overweight patients, the Spanish version by Escrivá-Martínez 2010 in college



**Figure 3.** ROC curve.

students (30), and the French version by Brunault et al. (15) in both the general population and persons with obesity. However, the original study by Gormally et al. (16) in 1982 proposed a two-factor model consisting of cognitive/emotional and behavioral factors in persons with obesity. This two-factor model was supported in subsequent studies, including the Malay version by Robert et al. (31) 2013 in both clinical and non-clinical samples, and the Arabic version in the general population by Zeidan et al. 2019 (20). In our study, there was a very high correlation between the two factors, lacking discriminant validity. Therefore, we propose a one-factor model for the Turkish version in individuals with obesity.

The internal consistency calculation demonstrated the consistency of the results across the items of the BES with a Cronbach's alpha of 0.84, closely matching the 0.85 value of the original study (16). Temporal stability was also confirmed by demonstrating a strong correlation between scores assessed at a 2-week interval. This supports the reliability of the Turkish version of the BES.

Our study has certain limitations. The low percentage of men in the sample and testing the BES only in people with obesity limits the generalizability of the findings. Additionally, the relatively small sample size and the absence of expert consultation in the field for assessing the content validity of the scale could also be considered limitations. It should also be noted that despite the low factor loadings of items sb 6 and sb1, they were retained in the scale to maintain face validity.

## CONCLUSION

In conclusion, our results suggest that the Turkish version of the BES is a unidimensional tool and a reliable measure for detecting binge eating disorder at a cut-off value of 18. The BES can be useful for both clinical and research purposes. However, the diagnosis of BED should always be confirmed by clinical assessment. Further studies in different samples, including non-obese individuals and bariatric surgery candidates, are needed to assess its performance in other populations.

| Contribution Categories |                                   | Author Initials                      |
|-------------------------|-----------------------------------|--------------------------------------|
| Category 1              | Concept/Design                    | A.G., R.Y.E., H.T.K., H.H.           |
|                         | Data acquisition                  | A.G., R.Y.E., H.T.K., H.H.           |
|                         | Data analysis/Interpretation      | R.Y.E., A.G., H.T.K., M.E.K.         |
| Category 2              | Drafting manuscript               | A.G., R.Y.E., H.T.K., H.H.M., M.E.K. |
|                         | Critical revision of manuscript   | A.G., R.Y.E., H.T.K., H.H.M., M.E.K. |
| Category 3              | Final approval and accountability | A.G., R.Y.E., H.T.K., H.H.M., M.E.K. |
| Other                   | Supervision                       | A.G., R.Y.E., M.E.K.                 |

**Ethical Approval:** The Istanbul Medeniyet University Goztepe Training and Research Hospital Ethics Committee granted approval for this study (date: 27.06.2018, number: 2018/0245).

**Informed Consent:** Informed consent was obtained from all participants.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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