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The Relationship Between Obesity with Depression and Anxiety Levels: a Cross-Sectional, Case-Control Study

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ABSTRACT

Aim: This study aims to investigate the relationship between obesity and depression and anxiety by determining the depression and anxiety levels of obese and non-obese patients.

Material and Methods: This study was carried out between 01.02.2022 and 30.04.2022 at Samsun University Faculty of Medicine. Among all the patients registered in the obesity center, 110 patients who met the inclusion criteria and 110 non-obese patients who applied to the family medicine clinic as the control group were included in the study. Data were collected through a questionnaire formed using sociodemographic characteristics, Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI).

Results: The study encompassed of 220 patients, among whom 144 individuals (constituting 65.5% of the sample) were identified as female. Depression and anxiety levels were higher in obese subjects than in non-obese subjects (p=0.020, p=0.040, respectively). Once the body mass index (BMI) groups of the participants were compared according to BDI and BAI, severe depression symptoms and severe anxiety symptoms higher in the morbidly obese group. The difference between the groups according to both BDI and BAI was found to be statistically significant (respectively; p=0.005, p=0.008). The presence of moderate and severe depression and anxiety symptoms were determined as independent risk factors for the development of obesity (respectively; OR=5.329, 95% CI 2.98-13.41, p=0.012; OR=3.452, 95% CI 1.56-7.89, p=0.023).

Conclusion: This study revealed that the prevalence of depression and anxiety symptoms was found to be high in obese individuals. It was observed that as BMI increased, the severity of depression and anxiety symptoms increased.

Keywords: *Obesity, Depression, Anxiety, Morbid obesity*

Obezite ile Depresyon ve Anksiyete Düzeyleri Arasındaki İlişki: Kesitsel, Vaka Kontrol Çalışması

ÖZ

Amaç: Bu çalışma, obez ve obez olmayan hastaların depresyon ve anksiyete düzeylerini belirleyerek obezite ile depresyon ve anksiyete arasındaki ilişkiyi araştırmayı amaçlamaktadır.

Gereç ve Yöntemler: Bu çalışma 01.02.2022-30.04.2022 tarihleri arasında Samsun Üniversitesi Tıp Fakültesi'nde gerçekleştirildi. Obezite merkezine kayıtlı tüm hastalardan dahil edilme kriterlerini karşılayan 110 hasta ve kontrol grubu olarak aile hekimliği kliniğine başvuran obez olmayan 110 hasta çalışmaya alındı. Veriler, sosyodemografik özellikler, Beck Depresyon Envanteri (BDÖ) ve Beck Anksiyete Ölçeği (BAÖ) kullanılarak oluşturulan anket aracılığıyla toplanmıştır.

Bulgular: Çalışmaya %65,5'i (n=144) kadın olmak üzere toplam 220 hasta dahil edildi. Depresyon ve anksiyete düzeyleri obezlerde obez olmayanlara göre daha yüksekti (sırasıyla p=0,020, p=0,040). Katılımcıların beden kütle indeksi (BKİ) grupları BDÖ ve BAÖ'ye göre karşılaştırıldığında, morbid obez grupta şiddetli depresyon semptomları ve şiddetli anksiyete semptomları daha yüksekti. Gruplar

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arasındaki fark hem BDÖ hem de BAÖ açısından istatistiksel olarak anlamlı bulunmuştur (sırasıyla; p=0,005, p=0,008). Orta ve şiddetli depresyon ve anksiyete semptomlarının varlığı, obezite gelişimi için bağımsız risk faktörleri olarak belirlendi (sırasıyla; OR=5,329, p=0,012; OR=3,452, p=0,023).

Sonuç: Bu çalışma, obez bireylerde depresyon ve anksiyete belirtilerinin yaygınlığının yüksek olduğunu ortaya koymuştur. BKİ arttıkça depresyon ve anksiyete belirtilerinin şiddetinin arttığı görülmüştür.

Anahtar Sözcükler: *Obezite, Depresyon, Anksiyete, Morbid obezite*

INTRODUCTION

According to the definition of the World Health Organization (WHO), obesity is defined as abnormal and excessive fat accumulation in the body that presents a risk to health (1). While the ratio of adipose tissue to body weight is 15-18% in adult male whereas this ratio is 20-25% in female. If this rate exceeds 25% in male and 30% in female, the condition is considered obesity (2). Although there are several methods to define and classify obesity, body mass index (BMI) is most commonly used in clinical practice BMI is computed through the division of an individual's weight in kilograms by the square of their height in meters (kg/m^2). Adults with a BMI over 30 kg/m^2 are considered obese (3).

Obesity is the second most important cause of preventable death after smoking. While it was previously deemed as a problem only in developed countries, it has now become a significant public health problem in developing countries. According to WHO data, 39% of adults are overweight and 13% are obese in 2016 (4). Similar to the adult obesity rate, the prevalence of obesity increases in childhood and adolescence. While the rate of obesity between the ages of 5-19 was less than 1% in 1975, this rate reached 6% for girls and 8% for boys in 2016 (5). When the results of the Turkey Diabetes Obesity and Hypertension Epidemiology Study-I (TURDEP-I), which examined the prevalence of obesity with 24788 participants in 15 provinces between 1997-1998, the general obesity prevalence was 22.3%, the prevalence of obesity was 30% in female, and the prevalence of obesity was 13% in male (5). 12 years later, in the TURDEP-II study, the prevalence of obesity was determined as 44% in female and 27% in male, and it was determined that it increased by 34% in female and 107% in male (6).

Obesity is a risk factor for many medical conditions, including endocrine and metabolic disorders, certain cancers, and cardiovascular diseases, resulting in impaired quality of life and increased mortality (7, 8). In addition to these clinical problems, it is known that many individuals experience psychological and psychosocial problems. These problems adversely affect the treatment compliance process and the motivation of patients to lose weight (9). The negative attitude and prejudice of society towards obese individuals contribute to the development of anxiety, depression, hatred, and guilt in individuals (10). Depression and anxiety are the most common psychiatric disorders among obese patients, and it has been reported that there is a bidirectional relationship between them (11, 12). It has been observed that the stress experienced by depressive patients causes obesity with both psychological and physiological mechanisms (11). It has been observed that patients diagnosed with depression demonstrate a decrease in physical activity and have a predisposition to obesity with inappropriate nutrition. Similarly, problems such as low self-esteem, lack of self-confidence, exclusion from social life, and depression may develop in obese patients (11).

Given the collective impact of obesity as well as depression and anxiety on the worldwide disease burden, gaining insight into the correlation between obesity and the occurrences of depression and anxiety has turned into a pivotal necessity. Obesity, depression, and anxiety problems have a rather significant place among the complaints of patients in primary care. For this reason, family physicians' understanding of the relationship between obesity and depression, and anxiety may contribute to the simultaneous treatment of patients and their physical and psychological recovery.

Obesity centers are task oriented established centers that enable people to reach and maintain their ideal weight by offering and bringing in lifestyle changes. The primary objective of these obesity institutes revolves around assisting patients in achieving their optimal weight and imparting accurate lifestyle adjustments. The patients are trained by physicians, dieticians, physiotherapists, psychologists, and the nurses in charge of the centers over a 3-month period (13).

The number of studies determining the level of depression and anxiety in patients registered with the obesity center is few. The aim of our study is to investigate the relationship between obesity and depression and anxiety by determining the depression and anxiety levels of patients with a diagnosis of obesity registered in our obesity center and patients with normal weight who applied to our family medicine clinic for any reason.

MATERIALS and METHODS

Our study was carried out between 01.02.2022 and 30.04.2022 at Obesity Clinic and Family Medicine Clinic. Ethics committee approval was obtained with the Ethics Committee decision no. 2021/21/5 of Samsun Training and Research Hospital Clinical Research Ethical Committee.

The research is observational, cross-sectional, analytical, and control group type. Inclusion criteria for the study were determined as participants being older than 18 years of age, voluntarily agreeing to participate in the study, not having any serious physical or mental problems that could block communication and having a BMI ≥30 kg/m² for obese patients and BMI <30 kg/m² for non-obese patients. Power analysis was performed according to similar studies in the literature, and the minimum number of patients planned to be included in the study was calculated as 103 for each group. 110 obese individuals who met the inclusion criteria and whose consent was obtained, and 110 non-obese individuals who applied to the family medicine clinic as the control group were included in the study. The control group was selected as having similar characteristics with the case group. Each individual was first informed about the content of the study, and questionnaires were filled in by face-to-face interview method. Data were collected through a questionnaire formed using sociodemographic characteristics, Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI).

The BDI was developed by Beck et al. (14). in order to determine the depression levels of the participants in 1961 and its Turkish validity and reliability study was performed by Hisli in 1989 (15). It has 21 items and each item is a Likert-type scale consisting of four options. According to the scores, the degree of depression among the cases was evaluated as normal (0-10 points), mild depression (10-18 points), moderate depression (19-29 points), and severe depression (30-63 points).

The BAI is a self-report scale that determines the frequency of anxiety symptoms (16). Turkish validity and reliability study was performed by Ulusoy et al. and its Cronbach alpha value was reported as 0.93 (17). It is a Likert-type scale consisting of 21 items and scored between 0-3. The high scores obtained from the scale indicate the severity of the anxiety experienced by the individual. A score between the range of 0-7 is considered normal, a score between the range of 8-15 is considered mild anxiety, a score between the range of 16-25 is considered moderate anxiety, and a score between the range of 26-63 is considered severe anxiety.

Data Analysis

IBM SPSS 25.0 (Statistical Package for the Social Sciences) package program was used for data analysis. Shapiro-Wilk normality tests were applied to determine the normality distribution of the data and to predict which test to use. An unpaired two-sample t-test was used for the normal distribution of the two-category variables, and the Mann-Whitney U test was used for the non-normally distributed variables. Descriptive statistics are presented as mean standard deviation, minimum-maximum values, frequency distribution, and percentage. Chi-square and Fisher tests were used to determine the relationship between categorical variables. The independent variables affecting obesity were analyzed by multivariate logistic regression using the enter method. Statistical significance between variables was accepted as $p<0.05$.

RESULTS

A total of 220 patients were included in the study, of which 65.5% (n=144) were women. The mean age of the individuals was 39.2±11.9 (18-68). The mean BMI of obese individuals was determined as 34.12 ±4.9 kg/m², and the mean of non-obese individuals was determined as 25.04 ±2.9 kg/m². When the participants were classified according to their BMI values, 3 (1.4%) were underweight, 51 (23.2%) were normal weight, 56 (25.5%) were overweight, 63 (28.6%) were first-degree obese, 29 (13.2%) second-degree were obese, and 18 (8.2%) were morbidly obese. 34 (15.5%) individuals used alcohol and 71 (32.3%) individuals smoked. When the participants were evaluated in terms of age, gender, and marital status, there was no difference between the two groups diagnosed with and without obesity, but a significant difference was found in the occupational groups. Obesity was significantly higher in non-working and retired participants (p=0.008). The incidence of chronic disease was significantly higher in obese individuals than in non-obese individuals (p=0.018). Chronic disease was detected in 64.1% of those diagnosed with obesity (Table 1).

Depression and anxiety levels were higher in obese subjects than in non-obese subjects (p=0.020, p=0.040, respectively). Obesity was found in 63.8% of participants with moderate depression symptoms and in 69.2% of participants with severe depression symptoms. Similarly, obesity was detected in 62.3% of individuals with moderate anxiety symptoms and in 63.3% of individuals with severe anxiety symptoms (Table 2).

Once the BMI groups of the participants were compared according to BDI and BAI, severe depression symptoms were 22.2% (n=4) and severe anxiety symptoms 11.1% (n=2) higher in the morbidly obese group. The difference

Table 1: Comparison of the demographic data of the obese and non-obese group.

Variables	Obese group (BMI ≥30) (n=110)	Non-obese group (BMI <30) (n=110)	p *
Gender, n (%)			
Female	78 (54.2)	66 (45.8)	0.089
Male	32 (42.1)	44 (57.9)	
Age (years ±SD)	42.36 ±11.4	36.04 ±11.6	0.830
BMI (Body Mass Index) (kg/m²±SD)	34.12 ±4.9	25.04 ±2.9	**<0.001**
Marital Status, n (%)			
Married	79 (59.4)	54 (40.6)	**0.030**
Single	27 (33.8)	53 (66.2)	
Divorced	4 (57.1)	3 (42.9)	
Occupation, n (%)			
Non-working	44 (61.1)	28 (38.9)	
Retired	12 (75.0)	4 (25.0)	**0.008**
Desk job	29 (40.8)	42 (59.2)	
Physical job	25 (41.0)	36 (59.0)	
Educational level, n (%)			
Primary school	16 (76.2)	5 (23.8)	
Middle school	17 (60.7)	11 (39.3)	**0.031**
High school	45 (46.4)	52 (53.6)	
University	32 (43.2)	42 (56.8)	
Chronic Disease, n (%)	68 (64.1)	38 (35.9)	
Diabetes mellitus	36 (62.1)	22 (37.9)	
Hypertension	56 (68.3)	26 (31.7)	
Cardiovascular disease	16 (59.3)	11 (40.7)	**0.018**
Hyperlipidemia	21 (72.4)	8 (27.6)	
Hypothyroidism	12 (46.2)	14 (53.8)	
Osteoporosis	5 (83.3)	1 (16.6)	
Other	5 (55.6)	4 (44.4)	

* Student's t-test, X^2: Chi-square test, bold values define the statistical significance of p <0.05.

Table 2: Comparison of groups according to Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI).

Variables		Obese group (BMI ≥30)	Non-obese group (BMI <30)	p*
BDI, n (%)	Normal	28 (40.0)	42 (60.0)	**0.020**
	Middle	36 (45.6)	43 (54.4)	
	Moderate	37 (63.8)	21 (36.2)	
	Severe	9 (69.2)	4 (30.8)	
BAI, n (%)	Normal	23 (41.8)	32 (58.2)	**0.048**
	Middle	37 (43.5)	48 (56.5)	
	Moderate	43 (62.3)	26 (37.7)	
	Severe	7 (63.3)	4 (36.7)	

* X^2: Chi-square test, bold values define the statistical significance of p <0.05.

between the groups according to both BDI and BAI was found to be statistically significant (respectively; p=0.005, p=0.008) (Table 3). Logistic regression multivariate analysis was performed with variables that make a significant difference in univariate analysis (female gender, age, single marital status, education level, occupation, moderate and severe depression symptoms according to BDI, moderate and severe anxiety symptoms according to BAI). The presence of moderate and severe depression and anxiety symptoms were determined as independent risk factors for the development of obesity. There was 5.32 times increase in the risk of being obese in those with moderate and severe depression, and 3.45 times increase in the risk of being obese in those with moderate and severe anxiety levels (respectively;

Table 3: Comparison of BDI and BAI according to BMI.

Variables		Underweight (<18.5) (n=3)	Healthy weight (18.5 to 24.9) (n=51)	Overweight (25.0 to 29.9) (n=56)	Class I obesity (30.0 to 34.9) (n=63)	Class II obesity (35.0 to 39.9) (n=29)	Class III obesity (≥ 40.0) (n=18)	P*
BDI, n (%)	Normal	1 (33.3)	23 (45.2)	18 (32.1)	22 (34.9)	3 (10.3)	3 (16.7)	**0.005**
	Middle	2 (66.7)	21 (41.2)	20 (35.7)	21 (33.3)	11 (37.9)	4 (22.2)	
	Moderate	0 (0)	7 (13.7)	14 (25)	16 (25.4)	14 (48.3)	7 (38.9)	
	Severe	0 (0)	0 (0)	4 (7.1)	4 (6.3)	1 (3.4)	4 (22.2)	
BAI, n (%)	Normal	1 (33.3)	19 (37.3)	12 (21.4)	18 (28.6)	5 (17.2)	0 (0)	**0.008**
	Middle	1 (33.3)	15 (29.4)	32 (57.1)	21 (33.3)	9 (31.0)	7 (38.9)	
	Moderate	0 (0)	16 (31.4)	10 (17.9)	21 (33.3)	13 (44.8)	9 (50.0)	
	Severe	1 (33.3)	1 (2)	2 (3.6)	3 (4.8)	2 (6.9)	2 (11.1)	

* X^2: Chi-square test, bold values define the statistical significance of p <0.05.

Table 4: Multivariate logistic regression analysis of factors affecting obesity.

	Beta	Exp (B) (95% CI)	P*
Gender (female)	0.473	1.604 (0.88-2.92)	0.122
Age	0.672	1.81 (0.84-3.98)	0.278
Marital Status (single)	-0.375	0.687 (0.46-1.02)	0.067
Educational level			
Primary school	1.435	4.2 (1.39-12.6)	**0.011**
Middle school	0.507	1.708 (0.83-3.2)	0.118
High school	0.127	1.126 (0.61-2.03)	0.682
University	0.052	0.934 (0.59-1.2)	0.703
Occupation			
Non-working	0.817	2.263 (1.12-4.54)	**0.022**
Retired	1.463	4.32 (1.24-9.94)	**0.021**
Desk job	0.633	0.994 (0.45-1.8)	0.787
Physical job	0.355	0.723 (0.56-1.4)	0.893
BDI (moderate-severe depression risk)	-1.171	5.329 (2.98-13.41)	**0.012**
BAI (moderate-severe anxiety risk)	-1.023	3.452 (1.56-7.89)	**0.023**

*Bold values define the statistical significance of p <0.05.
** The logistic regression model was made using the enter method.

OR=5.329, 95% CI 2.98-13.41, p=0.012; OR =3.452, 95% CI 1.56-7.89, p=0.023) Other independent risk factors for the development of obesity are summarized in Table 4.

DISCUSSION

Our study is a cross-sectional study conducted in Samsun University Medical Faculty Obesity Clinic and Family Medicine Clinic between 01.02.2022 and 30.04.2022, and it demonstrates escalated depression and anxiety symptoms in obese individuals compared to non-obese individuals. It was determined that the severity of depression and anxiety deteriorated as the BMI of the participants increased.

The prevalence of obesity has increased approximately threefold since 1975 and continues to rise at an alarming rate (18, 19). However, the rate of major depressive disorder and anxiety disorders has also increased, particularly in the last 10 years. Many studies have reported that obesity and major depressive disorder and anxiety disorders co-occur and there is a bidirectional relationship between them (11, 12). In our study, moderate and severe depression symptoms were found to be significantly higher in obese participants than in the non-obese group. According to the logistic regression analysis, a 5.32 times increase was found in the risk of developing obesity in individuals with moderate and severe depression. A meta-analysis published in 2019 revealed that obese adults were 23-36% more depressed than non-obese adults (20). Another meta-analysis suggested that obese adolescents have a 40% increased risk of being depressed (21). In a study conducted in our country, depression was found in 69.56% of obese participants and a statis-

tically significant difference was observed when compared with non-obese participants (22). In another study conducted in our country, a positive correlation was shown between the severity of depression and emotional eating behavior (23). Regardless of which one increases the risk of the other, it is observed that depression and obesity coexist in many cases. However, it has been reported that the coexistence of obesity and depression negatively affects the treatment of both diseases. Obese individuals diagnosed with depression had a lower antidepressant treatment response than non-obese individuals (24, 25).

Similar to depression, the relationship between obesity and anxiety has been described as bidirectional (12). In our study, anxiety symptoms were found to be statistically significantly higher in obese patients. In the regression analysis, it was observed that those with a BAI score above 15 (moderate-severe anxiety risk) were 3.45 times more likely to be obese. A meta-analysis of 25 studies published in 2019 demonstrated that the frequency of anxiety is higher in obese individuals compared to individuals with normal-weight (26). In a study conducted with more than 200 thousand participants, anxiety was detected in 30.5% of obese individuals. The prevalence of anxiety in obese women was found to be much higher than in obese men (27). In another study, a linear increase in the incidence of anxiety was found with BMI (28). According to a limited number of studies, no relationship was found between obesity and depression and anxiety (29, 30).

In our study, when depression and anxiety levels were compared with BMI, an increase was observed in depression and anxiety levels as BMI increased. Especially in the morbidly obese group, the severity of depression and anxiety was found to be significantly higher. The relationship between BMI and depression and anxiety levels was found to be statistically significant. In the literature, a positive correlation was observed between BMI and depression and anxiety levels in many studies, and similar to our study, severe depression and anxiety symptoms were found at a much higher rate, particularly in the morbidly obese group (28, 31). As mentioned before, the relationship between obesity and depression, and anxiety is evaluated as bidirectional and it is suggested that there are many psychogenic and metabolic conditions affecting this relationship (11, 12).

Our study has some limitations. BDI and BAI are self-report scales in which the individual evaluates herself/himself, individuals may interpret the questions subjectively while answering the scales and may have difficulty in understanding some questions, especially as the education level decreases, and may have marked the options that are not correct for them. In addition, repeating the study with larger sample groups will increase the reliability of the data. Despite its limitations, our study is one of the few studies conducted in obesity centers due to the newly opened obesity centers in our country. Our study is important in terms of providing information about the sociodemographic, depression, and anxiety levels of the patients registered in the obesity center.

The prevalence of depression and anxiety symptoms was found to be high in obese individuals. It was observed that as BMI increased, the severity of depression and anxiety symptoms increased. Fighting obesity is not only perceived as struggling with excess weight but requires a multidisciplinary approach. According to this approach, it is recommended to screen obese people for depression and anxiety and to provide appropriate support for individuals at risk.

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Authors' Contribution

Protocol/project development, data collection, data analysis, writing/editing, management: **Fatma Aydin Balkoca.** Protocol/project development, data collection, data analysis, manuscript reviewing: **Mahcube Cubukcu.** Protocol/project development, data collection, editing, manuscript reviewing: **Nur Simsek Yurt.** All authors have read and approved the submission.

Conflicts of Interest

The authors declare no conflict of interest.

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Ethics Approval

Ethics committee approval was obtained with the Ethics Committee decision no. 2021/21/5 of Samsun Training and Research Hospital Clinical Research Ethical Committee.

Peer Review Process

Extremely peer-reviewed and accepted.

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