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Original Article

Vitamin D Status in Jiroft City Population, South of Iran, 2015-2019

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ABSTRACT

Background and Aims: Vitamin D plays an important role in bone health, cardiovascular health, brain development, immune system regulation, mood regulation, and cancer prevention. This study aimed to evaluate the vitamin D status and the prevalence of vitamin D deficiency in Jiroft city, Kerman Province, south of Iran.

Materials and Methods: In this cross-sectional study, 5243 people were selected by random sampling during 2015-2019. Serum 25 (OH) D level was measured by VIDAS 25-OH vitamin D total testing kits. Levels used for definitions were deficient, D3 < 20 ng/ml; insufficient, D3 20-30 ng/ml; adequate, D3 30-100 ng/ml, and potential toxicity, >100 ng/ml.

Results: The mean of vitamin D was 26.03 ng/ml and 24.19 ng/ml in men and women, respectively (p=0.003). The prevalence of vitamin D deficiency was 41.55% and 51.7% in men and women, respectively. A significant relationship was seen between age and level of vitamin D (p=0.001).

Conclusions: The results of our study showed that vitamin D deficiency is common among the general population, especially in women in Jiroft city, Kerman Province, south of Iran. Serious plans are needed to improve the status of vitamin D in the people living in this region.

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Introduction

Vitamin D is a fat-soluble vitamin and steroid hormone that is present in two distinct forms; approximately 10 percent ergocalciferol or vitamin D2, that is in mushrooms, eggs, fortified milk, cod liver oil, fish, and certain plants, while 90 percent comes from cholecalciferol or vitamin D3 that synthesized in the skin from endogenous 7-Dehydrocholesterol during exposure to ultraviolet light [1]. In the circulation, the vitamin hydroxylated first to 25-(OH) D by the liver and then hydroxylated to 1, 25-(OH) D by the kidney that is the active and major circulating form of vitamin D were used to measure vitamin D status [2]. There is a growing awareness that vitamin D sufficiency is needed for optimal health. This vitamin has a vital role in maintaining bone and muscle health via balance in the absorption of calcium and phosphate [3]. Vitamin D plays a vital role in the proliferation and differentiation of various cells [4]. For example, in epithelial cells, vitamin D contributes to maintaining the quiescent, differentiated phenotype and promotes pathways that defend cells against endogenous and exogenous stresses via binding with the vitamin D receptor [5].

Furthermore, during the past two decades, many studies have illustrated the importance of vitamin D in reducing the risk of cancer and some diseases, including multiple sclerosis, rheumatoid arthritis, systemic lupus erythematosus, Crohn's disease, diabetes mellitus, autism, psoriasis, infertility, infection, coronary artery disease, depression and dementia [6-8]. The half-life of vitamin D is two months as it stores in the adipose tissue, and it is in the circulation for two weeks [9]. Daily, weekly, or monthly vitamin D intake is needed to achieve a vitamin D status sufficient for normal body functions [10]. Recently, vitamin D deficiency is a global health problem, and many people worldwide are exposed to various diseases related to this vitamin deficiency [11]. To reduce health risks associated with vitamin D deficiency, it is necessary to measure vitamin D levels in people. There are numerous studies on 25-(OH) D level [11-18]. Jiroft city is located in the south of Iran, with a warm and humid climate and unique cultures and lifestyles. So far, no comprehensive study has been done on the level of vitamin D in the people of this city. Furthermore, the level of vitamin D can vary based on geographic area and lifestyle. Therefore, this study was performed to examine the level of vitamin D in Jiroft city, Kerman Province, south of Iran.

Materials and Methods

This cross-sectional study was conducted among people who had come to Nabih Akram laboratory in Jiroft city, Kerman Province, south of Iran during 2015-2019. This study did not have any exclusion criteria. Participants were divided into groups of pediatric (≤ 14 years), juveniles (> 14- ≤ 16 years), adolescences (> 16- ≤ 19 years), adults (> 19- ≤ 60 years), and elderly (> 60 years). Blood sampling was performed regardless of the disease type. Serum samples were separated by centrifugation at 3500 rpm for 5 min. The samples were stored at -20 °C until examination. Vitamin D level is traditionally measured through assays of 25-(OH)D that is the major circulating form of vitamin D. Analysis of 25-(OH)D was done by

VIDAS 25-OH vitamin D total testing kits (Biomerieux, Marcy I'Etoile, France) on mini VIDAS automated immunoassay system. Status of 25(OH)D was categorized into deficient (< 20 ng/ml), insufficient (20-29 ng/ml), sufficient (30-100 ng/ml), and potential toxicity (> 100 ng/ml) based on manufacturer's instructions. This study was proved by the Ethical Committee of the Jiroft University of Medical Sciences, Jiroft, Iran.

Statistical analysis

The collected data were statistically analyzed by SPSS version 23 software using descriptive statistics, Pearson correlation coefficient, and a two-independent t-test. In the study, the p-value of less than 0.05 was considered statistically significant.

Results

A total of 5243 individuals (989 males and 4254 females) were included in this study. The lowest number of participants (N=599) was in 2015, and the highest number of participants (N=1771) was in 2017 (Table 1). The mean age of participants was 35.3 years (SD=16.01; range=0-94) and 34.48 years (SD=22.78; range=0-97) in males and females, respectively. The mean level of vitamin D was 26.03 ng/ml (SD=17.69; range=2.26-134.49) and 24.19 ng/ml (SD=18.21; range=0.76-195.89) in men and women, respectively (P=0.003). The lowest vitamin D levels (mean=23.19 ng/ml) were seen in 2016. The highest levels of vitamin D (mean=27.3 ng/ml) were seen in 2019 (p=0.001). The results are presented in Table 2. The Pearson correlation coefficient show a positive significant relationship between age and level of vitamin D (r=0.192, p=0.001). In this study, 12.2%, 2.1%, 4.0%, 73.4%, and 8.3% of participants were in the group of paediatric, juveniles, adolescences, adults, and old age, respectively. The lowest mean vitamin D level (mean=20.33±15.88 ng/ml) was seen in adolescences group (Fig. 1).

The post-doc test showed that the mean level of vitamin D was significantly higher in the old age group than in the other groups (mean=36.2±26.59 ng/ml; P=0.001). The data indicated that, of the total study participants, 2622 (50%) were vitamin D deficient, 1240 (23.65%) had insufficient vitamin D level, 1335 (25.47%) had sufficient vitamin D level, and 46 (0.88%) study participants had a toxic level of vitamin D (Table 3). The highest (37%) and lowest (9.4%) vitamin D deficiency rates were observed in 2017 and 2019, respectively. The highest (34.3%) and lowest (7.6%) rates of vitamin D insufficiency were detected in 2018 and 2015, respectively. The highest (29.7%) and lowest (11.5%) rate of vitamin D sufficiency were seen in 2018 and 2015, respectively.

Discussion

Various studies have shown that vitamin D deficiency is prevalent throughout the world [11-18]. In Iran, physicians have been special focusing on the deficiency of this vitamin and related diseases for the past five years. The main objective of this study was to evaluate vitamin D levels in the last five years in Jiroft city. The current study results showed that almost 74% of the participants have an inadequate level of vitamin D.

Table 1. Distribution of collected samples based on gender and year in Jiroft city

Year	Female		Male	
	Number	Percent	Number	Percent
2015	505	11.9	94	9.5
2016	702	16.5	146	14.8
2017	1449	34.1	322	32.6
2018	1100	25.8	299	30.2
2019	498	11.7	128	12.9
Total	4254	100	989	100

Table 2. The mean of age and vitamin D level according to year in Jiroft city

Year	Age (year)		Vitamin D level (ng/ml)	
	Mean±SD	Range	Mean±SD	Range
2015	35.23±18.79	0-94	24.27±20.83	5.01-126
2016	34.41±16.48	0-93	23.19±18.44	2.79-126
2017	35.85±16.39	0-93	23.45±18.84	1.13-195.89
2018	35.09±17.89	0-90	25.62±15.87	2.03-134.49
2019	34.62±19.5	0-97	27.3±17.17	0.76-108.20

Table 3. The mean of age and vitamin D level according to year in Jiroft city

Age group	Deficient	Insufficient	Sufficient	Toxic	Total
Paediatric	312(48.7)	181(28.2)	142(22.2)	6(0.9)	641(100)
Juveniles	61(56)	19(17.4)	28(25.7)	1(0.9)	109(100)
Adolescences	129(61.7)	47(22.5)	33(15.8)	0(0)	209(100)
Adults	1997(51.9)	890(23.1)	941(24.4)	21(0.5)	3849(100)
Old age	123(28.3)	103(23.7)	191(43.9)	18(4.1)	435(100)
Total	2622(28.3)	1240(23.7)	1335(25.5)	46(0.9)	5243(100)

Data are presented as number (percent)

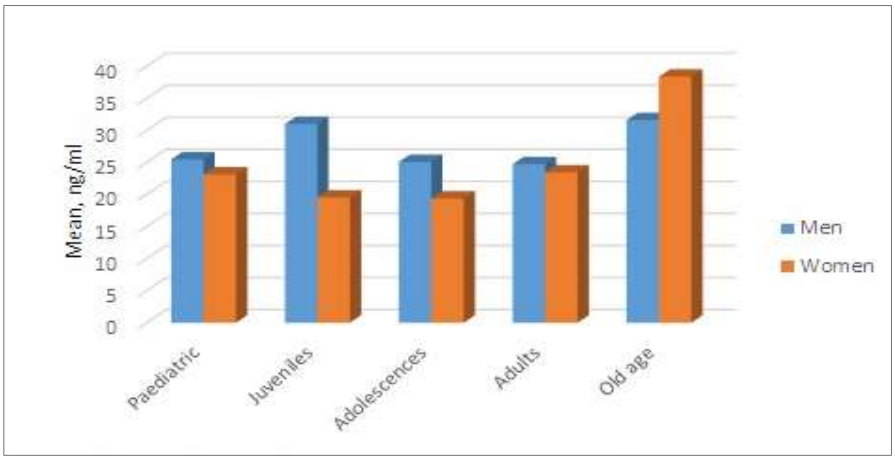

Fig 1. The mean level of vitamin D based on sex and age group

In the present study, 50% of participants were vitamin D deficient. This finding is almost in agreement with Song et al. from Gwangju in Korea, with a total prevalence of 59.7% vitamin D deficiency [14]. In disagreement with the results of the study by Ramnemark et al. conducted in Sweden [15] and study by Hovsepian et al. done in Isfahan in Iran with the total prevalence of 20.8% and 70.4% vitamin D deficiency, respectively [16]. These discrepancies in the results of various studies may be due to several factors, including season, latitude, smoking, aging, adiposity, physical activity, diet, measuring the vitamin, technician's skill in measuring the vitamin, and definition of vitamin D deficiency. The independent samples test showed that the mean level of vitamin D in men was significantly higher than in women. The result of the present study was inconsistent with the findings of Farhud et al. [13], Bawaskar et al. [17], and Ramnemark et al. [15] studies. However, it was consistent with the finding of Rabbani et al. [18] and Again et al. [19] studies. The study's outcome may be due to routine use of chador by women, socioeconomic status, and lifestyle. Besides, in this study, the females were a dominant sex group. Vitamin D deficiency in women can affect female reproduction via disruption in calcium homeostasis, cyclic sex steroid hormone fluctuations, and neurotransmitter function [20]. Our study showed a significant positive relationship between age and level of vitamin D. This finding was consistent with the result of Farhud et al.'s [13] study but was inconsistent with the result of Sochorová et al. [11] and Stein et al. [21] studies. The differences in results may be due to a lack of diversity concerning the participants' ages in Sochorová et al. [11] and Stein et al.'s [21] studies. In the present study, the highest vitamin D deficiency was seen in the adolescent group. Acne, dysmenorrhea, and anemia are diseases that are common in adolescence. Some studies have shown that vitamin D deficiency plays an important role in causing or exacerbating these diseases [20-23]. In the present study, vitamin D deficiency was observed in a high percentage of juveniles. In juveniles, deficiency in this vitamin is associated with juvenile idiopathic arthritis, which is a group of chronic inflammatory conditions affecting the joints, causing swelling, stiffness, and pain [24]. Vitamin D deficiency was found in about fifty percent of the adults' group. One of the causes of diseases such as depression, diabetes, infertility, and cancer common in adults may be vitamin D deficiency [25].

The study shows a high prevalence of vitamin D deficiency among the pediatric group. Therefore, many children are at risk for bone disease and disorders of mineral metabolism [2]. Although the lowest percentage of vitamin D deficiency was found in the elderly in the current study, about one-third of them were deficient in this vitamin. In the elderly, vitamin D deficiency can cause many diseases such as myopathy with muscle pain, fatigue, muscular weakness, gait disturbances, osteomalacia with deep bone pain, and prostate, colon, and breast cancer [26]. In this study, the mean of vitamin D in 2019 was significantly higher than in previous years. This result may be due to the increased awareness of

the role of vitamin D in the body and some lifestyle changes. However, further studies are required to assess the level of awareness about vitamin D deficiency among the population at risk in this region.

In the current study, 46 (0.88%) people had toxic levels of the vitamin. In Dudenkov et al.'s [27] study, toxic levels of the vitamin were seen in 37 (0.2%) persons. In Lee et al. [28] study, 89 (0.12%) people had toxic levels of the vitamin. There are many symptoms of vitamin D toxicity such as anorexia, constipation, diarrhea, nausea, vomiting, Bone pain, continuous headaches, drowsiness, irregular heartbeat, muscle, and joint pain, kidney stones, frequent urination, excessive thirst, weakness, and nervousness that appear within a few days or weeks. In healthy individuals, toxicity is not common and occurs almost exclusively in people who take long-term, high-dose supplements without monitoring their blood levels [29]. However, toxic levels of vitamin D may be found in diseases such as granulomatous disorders, lymphomas, and idiopathic infantile hypercalcemia [29, 30]. In granulomatous diseases such as tuberculosis, fungal diseases, sarcoidosis, leprosy, infantile subcutaneous fat necrosis, berylliosis, and giant cell polymyositis, toxic levels of vitamin D is related to the abnormal synthesis of $1,25(OH)_2D$ by macrophages. In lymphomas, the etiology of hypervitaminosis D is not fully recognized. In idiopathic infantile hypercalcemia, dysfunction of 24-hydroxylase (CYP24A1), an enzyme responsible for degradation of both 25(OH)D and $1,25(OH)_2D$, can increase the level of vitamin D [30]. In the present study, we could not determine the effect of seasons and various diseases on vitamin D level, so it is necessary to design studies in this field.

Conclusion

In conclusion, the current shows a high prevalence of vitamin D deficiency among the Jiroft city population, Kerman Province, south of Iran. All age groups were prone to vitamin D deficiency. Poor vitamin D status was more evident in women than men. In this region, special health plans are needed to correct the vitamin level improve the status of vitamin D. Sun exposure, vitamin D fortified foods, and regular physical activities are recommended to increase vitamin D levels.

Conflict of Interest

The authors of this study claimed that there is no conflict of interest.

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