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Impact of Sociodemographic Factors and Lifestyle on Body Composition and Biochemical Parameters in Obesity Clinic Patients

Obezite Polikliniğine Başvuran Hastaların Sosyodemografik Özellikleri ve Yaşam Tarzlarının Vücut Kompozisyonu ve Biyokimyasal Parametrelere Etkisi

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ÖZET

Amaç: Obezite, artan prevalansı ve kronik hastalıklarla ilişkisi nedeniyle önemli bir küresel sağlık sorunudur. Bu çalışma, obezite polikliniğine başvuran hastaların sosyodemografik özelliklerini, antropometrik ölçümlerini, biyokimyasal test sonuçlarını ve vitamin düzeylerini değerlendirmeyi amaçlamaktadır.
Yöntem: Ekim 2016 - Aralık 2018 tarihleri arasında Konya Eğitim ve Araştırma Hastanesi Obezite Polikliniği'ne başvuran, kilo verme amacıyla tıbbi destek arayan ve çalışma kriterlerini karşılayan 157 hasta dahil edilmiştir. Katılımcıların sosyodemografik verileri, fizik muayene bulguları, antropometrik ölçümleri ve biyokimyasal testleri analiz edilmiştir.
Bulgular: Katılımcıların %88,5'i kadın, yaş ortalaması 35,3±12,6 yıldır. Obez bireylerde evli olma oranı (p=0,002) ve kronik hastalık görülme sıklığı (p=0,021) daha yüksektir. Lise ve üzeri eğitime sahip bireylerde obezite daha düşüktür (p<0,001). Obez grupta bel/kalça çevresi, sistolik kan basıncı, glukoz, kolesterol, trigliserit ve LDL düzeyleri anlamlı şekilde daha yüksektir (tümü için p<0,01). Grade 3 obez grubunda yaş ve D vitamini düzeyi farklılık göstermektedir (p=0,003; p<0,05). İnsülin direnci %69,9 oranında saptanmış, bu grupta trigliserit, AST ve ALT daha yüksek, HDL daha düşüktür (tümü için p<0,001). İnsülin direnci erkeklerde (p=0,002) ve kronik hastalığı olanlarda (p=0,003) daha yaygındır.
Sonuç: Obezite; sosyodemografik faktörler, kan basıncı, biyokimyasal parametreler ve D vitamini düzeyleriyle yakından ilişkilidir.

Anahtar Kelimeler: Obezite, beden kitle indeksi, hiperinsülinizm

ABSTRACT

Objective: Obesity is a major global health concern linked to chronic diseases. This study assessed the sociodemographic data, anthropometric values, biochemical tests, and vitamin levels of patients at an obesity clinic.
Methods: The study included 157 patients between October 2016 and December 2018. Sociodemographic data, anthropometric measurements, and fasting blood tests were analyzed.
Results: Participants were predominantly women (88.5%) with a mean age of 35.3±12.6 years. Obesity was more prevalent in married and less-educated individuals. Obese patients had higher waist/hip circumferences, systolic blood pressure, glucose, cholesterol, triglyceride, and LDL (p<0.01). Age and vitamin D levels varied significantly by obesity grade. Insulin resistance was found in 69.9% and was associated with worse lipid profiles. It was more common in males and those with chronic illness.
Conclusion: Obesity is associated with anthropometric, biochemical, and sociodemographic factors.

Key words: Obesity, body mass index, insulin resistance

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INTRODUCTION

Obesity is recognized as a significant public health problem. It is defined as an excessive accumulation of body fat resulting from an imbalance between energy intake and expenditure, which significantly affects health (1,2). In 2022, approximately 2.5 billion adults aged 18 and older were classified as overweight, and more than 890 million individuals were living with obesity. This indicates that 43% of adults aged 18 and older are overweight. The global prevalence of obesity has more than doubled between 1990 and 2022. Moreover, obesity once considered a problem in high-income countries, is now increasing in low- and middle-income countries as well (1). Due to its rapidly rising prevalence, obesity has become a serious global health concern (3).

As in the rest of the world, the prevalence of obesity is also increasing in Türkiye. According to the results of the Turkish Diabetes, Obesity, and Hypertension Epidemiology Study-I (TURDEP-I), the prevalence of obesity was found to be 30% in women, 13% in men, and 22.3% overall. The TURDEP-II study, conducted 12 years after TURDEP-I, revealed that the obesity prevalence in the Turkish adult population increased by 40%, rising from 22.3% in 1998 to 31.2% in 2010 (4).

Obesity is a multifactorial and complex disease resulting from the interaction of genetic and environmental factors. Although our understanding of the mechanisms underlying obesity is still incomplete, it is evident that social, behavioral, cultural, psychological, metabolic, and genetic factors and pharmacological agents that disrupt energy balance play significant roles (5,6).

Obesity is associated with many health problems. Among obesity-related comorbidities, cardiovascular diseases (CVDs) are the most common cause of mortality, followed by type 2 diabetes (T2DM), various cancers (particularly rectal, esophageal, liver, and colon cancers), and chronic kidney disease (7,8). Given the significant health implications of obesity, we designed this study to evaluate the sociodemographic characteristics, anthropometric measurements, biochemical test results, and vitamin levels of patients attending an obesity clinic.

MATERIALS AND METHODS

A total of 157 patients who sought medical support for weight loss and met the study criteria were included in the study, which was conducted between October 2016 and December 2018 at the Obesity Clinic of Konya Training and Research Hospital. Patients with diabetes, pregnancy or lactation, liver or kidney failure, malignancies, or incomplete data were excluded from the study. Sociodemographic characteristics, physical examination findings, and anthropometric measurements, including height, weight, waist circumference (WC), hip circumference (HC), and blood pressure, were recorded.

In the study, body mass index (BMI) was used to categorize groups based on obesity grades. Body mass index (BMI) was calculated as kg/m^2. BMI was classified as overweight for values between 25–29.9, grade 1 obesity for values between 30–34.9, grade 2 obesity for values between 35–39.9, and grade 3 obesity for values of 40.0 and above.

Blood samples were collected after 12 hours of overnight fasting and analyzed on the same day. Educational level was categorized into two groups: Primary school or below and high school or above. Exercise habits were classified into two groups: Those who exercised one day or less per week and those who exercised more than one day per week. Insulin resistance was determined using the homeostatic model assessment (HOMA-IR). The calculation was made by multiplying glucose (mg/dl) by insulin (mIU/L) and then dividing by 405.

Table 1. Sociodemographic and Lifestyle Characteristics

	n	%
Gender		
Female	139	88,5
Male	18	11,5
Marital Status		
Married	118	75,2
Single	33	21,0
Widowed/Divorced	6	3,8
Occupation		
Housewife/Unemployed	117	74,5
Worker	13	8,3
Civil Servan	22	14,0
Tradesperson	2	1,3
Retired	3	1,9
Educational Level		
Illiterate	2	1,3
Primary School	87	55,1
High School	33	21,2
University or Higher	35	22,4
Exercise Frequency		
Never	61	38,9
Rarely	52	33,1
Once a week	5	3,2
1-3 times per week	19	12,1
More than 3 times per week	20	12,7
Smoking Status		
Smoker	26	16,1
Non-smoker	131	83,9
Alcohol Consumption		
Yes	2	1
No	155	99
History of Chronic Disease		
Yes	65	41,4
No	92	58,6
History of Psychiatric Treatment		
Yes	31	19,7
No	126	80,3

Table 2. Anthropometric Measurements and Biochemical Parameters

	Mean ± Sd	Median (max-min)
Age (years)	35,32±12,61	34 (65-18)
Height (cm)	160,53±7,64	159 (182-143,51)
Weight (kg)	84,82±14,91	83 (153-60)
Body Mass Index (kg/m²)	32,93±5,01	32,4 (51,10-25,71)
Waist Circumference (cm)	102,83±15,34	102,00 (168-761)
Hip Circumference (cm)	113,95±16,80	114,00 (168-931)
Systolic Blood Pressure (mmHg)	113,85±19,37	110 (180-70)
Diastolic Blood Pressure (mmHg)	74,45±12,69	80(110-401)
Fasting Glucose (mg/dL)	94,67±15,12	92 (130-72)
Total Cholesterol (ng/ml)	194,45±47,54	189 (346-68)
Triglycerides (ng/ml)	131,96±74,65	118 (549-22)
HDL (ng/ml)	48,03±11,12	47 (91-26)
LDL (ng/ml)	124,11±51,23	116,5 (400-261)
TSH (µIU/mL) (n=147)	2,57±4,76	1,9 (56-0,10)
Insülin (µIU/L) (n=140)	11,97±10,13	9,7(94-2)
Vitamin D (µg/L) (n=123)	14,62±25,48	10 (28,50-41)
Vitamin B12 (ng/L)	375,81±211,34	328 (2000-176)
Ferritin (ng/ml)	28,79±27,45	19,50 (6,30-142,20)
Folic Acid (ng/ml)	10,52±4,00	9,9 (21,90-3,32)

BMI: Body Mass Index, HDL: High-Density Lipoprotein Cholesterol, LDL: Low-Density Lipoprotein Cholesterol, TSH: Thyroid-Stimulating Hormone
The variables exhibit a normal distribution.

Table 3. Comparison of Anthropometric Measurements and Biochemical Parameters Between Overweight and Obese Groups

	Overweight (Mean±Sd)	Obese (Mean±Sd)	p
Age (years)	28,81±9,83	38,38±12,62	<0,001
Height (cm)	162,27±8,27	159,69±7,26	0,064
Waist Circumference (cm)	95,77±13,19	106,13±15,28	<0,001
Hip Circumference (cm)	106,67±6,54	117,31±19,01	<0,001
Systolic Blood Pressure (mmHg)	108,18±12,62	115,75±20,57	0,008
Diastolic Blood Pressure (mmHg)	72,27±9,61	75,20±13,74	0,145
Fasting Glucose (mg/dL)	89,30±7,45	97,34±17,12	<0,001
Total Cholesterol (ng/ml)	179,04±49,71	201,26±45,10	0,010
Triglycerides (ng/ml)	105,67±57,57	144,51±79,32	0,001
HDL (ng/ml)	49,12±12,73	47,39±10,36	0,410
LDL (ng/ml)	109,07±40,17	131,00±54,98	0,007
TSH (µIU/mL) (n=147)	3,20±7,92	2,28±1,83	0,431
Insülin (µIU/L) (n=140)	11,44±9,33	12,31±10,71	0,620
Vitamin D (µg/L) (n=123)	19,09±43,52	12,66±8,20	0,360
Vitamin B12 (ng/L)	361,34±129,39	382,86±242,23	0,502
Ferritin (ng/ml)	25,65±30,63	30,60±25,74	0,526
Folic Acid (ng/ml) (n=95)	10,01±4,30	10,79±3,99	0,414
AST (U/L)	21,17±5,37	22,25±6,38	0,292
ALT (U/L)	19,71±10,22	22,56±11,83	0,133

HDL: High-Density Lipoprotein Cholesterol, LDL: Low-Density Lipoprotein Cholesterol, TSH: Thyroid-Stimulating Hormone, ALT: Alanine Aminotransferase, AST: Aspartate Aminotransferase

All data in the study were retrospectively examined and evaluated through the hospital automation system.

Statistical Analysis

The computer software used for biostatistical analysis was the Statistical Package for the Social Sciences. Variables were reported as mean ± standard deviation for continuous variables and as frequency (percentage) for categorical variables. Pearson's chi-square test for categorical variables, two-sample t-test, and one-way ANOVA test for numerical variables were used to examine differences in patient characteristics between groups.

RESULTS

The sociodemographic characteristics and lifestyle factors of patients attending the obesity clinic are presented in Table 1, while their anthropometric measurements and biochemical

Table 4. Comparison of Anthropometric Measurements and Biochemical Parameters by Obesity Severity in Obese Patients

	Grade-1 Obese (Mean±Sd)	Grade-2 Obese (Mean±Sd)	Grade-3 Obese (Mean±Sd)	p
Age (years)	36,63±12,86	37,1436,63±11,33	49,3036,63±10,69	0,003
Height (cm)	159,6±6,7	159,7±8,2	159,9±6,4	0,900
Waist Circumference (cm)	99,38±16,48	108,92±7,07	123,30±13,91	<0,001
Hip Circumference (cm)	109,94±23,08	120,68±6,69	135,07±13,10	<0,001
Systolic Blood Pressure (mmHg)	110,7±17,4	119±20,8	123,8±26,6	0,54
Diastolic Blood Pressure (mmHg)	70,85±11,57	78,25±14,30	81,53±15,19	0,008
Fasting Glucose (mg/dL)	95,44±15,48	98,80±18,74	99,23±18,25	0,555
Total Cholesterol (ng/ml)	197,74±42,72	202,80±48,38	209,23±45,29	0,696
Triglycerides (ng/ml)	136,40±70,44	142,17±71,95	181,00±119,74	0,195
HDL (ng/ml)	47,86±10,80	46,41±10,23	48,69±9,59	0,724
LDL (ng/ml)	122,55±36,26	136,18±60,04	145,60±87,10	0,307
TSH (µIU/mL) (n=147)	2,30±2,08	2,02±1,08	3,03±2,57	0,246
Insülin (µIU/L) (n=140)	14,12±14,65	11,19±5,77	9,64±5,51	0,322
Vitamin D (µg/L) (n=123)	13,09±7,62	13,54±9,74	8,53±3,08	0,196
Vitamin B12 (ng/L)	352,61±113,27	394,67±289,96	457,33±394,04	0,389
Ferritin (ng/ml)	25,33±14,08	41,27±35,39	20,78±22,73	0,140
Folic Acid (ng/ml) (n=95)	10,30±3,62	10,94±4,28	12,38±4,73	0,465
AST (U/L)	21,02±5,69	23,51±6,64	23,08±7,70	0,188
ALT (U/L)	20,12±11,78	25,89±11,92	21,66±9,79	0,071

HDL: High-Density Lipoprotein Cholesterol, LDL: Low-Density Lipoprotein Cholesterol, TSH: Thyroid-Stimulating Hormone, ALT: Alanine Aminotransferase, AST: Aspartate Aminotransferase

Table 5. Comparison of Biochemical Parameters Based on Insulin Resistance

	HOMA-IR<2,5	HOMA-IR≥2,5	P
Age (years)	36,25±11,29	33,06±15,18	0,200
Height (cm)	160,06±7,29	161,63±8,47	0,272
Weight (kg)	84,66±14,83	85,58±15,50	0,732
Waist Circumference (cm)	102,45±17,01	103,95±11,00	0,517
Hip Circumference (cm)	113,71±19,42	114,38±9,14	0,822
Systolic Blood Pressure (mmHg)	112,25±18,04	117,04±21,84	0,206
Diastolic Blood Pressure (mmHg)	73,40±11,91	76,59±14,29	0,199
Total Cholesterol (ng/ml)	197,55±48,37	187,12±45,70	0,207
Triglycerides (ng/ml)	114,77±52,13	168,63±100,15	<0,001
HDL (ng/ml)	50,35±11,35	43,11±9,05	<0,001
LDL (ng/ml)	123,91±41,19	124,49±69,68	0,959
TSH (µIU/mL) (n=147)	2,66±5,54	2,48±2,13	0,769
Vitamin D (µg/L) (n=123)	11,98±6,80	20,06±43,30	0,242
Vitamin B12 (ng/L)	355,42±116,07	413,08±328,74	0,259
Ferritin (ng/ml)	24,27±19,17	36,59±37,07	0,158
Folic Acid (ng/ml) (n=95)	10,27±4,04	10,96±4,20	0,463
AST (U/L)	20,84±5,25	24,04±7,10	0,008
ALT (U/L)	19,18±9,59	26,51±13,26	0,001

HDL: High-Density Lipoprotein Cholesterol, LDL: Low-Density Lipoprotein Cholesterol, TSH: Thyroid-Stimulating Hormone, ALT: Alanine Aminotransferase, AST: Aspartate Aminotransferase

parameters obtained from blood test results are provided in Table 2 (Table 1, Table 2). There were no significant differences between the obese and non-obese groups in terms of gender, occupation, exercise habits, history of psychiatric treatment, smoking, or alcohol consumption. However, the proportion of married individuals was significantly higher in the obese group (p=0.002). The prevalence of chronic diseases was also significantly higher in the obese group compared to the non-obese group (p=0.021). When examining educational status, obesity was found to be less common among individuals with a high school education or above (p<0.001).

When anthropometric characteristics and biochemical parameters were compared between the non-obese and obese groups, the obese group exhibited significantly higher values for mean age (p<0.001), waist circumference (p<0.001), hip circumference (p<0.001), systolic blood pressure (p=0.008),

glucose (p<0.001), cholesterol (p=0.010), triglycerides (p=0.001), and Low-Density Lipoprotein Cholesterol (LDL) (p=0.007). Although other parameters did not show statistically significant differences, diastolic blood pressure, insulin, ferritin, folic acid, AST, and ALT levels were higher in the obese group compared to the non-obese group. In contrast, High-Density Lipoprotein Cholesterol (HDL), Thyroid-Stimulating Hormone (TSH), and vitamin D levels were lower in the obese group (Table 3).

When sociodemographic characteristics and lifestyle data were analyzed among obesity subgroups, no significant differences were found in gender, marital status, occupation, exercise habits, smoking, alcohol consumption, presence of chronic disease, or history of psychiatric treatment. However, a significant difference was observed in educational level, with the grade 3 obesity group having a lower educational level compared to the other groups (p=0.034).

Diastolic blood pressure was significantly higher in the grade 2 obesity group than in the grade 1 obesity group (p=0.008). Waist circumference and hip circumference differed significantly among all groups. Pairwise comparisons revealed that these differences were primarily between the grade 3 obesity group and the other two groups, with significantly higher values observed in the grade 3 obesity group (p<0.001, p<0.001). Additionally, age was significantly higher in the grade 3 obesity group compared to the other two groups (p=0.003). Among the biochemical parameters, only vitamin D levels showed a significant difference, being lower in the grade 3 obesity group compared to both the grade 1 obesity group (p=0.012) and the grade 2 obesity group (p=0.037) (Table 4).

Among the participants, 109 individuals (69.87%) had insulin resistance, while 47 (30.12%) did not. When biochemical parameters were compared according to insulin resistance status, triglycerides, AST, and ALT were significantly higher in the insulin-resistant group, whereas HDL levels were lower (p<0.001, p=0.008, p=0.001, p<0.001) (Table 5). Examination of the relationship between sociodemographic characteristics, lifestyle factors, and insulin resistance revealed that insulin resistance was significantly higher in men (p=0.002). Additionally, insulin resistance was found to be more prevalent among individuals with chronic diseases (p=0.003).

DISCUSSION

In our study, after comparing the obese and non-obese groups, the obese group was further divided into three subgroups based on obesity severity, and intergroup analyses were conducted. Similar to previous studies, the mean age of the obese group was higher (9-11). The effect of gender on obesity is complex and multifactorial. Various studies have shown that obesity is more prevalent in women than in men, which may be related to biological, social, and behavioral factors (12-15). A review examining the effect of gender on obesity indicated that while obesity was generally more common in women, study results varied by region and ethnicity (16). In this study, there was no significant difference in gender distribution between the obese and non-obese groups or among obesity severity groups.

Consistent with findings in the literature, obesity was more prevalent among individuals with lower educational levels (11). This may be attributed to difficulties in accessing healthy foods, lack of knowledge about proper nutrition, and limited access to physical activity opportunities among those with lower education levels. The relationship between obesity and smoking remains controversial, as some studies report lower obesity rates among smokers (17,18), whereas others indicate that long-term smoking is associated with higher obesity prevalence (19,20). In this study, no significant difference was observed between groups regarding smoking. Since only two participants reported alcohol consumption, the statistical data may not have provided a reliable outcome, and therefore, no further interpretation was made on this aspect.

The impact of sedentary behavior and physical inactivity on obesity has been well-established. A meta-analysis conducted by Silveira et al. in 2022 confirmed this relationship (21). In the present study, no significant differences were found between the obese and non-obese groups or among obesity severity groups regarding physical activity. This may be due to the study population consisting of individuals attending an obesity clinic, meaning there were no normal-weight participants, and the non-obese group comprised overweight individuals. Additionally, exercise habits were based on self-reports, which may not accurately reflect actual physical activity levels.

Similar to other studies, the obese group in our study had significantly higher systolic blood pressure, glucose, cholesterol, triglycerides, and LDL levels compared to the non-obese group (22,23). Diastolic blood pressure was also higher, and HDL was lower in the obese group, but these differences were not statistically significant. The absence of statistical significance may be due to the study population consisting of individuals attending an obesity clinic, with no normal-weight participants, and the non-obese group comprising overweight individuals.

Although insulin levels were not statistically significant, they were higher in the obese group, consistent with previous studies (24,25). Ferritin levels were also higher in the obese group compared to the non-obese group, but this difference was not statistically significant. The relationship between obesity and anemia-related parameters varies in the literature. Some studies have reported that hemoglobin, hematocrit,

or ferritin levels increase with BMI, whereas others have suggested an inverse correlation between serum iron levels and BMI. Elevated ferritin levels in obesity may be linked to chronic inflammation. Although ferritin is primarily an iron storage protein, it is also an acute-phase reactant and may increase with inflammation.

Additionally, regional differences and dietary habits may influence the relationship between obesity and iron deficiency. Some populations have reported a lower risk of anemia among obese women, while others found no significant differences. These findings highlight the complexity of the relationship between obesity and iron status, suggesting that hematological and inflammatory markers should be evaluated together (26).

Contrary to studies reporting lower B12 levels in obesity, no significant difference was observed in this study (22,24,27). This may be due to dietary variations among participants or the presence of individuals using B12 supplements. In this study, vitamin D levels were significantly lower in the grade 3 obesity group compared to the grade 1 and grade 2 obesity groups. However, no significant difference was found between the obese and non-obese groups or among obesity severity groups. The relationship between obesity and vitamin D has been extensively studied. A review on this topic demonstrated that obesity is associated with lower vitamin D levels in many studies (28).

Obesity is known to be associated with endocrine alterations, including hypothyroidism and subclinical hypothyroidism. Multiple studies and meta-analyses have examined the relationship between thyroid hormone disorders and obesity, supporting the finding that obese individuals have higher TSH levels than normal-weight individuals (29,30). However, in this study, similar to the findings of Layegh et al., no significant difference in TSH levels was observed among groups (25).

When comparing biochemical parameters according to insulin resistance status, triglycerides, AST, and ALT were significantly higher in the insulin-resistant group, whereas HDL levels were lower. Insulin resistance was also found to be higher among men and individuals with chronic diseases. Although insulin resistance is generally expected to be more prevalent in women, the opposite was observed in this study. This discrepancy may be due to the small number of male participants, 11 of whom had insulin resistance (31). Insulin resistance is a well-established risk factor for diabetes and also plays a critical role in obesity. Given that obesity is associated with multiple chronic diseases, it is expected that individuals with insulin resistance would have a higher prevalence of chronic diseases.

A notable strength of this study is its comprehensive evaluation of obesity and insulin resistance in relation to sociodemographic characteristics, anthropometric measurements, and biochemical parameters, an approach that is less frequently explored in the literature. However, the primary limitation of the study is that it included only overweight and obese individuals from an obesity clinic, with no normal-weight participants. Additionally, factors such as dietary habits, occupational or cultural lifestyle differences, daily physical activity levels, and vitamin supplementation may have influenced the results.

Conclusion

In this study, the relationship between obesity, insulin resistance, sociodemographic characteristics, anthropometric measurements, and biochemical parameters was evaluated. It was observed that obese individuals had a higher mean age, and obesity prevalence increased as educational levels decreased. Chronic diseases were more common among obese individuals, and vitamin D levels were significantly lower in the grade 3 obesity group. Obesity was associated with higher waist circumference, hip circumference, systolic blood pressure, glucose, cholesterol, triglyceride, and LDL levels. However, no statistically significant difference was found in thyroid function or specific biochemical parameters. Additionally, the prevalence of chronic diseases was higher among individuals with insulin resistance. These findings reinforce that obesity is not only an individual concern but also a significant public health issue that must be addressed at the societal level. The development of multidisciplinary approaches for the prevention and treatment of obesity is essential.

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