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Change of Vitamin D Levels According to Age, Gender and Seasons in Şırnak Province

Şırnak İlinde D Vitamini Seviyesinin Yaş, Cinsiyet ve Mevsimlere Göre Değişimi

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Abstract

Objective: This study determines the 25-hydroxy vitamin D [25(OH)D] profile according to season, age, and gender by examining the vitamin D levels of the patients who applied to Cizre State Hospital, which is the warmest district of Turkey, in 2021.
Materials and Methods: 13,387 patients admitted to Cizre State Hospital were included in the study, and their [25(OH)D] levels were analyzed retrospectively. In the study, [25(OH)D] levels were evaluated according to the age, gender and seasonal differences of the patients. [25(OH)D] levels in serum are <12 ng/mL, severe deficiency, 12-20 ng/mL mild-moderate deficiency, 21-30 ng/mL insufficient, >30 ng/mL conditions were accepted as qualifications.
Results: The findings of 9,800 women and 3,587 men were evaluated in the study. The mean serum level of [25 (OH)D] was 12.31±0.08 ng/mL in women and 17.58±0.15 ng/mL in men. Amongst the age groups, vitamin D levels in both male and female patients were statistically significant (p<0.01). Statistically significant changes were identified across seasons, with [25(OH)D] levels in both women and men being lowest in winter and greatest in summer (p<0.01).The mean [25(OH)D] level was 18.51±0.17 ng/mL in patients aged 0-15 years (n=3,219), 11.86±0.12 ng/mL in patients aged 16-30 years (n=4,093), between 31-45 years old 12.12±0.14 ng/mL in patients (n=3,008), 12.39±0.18 ng/mL in patients aged 46-60 years (n=1,817), and 13.40±0.28ng/mL in patients aged 61-75 years (n=962).
Conclusion: In this study, very serious vitamin D deficiency was detected in patients admitted to Cizre State Hospital.
It is thought that low vitamin D levels may be related to the absence of vitamin D synthesis because of insufficient sunlight in winter, the closed dressing habits of the region, or foods deficient in vitamin D. Because of this study, the need for supportive treatment gained more importance.
Keywords: Osteoporosis, gender, vitamin D, seasons, age

Öz

Amaç: Bu çalışma, 2021 yılında Türkiye'nin en sıcak ilçesi olan Cizre Devlet Hastanesi'ne başvuran hastaların D vitamini düzeylerini inceleyerek mevsim, yaş ve cinsiyete göre 25-hidroksi vitamin D [25(OH)D] profilini belirlemeyi amaçlamaktadır.
Gereç ve Yöntem: Cizre Devlet Hastanesi'ne başvuran 13.387 hasta çalışmaya dahil edilmiştir ve [25(OH)D] düzeyleri retrospektif olarak incelenmiştir. Çalışmada [25(OH)D] düzeyleri, hastaların yaş, cinsiyet ve mevsimlerdeki farklılık durumlarına göre değerlendirilmiştir. [25(OH)D] düzeyinin serumdaki düzeyleri <12 ng/mL olduğu durumlar ciddi eksiklik, 12-20 ng/mL olduğu durumlar hafif-orta düzeyde eksiklik, 21-30 ng/mL olduğu durumlar yetersizlik, >30 ng/mL olduğu durumlar ise yeterlilik olarak kabul edilmiştir.
Bulgular: Çalışmada 9.800 kadın ve 3.587 erkeğe ait bulgular değerlendirilmiştir. Kadınlarda [25(OH)D] serum düzeyi ortalaması 12,31±0,08 ng/mL, erkeklerde 17,58±0,15 ng/mL olarak tespit edilmiştir. Yaş grupları arasında hem erkek hem de kadın hastalarda D vitamini düzeyleri istatistiksel olarak anlamlıydı (p<0,01). [25 (OH)D] düzeylerinin hem kadınlarda hem de erkeklerde kışın en düşük ve yazın en yüksek olduğu mevsimler boyunca istatistiksel olarak anlamlı değişiklikler belirlendi (p<0,01). 0-15 yaş arası hastalarda (n=3.219) ortalama [25(OH)D] düzeyi 18,51±0,17 ng/mL, 16-30 yaş arası hastalarda (n=4.093) 11,86±0,12 ng/mL, 31-45 yaş arası hastalarda (n=3.008) 12,12±0,14 ng/mL, 46-60 yaş arası hastalarda (n=1.817), 12,39±0,18 ng/mL ve 61-75 yaş arası hastalarda (n=962) 13,40±0,28 ng/mL bulunmuştur.
Sonuç: Bu çalışmada Cizre Devlet Hastanesi'ne başvuran hastalarda çok ciddi D vitamini yetersizliği tespit edilmiştir. Düşük D vitamini seviyelerinin, kışın güneş ışığının yetersizliği sonucunda hemen hemen hiç D vitamini sentezinin olmaması, bölgenin kapalı giyinme alışkanlıkları veya D vitamininden yetersiz yiyecekler ile ilişkili olabileceği düşünülmektedir. Bu çalışma sonucunda, destek tedaviye olan ihtiyaç daha fazla önem kazanmaktadır.
Anahtar kelimeler: Osteoporoz, cinsiyet, D vitamini, mevsimler, yaş

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Introduction

Although some of the vitamin D is obtained from the diet, its main source is ultraviolet exposure. Vitamin D is also defined as a steroid-formed vitamin that occurs in the skin with sunlight (1). Vitamin D; It is available in form of vitamin D2 and vitamin D3. Vitamin D2 is dietary ergocalciferol. Vitamin D3 is cholecalciferol, which is synthesized in the skin of the human body. First these two inactive forms it is hydroxylated by 25 hydroxylases and 25 dihydroxy vitamin D (25-OH D) in the liver and then in the kidneys. Its active form, 1.25 dihydroxy vitamin D, is hydroxylated by 1 α-hydroxylase (2). Apart from calcium homeostasis, vitamin D has versatile functions for bone and muscle (3). Rickets or osteomalacia, characterized by impaired bone mineralization, occurs in vitamin D deficiency. Apart from bone, vitamin D has potential benefits on diabetes mellitus, cardiovascular diseases, cancer, multiple sclerosis, allergies, asthma, infections, depression, psychiatric disorders and pain (4). Vitamin D is very important for our immune system, especially in winter, it is not easy to replenish vitamin D stores. Vitamin D reduces vitamin D stores for various reasons, such as the reduce in vitamin D synthesis by tropospheric ozone in the skin after malnutrition and environmental pollution (5). Today, [25(OH)D] levels below 50 nmol/L (<20 ng/mL) are defined as deficiency, and 50-75 nmol/L (20-30 ng/mL) as deficiency (subclinical deficiency) (6). The preference of [25(OH)D] in serum is explained the long half-life, an indicator of the storage of vitamin D in the body, which is taken in the diet and synthesized in the skin (7). Vitamin D insufficiency is a problem that significantly effects health costs, morbidity and mortality, especially among the elderly and closed communities. The goal of this study was to assess the district's [25(OH)D] profile by gender, age, and season by looking at the vitamin D levels of patients admitted to Cizre State Hospital.

Materials And Methods

The Şırnak University Scientific Research and Publication Ethics Committee authorized the study protocol (decision no: 2022/71, dated no: 20/04/2022). The study looked back at desired [25(OH)D] levels in patients admitted to Cizre State Hospital between January 2021 and January 2022. The data obtained from the electronic health records of the patients in the hospital database were analyzed retrospectively. As a result, patients were unable to sign an informed consent form. This study included 13,387 participants who applied to the hospital. The patients' [25(OH)D] levels were calculated based on their gender, age, and season. Patient names were kept anonymous during data analysis, and ethical guidelines were observed. In age group comparisons, patients above the age of 75 were omitted. The electrochemiluminescence technique was used using the Roche cobas device and Immunoassay equipment considered serum [25(OH)D] levels. Severe adequate was described as serum [25(OH)D] level of 12 ng/mL, mild-moderate adequate as 12-20 ng/mL, deficiency as 21-30 ng/mL, and sufficiency >30 ng/mL.

Statistical Analysis

To detect the link among vitamin D and gender, age and seasons, the compatibility of the variables with the normal distribution was examined by the skewness-kurtosis test using the Statistical Package for the Social Sciences 21.0 package program. Distanced samples t-test was applied to identify whether there was a important variation between vitamin D averages according to gender. One-way ANOVA test was used to determine whether there was a significant different between the mean vitamin D levels of age, month and season. Tukey test was applied in multiple comparison (post-hoc) tests to find out the significance of the difference within the groups. Mean and standard error values are given in descriptive statistics. A value of $p<0.05$ was considered important.

Results

The age and gender status of the patients who came to Cizre state hospital were divided into groups according to months and seasons, and descriptive statistics, mean and standard deviation values were given in the tables. Demographic information and mean vitamin D levels of the patients are given in Table 1. Considering the gender of the patients; It is seen that this study consisted of 9,800 women and 3,587 men. When the mean vitamin D level of the patients was evaluated as a total, it was found that the mean was 12.31±0.08 ng/mL in women and 17.58±0.15 ng/mL in men. D vitamin levels in females were found to be significantly lower than those in men $p<0.01$ significance level (Table 1).

Vitamin D levels based on the patients' ages are given in Table 2. In patients aged 0-15 years, the mean vitamin D level (n=3,219)

Table 1. Demographic information of patients and average 25-OH Vitamin D levels

Gender	n	Average (ng/mL)	p
Woman	9,800	12.31±0.08	p<0.01
Man	3,587	17.58±0.15	

Data are given as mean and standard error

Table 2. 25-OH D change according to the age of the patients

Age group	n	Average (ng/mL)	p
Group 1	3,219	18.51±0.17	Group 1-2, p<0.01 Group 1-3, p<0.01 Group 1-4, p<0.01 Group 1-5, p<0.01 Group 2-3, NS Group 2-4, NS Group 2-5, p<0.01 Group 3-4, NS Group 3-5, s<0.01 Group 4-5, s<0.05
Group 2	4,093	11.86±0.12	
Group 3	3,008	12.12±0.14	
Group 4	1,817	12.39±0.18	
Group 5	962	13.40±0.28	

Data are given as mean and standard error,
NS: Not significant, Group 1: 0-15 years, Group 2: 16-30 years, Group 3: 31-45 years, Group 4: 46-60 years, Group 5: 61-75 years

was found to be 18.51±0.17 ng/mL. Mean vitamin D level in patients aged 16-30 years (n=4,093) 11.86±0.12. The mean vitamin D level in patients aged 31-45 years (n=3,008) was 12.12±0.14 ng/mL, In patients aged 46-60 years, the mean vitamin D level (n=1,817) was 12.39±0.18 ng/mL, The mean vitamin D level in patients aged 61-75 years was 13.40±0.28 (n=0,962). As a variable of age, consequently the regression analysis, it can be said that the p value is statistically significant ($p<0.05$) and the vitamin D value changes at the highest level, especially in the 0-15 age group. (Table 2). Tukey test was applied between 4 groups for seasonal differences. As a result of the test, statistical differences were observed between the seasons (Table 3). One-Way ANOVA test was used to test whether there is a relationship between vitamin D and month. Since the variances assume homogeneity, the Tukey test was applied to determine in which months the difference was experienced and the average values of the months were given. All groups except Eylul group had a significant difference within themselves ($p<0.01$) (Table 4).

Discussion

Vitamin D absence is a global public health problem. This problem effects 92% of the world. It is the most common among the diseases seen in Northern Europe. In Turkey, on the other hand, this rate is between 57-64% (8,9). Reports from many different countries show that; Vitamin D levels show insufficiency and deficiency depending on defined threshold values (10). Asians do not have adequate vitamin D levels despite living in an area with sufficient sun (11,12). Apart from external factors such as exposure to direct sunlight, location of the place of residence, air pollution, seasonal changes, and clothing style, vitamin D taken with food also directly affects vitamin D level (13-17). The vitamin D levels of patients hospitalized to Cizre State Hospital were examined retrospectively in this study. Vitamin D levels in women were found to be statistically significantly lower than in men (Table 1). On the other hand, Öğüş et al (18) in a study conducted in Ankara, they reported the mean vitamin D level of 3,242 patients as 22.80±13.27 ng/mL. In the same study, 50% of women and 38% of men had vitamin D levels below 20 ng/mL. Similarly, in our results, we found that women's vitamin D levels were significantly lower than men. Bolland et al (19) in 1,606 healthy postmenopausal women and 378 middle-aged and elderly men. He studied vitamin D levels. They reported that 73% of women and 39% of men were vitamin D deficient. Hekimsoy et al. (5) investigated the vitamin D levels of 391 patients over the age of 20 living in rural and rural areas. They found the mean of vitamin D levels to be 16.9±13.09 ng/mL. They found that the deficiency was 66.4% and 78.7% higher in women than in men. In a recent study that included 21,555 women and 9,596 men in the Siirt region, women found lower levels of vitamin D than men (20). This study, which was conducted in Siirt, was found to be remarkable both in terms of being a region close to Cizre and the similarity of social habits, customs and traditions. Studies have mentioned the presence of vitamin D levels similar to our results, and the data obtained show that women have lower vitamin D levels than men. Vitamin D levels were also observed to be lower in women than in males in our research ($p<0.01$). The fact that we think it is related to high fertility, wearing traditional and covered clothes in Şırnak province, and the fact that women have a lower vitamin D profile than men will support the literature. This study is important both in terms of clarifying the profile of the region and the measures that can be taken.

Rabenberg et al. (21) found that serum 25-OH D levels of the adult population between the ages of 18-79 were below 50 nmol/L (<20 ng/mL) especially in winter and spring. Brustad and colleagues measured vitamin D levels in Norwegian people living in the northern part of the country. Those who spent the previous summer in the south of the country found higher levels of vitamin D in winter measurements than those in the north of the country (22). The highest vitamin D levels are reached especially in the summer months, and very little vitamin D is synthesized in the November-March period as the parallels increase in northern spherical countries (23,24). In addition, vitamin D levels were found to be below the normal value (22.5 nmol/L) in 80% of those who wore closed clothes in Australia (25). In a study conducted in Adana province, [25(OH)D] levels in

Table 3. Seasonal variation of patients' mean 25-OH Vitamin D levels

Season	n	Average (ng/mL)	p
Group 1	2,064	13.07±0.18	Group 1-2, p<0.01 Group 1-3, p<0.01 Group 1-4, p<0.01 Group 2-3, p<0.01 Group 2-4, p<0.01 Group 3-4, p<0.01
Group 2	3,835	11.32±0.12	
Group 3	4,173	14.77±0.14	
Group 4	3,315	15.59±0.15	

Data are given as mean and standard error,
NS: Not significant, Group 1: Autumn, Group 2: Winter, Group 3: Spring, Group 4: Summer, NS: Not Significant

Table 4. Average 25-OH Vitamin D levels by month

Months	n	Average (ng/mL)
January	1,190	12.33±0.23
February	1,565	11.49±0.19
March	1,810	13.98±0.23
April	1,219	15.30±0.25
May	1,144	15.46±0.27
June	1,675	16.36±0.22
July	843	15.43±0.30
August	797	14.12±0.29
September	65	13.17±1.11
October	947	13.81±0.28
November	1,052	12.40±0.23
December	1,080	9.96±0.20

Data are given as mean and standard error

the extremities were dimensions as 53.9 ng/mL and 33.1 ng/mL in women with uncovered heads and hands and face covered, respectively, in August-September (26). A study conducted in Canada displayed that 25-OH D levels were especially in black people and older people (<30 ng/mL). Particularly in the winter and spring seasons, approximately 25-OH D levels have been shown to be low with a seasonal variation between 60% and 120% (<20 ng/mL) (27). In a study conducted in young adults in India, it was reported that vitamin D was found to be 38.7 nmol/L in women with open arms and forearms, and 47.5 nmol/L in women with open body parts living in villages and living in rural areas (28). Telo et al. (29) In a study conducted by the Turkish side in Elazığ, they found that 25-OH vitamin D levels were highest in summer and autumn, and lowest in winter and spring. Given the information from our investigation, it is clear that [25(OH)D] levels are low. It has been determined that [25(OH)D], which is low in the fall and winter and high in the summer and spring when exposed to the sun's potent rays, is below the necessary levels in all four seasons. This low vitamin D level may be brought on by inadequate vitamin D consumption and nearly nonexistent winter vitamin D production. Considering the social diet, it should not be forgotten that the people of Cizre are actually engaged in small cattle breeding and are fed rich in animal fats. Considering the high vitamin D content of animal fats, a new hypothesis emerges about why vitamin D is low in Cizre. In addition, when the distribution table according to months is examined, it is quite interesting (Table 4). Namely; while an increase in vitamin D was observed in April, May and June, vitamin D levels showed a decreasing trend in July, August and September, respectively (Figure 1). What we knew was the assumption that vitamin D stores would increase rather than decrease in these months when we are mostly faulted by the sun's rays in summer. In the studies of Telo et al. (29) and Alayunt et al. (20), vitamin D levels exceeded 20 ng/mL in summer months, while our graphs remained at 16 ng/mL levels. While interpreting the data obtained in our study, it is clear that low vitamin D levels cannot be explained only by the living conditions of a closed-knit community. Large-scale studies are needed to explain this profile with other hypotheses. I wonder if it's too much fertility that keeps vitamin D or whether a social

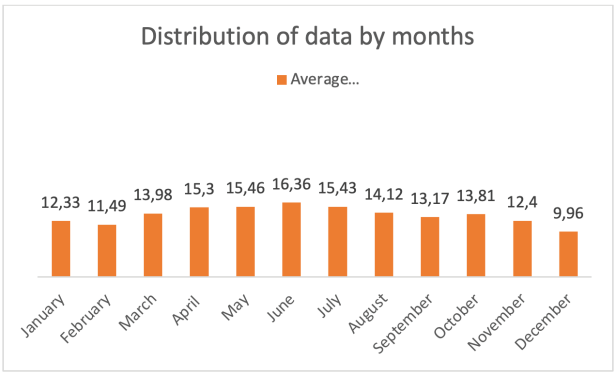

Figure 1. 25-OH vitamin D levels by month

bone disease related to vitamin D or a chain of diseases related to regional metabolic predisposition have an effect on vitamin D, we will try to reveal this in our future studies. In the first place and urgently, it will be to inform the society and recommend vitamin D supplements with plenty of sun and nutrients.

Study Limitations

The most important limitation of this study is that more comprehensive studies are needed to establish a relationship between vitamin D levels and metabolic bone disorders. Furthermore, the relationship between the region's fertility rates and bone mineralization has yet to be discovered. There is a need for new studies that will take into account the average age of menopause, including the osteoporosis rates of women, and there are limitations in this regard.

Conclusion

Because the Cizre district of Şırnak Province is Turkey's hottest and most sun-drenched location, vitamin D deficiency is unlikely to be detected. However, this study revealed that people living in Cizre have serious levels of vitamin D deficiency in all seasons, especially in winter, and in both sexes, especially in women. It is not surprising that vitamin D insufficiency is detected in this district during the summer, considering that women wear clothing that covers all regions save the face and hands, and that males wear clothing that is somewhat covered compared to western provinces. In late years, the importance of vitamin D has been growing day by day. This is due to osteoporotic fracture studies, vitamin D and calcium meta-analyses and their relationship. The data obtained in this study will require new and more comprehensive studies on the relationship between the low vitamin D profile of the region and metabolic bone diseases such as osteomalacia and osteoporosis, as well as cancer, diabetes, multiple sclerosis and cardiovascular diseases.

Ethics

Ethics Committee Approval: The present study is retrospective and its permission was obtained from Şırnak University Ethics Committee on (decision no: 2022/71, date: 20/04/2022).
Informed Consent: Retrospective study.
Peer-review: Externally peer-reviewed.

Authorship Contributions

Design: Ö.N.A., Data Collection or Processing: V.T., Ö.N.A., Analysis or Interpretation: V.T., Literature Search: V.T., Ö.N.A., Writing: V.T., Ö.N.A.
Conflict of Interest: No conflict of interest was declared by the authors.
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