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Relationship Between Degree of Obesity and Vitamin D Level in Obese Women Applying to A Family Medicine Outpatient Clinic

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ABSTRACT

Aim: The aim of this study was to investigate the relationship between the degree of obesity and vitamin D level in obese women who applied to a family medicine outpatient clinic.

Methods: In our cross-sectional and descriptive study, 297 obese female patients who applied to our family medicine outpatient clinic were included. The patients were evaluated by the researcher in the polyclinic, sociodemographic information and medical history was obtained, anthropometric measurements were made and vitamin D results were recorded.

Results: The mean age of the 297 female patients included in the study was 44.7±11.7 years. A significant relationship was found between the degree of obesity and vitamin D level (p=0.001).. Statistically, a significant relationship was detected between the presence of menopause and vitamin D level (p=0.000).

Conclusions: In the present study, it was observed that as the degree of obesity increased, the level of vitamin D decreased. And, vitamin D levels of the women in menopause were higher than the women who were not in menopause. Vitamin D supplementation during menopause may explain this unexpected relationship. Family physicians should make vitamin D supplementation in addition to diet and other recommendations in obese patients when necessary.

Keywords: Menopause, Obesity, Primary Care, Vitamin D

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Introduction

Obesity is one of the most important problems threatening public health. Obesity is more common among women in society and is a health problem with an increasing incidence day by day (1). Obesity is a complex and multifactorial disease. It contributes to the development of various health problems, including type 2 diabetes mellitus, cardiovascular disease, hypertension, hyperlipidemia, cerebrovascular disease, various cancers, obstructive sleep apnea syndrome, liver steatosis, gastroesophageal reflux, polycystic ovary syndrome, osteoarthrosis and depression, and creates a heavy burden on health budgets of societies (2). It is defined by the World Health Organization (WHO) as "excessive fat accumulation in the body that presents a risk to health". In general, the total body fat percentage is between 15-20% for adult males and 25-30% for adult females. When this rate exceeds 25% in males and 30% in females, or a body mass index (BMI) over 30 kg/m2, this is defined as obesity (3). Several factors, such as dietary habits, sedentary lifestyle, genetic factors, prenatal factors, vitamin D deficiency, drug use, maternal age and sleeping pattern are considered to have an effect in the development of obesity (4).Adipose tissue has a critical role in the regulation of fatty acid homeostasis throughout the body. Previous studies support the hypothesis that fatty tissue is an endocrine organ that synthesizes adipokines involved in many metabolic events (5).

Vitamin D is known as a fat-soluble prohormone with a secosteroid structure that is mostly produced in the skin in response to sunlight. Following metabolic changes, it is converted to calcitriol, which takes part in calcium and phosphate metabolism (6). In addition, it regulates glucose transporter 4 (GLUT-4) expression in skeletal muscle and stimulates GLUT-4 translocation in fatty tissue. Vitamin D is an essential vitamin for human health and its deficiency can be associated with serious health problems. Thus, it is of great importance to detect preventable and treatable vitamin D deficiency primarily in risk groups (7). In some studies conducted in Turkey, vitamin D deficiency was found in 51.8% and vitamin D insufficiency in20.7% of individuals (8). Lipogenesis is stimulated in cases with increased calcium transport to adipose tissue, while lipolysis is suppressed. As a result of this, triglyceride accumulation occurs in adipose tissue. Previous studies emphasized that vitamin D can play a role in the development of obesity through these effects (9).

One of the main purposes of primary healthcare services is to detect risk factors at an early stage that could lead to disease development and to fight against changeable risk factors. The purpose of this current study was to investigate the relationship between vitamin D level and degree of obesity in obese women who applied to our family medicine outpatient clinic.

METHOD

This sectional study included 297 female patients between age 18-70 with BMI≥30 who applied to the S.B.Ü. Dr. Lütfi Kırdar Kartal City Hospital Family Medicine Outpatient Clinic between 01.01.2020-01.04.2020 and who accepted to participate by signing a voluntary consent form. Male patients under 18 years old with BMI<30 were excluded from the study. The study data consisted of the patients' demographic, clinical and laboratory findings. The patients were evaluated by the researcher and their height (cm), weight (kg), waist circumference (cm) and hip circumference were measured. BMI was calculated as kg/m2.

Patients with a BMI between 30.0 and 34.9 were classified as mildly obese, those between 35.0-39.9 as moderately obese, those between 40.0 and 49.9 as

morbidly obese and those with BMI over 50.0 were considered to be super obese (10).

A level of vitamin D ≤20 ng/mL was considered as vitamin D deficiency, 21-29 ng/mL as vitamin D insufficiency and ≥30 ng/mL as vitamin D sufficiency (11).

Ethics committee approval dated 25.11.2020, no: 514/190/27 was obtained from our hospital's ethics committee.

STATISTICAL ANALYSIS

Study data was analyzed with the SPSS 21.0 package program. Descriptive criteria (frequency, percentage, mean, median, and standard deviation and minimum-maximum values) were used in the analysis. Kolmogorov Smirnov test was used as the normality test. Data with abnormal distribution were statistically compared with Kruskal Wallis test. Mann Whitney U test was used in sub-group analysis. Spearman correlation test was used in analysis. In results from the analysis, a p value below 0.05 was accepted as significant.

RESULTS

Mean age of the 297 female participants was calculated as 44.7±11.7 years. Sociodemographic characteristics and anthropometric measurements of the patients included in the study are shown in Table 1

Table 1. Sociodemographic characteristics and anthropometric measurements

	n (%)	**Mean±SD**
Age (years)	297 (100.0)	44.7±11.7
	N	**%**
Education		
Primary school and lower	163	54.9
Secondary-High school	92	40.0
University	42	14.1
Employment		
Employee or student	64	21.6
Nonworker	233	78.4
Marital Status		
Married	235	79.1
Single	62	20.9
Smoking		
No/Quit	236	79.4
Yes	61	20.5
Obesity in Childhood		
Yes	99	33.3
No	198	66.7

Obesity in the Family		
Yes	209	70.4
No	88	29.6
State of Menopause		
Yes	124	41.8
No	173	58.2
Diabetes Mellitus		
Yes	100	33.7
No	197	66.3
Prediabetes		
Yes	98	33.0
No	199	67.0
	n (%)	**Mean±SD**
BMI (kg/m^2)	297 (100.0)	38.8±6.5
Waist Circumference (cm)	297 (100.0)	116.2±14.3
Hip Circumference(cm)	297 (100.0)	126.4±12.0

BMI: Body mass index.

100 participants (33.7%) were in the mildly obese group, 86 patients (29.0%) in the moderately obese group, 93 patients (31.3%) in the morbidly obese group and 18(6.1%)were in the super obese group.

Median Vitamin D level of the participants was 16.0 (3.7-78.0) ng/mL and classification of the participants in terms of vitamin D is given in Table 2.

Table 2. Classification of the participants according to their vitamin D levels

	Median (Lowest-Highest)
Vitamin D Level (ng/mL)	16.0 (3.7-78.0)
	n (%)
Vitamin D Deficiency (≤20 ng/mL)	199 (67.0%)
Vitamin D Insufficiency (21-29 ng/mL)	77 (25.9%)
Sufficient Level of Vitamin D (≥30 ng/mL)	21 (7.1%)

Vitamin D levels of the participants according to their obesity groups are given in Table 3.

Table 3. Vitamin D levels of the participants in terms of obesity groups

Obesity Classification	Vitamin D Deficiency	Vitamin D Insufficiency	Sufficient Level of Vitamin D
	n (%)	n (%)	n (%)
Mildly Obese	56 (56.0%)	34 (34.0%)	10 (10.0%)
Moderately Obese	58 (67.4%)	21 (24.4%)	7 (8.1%)
Morbidly Obese	72 (77.4%)	17 (18.3%)	4 (4.3%)
Super Obese	13 (72.2%)	5 (27.5%)	0 (0.0%)

Statistically, a significant difference was detected between vitamin D level and the obesity group (p=0.001). The relationship between obesity group and vitamin D level is shown in Table4. In the post hoc analysis of obesity sub-groups, a statistically significant relationship was detected between the mildly obese-moderately obese groups, mildly obese-morbidly obese groups and mildly obese-super obese groups in vitamin D levels(p=0.014, p=0.000, p=0.011, respectively). No statistically significant difference was detected between moderately obese –morbidly obese groups, moderately obese -super obese groups and morbidly obese-super obese groups in vitamin D levels (p=0.423, p=0.296, p=0.504, respectively).

No significant difference was detected between vitamin D level and presence of diabetes or prediabetes (p=0.456 and p=0.189, respectively). It was found that 124 (41.8%) of the participants were in the menopause period and the vitamin D median of the participants in the menopause period was 19.0 (3.7-78.0) ng/mL, whereas the vitamin D median in those who were not in menopause was 14.0 (6.0-44.0) ng/mL. Statistically, a significant difference was detected between the presence of menopause and vitamin D level (p=0.000). The relationship between vitamin D levels of the participants and their diseases and state of menopause is shown in Table 5.

Table5. Relationship of the participants' vitamin D levels with diseases and menopause

	n (%)	Vitamin D Level Median (Lowest-Highest)	P
Diabetes Mellitus			
Yes	100 (33.7%)	16.6 (5.4-78.0)	0.456
No	197 (66.3%)	16.0 (3.7-77.0)	
Prediabetes			
Yes	98 (33.0%)	15.2 (6.0-77.0)	0.189
No	199 (67.0%)	16.3 (3.7-78.0)	
Menopause			
Yes	124 (41.8%)	19.0 (3.7-78.0)	**0.000***
No	173 (58.2%)	14.0 (6.0-44.0)	

DISCUSSION

In the present study, a significant relationship was observed between vitamin D level and degree of obesity. It was observed that the level of vitamin D decreased as the degree of obesity increased. Especially with detection of vitamin D deficiency or insufficiency in obese patients, who are in the high-risk group, replacement of vitamin D is important in follow-up and treatment of obesity. It is known that serum vitamin D level is lower in obese patients. Vitamin D is a fat-soluble vitamin and disperses to the liver and serum. The volume of all these fractions increases in obesity. Therefore, serum vitamin D level is found to be approximately 20% lower in obese individuals (12).

In a meta-analysis performed by Pereira-Santos M. et al., in which they included 84 studies, the relationship of obesity and vitamin D was examined. As a result of this meta-analysis, similar to our study, it was found that obesity was associated with vitamin D deficiency regardless of the patient's age. It is recommended that different studies should be conducted to detect the causes of the relationship between BMI and vitamin D deficiency. Vitamin D deficiency in obese individuals should be treated, while considering the effects of confounding factors such as body weight, dietary intake, physical activity, education level and season (13). Khosravi Z.S. et al. included 75 female patients between ages 20-40 in their study in which they researched the effect of vitamin D supplements on weight. The participants were selected from among overweight and obese patients with BMI>25 and vitamin D deficiency, without any known chronic disease, non-smokers and menstruating regularly. The participants were divided into two groups and one of the groups was given vitamin D treatment for 6 weeks. A significant decrease was observed in the BMI and body weight of the intervention group among 53 patients who completed the study at the end of 6 weeks (14).

In a study conducted by Hussain Gilani et al. on the relationship of obesity and diabetes with vitamin D deficiency, vitamin D deficiency was detected in 60.6% and vitamin D insufficiency was detected in15.6% of 109 patients included in the study, whereas vitamin D level was sufficient in 23.9% of the patients. 42.2% of the study group was overweight, 22% of them were obese and 35.8% of them were normal weight. They detected a significant difference between diabetic patients and non-diabetic patients and between BMI and vitamin D status (15).In our study, on the other hand, a significant relationship was detected between BMI and vitamin D level, whereas no relationship was observed with presence of diabetes or prediabetes. In the study performed by Kaddam et al., it was found that prevalence of vitamin D deficiency was higher in obese patients compared to overweight and normal weight individuals (16). In the study of Gannage-Yared et al., postmenopausal female patients between ages 50-87 were analyzed and their mean 25 (OH) D levels were 19.5±9.8 ng/ml. A negative correlation was shown between BMI and vitamin D level, similar to our study (17).

Alloubani et al. have demonstrated in their study in which they examined the relationship of vitamin D deficiency with diabetes and obesity in 350 female and male patients between ages 18-60, that vitamin D deficiency was more frequent in women and this frequency increased with an increase in BMI (18). Botella-Carretero et al. detected vitamin D deficiency in 50.7% of 73 morbidly obese patients with BMI≥40 and they observed a significant relationship between vitamin D level and prevalence of metabolic syndrome (19). Although the number of morbidly obese patients was higher in our study, vitamin D deficiency was detected in 77.4% of these patients. High rate of

vitamin D deficiency can be caused by seasonal or regional differences. Wimalawansa et al. examined related studies in their review, which they conducted to determine the relationship between vitamin D and diabetes, insulin resistance, obesity and metabolic syndrome. In observational studies, they found that sufficient vitamin D level supported recovery from diabetes, metabolic syndrome and obesity (20). Kang et al. examined children between ages 8-14 they followed during the Covid-19 pandemic. They observed a significant increase in the BMI of the participants and a significant decrease in their vitamin D levels within a one year period (21). As seen in our study, the rate of vitamin D deficiency and insufficiency increases as the degree of obesity increases. Exclusion of male patients from our study and the fact that it was conducted in the winter season, when vitamin D levels can be detected to be lower, constitute the weakness of our study. Vitamin D deficiency is a common condition in the postmenopausal period. Untreated vitamin D deficiency leads to osteoporosis, fracture and other cardio-metabolic risks (22-25). Therefore, nutritional recommendations and vitamin D supplementation are recommended for postmenopausal elderly women to avoid these risks.

In conclusion, it was observed in this study that as the degree of obesity increased, the level of vitamin D decreased. However, vitamin D levels of the women in menopause were higher than the women who were not in menopause. Vitamin D supplementation during menopause may explain this unexpected relationship. Family physicians should make vitamin D supplementation in addition to diet and other recommendations in obese patients when necessary.

Conflict of interest

The authors declare that they have no conflict of interest.

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