

Validity and reliability of the Turkish version of the Düsseldorf orthorexia scale (TR-DOS) and the prevalence of orthorexia nervosa among Turkish university students

Hasan Kaan Kavsara, Açelya Gül Koyuncu, Handenaz Dere Yelken, Friederike Barthels & Nanette Stroebele-Benschop

To cite this article: Hasan Kaan Kavsara, Açelya Gül Koyuncu, Handenaz Dere Yelken, Friederike Barthels & Nanette Stroebele-Benschop (2025) Validity and reliability of the Turkish version of the Düsseldorf orthorexia scale (TR-DOS) and the prevalence of orthorexia nervosa among Turkish university students, *Psychology, Health & Medicine*, 30:4, 782-797, DOI: [10.1080/13548506.2024.2439133](https://doi.org/10.1080/13548506.2024.2439133)

To link to this article: <https://doi.org/10.1080/13548506.2024.2439133>



Published online: 08 Dec 2024.



Submit your article to this journal [↗](#)



Article views: 373



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)



Validity and reliability of the Turkish version of the Düsseldorf orthorexia scale (TR-DOS) and the prevalence of orthorexia nervosa among Turkish university students

Hasan Kaan Kavsara ^{a,b}, Açelya Gül Koyuncu ^a, Handenaz Dere Yelken ^a,
Friederike Barthels ^c and Nanette Stroebele-Benschop ^d

^aFaculty of Health Sciences, Department of Nutrition and Dietetics, Yeditepe University, Istanbul, Türkiye;

^bGraduate School of Health Sciences, Nutrition and Dietetics, Istanbul Medipol University, Istanbul, Türkiye;

^cDepartment of Clinical Psychology, Institute of Experimental Psychology, Heinrich Heine University Düsseldorf, Düsseldorf, Germany; ^dDepartment of Nutritional Psychology, Institute of Nutritional Medicine, University of Hohenheim, Stuttgart, Germany

ABSTRACT

Orthorexia Nervosa (ON) is characterized by an excessive preoccupation with healthy foods accompanied by the avoidance of self-declared unhealthy options, yet it remains unrecognized in major diagnostic guidelines. The Düsseldorf Orthorexia Scale (DOS), a 10-item self-report questionnaire using a four-point Likert scale, assesses the obsession with healthy eating. This study evaluates the reliability and validity of the TR-DOS in the Turkish context and estimates the prevalence of ON among university students. Several studies have shown that translating the DOS into various linguistic groups may exhibit different models of DOS scores. However, the psychometric properties and model fit of the DOS have not yet been investigated in Turkish-speaking populations; to address this gap, we assessed the psychometric properties of a Turkish translation of DOS (TR-DOS) in a sample of 425 university students in Türkiye. The TR-DOS revealed a 7.3% ON prevalence and a 9.0% risk of development. Weak positive associations were observed between TR-DOS total scores and BMI ($r = 0.152$, $p = .002$). Exploratory Factor Analysis confirmed the validity of TR-DOS ($KMO = 0.867$) with satisfactory reliability (Cronbach's $\alpha = 0.854$). Confirmatory Factor Analysis indicated an acceptable fit for the TR-DOS model ($\chi^2/df = 3.127$, $RMSEA = 0.071$, $SRMR = 0.046$, $IFI = 0.955$, $CFI = 0.955$, $GFI = 0.956$, $TLI = 0.932$). Moderate positive correlations were found between TR-DOS and eating disorder measures (EAT-26: $r = 0.428$, $p < .001$; EDE-Q-13: $r = 0.430$, $p < .001$). The findings demonstrated that the TR-DOS is both culturally appropriate and psychometrically adequate for Turkish university students. It is a reliable and valid instrument for assessing obsessive healthy eating behaviors in this population.

ARTICLE HISTORY

Received 25 March 2024

Accepted 20 November 2024

KEYWORDS

Orthorexia nervosa; eating attitudes; Dusseldorf orthorexia scale; eating disorders; validation studies

Introduction

Orthorexia Nervosa (ON) is a condition characterized by excessive, obsessive thoughts and behaviors about healthy eating, and the term was first defined by Bratman in 1997 (Bratman, 1997). Individuals with ON exhibit behaviors such as restricting certain foods, avoiding those considered unhealthy, spending extensive time and energy planning and preparing meals, experiencing obsessive thoughts about healthy eating, and feeling significant guilt, anxiety, or shame when deviating from their self-imposed diets (Levin et al., 2023). Despite its distinctive features, ON is not recognized as an official disorder in diagnostic manuals such as the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision, International Statistical Classification of Diseases and Related Health Problems 11th Revision; this is because the diagnostic criteria for ON are not sufficiently standardized, and no international consensus has been reached (Donini et al., 2022). The recent surge in research on ON reflects a growing interest in understanding this phenomenon (Waterman et al., 2022).

In a systematic review conducted by Opitz et al. (2020), ten different scales used to evaluate ON were identified, with the most widely used being a version of the ORTO-15. Existing ON scales have been widely criticized for their lack of standardized measures, with only 48.23% of studies reporting psychometric quality assessments (Opitz et al., 2020), thereby complicating validity judgements due to the absence of a 'gold standard' definition of ON (Cena et al., 2019). The BOT and ORTO-15 scales are notably discouraged for assessing ON due to their poor psychometric properties and conceptual issues (Meule et al., 2020; Missbach et al., 2015). The ORTO-15 exhibits poor psychometric properties and tends to overestimate the prevalence of orthorexia. The ORTO-15, initially designed for the Italian population in 2005 (Donini et al., 2005), was later validated for the Turkish population as ORTO-11 (Arusoglu et al., 2008). However, research in Türkiye using the ORTO-11 has revealed varying prevalence rates of ON, ranging from 59% to 45.5% (Bağcı Bosi et al., 2007; Caferoglu & Toklu, 2022), highlighting the need for new scales and more comprehensive studies to accurately assess ON prevalence in Türkiye.

The DOS is considered more precise among the available scales, such as ORTO-15 (Azzi et al., 2023; Meule et al., 2020; Opitz et al., 2020). Although the DOS was originally designed for the German population, it has been successfully adapted for various languages and cultures, including English (E-DOS) (Chard et al., 2019), Chinese (C-DOS) (He et al., 2019), Arabic (Hallit et al., 2021), Polish (PL-DOS) (Brytek-Matera, 2021) Brazilian (DOS-BR) (Souza et al., 2021), Spanish (Parra-Fernández et al., 2019), Portuguese (Ferreira & Coimbra, 2021), and Italian (I-DOS) (Cerolini et al., 2022). However, no study has validated the TR-DOS or assessed its psychometric properties among Turkish university students.

University students are an important demographic for studying ON due to various factors influencing their eating behavior and dietary intake. Kabir et al. (2018) identify these factors as including individual elements such as cooking skills, food taste preferences, and nutrition knowledge; societal influences like peer pressure and social norms; aspects related to university life such as campus culture and examination frequency; and environmental factors like the availability of cooking resources and food prices (Kabir et al., 2018). This unique combination of

influences makes university students a relevant and critical population for examining ON, as early identification and intervention can address habits that may persist into adulthood. Furthermore, most validation studies of ON scales have been conducted within university student samples, underscoring the importance of this population in the research on ON (Chard et al., 2019; He et al., 2019; Lasson et al., 2021).

This study is significant as it represents the first attempt to validate the TR-DOS and assess its psychometric properties among Turkish university students. The primary aim of this study is to translate and transculturally adapt English DOS to assess ON in this demographic. The study addresses the question of whether the TR-DOS is a reliable and valid instrument for measuring Orthorexia Nervosa among Turkish university students? This validation will provide valuable insights, contribute to the broader understanding of ON, and aid in the development of targeted interventions tailored to the Turkish population. We hypothesize that the TR-DOS will demonstrate strong reliability and validity, making it a useful tool for identifying ON in Turkish university students.

Materials and methods

Study setting and ethical approval

This study, conducted at Yeditepe University, was approved by the Yeditepe University Non-Interventional Clinical Research Institutional Review Board and Ethics Committee with the number 'E.83321821-805.02.03-211' The study was conducted between 11 September 2023, and 11 December 2023, using online surveys conducted through Google Forms.

Participants

The study was conducted with 425 volunteers randomly selected among Turkish-literate individuals between the ages of 18 and 65 years who were enrolled at Yeditepe University and agreed to participate. Inclusion criteria were participants aged 18–65 years, fluent in Turkish, and able to provide informed consent before completing survey. Exclusion criteria included those who refused to participate in the study, those who were not literate in Turkish, those with self-report psychiatric disorders, and those who adhered to a specific dietary regimen (e.g. weight loss diet).

Scale adaptation and translation process

Before adopting the DOS into Turkish, the author of the scale was contacted via email to request permission to carry out the study. After receiving permission, the scale items were translated from English to Turkish by two experts with Ph.D. degrees in Nutrition and Dietetics who were proficient in English. The two translations were then reviewed and merged into a final form, which was back-translated into English by another expert. After completing the back-translation, we examined the back-translated version against the original source (Brislin, 1970). The two versions were compared to identify any inconsistencies or potential issues related to cultural differences, and the translated

material was found to be culturally relevant and appropriate for the target audience, so no changes were made.

Pilot study phase

A preliminary investigation involving 30 university students meeting the study's inclusion criteria was undertaken to assess Turkish students' readability, comprehension, and appropriateness of the TR-DOS scale. No revisions were deemed necessary due to the absence of negative feedback during the pilot study. Consequently, the Turkish version of the DOS was considered to have satisfactory readability and comprehensibility. The final study sample did not include participants from the pilot study.

Data collection procedure

Data were collected using an online survey platform (Google Forms) distributed via email. Participants were recruited through convenience sampling. After obtaining ethical approval from the university's ethics committee and permission from the Rectorate to conduct research on university students, we sent the Google Form link to the mailing list of 577 students registered in the academic announcement Google Classroom group.

A reminder email was sent to the academic announcement group every two weeks during the data collection period to encourage participation. A total of 425 students responded (response rate: 73.7%) to the study email. Participation in the study was voluntary, and no incentives were offered in return for participation. Informed consent was obtained from all participants before they started the survey.

The researchers designed a comprehensive sociodemographic information form to capture essential demographic details, including age, gender, and self-reported height and weight for BMI calculation. Subsequently, participants completed two established scales described in the following section: the Eating Attitude Test (EAT-26) and the Eating Disorder Examination Questionnaire (EDE-Q-13), chosen for their proven reliability and validity in similar research contexts. These scales were used to assess the concurrent validity and psychometric properties of the TR-DOS.

To evaluate the test-retest reliability of the TR-DOS, the scale was re-administered 3–4 weeks later to a randomly selected sub-sample of university students from the initial sample. This follow-up survey was also conducted online and distributed via email. Out of the initial 425 participants, 187 completed (response rate: 44%) the TR-DOS again, forming the final sample for the test-retest reliability analysis.

Measures

Eating attitude test

In the late 1970s, Garner and colleagues developed the Eating Attitude Test to evaluate eating attitudes and detect Anorexia Nervosa on a 40-item scale (Garner & Garfinkel, 1979). Subsequent studies have confirmed its sensitivity to Bulimia Nervosa and other eating disorders (Garner et al., 1982). Validation of the short form of the EAT-26 for the Turkish population was conducted by (Ergüney-Okumuş & Sertel-Berk, 2020), employing a 6-point Likert scale with scores of 21 or higher indicating a potential abnormal

eating attitude (Ergüney-Okumuş & Sertel-Berk, 2020). Factor analysis identified three factors regarding preoccupation with eating, restriction, and social pressure. The scale shows robust psychometric properties thanks to Cronbach's alpha of 0.84 and a test-retest reliability coefficient of 0.78 (Ergüney-Okumuş & Sertel-Berk, 2020).

Eating disorder examination questionnaire

Developed by Fairburn and Beglin (1994), the EDE-Q assesses eating disorders through a 28-item questionnaire covering Restriction, Shape Concern, Weight Concern, and Eating Concern (Fairburn & Beglin, 1994). The 13-item short form has been validated for the Turkish population, demonstrating high validity and reliability (Esin & Ayyıldız, 2022). The scale's factor analysis explained 83.54% of the total variance, and Cronbach's alpha values for the five subscales ranged from 0.75 to 0.94 (Esin & Ayyıldız, 2022).

Düsseldorf orthorexia scale

The DOS is an assessment tool developed by Barthels and colleagues from Düsseldorf University in 2015 to measure the obsession with healthy eating (Barthels et al., 2015). ON is characterized by an excessive focus on healthy and natural foods, avoidance of unhealthy foods, and an impulse to control food. The self-report questionnaire consists of 10 items and utilizes a four-point Likert scale, ranging from a 1-point response of 'This does not apply to me' to a 4-point response of 'This applies to me'. Higher scores indicate a more pronounced orthorexic trait, with a maximum score of 40. A cutoff score of $ON \geq 30$ was proposed, with a range indicating the risk of an orthorexic trait from 25 to 29. The scale's internal consistency is considered high due to the calculation of Cronbach's α value of 0.84 and test-retest reliability between three-time points ($r = 0.67-0.79$, $p = .001$) in its original German version. Assessment of construct validity was conducted by correlating the scale with self-assessment of healthy eating behaviors and subjective importance of healthy nutrition ($r = 0.21$, $p < .001$, $n = 1303$ and $r = 0.42$, $p < .001$, $n = 1297$, respectively). An English version has been developed to facilitate international use (Chard et al., 2019). Reliability analysis of the E-DOS revealed a Cronbach's alpha coefficient of 0.882 and an omega coefficient of 0.881, indicating strong internal consistency. The significant correlation of 0.762 ($p < .001$) between the E-DOS and the Eating Habits Questionnaire total scores indicates good construct validity. However, further validation studies and psychometric properties of E-DOS are required to determine its applicability in Türkiye.

Data analysis

The exploratory factor analysis (EFA) aimed to identify underlying factors among the observed variables. These factors, conceptualized as latent constructs (Rencher, 2002), were assessed for appropriateness by examining the correlation matrix. Coefficients within the correlation matrix were evaluated against a criterion of ≤ 0.30 to align with the underlying factor structure (Hair et al., 2010). The Bartlett test of sphericity (Bartlett, 1950) examined the correlation matrix's suitability, assessing whether it approximated a unit matrix. Concurrently, the Kaiser-Meyer-Olkin (KMO) (Cerny & Kaiser, 1977) measure was used to determine sample adequacy, with values above 0.5 considered acceptable.

The principal component analysis determined factors based on eigenvalues exceeding one, with subsequent varimax rotation highlighting variables contributing to each factor (Crocker & Algina, 1986). Intra-rater agreement was measured using the intraclass correlation coefficient (ICC), with values ≥ 0.70 considered reliable (Salvucci et al., 1997). Item-total correlation coefficients of ≥ 0.20 were interpreted as consistent with the overall scale (Crocker & Algina, 1986). The Wilcoxon test assessed structure validity before inter-rater comparisons, test-retest reliability evaluated temporal stability, and Hotelling's T^2 test examined response bias (Seçer, 2018).

EFA was conducted prior to Confirmatory Factor Analysis (CFA) to explore the potential factor structure without imposing a preconceived model. This approach allows for the identification of the most parsimonious model, which is then tested in the CFA for model fit and validation. CFA corroborated EFA findings, confirming the structure derived from exploratory or theoretical analyses (Brown, 2015). Unlike EFA, CFA presupposes the number of factors, providing a rigorous assessment of model fit. Data were analyzed using IBM SPSS version 23 (SPSS Inc., Chicago, Illinois, U.S.A.) and Amos software for CFA using the Maximum Likelihood (ML) estimator.

Descriptive statistics included counts (n), percentages (%), means (M), standard deviations (S.D.), medians (Md), minimums (min), and maximums (max). The normality of numerical variables was assessed via the Shapiro-Wilk test. Group comparisons employed the independent samples t-test or Analysis of Variance (ANOVA) for variables with more than two categories, followed by posthoc Bonferroni tests for significant ANOVA results. The Pearson correlation coefficient assessed relationships between numerical variables. A significance level of $p < .05$ was employed with a 95% confidence interval.

Results

Characteristics of participants

Table 1 presents the sample characteristics observed in 425 individuals who participated in the study, of which the mean age was 21.83. Regarding gender distribution, 393 (92.5%) participants were female, and 32 (7.5%) were male.

Table 1. Descriptive statistics of the sociodemographic characteristics of the participants ($N = 425$).

	Statistics	TR-DOS	Test (p)	Difference
Age				
Mean $\pm$ SD	21.83 $\pm$ 3.32			
Age in years, n (%)				
18–20 ^a	130 (30.6%)	20,85 $\pm$ 5,45	F = 5,724 p = 0,004	a < c b < c
21–25 ^b	276 (64.9%)	20,43 $\pm$ 5,42		
25+ ^c	19 (4.5%)	24,84 $\pm$ 6,96		
Gender, n (%)				
Female	393 (92.5%)	20,43 $\pm$ 5,42	t = –0,055 p = 0,956	–
Male	32 (7.5%)	24,84 $\pm$ 6,96		
BMI (kg/m²)				
Mean $\pm$ SD	21.13 $\pm$ 3.06	0,152 p = 0,002		
M (min – max)	20.7 (15.6–37)			

r: Pearson Correlation Coefficient; Independent Sample t Test (t); ANOVA (F); Summary statistics are presented as mean $\pm$ standard deviation. Categorical data is given as a Number (Percentage) value. The sections highlighted in bold are statistically significant ($p < .05$).

Reliability

Our study used Cronbach's alpha and McDonald's omega values for reliability analysis. The study demonstrated that the Cronbach's Alpha reliability coefficient for the Turkish version of the scale score was 0.854, and the reliability is considered sufficient as Cronbach's Alpha is above 0.70. Moreover, the omega value obtained in our study was 0.85, which indicates good internal consistency ($\omega = 0.85$).

Exploratory factor analysis

Table 2 presents that the KMO value for testing the adequacy of factor analysis is quite high, and the Barlett test result is 1440.624 ($p < .05$). The amount of variance obtained, which is 43.40%, may be considered sufficient. The factor loadings of the questions in the scale vary between 0.597 and 0.782. The Cronbach's Alpha reliability coefficient for the Turkish version of the scale score was 0.854, and the reliability is considered sufficient as Cronbach's Alpha is above 0.70.

The Intraclass Correlation Coefficient of the TR-DOS total score is 85.4% (Table 3). Additionally, the test-retest reliability analysis showed statistically significant correlations between the scale items and total scores ($p < .05$). The item-total correlation values ranged from 0.423 to 0.694, exceeding the significance threshold of 0.20, which emphasizes the importance of each item for the scale. Therefore, these results confirm the scale's validity as a reliable measurement tool.

Confirmatory factor analysis

CFA was conducted on the TR-DOS, consisting of 10 items. The model is visually presented in Figure 1. The most influential item on the TR-DOS was Item 8, while the item with the lowest impact was Item 1. The path coefficients of the scale score on each of the 10 items are statistically significant ($p < .05$). A CFA was performed to test the DOS's unidimensional structure, and χ^2/df , RMSEA, SRMR, IFI, TLI, CFI, and GFI were used to assess the model's factor validity within the CFA framework (Table 4). RMSEA is an index that is least affected by sample size. However, the RMSEA fit index criteria are inconsistent in different literature (Schreiber et al., 2006). Generally, this field considers a cutoff value close to 0.06 or 0.08 acceptable.

Table 2. The results of the EFA of TR-DOS.

Item No	Factor Loadings	Explained Variance %
1	0.597	43.40
2	0.662	
3	0.624	
4	0.667	
5	0.663	
6	0.732	
7	0.524	
8	0.782	
9	0.624	
10	0.678	
$KMO = 0.867$ $df = 45$ $\chi^2 = 1440.624$ $p < .001$		

KMO: Kaiser – Meyer – Olkin test; Df: Degree of Freedom; χ^2 , Chi-square.

Table 3. TR-DOS test-retest analysis results.

Item No	Test	Retest	Wilcoxon Test (p)	Item-Total Correlations	ICC (%95 CI)
1	2.51 ± 0.75	2.55 ± 0.72	$Z^* = -0.110$ $p = .912$	0.501	0.655 (0.536–0.744)
2	2.61 ± 0.87	2.64 ± 0.87	$Z^* = -0.456$ $p = .649$	0.563	0.686 (0.578–0.767)
3	1.99 ± 0.85	1.91 ± 0.78	$Z^* = -1.193$ $p = .233$	0.520	0.516 (0.350–0.640)
4	1.52 ± 0.74	1.60 ± 0.76	$Z^* = -1.465$ $p = .143$	0.566	0.628 (0.500–0.724)
5	2.40 ± 0.93	2.67 ± 0.83	$Z^* = -2.953$ $p = .003$	0.562	0.684 (0.575–0.765)
6	2.36 ± 0.94	2.39 ± 0.89	$Z^* = -1.302$ $p = .193$	0.643	0.714 (0.616–0.788)
7	1.32 ± 0.65	1.42 ± 0.70	$Z^* = -3.369$ $p = .001$	0.423	0.400 (0.194–0.554)
8	1.84 ± 0.88	1.97 ± 0.91	$Z^* = -1.883$ $p = .060$	0.694	0.715 (0.617–0.788)
9	1.94 ± 0.83	2.03 ± 0.77	$Z^* = -2.576$ $p = .010$	0.518	0.525 (0.361–0.647)
10	2.29 ± 0.97	2.41 ± 0.95	$Z^* = -2.877$ $p = .004$	0.577	0.703 (0.601–0.779)
Total	20.76 ± 5.57	21.60 ± 5.61	$Z^* = -2.737$ $p = .006$	-	0.854 (0.804–0.892)

ICC, Intra-Class Correlation Coefficient; CI, Confidence Interval; Wilcoxon Test (Z^*); Summary statistics are presented as mean ± standard deviation. Sections highlighted in bold are statistically significant ($p < 0.05$).

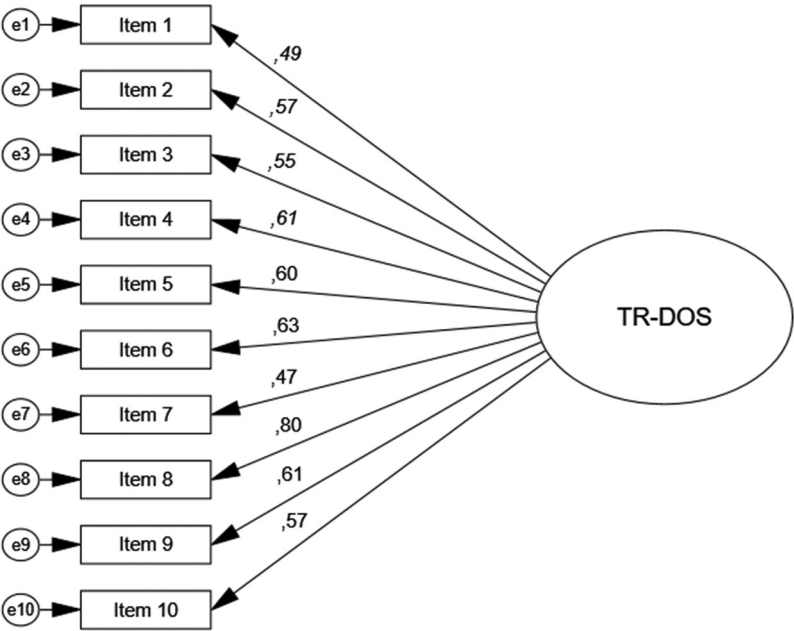


Figure 1. Confirmatory factor analysis Model of the TR-DOS.

IFI, TLI, CFI, and GFI fit indices exceeding 0.90 prove sufficient model fit. This study’s criteria were set as $RMSEA \leq 0.05$, IFI, TLI, CFI ≥ 0.90 , and GFI ≥ 0.85 . The obtained fit indices for the TR-DOS model ($\chi^2 = 93.808$, $df = 30$) indicate that the model is acceptably consistent.

Table 4. Multiple goodness of fit indices for the TR-DOS model.

Scale	(χ^2/df)	RMSEA	SRMR	IFI	CFI	GFI	TLI
TR-DOS Model	3.127	0.071	0.046	0.955	0.955	0.956	0.932

TR-DOS, Turkish Version of the Dusseldorf Orthorexia Scale; RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Square Residual; IFI, Incremental Fit Index; CFI, Comparative Fit Index; GFI, Goodness of Fit Index; TLI, Tucker – Lewis Index.

Table 5. Correlations between the TR-DOS and other variables.

	TR-DOS
EAT-26	$r = 0.428$ $p < .001$
EDE-Q-13	$r = 0.430$ $p < .001$
Eating Restraint	$r = 0.499$ $p < .001$
Shape and Weight Over-Evaluation	$r = 0.311$ $p < .001$
Body Dissatisfaction	$r = 0.234$ $p < .001$
Bingeing	$r = 0.246$ $p < .001$
Purging	$r = 0.275$ $p < .001$

r: Pearson Correlation Coefficient; Sections highlighted in bold are statistically significant ($p < .05$).

TR-DOS, Turkish Version of Dusseldorf Orthorexia Scale; EAT-26, Eating Attitude Test; EDE-Q-13, Eating Disorder Examination Questionnaire.

Construct validity

The mean total score of participants on the EAT-26 was 9.48 ± 8.82 points. The mean total score on the EDE-Q-13 was 1.29 ± 1.06 points. The scale comprised five dimensions: restricted eating, concerns about body shape and weight, body dissatisfaction, binge eating, and purging. Cronbach's Alpha reliability coefficient was 0.883. Table 5 shows a statistically significant positive correlation between EAT-26 and TR-DOS total scores ($r = 0.428$, $p < .001$). Similarly, there was a statistically significant positive correlation between EDE-Q-13 total scores and TR-DOS total scores ($r = 0.430$, $p < .001$). Positive correlations were observed among the sub-dimensions ($p < .05$). Additionally, Hotelling's T^2 value for TR-DOS was calculated as 1183.545, with a p-value $< .001$.

Prevalence of on in Turkish university students' sample

The mean score of TR-DOS among participants was $20.76 (\pm 5.57)$, with scores ranging from a minimum value of 10 to a maximum value of 40.

The prevalence of ON among university students was found to be 7.3%, as indicated by total scores greater than 30 on the TR-DOS. Additionally, 9.0% of participants were identified to be at risk of developing ON, with total scores falling within the range of 25–29 on the TR-DOS. Notably, the majority of the study sample (83.7%) exhibited no risk of developing ON, as their total scores were lower than 25 on the TR-DOS. When examining the differences in prevalence rates by gender, ON was observed in 7.1% of female university students and 9.4% of male university students. The at-risk rates for ON were 17.1% for females and 15.6% for males. The percentage of students not at risk for ON was 75.8% for females and 75% for males.

Discussion

In this study, we successfully translated the E-DOS into Turkish (TR-DOS) and rigorously evaluated its psychometric properties, marking the first comprehensive assessment of this instrument within the Turkish cultural context. This study explored the construct validity of TR-DOS by scrutinizing its total score against various psychopathological symptoms, including eating disorders, restricted eating, anxiety related to body shape and weight, body dissatisfaction, and BMI. This pioneering study has effectively adapted the DOS measure for the Turkish population, providing a new tool for future research and clinical practice.

The evaluation of the unidimensional structure of the questionnaire by the CFA initially raised concerns about model fit in the Portuguese validation study of DOS (Ferreira & Coimbra, 2021). However, the analysis of modification indices suggested an association of the error covariances between items 6 and 10 and 1 and 3. T model fit was subsequently corrected and brought to an acceptable level (Ferreira & Coimbra, 2021). Italian validation study of DOS reported that all model fit indices increased to an acceptable level due to associating the error covariances between items 4 and 7 and 6 and 10 (Cerolini et al., 2022). In our study, CFA confirmed that the fit indices for TR-DOS are at an acceptable level, with various fit indices such as RMSEA, SRMR, CFI, and TLI aligning with recommended thresholds (Schreiber et al., 2006). These findings support the single-factor structure for TR-DOS, consistent with previous studies (Ferreira & Coimbra, 2021; Lasson et al., 2021; Parra-Fernández et al., 2019).

Reliability analysis using McDonald's omega and Cronbach's alpha revealed high internal consistency, with moderate to high item-total correlations supporting the scale's reliability. The omega value ($\omega = 0.85$) further indicates good internal consistency, aligning with values from the Polish ($\omega = 0.84$), French ($\omega = 0.87$), and Italian ($\omega = 0.87$) versions of the DOS (Aloi et al., 2023; Brytek-Matera, 2021; Lasson et al., 2021). Significant test-retest consistency supports the use of TR-DOS in the Turkish population, similar to the C-DOS for the Chinese population (He et al., 2019).

General population data on ON prevalence have been reported to have broad and inconsistent ranges (Ferreira & Coimbra, 2021). Our study revealed that the prevalence of ON among university students was 7.3%, with a 9.0% risk of development. These results are comparable to findings in the U.S. (8% ON, 12.4% at risk) and China (7.8% ON, 18.2% at risk) (Chard et al., 2019; He et al., 2019), but higher than those in Germany (3.3% ON, 9.0% at risk) and Poland (6.6% ON, 11.9% at risk) (Brytek-Matera, 2021; Depa et al., 2017). The TR-DOS used in our study is a translation of the English version, not the original German, which may introduce subtle differences in item meanings and cultural nuances (Brytek-Matera, 2021).

Validity analyses showed significant correlations between TR-DOS total score and EAT-26, EDE-Q-13 total scores, and subscales, supporting the scale's validity. These findings align with studies showing associations between orthorexic traits and eating disorder psychopathology (Barthels et al., 2017; Cerolini et al., 2022; Ferreira & Coimbra, 2021; Parra-Fernández et al., 2019). Orthorexic traits, such as an obsessive focus on healthy eating, are linked to eating disorder symptoms, particularly in restricted eaters, suggesting a significant relationship between ON and eating disorders (Barthels et al., 2017; Cerolini et al., 2022).

Previous findings on relevance of BMI to ON have been inconsistent. While some studies found no significant relationship (Ferreira & Coimbra, 2021; He et al., 2019; Rogoza et al., 2021), others reported positive correlations between ON symptoms and higher BMI (Bundros et al., 2016; Lasson et al., 2021; Maghetti et al., 2015; Oberle et al., 2017). Our study found a significant positive correlation between TR-DOS total scores and BMI, suggesting that individuals with higher body weight may develop ON symptoms as they strive for optimal body weight and health (Aloi et al., 2023). Further research is needed to explore this relationship in depth.

Gender differences in ON have also shown divergent results. While some studies report higher ON behavior in females (Dell'osso et al., 2022; Ferreira & Coimbra, 2021; Koven & Senbonmatsu, 2013), others found no significant gender difference (Anastasiades & Argyrides, 2023; Oberle et al., 2017; Sezer Katar et al., 2024). Our study found no significant gender difference, possibly due to the imbalance in the distribution of male and female participants.

Limitations of the study

Some limitations of this study are noteworthy. First, the cross-sectional design necessitates prospective studies to further validate the TR-DOS. Second, reliance on self-reported data may introduce social desirability effects and recall bias. Additionally, the disproportionate number of male students (7.5%) highlights the need for more diverse samples in future research. Objective anthropometric measurements and biomedical parameters should be included alongside self-reported data. Third, the non-clinical sample limits generalizability; future research should evaluate the TR-DOS in clinical samples, such as those with eating disorders or obsessive-compulsive disorder. Fourth, the use of a convenience sampling method to gather data from university students may introduce bias, as this sample may not be representative of the broader population. Finally, using the English version instead of the original German for the Turkish translation may introduce minor errors or differences in item meanings.

Conclusion

This study successfully introduced the TR-DOS to non-clinical university students, demonstrating its strong reliability and validity in evaluating orthorexic behaviors and attitudes. As a concise and practical 10-item scale, TR-DOS shows great promise for identifying and preventing orthorexia risk in non-clinical settings. Future research should further explore its psychometric properties, including predictive validity and sensitivity to change, and assess its utility in clinical settings. Such efforts will solidify its role as an effective tool for identifying and preventing orthorexia risk across diverse populations.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

ORCID

Hasan Kaan Kavsara  <http://orcid.org/0000-0002-0322-0397>

Açelya Gül Koyuncu  <http://orcid.org/0000-0003-1776-1829>

Handenaz Dere Yelken  <http://orcid.org/0000-0002-3529-3785>

Friederike Barthels  <http://orcid.org/0000-0003-2801-2209>

Nanette Stroebele-Benschop  <http://orcid.org/0000-0002-5835-6945>

Data availability statement

Data will be made available on request.

Ethical statement

This study was approved by the Yeditepe University Non-Interventional Clinical Research Institutional Review Board and Ethics Committee with the number 'E.83321821-805.02.03-211' on 9 June 2023. The authors declare that the protocols of the Declaration of Helsinki were followed for all experiments involving human subjects and that all procedures were carried out with the informed and signed written consent of the participants.

Credit authorship contribution statement

Hasan Kaan KAVSARA: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. **Açelya GÜL KOYUNCU:** Conceptualization, Writing – review & editing, Supervision. **Handenaz DERE YELKEN:** Conceptualization, Writing – review & editing, Supervision. **Friederike BARTHEL:** Writing – review & editing, Supervision. **Nanette STROEBELE-BENSCHOP:** Writing – review & editing, Supervision.

Abbreviations

ANOVA	Analysis of Variance
BOT	Bratman Orthorexia Test
BMI	Body Mass Index
C-DOS	Chinese Version Düsseldorf Orthorexia Scale
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
DOS	Düsseldorf Orthorexia Scale
E-DOS	English Version of Düsseldorf Orthorexia Scale
EAT-26	Eating Attitude Test
EDE-Q-13	Eating Disorders Examination Questionnaire
EHQ	Eating Habits Questionnaire
EFA	Exploratory Factor Analysis
GFI	Goodness-of-Fit Index
I-DOS	Italian Version of Düsseldorf Orthorexia Scale
ICC	Intraclass Correlation Coefficient

IFI	Incremental Fit Index
KMO	Kaiser-Meyer-Olkin
ON	Orthorexia Nervosa
PL-DOS	Polish Version of Düsseldorf Orthorexia Scale
RMSA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
TLI	Tucker – Lewis Index
TR-DOS	Turkish version of Düsseldorf Orthorexia Scale

References

- Aloi, M., Moniaci, M., Rania, M., Carbone, E. A., Martino, G., Segura-Garcia, C., & Liuzza, M. T. (2023). Relationship between disgust and orthorexia nervosa and psychometric properties of the Italian Dusseldorf orthorexia scale in a general population sample. *Journal of Eating Disorders*, 11(1). <https://doi.org/10.1186/s40337-023-00899-5>
- Anastasiades, E., & Argyrides, M. (2023). Exploring the role of positive body image in healthy orthorexia and orthorexia nervosa: A gender comparison. *Appetite*, 185, 106523. <https://doi.org/10.1016/j.appet.2023.106523>
- Arusoglu, G., Kabakci, E., Koksall, G., & Kutluay Merdol, T. (2008). Orthorexia nervosa and adaptation of ORTO-11 into Turkish. *Turk Psikiyatri Dergisi*, 9(3), 283–291.
- Azzi, R., Mhanna, M., Hallit, S., Obeid, S., & Soufia, M. (2023). Attachment styles and orthorexia nervosa among Lebanese adolescents: The indirect effect of self-esteem. *Archives de Pédiatrie*, 30(5), 314–320. <https://doi.org/10.1016/j.arcped.2023.04.003>
- Bağcı Bosi, A. T., Çamur, D., & Güler, Ç. (2007). Prevalence of orthorexia nervosa in resident medical doctors in the faculty of medicine (Ankara, Turkey). *Appetite*, 49(3), 661–666. <https://doi.org/10.1016/j.appet.2007.04.007>
- Barthels, F., Meyer, F., Huber, T., & Pietrowsky, R. (2017). Orthorexic eating behaviour as a coping strategy in patients with anorexia nervosa. *Eating and Weight Disorders*, 22(2), 269–276. <https://doi.org/10.1007/s40519-016-0329-x>
- Barthels, F., Meyer, F., & Pietrowsky, R. (2015). Die Düsseldorf Orthorexie Skala–Konstruktion und Evaluation eines Fragebogens zur Erfassung ortho-rektischen Ernährungsverhaltens. *Zeitschrift für Klinische Psychologie und Psychotherapie*, 44(2), 97–105. <https://doi.org/10.1026/1616-3443/a000310>
- Bartlett, M. S. (1950). Tests of significance in factor analysis. *British Journal of Statistical Psychology*, 3(2), 77–85. <https://doi.org/10.1111/j.2044-8317.1950.tb00285.x>
- Bratman, S. (1997). The health food eating disorder. *Yoga Journal*, 42, 50.
- Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185–216. <https://doi.org/10.1177/135910457000100301>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.
- Brytek-Matera, A. (2021). The Polish version of the Dusseldorf orthorexia scale (PL-DOS) and its comparison with the English version of the DOS (E-DOS). *Eating and Weight Disorders*, 26(4), 1223–1232. <https://doi.org/10.1007/s40519-020-01025-z>
- Bundros, J., Clifford, D., Silliman, K., & Neyman Morris, M. (2016). Prevalence of orthorexia nervosa among college students based on Bratman's test and associated tendencies. *Appetite*, 101, 86–94. <https://doi.org/10.1016/j.appet.2016.02.144>
- Caferoglu, Z., & Toklu, H. (2022). Orthorexia nervosa in Turkish dietitians and dietetic students. *L'Encéphale*, 48(1), 13–19. <https://doi.org/10.1016/J.ENCEP.2020.12.006>
- Cena, H., Barthels, F., Cuzzolaro, M., Bratman, S., Brytek-Matera, A., Dunn, T., Varga, M., Missbach, B., & Donini, L. M. (2019). Definition and diagnostic criteria for orthorexia nervosa: A narrative review of the literature. *Eating and Weight Disorders*, 24(2), 209–246. <https://doi.org/10.1007/s40519-018-0606-y>

- Cerny, B. A., & Kaiser, H. F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, 12(1), 43–47. https://doi.org/10.1207/s15327906mbr1201_3
- Cerolini, S., Vacca, M., Zagaria, A., Donini, L. M., Barbaranelli, C., & Lombardo, C. (2022). Italian adaptation of the Düsseldorf Orthorexia Scale (I-DOS): Psychometric properties and prevalence of orthorexia nervosa among an Italian sample. *Eating and Weight Disorders*, 27(4), 1405–1413. <https://doi.org/10.1007/s40519-021-01278-2>
- Chard, C. A., Hilzendegen, C., Barthels, F., & Stroebele-Benschop, N. (2019). Psychometric evaluation of the English version of the düsseldorf orthorexia scale (DOS) and the prevalence of orthorexia nervosa among a U.S. student sample. *Eating and Weight Disorders*, 24(2), 275–281. <https://doi.org/10.1007/s40519-018-0570-6>
- Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Holt, Rinehart and Winston.
- Dell'osso, L., Cremone, I. M., Chiarantini, I., Arone, A., Casagrande, D., Massimetti, G., Carmassi, C., & Carpita, B. (2022). Investigating orthorexia nervosa with the ORTO-R in a sample of university students with or without subthreshold autism spectrum: Focus on dietary habits and gender differences. *Frontiers in Psychiatry*, 13. <https://doi.org/10.3389/fpsyt.2022.900880>
- Depa, J., Schweizer, J., Bekers, S. K., Hilzendegen, C., & Stroebele-Benschop, N. (2017). Prevalence and predictors of orthorexia nervosa among German students using the 21-item-DOS. *Eating and Weight Disorders*, 22(1), 193–199. <https://doi.org/10.1007/s40519-016-0334-0>
- Donini, L. M., Barrada, J. R., Barthels, F., Dunn, T. M., Babeau, C., Brytek-Matera, A., Cena, H., Cerolini, S., Cho, H. H., Coimbra, M., Cuzzolaro, M., Ferreira, C., Galfano, V., Grammatikopoulou, M. G., Hallit, S., Håman, L., Hay, P., Jimbo, M., Lasson, C., & Lombardo, C. (2022). A consensus document on definition and diagnostic criteria for orthorexia nervosa. *Eating and Weight Disorders*, 27(8), 3695–3711. <https://doi.org/10.1007/s40519-022-01512-5>
- Donini, L. M., Marsili, D., Graziani, M. P., Imbriale, M., & Cannella, C. (2005). Orthorexia nervosa: Validation of a diagnosis questionnaire. *Eating and Weight Disorders*, 10(2), e28–e32. <https://doi.org/10.1007/BF03327537>
- Ergüney-Okumuş, F. E., & Sertel-Berk, H. Ö. (2020). Yeme Tutum Testi Kısa Formunun (YTT-26) Üniversite Örnekleminde Türkçeye Uyarlanması ve Psikometrik Özelliklerinin Değerlendirilmesi. *Psikoloji Çalışmaları/Studies in Psychology*, 40(1), 57–78. <https://doi.org/10.26650/sp2019-0039>
- Esin, K., & Ayyıldız, F. (2022). Validity and reliability of the Turkish version of the eating disorder examination questionnaire (EDE-Q-13): Short-form of EDE-Q. *Journal of Eating Disorders*, 10(1), 102. <https://doi.org/10.1186/s40337-022-00628-4>
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, 16(4), 363–370. [https://doi.org/10.1002/1098-108X\(199412\)16:4<363::AID-EAT2260160405>3.0.CO;2-#](https://doi.org/10.1002/1098-108X(199412)16:4<363::AID-EAT2260160405>3.0.CO;2-#)
- Ferreira, C., & Coimbra, M. (2021). To further understand orthorexia nervosa: DOS validity for the Portuguese population and its relationship with psychological indicators, sex, BMI and dietary pattern. *Eating and Weight Disorders*, 26(7), 2127–2134. <https://doi.org/10.1007/s40519-020-01058-4>
- Garner, D. M., & Garfinkel, P. E. (1979). The eating attitudes test: An index of the symptoms of anorexia nervosa. *Psychological Medicine*, 9(2), 273–279. <https://doi.org/10.1017/S0033291700030762>
- Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The eating attitudes test: Psychometric features and clinical correlates. *Psychological Medicine*, 12(4), 871–878. <https://doi.org/10.1017/S0033291700049163>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Pearson.
- Hallit, S., Barrada, J. R., Salameh, P., Sacre, H., & Roncero, M. (2021). The relation of orthorexia with lifestyle habits: Arabic versions of the eating habits questionnaire and the dusseldorf

- orthorexia scale. *Journal of Eating Disorders*, 9(1), 1–12. <https://doi.org/10.1186/s40337-021-00455-z>
- He, J., Ma, H., Barthels, F., & Fan, X. (2019). Psychometric properties of the Chinese version of the düsseldorf orthorexia scale: Prevalence and demographic correlates of orthorexia nervosa among Chinese university students. *Eating and Weight Disorders*, 24(3), 453–463. <https://doi.org/10.1007/s40519-019-00656-1>
- Kabir, A., Miah, S., Islam, A., & Wieringa, F. (2018). Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLOS ONE*, 13(6), e0198801. <https://doi.org/10.1371/journal.pone.0198801>
- Koven, N. S., & Senbonmatsu, R. (2013). A neuropsychological evaluation of orthorexia nervosa. *Open Journal of Psychiatry*, 03(2), 214–222. <https://doi.org/10.4236/ojpsych.2013.32019>
- Lasson, C., Barthels, F., & Raynal, P. (2021). Psychometric evaluation of the French version of the düsseldorfer orthorexia skala (DOS) and prevalence of orthorexia nervosa among university students. *Eating and Weight Disorders*, 26(8), 2589–2596. <https://doi.org/10.1007/s40519-021-01123-6>
- Levin, R. L., Mills, J. S., McComb, S. E., & Rawana, J. S. (2023). Examining orthorexia nervosa: Using latent profile analysis to explore potential diagnostic classification and subtypes in a non-clinical sample. *Appetite*, 181, 106398. <https://doi.org/10.1016/j.appet.2022.106398>
- Maghetti, A., Cicero, A. F. G., D'Ignazio, E., Vincenzi, M., Paolini, B., Lucchin, L., Malvaldi, F., Maghetti, A., Culicchi, V., Del Ciondolo, I., D'Ignazio, E., Paolini, B., Malfi, G., Vassallo, D., De Donà, F., Caregaro, L., Situlin, R., Vinci, P., Marucci, S., & Vincenzi, M. (2015). Orthorexia prevalence among health care professionals involved in nutrition education: The ADI-O study. *Mediterranean Journal of Nutrition and Metabolism*, 8(2), 199–204. <https://doi.org/10.3233/MNM-140039>
- Meule, A., Holzapfel, C., Brandl, B., Greetfeld, M., Hessler-Kaufmann, J. B., Skurk, T., Quadflieg, N., Schlegl, S., Hauner, H., & Voderholzer, U. (2020, March). Measuring orthorexia nervosa: A comparison of four self-report questionnaires. *Appetite*, 146(1), 104512. <https://doi.org/10.1016/j.appet.2019.104512>
- Missbach, B., Hinterbuchinger, B., Dreiseitl, V., Zellhofer, S., Kurz, C., & König, J. (2015). When eating right, is measured wrong! A validation and critical examination of the ORTO-15 questionnaire in German. *August*, 10(8), e0135772. <https://doi.org/10.1371/journal.pone.0135772>
- Oberle, C. D., Samaghabadi, R. O., & Hughes, E. M. (2017). Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*, 108, 303–310. <https://doi.org/10.1016/j.appet.2016.10.021>
- Opitz, M.-C., Newman, E., Alvarado Vázquez Mellado, A. S., Robertson, M. D. A., & Sharpe, H. (2020). The psychometric properties of orthorexia nervosa assessment scales: A systematic review and reliability generalization. *Appetite*, 155, 104797. <https://doi.org/10.1016/j.appet.2020.104797>
- Parra-Fernández, M. L., Onieva-Zafra, M. D., Fernández-Muñoz, J. J., Fernández-Martínez, E., & Stroebele-Benschop, N. (2019). Adaptation and validation of the Spanish version of the DOS questionnaire for the detection of orthorexic nervosa behavior. *PLOS ONE*, 14(5), e0216583. <https://doi.org/10.1371/journal.pone.0216583>
- Rencher, A. C. (2002). *Methods of multivariate analysis* (2nd ed.). John Wiley & Sons.
- Rogoza, R., Hallit, S., Soufia, M., Barthels, F., & Obeid, S. (2021). Validation of the Arabic version of the dusseldorf orthorexia scale (DOS) among Lebanese adolescents. *Journal of Eating Disorders*, 9(1). <https://doi.org/10.1186/s40337-021-00488-4>
- Salvucci, S., Walter, E., Conley, V., Fink, S., & Saba, M. (1997). *Measurement error studies at the national center for education statistics*. U. S. Department of Education.
- Schreiber, J. B., Stage, F. K., King, J., Nora, A., & Barlow, E. A. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *Journal of Educational Research*, 99(6), 323–338. <https://doi.org/10.3200/JOER.99.6.323-338>
- Seçer, I. (2018). *Psychological test development and adaptation process: SPSS and LISREL applications* (2nd ed.). Anı Publishing.

- Sezer Katar, K., Şahin, B., & Kurtoğlu, M. B. (2024). Healthy orthorexia, orthorexia nervosa, and personality traits in a community sample in Turkey. *International Journal of Psychiatry in Medicine*, 59(1), 83–100. <https://doi.org/10.1177/00912174231194745>
- Souza, H. M. A. V., Do Carmo, A. S., & dos Santos, L. C. (2021). The Brazilian version of the DOS for the detection of orthorexia nervosa: Transcultural adaptation and validation among dietitians and nutrition college students. *Eating and Weight Disorders*, 26(8), 2713–2725. <https://doi.org/10.1007/s40519-021-01143-2>
- Waterman, M., Lee, R. M., Carter, J. C., & Garland, S. N. (2022). Orthorexia symptoms and disordered eating behaviors in young women with cancer. *Eating Behaviors*, 47, 101672. <https://doi.org/10.1016/j.eatbeh.2022.101672>