

## Food Insecurity in Relation to Sustainable and Healthy Eating Behaviors and Obesity in Türkiye

### Türkiye'de Besin Güvencesizliğinin Sürdürülebilir ve Sağlıklı Beslenme Davranışları ve Obezite ile İlişkisi

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#### ABSTRACT

**Objective:** This study aims to determine food insecurity (FI) in relation to sustainable and healthy eating behaviors and obesity in Türkiye.

**Materials and Methods:** The study was conducted between March and May 2023 in Samsun, Türkiye and included 461 people (67.0% women; aged 19 years and over). Data were collected via the online survey method. Using self-reported body weight (kg) and height (m), obesity was determined based on BMI  $\geq 30$  kg/m<sup>2</sup>. The Food Insecurity Experience Scale (FIES) and Sustainable and Healthy Eating Behaviors Scale (SHEBS) were administered.

**Results:** The rate of FI was 42.5% and was higher in individuals aged 19–34 years (50.9%) than in individuals aged 35–49 years (36.4%) and 65+ years (34.0%) ( $p=0.03$ ). FI was associated with a lower risk of obesity in the unadjusted model ( $p=0.005$ ). After adjusting for gender, age, marital status and education degree, FI was no longer significantly associated with obesity ( $p=0.07$ ) and was not associated with SHEBS score ( $p=0.61$ ).

**Conclusions:** This study suggests that FI is not related to sustainable and healthy eating behaviors and obesity in this population. More studies investigating FI at the individual level in larger populations in Türkiye and the environmental and health impacts of FI are needed.

**Keywords:** Diet, environmental health, food insecurity, hunger, sustainable development

#### ÖZ

**Amaç:** Bu çalışma, Türkiye'de besin güvencesizliğinin (BG) sürdürülebilir ve sağlıklı beslenme davranışları ve obezite ile ilişkisini belirlemeyi amaçlamaktadır.

**Materyal ve Metot:** Çalışma Mart-Mayıs 2023 tarihleri arasında Samsun'da (Türkiye) gerçekleştirilmiş ve 461 bireyi (%67,0 kadın; 19 yaş ve üzeri) kapsamıştır. Veriler çevrimiçi anket yöntemiyle toplanmıştır. Bireylerin kendi bildirdikleri vücut ağırlığı (kg) ve boy uzunluğu (m) bilgileri kullanılarak, obezite BKİ  $\geq 30$  kg/m<sup>2</sup> olarak belirlenmiştir. Gıda Güvencesizliği Deneyim Ölçeği (GGDÖ) ve Sürdürülebilir ve Sağlıklı Beslenme Davranışları Ölçeği (SSBDÖ) uygulanmıştır.

**Bulgular:** BG oranı %42,5'tir ve 19-34 yaş arası bireylerde (%50,9), 35-49 yaş arası (%36,4) ve 65 yaş üstü (%34,0) bireylere göre daha yüksektir ( $p=0,03$ ). BG, düzeltilmemiş modelde daha düşük obezite riski ile ilişkilendirilmiştir ( $p=0,005$ ). Cinsiyet, yaş, medeni durum ve eğitim derecesi için düzeltme yapıldıktan sonra, BG ile obezite ( $p=0,07$ ) ve SSBDÖ puanı arasında anlamlı bir ilişki bulunmamıştır ( $p=0,61$ ).

**Sonuç:** Bu çalışma, BG'nin bu popülasyonda sürdürülebilir ve sağlıklı beslenme davranışları ve obezite ile ilişkili olmadığını göstermektedir. Türkiye'de daha geniş popülasyonlarda bireysel düzeyde BG'yi ve BG'nin çevresel ve sağlık etkilerini araştıran daha fazla çalışmaya ihtiyaç vardır.

**Anahtar Kelimeler:** Açlık, besin güvencesizliği, çevre sağlığı, diyet, sürdürülebilir kalkınma

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## INTRODUCTION

Food insecurity (FI) is a growing public health problem, especially in low- and middle-income countries, where a rapid transition in dietary habits, characterized by increased access to fast-food foods, is taking place.<sup>1</sup> One of the reasons for the dietary transition is the limited access to healthy foods that provide the nutrients necessary for a healthy life.<sup>2</sup> FI refers to inadequate access to food as well as low-quality nutrition. Around 41 per cent of the world's population is estimated to have suffered from FI in 2021.<sup>3</sup> This has implications for increasing rates of non-communicable diseases, particularly obesity and obesity-related hypertension, diabetes and cardiovascular diseases.<sup>4</sup> The global prevalence of obesity has been increasing,<sup>5</sup> and according to the most recent report, Türkiye, a middle-income Eastern Mediterranean country, has the highest prevalence of overweight and obese individuals in the European region.<sup>6</sup> The relationship between FI and obesity is mediated by many factors, including diet. Households experiencing FI were reported to have unhealthier diets than food-secure households, with higher consumption of fast food and sugary drinks and lower consumption of vegetables and fruits.<sup>7</sup> As FI increases, the consumption of nutrient-rich milk, vegetables and fruits decreases while the consumption of foods with high energy density and low nutrient content increases.<sup>8</sup>

Sustainable nutrition refers to the ability to meet the nutritional needs of current populations without reducing the ability of future generations to meet their needs and without harming the environment and natural assets. Sustainable diets are nutritionally adequate, safe, healthy, culturally acceptable, accessible, economically fair and affordable, while also maximizing human and natural resources. They are also protective and respectful of ecosystems and biodiversity.<sup>9</sup> Accordingly, sustainable dietary options that take into account the economic, health and sustainable aspects of food consumption are expected to alleviate FI and the health burden that it causes.<sup>10</sup> Unsustainable food systems often fail to provide the amount or type of food needed to maintain population health, leading to FI and obesity as a result of unhealthy diets.<sup>11</sup> Unsustainable and unhealthy diets can lead to overweight, obesity and obesity-related health problems, jeopardize food resources for current and future generations and cause irreversible environmental problems.<sup>12,13</sup>

This study aims to define FI, sustainable and healthy eating behaviors and obesity among individuals over 19 years of age in Türkiye and to determine FI in relation to sustainable healthy eating behaviors and obesity.

## MATERIALS AND METHODS

**Ethics Committee Approval:** Ethics committee approval was received from the Ondokuz Mayıs University Ethics Committee (Date: 11/01/2023, decision no: 2022/584). The study was planned under the Helsinki Principles.

**Study Design and Participants:** This is a descriptive, cross-sectional study. The study sample was determined using a convenience sampling method. The study was conducted between March 2023 and May 2023 at Ondokuz Mayıs University in Samsun, Türkiye. Data were collected via the online survey method. The study was based on volunteers, and the subjects were included after having given their informed consent. Following the announcement of the survey via social media and messaging applications, individuals who consented to participate were included. Individuals under the age of 19 (children and adolescents) and pregnant women were excluded from the study. A sample size calculation was performed by calculating the effect size based on the data from the study, which found a significant difference between the diet quality scores of individuals with high and very low levels of FI.<sup>14</sup> The sample size was calculated using G\*Power software: employing a one-tailed analysis with a 0.33 effect size and applying a power of 0.95 and a significance level of 0.05. This resulted in a sample size of 394.

**Measures:** Participants' characteristics (i.e., gender, age, marital status, education degree, smoking status, income/expenditure balance) were noted. The participants were grouped into four categories: 19–34 years, being young adults; 35–49 years, being early middle-aged adults; 50–64 years, being late middle-aged adults; 65+, being old age. These age cut-off points have been chosen so they represent the life phases of the adult life span based on a previous study by Franssen et al. and the United Nations' definition of old age.<sup>15,16</sup> Self-reported body weight (kg) and height (cm) values of the participants were recorded, and body mass index (BMI) was calculated by dividing body weight (kg) by height squared (m<sup>2</sup>). According to the World Health Organization classification, underweight was defined as <18.50 kg/m<sup>2</sup>, normal weight as 18.50–24.99 kg/m<sup>2</sup>, overweight as 25.00–29.99 kg/m<sup>2</sup> and obesity as ≥30.00 kg/m<sup>2</sup>.<sup>17</sup>

The Food Insecurity Experience Scale (FIES), which was developed by the Food and Agriculture Organization of the United Nations<sup>18</sup> to measure FI at the individual level, was used to measure FI in this study. The scale has been translated into many languages, including Turkish,<sup>1,19</sup> and used in Turkey Nutrition and Health and Health Survey (TNHS) 2017.<sup>20</sup> The measurement is based on the circumstances and behaviors that respondents to an 8-item

questionnaire reported, which resulted from their inability to access food due to a lack of money or other resources. Responses are coded as 1 for “yes” or 0 for “no”.<sup>1</sup> Those who answered no to all 8 items were defined as food-secure, while those who answered yes to at least one item were identified as food-insecure. While defining groups based on food security, this study focused on the dichotomous variable: being food-secure versus being food-insecure, based on a previous study.<sup>21</sup>

The Sustainable and Healthy Eating Behaviors Scale (SHEBS) was applied to evaluate sustainable and healthy eating behaviors. The scale was created based on the LiveWell method, the FAO definition of a sustainable diet, and the essentials of sustainable and healthful eating practices.<sup>22</sup> The scale’s Turkish version’s validity was assessed by Koksall et al.<sup>23</sup> The scale consists of 32 items in total, with responses on a seven-point Likert scale ranging from never to always. The items are divided into the following seven components: considering quality labels and choosing regional and organic foods, consuming seasonal food and avoiding food waste, reckoning with animal welfare, reduction of meat consumption, choosing healthy foods and aiming for a balanced diet, favoring local food, and choosing low-fat foods. Higher scores on this scale indicate higher numbers of sustainable and healthy eating behaviors. Cronbach’s alpha coefficient was reported as 0.90 for the whole scale and 0.61-0.82 for the subscales.

**Statistical Analyses:** Data analysis was performed in the IBM Statistical Package for the Social Sciences

(SPSS), Version 24. The study variables were described using percentages, frequencies, means, and standard deviations. The independent samples t-test and the one-way analysis of variance (One-Way ANOVA) test, followed by the Bonferroni post hoc test, were conducted to identify differences in SHEBS scores based on participant characteristics. Chi-square tests were applied to report differences in rates of FI and obesity according to the characteristics of the participants. Linear regression models were evaluated to determine associations between FI (independent variable) and sustainable and healthy eating behaviors (total and component scores of SHEBS) as dependent variables. Binary logistic regression models were administered to investigate the associations between FI (independent variable) and obesity as the dependent variable. Models adjusted for gender, age, marital status, and education degree. The results were evaluated at the 95% confidence interval and the significance level of  $p < 0.05$ .

## RESULTS

A total of 461 individuals, mostly women (67.0%) and the majority of whom were between the ages of 19-34 (37.5%), participated in the study. The participants were mainly married (54.7%), graduates of high school and above (67.9%) and non-smokers (73.5%). They mostly (80.5%) had an income that was equal to or more than their expenditure. Most individuals (39.0%) had a normal weight, while the overweight rate was 33.6% (Table 1).

**Table 1.** Demographic information.

Characteristics	Data n (%)
<b>Gender</b>	Women 309 (67.0)
	Men 152 (33.0)
<b>Age</b>	19-34 years 173 (37.5)
	35-49 years 99 (21.5)
	50-64 years 95 (20.6)
	65+ years 94 (20.4)
<b>Marital status</b>	Single 209 (45.3)
	Married 252 (54.7)
<b>Education degree</b>	Middle school and below 148 (32.1)
	High school and above 313 (67.9)
<b>Smoking status</b>	Yes 122 (26.5)
	No 339 (73.5)
<b>Income/expenditure balance</b>	More 113 (24.5)
	Equal 258 (56.0)
	Less 90 (19.5)
<b>BMI categories</b>	Underweight 24 (5.3)
	Normal weight 180 (39.0)
	Overweight 155 (33.6)
	Obesity 102 (22.1)

BMI: Body Mass Index.

Table 2 shows that 42.5% of the participants were food-insecure and that the rate of participants with obesity was 22.1%. The SHEBS score differed according to gender (higher among women), age (higher among older ages), marital status (higher among married people) and education degree (higher among middle-school graduates and below) ( $p<0.001$ ). The obesity rate differed according to age (higher among older ages), marital status (higher among married people) and education degree (higher among middle-school graduates and below) ( $p<0.001$ ). Moreover, food-insecure participants had lower rates of obesity than those who were food-secure (15.8% vs. 26.8%;  $p=0.005$ ). The FI rate dif-

fered significantly by age. Accordingly, the rate of FI was higher in individuals aged 19–34 years (50.9%) than in individuals aged 35–49 years (36.4%) and 65 years and over (34.0%) ( $p=0.03$ ).

The two models (unadjusted and adjusted) for linear regression indicated associations between FI (independent variable) and SHEBS (total and component scores). There were no significant associations between FI and SHEBS total scores in the unadjusted ( $B=-1.133$ , SE: 2.396,  $\beta=-0.026$ ,  $p=0.58$ ) and the adjusted model ( $B=1.144$ , SE: 2.249,  $\beta=0.022$ ,  $p=0.61$ ). Furthermore, there were no significant associations between FI and SHEBS component scores (Table 3).

**Table 2.** SHEBS scores, food insecurity and obesity rates by characteristics.

Characteristics		SHEBS score <sup>1</sup>		Obese <sup>2</sup>		Food-insecure <sup>2</sup>	
		Mean±SD	p-value	n (%)	p-value	n (%)	p-value
<b>Total</b>		131.7±25.4		102 (22.1)		196 (42.5)	
<b>Gender</b>	Women	134.8±23.4	<b>0.001</b>	68 (22.0)	0.93	134 (43.4)	0.60
	Men	125.4±28.1		34 (22.4)		62 (40.8)	
<b>Age</b>	19-34 years	122.7±26.7 <sup>a</sup>	<b>0.001</b>	7 (4.0) <sup>a</sup>	<b>0.001</b>	88 (50.9) <sup>a</sup>	<b>0.03</b>
	35-49 years	132.0±21.7 <sup>b</sup>		21 (21.2) <sup>b</sup>		36 (36.4) <sup>b</sup>	
	50-64 years	138.3±23.6 <sup>bc</sup>		37 (38.9) <sup>c</sup>		40 (42.1)	
	65+ years	141.3±23.0 <sup>cd</sup>		37 (39.4) <sup>c</sup>		32 (34.0) <sup>b</sup>	
<b>Marital status</b>	Single	124.8±26.7	<b>0.001</b>	23 (11.0)	<b>0.001</b>	106 (50.7)	<b>0.001</b>
	Married	137.5±22.8		79 (31.3)		90 (35.7)	
<b>Education degree</b>	Middle school and below	141.9±21.8	<b>0.001</b>	62 (41.9)	<b>0.001</b>	53 (35.8)	<b>0.05</b>
	High school and above	126.9±25.6		40 (12.8)		143 (45.7)	
<b>Smoking status</b>	Yes	127.9±27.9	<b>0.05</b>	20 (16.4)	0.08	52 (42.6)	0.98
	No	133.1±24.4		82 (24.2)		144 (42.5)	
<b>Food security</b>	Food-insecure	130.9 ± 24.1	0.58	31 (15.8)	<b>0.005</b>		
	Food-secure	132.3 ± 26.4		71 (26.8)			

SHEBS: Sustainable and Healthy Eating Behaviors Scale; Score range for SHEBS is 32–224; SD: Standard Deviation; <sup>1</sup>Independent samples t-test results are displayed except for the age variable. One-way analysis of variance followed by Bonferroni post hoc test used for age. Different letters indicate differences between groups after post hoc tests (Bonferroni test results); <sup>2</sup>Chi-square test results; <sup>a,b,c,d</sup>: Different letters indicate differences between groups.

**Table 3.** Linear regression results of associations between food insecurity (independent variable) and Sustainable and Healthy Eating Behaviors Scale (SHEBS) total and component scores as dependent variables.

Dependent variables		Independent variable: Food security (ref. food-secure)					
		Model 1 (Unadjusted)			Model 2 (Adjusted)		
		B (SE)	$\beta$	p-value	B (SE)	$\beta$	p-value
<b>SHEBS total score</b>		-1.333 (2.396)	-0.026	0.58	1.144 (2.249)	0.022	0.61
<b>SHEBS components</b>	Quality labels (regional and organic)	-0.438 (0.700)	-0.029	0.53	-0.035 (0.679)	-0.002	0.96
	Seasonal food and avoiding food waste	-1.181 (0.660)	-0.083	0.07	-0.334 (0.606)	-0.024	0.58
	Animal welfare	0.267 (0.497)	0.025	0.59	0.628 (0.492)	0.059	0.20
	Meat reduction	0.197 (0.353)	0.026	0.58	0.445 (0.342)	0.059	0.19
	Healthy and balanced diet	0.030 (0.398)	0.003	0.94	0.192 (0.398)	0.023	0.63
	Local food	-0.621 (0.407)	-0.071	0.13	-0.291 (0.388)	-0.033	0.45
	Low fat	0.413 (0.303)	0.063	0.17	0.538 (0.305)	0.083	0.08

SHEBS: Sustainable and Healthy Eating Behaviors Scale.; Model 1: Unadjusted model.; Model 2: Model adjusted for gender, age, marital status, and education degree.

As displayed in Table 4, FI was associated with a lower risk of obesity in the unadjusted model (OR=0.513, 95%CI:0.321–0.822,  $p=0.005$ ). However, after adjusting for gender, age, marital status and

education degree, the regression analyses indicated that FI was no longer associated with obesity (OR=0.625, 95%CI:0.376–1.039,  $p=0.07$ ).

**Table 4.** Binary logistic regression results of associations between food insecurity (independent variable) and obesity as dependent variable.

Dependent variable	Independent variable: Food security (ref. food-secure)					
	Model 1 (Unadjusted)			Model 2 (Adjusted)		
	B	OR (CI 95%)	p-value	B	OR (CI 95%)	p-value
Obesity (ref. non-obese)	-0.667	0.513 (0.321–0.822)	<b>0.005</b>	-0.469	0.625 (0.376–1.039)	0.07

Model 1: Unadjusted model; Model 2: Model adjusted for gender, age, marital status, and education degree. Note: The OR lower than 1 indicates the independent variable (being food-insecure) is associated with a lower risk of the dependent variable (being obese).

## DISCUSSION AND CONCLUSION

FI causes unsustainable dietary behaviors, such as insufficient consumption of fruits and vegetables and increased consumption of ultra-processed foods, leading to increasing rates of obesity and obesity-related non-communicable diseases.<sup>2,4,8</sup> Global food affordability has been negatively affected by the COVID-19 epidemic and rising international conflicts, which have worsened FI.<sup>3</sup> All these factors suggest that the rates of FI and its nutritional consequences (e.g. unsustainable dietary behaviors and obesity) should be analyzed in Türkiye. The present study revealed a high rate of FI (42.5%). After adjusting for gender, age, marital status and education degree, FI was not significantly associated with obesity. Additionally, FI was not associated with sustainable and healthy eating behaviors in the present study.

By 2024, the FAO had reported a global prevalence of FI of 28.9%.<sup>18</sup> In a recent study from Türkiye, the household FI rate was found to be 24.4 per cent,<sup>24</sup> which is considerably lower than that found in the present study, in which FI at the individual level was 42.5%. In the previous study,<sup>24</sup> the education level of individuals (approximately 80 per cent had a university education) was much higher than that in the current study (67.9% had high school and above education). Considering the adverse association between a lower education level and FI,<sup>25</sup> this may explain the higher level of FI in the current study than in the previous study. The rate of obesity in this study (22.1%) was lower than that in the most recent TNHS 2017 study (34.1%).<sup>20</sup> This may be due to the participation of a large proportion (37.7%) of young people. The SHEBS scores of the individuals who participated in the study ( $131.7 \pm 25.4$ ) were found to be at a moderate level (score range: 32–224) and were similar to those reported by previous studies conducted in Türkiye.<sup>26,27</sup>

The increase in consumption of unsustainable diets with highly processed food due to convenience, cost and taste is leading the world's population towards a more processed, easier and less varied, low-quality diet, resulting in a large proportion of the world's population being undernourished in terms of nutrients.<sup>9</sup> Sustainable nutrition emphasizes a healthy and balanced diet rich in nutrients, while limiting sugar and artificial ingredients.<sup>22</sup> Studies have shown the negative effect of FI on overall diet quality. A study highlighted that food-insecure women eat less healthy foods, such as vegetables, fruits, while eating higher unhealthy foods such as processed meat and sweets. Therefore, this unsustainable, low-quality diet has been linked to FI.<sup>28</sup> Another research identified a significant association between FI and poor diet quality in low-income adults.<sup>8</sup> The results of the studies on the relationship between FI and dietary environmental impact vary. Unlike the similar study conducted in Türkiye, which found a negative relationship between FI and sustainable eating behaviors with low environmental impact,<sup>24</sup> this study found no relationship between FI and these behaviors. Similar to the present study, research conducted among French adults did not find a relationship between FI and sustainable diets.<sup>29</sup> In this study, individuals' knowledge about sustainable nutrition and access to a sustainable diet were not investigated. Sustainable nutrition and sustainable diets are relatively new concepts-and knowledge of the subject and accessibility of sustainable foods are necessary to implement these behaviors. These and other factors that may affect adherence to sustainable dietary behaviors should be investigated in future studies while assessing the relationship with FI. In this study, no association was found between FI and obesity. FI is predicted to cause weight gain by increasing the consumption of unhealthy foods and leading to obesity and related health consequenc-

es.<sup>28,4</sup> However, previous studies have not shown a constant relationship between FI and obesity. A past study on women did not find an association between FI and BMI and other anthropometric measurements (waist circumference, fat mass) indicative of obesity.<sup>28</sup> Another study reported that the relationship between FI and obesity is particularly evident in women living in high-income countries.<sup>3</sup> Here, FI levels of the food-insecure individuals may also be contributing factors. To explain, while obesity is an expected outcome for individuals who are mildly food-insecure and have access to unhealthy, high-calorie, high-fat foods, it may not be an expected outcome in the short term for individuals who are severely food-insecure (at the hunger level). In the current study, it is difficult to make an inference as FI levels were not determined. In a study conducted among university students in Türkiye, no relationship was found between food security level and body weight.<sup>30</sup> The relationship between FI and obesity has been shown in children and young people but has not yet been determined in young adults and the elderly, but it has been pointed out that more research is needed.<sup>3</sup> Lastly, food-insecure individuals have a high risk of poor mental health, such as stress, anxiety and depression, which may possibly mediate the association of FI to obesity through increased consumption of high-calorie, high-fat, unhealthy foods.<sup>3,25</sup>

There are limitations to be mentioned regarding this study. First, the cross-sectional design of the study could not demonstrate causation. Second, the individuals participating in the study were not homogeneously distributed according to age groups. Finally, it relied on self-reporting, so participants' responses might have been subject to social-desirability bias.

In conclusion, this study reported a high level of FI in the Turkish population. However, sustainable and healthy eating behaviors and obesity did not vary according to FI. It is anticipated that the negative effects of FI will be clearer in the coming years. Obesity is a condition that requires a process, and the effects of FI will become evident, particularly among the currently young population. Longitudinal studies showing the effects of FI on obesity and health, especially in children and young people, are needed. Sustainable diets have been proposed as low-budget and affordable diets to tackle FI. Therefore, efforts to make sustainable diets economically advantageous and to increase accessibility to these diets may be useful for reducing FI and its negative consequences in Türkiye and other countries.

**Ethics Committee Approval:** Ethics committee approval was received from the Ondokuz Mayıs University Ethics Committee (Date: 11/01/2023, decision no: 2022/584). The study was planned under the

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**Author Contributions:** Concept – GÜ; Supervision – GÜ; Materials – GÜ; Data Collection and/or Processing – GÜ; Analysis and/or Interpretation – GÜ; Writing – GÜ.

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