

## DEVELOPMENT AND VALIDITY-RELIABILITY STUDY OF THE ASSESSMENT OF THE OBESOGENIC ENVIRONMENT SCALE FOR ADULTS

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### ABSTRACT

**BACKGROUNDS:** In consequence of obesity is multi-factorial health problem that occurs with the interaction of environment and genetic factors, evaluating and intervening the obesogenicity of the environment in which individuals live can play a role as supportive therapy in the treatment of obesity.

**AIMS:** This study aimed that develop and test the reliability-validity analyses of “Assessment of Obesogenic Environment in Adults” which can be used to evaluate the obesogenic environment in Turkey.

**METHODS:** The sample size (n=282) was determined based on the requirement of factor analysis, which should be done with 5-10 times the number of items (38) in the questionnaire. Test-retest and internal consistency reliability methods were used for scale’s reliability analysis. For scale’s validity analysis, expert opinion was consulted, and factor analysis was performed.

**RESULTS:** The analysis shows that the test-retest reliability coefficient value is moderately reliable, and the internal consistency correlation coefficient is reliable. Because of the Content Validity Ratio and Content Validity Index of the scale was determined as 1, no question extraction was performed. According to Kaiser-Meyer-Olkin (KMO) and Bartlett’s test, the scale was suitable for factor analysis. Outcome of the factor analysis, 32 items were grouped under 4 headings.

**CONCLUSIONS:** The scale developed in the study is a reliable and valid measurement tool for use in Turkey. By using the scale, the environment in which individuals live can be evaluated in the prevention and treatment of obesity, which is a public health problem, and interventions can be made according to the evaluation results.

**Keywords:** Obesity, obesogenic, public health, scale.

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## INTRODUCTION

Obesity is now recognised as one of the most serious public health issues facing the world today. Adult obesity is more common than undernutrition worldwide. Obesity defined as excessive fat accumulation in adipose tissue at a level that threatens health and accepted as non-communicable disease (Purnell, 2000; WHO, n.d.).

Obesity occurs with the interaction of genetic and environmental factors. Obesity risk factors include diet, inadequate physical activity, genetic, hormonal and metabolic factors as well as the built environment (Hruby et al., 2016). Obesogenic environment can be defined as environmental factors that support obesity or body weight gain and there are different approaches in the evaluation of the obesogenic environment. The built-environment consists of three elements: physical design, land use style, and transportation systems (Lake & Townshend, 2006). These three factors can affect human health both through physical, chemical and biological agents and through housing, urban development, transportation, land use (Papas et al., 2007). The macro and micro-environment is as important as the built-environment. While factors such as education and health systems, government policy and society's attitudes and beliefs make up the macro environment (Lake & Townshend, 2006; Swinburn et al., 1999); areas such as home, workplace, school, and supermarkets form the individual's micro-environment. Since it is the area where we most interact the during the day, the macro and micro-environment are also important factors that should be evaluated in the etiology of obesity (Swinburn et al., 1999). Obesogenicity of both micro and macro environment is examined under 4 subtitles. Each dimension (macro and micro-environment) of the obesogenic environment includes 4 subtypes (Kirk et al., 2010). These are " physical ", "economic ", " political " and " socio-cultural " respectively (Kirk et al., 2010; Swinburn et al., 1999). The physical environment is about what is around us in physical activity and nutrition. The physical environment for food refers to what is available in various food stores, including restaurants, supermarkets, vending machines, schools, community, sports, and arts venues. Physical environment for physical activity refers to environmental factors affecting the active use of motorized transport, bicycle paths, pedestrian paths, street lighting, public transport, and accessible stairs in buildings. The economic environment can be briefly defined as the amount of physical activity and food expenses. Political-environment; it covers rules and informal / formal laws affecting physical activity and nutritional status (Swinburn et al., 1999). The sociocultural environment is the sum of the beliefs, cultures, behaviours, and attitudes of the society in which the individual lives.

The rapid increase in obesity rates in the last 30 years has profound effects on the health of populations. The fact that this increase occurred on a relatively short biological time scale suggests that changes in the environments we are exposed to may be blamed (Smith & Cummins, 2009). For this reason, obesity is believed to be primarily an environmental problem (Poston & Foreyt, 1999). Looking closely at the obesity prevalence in Turkey, the Turkish population has a higher prevalence of obesity than most European countries, and in general, it has been determined that 56% of the Turkish population is overweight and 41% is within the normal range (Iseri & Arslan, 2008). Some regional studies in Turkey; the relationships between obesity prevalence and working/not working status, widespread use of individual vehicles, mechanization of agricultural activities, gender inequality in participation in sports activities, insufficient activity related to housework were determined as risk factors (Erem et al., 2004). Since these factors are associated with obesity, understanding the obesogenic environment will be an integral part of the treatment process in order to control the increasing obesity prevalence in Turkey. At this point, the development and use of this scale enables to highlight the neglected points in the treatment process and to intervene in a targeted way.

There is no valid and reliable scale examining social, economic and physical factors affecting obesity prevalence in Turkey. For this reason, this study is a methodological study that aimed to develop a valid and reliable scale for the evaluation of obesogenic factors affecting the physical activity and behaviour of an adult individual for Turkish population. The data obtained as a result of the study will determine the obesogenic environmental scores of each individual.

## MATERIAL AND METHOD

### Participants and Procedure

The sample size required to conduct the validity and reliability study of the developed questionnaire was determined according to the factor analysis conditions. The sample size is closely related to the number

of items in the research questionnaire. It is suggested that the ratio of the number of participants to the number of items in the scale should be between 5 and 10 in order to perform factor analysis (Gorsuch, 1997). There are 38 items in the questionnaire prepared for the study, and the number of participants must be between 190 and 380 accordingly. This study carried out with 291 male and female participants who, ii) between 18-65 years of age, ii) not in any nutritional treatment period and iii) for at least 6 months residing in Republic of Turkey. Data collection took place between December 2019 and February 2020. The number of participants, which was 293 at the beginning, was reduced to 282 by arranging the criteria and protocols. According to the test-retest method, each participant must fill in the questionnaire twice. Due to the absence of 9 participants in the second stage of data collection, the number of participants decreased to 282.

This research was approved by Human Clinical Research Ethics Committee code of ethics 2020-05/21 (Istanbul/Turkey). Written and verbal consents were obtained from individuals that they voluntarily agreed to participate in the study.

The questionnaires were administered to the individuals under the supervision of the researcher after the consent form was read. Participants answered typical socio-demographic questions about their age, gender, height, body weight, diet and physical activity behaviour, and disease history. Based on the answers given by individuals to the questions of body weight and height, body mass indexes were calculated using the formula "body weight (kg) / height m<sup>2</sup>."

## Research Steps

1. Literature Search and Determination of Scales's Questions Obesity is a chronic and global health condition that affects the whole world. Besides being a health problem, obesity is an economic and social problem. The obesogenicity of an environment is defined as "the sum of the effects of the environment, opportunities or living conditions on promoting obesity in individuals or populations" (Lake & Townshend, 2006). There are many approaches in terms of basic or supportive care in obesity treatment. A new approach is to explore environments that support high energy intake and sedentary life, but these conditions are not yet fully understood. Shaping the environment to support health-promoting decisions and behaviour has the potential to be one of the key steps in a successful obesity treatment (Lake & Townshend, 2006). In the light of all this information, studies on obesogenic factors and their effects on body weight were scanned and questionnaire questions were prepared (Cohen, 2008; Delavari et al., 2014; Frank et al., 2004; Kirk et al., 2010; Lake & Townshend, 2006; Swinburn et al., 1999).

The questionnaire form prepared for data collection is as follows; It consists of 4 sub-titles: "Demographic Information", "Questions About Health Status", "Questions About Nutritional Habits" and "Scale Questions Developed for Evaluation of Obesogenic Environment". The subtitle titled "Scale Questions Developed for Evaluation of Obesogenic Environment" consists of 4 different subtitles: "Questions that evaluate the effects of the physical environment on physical activity and eating habits (F)", "Question that evaluate the effects of social environment on physical activity and eating habits (S)", "Questions that evaluate the effects of public policies on physical activity and eating habits (K)", "Questions that evaluate the effects of economic factors on physical activity and eating habits (E)". Seventeen of the sub-section questions consisting of 38 items (F1, F2, F3, F8, F10, F11; S2, S3, S4, S5, S6, S9, S13; K1, K4; E3, E7) consist of reverse coded questions. Individuals were asked to score from 1 to 7 according to the Likert scale how much they participated in each item of the scale questions. It is expressed as "1- Disagree (healthy factor), 4- Partially agree, 7- Absolutely Agree (obesogenic factor)".

2. Evaluation of scale questions and changing / subtracting procedures by getting expert opinion In order to get the expert opinion, which is one of the steps of validity and reliability study, and to calculate the content validity index and rates, a group of experts consisting of 5 people has been formed. To make content validity calculations and obtain objective results, the quality and number of experts (5-40) is of great importance (Yeşilyurt & Çapraz, 2018). In order to get the opinions of the experts, the candidate scale form was prepared and in the Lawshe (1975) technique, the terms 'item measures the targeted structure', 'the item is related to the structure but unnecessary', 'the item does not measure the targeted structure' expressions are 'appropriate', It has been reorganized as "appropriate but should be corrected" and "removed" (Yeşilyurt & Çapraz, 2018). Content Validity Rate (CVR) and Index (CVI) were calculated after expert opinions were received. The analysis of the data obtained determined which expressions and which expressions would be removed and the questionnaire was finalized.

3. Determining the Sample Size The sample of the study was determined based on scale validity and reliability studies necessity. In determining the sample size, 5-10 participants should be included in the study for each scale's items included in the analysis (Gorsuch, 1997). The scale of this study was developed with the aim of assessing the obesogenic environment in Turkey consists of 38 items. For this reason, the number of participants must be between 190-380 to perform factor analysis. In this study, 282 volunteers participated.

4. Collection of Survey Data twice with Snowball Sampling Method (Test-retest Method) Data collection was carried out face-to-face after the participants (n=282) were informed and their approval was obtained. For the test-retest method, which is a procedure of data validity and reliability study, the data were collected again by face-to-face after 2-4 weeks, and the Cronbach  $\alpha$  value was calculated with the SPSS 22.0 package program to prove the reliability of the questionnaire.

### Statistical Analysis of Data

This study includes the development and validity-reliability analysis of the scale that can be used for assessment of obesogenic environment in Turkey. Validity and reliability analyses of the scale were analysed using SPSS 22.0 and Microsoft Excel 2016 program. The analysis methods used are summarized in Table 1.

**Table 1.** Statistical Analysis Methods Used in the Study

<b>Validity Analysis</b>	
Content Validity	Content Validity Index (CVI) and Ratio (CVR)
Construct Validity	Factor Analysis
Test for Factor Analysis	Bartlett's and Kaiser-Meyer Olkin Tests
<b>Reliability analysis</b>	
Form Repetition	Test-retest
Internal Consistency	Internal Consistency Cronbach $\alpha$ Coefficient
<b>Analysis on the Calculation and Evaluation of Participants' Total Scores</b>	
	Number-Percentage, Sum and Mean, Minimum, Maximum, Standard Deviation

## RESULTS

### Descriptive Statistics

A total of 282 people participated in the study. 75.2% (212 people) of the participants are women and 24.8% (70 people) are men. The average age of the individuals was calculated as  $31.26 \pm 12.80$  and the participants were divided into 5 groups according to their ages. Participants are individuals, who residing in 22 different cities (Adana, Afyonkarahisar, Ankara, Bayburt, Bursa, Edirne, Elazığ, Eskişehir, Giresun, Gümüşhane, Hatay, İstanbul, İzmir, Kahramanmaraş, Kayseri, Kocaeli, Kütahya, Rize, Samsun, Trabzon, Tunceli, Uşak) in Turkey at least 6 months. Demographic data of the participants are summarized in Table 2.

Medical stories of individuals were examined in the "Questions About Health Status" section of the questionnaire. 23.4% (66 people) of 282 participants had a history of disease. 5.3% of the participants (n=15) have skeletal system diseases, 4.6% (n=13) have thyroid diseases, 5.3% (n=15) have diabetes, 0.7% (n=2) have respiratory system diseases, 2.1% (n=6) have digestive system diseases, 1.1% (n=3) have nervous system diseases, 6.4% (n=18) have circulatory system diseases, 1.1% (n=3) have excretory system diseases, 1.4% (n=4) have visual impairments, 0.4% (n=1) have skin diseases and 4.6% (n=13) have other system diseases.

In the "Questions About Nutrition Habits" section of the questionnaire, the participants were asked questions regarding nutritional habits and social media habits. Means of participant's body weight (kg), height (cm), BMI values and eating habits are summarized in Table 3.

**Table 2.** Participant's Demographic Characteristics

		n	%
<b>Gender</b>	<b>Woman</b>	212	75,2
	<b>Man</b>	70	24,8
<b>Age</b>	<b>18 years</b>	24	8,5
	<b>19-24 year</b>	100	35,5
	<b>25-50 year</b>	129	45,7
	<b>51-64 year</b>	26	9,2
	<b>65 years</b>	3	1,1
<b>Place of Residence</b>	<b>Home (student house, I am living alone)</b>	11	3,9
	<b>Home (student house, I am living with my friends)</b>	12	4,3
	<b>Home (I am living with my family)</b>	224	79,4
	<b>Dormitory (there is regular food service)</b>	28	9,9
	<b>Dormitory (no regular food service)</b>	7	2,5
<b>Working Status</b>	<b>Yes</b>	95	33,7
	<b>No</b>	187	66,3
<b>Number of Days Worked</b>	<b>1 day or less in a week</b>	1	1,1
	<b>2 days in a week</b>	5	5,3
	<b>3 days in a week</b>	7	7,4
	<b>4 days or more in a week</b>	82	86,3

**Table 3.** Information on Participants' Eating Habits

	Minimum	Maximum	Mean ± S.D
<b>Body Weight (kg)</b>	40	115	68,02±15,62
<b>Height (cm)</b>	150	190	165,3±7,95
<b>BMI</b>	15,62	39,54	24,79±4,98
<b>Number of Meal</b>	1	4	2,39±0,57
<b>Number of Snack</b>	0	8	1,54±1,01
		N	%
<b>Frequency of eating outside the home/dormitory</b>	<b>1 day or less in a week</b>	146	51,8
	<b>2 days in a week</b>	29	10,3
	<b>3 days in a week</b>	37	13,1
	<b>4 days or more in a week</b>	70	24,8
<b>Frequency of exercise</b>	<b>1 day or less in a week</b>	195	69,1
	<b>2 days in a week</b>	39	13,8
	<b>3 days in a week</b>	27	9,6
	<b>4 days or more in a week</b>	21	7,4
<b>Daily Internet / Social Media Usage Time</b>	<b>1 hour or less in a day</b>	66	23,4
	<b>2 hours in a day</b>	81	28,7
	<b>3 hours in a day</b>	57	20,2
	<b>4 hours or more in a day</b>	78	27,7

### Reliability Analysis Findings

The reliability of a measuring instrument is an indicator of how far the scale has been free from accidental error (20). The most used methods for evaluating scale reliability are test-retest and internal consistency. The test-retest method is to apply the same questionnaire to the participants 2 times in specified periods. In this way, how consistent the scale is evaluated. As a result of the analysis, the intraclass correlation coefficient is calculated. The test-retest Cronbach  $\alpha$  value is less than 0.5, it is poor reliability, it is between 0.5-0.75, it is medium level reliability, it is between 0.75-0.9, it is good reliability, and it is above 0.9 value, it is excellent reliability. As a result of the analyses, the test-retest Cronbach  $\alpha$  value was 0.815 and the intraclass correlation coefficient was 0.687.

Another most common method of reliability analyses is internal consistency. Internal consistency is the degree to measure the same targeted feature in each measurement of the items that make up the scale (Pallant, 2017). To measure internal consistency, Cronbach  $\alpha$  was calculated with SPSS 22.0 package program. For high reliability, the Cronbach  $\alpha$  of the questionnaire should be over 0.7 (Pallant, 2017). As a result of the analysis, the internal consistency Cronbach  $\alpha$  value of the questionnaire was calculated as 0.761.

### Validity Analysis Findings

Validity is the degree to measure the desired feature of the scale (Pallant, 2017). Validity is briefly examined under three headings: content validity, criterion validity, structural validity (Hayran, Osman; Özbek, 2017). In this study, expert opinion was consulted to analyse content validity. For the 5 expert opinions, the smallest CVR value is 1 (Ayre & Scally, 2014). When the answers given by the experts were analysed, the CVR values of all questions were found to be 1. Content Validity Index (CVI) is calculated by taking the average of the CVR values of the expressions determined to remain in the scale. The CVI of the scale was obtained as 1.

Factor analysis method is used for construct validity analysis. It is a technique used to reveal whether there is a certain order between the responses of the participants to the items in the measurement tool being developed. Before factor analysis was done, it was determined whether the sample size was enough for factor analysis by performing KMO and Bartlett's test. Bartlett's test should be significant for factor analysis ( $p < 0.05$ ) and the KMO index, which can take a value between 0 and 1, should be at least 0.6. As a result of the analysis, the sample size was found to be enough (Bartlett test:  $0.00 < 0.05$ ; KMO Index 0.871). Factor analysis was done twice for the scale. In the first analysis, 1 item (E4) was not loaded to any factor and 5 items (F1, F2, F10, F11, S1) were loaded to more than one factor. In the second analysis, these 6 items were subtracted from the scale and the analysis was performed. As a result of the analysis, 32 items in the scale were loaded on 4 factors (Table.4)

**Table 4:** Factor Analysis of Scale Items

	FACTORS			
	Factors regarding physical environment and opportunities	Cultural determinants and access to experts	Social determinants and their effects	Economic determinants and their effects
F6	,705			
F9	,646			
F5	,629			
F7	,607			
F4	,581			
K5	,503			
F8	-,477	,306		
F3	-,407			
K3	,398			

K2	,391			
S4		,687		
S2		,608		
S5		,573	-,335	
K1		,566		
S3		,541	-,362	
K4		,509		
S13		,507		
S9		-,427		
E6		,403		
E3		,399		
S10			,741	
S12			,640	
S7			,586	
S8	,340		,550	
S11			,529	
K7			,446	
S6			-,434	
K6			,374	
E2				-,877
E1				-,826
E5				-,451
E7				-,433

## DISCUSSION

### Discussing the Findings of Reliability Analysis

Reliability can be defined as the degree to which a scale measures the data to be measured consistently. When a reliable scale is reapplied under similar conditions, it gives similar and consistent results.

Within the scope of the reliability analysis, test-retest and the internal consistency methods was used. The test-retest method was made by refilling the scale of 282 participants after 2-4 weeks. The purpose of the test-retest method is to measure the consistency of the answers given by the same participant at different times. The more consistent the answers given by the participants at different times, the more reliable the scale. In short, internal consistency is that the questions measuring the same concept find the same result.

As a result of the analyses, the test-retest Cronbach  $\alpha$  value was 0.815 and the intraclass correlation coefficient was 0.687. And Internal Consistency Cronbach's alpha was 0,761. From these results, it is concluded that the Assessment of Obesogenic Environment in Adults has good reliability and moderate test-retest consistency and very good internal consistency.

Apart from these analyses, it was also analysed how the reliability coefficient changes if each expression is removed from the scale. It is known that if an increase in the reliability coefficient obtained after subtracting the measured expression from the scale is observed, that the expression decreases the

reliability of the scale, and if the reliability coefficient decreases after the expression is removed, that expression is very important for the scale. No item in the developed scale reduces the reliability coefficient to less than 0.7. For this reason, no removal has been done.

### Discussing the Findings of Validity Analysis

The items contained in the designed scale should be related to the researched feature and should be able to determine the feature to be investigated. For this purpose, validity analyses are made. Validity analysis can basically be categorized under three headings: content validity, criterion validity, structural validity.

In order to determine the content validity within the scope of the study, the content validity index and rates were calculated with the MS Office Excel 2016 program by taking the expert opinion. For this purposes, prepared scale given to expert delegation that consist of five expert and their opinions were consulted. A content validity evaluation form was given for each item to evaluate as "1 = Not suitable", "2 = Suitable but should be corrected", "3 = Suitable". According to Lawshe (1975), for the items with positive value, it is necessary to look at the CVR Critical at the level of  $\alpha = 0.05$  significance. CVR Critical is the CVR value that should be looked at in order to decide whether an expression is suitable (Yeşilyurt & Çapraz, 2018). The CVR Critical value is used when determining at least how many experts should approve to decide whether an item is necessary or unnecessary. While the number of experts is 5, the CVR minimum value should be 1 at the level of  $\alpha = 0.05$  significance (Ayre & Scally, 2014; Yeşilyurt & Çapraz, 2018). After analysing the data, CVR value for each item and CVI value of the scale were obtained as 1, therefore, any items have not been removed from the scale.

Construct validity is related to the extent to which the items in the prepared scale accurately measure the desired parameter. Many methods are used to assess construct validity. In this study, factor analysis was used. The items in the scale are categorized under different headings by factor analysis. Factor analysis was made on 38 items in the scale by using the Maximum Likelihood Estimation method with the rotation of the direct oblimin. As a result of the two analyses, items were grouped under 4 different factors.

### CONCLUSION

The validity and reliability of the questionnaire, which was developed as a result of the analyses, was proved and can be used to measure the obesogenic environment in Turkey. The environment can play a critical role in preventive management of obesity and its comorbid diseases, but more studies are needed to understand the obesogenicity of the environment in which individuals live. Due to the living environment is dynamic and complex, so it is difficult to characterize it. Nevertheless, with the scale developed in the study, information about the environment of the individuals can be obtained as first step for understanding it and may be a part of the treatment plan while intervening in diet and physical activity. The development of a scale that addresses other factors affecting obesity as a public health problem reveals the parameters of the treatment process that need to be changed for Turkey. As a result, the evaluation of the obesogenic environment is a candidate to be one of the other solution methods to slow down/prevent the increase in obesity prevalence.

### COMPETING INTERESTS

There is no competing interest.

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