ORIGINAL ARTICLE

Assessment of the Status of Vitamin D Deficiency in Medical Student Population

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ABSTRACT
Objective: To assess the 25–hydroxyvitamin D deficiency and to compare vitamin D deficiency between male and female subjects in medical students.
Study Design: Cross-sectional study
Place and Duration of Study: Department of Physiology, Liaquat University of Medical & Health Sciences Jamshoro from 1st September 2018 to 30th September 2020.
Methodology: One hundred healthy MBBS students were randomly enrolled. Serum 25(OH) vitamin D was estimated by chemiluminescent immunoassay. Serum calcium was estimated by an autoanalyzer.
Results: There were 54% females and 46% males. Most of the students were aged between 21 to 25 years (56%). The mean age was 20.79±1.55 years. History of suntan in past 12 months was noted in 54% and use of sunscreen in 34% of the students. 51% of the students had duration of exposure to the sun between 5 to 15 minutes. 50% of the students were taking 1 glass of milk daily and their (44%) BMI remained normal. The mean BMI was 22.34±3.23 Kg/m2. Most of the students (89%) were deficient of 25–hydroxyvitamin D where as 8% had insufficiency and only 3% had normal vitamin D levels. Serum calcium level was normal in majority 65% of students. The average level of serum calcium was 9.56±0.85 mg/dL. No linkage was present between 25–hydroxyvitamin D levels and gender, use of suntan¸ tanning booth and sunscreen, duration of exposure to the sun, quantity of daily milk serving, calcium and BMI (p>0.050).
Conclusion: Vitamin D insufficiency is highly predominant in both male as well as female medical students' resident of the study area. There is a lack of relationship between vitamin D insufficiency and dietary intake and long term sun exposure.
Keywords: 25–hydroxyvitamin D, Chemiluminescent immunoassay, Medical students, Vitamin D insufficiency

INTRODUCTION

Vitamin D, regarded as "sunshine vitamin," is a fat-soluble vitamin. It resembles sterols in structure and functions like a hormone. It is received primarily from exposure to Ultraviolet B (UVB) light rays of sunlight, it has numerous health benefits. Nutritionally important forms in man are ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3), also referred to as pro-vitamins. The recommended daily intake of vitamin D for adults is 1500-2000 IU/day so as to sustain the serum level consistently more than 30 ng/mL.[1,2]

The shortage of Vitamin-D is a widespread and significant global medical concern causing rickets in children that can cause musculoskeletal pain, fibro-myalgia, osteoporosis and fractures in adults to induce or exacerbate. The risk of common malignancies, autoimmune illnesses, high blood pressure, infectious diseases and even depression has been elevated.[3,4]

Vitamin D deficiency has been recognized as an independent risk factor for total mortality in the general population. Besides the well-known role of vitamin D in growing children and women for maintaining skeletal health, emerging studies indicate the likely role of vitamin D as prevention against a vast array of non-communicable and chronic diseases such as cancer, heart disease, autoimmune diseases, Type 2 diabetes, and depression.[5]

Vitamin-D is 25-hydroxy vitamin D as the predominant circulating vitamin, hence the total serum level of vitamin-D is now considered greatest measure of supply of 25-hydroxy vitamin D from skin production and food intakes to the body. The overall 25(OH)D reference range is 20-100 ng/mL.[6]

Studies all over the world indicate very high prevalence of vitamin D deficiency. At the national level, vitamin D deficiency has been reported to be 70-100% in the general population.[7] The high prevalence of vitamin D deficiency both globally and nationally is a public health problem, as many disease conditions are being recognized to be directly or in directly related to vitamin D status.[2]

Several researchers in 25-hydroxy vitamin D advised that around half an hour of sunlight, usually lead to sufficient vitamin D synthesis, minimum two days a week in the arms, face, back or legs except as un-screen. Dark skinned individuals are at a relative disadvantage for vitamin D synthesis as the increased amount of melanin acts as a barrier to penetration of sunlight.[8,9]

The major source of dietary Vitamin D is from animal foods. This is a disadvantage for vegetarians. Single steady source of vitamin-D remains fortified foods like milk, butter, bread and some other processed foods.[10] Hence vitamin D deficiency is increasingly seen in affluent populations who have access to health information and adequate health care.

Depending upon few latest evidences, health individuals look to become such a subgroup.[3,11-16] Specific professions such as medical students may have higher risk for developing hypovitaminosis D as they have to spend many years of their life in staying indoors for studying intensely for the entrance examinations of professional courses.

Although a number of studies have been carried out to estimate the blood levels of Vitamin D in elderly populations and limited number of studies have been carried out in student populations. Considering the above facts, the present study was designed to assess the 25–hydroxyvitamin D [25(OH)D] deficiency in medical students, to compare vitamin D deficiency between male and female subjects and to correlate dietary intake and long term sun exposure to vitamin D insufficiency using questionnaire.

MATERIAL AND METHODS

This cross-sectional study was conducted on 100 Medical students at Department of Physiology, Liaquat University of Medical & Health Sciences Jamshoro from 1st September 2018 to 30th September 2020. Apparently healthy medical students, aged between 18-25 years. Either gender was included and history of hepatic illness, history of renal illness, receiving vitamin D supplementation, receiving any other drugs that are likely to alter vitamin D levels, medical history suggestive of malabsorption syndrome will be excluded. History suggestive of hypothyroid, hypertension and diabetes mellitus were omitted.

An interview was taken by medical students and the demographic data such as age gender were documented, as well as an extensive history of hepatic disease, kidney disease, vitamin D supplementation and other health histories such as diabetes mellitus, high blood pressure and hypothyroidism. All the data obtained was noted on a predesigned proforma.

The estimation of 25-hydroxy Vitamin D was done by Beckman Coulter 25 (OH) vitmin D total kit manufactured by Beckman Coulter Inc. California USA. The levels of hydroxyl vitamin D ranging from 30-60 ng/mL were normal. The short fall is <20 ng/mL, and the vitamin level is insufficient between 21-29 ng/mL.

SPSS version 20.0 was used for statistical analysis. Chi-square test and the Fisher Exact test was applied to assess the association of the categorical factors with hypovitamin D. Mean levels of vitamin D were compared with independent sample T tests between men and women. A one-way ANOVA test has examined the comparison of more than two methods. P-value less than 0.05 was considered as significant level.

RESULTS

The age of the participants ranged between 18 to 25 years. Out of them, 54% were female medical students while 46% were male students. Most of the students (56%) were observed in the age group 21 to 25 years. The average age range was 20.79±1.55 years, whereas the median age varied from 18 to 28. 54 percent of students had been using sun in the past 12 months in the current survey. In this survey, 34% of students said sunscreen was used. 51 percent of kids in this study had a solar exposure time between 5 and 15 minutes. One student (1%) reported the use of tanning boot in this study while 99% did not utilize the tanning booth in the last year. Most students in the present study (50%) had a daily portion of milk.

Table 1: Baseline characteristics of the study participants (n = 100)

Characteristics	No.	%
Gender		
Male	46	46.0
Female	54	54.0
Age (years)		
≤20	43	43.0
21-25	56	56.0
>25	1	1.0
Sun Tan		
Yes	54	54.0
No	46	46
Use of sunscreen		
Yes	34	34.0
No	66	66.0
Duration of sun exposure (minutes/day)		
<5	2	2.0
5 - 10	51	51.0
16 – 30	26	26.0
>30	21	21.0
Use of tanning booth		
Yes	1	1.0
No	99	99.0
Quantity of milk servings per day		
Nil	20	20.0
1	50	50.0
2	25	25.0
3	4	4.0
4	1	1.0
25–hydroxyvitamin D levels (ng/mL)		
Deficient (<20)	89	89.0
Insufficient (20-29)	8	8.0
Sufficient (30-100)	3	3.0
Serum calcium levels (mg/dL)		
<8.4	13	13.0
8.4 – 10.2	65	65.0
> 10.2	22	22.0
Body mass index(kg/m^2)		
<18.5	10	10.0
18.5 - 22.99	44	44.0
23.00 - 24.99	23	23.0
25 - 29.99	23	23.0
>30	-	-

Table 2: The descriptive statistics of the study population (n = 100)

Variable	Mean±SD
Age (Years)	20.79±1.55
Qty.of milk servings daily	1.16±0.83
Vitamin D levels (ng/mL)	14.01±6.20
Serum calcium level (mg/dL)	9.56±0.85
Weight (kg)	63.00±12.84
Height (m)	1.67±0.11
Body mass index (Kg/m^2)	22.34±3.23

11% of students were using multivitamins, 9% had history of the ingestion of omega-3-fatty acids and 5% stated diarrhea history. Many kids in this study (89%) exhibited 25-hydroxyvitamin deficiency. D (<20ng/mL) but 8% had insufficient amounts of 25–hydroxyvitamin D, while 3% had enough of 25–hydroxyvitamin D (30 to 100 ng/mL) and 20 to 29 ng/mL, respectively. Median values were 12.95 ng/ml and between 5.15 to 43.01 ng/ml with a median of 15-hydroxyvitamin D of 14.01±6.20 ng/ml. 65% of students had serum calcium levels between 8.4 mg/dL and 10.2 mg/dL whereas 22% had over 10.2mg/dL and 13% had below 8.4 mg/dL.The serum calcium median levels were between 9.56±0.85 mg/dL and 9.80 mg/dLwith an interval ranging from 7.62 to 10.90 mg/dL. Most pupils (44%) had normal BMI (18.5 to 22.99 kg/m2), but 10% of the pupils suffered weight loss (< 18.5 kg/m2). The median BMI was 22.34±3.23 Kg/m2 and 22.27 were median BMI with range of 15.63 to 29.32 kg/m^2. No links in-between gender and vitamin-D levels were discovered in this study (p=0.597). The average values of vitamin-D for men (15.17±5.06 ng/mL) were slightly higher than women (13.01±6.92 ng/mL). But statistically the difference (p=0.084) was not important. Vitamin D levels (p=0.597) have not been used in the preceding 12 months. No connection between sunscreens with vitamin-D (p=0.185) levels has been identified in this investigation. Tanning boothuse of vitamin D levels (p=1.000) in the last year was not linked. No correlation between 25–D levels of hydroxyvitamin D in serum calcium (p=0,962) was seen in this investigation. Vitamin-D levels (p=0.681) were not linked with the body mass index. For students with BMI, the mean of vitamin D was low (13.48±4.28 ng/mL) compared to those with BMIs of 23.00-29.99 kg/m2 (13.70±7.40 ng/mL) and BMIs of 18.5-22.99 kg/m2 (14.55±6.71 ng-mL) compared with those with BMI of 13.48±4.28 ng/mL. However, statistically the change was not substantial (p=0.896).

Table 3: Baseline characteristics of the study participants with Vitamin D levels (n = 100)

Variable	25–hydroxyvitamin D levels						P value
	Deficient		Insufficient		Sufficient		
	No.	%	No.	%	No.	%	
Gender							
Male	40	86.96	5	10.87	1	2.17	0.597
Female	49	90.74	3	5.56	2	3.70	
Daily milk servings							
0	19	95.0	-	-	1	5.0	0.215
1	43	86.0	5	10.0	2	4.0	
2	23	92.0	2	8.0	-	-	
3	4	100.0	-	-	-	-	
4	-	-	1	100.0	-	-	
Sunlight exposure time during last week (minutes/day)							
<5	2	100.0	-	-	-	-	0.948
5-10	45	88.24	5	9.80	1	1.96	
16 – 30	23	88.46	2	7.69	1	3.85	
>30	19	90.48	1	4.76	1	4.76	
Sun tan in last 12 months							
Yes	49	90.74	3	5.56	2	3.70	0.597
No	40	86.96	5	10.87	1	2.17	
Use of sunscreen							
Yes	31	91.18	1	2.94	2	5.88	0.185
No	58	87.88	7	10.61	1	1.52	
Use of tanning booth in past year							
Yes	1	100.0	-	-	-	-	1.000
No.	88	88.89	8	8.08	3	3.03	
Serum calcium levels (mg/dL)							
<8.4	12	92.31	1	7.69	-	-	0.962
8.40 to 10.20	57	87.69	6	9.23	2	3.08	
>10.20	20	90.91	1	4.55	1	4.55	
Body mass index (kg/m^2)							
<18.5	8	80.0	2	20.0	-	-	0.681
18.5 – 22.99	38	86.36	4	9.09	2	4.55	
23.0 – 24.99	21	91.30	1	4.35	1	4.35	
25.0 – 29.99	22	95.65	1	4.35	-	-	

Table 4: Comparison of mean body mass index and mean vitamin D levels

Body mass index (kg/m^2)	Students (No.)	25–hydroxyvitamin D levels
<18.5	10	13.51±5.08
18.5 – 22.99	44	14.55±6.71
23.0 – 24.99	23	13.7±7.40
25.0 – 29.99	23	13.48±4.28
F value	0.2	
P value	0.896	

DISCUSSION

The most common age group was between 21 to 25 years (56%) and the mean age was 20.79±1.55 years and median age was 21 years. The age was comparable to an Indian study by Walia et al[17] who reported mean age as 19.46±1.01 years. Al-Elq[16] reported mean age as 19.54 years and with another study by Shah et al[18] in Karachi among Healthy female medical students which reported the mean age as 18.49±0.7 years. In male patients aged between 25 and 35 years and 0.550. Sadat Sadat-Ali et al[19] reported a 28 and 37 percent prevalence of hypovitaminosis. However no association could be found in this study due to the narrow age range of the study population. 54% of students have experienced sun use over the last 12 months in this survey. The lack of vitamin D was nonetheless detected in nearly equally many students with sun tanning history (90.74%) and those who were not sun tanning history (86.96%; p=0.597) suggested a lack of connections from the history of suntan to the history of vitamin D. These findings need more validation because the literature does not have similar data.

In this study no use of sunscreen was reported by majority of the students (66%). But the vitamin-D levels were deficient in about similar number of students with history of use of sunscreen (91.18%) and without the history of sunscreen use (87.88%) suggesting no association between use of sunscreen and Vitamin-D levels (p-value 0.185). However, we do not have clear explanation for this controversial finding. In persons with darker skin pigmentation and sunscreen users, the effects of UV exposure on Vitamin-D synthesization are reduced.[17]

In the present study the exposure to sunlight was evaluated as dichotomous variable in the questionnaire as duration of sunlight exposure during last with options as <5 minutes per day, 5-15 minutes per day, 15-30 minutes per day, > 30 minutes per day. However, more than half the students that is, 51% had sunlight exposure between 5 to 15 minutes' duration. However, there was no relation in-between period of sun exposure with vitamin-D levels as vitamin D deficiency was statistically comparable among the students with <5 minutes per day (66.67%), 5-15 minutes per day (88.24%), 15–30 minutes per day(88.46%), >30 minutes per day (90.48%, p=0.948). On the contrary, a study by Walia et al[17] found positive correlation between sunlight exposure and vitamin D status. Another study by Sivakumar et al[20] conducted on healthy adults above 20 years age living in Potheri village of Kancheepuram district of Tamil Nadu revealed similar findings. The disparity regarding relationship in-between vitamin-D deficiency and exposure can be owing to the fact that the exposure to sunlight was evaluated as dichotomous variable in the questionnaire in the present study while other studies have evaluated as continuous data in latter studies. Furthermore, a study by, Walia et al[17] attributed the positive association between vitamin D deficiency and exposure to sunlight to the sedentary indoor lifestyle among the students with limited sunlight exposure (26.67±10.53 minutes per day). The students were free from their classes only in the early mornings and late afternoons when the sun's rays are less efficient for vitamin D synthesis which was not the fact in this study.

The majority of pupils in the current study (50%) consumed one serving of milk each day. Eleven percent of pupils indicated multivitamin use history, ninety percent reported consumption of omega 3 fatty acids, and five percent reported history of diarrhoea. Further, the Vitamin-D deficiency was high in students with no milk serving in a day (95%), one milk serving in a day (86%), two milk servings in a day (92%), three milk serving in a day (100%) while none of the student had vitamin D deficiency who had four milk serving in a day. However, statistically this was not significant (p-value 0.215) indicated that the amount of daily milk that was served at levels Vitamin-D (p-value 0.215) is not associated. This finding is consistent with a Walia et al[17], which found that dietary consumption of milk, egg or non-vegetarian cuisine did not alter the amount of vitamin D in this study.

Calcium serum values ranged from 7.62 to 10.90 mg/dL in the current investigation. The majority (65%) of students had normal serum calcium (8.4 to 10.2 mG/dL), whereas 22% had >10.2 mg/dL and 13% had <8.4 mg/dL. Serum calcium mean concentrations were 9.56±0.85 mg/dL and serum calcium medium 9.80 mg/dL. However, majority (92.31%) of the students with low serum calcium levels (<8.4mg/dL) had vitamin D deficiency while 87.69% of the students with normal serum calcium levels (8.4 to 10.2mg/dL) had vitamin D deficiency and 90.91% of the students with serum calcium levels of >10.2mg/dL had vitamin D deficiency. But this difference was statistically not significant suggesting lack of association between serum calcium levels and vitamin-D levels (p=0.962). In contrast to these findings, Walia et al[17] reported positive correlation between serum calcium and serum vitamin D.

Body mass index ranged between 15.63 to 29.32 kg/m^2 in this study. The majority (44%) of pupils had regular (18.5 to 22.99 kg/m2) BMI and 10% were underweight (<18.5 kg/m^2). The median BMI levels were 22.34±3.23 kg/m^2 and 22.27 kg/m^2 and 15.63 to 29.32 Kg/m^2. In the present study, Vitamin-D levels (p=0.681) were not linked to the body mass index. The vitamin-D deficiency increased with obesity that is, 80% of the students with underweight BMI had vitamin-D deficiency which increased to 95.65% in overweight individuals. But same was statistically not true (p=0.681). In addition, the mean levels of 25–hydroxyl vitamin D were lower (13.48±4.28 ng/mL) among overweight pupils (BMI between 25 and 29.99 kg/m^2) compared to students at a risk of obesity (BMI between 23.0 and 24.99 kg/m$^{2;}$ 13.70±7.40 ng/mL) and normal BMI (14.55% to 22.99 kg/m^2). The statistically not significant difference was discovered (p=0.896), which suggested that the body mass index was not linked to 25–hydroxyvitamin D. A study carried out in Sivakumar et al[20] by 95.83% of the pupils had enough vitamin D with appropriate BMI. 19.7% of the study participants had elevated BMI hypovitaminosis and 36.84% of the study population had obesity I hypovitaminosis whereas 42.1% had obesity II hypovitaminosis. The results demonstrated that hypovitaminosis has been observed in students with increasing BMI and among obese students which, despite methodological variations, has been similar to previous research by Konradsen et al.[21]

CONCLUSION

Vitamin D insufficiency in medical students in the study area can be determined to be relatively widespread. The deficit in vitamin D is high in both men and women. It was found that vitamin D deficiency and dietary consumption were not linked together with long-term exposure to sun.

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