

Validity and Reliability Study of the Turkish Version of the Hunger Sensitivity Scale for University Students

Üniversite Öğrencilerine Yönelik Açlık Duyarlılığı Ölçeği'nin Türkçe Versiyonunun Geçerlilik ve Güvenirlik Çalışması

Şenay DEMİR¹, Dilek DEMİR^{2,*}, Murat BEKTAŞ³, İlknur BEKTAŞ⁴, Thomas HADJISTAVROPOULOS⁵

Abstract

Objective: This study was carried out to evaluate the validity and reliability of the Turkish version of the Hunger Sensitivity Scale for university students.

Methods: This methodological study was conducted with 913 university students between September 2018 and December 2018. Data were collected using a socio-demographic information form and the Hunger Sensitivity Scale. Factor analysis, Cronbach's alpha, and item-total score analysis were used for the analysis of the data.

Results: The scale consisted of 29 items and three subscales. The three subscales were found to explain 56.32% of the total variance. The total factor loads were found to be greater than 0.30 in both exploratory and confirmatory factor analysis. In confirmatory factor analysis, all the fit indexes were found to be greater than 0.88, while RMSEA was less than 0.080. The Cronbach's alpha coefficient for the overall scale was 0.95, while the Cronbach's alpha values for the subscales were determined to range between 0.77 and 0.93.

Conclusion: In this study, it was found that the Hunger Sensitivity Scale for University students was a valid and reliable measurement tool for Turkish sampling.

Keywords: Hunger, sensitivity, eating, eating attitudes, validity, reliability.

Özet

Amaç: Bu çalışma, üniversite öğrencilerine yönelik Açlık Duyarlılığı Ölçeği'nin, Türkçe versiyonunun, geçerlilik ve güvenirliliğinin değerlendirilmesi amacıyla gerçekleştirilmiştir.

Yöntem: Bu metodolojik tipte bir çalışma, Eylül 2018-Aralık 2018 tarihleri arasında 913 üniversite öğrencisi ile gerçekleştirilmiştir. Veriler, sosyo-demografik veri toplama formu ve Açlık Duyarlılığı Ölçeği ile toplanmıştır. Verilerin değerlendirmesinde faktör analizi, cronbach alfa ve madde-toplam puan analizi kullanılmıştır.

Bulgular: Ölçeğin 29 madde ve üç alt boyuttan oluştuğu, üç alt boyutun toplam varyansın %56.32'sini açıkladığı belirlenmiştir. Hem açıklayıcı hem de doğrulayıcı faktör analizinde tüm faktör yüklerinin 0.30'dan büyük olduğu belirlenmiştir. Doğrulayıcı faktör analizinde uyum indekslerinin tümünün 0.88'den büyük, RMSEA'nin 0.080'den küçük olduğu saptanmıştır. Ölçeğin bütünü için cronbach alfa 0.95 olarak saptanmış olup, tüm alt boyutlarının cronbach alfa değerleri 0.77 ile 0.93 arasında olduğu belirlenmiştir.

Sonuç: Bu çalışmada, üniversite öğrencilerine yönelik Açlık Duyarlılığı Ölçeği'nin, Türk örneklemini için geçerli ve güvenilir bir ölçme aracı olduğu bulunmuştur.

Anahtar Kelimeler: Açlık, duyarlılık, yeme, yeme tutumları, geçerlilik, güvenirlilik.

INTRODUCTION

Nutrition is one of the primary needs of human life. It has a particularly important role in the struggle for survival that arises out of hunger and the need for energy (Fetissov, 2016; Ribeiro et al., 2018). Hunger is a feeling that arises as a result of food deprivation accompanied by physiological symptoms and arouses the

¹Selcuk University Faculty of Health Sciences, Selcuklu, Konya, Turkey, sdemir@selcuk.edu.tr
ORCID: 0000-0002-7562-5158

^{2,*}Dokuz Eylul University Health Science Institute Department of Pediatric Nursing, Inciraltı, Izmir, Turkey, dilekdemir624@gmail.com,
ORCID: 0000-0001-9914-8299

³Dokuz Eylul University Faculty of Nursing, Inciraltı, Izmir, Turkey, mbekta@gmail.com,
ORCID: 0000-0003-3327-8204

⁴Dokuz Eylul University Faculty of Nursing, Inciraltı, Izmir, Turkey, ilknurbektas23@gmail.com,
ORCID: 0000-0001-8048-9501

⁵ Department of Psychology University of Regina, Regina, SK, Canada, S4S 0A2, Thomas.Hadjistavropoulos@uregina.ca,

*Sorumlu Yazar

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desire to eat in the individual. It also shapes the behaviors and attitudes of individuals (Ribeiro et al., 2018; Serin & Şanlıer, 2018). The term “hunger sensitivity” has especially been on the agenda in recent years (Walker, Hadjistavropoulos, Gagnon, & MacNab, 2015). It is assumed that hunger sensitivity may be associated with eating attitudes. Hunger sensitivity is defined as a cognitive style associated with increasing distress in response to hunger sensations (Walker et al., 2015).

Hunger sensitivity can cause behavioral and mental change. Behavioral symptoms of hunger sensitivity include always carrying a snack, sensitivity to external eating stimuli (smell, taste, or appearance of the food), or having snacks in reach in case you get hungry. Mental symptoms, on the other hand, are lack of concentration when hungry and being unable to talk due to eating the desired food (Walker et al., 2015). People who are sensitive to stimuli of hunger (high hunger sensitivity) may have difficulty in focusing while talking to others when they are hungry. These people feel anxious about getting sick unless they eat shortly after they feel hungry. The longer they wait before they eat, the more furious they get and the more unrest they experience. On the other hand, individuals who have low hunger sensitivity do not even recognize the signs of hunger and become insensitive to stimuli of eating from the external environment (Booth, Jarvandi, & Thibault, 2012; Serin & Şanlıer, 2018; Walker et al., 2015).

It is stated that BMI is an important factor that affects the hunger sensitivity of individuals. It is emphasized that the hunger and eating sensitivities of individuals with normal BMI and overweight/obese individuals vary. While hunger is often stimulated by internal stimuli in normal-weight individuals who control their desire to eat, it is emphasized that external stimuli trigger a constant feeling of hunger in overweight/obese individuals without a physiological hunger and that the hunger sensitivity of overweight/obese individuals is higher (Amin & Mercer, 2016; Schüz, Schüz, & Ferguson, 2015; Vartanian, Spanos, Herman, & Polivy, 2017). It has also been found that obese people are more sensitive to taste stimuli than normal-weight/underweight individuals (Amin & Mercer, 2016; Van Strein & Bazelier, 2007). In other words, it is assumed that obese people show a low sensitivity to internal satiety stimuli; instead they show extreme sensitivity to external eating stimuli such as taste and smell, so they eat excessively when stimulated by sensational stimuli and they quickly reach satiety during eating (Amin & Mercer, 2016; Fetissov, 2016; Van Strein & Bazelier, 2007).

Anxiety and restrictive eating can contribute to hunger sensitivity (Van Strien et al., 2013). It has been found that obese individuals consume excessive food when they are anxious or nervous, they cannot distinguish between hunger and anxiety, and that they are prone to eating in case of anxiety when they are physiologically hungry (Serin & Şanlıer, 2018; Schneider, Appelhans, Whited, Oleski, & Pagoto, 2010; Van Strien et al., 2013). It has been shown that individuals with restricted food intake are more susceptible to hunger when food stimuli are more salient, and therefore that their hunger sensitivity can be associated with eating patterns and impulsive eating (Booth et al., 2012; Schneider et al., 2010).

As a result, food deprivation accompanied by the anxiety about getting hungry may increase the likelihood of overeating in a person with hunger sensitivity. People with high hunger sensitivity may be more likely to

gain weight by eating in response to hunger stimuli. Eating restrictions may exacerbate concerns about hunger. Furthermore, it is assumed that eating behaviors of people with hunger sensitivity are sensitive to both internal and external stimuli and that these people cannot control their eating behavior (Booth et al., 2012; Vartanian et al., 2017; Walker et al., 2015).

Evaluation of hunger sensitivity is important in terms of sustaining adequate-balanced nutrition, identifying risky individuals, and providing health care to these individuals when necessary (Özdamar, 2016; Walker et al., 2015). For this reason, there is a need for valid and reliable tools to determine hunger sensitivity. To address this need, a measurement tool has been developed by Walker et al. (2015) to evaluate hunger sensitivity. This scale provides information on internal and external stimuli in case of hunger (Walker et al., 2015).

In order to disseminate the use of these scales, compare the results, and collect information on hunger sensitivity in a large sampling scale, intercultural use of the scales is extremely important. The review of studies analyzing hunger sensitivity especially among university students has revealed that a standard valid and reliable scale is not available. This study was planned to adapt the English version of the Hunger Sensitivity Scale to Turkish and conduct its validity and reliability study.

METHODS

Study Design

This study was carried out in methodological type to analyze the validity and reliability of the Hunger Sensitivity Scale for university students.

Sample and Setting

The study was conducted between September 2018 and December 2018 with students from two universities in the western and central regions of Turkey.

In the literature, it is reported that a sampling size of up to 100 for scale development and validity and reliability studies is insufficient, medium up to 200, good up to 300, very good up to 500, and excellent up to 1000 (Kartal, Bardakçı, & Sait, 2018; Özdamar, 2016; Seçer, 2018). For this reason, the sampling was planned to involve a total of 1000 students between the ages of 18 and 25 who were studying in the 1st, 2nd, 3rd, and 4th grades of two universities in the 2018-2019 academic year and who volunteered to participate in the study. A total of 913 students who voluntarily accepted to participate in the study and filled out the forms were included in the study. A pilot study was administered to 20 students who accepted to participate in the study and this group was excluded from the sampling. Therefore, the sampling consisted of a total of 913 students.

Instruments

The study data were collected using a “Socio-Demographic Information Form” and the “Hunger Sensitivity Scale” between September 2018 and December 2018. The students were informed through the consent forms and they were given the questionnaires.

Socio-Demographic Information Form: This form consisted of a total of 9 questions about the age, class, gender, economic status, body weight, and the height of the students, how the students evaluated their body weight, and whether the students had an adequate and balanced diet.

Hunger Sensitivity Scale: The Hunger Sensitivity Scale was developed by Walker et al. (2015) in order to assess the behaviors of individuals about hunger sensitivity, how they respond to hunger, and the ability of the individual to regulate his/her eating habits. The scale consists of 29 items. It's a Likert-type scale scored between 0 and 6. Each item in the scale is scored as “0 = strongly disagree”, “3 = neutral”, and “6 = strongly agree”. Items 9, 11, 24, 28 and 29 are rated inversely. The construct validity of the scale was evaluated using both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) methods. The test-retest method and the Cronbach's alpha reliability coefficient were used to assess the reliability of the scale. Cronbach's alpha coefficient was found to be 0.90, which was excellent. The test-retest reliability coefficient of the scale was found to be 0.81 and the Cronbach's alpha coefficient was 0.92. It was concluded that the adapted scale was a valid and reliable measurement tool which could be used to measure hunger sensitivity of individuals.

Procedures

At the outset, the written consent of the scale developers was obtained. Then the scale was translated from English to Turkish by two language experts. Two translations were reviewed by the researchers and a single Turkish form was obtained. The obtained Turkish form was sent to a language expert who had not seen the scale before and it was translated back into English. After the language equivalence was established, the Turkish and English versions of the scale were sent to 9 experts including Pediatric Health Nursing experts, Pediatric Health Specialists, and Dietitians. The nine experts found four unsuitable Turkish and English words and these four words were sent back to the language experts for re-evaluation. The final form of the scale was reviewed by the language experts. Expert opinions were evaluated with the scope validity index on the basis of both items and the scale. Upon reaching a fit between the expert opinions, the scale was piloted to 20 students. Since there was no question about the comprehensibility of the scale, it was found suitable for the large group administration. After it was administered to the large group, its validity and reliability analyses were performed.

Statistical Analysis

In the analysis of the data, percentage and mean scores were used for descriptive statistics, Pearson correlation analysis for the item total score analysis of the scale and subscales, Cronbach's alpha coefficient for determining the internal consistency of the scale and subscales, exploratory factor analysis for determining

the item-factor relationship, confirmatory factor analysis for finding whether items and the subscales explained the original structure of the scale, Pearson correlation analysis for determining the relationship of the scale with its factors, One-Way ANOVA for comparing the total mean scores of the scale according to BMI of the students, and Scheffe test for advanced analyses (Özdamar, 2016; Seçer, 2018). The BMI of the students was evaluated according to the WHO-2007 reference ranges for the 5-19 age group. Based on age and gender, a BMI value below the 5th percentile refers to being underweight, it refers to normal weight between the 5th and the 85th percentile, a BMI value between the 86th and the 95th percentile means being overweight, and the 95th percentile and over is considered to be obese (WHO, 2007). The self-reported height and weight of participants aged 20 and older were evaluated according to adult BMI classification of WHO. According to body mass index classification, <18.50 is underweight, 18.50-24.99 normal, 25.00-29.99 overweight, and ≥ 30.00 obese (WHO, 2000). In the evaluation of the data, the error margin was taken as $p = 0.05$.

Ethics

For the utilization of the Hunger Sensitivity Scale for university students, the permission of Thomas Hadjistavropoulos, one of the scientists who developed the scale, was taken through e-mail. Ethics approval of the Ethics Committee of Non-Interventional Research was obtained at the outset (Date: 9 August 2018 and Issue: 4218-GOA-2018/21-09). Necessary permissions were procured from the two universities in the western and central regions of Turkey. The students participating in the study were informed about the aim of the study. Participation in the study was on a voluntary basis. In addition, verbal and written consent of the students was obtained.

RESULTS

Participants: The mean age of the students who participated in the study was $19.89 + 1.51$. 76.41% of the participants (n: 695) were female. 56.3% (n: 514) stated their income and expenses were equal. 68.8% of the students (n = 628) perceived their weight normal, while 65.3% (n = 596) evaluated their height as normal. Of the students participating in the study, 17.3% (n = 158) had a low BMI, 68.4% (n = 624) had a medium BMI, and 14.3% (n = 131) had a high BMI.

Content Validity of Scale: 9 expert opinions were received in the draft scale form. As a result of expert opinions, the scope validity index on the basis of item was found to be between 0.95-1.00 and the scope validity index on the scale basis was 0.98.

Construct Validity of Scale: As a result of the Explanatory Factor Analysis (EFA), the Kaiser-Meyer Olkin (KMO) coefficient was 0.968, the Bartlett test X^2 value was 16101.470 and $p < 0.01$. It was determined that the scale consists of three (3) sub-dimensions. Three (3) sub-dimensions accounts for 56.32 % of total variance. The hunger catastrophizing sub-dimension of the scale accounts for 45.49 % of the total variance,

the psychological effects of hunger sub-dimension of the scale accounts for 5.73 % of the total variance and the hunger inconvenience sub-dimension of the scale accounts for 5.09 % of the total variance. Factor loadings of hunger catastrophizing sub-dimension of the scale ranged between 0.47-0.78, factor loadings of psychological effects of hunger sub-dimension were between 0.36 ile 0.78 and factor loadings of hunger inconvenience sub-dimension ranged between 0.66 ile 0.73 (Table 1).

Table 1. Results of Explanatory Factor Analysis (n=913)

Items	Sub-Scale		
	Hunger Catastrophizing	Psychological Effects of Hunger	Hunger Inconvenience
1		0.63	
2		0.78	
3		0.72	
4		0.70	
5		0.72	
6		0.37	
7		0.74	
8		0.68	
9		0.45	
10		0.36	
11			0.66
12		0.68	
13		0.59	
14	0.67		
15	0.74		
16	0.55		
17	0.77		
18	0.78		
19	0.71		
20	0.53		
21	0.50		
22	0.59		
23	0.58		
24			0.73
25	0.67		
26	0.47		
27	0.58		
28			0.70
29			0.67
Eigenvalue	13.193	1.664	1.476
Explained Variance (%)	45.49	5.73	5.09

As a result of the Confirmatory factor analysis (CFA) results, fit indices are determined as follows: $\chi^2 = 1816.84$, $df = 371$, $\chi^2 / df = 4.89$, $RMSEA = 0.065$, $GFI = 0.88$, $CFI = 0.98$, $IFI = 0.98$, $NFI = 0.98$, $TLI = 0.98$, $RFI = 0.97$ (Table 2). As a result of the CFA, the factor loadings of the hunger catastrophizing sub-dimension of the scale ranged from 0.58 to 0.80, the factor loadings of the psychological effects of hunger sub-dimension ranged from 0.34 to 0.81 and the factor loadings of the hunger inconvenience sub-dimension ranged from 0.62 to 0.78 (Figure 1).

Table 2. Model Fit Indices of the Hunger Sensitivity Scale

	X ²	DF ^a	X ² /DF	RMSEA ^b	GFI ^c	CFI ^d	IFI ^e	RFI ^f	NFI ^g	TLI ^h
One Factor Model	3742.84	373	10.03	0.100	0.78	0.97	0.97	0.96	0.96	0.96
Two Factor Model	2412.27	372	6.48	0.078	0.85	0.98	0.98	0.97	0.97	0.97
Three Factor Model	1816.84	371	4.89	0.065	0.88	0.98	0.98	0.97	0.98	0.98

a: Degree of Free; b: Root Mean Square Error of Approximation; c: Goodness of Fit Index; d: Comparative Fit Index; e: Incremental Fit Index; f: Relative Fit Index; g: Normed Fit Index; h:TLI (NNFI): Trucker-lewis Index.

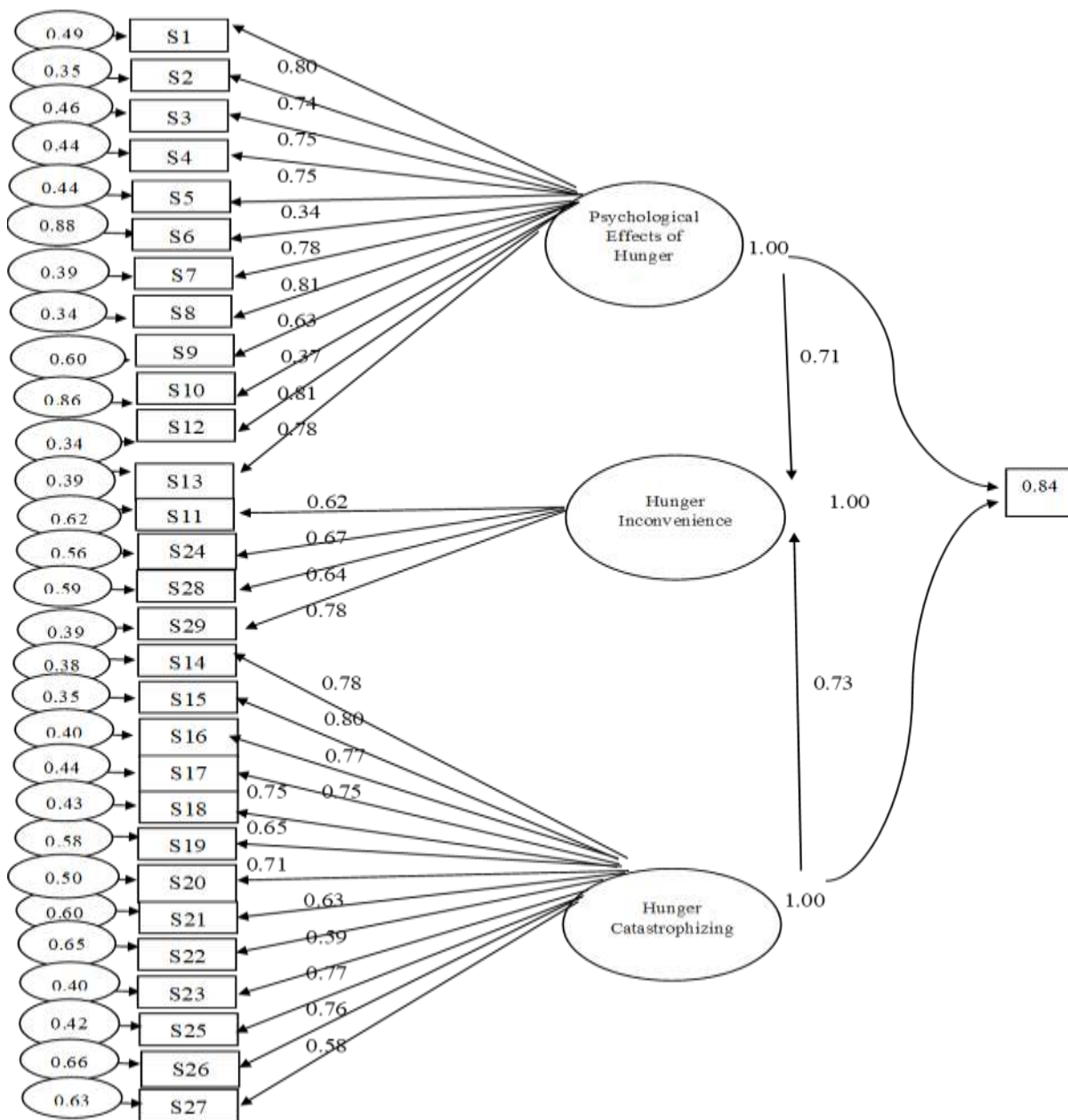


Figure 1. Confirmatory Factor Analysis of the Hunger Sensitivity Scale

Reliability Analysis: The additivity of the scale was determined by Tukey's test of additivity as $F= 0.289$ and $p= 0.591$. It was identified that the scale was collectable. Whether the scale had response bias or not was assessed by the Hotelling T-square test and it was determined that the Hotelling T square value was 1555.487, $F=53.908$ and $p <0.01$. It was detected that there was no reaction bias in the scale. The cronbach's alpha coefficient of the whole scale was 0.95. The cronbach's alpha values of the sub-dimensions were 0.93, 0.91, 0.77, respectively. As a result of the two halves analysis, the cronbach's alpha value of the first half was 0.92, the cronbach's alpha of the second half was 0.91, the spearman Brown coefficient was 0.91, the Guttman-split-half coefficient was 0.91, and the correlation coefficient between the two halves was 0.83. No floor effect and ceiling effect was detected for the whole scale. For the hunger catastrophizing sub-dimension, the base effect was found to be 0.3 % and the ceiling effect was 3.5 %, for the psychological effects of hunger sub-dimension the baseline effect was 0.1 % and the ceiling effect was 3.6 %, and for the hunger inconvenience sub-dimension the floor effect was 1.3 % and the ceiling effect was 6.7 % (Table 3). The correlations of the scale items with the scale total score ranged between 0.37-0.80, item-subscale total score correlations ranged between 0.46 to 0.82 (Table 4).

Table 3. Results of the Reliability Analyses of the Scale and Sub-dimensions (n=913)

Sub-dimensions	Cronbach α	First half of Cronbach α	Second half of Cronbach α	Spearman-Brown	Guttman split-half	Correlation between two halves	M \pm SD (Min-Max)	Floor Effect %	Ceiling Effect %
Scale Total	0.95	0.92	0.91	0.91	0.91	0.83	108.81 \pm 35.03 (1-174)	0.0	0.9
Hunger Catastrophizing	0.93						46.04 \pm 17.78 (0-78)	0.3	3.5
Psychological Effects of Hunger	0.91						48.67 \pm 15.23 (0-72)	0.1	3.6
Hunger Inconvenience	0.77						14.10 \pm 5.71 (0.-24)	1.3	6.7

The Scale total score of the underweight student was found to be 115.22 ± 34.66 , while the scale total score of normal-weight student was 109.25 ± 35.01 and the scale total score of over weight/obese student was 98.97 ± 33.70 . The hunger catastrophizing subscale score of the underweight student was found to be 49.84 ± 17.50 , while the scale total score of normal-weight student was 46.41 ± 47.69 and the scale total score of over weight/obese student was 39.64 ± 16.97 . The psychological effects of hunger subscale score of the underweight student was found to be 50.37 ± 15.19 , while the scale total score of normal-weight student was 48.66 ± 15.27 and the scale total score of over weight/obese student was 46.61 ± 14.96 . The third subscale score of the underweight student was found to be 15.01 ± 5.57 , while the scale total score of normal-weight student was and the scale total score of over weight/obese student was 12.71 ± 5.46 . The difference among the scale total scores and subscale total scores according to BMI of the student was found to be statistically significant. In the post-hoc analysis, the difference between the total score and the subscales 1 and 3 was found to stem

from the mean scores of obese and underweight individuals ($p<0.01$), and the mean scores of obese and normal-weight individuals ($p<0.01$). The score of the obese individuals was found to be significantly lower than those of the normal and underweight individuals (Table 5).

Table 4. Correlations of the Item Total Score and Sub-Dimension Total Score (n=913)

Items	Item-Total Score Correlation	Item-Subscale Total Score Correlation
	(r)*	(r)*
1	0.69	0.74
2	0.73	0.81
3	0.67	0.75
4	0.70	0.76
5	0.72	0.78
6	0.37	0.45
7	0.72	0.80
8	0.78	0.82
9	0.65	0.66
10	0.40	0.46
11	0.53	0.74
12	0.79	0.82
13	0.80	0.80
14	0.76	0.79
15	0.77	0.82
16	0.78	0.77
17	0.72	0.80
18	0.72	0.80
19	0.62	0.70
20	0.71	0.72
21	0.64	0.67
22	0.58	0.66
23	0.77	0.78
24	0.54	0.78
25	0.73	0.79
26	0.59	0.62
27	0.61	0.66
28	0.51	0.77
29	0.66	0.80

* $p<.001$

Table 5. Comparison of Scale Total and Subscale Scores of Student According to Body Mass Index (n=913)

BMI*	Total Score		Hunger Catastrophizing	Psychological Effects of Hunger	Hunger Inconvenience
	n	M±SD	M±SD	M±SD	M±SD
Underweight	158	115.22±34.66	49.84±17.50	50.37±15.19	15.01±5.57
Normal-weight	624	109.25±35.01	46.41±47.69	48.66±15.27	14.17±5.74
Overweight/Obese	131	98.97±33.70	39.64±16.97	46.61±14.96	12.71±5.46
	F	7.976	12.533	2.188	5.920
	p	0.000	0.000	0.113	0.003

*BMI: Body Mass Index; M: Scale Total Score Mean; SD: Standart Deviation

DISCUSSION

This study was carried out in to analyze the validity and reliability of the Hunger Sensitivity Scale for university students.

The content validity of the scale was evaluated by 9 experts and I-CVI and S-CVI were used in the evaluation of the expert opinions. Both I-CVI and S-CVI should be above 0.80 in order to be able to say that there is an agreement between the expert opinions (DeVellis, 2012; Jonhson, & Christensen, 2014). In this study, both I-CVI and S-CVI levels were found to be above 0.80. The results of I-CVI and S-CVI in this study showed that there was an agreement between the experts, which meant the scale measured the subject adequately and the content validity was ensured.

Barlett's Sphericity test and KMO were used to evaluate the suitability and sufficiency of the data for factor analysis. In the literature, it is emphasized that Barlett's Sphericity test value should be statistically significant and KMO value should be at least 0.60 to do the factor analysis (DeVellis, 2012; Jonhson, & Christensen, 2014; Karagöz, 2016; Kartal, & Bardakçı, 2018). In this study, it was found that Barlett's Sphericity test value was $p < 0.05$ and the KMO value was greater than 0.60. For this study, it was determined that the database and sampling sizes were suitable for factor analysis (Erkuş, 2016; Jonhson, & Christensen, 2014; Karagöz, 2016; Kartal, & Bardakçı, 2018). The sampling size and data sets in our study were similar to those of Walker et al. (2015), who developed the original scale.

In the exploratory factor analysis, the eigenvalue was accepted as 1 and above to determine the number of factors (Karagöz, 2016; Kartal, & Bardakçı, 2018; Özdamar, 2016) and the scale was found to consist of three subscales. In this study, the three-factor scale explained 56.32% of total variance. In the study of Walker et al. (2015), the scale was found to consist of one dimension and explain 44.47% of the total variance. In the literature, it is emphasized that the explained variance in multidimensional scales should be above 40%, and that the higher the total variance, the stronger the construct validity of the scale (Karagöz, 2016; Kartal, & Bardakçı, 2018; Özdamar, 2016). It was determined that the total variance obtained in this study was over 50% and that the scale had a fairly high explained variance. These findings supported the construct validity of the scale.

As a result of the exploratory factor analysis, it was determined that the factor loads in the three subscales varied between 0.36 and 0.78. In the literature, it is emphasized that the minimum factor load should be 0.30 and above and the items under this value should be excluded from the scale (DeVellis, 2012; Erkuş, 2016; Jonhson, & Christensen, 2014; Karagöz, 2016). In this study, it was determined that the factor loads of all sub-scales were greater than 0.30. In the study of Walker et al. (2015), the factor loads of the items in the single dimensional scale were found to vary between 0.418-0.791. The factor loads in the original scale and the factor loads in this study were similar. In this study, the fact that the factor loads obtained from each subscale were greater than 0.30 showed that the scale had a strong factor construct.

In the literature, it is recommended that the construct obtained by exploratory factor analysis should be analyzed by confirmatory factor analysis (Özdamar, 2016; Seçer, 2018). Unlike the original scale, the scale in this study consisted of three subscales. For this reason, this study aimed to determine the best and close-to-original construct by comparing the results of the scales with one, two, and three subscales. Therefore, one, two, and three-factor-CFA was performed. As a result of the three analyses, it was found that the fit indexes of the one and two-factor construct were low, the RMSEA was greater than 0.08, and that the division of the Chi-square by the degree of freedom was greater than 5. These results showed that one and two-factor constructs were not suitable for Turkish sampling. As a result of the three-factor CFA, it was determined that factor loads of all subscales were greater than 0.30, fit indexes (GFI, NFI, CFI, and IFI) were greater than 0.90, and that RMSEA was less than 0.080. The division of Chi-square value by the degree of freedom was found to be less than 5. A strong and significant relationship was found between the scale and its subscales. In the literature, the model fit indicator of greater than 0.90, X^2/DF of less than 5, and RMSEA value of less than 0.08 is considered to be a good fit indicator (Özdamar, 2016; Seçer, 2018). The results of CFA in this study were consistent with the criteria specified in the literature. In the study of Walker et al. (2015), it was found that general fit indexes were greater than 0.90 and RMESA was less than 0.08. The results of the confirmatory factor analysis indicated that the data were consistent with the model, confirmed the three-factor construct, the subscales were associated with the scale, and that the items in each subscale adequately defined their factor.

The results of the exploratory and confirmatory factor analysis in this study supported the construct validity of the scale and suggested that the scale was a valid tool.

Cronbach's alpha coefficient indicates whether the items measure the same property and whether the items are related to the subject to be measured. This value is expected to be as close to 1 as possible. A value between 0.60 and 0.80 indicates the scale is quite reliable, while a value between 0.80 and 1.00 shows the scale is highly reliable (DeVellis, 2012; Seçer, 2018). In this study, the overall and subscale Cronbach's alpha values were determined to be greater than 0.70. The results of this study showed that the Cronbah alpha values of the scale and its subscales were highly reliable. The Cronbach's alpha values obtained from this study showed that the items measured the subject sufficiently, the items were relevant to the subject, and that the scale had quite good reliability (Kartal, 2018; Özdamar, 2016; Seçer, 2018). In the study of Walker et al. (2015), it was found that the total Cronbach alpha values of the scale were greater than 0.70. This result showed that the scale in this study was similar to its original construct and had a strong internal consistency.

In this study, it was found that the Cronbach's alpha values obtained from the split-half method were greater than 0.70, there was a strong and significant relationship between the halves, and that both the Spearman-Brown and Guttman Split-Half coefficients were greater than 0.70. These results proved that the scale had a high level of reliability (DeVellis, 2012; Kartal, 2018; Seçer, 2018). While these results showed that the

internal validity of the scale was high, the results could not be compared to those of the original study since it did not involve a split-half analysis.

One of the important factors affecting the reliability of the scales is response bias. Response bias means that individuals respond to the scale items in line with the expectations of the researchers or the society instead of basing their answers on their opinions. This negatively affects the reliability of a scale, and thus validity indirectly. The Hotelling T-square test was used to analyze the scale to determine the existence of response bias. The test revealed that the respondents answered the items according to their opinions, the responses of the participants were different, and that there was no response bias in the scale. This proved that the scale was reliable (Kartal, 2018; Özdamar, 2016; Seçer, 2018).

One of the important factors affecting the reliability and validity of the scales is the floor and ceiling effect. In scale studies, it is recommended that the floor and ceiling effect should be below 20%. In this study, it was found that both the floor and the ceiling effect were less than 20% both in the scale and in the subscales. This showed that the scale was very reliable (DeVellis, 2012; Kartal, 2018; Özdamar 2016; Seçer, 2018). Item-total score analysis explains the relationship between the scores obtained from each item of the scale and the total score of the scale. It is an indicator of whether the items in the scale measure the desired quality (Jonhson, & Christensen, 2014; Karagöz, 2016; Özdamar 2016). This value should be greater than 0.20, positive, and as close to 1 as possible (Kartal, 2018; Özdamar 2016). In this study, the correlation of the items with the total score of the scale was found to be between 0.37-0.80, and the correlations of items with the total score of the subscales ranged between 0.46 and 0.82. The correlation coefficients of both the item-total score and the item-subscale total scores were found to be positive and greater than 0.20. According to these findings, it was found that all the items of the scale showed a high correlation with the total score and the total score of their subscale, the scale measured the desired quality adequately, and that the item reliability of the scale and the subscales was high. Since the item-total score analysis had not been performed in the original study by Walker et al. (2015), the results of this study were not comparable to the original study findings. This finding, too, proved that our study had a high level of internal consistency.

In this study, students' BMI was used for the comparison of known groups. In the comparison of known groups, it is recommended that the scale should be administered to the groups that may get different scores from the scale. A statistically significant difference is expected between the mean scores of these groups (Jonhson, & Christensen, 2014; Karagöz, 2016). In this study, it was found that the scores of obese individuals were significantly low and that they were lower than those of the underweight individuals ($p < 0.01$). This finding showed that the scale could distinguish the groups expected to get different scores and that the scale had a strong distinguishing characteristic. This provided evidence for the reliability and validity of the scale (Jonhson, & Christensen, 2014; Karagöz, 2016; Özdamar, 2016; Seçer, 2018).

Limitations

In spite of the many strengths of this study, the use of random sampling made up a limitation for the study. This may affect the generalizability of the study.

CONCLUSION

In this study, it was found that the Hunger Sensitivity Scale for university students was a valid and reliable measurement tool for Turkish sampling. It is recommended that the Hunger Sensitivity Scale should be used for determining risky groups with nutritional problems due to hunger sensitivity and planning the necessary interventions. In addition, cross-cultural comparative studies can also be conducted using the scale.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SD, DD, MB, IB and TH conceptualized and designed the study, acquired, analyzed and interpreted the data, and drafted the manuscript. SD, DD, MB, IB and TH designed the study, search literature and revised the manuscript. All authors read and approved the final manuscript.

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