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THE RELATIONSHIP BETWEEN FOOD INSECURITY AND OBESITY IN UNIVERSITY EMPLOYEES: A CROSS-SECTIONAL STUDY  
ÜNİVERSİTE PERSONELİNDE BESİN GÜVENCESİZLİĞİ İLE OBEZİTE İLİŞKİSİ: KESİTSEL BİR ÇALIŞMA\*

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Food insecurity is the lack of availability or access to safe and healthy food due to limited resources and is a nutritional factor associated with obesity. We aimed to evaluate the relationship between food insecurity and obesity in university employees. This study was conducted among 142 administrative employees of a private university between January 2020 and October 2020. Data was collected with Household Food Security Survey Module-Short Form (HFSSM-SF), and anthropometric measurements and socio-demographic characteristics were recorded. Of the participants 39.4% were overweight, and 21.8% were obese. 64.1% of the individuals were food secure, and 35.9% were food insecure. There was no statistically significant relationship between body mass index (BMI) classes or waist circumference (WC) categories and both food accessibility levels and food security status ( $p>0.05$ ). A weak significant positive relationship existed between the BMI ( $\text{kg}/\text{m}^2$ ) and HFSSM-SF scores ( $r=0.219, p=0.009$ ). As the risk of inaccessibility of food increased, the BMI of the participants increased. According to the data collected with the HFSSM-SF, it has been determined approximately one-third of the employees experience food insecurity. It is crucial to develop policies that will contribute to preventing food insecurity with the necessary investigations and future studies.

**ÖZ**

Besin güvensizliği, kaynakların yetersizliği nedeniyle güvenli ve sağlıklı yiyeceklerin bulunamaması veya bunlara erişimin olmaması durumudur. Beslenme ile ilgili bir faktör olan besin güvensizliği aynı zamanda obezite ile ilişkilidir. Bu çalışmada üniversite çalışanlarında besin güvensizliği ve obezite ilişkisini incelemek amaçlanmıştır. Çalışma, Ocak 2020- Ekim 2020 tarihleri arasında bir vakıf üniversitesinde 142 idari personel ile yürütülmüştür. Veriler, Hane Halkı Besine Ulaşılabilirlik Ölçeği- Kısa Formu (HFSSM-SF) ile toplanmış ve antropometrik ölçümlerin yanı sıra sosyodemografik özellikleri kaydedilmiştir. Katılımcıların % 39.4'ünün fazla kilolu ve %21.8'inin obez olduğu saptanmıştır. %64.1'i besin güvencesine sahiptir ve % 35.9'u besin güvensizliği yaşamaktadır. Beden kütle indeksi (BKİ) sınıfı veya bel çevresi sınıfları ile hem besine ulaşım düzeyleri hem de besin güvencesi durumu arasında istatistiksel olarak anlamlı bir ilişki saptanmamıştır ( $p>0.05$ ). Beden kütle indeksi ( $\text{kg}/\text{m}^2$ ) ile HFSSM-SF skoru arasında zayıf derecede anlamlı pozitif bir ilişki vardır ( $r=0.219, p=0.009$ ). Katılımcıların besine ulaşamama riski arttıkça BKİ değerinin de arttığı görülmüştür. Çalışanların HFSSM-SF ile toplanan verilere göre yaklaşık olarak her üçünden birinin besin güvensizliği yaşadığı tespit edilmiştir. Besin güvensizliği ile ilgili gerekli incelemeler ve ileride yapılacak çalışmalarla birlikte besin güvensizliğinin önlenmesine katkı sağlayacak politikaların geliştirilmesi büyük önem arz etmektedir.

**Keywords:** Food access, food insecurity, obesity**Anahtar kelimeler:** Besine erişim, besin güvencesizliği, obezite

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## INTRODUCTION

Food security occurs when individuals have physical and economic access to healthy food in recommended amounts for sustainable general health (1). Household food security is the family dimension of this definition, and individuals in the household are the focus of concern (2). Supposing food is accessible and available in sufficient quantities and variety, the individuals and family can use (store, cook, prepare and share) food appropriately and accepted as food secure (3). In contrast, food insecurity exists when healthy food is unavailable or individuals cannot access healthy food because of inadequate resources and insufficient money (4). On the other hand, obesity is a growing public health problem. The shift in nutritional patterns to Western-type diets and sedentary lifestyles has increased rates of obesity in many countries (5).

Food insecurity and obesity are public health problems with personal and environmental effects (6). Food insecurity is also related to under nutrition and malnutrition. A study using data from the 2007–2008 continuous National Health Nutrition Examination Survey (NHANES) reported that food intake has decreased, and regular eating habits have deteriorated in food-insecure households (7). Food insecurity can affect diet quality differently, potentially leading to being overweight (8). In 1995, Dietz first stated that food-insecure people are more prone to develop obesity (9). Therefore, food insecurity is related to increased adverse health consequences. In recent years, especially in middle and high-resource countries, it has become increasingly evident that food insecurity is often linked to being overweight and obese (10).

Especially for low-income individuals, food insecurity may occur together with obesity (4).

Today, it is seen that the prevalence of overweight and obesity in low-income countries is approaching countries with high-income levels and high obesity rates, such as the United States (U.S.). Among those, although micronutrient deficiencies, particularly vitamins, and minerals, continue at old rates, body weight increases. The reason is assumed to be accessible, inexpensive, but non-nutritive foods (11). In low-income countries, inadequate nutrient intake or nutrient-poor diets cause micronutrient deficiencies and diseases, including obesity, coronary heart disease, stroke, and diabetes (12). One of the explanations for the relationship between food insecurity and obesity is that families with limited resources risk the quality of nutrition in response to high energy intake. Budget constraints may lead to a reduction in healthy food consumption while increasing the purchase of non-nutritious, low-cost, and high-energy-containing foods (13). Individual and household-level analyzes show that food insecurity impairs nutritional quality. Moderate or severe food-insecure people consume less meat, milk, and fruits and vegetables than mild food-insecure individuals indicating that the price and affordability of healthy foods are important factors that affect food security and, therefore, diet quality (8). A systematic review in 2015 examined the relationship between diet quality, food prices, and dietary costs and found that the energy intensity of the diet was inversely correlated with its cost. As this study reveals, processed foods and refined grains are less expensive than fruits,

vegetables, and whole grains, which are emphasized as the main components of a healthy diet (14). Therefore, food insecurity may result in increased consumption of calorie but not nutrient-dense food resulting in increased body weight and non-communicable diseases, including diabetes mellitus, metabolic syndrome, and cardiovascular diseases (15). Moreover, for the ones suffering from food insecurity, when food is available, increased consumption increases body fat with food restriction, decreases lean body mass, increases fat storage in case of food shortages, and, finally, psychological problems, including depression (6).

The NHANES study found that food-insecure individuals had higher Body Mass Index (BMI) and higher Waist Circumference (WC) (16). Similarly, among 66553 individuals in 12 states of the U.S., food-insecure individuals had higher body weights (6). In another study conducted with 754 university students, marginal and low food security status was positively associated with BMI (17).

In this context, it is suggested that several interventions might be developed to maintain a healthy diet and prevent obesity with the awareness of food insecurity and its relationship with obesity. We aimed to evaluate the possible relationship between food insecurity and obesity among private university employees.

## MATERIALS AND METHODS

### Participants and Data Collection

This study was conducted among a private university employee between January 2020 and October 2020. The universe of the study was 339 full-time administrative employees, and the minimum sample size was calculated as 181 with a 5% type 1 error and 95 % confidence interval. Due to the COVID-19 restrictions, data collection ended, and the study was completed with 162 voluntary individuals. The inclusion criteria were being a volunteer, being between the ages of 18-65, being premenopause, not pregnant/lactating for women, not having a disease like hypothyroid that can trigger obesity, and not having a disease like diabetes that requires a specific dietary restriction. After the exclusion, 20 individuals were excluded from the study, and the study was completed with 142 individuals.

Data collection forms were applied through face-to-face interviews with the individuals who agreed to participate in the study. Participants' socio-demographic characteristics and physical activity status were questioned. Physical activity levels were examined at medium intensity for 150 minutes per week as recommended by the World Health Organization (WHO) (18). Household Food Security Survey Module- Short Form (HFSSM-SF) was applied to evaluate food security. Anthropometric measurements of the individuals (height, body weight, waist circumferences) were performed. BMI was calculated as  $\text{kg}/\text{m}^2$ .

Researchers developed HFSSM-SF at the National Center for Health Statistics (19), and its Turkish validity and reliability were also performed (20). It consists of 6 items questioning the sufficiency of food intake in the previous 12 months, attainment of balanced meals, and occurrence of skipping meals despite being hungry because of economic deficiency. The score on the scale ranges from 0 to 6. The score on the scale ranged from 0

to 6. If the score was 0, it was interpreted as high food security. If the score was 1, it was interpreted as marginal food security (there was a risk for accessibility to food). If the score was 2-4, it was interpreted as low food security (no access to food, but this situation was not accompanied by hunger). If the score was 5-6, it was interpreted as very low food security (food was not attainable, and this was accompanied by moderate hunger) (20).

The participants' body weights in kilogram (kg) were measured without shoes, metal items, wallets, key rings, telephones, etc., on flat and hard ground by the researcher. Height in centimeter (cm) measurement was performed while the individuals were in the upright position and the head was in the Frankfort plane, the heels, hip, and back were based on the wall, and their feet were adjacent to the wall from the heels by the researcher. BMI was calculated with  $\text{weight}/(\text{height})^2$  and classified regarding the Centers for Disease Control (CDC) criteria (21).

Participants' WC was measured, and a  $\text{WC} \geq 102$  cm for men and  $\leq 88$  cm for women was considered an increased risk (22).

Due to the emergence of the Covid-19 pandemic, some participants' height and body weight were taken based on the statement, and the WC of 79 participants was obtained.

#### Statistical Analyses

Statistical Package for the Social Sciences software 22 program was used to analyze the data. Numerical variables were evaluated with mean, standard deviation, minimum-maximum (min-max) values, and categorical variables with frequency (n) and percentages (%). The distribution of normality was tested by the Shapiro-Wilk test. The Chi-square test was used to describe the relationship between two qualitative variables. Spearman Correlation Coefficient was also used to evaluate the relationships between independent variables. A p-

**Table I.** Characteristics of the participants.

		Women		Men		Total	
		n	%	n	%	n	%
<b>Marital Status</b>	Single	27	40.9	24	31.6	51	31.5
	Married	39	59.1	52	68.4	91	68.5
<b>Number of Children</b>	No Child	30	45.4	38	51.3	68	47.9
	1	16	24.2	14	18.9	30	21.1
	2	18	27.3	12	16.2	30	21.1
	3 and more	2	3.0	10	13.5	14	9.9
<b>Educational Status</b>	Primary School Graduate	8	12.1	16	21.1	24	16.9
	Secondary School Graduate	6	9.1	9	11.8	15	10.6
	High School Graduate	7	10.6	21	27.6	28	19.7
	University Graduate	45	68.2	30	39.5	75	52.8
<b>Income Level</b>	Income More Than Expenditure	3	4.5	13	17.1	16	11.3
	Income Less Than Expenditure	36	54.5	28	36.8	64	45.1
	Income Equal with Expenditure	27	40.9	35	46.1	62	43.6
<b>Physical Activity</b>	Yes	21	31.8	26	34.2	47	33.1
	No	45	68.2	50	65.8	95	68.9
<b>Physical Activity Duration</b>	<150 minutes per week	11	16.7	21	27.6	32	23.3
	$\geq 150$ minutes per week	10	15.2	7	9.2	17	12.6

value  $<0.05$  is accepted as statistically significant.

#### Ethics approval

This study was performed with the ethical approval of Yeditepe University Clinical Researches Ethics Committee, dated 31.12.2019, and number 1140.

#### RESULTS

Among the participants, 50.6% were women, and 49.4% were men. The age of the individuals varied between 21 and 63 years, and the mean age was  $37 \pm 7.86$  years. The general characteristics of the participants, as well as their physical activity status, are shown in Table I. 38.7% of the participants had a healthy BMI; 39.4% were overweight, and 21.8% were obese; 51.9% of the individuals had normal WC, and 48.1% had increased WC.

38.7% of individuals had access to food, 25.3% had a risk of access to food, 26.0% were unable to reach food, but hunger was not accompanied, and 10.1% of them could not reach food and were in moderate hunger. According to these distributions, 64.1% of the individuals were food secure, and 35.9% were food insecure (Table II).

While food security is significantly related to having children ( $p < 0.05$ ), and food security increased as the educational status increased ( $p < 0.001$ ). There was no significant relationship between food security status and the marital status of individuals ( $p > 0.05$ ); there was also a statistically significant relationship between food security and income level ( $p < 0.05$ ). Food insecurity increased as the income level decreased (Table III).

The relationship between BMI, WC, and access to food is examined in Table IV. No statistically significant relationship existed between BMI values, WC, and food accessibility levels ( $p > 0.05$ ).

There was no statistically significant relationship between individuals' BMI and WC classification and their food security status ( $p > 0.05$ ) (Table V). However, the

**Table II.** Distribution of individuals' access to food and food security status.

		n	%
<b>Access to Food</b>	<b>Food is accessible (High food security)</b>	55	38.7
	<b>There is a risk for accessibility to food (Marginal Food Security)</b>	36	25.3
	<b>No access to food, but this situation was not accompanied by hunger (Low food security)</b>	37	26.0
	<b>Food was not attainable, and this was accompanied by moderate hunger (Very low food security)</b>	14	10.1
<b>Food Security Status</b>	<b>Food Secure</b>	91	64.1
	<b>Food Insecure</b>	51	35.9

**Table III.** The relationship between demographic characteristics and food security.

		Food Secure		Food- Insecure		p*
		n	%	n	%	
<b>Marital Status</b>	Single	37	40.7	14	27.5	0.115
	Married	54	59.3	37	72.5	
<b>Having Children</b>	No	50	54.9	18	35.3	0.025*
	Yes	41	45.1	33	64.7	
<b>Educational Status</b>	Primary School Graduate	6	6.6	18	35.3	<0.001*
	Secondary School Graduate	10	11.0	5	9.8	
	High School Graduate	17	18.7	11	21.6	
	University Graduate	58	63.7	17	33.3	
<b>Income Level</b>	Income More Than Expenditure	10	11.0	6	11.8	0.010*
	Income Less Than Expenditure	33	36.3	31	60.8	
	Income Equal with Expenditure	48	52.7	14	27.5	

Pearson Chi-square test.

\*p<0.05 is accepted as statistically significant.

**Table IV.** The relationship between Body Mass Index (BMI), Waist Circumference (WC) classes, and Level of Access to Food

		Food is accessible	There is a risk for accessibility to food	No access to food, but this is not accompanied by hunger	No access to food and this is accompanied by moderate hunger	p*
		n (%)	n (%)	n (%)	n (%)	
<b>BMI</b>	18.5- 24.9 kg/m <sup>2</sup>	23 (41.8)	16 (44.4)	15 (28.1)	1 (7.1)	0.079
	25.0- 29.9 kg/m <sup>2</sup>	25 (45.5)	12 (33.3)	11 (29.7)	8 (57.1)	
	≥ 30 kg/m <sup>2</sup>	7 (12.7)	8 (22.2)	11 (29.7)	5 (35.7)	
<b>WC</b>	Normal	17 (60.7)	10 (52.6)	11 (52.4)	3 (27.3)	0.314
	High	11 (39.3)	9 (47.4)	10 (57.6)	8 (72.7)	

Pearson Chi-square test.

BMI: Body Mass Index; WC: Waist Circumference

results showed a weakly significant positive relationship between the BMI value (kg/m<sup>2</sup>) and HFFSM-SF score (r=0.219,p=0.009), while there was no significant relationship between the HFFSM-SF score and WC (r=0.156, p=0.169).

#### LIMITATIONS

There are some limitations in this study. Firstly, it was not possible to work with all staff due to Covid-19 and time constraints; thus, the nature of the sample may have affected the findings. Secondly, some of the questions resulted in difficulty in face-to-face data collection. Some participants answered hesitantly, while others refrained from giving the correct answer, especially

when examining the cases of reducing the number/ amount of meals, skipping meals, and not eating despite being very hungry, mainly because of the lack of money.

#### DISCUSSION AND CONCLUSION

Food insecurity is a nutritional factor associated with obesity in low-income individuals (4). A limited budget reduces the access to and intake of healthy foods, including whole grains, fruits, and vegetables. Thus, there might be an increase in the supply of less costly energy-dense foods which are not nutritious. As a description of the effect of food insecurity on increased body weight, households with limited resources prefer the high en-

**Table V.** The relationship between Body Mass Index (BMI), Waist Circumference (WC) classes, and Food Security Status

		Food Secure	Food-insecure	p*
		n (%)	n (%)	
BMI	18.5-24.9 kg/m <sup>2</sup>	39 (42.9)	16 (31.4)	0.104
	25.0-29.9 kg/m <sup>2</sup>	37 (40.7)	19 (37.3)	
	≥30 kg/m <sup>2</sup>	15 (16.5)	16 (31.4)	
WC	Normal	27 (57.4)	14 (43.8)	0.232
	High	20 (42.6)	18 (56.3)	

Pearson Chi-square test.

\*p<0.05 is accepted as statistically significant.

BMI: Body Mass Index; WC: Waist Circumference

ergy they receive over their nutritional quality (13). This study was conducted to examine the relationship between food insecurity and obesity.

Previously, it has been stated that food insecurity is associated with a lack of food and social problems involving socioeconomic and demographic variables (23). We found a significant relationship between having children and food insecurity ( $p<0.05$ ). The relationship between having children and food insecurity may be due to the increased amount of food consumed in the household with children. In addition, an increased number of children will result in increased food costs. Therefore, food-insecure families may have difficulties accessing food. In a study that determined the prevalence of food security situation and associated factors in Iran, food insecurity was associated with the number of household members. Participants with a household size of less than three were found to have significantly greater food security than those with a household size greater than 3 (24).

Regarding nutritious food, price, and affordability are among the most critical barriers to accessing food. Better salary levels may contribute to more substantial financial resources and thus provide better access to food for families. This study found a statistically significant relationship between food security status and income level. Several studies also reported that low-income households living in urban and urban areas increase the risk of food insecurity (25,26). Low-income families are unable to access healthy diets with nutrient-dense foods. Ultra-processed products have a long shelf life, are ready-to-eat, and are relatively inexpensive. Therefore, they result in the intake of excessive amounts of sugar, fat, and highly processed foods with high energy density. This phenomenon is often described as the nutritional transition. It is crucial to stress that these consequences are related to socioeconomic problems (27). The State of Food Security and Nutrition in the World (SOFI) 2020 data reported that diets containing healthy foods cost 60% more than those that meet the needs of essential foods and are five-fold more expensive than diets that meet dietary energy with raw starch supplies (8).

This study found a statistically significant relationship between food security and educational status. Previous studies on food insecurity also reported an increased risk with decreased educational levels (23,28). In a study conducted to examine whether neighborhood conditions affect the household food security status

differently depending on the individual or family characteristics of the residents, it was observed that the neighborhood's educational level and food security spread similarly. As a result, among the low-middle income sample, the family with a high academic status faced the lowest risk of food insecurity in the neighborhoods with the most elevated educational level(29).

Improvements in educational status also provide opportunities for better employment and may increase food security (30). As cognitive abilities develop due to higher academic levels, access to information that can improve the quality of life of all family members may also increase (23). On the other hand, all participants in this study were employees and had regular incomes; however, soaring food prices that depend on several factors worldwide are one of the primary reasons for food insecurity (8,10).

Several studies determined that individuals with food insecurity have higher BMI and WC values (15,29,30). A significant relationship was found in a cross-sectional study with 683 second-year students from 8 universities. Food insecurity was specified as a significant predictor of obesity, and the body weight increased in parallel with the severity of food insecurity (15). Another study with 250 participants in the Netherlands found food insecurity was again associated with obesity (28). Additionally, a study examining the relationship between health and nutritional status and food insecurity determined that individuals with food insecurity had higher WC values than individuals with food insecurity (30).

Similarly, researchers examining food insecurity and adiposity found a significant relationship between food security and WC (31). However, some studies could not conclude with statistically significant results (30,32). For example, in a study, food security was not associated with obesity among 212 food pantry clients (33). In another study investigating whether the prevalence of chronic disease and obesity increases in households with food insecurity, no significant relationship was found (32). We found no significant relationship between BMI and food security, possibly due to our limited sample size. In addition, during the Covid-19 pandemic, the BMI classification made with these data may be inaccurate, as some of our participants reported their body weight and height themselves due to social distance principles. Since the WC measurement could not be continued for the same reason, the WC of a small number of participants was recorded, which may affect

the relationship between WC measurements used to assess obesity and food security status. Additionally, because some participants consumed meals free of charge at the university cafeteria, considering access to food may not have given an accurate result.

Recently, people living in households with marginal food security (risk of access to food) but generally classified as food security also face malnutrition. In this study, those with marginal food security in compliance with the guidelines were accepted as secure (34). However, some studies show that individuals with marginal food security may also have obesity and other health problems resulting from this situation (17,35). Therefore, having a clear concept of marginal food security is essential. Without a clear conception of marginal food security, the possibility of underestimating the negative health consequences associated with the lack of regular access to adequate food resulting from marginal food insecurity may increase (34).

Many nutritional assistance programs are implemented worldwide to increase people's food access and prevent food insecurity. The Supplemental Nutrition Assistance Program (SNAP), the most comprehensive support program in the U.S., aims to supplement households with the money they need to buy food. Individuals willing to benefit from this program must be below a certain income level, and the cards given to those enable them to purchase food and plants for home use and production (36). The food insecurity rate of households participating in this program was 30% less than those who did not (37). Another example of an assistance program is the Emergency Food Assistance Program (TEFAP). This program aimed to support the diet of low-income or unemployed Americans for free. The State Distribution Agencies distribute nutritious food to those eligible for the program (38).

We found no significant relationship between food insecurity and obesity. However, it was observed that as the BMI of the participants increased, the risk of access to food increased. In addition, food insecurity and the percentage of obese individuals among food-insecure of administrative staff were found to be substantial. It is crucial to carry out the necessary investigations and provide support to prevent the food insecurity experienced by the employees. Studies in larger populations are needed to better understand food insecurity and its relations with obesity.

#### Conflict of Interest

The authors have no conflicts of interest to disclose, and this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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