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Pattern of Vitamin-D Deficiency Among Medical College Girls of Aseer Region in South-Western Saudi Arabia

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Abstract

Introduction: *Incidence of vitamin D deficiency (VDD) is recognized globally, affecting healthy populations. VDD leads to rickets in children and osteomalacia in adults. Aim of study was to evaluate prevalence of hypovitaminosis D in healthy Saudi medical female students.*

Materials and Methods: *Cross-sectional study was conducted to estimate the prevalence of VDD among female medical students of King Khalid University (KKU) main medical colleges' complexes. Questionnaire was completed by students to assess their health status, lifestyle and socio-economic behavior to study any correlation with Vitamin D deficiency. Total number of students at the time of study was 2614 students. Venous blood was collected from every student for measurement of serum(s) calcium, albumin, phosphorus, alkaline phosphatase, fasting parathyroid hormone, vitamin D levels. VDD was defined as serum 25-hydroxy vitamin D (25[OH]D) < 50 nmol/l.*

Results: *Study was performed in 200 medical college girl students of Aseer region. Average age of students was 22.9 ± 1.5 years old, ranging from 19 to 25 years. Mean vitamin D concentration was 18.0 ± 9.9 ng/ml. Participants were divided into 3 groups according to their vitamin D levels. Patients who had vitamin D level of 20-29 ng/mL were suffering from Vitamin D insufficiency and represented 14% of studied population. Low Vitamin D levels were found in 82% of female students.*

Discussion: *VDD is prevalent among medical students included in this study. Initiatives are required to prevent adverse consequences of VDD in young, otherwise healthy populations.*

Keywords: *Vitamin D deficiency, Medical students, Insufficiency, Saudi*

Introduction

Vitamin D deficiency (VDD) is a global healthcare burden affecting more than 1 billion population and contributing to mortality, morbidity and increasing economic burden through related chronic ailments. Vitamin D is significant in childhood and adolescent phases of life mainly for calcium metabolism and regularized growth pattern and normal bone growth. Its role is well known in prevention and development of rickets in paediatric population and osteomalacia in adults but also it provides defensive support against development of cancer, diabetes mellitus, hypertension, and multiple sclerosis **[**1**]**. There is also a well-documented association with mortality for major cardiovascular diseases like myocardial infarction, heart failure, atrial fibrillation, sudden cardiac death, stroke, and different types of peripheral vascular diseases **[**2**]**.

Even though Saudi Arabia is among the sunniest countries, VDD has long been noted as common in Saudi population **[**3**]**. A few research studies conducted over last few years to evaluate the condition of vitamin D in Saudi nationals have demonstrated high prevalence of VDD **[**4**]**.

There are increasing evidences from research studies conducted with young adults **[**5**]**, elderly persons **[**6**]**, and youth in other countries that VDD is unrecognized and common health issue **[**7**]**. Regardless of different types of fortification programs, subclinical vitamin D deficiency has been noted, with significant prevalence in adult medical inpatients **[**8**]**, homebound elderly population, post-menopausal women **[**9**]** and healthy young adults **[**10**]**. Third National Health and Nutritional Examination Survey Data in which serum 25**[**OH**]**D levels were evaluated and correlated with VDD , (25**[**OH**]**D level, ≤15 ng/mL **[**≤37.5 nmol/L**]**) ,was reported in 17% of southern adolescent population in winter and 8% of northern teenagers in summer **[**11**]**.

There is inadequate understanding among young adolescent population with high prevalence of VDD regardless of living in sunny areas like Saudi Arabia and India **[**12**]**

Materials and Methods

Study Design

A cross-sectional study intended to estimate prevalence of VDD among female medical students of medical colleges by evaluating blood samples. Questionnaire was completed by students to assess their health status, lifestyle and socio-economic behavior to study any correlation with VDD. Study was

conducted by Department of Medicine, KKU, and its affiliated Aseer Central Hospital (ACH), between November - December 2018.

Study Participants

We chose KKU main medical colleges complexes, located in Abha city at 2270 m above sea level, for recruiting participants due to its proximity to hospital and feasibility of taking and processing blood samples. It includes college of medicine, college of health sciences, college of pharmacy and college of dentistry. Total number of students at time of study was 2614 students. We estimated that a representative sample size of 200-250 participants will enable us to discover a prevalence of VDD by extrapolation of results for female student population of KKU in selected age range of 19 to 25 years. Clinical research was advertised as a study to explore nutrient deficiencies and particularly VDD. The present study included a total of 200 female medical students who were voluntarily recruited between ages of 19 and 25 years. Study protocol was approved by ethics committee of ACH, Abha, Saudi Arabia. Questionnaires were sent by email from each female medical student to assess their dietary habits, socioeconomic status, demographic data, and previous medical history. Students were well informed in advance about purpose of study and research protocol. Written informed consent was signed by all participants in advance.

Data Collection

Questionnaire was intended to accumulate demographic, socioeconomic, and nutritional information of female medical students.

Statistical Analysis

Statistical analysis of data was achieved with the help of the Statistical Package for Social Sciences (SPSS).

Results

Vitamin D low levels prevalence

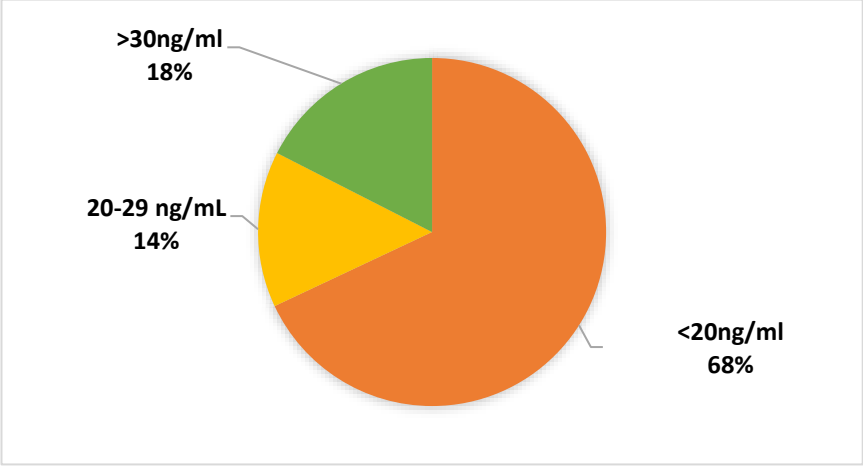
This study was performed in 200 medical college female students of Aseer region. Average age of students was 22.9 ± 1.5 years old ranging from 19 to 25 years. According to NCBI study on Vitamin D insufficiency/deficiency management, VDD is defined as levels <20 ng/mL and vitamin D

insufficiency is defined as levels ranging from 20 to 29.9 ng/ml. Mean vitamin D concentration was 18.0 ± 9.9 ng/ml. Participants were divided into 3 groups according to their vitamin D levels and mean vitamin D levels are shown in Table 1.

Normal (Vitamin D>30ng/ml)	Insufficiency (Vitamin D 20-30ng/ml)	Deficiency (Vitamin D < 20ng/ml)
37.6 ± 7.8 N=26	23.8 ± 2.2 N=28	13.5 ± 3.0 N=142

Table 1: Mean levels of vitamin D (ng/ml) of study groups. Results are expressed as mean ± standard deviation (SD).

Figure 1 represents prevalence of VDD, where 68 % college girls were found to be suffering from VDD. Patients who had vitamin D level of 20-29 ng/mL were suffering from Vitamin D insufficiency and represented 14% of studied population. Low Vitamin D levels were found in 82% of female students (Figure 1).



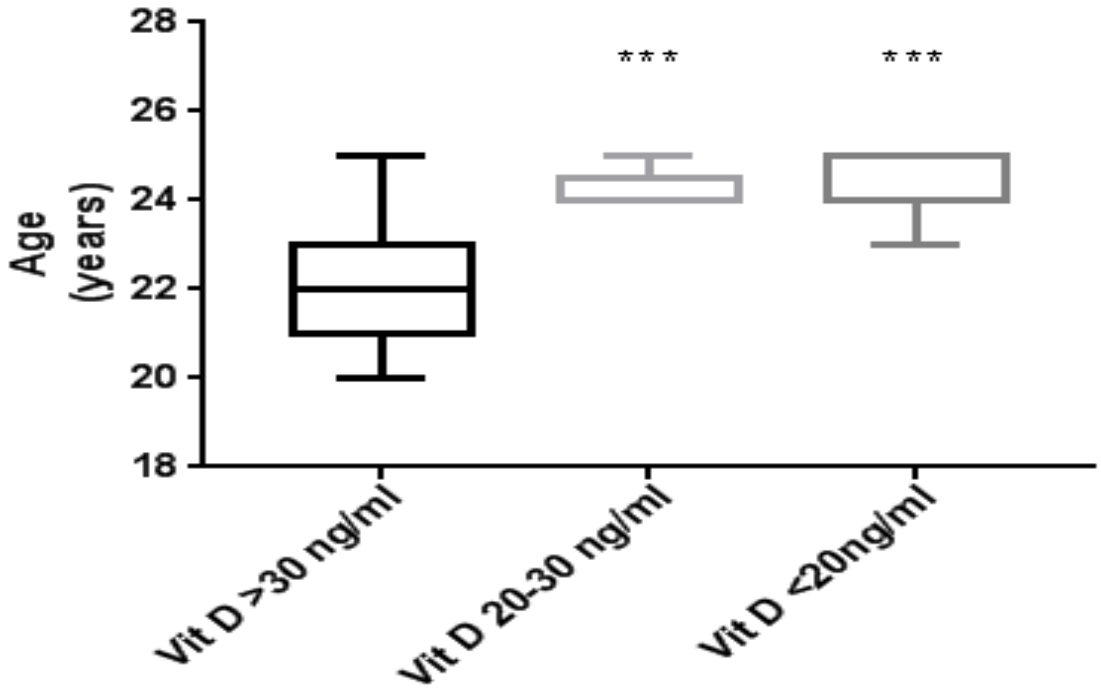


Figure 1: Prevalence of Vitamin D deficiency and Vitamin D insufficiency among sampled medical college female students.

Vitamin D low levels and age

Mean age of three vitamin D levels groups was compared by ANOVA analysis and results showed that patients with low levels of vitamin D were significantly older than students with normal vitamin D levels (Figure 2).

Figure 2: Plot of the age of female student according to their vitamin D levels.

(ANOVA analysis indicated statistical differences of low vitamin D levels compared to normal levels. *** $p<0.01$)

Further statistical analysis did not show any significant correlation between age and Vitamin D (Pearson's coefficient=0.04), meaning that age could be indirectly related to VDD but not necessarily indicate that the younger the patient the better Vitamin D serum levels.

Vitamin D low levels and anaemia

Potential association between vitamin D levels and anaemia has been proposed by some authors **[**13**]**. In this study, blood parameters related to anaemia and a survey to assess anaemic symptoms were performed to evaluate whether the recruited female students showed anaemia potentially associated to their VDD.

Students were asked to answer a survey to determine if they had any clinical manifestations related to anaemia (Table 2). It was observed that almost 80% of the students that had vitamin D insufficiency manifested clinically as having fatigue with high frequency. Low vitamin D levels can cause diverse manifestations and fatigue is one of the most common (although non-specific) symptoms. 36 students expressed that they felt fatigued most of the time or always, and, interestingly, 80.5% of them presented vitamin D levels below 30 ng/ml, (Vitamin D insufficient status clinically).

Students with low vitamin D levels said that they felt nausea always or most of the time, whereas 44% of students with insufficient vitamin D levels and 15% of the students with deficient vitamin D levels expressed that they felt nausea, compared to 9% of the students with normal vitamin D levels.

Palpitations, fainting, and breathlessness were more frequent in low vitamin D level compared to normal level group which exhibited low frequency of these symptoms.

		% students Normal (Vitamin D>30ng/ml)	% students Insufficiency (Vitamin D 20-30ng/ml)	% students Deficiency (Vitamin D < 20ng/ml)
Headache				
	Rare	18	22	40
	Sometimes	64	56	38
	Most time	18	11	17
	Always	0	11	5
Fatigue				
	Rare	0	11	7
	Sometimes	36	11	57
	Most time	64	56	22
	Always	0	22	14

Poor concentration				
	Rare	9	11	26
	Sometimes	36	22	28
	Most time	36	33	36
	Always	18	33	10
Nausea				
	Rare	64	33	66
	Sometimes	27	22	19
	Most time	9	22	9
	Always	0	22	7
Palpitations				
	Rare	45	56	43
	Sometimes	55	33	45
	Most time	0	11	9
	Always	0	0	3
Fainting/light-headedness				
	Rare	73	33	64
	Sometimes	27	33	33
	Most time	0	33	3
	Always	0	0	0
Breathlessness				
	Rare	55	33	59
	Sometimes	36	33	33
	Most time	9	22	7
	Always	0	11	2

Table 2: % of students that presented symptoms related to anaemia according to vitamin D levels groups.

Blood measures were taken to assess whether students also presented anaemia mean ± SD results are shown in Table 3.

	Normal (Vitamin D>30ng/ml)	Insufficiency (Vitamin D 20-30ng/ml)	Deficiency (Vitamin D < 20ng/ml)
Ferritin (ng/ml)	17.5±15.4	15.6±12.4	21.7±20.0
HG (g/dl)	13.8±0.9	13.7±1.2	13.7±1.3

Table 3: Blood parameters related to anaemia measurement in 3 vitamin D levels groups. RBC: red blood cells; MCHC: mean corpuscular haemoglobin concentration; MHC: mean corpuscular haemoglobin; MCV: mean corpuscular volume; HG: haemoglobin.

Statistical analysis showed that there was no significant difference between means of 3 groups ($p>0.05$). Mean blood levels of haemoglobin were above 12 g/dl. VDD group presented 6.9% of patients with haemoglobin levels below 12g/dl, vitamin D insufficiency group presented 6.6% and normal vitamin D levels group showed only 3% of anaemic patients. No significant association between vitamin D levels and haemoglobin concentration was found (Pearson's coefficient= 0.04).

Depending on data obtained, these results indicate that some symptoms could be causally related to low vitamin D levels, and not to anaemia per se.

Discussion

In this study we have assessed prevalence of low vitamin D levels in female medical students from medical college girls of Aseer region. Our results showed that 68 % of female students showed VDD, while 14% showed Vitamin D insufficiency. Similar results were reported in female students from University of Tabuk **[**14**]**, and in young female medical students by Hasanato and team in Saudi Arabia **[**15**]**. Authors attributed these vitamin D levels to low sun exposure due to cultural clothing behaviour and excessive ambient heat outdoors. A recent meta-analysis study on VDD in over 20,000 Saudi Arabian participants indicated overall prevalence in healthy population of 60% **[**16**]**. Latter study assessed vitamin D levels and considered only values below 20 ng/ml to calculate prevalence. However, authors proposed that methods used in different studies may affect conclusions, since results' differences between vitamin D concentrations could be of 5 ng/ml.

Our results showed that mean vitamin D levels in medical students recruited for study was 18 ng/ml, regardless of age, which was higher than levels reported in the region. A systematic review performed

in 2300 women in reproductive age in Saudi Arabia by Alzaheb [17] showed that mean 25[OH]D levels was found to be 13.1 ng/ml, as well as other reports from same country [18,19,20]. Another study showed mean levels as low as 8.4 ± 6.0 ng/ml in Emirati women aged 16-24 years old, 14.7 ± 5.9 in Egyptian women aged 25-35 years old, and 15.8 ± 8.2 in Lebanese women aged 30-50 years old [21,22,23]. Depending on these reports, VDD would be related to younger age, and this has been shown in previous report [24]. Similarly, in another Saudi study younger women with higher education level presented with higher prevalence of VDD [25]. Nevertheless, our results were not in accordance in relation to age, since students with normal vitamin D levels were younger than students with low levels.

Previous reports show an association between hypovitaminosis D and anaemia is becoming evident. Smith et al., [13] suggested in his review that vitamin D might have significant role in iron homeostasis and erythropoiesis. Particularly, Smith et al., correlated low vitamin D levels to anaemia of chronic diseases. Considering that both vitamin D deficiency and anaemia are prevalent diseases, and that a possible association between the two has been reported, we proposed to study blood parameters related to anaemia and to perform a survey to assess presence of typical clinical manifestations of anaemia among different vitamin D groups. Usual symptoms of anaemia include fatigue, decreased physical capacity and breathlessness. Students with low vitamin D levels tended to show more of known anaemia related symptoms as well. However, blood parameters did not support these observations. Anaemia is defined by presence of haemoglobin levels below 13 g/dl. Some studies have shown that vitamin D levels are positively associated to haemoglobin levels [26, 27]. In this study, mean haemoglobin levels in normal, insufficient, and deficient vitamin D level groups were not significantly different, and no significant association between vitamin D levels and haemoglobin concentration was observed. The latter analysis, however, shows a limitation since most patients presented with normal haemoglobin levels, and further studies should be performed in anaemic patients to assess such correlation. Also, some patients might be experiencing some symptoms due to low vitamin D levels, which can be like anaemic symptoms. It has been reported that vitamin D-anaemia associations are related to ethnicity and race, which is why we believe that further studies should be performed in the region [28,29,30].

In cross-sectional multivariate analyses, female sex, advancing age, diabetes, current smoking, non-white ethnicity and higher body mass index were all independently associated with higher odds of VDD whereas greater physical activity, vitamin D supplementation and non-winter season were inversely associated with VDD[31].

Conclusion

VDD was found to be highly prevalent among medical students included in this study. Urgent initiatives are required to be taken to further prevent adverse consequences of low vitamin D in young, otherwise healthy populations.

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