Vitamin D Levels and Diabetes Mellitus: A Study on Age, Sex, and Body Mass Index

Enver Çiftel¹, Serpil Çiftel², Ramazan Dayanan³*, Hasan Atlı⁴

¹ Department of Endocrinology and Metabolism, Sivas Numune Hospital, Sivas, TR
² Department of Endocrinology and Metabolism, Faculty of Medicine, Erzurum Regional Education and Research Hospital, Erzurum, TR
³ Department of Endocrinology and Metabolism, Batman Training and Research Hospital, Batman, TR
⁴ Department of Internal Medicine, Batman Training and Research Hospital, Batman, TR

* Corresponding Author: Ramazan Dayanan E-mail: ramazandayanan9@gmail.com

ABSTRACT

Objective: The correlation between Body Mass Index (BMI) and vitamin D levels has garnered considerable attention in contemporary medical investigations. Vitamin D, an essential fat-soluble micronutrient, significantly influences bone health, immune system functionality, and various other physiological functions. The bioavailability of vitamin D may be affected by adiposity, which might result in possible deficits in persons with elevated body mass indices. The objective of this retrospective study conducted at a single center was to examine the potential relationship between BMI and diabetes mellitus (DM) with vitamin D serum levels in a cohort of 680 individuals, comprising 511 females and 169 males.

Methods: The present study utilized a methodology in which medical records from a single facility were comprehensively reviewed to collect relevant information on BMI and blood 25-hydroxyvitamin D [25(OH)D] levels. The participants were classified into four distinct groups based on their BMI categories, which included normal weight, overweight, obese, and morbidly obese. Statistical methods were employed to investigate the relationship between BMI, diabetes mellitus (DM), age, and 25-hydroxyvitamin D (25(OH)D) levels. Furthermore, multivariate regression analysis was conducted to account for potential confounding variables such as age and gender.

Results: The study included a sample of 680 individuals, comprising 511 women (75.1%) with an average age of 41 (±12) and 169 men (24.9%) with an average age of 38 (±13). Vitamin D levels in women were found to be 14±7 ng/mL, while in men, the levels measured at 16.6±7 ng/mL. The study identified a statistically significant difference in vitamin D levels between women and men (p<0.001). The study's findings indicate that there was no significant correlation between vitamin D levels and age among all individuals (p=0.258). However, a significant albeit weak correlation was observed between vitamin D levels and BMI (p=0.002, R²=0.0141). The vitamin D levels of the obese group were measured to be 14±7 ng/mL, while the non-obese group had levels of 16±7 ng/mL. Statistical analysis revealed that vitamin D levels in the obese group were significantly lower compared to the non-obese group (p=0.012).

When comparing vitamin D levels between individuals with and without diabetes mellitus (DM), it was observed that the mean vitamin D level was 13.8±6.3 ng/mL in the non-DM group and 16.6±7.6 ng/mL in the DM group. Statistical analysis revealed that vitamin D levels were significantly higher in the DM group (p=0.012).

Conclusion: Our study's findings suggest a potential connection between low vitamin D levels and obesity, while factors such as diabetes, age, and gender do not seem to significantly impact this association.

Keywords: Age, D vitamin, Diabetes Mellitus, Gender, Obesity

INTRODUCTION

Vitamin D, often referred to as the "sunshine vitamin," is a vital fat-soluble prohormone-vitamin known for its essential role in preserving bone health, bolstering immune function, and overseeing numerous metabolic processes (1). The primary source of vitamin D for humans is sunlight exposure, although it can also be acquired through dietary sources and supplements. The synthesis of vitamin D takes place in the skin when it is exposed to ultraviolet B (UVB) radiation. During this process, 7-dehydrocholesterol is transformed into cholecalciferol, also known as vitamin D3 (2).
Cholecalciferol undergoes hydroxylation in the liver, resulting in the formation of 25-hydroxyvitamin D (25(OH)D), which serves as the primary circulating form of vitamin D. The kidneys are responsible for the subsequent hydroxylation process, resulting in the production of the physiologically active form of vitamin D, known as 1,25-dihydroxyvitamin D [1,25 (OH)2D] (4,5). The active metabolite in question plays a pivotal role in the processes of calcium absorption, maintenance of bone health, and regulation of immunological function (6). The prevalence of vitamin D (VD) deficiency is increasing and has become a significant epidemiological concern, impacting a substantial population (7). The global incidence of vitamin D deficiency, characterized by serum 25-hydroxyvitamin D (25(OH)D) levels below 30 ng/mL, is reported to range from 30% to 80% among adult populations (8). It is worth noting that more than 1 billion people worldwide suffer from vitamin D insufficiency or deficiency (8). Vitamin D deficiency has been documented in a range of 30% to 50% among both children and adults in Turkey, with geographical variations (9–13).

Vitamin D insufficiency is a prevalent condition (13). Vitamin D plays a crucial role in regulating bone and mineral metabolism, as well as exhibiting a range of biological actions such as antioxidative, anti-inflammatory, antibacterial, lipid-lowering, and cardiovascular protective properties (1). The association between vitamin D insufficiency and several health conditions such as hypertension, diabetes, dyslipidemia, obesity, metabolic syndrome, and osteoporosis has been established (1,14). According to existing literature, evidence suggests that individuals belonging to specific demographic groups, namely children, women, and the elderly, exhibit a higher propensity for experiencing vitamin D deficiency (15,16). Despite the widespread prevalence of vitamin D insufficiency and its correlation with numerous disorders, the existing data is still inadequate to support the recommendation of routine screening for vitamin D. Consequently, research endeavors focused on identifying individuals with a heightened susceptibility to vitamin D insufficiency may yield valuable insights for determining the target group for screening purposes. Nevertheless, the global issue of vitamin D deficiency exhibits significant variations in incidence across different civilizations, mostly influenced by ethnic characteristics including the geographical location of countries, duration of solar exposure, dietary patterns, and clothing choices (9). This project aims to investigate the correlation between vitamin D levels and age, gender, and body weight within a specific demographic subset comprising a restricted number of males and females residing in our region. Additionally, we seek to identify potential cohorts for targeted screening of vitamin D deficiency.

**MATERIAL and METHODS**

This retrospective study was conducted by analyzing the vitamin D levels, age, gender, height, and body weight data of adults 18 years old who applied to the Sivas Numune Hospital Division of Endocrinology outpatient clinic between December 2022 and March 2023 for overweight or routine control. The acquisition of pertinent clinical data for this investigation was facilitated by conducting a comprehensive evaluation of medical electronic records. The study protocol received approval from the institutional review board of Sivas Numune Hospital. The research was carried out in compliance with the principles outlined in the Declaration of Helsinki.

The present investigation was conducted at the geographical coordinates of 39°45′0.7″N 37°0′58.0″E, specifically located in the city of Sivas. A total of 680 male and female individuals ranging in age from 18 to 72 were included as participants in the study. The present study assessed vitamin D levels for the period spanning from December to March. The study was conducted at a secondary healthcare institution. The study comprised a sample size of 680 individuals, consisting of 511 females and 169 males. The study excludes pregnant women, breastfeeding women, individuals with a body mass index below 18kg/m2 to account for potential malabsorption issues, individuals with a confirmed diagnosis of malabsorption disease, individuals with liver and kidney failure, individuals with a confirmed diagnosis of osteoporosis and hyperparathyroidism, individuals using medications that enhance the metabolism of vitamin D, and individuals currently undergoing vitamin D treatment. Vitamin D levels, chemiluminescent microparticle immunoassay Worked on the Abbott Architect i2000 (USA) autoanalyzer using the (CMIA) method. Serum 25 Hydroxy vitamin D’s values are expressed in nanograms per milliliter (ng/mL).

Vitamin D results were evaluated based on variables such as gender, age, obesity, and BMI ranges. A comparison was conducted to assess the levels of Vitamin D in females (n=511) and males (n=169). Simultaneously, the participants were categorized into two distinct groups based on their body mass index (BMI) values: those with a BMI less than 30 kg/m2 (non-obesity, n=194) and those with a BMI equal to or greater than 30 kg/m2 (obese, n=486). Subsequently, a comparison of vitamin D levels was conducted between these two groups. In order to assess patients based on BMI subcategories, the following BMI ranges were utilized: 18-25kg/m2 (n=55, Group 1), 25-29.9kg/m2 (n=140, Group 2), 30-39.9kg/m2 (n=335, Group 3), and >40 kg/m2 (n=150, Group 4). Furthermore, the individuals were classified based on their diabetes mellitus (DM) status. The study aimed to examine Vitamin D levels in two groups, one with DM (n=218) and the other without DM (n=462).

**Statistical Analysis:** The statistical program utilized for all analyses was SPSS 22.0 (SPSS Inc., Chicago, IL, USA). The variables were examined using visual and analytical techniques, including the Skewness and Kurtosis Tests, in order to ascertain their adherence to a normal distribution. The data exhibited a normal distribution. The t-test was employed to compare variables that followed a normal distribution. The mean and standard deviation (SD) were employed to describe continuous variables that exhibited a normal distribution. Frequency and percentage were used to present categorical variables. The Tukey test with Bonferroni confirmation was utilized to do pairwise comparisons. The Pearson correlation coefficient was employed to conduct the correlation analysis. A multivariable linear regression analysis was conducted in order to determine the independent determinants of vitamin D levels. All variables were incorporated into the analysis as potential predictors or covariates. The results are reported in the form of odds ratios.
The presence or absence of diabetes mellitus (DM) was observed to be 34±7.3 kg/m², while the BMI of the group without diabetes mellitus (non-DM) was measured at 34.6±7.5 kg/m². Statistical analysis revealed no significant difference between the two groups (p=0.331, Table 5). When comparing vitamin D levels across individuals with and without DM, it was observed that the mean vitamin D level was 13.8±6.3 ng/mL in the non-DM group and 16.6±7.6 ng/mL in the DM group. Statistical analysis revealed that the DM group's vitamin D levels were significantly higher (p=0.012 Table 5).

Within the cohort, a total of 194 individuals exhibited a BMI below 30kg/m², representing the non-obesity group, which accounted for 28.5% of the participants. Conversely, the cohort consisted of 486 individuals with a BMI equal to or higher than 30 kg/m², representing the obese group, which comprised 71.5% of the cohort. The mean age of individuals with a BMI less than 30 kg/m² was 37±12.4 years, while the mean age of individuals with a BMI greater than or equal to 30 kg/m² was 41.8±12.3 years. The mean age of the obese cohort was considerably greater than that of the non-obese cohort (p=0.001, Table 6). The vitamin D levels of the obese group were measured to be 14±7 ng/mL, whereas the non-obesity group had levels of 16±7 ng/mL. Statistical analysis revealed that the vitamin D levels of the obese group were considerably lower compared to the non-obese group (p=0.012, Table 6).

The participants underwent evaluation based on their body mass index (BMI) subgroups, which were categorized as follows: BMI 18-25kg/m² (n=55, 8.1%, Group 1), BMI 25-29.9kg/m² (n=140, 20.6%, Group 2), BMI 30-39.9kg/m² (n=335, 49.3%, Group 3), and BMI ≥40kg/m² (n=150, 22.1%, Group 4). The study revealed that the mean vitamin D levels in Group 1 were 15.67±7.5 ng/mL, in Group 2 were 16±7 ng/mL, in Group 3 were 14.9±7 ng/mL, and in Group 4 were 12.9±5.9 ng/mL. A notable disparity in vitamin D levels was observed among the groups (p = 0.001, Table 7). Upon examining the source of this disparity, it becomes evident that Group 2, characterized by a BMI ranging from 25 to 29.9 kg/m², had the highest amounts of vitamin D. Conversely, Group 4, with a BMI equal to or beyond 40 kg/m², displayed the lowest levels of vitamin D. The vitamin D levels of Group 4 were found to be considerably lower than those of Group 2 (p=0.001, Table 7). However, although the vitamin D levels of Group 4 were lower than those of Group 1 and Group 3, no statistical significance was observed (p=0.06, p=0.017 respectively, Table 7). Furthermore, no statistically significant variation was observed in the vitamin D levels among Groups 1, 2, and 3. A statistically significant inverse relationship was observed between BMI and vitamin D levels, with a small effect size (p=0.002, r=-0.119, R²=0.014). The present study utilized multivariate linear regression analysis to investigate the association between various variables. The results indicate that male gender positively affects vitamin D levels (p=0.006, F=10.72, B=1.73, 95% CI= 0.5-2.96). On the contrary, BMI has a negative effect on vitamin D levels (p=0.01, F=10.72, OR=-0.092, 95% CI=0.163-0.021). Additionally, the presence of diabetes mellitus (DM) is associated with vitamin D levels (p<0.001, F=10.72, B=2.354, 95% CI=1.251-3.457). Vitamin D levels are independently influenced by gender, BMI, and DM.
Table 1. General characteristics of the study patients (n = 680)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>680</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>511</td>
<td>75.1</td>
</tr>
<tr>
<td>Male</td>
<td>169</td>
<td>24.9</td>
</tr>
<tr>
<td>Age (years), mean ± standard deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>41±12</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38±13</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus (DM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>218</td>
<td>32.1</td>
</tr>
<tr>
<td>No</td>
<td>462</td>
<td>67.9</td>
</tr>
<tr>
<td>Obesity Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI&lt;30kg/m2</td>
<td>194</td>
<td>28.5</td>
</tr>
<tr>
<td>BMI≥30kg/m2</td>
<td>486</td>
<td>72.5</td>
</tr>
<tr>
<td>BMI Categories</td>
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</tr>
<tr>
<td>18-24.9kg/m2</td>
<td>55</td>
<td>8.1</td>
</tr>
<tr>
<td>25-29.9kg/m2</td>
<td>140</td>
<td>20.6</td>
</tr>
<tr>
<td>30-39.9kg/m2</td>
<td>335</td>
<td>49.3</td>
</tr>
<tr>
<td>&gt;40kg/m2</td>
<td>150</td>
<td>22.1</td>
</tr>
</tbody>
</table>

Table 2. Relationship between Age, BMI (Body Mass Index) and D vitamin levels with sex.

<table>
<thead>
<tr>
<th></th>
<th>Female (n=511) (Mean±SD)</th>
<th>Male (n=169) (Mean±SD)</th>
<th>p</th>
<th>Total N=680 (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>41±12</td>
<td>38±13</td>
<td>0.004*</td>
<td>40.4±12.5</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>35.8±7.6</td>
<td>31.5±6.2</td>
<td>0.001*</td>
<td>34.4±7.4</td>
</tr>
<tr>
<td>D vitamin (ng/mL)</td>
<td>14±7</td>
<td>16±6.7</td>
<td>0.001*</td>
<td>14.7±6.9</td>
</tr>
</tbody>
</table>

*p <0.05 is significant, BMI, Body Mass Index

Table 3. Correlation Between Age and BMI with D vitamin Levels

<table>
<thead>
<tr>
<th>Correlations</th>
<th>With D vitamin Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>r=0.043</td>
</tr>
<tr>
<td>p=0.258</td>
<td></td>
</tr>
<tr>
<td>BMI (Body Mass Index)</td>
<td>r=-0.119</td>
</tr>
<tr>
<td>p=0.002*</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05 is significant, BMI, Body Mass Index

Table 4. Comparison of Age and BMI according to Vitamin D Levels

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Dvit. &lt;20 ng/ml (n=517) (Mean±SD)</th>
<th>D vit. ≥ 20 ng/ml (n=163) (Mean±SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.8±7.6</td>
<td>33.2±7</td>
<td></td>
<td>0.019*</td>
</tr>
<tr>
<td>40.3±12</td>
<td>40.6±12</td>
<td></td>
<td>0.796</td>
</tr>
</tbody>
</table>

*p <0.05 is significant, BMI, Body Mass Index

Table 5. Age, BMI and D vitamin Levels in DM.

<table>
<thead>
<tr>
<th>Age (year) (mean±SD)</th>
<th>p</th>
<th>BMI (mean±SD)</th>
<th>p</th>
<th>D Vitamin (ng/mL) (mean±SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM Yes (n=218)</td>
<td>0.173</td>
<td>34.6±7.5</td>
<td>0.331</td>
<td>16.6±7.6</td>
<td>0.001*</td>
</tr>
<tr>
<td>No (n=462)</td>
<td>39.9±12.4</td>
<td>34±6.3</td>
<td></td>
<td>13.8±6.3</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05 is significant, BMI, Body Mass Index, DM, Diabetes Mellitus

Table 6. Age and D vitamin Levels in Obesity.

<table>
<thead>
<tr>
<th>Obesity (≥30kg/m²)</th>
<th>Age (year) (mean±SD)</th>
<th>p</th>
<th>D Vitamin (ng/mL) (mean±SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (n=486)</td>
<td>41.8±12.3</td>
<td>0.001*</td>
<td>14±7</td>
<td>0.012*</td>
</tr>
<tr>
<td>No (n=194)</td>
<td>37±12.4</td>
<td></td>
<td>16±7</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05 is significant

Table 7. Relationship Between D Vitamin with BMI Subgroups.

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>D vit.(ng/mL) (Female) (mean±SD)</th>
<th>D vit.(ng/mL) (Male) (mean±SD)</th>
<th>p</th>
<th>Female-male</th>
<th>D vit.(ng/mL) (Total) (mean±SD)</th>
<th>Total p</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25 (n=55)</td>
<td>15.4±8.3 (n=38)</td>
<td>16±5.4 (n=17)</td>
<td>0.783</td>
<td></td>
<td>15.6±7.5</td>
<td></td>
</tr>
<tr>
<td>25-29.9 (n=140)</td>
<td>14.6±6.8 (n=79)</td>
<td>17±6.7 (n=61)</td>
<td>0.008*</td>
<td></td>
<td>16±7.1</td>
<td>0.001*</td>
</tr>
<tr>
<td>30-39.9 (n=335)</td>
<td>14.4±7 (n=256)</td>
<td>16.2±6.8 (n=79)</td>
<td>0.047*</td>
<td></td>
<td>14.9±7</td>
<td></td>
</tr>
<tr>
<td>≥40 (n=150)</td>
<td>12.9±138 (n=138)</td>
<td>12.4±4.3 (n=12)</td>
<td>0.781</td>
<td></td>
<td>14.7±6.9</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05 is significant
The current study provides evidence for the potential association of obesity and female gender on vitamin D levels. However, the study did not find any substantial impact of age on vitamin D levels. The results of this study indicate that gender and obesity are potentially influential factors in determining vitamin D levels, although age does not appear to alter this association significantly. The results of our investigation align with certain studies documented in the current body of literature, while disparities also exist. To begin, it is widely recognized that a correlation exists between vitamin D deficiency and obesity (17,18). This phenomenon can be elucidated by vitamin D being retained within adipose tissue, given its liposolubility as a fat-soluble vitamin (2). Simultaneously, it should be noted that certain characteristics, such as reduced levels of physical activity and restricted engagement in outdoor activities, have the potential to impede the generation of vitamin D in those who are obese (4).

One noteworthy finding of this study is the absence of a significant age-related disparity in vitamin D levels. Several investigations have suggested a decline in vitamin D production with advancing age (19). The age factor can exert various influences on vitamin D levels. As individuals progress in age, there is a decline in the skin's ability to synthesize vitamin D through exposure to UV radiation (19,20). Nevertheless, the results of our study indicate that aging does not significantly influence vitamin D levels. This observation suggests that the impact of obesity on vitamin D levels surpasses any potential alterations associated with aging. The observed phenomenon may be attributed to the specific attributes of our selected sample or the omission of accounting for the potential influence of additional lifestyle variables. Based on the findings of a nationwide study involving the examination of vitamin D levels in a sample size of 108,742 individuals, it was determined that the prevalence of vitamin D deficiency was highest among those aged 19-30. Furthermore, a positive correlation between age and vitamin D levels was detected, indicating an upward trend in vitamin D concentrations as individuals grew older (13). The potential explanation for this phenomenon could be attributed to the disparity in the utilization of replacement therapy among individuals in different age groups. Specifically, younger individuals may receive less replacement therapy due to their relatively lower frequency of visits to healthcare facilities. Conversely, older individuals may receive intermittent vitamin D replacement therapy as they seek medical attention from multiple healthcare institutions, often due to comorbid conditions.

Based on existing evidence, it has been postulated that potential disparities may exist between males and females in the metabolism of vitamin D (8,19). The potential influence of gender on vitamin D levels can be elucidated by variations in hormonal, social, dietary, and clotting factors. This study provides evidence in line with existing literature, indicating a correlation between gender and vitamin D levels (13,21). This phenomenon could perhaps be attributed to the impact of various additional elements, including hormonal equilibrium as well as dietary and sartorial practices. The impact of estrogen on the metabolism of vitamin D has been established (19).

One notable finding from our investigation is the observation of elevated vitamin D levels in individuals with diabetes. This discovery may be unexpected, given that existing evidence generally links low vitamin D levels with an increased risk of diabetes (24,25). This discovery implies that persons diagnosed with diabetes may experience increased exposure to sunshine or that the treatment of diabetes may potentially impact the metabolism of vitamin D.
Diabetes has emerged as a significant global public health concern, prompting numerous ongoing investigations into the underlying mechanisms and development of this condition (26). In recent years, a growing focus has been on the correlation between vitamin D and diabetes. The existing body of research commonly asserts that individuals diagnosed with diabetes often have a shortage of vitamin D (25,27). In the study conducted by Dogan et al., it was shown that the vitamin D levels of 296 patients with Type 1 DM were comparable to those of the control group (10). Simultaneously, investigations carried out in other nations have revealed no discernible disparity in vitamin D deficiency between those with Type 1 DM and those without the condition (28–31). Hence, the current research does not indicate vitamin D deficiency among individuals with Type 2 diabetes mellitus, thereby implying a stronger correlation between vitamin D deficiency and obesity rather than diabetes (23). Our investigation revealed that diabetes patients exhibited elevated levels of vitamin D, surpassing initial expectations. This discovery, in contrast to other research, suggests that vitamin D could either serve as a protective factor or assume a distinct role in the development of diabetes. It is plausible that there exists an association between diabetes and genetic variations in the vitamin D receptor (VDR) (32). These genetic variations have the potential to influence an individual’s vulnerability to vitamin D deficiency and the processes involved in the metabolism of this essential nutrient. An alternative hypothesis is that this study’s sample group might constitute a distinct population subset. For instance, the geographic region or ethnicity of the study group may have an impact on the levels of vitamin D. In summary, the findings of this study indicate that diabetic patients may exhibit elevated levels of vitamin D beyond anticipated values. These data suggest that the relationship between vitamin D and the development of diabetes is multifaceted and that individual variations may influence vitamin D metabolism.

The evaluation of our work necessitates the consideration of certain constraints. This study is based on data obtained from a singular research facility, with a somewhat limited sample size and a brief duration of data collection. The data were collected retrospectively. As mentioned earlier, the sample consists of individuals seeking admission to healthcare facilities and may not be representative of the broader population. Additionally, it represents a diverse group characterized by variations in both age and gender.

CONCLUSION

In summary, the findings of this study suggest a potential link between low vitamin D levels and obesity, while factors such as diabetes, age, and gender do not seem to significantly impact this association. This implies that obesity might have a notable influence on vitamin D levels, regardless of other variables. Further research is needed to explore the various factors contributing to this correlation, including the potential effect of increased adipose tissue on the bioavailability of vitamin D in individuals.

It is essential for healthcare professionals to be aware of the likelihood of decreased vitamin D levels in individuals with a high body mass index (BMI) and to consider routine assessment and supplementation when necessary. These findings underscore the importance of personalized approaches in managing and treating vitamin D insufficiency. However, it’s crucial to establish these findings’ generalizability and clinical significance through studies involving larger sample sizes and diverse geographical regions.

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Author Contributions: EÇ, SC, RD, HA: designed and directed the study. Data collection, analysis and interpretation of results RD: wrote the final draft of the manuscript. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval: The present study was conducted in strict accordance with the principles outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the Batman Training and Research Hospital Ethics Committee and all participants provided informed consent before participating in the study. The sentence will be written.

REFERENCES


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