



Validation of the Turkish version of the Orthorexia Nervosa Inventory (ONI) in an adult population: its association with psychometric properties

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Abstract

Purpose To examine the reliability and validity of the Turkish version of the Orthorexia Nervosa Inventory (ONI) in a large adult population.

Methods Included in this cross-sectional study, were 710 individuals living in Turkey who were between 18 and 65 years of age. The individuals were reached via an online questionnaire that included their sociodemographic characteristics and the ONI and Eating Attitude Test-26 (EAT-26). Confirmatory factor analysis (CFA) was used to test the validity of the ONI. The ONI contains three sub-factors (behaviors, emotions, and impairments). Analyses were conducted using LISREL 8.80 for Windows and IBM SPSS Statistics for Windows 22.0.

Results The Cronbach's alpha coefficient was 0.91 for the ONI total factor scores and Cronbach alpha values for behaviors, impairments, and emotions were found to be 0.82, 0.84, and 0.81, respectively. The CFA performed supported the three-factor structure of the ONI obtained in the first sample. The minimum discrepancy per degree of freedom = 5.65 and the model generally fit well to the structure (RMSEA = 0.08, CFI = 0.94, NFI = 0.93, SRMR = 0.07, IFI = 0.94). A positive and moderate relationship ($r = 0.42$) was found between the ONI and EAT-26. A positive and low level ($r = 0.16$) correlation was found between the ONI and body mass index. There was no statistically significant difference between the ONI scores according to gender ($p = 0.22$).

Conclusion The findings suggested that the Turkish version of the ONI is a valid and reliable scale for determining the tendency for ON in a Turkish adult population.

Level of evidence Level V, descriptive cross-sectional study.

Keywords Orthorexia nervosa · Orthorexia Nervosa Inventory · Eating behavior disorder · Validation

Introduction

Eating disorders are defined as serious psychiatric disorders that are characterized by abnormal eating or weight-control behaviors that cause changes in the consumption or absorption of food, including weight, body shape, and disturbing attitudes towards eating [1, 2]. Anorexia nervosa (AN) and bulimia nervosa (BN) are the most well-known

eating disorders. Another eating behavior disorder with a few symptoms that are similar to AN and BN, and several that are unique is orthorexia nervosa (ON) [3]. In the late 1990s, ON was first described by Bratman as an obsession with eating healthy food to be healthier [4]. ON, which literally means 'proper appetite', is derived from the Greek words orthos (correct) and orxis (appetite) [5]. Although ON has been described in the scientific literature, it is not formally recognized as a formal psychiatric diagnosis. There has been controversy over whether ON should be included in the published edition of the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) or not [6]. However, it was not included as a psychiatric diagnosis in the DSM-5 [7].

Generally the term ON describes a pathological obsession with proper nutrition that is characterized by the avoidance

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of unhealthy and impure foods, and restrictive and ritualized food preparation and eating habits [8, 9]. In other words, ON is defined as an obsession with healthy eating that causes clinical consequences such as medical or psychological complications, major distress, and/or impairment in key areas of functioning with an obsessive focus on dietary practices believed to provide optimum well-being [10]. Striving for optimal health is an admirable goal for both individuals, the community, and healthcare professionals. However, the food restrictions and attitudes of some individuals that lead to eating disorders can create life-threatening problems [11]. These problems can emerge and result in social isolation, imitation of learned and accepted irregular eating habits, transmission to other family members (especially children), obsessive–compulsive disorder, addiction, and a poor quality of life [4, 12].

In Turkey, studies have been conducted to determine the tendency towards ON using the Orthorexia Nervosa Evaluation Scale-11 (ORTO-11) questionnaire, which is a shorter variation of the ORTO-15 [13–15]. However, the results of these studies were contradictory in terms of validity and reliability, and as seen in studies, the prevalence of ON was not considered as a definitive psychiatric diagnosis, and there is currently no standard diagnostic scale.

Four consensus diagnostic criteria have been proposed for ON [10, 12, 16]. Criterion A comprises a preoccupation with healthy nutrition and rigidly following a restrictive ‘healthy’ diet (which the individual believes to be healthy and pure), and strictly avoiding foods believed to be unhealthy. Criterion B comprises the violation of restrictive dietary guidelines that cause extreme emotional distress combined with feelings of guilt, shame and/or anxiety. Criterion C comprises physical impairments where nutritional deficiencies could lead to significant weight loss, malnutrition and/or physical health complications. Criterion D comprises psychosocial disorders in social, occupational, and/or academic functionality that may result from other diagnostic criteria [12, 16]. Scales such as the Bratman Orthorexia Test [5], ORTO-15 [17], Eating Habits Questionnaire [18], and Dueseldorf Orthorexia Scale [19] have been used to measure ON. However, these scales generally lack items that assess the latter three consensus diagnostic criteria. In all these scales, there are 0–2 items assessing Criterion B (emotional distress) and 2–5 items assessing Criterion D (psychosocial disorders). There is no item that evaluates Criterion C (physical disorders) in any of these scales [5, 17–19]. Therefore, the fact that there is no fully studied ON inventory measure with clear psychometric properties makes it difficult to obtain reliable estimates of its prevalence. And, the ONI was developed by Oberle et al. (2020) to measure a reliable ON symptomatology that includes a sufficient number of items to evaluate each of the four consensus diagnostic

criteria for ON and items expressed to better discriminate non-pathological healthy ones [20].

The aim of the present study was to examine the reliability and validity of the Turkish version of the Orthorexia Nervosa Inventory (ONI) [20], which includes a sufficient number of items to evaluate each of the four consensus diagnostic criteria for ON, in an adult Turkish population.

Method

Initially, permission for use of the scale was obtained via e-mail from the researchers who developed it. Later, the adaptation process was carried out in two phases.

Phase 1: Cross-cultural adaptation process.

The translation and adaptation process (Suppl. File 1) was based on the methodology of Beaton et al. [21] and aimed to evaluate the linguistic, semantic, and cultural agreement between the Turkish version and the original scale. Five translators independently performed five translations from English into Turkish, which were compared to develop a common version. A sixth translator produced a backtranslation [21]. Finally, an expert panel of three members evaluated both translations looking for any inconsistencies between the two versions and developed a prefinal version of the scale [21]. The ONI was piloted on 10 individuals (five women and five men) to obtain an initial assessment of the scale, and determine the time required and the difficulty involved in responding. Feedback was requested and the participants were asked to suggest any changes that might be necessary. They were asked to answer three open-ended questions about the clarity, potential ambiguity, and intelligibility of each item [21]. The responses of the participants were consolidated and summarized [21–23].

Phase 2: psychometric testing.

This study was conducted between November and December 2020. The online questionnaire was openly accessible for two months. A link to the electronic survey was distributed across the country by researchers via a range of methods, including invitation via e-mails, and being shared on ResearchGate, LinkedIn, Facebook, WhatsApp, Instagram, and Twitter. It was aimed to include healthy individuals between 18 and 65 years of age in the study. With these diverse recruitment methods, the survey was completed by 720 people, which exceeded the 500 recommended by the International Test Commission for the purpose of adequately revealing the factor structure of a test [24]. Data from 10 of those people were excluded due to not meeting the inclusionary criteria of the study (being 18 years of age or older, not being pregnant/lactating).

The data were collected through online surveys (Google Forms). The procedures used in this study were in line with the principles of the Declaration of Helsinki and informed

consent was obtained from the participants in electronic form prior to data collection. The research protocol of the study was approved by the Ethics Committee of Ondokuz Mayıs University (number: B.30.2.ODM.0.20.08/765).

Participants

Included in this cross-sectional study were 710 participants from Turkey who were between 18 and 65 years of age. The frequency distributions and descriptive statistics of the demographic information of the individuals participating in the research are given in Table 1. The majority of the sample were females ($n = 503$; 70.8%) and 58.5% of the participants were single. The mean age of the participants was 30.15 ± 7.47 years. In addition, 91.1% of the participants had attained master's/doctorate degrees or bachelor's degrees. The physical activity status of 47.6% of the participants was light physical activity. The rate of smokers was 15.9% and the mean body mass index (BMI) of the participants was 23.56 ± 4.04 kg/m².

Questionnaire

The Turkish questionnaire consisted of two parts. The first part evaluated the sociodemographic characteristics (age,

gender, marital status, education level, physical activity status, etc.) of the participants. The BMI was calculated by dividing the weight (in kg) by the height in square meters [25]. The second part included the ONI and Eating Attitude Test-26 (EAT-26), which were the scales used in this study.

Orthorexia Nervosa Inventory

The ONI was developed by Oberle et al. (2020) to measure a reliable ON symptomatology that includes a sufficient number of items to evaluate each of the four consensus diagnostic criteria for ON and items expressed to better discriminate non-pathological healthy ones [20]. It is a 4-point Likert-type scale and includes 24 questions with values given as follows: 1 = not at all true, 2 = slightly true, 3 = mainly true, 4 = very true. A total score is calculated by adding up each item score. The ONI consists of a total score and separate sub-factors. The first sub-factor is behaviors (items 2, 4, 6, 8, 11, 15, 17, 18, 22). The second sub-factor is impairments (items 3, 5, 7, 10, 12, 14, 16, 19, 20, 24). The third sub-factor is emotions (items 1, 9, 13, 21, 23). The higher score, the greater the level of ON symptomatology.

Eating Attitude Test-26

The EAT-26 was developed by Garner et al. (1982) in the late 1970s as a 40-item scale to assess food attitudes and detect AN [26]. Subsequent studies found that the scale was sensitive to BN and other eating disorders [27, 28]. A subsequent factor analysis showed that when the 14 items were removed, the scale had almost the same psychometric properties. The EAT-26 is as effective as the EAT-40. The EAT-26 was validated for the Turkish population by Ergüney-Okumuş and Sertel [29]. The EAT-26, which is a 6-point Likert-type scale includes 26 questions with answers graded from 0 (never, almost never, and infrequently) to 3 (always). Scores equal or higher than 21 indicate a possible abnormal eating attitude. In this study, it was used to test the construct validity of the ONI and the reliability coefficient of the scale was found as $\alpha = 0.79$.

Statistical analysis

The validity and reliability analysis of the ONI, which was adapted to Turkish, was conducted. In the study, confirmatory factor analysis (CFA) was used to test the validity of the adapted scale using LISREL 8.80 for Windows (Scientific Software Int. Inc., Lincolnwood, IL, USA) and the other data (demographic characteristics of the individuals participating) were tested using IBM SPSS Statistics for Windows 22.0 (IBM Corp., Armonk, NY, USA). The maximum likelihood estimation method was used for the CFA analysis. Prior to the analysis, a check was performed to determine

Table 1 Basic demographic characteristics of study individuals

Variables	<i>n</i> (%) or mean \pm SD
Age (years)	30.15 \pm 7.47
BMI (kg/m ²)	23.56 \pm 4.04
Gender	
Female	503 (70.8)
Male	207 (29.2)
Marital status	
Single	415 (58.5)
Married	295 (41.5)
Education level	
Primary school graduate	12 (1.7)
High school graduate, diploma or the equivalent	51 (7.2)
Bachelor's degree	196 (27.6)
Master's/doctorate degree	451 (63.5)
Smoking status	
Yes	113 (15.9)
No	597 (84.1)
Physical activity status	
Inactive or insufficiently active	236 (33.2)
Lightly active	338 (47.6)
Moderate active	123 (17.3)
Highly active	13 (1.8)

Values are expressed as *n* (%) or mean \pm SD

whether there were any missing data, and no missing data were found. For the extreme value, the standard z-value transformation of each item was made and since there were no values other than -4 and 4 , an extreme value was not found [30]. To evaluate the internal consistency of the ONI, Cronbach Alpha reliability analysis was performed. In addition, whether there was a relationship between the variables was determined using the Pearson correlation coefficient, which is the method used when all of the variables are continuous. In addition, the independent samples t-test was used to examine the relationship of the adapted scale score scores with gender. This method is a parametric test and it was chosen because the number of data in each group was large enough ($n > 30$).

Results

This section investigated the reliability and validity of the ONI. First, reliability scores were obtained for all of the sub-factors and factors in the ONI. Then, the factor structure was sought for the ONI. In the adaptation study of the ONI, the validity analysis was analyzed using CFA. The final scale was obtained with three sub-factors. CFA was used to verify this structure. The reason for this was that the dimensions in the original scale were analyzed by exploratory factor analysis and the relevant structure was specified. In addition, an outlier controlling was conducted for all of the items on the scale. First of all, among the factors related to the structure of the three sub-factors that were obtained, the regression path coefficients for the items were determined to be statistically significant. The t values for the standard regression coefficients of each item were examined and obtained outside the critical value of ± 1.96 at a significance level of 0.05. Factor loadings were obtained in the range of 0.29–0.58 (Table 2).

There are many model data fit indices in the literature for model data fit. In this study, among these fit indices, the most frequently used fit indices, which comprise the relative chi-square (χ^2/df), the root mean square error of approximation (RMSEA), Normed Fit Index (NFI), Comparative Fit Index (CFI), standardized root mean square residual (SRMR), and Incremental Fit Index (IFI) were given (Table 3). A ratio of the chi-square (X^2) to degrees of freedom below 3 indicated a perfect fit, and a value below 5 indicated a good fit [31]. In this study, the minimum discrepancy per degree of freedom (CMIN/df) result was obtained as 5.65, which indicated an acceptable fit. According to the statistics related to the other model data fit indices, the model generally fit well to the structure (RMSEA = 0.08, CFI = 0.94, NFI = 0.93, SRMR = 0.07, IFI = 0.94) [32]. Although the first CMIN/df result was out of the specified range, no modification was

Table 2 CFA standardized factor loadings

Items	Behaviour	Emotions	Impairments
ORTO2	0.37		
ORTO4	0.40		
ORTO6	0.58		
ORTO8	0.47		
ORTO11	0.38		
ORTO15	0.54		
ORTO17	0.54		
ORTO18	0.55		
ORTO22	0.47		
ORTO1		0.47	
ORTO9		0.59	
ORTO13		0.58	
ORTO21		0.50	
ORTO23		0.55	
ORTO3			0.36
ORTO5			0.37
ORTO7			0.38
ORTO10			0.32
ORTO12			0.42
ORTO14			0.29
ORTO16			0.36
ORTO19			0.44
ORTO20			0.36
ORTO24			0.42

required, as the other fit indices fit well. Therefore, the ONI of the three sub-factors compared to the CFA adaptation of the inventory analysis work sample structure was also confirmed in Turkey.

The reliability coefficient for each factor and the whole scale was examined using the Cronbach alpha coefficient. The Cronbach alpha coefficient was over 0.80 in the sub-factors and total factor scores for the ONI. The Cronbach alpha coefficient was 0.91 for the ONI total factor scores and Cronbach alpha values for the ‘behaviors, impairments, and emotions’ were 0.82, 0.84, and 0.81, respectively. The Cronbach alpha reliability coefficient was expected to be above 0.70 [33]. Accordingly, the whole scale and its sub-factors were found to be reliable with high internal consistency.

There was a statistically significant relationship between the total scores of the ONI and total EAT-26 scores ($p < 0.01$). A positive and moderate relationship ($r = 0.42$) was found between the ONI and EAT-26 scores. In addition, the correlation coefficient between the ONI and BMI was statistically significant ($p < 0.01$). A positive and low level ($r = 0.16$) correlation was found between the ONI and BMI. In other words, as the ONI scores increased, both the BMI and EAT-26 scores increased, or vice versa (Table 4).

Table 3 Model fit indexes

Index	Perfect fit measure	Good fit measure	Research finding	Conclusion
CMIN/df	0–3	3–5	5.65	Acceptable
RMSEA	$0.00 \leq RMSEA \leq 0.05$	$0.05 < RMSEA \leq 0.10$	0.08	Good
CFI	$0.95 \leq CFI \leq 1.00$	$0.90 \leq CFI < 0.95$	0.94	Good
NFI	$0.95 \leq NNFI \leq 1.00$	$0.90 \leq NNFI < 0.95$	0.93	Good
SRMR	$0.00 \leq SRMR \leq 0.05$	$0.05 < SRMR \leq 0.08$	0.07	Good
IFI	$0.95 \leq IFI \leq 1.00$	$0.90 \leq IFI < 0.95$	0.94	Good

CMIN/df relative Chi-square, *RMSEA* root mean square error of approximation, *NFI* normed fit index, *CFI* comparative fit index, *SRMR* standardized root mean square residual, *IFI* incremental fit index

Table 4 ONI relationships with the EAT-26 and BMI scores

	ONI total	ONI behaviors	ONI impairments	ONI emotions
EAT-26	0.42*	0.31*	0.37*	0.40*
BMI	0.16*	0.06	0.22*	0.15*

*Correlation was significant at 0.01

Table 5 ONI relationships with gender

Gender	<i>n</i>	Mean \pm SD	<i>t</i>	<i>df</i>	<i>p</i> value
Female	503	39.03 \pm 9.99	–1.23	708	0.22
Male	207	40.04 \pm 10.04			

Values are expressed as the *n* (%) or mean \pm SD

Skewness and kurtosis are statistics that provide information about the normality of the data distribution, and when it is between – 2 and 2, the data distribution is normal [34]. Accordingly, the skewness and kurtosis value for the women and men was 1.05/0.06 and 0.81/0.73, respectively. Hence, the data distribution was normal. Whether there was a difference according to gender is shown in Table 5. There was no statistically significant difference between the ONI scores according to gender ($t_{(708)} = -1.23$, $p = 0.22$, $p > 0.05$). The average ONI of the females and males were similar.

Discussion

In the present study, it was aimed to investigate the psychometric properties of a translated Turkish version of the ONI among a heterogeneous population sample. This study was the first attempt to validate the original version translated into the Turkish language. The Turkish form of the scale was sent online to adult individuals and the data obtained from the 710 participants were analyzed.

In the study, a three-factor solution was suggested while retaining all 24 items from the original ONI. With regard to

the results based on CFA, it found the ONI had good performance on all of the psychometric indicators. An acceptable internal consistency of the Turkish test was found with a Cronbach alpha coefficient of 0.91 and the Cronbach alpha values of the ‘behaviors, impairments, and emotions’ sub-factors were 0.82, 0.84, and 0.81 respectively. This demonstrated that the Turkish version of the ONI is a reliable screening scale. The ONI developed by Oberle et al. (2020) was the internal consistency coefficient of the inventory was 0.94 and ranged from 0.88 to 0.90 for the three sub-factors of Cronbach alpha values [20]. The Cronbach alpha coefficient of the ORTO-15 scale adapted to Turkish was 0.62 [35]. The internal consistency of this scale was found to be greater than that of the ORTO-15.

ON, which tends to shift from healthy nutrition to obsessive nutrition, is closely associated with eating disorders. Positive correlations were found between the EAT-26 and ONI scores, and the sub-factors, similar to the study of Obler et al. (2020). These results were consistent with those of numerous studies that have shown that ON symptomatology involves disordered eating above and beyond a simple commitment to healthy eating behaviors, and is associated with more disordered eating [20, 36–40]. Similar to the literature, the tendency towards ONI according to gender did not significantly differ in the current study [41]. A low positive correlation was found between the ONI scores and the BMI. The relationship between the BMI and ONI scores is controversial [20, 42]. However, there are studies that have shown a positive correlation, like the results in the literature. Different results can be found in scales evaluating ON tendency, especially when there are questions evaluating the physical condition and when different groups are selected as samples [19, 42].

Limitations

Although there are various strengths of the study (the sample is generally relatively heterogeneous in Turkey, representative sample of the population etc.), a few limitations should be noted. First, the findings of this study were based

on self-report data. There is a risk of resource bias. Second, there are no clear diagnostic criteria for ON for researchers or clinicians. This inventory should be used not for the diagnosis, but for assessing the risk of ON in the Turkish population. Third, the majority of the sample consisted of female and well-educated individuals, which may have affected the generalizability of the findings.

Conclusion

This study indicated that the scale was able to measure the presence of orthorexic tendencies and behaviors in the Turkish population as a whole, not for diagnosis. Values obtained from the validation and psychometric properties of the ONI appropriately fit the indices and supported the quality of the scale, which has been approved for good internal consistency and proper structural compatibility. Further studies are needed to detect the tendency towards ON in larger populations and in different groups.

What is already known on this subject?

The 24-item ONI is the first inventory to evaluate each of the four consensus diagnostic criteria for ON in scientific research.

What does this study add?

This study was the first study to validate and report the Turkish version of the ONI, which demonstrated high reliability and acceptable validity in the Turkish adult population. Further studies could determine the tendency of individuals in the adult Turkish population towards ON and it could be applied to different groups. Moreover, to determine ON trend, increasing in the whole world and in Turkey this inventory is thought to be important.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40519-021-01199-0>.

Declarations

Conflict of interest All authors declare that they have no conflicts of interest.

Ethical approval The procedures used in this study were in line with the principles of the Declaration of Helsinki and the research protocol of the study was approved by the Ethics Committee of Ondokuz Mayıs University (number: B.30.2.ODM.0.20.08/765).

Informed consent In the study, informed consent was obtained from the participants in electronic form prior to data collection.

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