Volume 12, Issue 3, Page 134-138, 2023 https://doi.org/10.46810/tdfd.1342527 Research Article

BİNGÖL ÜNİVERSİTESİ

Türk Doğa ve Fen Dergisi
Turkish Journal of Nature and Science
www.dergipark.gov.tr/tdfd

Retrospective Evaluation of Vitamin D Levels According to Age, Gender and Seasonal Characteristics: Ardahan- Gole

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(Received: 13.08.2023, Accepted: 14.09.2023, Online Publication: 27.09.2023)

Keywords
Vitamin D,
25(OH)D,
Vitamin D deficiency

Abstract: In recent years, there has been an increase in vitamin D tests in order to determine the prevalence and definition of vitamin D deficiency, which is clinically recognized to be associated with many diseases. The increase in vitamin-supported supplements is also related to this. This deficiency, which is tried to be prevented by taking precautions such as sun exposure, food and diet in local conditions, is tried to be prevented by health professionals with guidance, supervision and drug supplementation. This study covers the period between 2015 and 2022. All patient data were randomly obtained from hospital automation (Göle state hospital) and then 1,25-dihydroxyvitamin D (25(OH)D) levels were retropectively analyzed. The findings of the study showed that vitamin D levels were insufficient (<20ng ml^{-1}) in male and female populations, there was no significant difference between gender and age groups, and there was a significant seasonal change in vitamin D levels in both genders in summer and winter periods. As a result, it is important to evaluate the prevalence of vitamin D deficiency in Ardahan province and to expand the screening in the whole population and the experience of health professionals.

D Vitamini Düzeylerinin Yaş, Cinsiyet ve Mevsimsel Özelliklerine Göre Retrospektif Değerlendirilmesi: Ardahan- Göle

Anahtar Kelimeler
D vitamini,
25(OH)D,
D vitamini eksikliği

Öz: Klinik olarak birçok hastalıkla ilişkili olduğu kabul edilen D vitamini eksikliğinin prevalansını belirlemek ve tanımını yapabilmek amacıyla son yıllarda D vitamin testlerinde artış gözlenmektedir. Vitamin destekli takviyelerin artması da bununla ilişkilidir. Yerel koşullarda güneşe maruziyet, gıda, diyet gibi önlemlerin alınması ile önüne geçilmeye çalışılan bu eksiklik sağlık profesyonelleri tarafından yönlendirme, denetleme ve takviye ile engellenmeye çalışılır. Bu çalışma, 2015- 2022 arası dönemi kapsamaktadır. Tüm hasta verileri rastgele olarak hastane otomasyonundan (Göle devlet hastanesi) elde edildi ve ardından 1,25-dihidroksi vitamin D (25(OH)D) seviyeleri retrospektif olarak analiz edildi. Çalışma bulguları kadın ve erkek popülasyonunda D vitamini seviyelerinin yetersiz düzeyde olduğunu (<20ng ml^{-1}), cinsiyet ve yaş grupları arasında anlamı bir farkın olmadığını ve her iki cinste de mevsimsel olarak yaz ve kış periyotlarında D vitamini seviyelerinde anlamlı bir değişimin olduğunu göstermiştir. Sonuç olarak Ardahan İli D vitamini eksikliğinin prevalansının değerlendirilip tüm popülasyonda taramaların yaygınlaştırılması ve sağlık profesyonellerin deneyimi önemlidir

1. INTRODUCTION

Vitamin D is an essential fat-soluble vitamin obtained from animal and plant food sources, as well as being synthesized by the body from sunlight. There are 2 main forms of vitamin D. These are the vitamin D prohormones, D2 (ergocalciferol) and D3 (cholecalciferol). D2 can be obtained from plant food sources, while D3 can be obtained from animal foods and synthesized by the body through exposure to sunlight[1]. Although there are structural chain differences in these forms of vitamin D, their metabolism and functions within the body are not different. As a result of D2 and D3 metabolizations, they are converted to calcitriol (1,25-dihydroxyvitamin D or 1,25[OH] 2D), which is the active form of vitamin D[2].

1,25(OH)2D is the active metabolite and stimulates calcium absorption in target organs. The active metabolite enters the target cell and then binds to the vitamin D receptor to form a complex. This complex activates the synthesis of proteins such as calcium-binding protein or osteocalcin in the target cell. As a result, calcium is taken into the cell through the proteins in the membrane. This calcium in the target cell is transported to the extracellular fluid by an ATP-dependent mechanism, and then to the blood. Thus, the calcium level in the blood is increased. Target organs for 1,25(OH)2D are bone tissue, intestinal and kidney cells. 1,25(OH)2D acts by stimulating calcium transport from these tissues to the blood. Calcium in the blood functions as the basic component of the functioning mechanism of many systems and tissues in the body, especially bone mineralization and muscle activities [3].

Vitamin D is assessed by determination of 25(OH)D levels in serum. A 25(OH)D level between 20-60 ng mL^{-1} is considered normal in individuals under 65 years of age. Below 20 ng mL^{-1} is defined as 'vitamin D deficiency', and below 12 ng mL^{-1} is defined as 'severe deficiency'. If it is over 100 ng mL^{-1}, it may cause hypercalcemia [4, 5].

Vitamin D synthesis begins rapidly when ultraviolet rays (UVB) reach the skin. However, some environmental factors such as different latitude regions of countries, seasonal differences and air pollution also affect the synthesis of vitamin D as they affect UVB wavelengths and exposure times. Age of the individual, clothing, pigment status of the skin, use of sunscreen will also affect the synthesis. On the other hand, the inability to take foods rich in vitamin D into the body disrupts the continuity of homeostasis[6].

Vitamin D is an important component of the endocrine system that regulates calcium homeostasis and stimulates bone development. In addition, vitamin D is effective on immune functions[7, 8].

Additionally, some vitamins, such as vitamin C, vitamin E, and beta-carotene (a form of vitamin A), act as antioxidants in the body. And these antioxidants are molecules that help protect the body's cells from damage caused by harmful molecules called free radicals. Vitamin D is not typically considered an antioxidant in the same way as vitamins C or E, which are well-known antioxidants. However, there is some evidence to suggest that vitamin D may have antioxidant-like properties and play a role in reducing oxidative stress in the body[9-11].

Severe deficiency of vitamin D increases the risk of serious bone and muscle diseases such as rickets and osteomalacia. It has been reported that vitamin D deficiency can also lead to the development of autoimmune diseases. For example, studies have shown that it reduces the risk of multiple sclerosis in cases where they benefit more from sunlight at the age of 6-15 years. Various studies on ecology have also shown that less exposure to sunlight may be associated with higher cancer prevalence and cancer deaths[3].
Considering this information, vitamin D deficiency is accepted as a general health problem because it can affect all periods of life and individuals in different continents and cause health problems such as serious diseases[12, 13].

Vitamin D synthesis is considered sufficient in individuals living in low latitude regions due to the appropriate wavelength of UVB rays throughout the year, but studies have shown that vitamin D deficiency is high even in these tropical countries[12, 14] . For this reason, a population-based retrospective study was conducted showing the vitamin D levels of individuals living in our region (Ardahan-Gole), taking into account the seasonal periods.

2. MATERIAL AND METHOD

2.1. Working Order

This retrospective study was conducted with the approval of Ardahan University Scientific Research and Publication Ethics Committee (Protocol No: 2022-2ÖNP-0102, Approval Date: 14.12.2022- Issue: E-67796128-000-2200037489).

This study covers the period between 2015 and 2022. All patient data were obtained from Gole state hospital automation, and then 25(OH)D levels were analyzed retrospectively. The 25(OH)D levels of the individuals were determined by the electrochemiluminescence method, and the values were measured with the Cobas 6000-E601 device. Data from patients with conditions that may affect vitamin D levels, such as metabolic diseases, were not included in the study. Results of the same patient at different times were included. All patients included in the study (n:349) were classified according to age groups, season, gender and vitamin levels.

In the study, 25(OH)D levels obtained from a total of 349 people, 223 women and 126 men, were evaluated. The data were grouped by gender as male and female, by age as (10-19), (20-45), (46-65) and (66+) and by season as autumn, winter, spring and summer.

2.2. Statistical Analysis

SPSS 26 and MS-Excel were used for all analyses, calculations and evaluations in this study. Statistical results were evaluated at 95% confidence interval, significance level at $p<0.05$, and $p<0.01$ and $p<0.001$ level of forward significance. In the evaluation of the data, Kruskal Wallis test was used for the comparison of the descriptive statistical methods (mean, standard deviation, median) as well as the non-normally distributed parameters. Mann Whitney U test was used in the evaluations between the two groups.

3. RESULTS

The effect of gender difference on serum 25(OH)D levels was not found statistically significant (Table 1).

Table 1. 25(OH)D levels by gender

25(OH)D (ng mL^{-1})	N	Mean	S.E.	p
Female	223	15,92	0,65	> 0.05
Male	126	15,61	0,96	

When the effects of different age groups on 25(OH)D levels were examined by looking at the gender differences, no statistically significant difference was found (Table 2).

Table 2. 25(OH)D levels in different ages and genders.

25(OH)D (ng mL^{-1})	Grup	N	Mean	S.E.	p
10-19	Female	26	15,0915	1,64	> 0.05
	Male	3	15,7433	1,62	
20-45	Female	83	14,8461	0,93	> 0.05
	Male	62	13,8047	0,89	
46-65	Female	78	16,2818	1,11	> 0.05
	Male	42	17,9083	2,30	
≥66	Female	36	18,2189	2,01	> 0.05
	Male	19	16,4153	2,36	

The effect of seasonal changes on the 25(OH)D levels of the population was investigated by taking gender differences into account. When vitamin levels were examined across seasonal periods, no difference was observed between genders. However, seasonal differences caused significant changes in vitamin levels in both genders ($p<0.01$), (Table 3).

When the 25(OH)D levels in individuals were compared in autumn and winter seasons, it was determined that vitamin values decreased in both male and female groups in a statistically significant way compared to autumn in winter ($p<0.01$).

When the winter and spring periods were compared in both female and male groups, there was no significant change in vitamin levels.

A significant difference was found in the vitamin levels in the spring and summer seasons ($p<0.01$). According to this, vitamin levels increase in both men and women in summer compared to spring.

When the summer and autumn periods were compared, although a decrease was observed in the female group, the change in vitamin levels between the groups in both males and females was not statistically significant.

According to the analysis, it was determined that the period with the highest serum vitamin value in women was summer (although there was no significant difference between autumn and summer). In men, this period is the summer-autumn period.

Table 3. Serum 25(OH)D levels in different seasons.

25(OH)D (ng mL^{-1})	Season	Mean	N	S.E.	p
Female	**autumn**	17,3546	54	1,06	< 0.01
	winter	12,8826	61	0,91	
	Spring	14,1970	67	1,09	< 0.01
	Summer	21,3727	41	02,06	
Male	**autumn**	20,6132	28	3,16	< 0.01
	winter	12,6862	45	1,2	
	Spring	11,8357	30	1,02	< 0.01
	Summer	20,1757	23	1,57	

4. DISCUSSION AND CONCLUSION

25(OH)D deficiency is shown as a social problem by researchers[15]. It has been reported that there is a strong connection between this condition, which is common in society, and the development of the immune system, endocrine system, and acute and chronic diseases[16]. In addition, Karin et al reported that 25(OH)D deficiency is closely related to bone loss, infection and many diseases[17]. There are also studies talking about the relationship between vitamin D deficiency and muscle weakness, cardiovascular diseases, autoimmune diseases and cancer[18].

In this study, it was determined that there was no difference in 25(OH)D values between men and women, but the average 25(OH)D levels in both groups were below 20 ng mL^{-1} (15.92 ng mL^{-1} women; 15.61). ng mL^{-1} male). Clinically, serum 25(OH)D concentrations below 20 ng mL^{-1} have been reported as vitamin D deficiency, and levels below 12 ng mL^{-1} have been reported as severe deficiency. Accordingly, it can be said that individuals in the Ardahan-Gole region have vitamin D deficiency[4, 5].

A study similar to ours was conducted in the Mediterranean region. According to the study, they stated that 24.65% of individuals in the region had 25(OH)D deficiency. In the study, they reported that the mean 25(OH)D for men was approximately 15 ng mL^{-1} (52.95±0.92 nmol L^{-1}) and the mean 25(OH)D for women was about 14ng mL^{-1} (48.42±0.54 nmol L^{-1}). They also showed that men's 25(OH)D average was higher than women's[15]. In our study, no difference was found between genders.

In another study, they showed that 25(OH)D levels were sufficient in only 8.6% of people. The study also stated that there was no age-related difference as in our study[19].

Serum 25(OH)D levels increase as a result of sun exposure, as 7-dihydrocholesterol in the skin converts to vitamin D. Therefore, 25(OH)D level is affected by many parameters such as skin pigmentation, altitude, latitude and season [20, 21]. In the study by Samefors et al., where they investigated the 25(OH)D level in adults, it was shown that the vitamin level increased significantly in the summer months. According to the study, the average 25(OH)D level of all participants before summer was 45 nmol L^{-1}. Participants were encouraged to go outside for half an hour between 11-15:00 every day and As a result, it was shown that 25(OH)D values reached 64 nmol L^{-1} at the end of summer.[22]. In another study, they stated that 25(OH)D deficiency was highly prevalent in high latitude regions [23]. As a result, levels can change with the season, and this variability may differ from population to population[24]. Our study showed that vitamin D levels of both genders are affected by seasonal differences and that this level may be highest in summer in women and in autumn-summer months in men. In addition, it was determined that there was a significant change in autumn and spring months and 25(OH)D levels were higher in autumn. Winter for women, winter-spring for men is the period when the decrease in vitamin D values is highest. According to the results, it was determined that 25(OH)D levels reached normal levels for both genders towards the summer period. In addition, it can be said that the increase in 25(OH)D levels in the summer months continues in the autumn period and the levels that decrease in the winter tend to decrease in the spring as well. This suggests that it is related to seasonal transition processes.

When the effect of age on 25(OH)D levels was examined in the literature, it was reported that there was a significant difference in vitamin levels between age groups and lower 25(OH)D levels were found in those under 65 years of age[19]. However, in the study of the Australian population, the researchers noted that they did not find a significant difference between the age groups[24]. The data obtained in our study were classified according to 4 different age groups, and 25(OH)D levels were evaluated between the groups, and it was determined that the age parameter did not create a significant difference in 25(OH)D levels. As mentioned above, different from our study, some studies reported a significant difference in 25(OH)D levels depending on age[19]. This may be due to the low vitamin D levels of the individuals in our study.

Although many factors affect the 25(OH)D level, according to the results obtained, the vitamin D level of the population living in the province of Ardahan-Gole, which is at high latitude, is generally insufficient. In addition, it can be thought that the 25(OH)D level is low in winter and spring because sun exposure is insufficient, and the 25(OH)D level is high in summer and autumn months because sun exposure is high.

As a result, the reasons for the low 25(OH)D levels in this region should be carefully investigated. It is important that this situation is recognized as a public health problem and that studies are carried out on the whole population. It is also important to make the necessary interventions.

Limitations of the Study

Due to the insufficient sample and research conducted in the region, the study cannot reflect the entire population. Therefore, further studies are needed.

Acknowledgement

We thank Prof. Dr. Orhan ATALAY, PhD.Zehra Gul YASAR, Deniz PARLAK and Ardahan Governorship Provincial Health Directorate for their support in this study.

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