Vitamin D status of adults in Kayseri, Turkey: Summer time population based cross-sectional study

Türkiye Kayseri ili yaz aylarında yetişkinlerin vitamin D durumu: toplum tabanlı kesitsel çalışma

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Öz

Amaç: Yapılan araştırmalar tüm dünyada eksikliği ve yetersizliğinin yüksek oranda olduğunu göstermektedir. Türkiye genelinde yapılmış bir çalışma olmamakla birlikte, yapılan çalışmalarda vitamin D eksikliğinin Türkiye'de de yüksek olduğu gösterilmiştir. Bu çalışmanın amacı toplum tabanlı olarak vitamin D eksikliği ve yetersizliği prevalansını saptamak, yaş, cinsiyet, eğitim gibi değişkenlere göre dağılımını incelemektir. Gereç ve Yöntem: 18-65 yaş arasında yetişkin bireyler üzerinde yaz aylarında gerçekleştirilmiştir. Örneklem büyüklüğü 323 olarak hesapalanmış ve araştırma 381 kişi ile tamamlanmıştır. Sosyodemografik özellikleri, fiziksel aktivite durumunu ile vitamin D düzeyini etkileyebilecek değişkenlerin sorgulanmıştır. Kan örnekleri LC-MS/MS yöntemiyle analiz edilmiştir. Bulgular: Katılımcıların yaş ortalaması 36.21±12.10'dir. Katılımcıların serum vitamin D düzey ortalaması 15.11±9.07 ng/ml olup vitamin D eksikliği %72.2 (<20 ng/ml), vitamin D yetersizliği (20 – 30 ng/ml) % 20.5 ve serum vitamin D düzeyi normal (>30 ng/ml) olanların oranı %7.3'dür. Erkeklerde vitamin D eksikliği %68.8, kadınlarda %75.7 olarak bulunmuştur. Yaz aylarında açık alanlarda bir saatten az süre geçirenlerde 1.7 kat, 35 yaş üzeri bireylerde 1.8 kat, bekârlarda 1.8 kat, Güneş kremi kullananlarda 2.4 kat ve ekonomik durumu iyi olmayanlarda 2.6 kat D vitamini eksikliği daha fazla görülmektedir. Tartışma: Kayseri ilinde vitamin D eksikliği ve yetersizliği görülme oranı yüksektir. Bu çalışmada vitamin D düzeyine en çok etki eden faktörler, cinsiyet, medeni durum, ekonomik durum, güneş kremi kullanımı ve yaz aylarında güneşten faydalanma olarak belirlenmiştir.

Anahtar Kelimeler

D Vitamini; D Vitamini Eksikliği; D Vitamini Yetersizliği

Abstract

Aim: Research shows that deficiency and insufficiency of vitamin D is high in the world. There are limited studies in Turkey but it has been shown that deficiency and insufficiency are high in Turkey. The aim of this study is to determine the prevalence of vitamin D deficiency and insufficiency and related factors in an adult population. Material and Method: This study was conducted in urban area of Kayseri in Central Anatolian region of Turkey, in adults aged 18-65 years in the summer period. The minimum sample size was calculated as 323 and the survey was completed with 381 people. A questionnaire about sociodemographic characteristics, and variables that may affect vitamin D level was administered. Blood samples were analyzed by LC-MS/MS. Results: The mean age of the participants was 36.21±12.10. The mean serum vitamin D level was 15.11±9.07 ng/ml. Vitamin D deficiency (<20 ng/ml) was found in 72.2%, vitamin D insufficiency (20-30 ng/ml) was found in 20.5% and only 7.3% of participants had a sufficient vitamin D level (>30 ng/ml). Vitamin D deficiency was found in 68.8% of males and in 75.7% of females. People who have exposure to the sun for less than 1 hour in the summer have 1,7 fold higher vitamin D deficiency. Vitamin D deficiency was 1.8 fold higher in those >35 years old, 1.8 times higher in the unmarried, 2.4 fold higher in those using sunscreen and 2.6 fold higher in those who did not have a good economic condition. Discussion: Kayseri has a high prevalence of vitamin D deficiency and insufficiency. Factors that have the most effect on vitamin D levels were determined as gender, marital status, economic status, use of sun cream and exposure to sunlight in summer.

Keywords

Vitamin D; Vitamin D Deficiency; Vitamin D Sufficiency

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Introduction

Vitamins are generally defined as water-soluble and oil-soluble vitamins, and function in different systems of the human organism [1]. Vitamin D is mainly effective on the musculoskeletal system, but it is considered to be a hormone rather than a vitamin because: as a steroid hormone it is synthesized in the human body under sunlight and affects many systems [1]. Following the discovery of Vitamin D receptors in different organs and tissues has been shown to have effects on other systems in addition to its effect on bone mineralization and calcium metabolism [2]. In addition to the effect of vitamin D on calcium absorption, it is known that it plays a role in intracellular calcium and phosphorus metabolism, which increases calcium uptake in muscle cells [3]. Vitamin D has an effect on the cardiovascular system and has been shown to strengthen cardiac output. It also affects cognitive functions positively on the neurological system, reduces the risk of cancer, has an effect on immune system regulation and low vitamin D level is associated with increased risk of death [4]. In the presence of the right angle and sufficient sunlights; Vitamin D is synthesized from 10:00 to 15:00 hours, with the effect of 280-315nm UVB rays. Vitamin D is first of all synthesized as previtamin D3; It then undergoes hydroxylation in the liver and kidneys cells and is converted to its active form (cholecalciferol, 1, 25-diOHD3) [1]. It is known that 80-90% of the vitamin D required for the human organism is synthesized by sun exposure. Vitamin D synthesized in this way is influenced by many different conditions, including age, geographical position, skin colour, use of sun cream and style of dressing [5]. On the other hand, the amount of vitamin D that can be obtained from food by the body is quite low, and sufficient vitamin D synthesis for the body is not provided in this way. Oily fish products and egg-yolk can be considered as rich food sources in terms of vitamin D [6].

The sun's zenith angle is a critical factor in allowing the human body to synthesize enough vitamin D. Sufficient vitamin D synthesis in Turkey can be achieved from May-November [7]. In studies conducted in different regions of the world, the level of vitamin D deficiency is high and vitamin D deficiency is considered as a pandemic and it is thought to affect more than one billion people in the world [8]. Although vitamin D deficiency differs from country to country and according to measurement technique, deficiency varies between 20% and 80% worldwide [9]. The incidence of vitamin D deficiency in Turkey is high, and studies report a range from 50% to 90% [10]. Investigation of Vitamin D deficiency in terms of preventive medicine and knowledge of the vitamin D deficiency rate in the population are necessary to enable professionals to carry out projects that require Vitamin D supplementation in the future.

The aim of this study is to determine the prevalence of vitamin D deficiency and insufficiency in adults inn a community-based and its distribution according to variables such as age, gender and education.

Material and Method

Setting and sample size

The study was conducted as a cross-sectional study between June and August 2016 in the urban area of Kayseri in the Central Anatolian region of Turkey. According to studies conducted in Turkey, vitamin D deficiency rate was accepted as 70% [10]. The minimum sample size was calculated as 323 people by taking a tolerance value=0.05, α=0.05 and β=0.20. To reach the minimum sample size, 400 people were taken as a sample group and research was completed with 381 (95.3%) people because of problems in blood-letting and laboratory work.

This study was approved by the Erciyes University Clinical Studies Ethical Committee and informed consent was obtained from participants.

Data Collection

Exclusion criteria in the study were as follows; vitamin D users in the last 3 months, those with chronic liver and kidney disease, any skin disease, type 1 diabetes, any malignancy, any endocrinological disease, metabolic bone disease, those on medication for bone metabolism, alcoholics and pregnant women. In order to select suitable individuals within the scope of the research a screening form was applied to 1,200 people who applied to the family health centers of urban area of Kayseri and appropriate individuals were given an invitation form. Volunteers were invited to Erciyes University Public Health Department. The questionnaire was prepared by the researchers based on the literature. A questionnaire consisting of 28 questions with socio-economic characteristics and other variables that could affect vitamin D level was applied by the face to face interview technique. After the questionnaire form was filled in, 3 cc blood samples were taken. Blood samples from donors were then transferred to the laboratory without of delay.

Laboratory Analysis

The Erciyes University Hospital Metabolism Laboratory uses liquid chromatography tandem mass spectroscopy (LC-MS / MS), which is accepted as the gold standard for 25 (OH) D analysis. Assessment of Vitamin D levels: as suggested by the Turkish Endocrinology and Metabolism Association was as follows; <20 ng / ml (50 nmol / L) deficiency, 20-30 ng / ml (50-75 nmol / L) insufficient, >30 ng / ml (75 nmol / L) sufficient [7].

Statistical Analyses

The student-t test was used for the analysis of binary variables, ANOVA was used for analysis of multiple variables, and for post hoc test the LSD test was used. Variables that may affect vitamin D deficiency were assessed by multiple analyses. Logistic regression was used for the analysis and the backwald algorithm was used as the enter model. The variables included in multiple regression analysis were as follows: age (≤35,> 35), gender, marital status (married, unmarried), economic status (good, not good), presence of chronic illness, smoking status, nutrition with fruit and vegetables (daily, less), nutrition with milk and dairy products (daily, less), physical activity status (inactive, active), use of sunscreen, sun exposure in summer and winter (more than one hour, less than one hour), clothing style, skin type and the history of bone fracture.

Results

The mean age of the participants was 36.21±12.10 years. 50.4% were male, 49.6% were female, 45.9% had a good economic status and 44.9% had a college and higher educational

Table 1. Vitamin D deficiency status according to socio-demographic characteristics

	Vitamin D Deficiency				
	n	Number	%	χ^2	p
Gender					
Male	192	132	68.8	2.27	0.132
Female	189	143	75.7		
Age					
≤35	206	143	69.4	1.70	0.192
>35	175	132	75.4		
Economic Condition					
Good	175	113	64.6	9.33	0.002
Not good	206	162	78.6		
Marital Status					
Married	196	136	69.4	1.56	0.211
Unmarried/Divorced	185	139	75.1		
Education					
Lower than high school	75	59	78.7	1.99	0.370
High school	135	96	71.1		
Higher than high school	171	120	70.2		
Sunscreen use					
Never	212	141	66.5	7.65	0.006
Continually or occasionally	169	134	79.3		
Sun Exposure in Summer					
More than 1 hour daily	219	149	68.0	4.40	0.036
Less than 1 hour daily	162	126	77.8		

level. The Vitamin D level in participants (<20 ng/ml) was found to be 72.2%. The rate of vitamin D deficiency (20-30 ng / ml) is 20.5% and that of Vitamin D sufficiency (> 30 ng / ml) was 7.3%. The prevalence of vitamin D deficiency in males was 68.8% and in females it was 75.7%. Although vitamin D deficiency was higher in females, sufficient vitamin D level was found to be higher in females than in males 8.5% and 6.3% respectively (Figure 1). The mean serum 25 (OH) D level of the participants was 15.11 ± 9.07. (Male: 16.21 ± 7.96 ng / ml, female: 13.99 ± 9.97 ng / ml, p <0.05). There was no significant difference between serum vitamin D levels according to age groups, marital status and educational status. However, the serum 25 (OH) D mean of individuals with good economic condition (16.43±9.82) was significantly higher than those who did not have a good economic condition (13.99±8.24) (p <0.05). Vitamin D deficiency was found to be higher in women, over in those over 35 years of age, in single people those with a low educational level, but there were no significant difference between groups. Vitamin D deficiency was found to be significantly higher in those who used sunscreen, who did not have a good economic condition and who were exposed to sunlight in the summer for less than one hour.

The serum 25 (OH) D mean of participants who preferred to wear clothing that does not block sunlight (16.00±9.32) was found to be significantly higher than that of those who wear clothing that blocks sunlight (13.93±7.81 (p <0.05).

According to the logistic regression analysis: vitamin D deficiency in those who had exposure to sunlight for less than one hour in summer was 1.7 fold than compared to those who had exposure to sunlight more than one hour (p <0.05). In those over 35 years of age was 1.8 fold more than that in those under 35 years individuals. Vitamin D deficiency in single individuals was about double that of married people. in those who use sunscreen it was 2.4 fold higher compared to those who never use sunscreen (p <0.05). Those who did not have a good economic condition were 2.6 times more likely to have vitamin D deficiency than those with have a good economic condition (p <0.05).

Discussion

Vitamin D deficiency is widespread in the world and high levels of vitamin D deficiency have been reported in many parts of the world [9]. Research on vitamin D deficiency in Turkey has been conducted mostly in pediatric age groups, special patient groups and women, and these studies indicate that vitamin D deficiency is a health problem in our country. This study had a population-based design. Blood samples were taken from selected individuals between June and July 2016 after excluding diseases or conditions that could cause vitamin D deficiency. Vitamin D deficiency in Kayseri province was found as 72.2%. The reason we choose the summer months for our study is because the solar rays in June and July in Turkey provide sufficient vitamin D synthesis [7]. There is only one population-based study in Turkey this was conducted in February in the Aegean region of Turkey. According to the results of that's study, vitamin D deficiency was found in 74.6% of participants[10]. Although our study showed a similar result with the study in the Aegean region, ours study was conducted in the period when the sun's rays were sufficient for vitamin D synthesis. Vitamin D deficiency was found to be higher in women, the vitamin D deficiency (<20 ng / ml) rate in men was 71.9% and it was 81.5% in women. In our study, the mean vitamin D score for women was 13.99 ± 9.97 and for men it was 16.21 ± 7.96. In a retrospective study of patients with osteoporosis, the prevalence of vitamin D deficiency in women was found as 45.3% and in males it was 38.4% [11]. In a 3-year study, patients who were referred to the physical therapy and rehabilitation polyclinic of a hospital in Istanbul reported a 2.15 fold (95% CI: 1.83 - 2.53) higher rate of vitamin D deficiency in females than in males [12]. In a study on 5531 people aged 5-101 in China, Vitamin D deficiency in women was reported as 89.0%, and in males it was reported as 84.9% [13]. In healthy volunteers in the Punjab region of India, the proportion of women with vitamin D deficiency <10 ng / mL was 52%, compared with 28% for men [14]. In Amsterdam in subjects over 65 years of age, vitamin D deficiency (<20 ng / ml) was found to be 44.7% in males and 56.1% in females [15]. According to the vitamin D results of 60,979 people in United Arab Emirates, Vitamin D deficiency was reported in 61.4% of women and in 58.3% of males [16].

Vitamin D deficiency increases with age. In the United States, 86% of women over 69 years of age have vitamin D levels below 30 ng / mL [17]. In Australia; In a population-based study with 11247 people aged 25 and over years, the prevalence of vitamin D deficiency increases with age and is most commonly seen in the ≥75 age group [18]. In our study, vitamin D deficiency was approximately double as high in individuals aged> 35 years (Table 3). The Vitamin D deficiency rate is almost double as severe in single participants (Table 3). In studies investigating marital status in the literature, similarly, it was shown that the vitamin D levels of married individuals are higher [19,20].

However, the relation of vitamin D level to marriage is not fully explained in the literature. In our study, the participants were not evaluated in this way and the effects of marriage were not investigated either the prevalence of vitamin D deficiency in rural areas in the Aegean region was as follows; 88.4% in urban areas, 76.8% in urban areas and 70.5% in semi-urban areas. Individuals living in rural areas have a 4.13 fold higher vitamin D deficiency and insufficiency rate than those living in semi-urban areas [10]. Vitamin D deficiency is 2.6 times higher in individuals who do not have good economic conditions (Table 3). Although there is no study showing daily vitamin D intake in Turkey, studies in the literature show that daily vitamin D intake increases as income level increases [21]. The use of sunscreen reduces the synthesis of vitamin D, while it protects the skin against the harmful effects of UVA and UVB. The use of SBF 8 sunscreen inhibits vitamin D syntheses >95%, while SBF 15 sunscreen inhibits over >98% of vitamin D synthesis [5]. Vitamin D deficiency is 2.6 fold higher in individuals using sunscreen and is about 2 times higher in individuals who have daily exposure to sunlight of less than one hour in summer (Table 3). Hekimsoy et al. [10] found that individuals with sun exposure had the highest score compared with individuals with vitamin D deficiency (82.4 %) who had a score of less than 8. In Egypt; in a comparison between those who were exposed to the sun for less than 5 minutes per day and those who were exposed to the sun more than 30 minutes per day; Those exposed to the sun former for less than 5 minutes were reported to be 5 times more at risk for vitamin D deficiency [22].

When serum vitamin D levels were analyzed according to the participants clothing style, the mean serum vitamin D level of subjects who were clothing which obstructed sunlight was found to be 13.93 ± 7.81 ng / ml and was significantly lower than those who were clothing which did not block sunlight (Table 2). Hekimsoy et al. [10] showed that vitamin D deficiency and insufficiency are higher in individuals who dressed in a style which blocks sunlight and reported that vitamin D deficiency is three times higher in individuals who dressed in a style which blocks sunlight. In Istanbul, the serum vitamin D levels of women who prefer traditional clothing and Islamic clothing were shown to be at a lower level than in those whose clothing styles allowed exposure to sunlight [23]. A study conducted in Jordan showed that men had significantly higher serum vitamin D levels than females. According to the preference of clothing among the women, 3 groups were formed completely covered, uncovered and western type, and the mean serum vitamin D levels were respectively, 24.3 ± 5.8 ng / ml, 28.3 ± 4.5 ng / ml and 36.7 ± 6.1 ng / ml [24].

Table 2. Serum vitamin D levels of participants according to clothing, skin type, use of sunscreen, sun exposure in summer and winter

	n	25(OH)D (ng/ml) ($\bar{X}$ ± SD)	t, F	p
Clothing				
Block sunlight	218	16.00 ± 9.32	2.215	p* = 0.027
Does not block sunlight	163	13.93 ± 7.81		
Skin Type				
White-skinned	107	15.30 ± 9.17		
Wheat colored skinned	198	14.76 ± 8.98	1,330	p* = 0,184
Dark-skinned	76	15.75 ± 9.23		
Sunscreen use				
Never	212	16.24 ± 9.82 (a)[1]		
Occasionally	125	14.01 ± 7.82 (b)[1]	4.025	p** = 0.019
Continually	44	12.82 ± 7.87 (b)[1]		
Sun exposure in summer				
Less than one hour	162	13.89 ± 8.63	2.273	p* = 0.023
More than one hour	219	16.01 ± 9.30		
Sun exposure in winter				
Less than one hour	244	14.78 ± 9.00	0.940	p* = 0.347
More than one hour	137	15.69 ± 9.20		
Total	381	15.11 ± 9.07		

* : Student-t test
** : ANOVA test, Post Hoc LSD test

Table 3. Logistic regression analysis of factors affecting vitamin D deficiency

	Odds Ratio	%95 CI	p
Age			
≤35	1		0,043311
>35	1.79	1.02 – 3.16	
Marital Status			
Married	1		0,035434
Unmarried / Divorced	1.83	1.04 – 3.23	
Economic Condition			
Good	1		0,000201
Not good	2.55	1.56 – 4.18	
Sunscreen Use			
Never	1		0,000816
Continually or occasionally	2.37	1.43 – 3.93	
Sun Exposure in Summer			
More than 1 hour daily	1		0,028838
Less than 1 hour daily	1.72	1.06 – 2.82	

Conclusion

As a result of this community-based study, it can be said that vitamin D deficiency is high in Central Anatolia. Although this study was conducted in the period when the sun's rays are sufficient for vitamin D synthesis, vitamin D deficiency and insufficiency are high. The lack of vitamin D in Turkey should be considered as a serious public health problem that concerns the population. New research should be done to ensure that healthcare providers' give their attention to this problem, take steps to prevent it or conduct intervention studies.

Limitations

It is not possible to generalize our findings to the whole of Turkey because the study was performed in a certain region, but it can be said that the life style of people in this region is very similar to the Middle Anatolian region. The participants invited may have caused bias in the sample. Individuals in distant and rural areas may have refrained from coming to Erciyes University to give blood. Questioning the variables that might affect the vitamin D level was evaluated according to the participants' statements, but their knowledge on vitamin D was not questioned.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Competing interests

The authors declare that they have no competing interests.

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