



Vitamin D Sources and Consequences of Hypovitaminosis D: Knowledge and Awareness among Pre-Medical Year Students

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ABSTRACT

Introduction: Vitamin D deficiency is a common and one of the neglected global medical problems. Vitamin D deficiency could lead to musculoskeletal disorders and also may be associated with systemic disorders such as diabetes mellitus, cancers, depression, cardiovascular, autoimmune, and infectious diseases. Sunlight is the major source of vitamin D. Apart from it, oily fishes, egg yolk, and milk products are the important dietary sources rich in vitamin D. The objective of this study was to assess the knowledge and awareness about vitamin D among pre-medical students of Oman Medical College.

Methodology: It is a cross sectional study and all the pre-medical year students were included in the study. The study was approved by the Institutional Research and Ethical committee and the study was conducted after obtaining informed consent from the students. A pre-designed questionnaire to assess the knowledge of vitamin D was distributed to all the participants. The data was collected, tabulated and statistically analyzed using Microsoft Excel.

Results: A total of 127 students voluntarily participated in the study. Majority of the students (97.64%) were heard of vitamin D. However, with regards to knowledge about sources of vitamin D, consequences of hypovitaminosis D, and recommended daily intake of vitamin D is lacking among participants.

Conclusion: The study results revealed that pre-medical students have inadequate knowledge about vitamin D rich sources, problems associated with vitamin D deficiency, and recommended daily intake of vitamin D. Therefore it is essential to create awareness in them, so that they can adopt themselves and disseminate information among the public to have a better health status.

Key words: Hypovitaminosis, Rickets, Skeletal disorders, Sunlight, Vitamin D

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INTRODUCTION

Vitamin D is a fat soluble vitamin and is naturally present only in few foods [1]. It is fortified in many food items, and also endogenously synthesized by the skin on exposure to sunlight [1-3]. Dietary vitamin D₃ absorbed in the intestine or vitamin D₃ actively synthesized in the skin, on exposure to ultraviolet B (UVB) rays is then transported to the liver. Vitamin D is metabolized in the liver to 25-hydroxyvitamin D (25OHD). It is further converted into active form, 1,25-hydroxyvitamin D (1,25OHD) in the kidney [2]. However, 25-hydroxyvitamin D has a long serum half-life (approximately 2-3 weeks) and hence its estimation in the blood is a good measure of vitamin D status of an individual [2]. Vitamin D deficiency is a

common and one of the most neglected medical problems seen worldwide [1]. Rickets, a skeletal disorder is the major problem associated with vitamin D deficiency in children. Deficient status of vitamin D in adults result in bones and joint pains, muscle weakness, osteomalacia, and increased susceptibility to fractures. It is also associated with increased risk of chronic conditions such as diabetes, cancers, depression, autoimmune, cardiovascular, and infectious diseases [1,4-8].

Inadequate exposure to sunlight is the major risk factor for vitamin D deficiency. Anything that interferes with the direct penetration of the skin by the ultraviolet B (UVB) rays, emitted from the sun will affect the cutaneous synthesis of vitamin D₃ [9,10]. In Middle-Eastern countries the problem of hypovitaminosis D is very common, though climate is sunny with clear skies in most part of a year [2]. Several social and cultural factors have contributed to this unexpected circumstance. Women of all age group in Middle-East are

inadequately exposed to sunlight due to their custom of covering complete body including hands and face with cloths [11,12]. Studies have shown that at least 15%-20% of the body surface needs to be exposed to sunlight for adequate period of 10-20 minutes for synthesis of sufficient amount of vitamin D [13]. Added to this, women are more concerned about their appearance and health and are afraid of their skin getting tanned on exposure to sunlight [2]. Therefore they like to stay inside the house or office during most of the daytime. Studies have shown that vitamin D deficiency is more prevalent in females, including pregnant and lactating women of Gulf nations [2,14]. Besides inadequate sun light exposure, many other factors contribute to vitamin D deficiency. Topical application of the sunscreen will decrease vitamin D3 synthesis in the skin by 99% [15]. Insufficient oral intake of oily fishes (Salmon, Tuna, and Mackerel), dietary egg, and fortified milk and milk products are the other factors that contribute to vitamin D deficiency [10]. The Institute of Medicine, USA recommends daily intake of 600 IU of vitamin D from food and supplements in children and adults [9]. The present research was aimed at assessment of knowledge and awareness about sources of vitamin D and consequences of hypovitaminosis D among pre-medical year students of Oman Medical College.

MATERIALS AND METHODS

It is a cross sectional study and the study group includes all the pre-medical year students (2nd and 3rd year) enrolled in the year 2017-2018. The study was approved by the Institutional Research and Ethical committee. The study was conducted after obtaining necessary informed consent from the students.

A pre-designed questionnaire was distributed to all the participants to assess their knowledge about vitamin D rich sources, recommended daily intake of vitamin D, and consequences of hypovitaminosis D. The data were collected, tabulated, and statistically analyzed using Microsoft Excel. Qualitative data were expressed as numbers and percentage.

RESULTS AND ANALYSIS

The results of the study were illustrated in Table 1 and Table 2. A total of 127 pre-medical year students voluntarily participated in the study. The current study revealed that majority of the students were aware of vitamin D (97.64%) and that vitamin D deficiency leads to bones and joint (80.31%) pains. More than fifty percent (>50%) of the students were unaware of other consequences of vitamin D deficiency such as rickets, diabetes mellitus, cancer, depression, autoimmune, cardiovascular, and infectious diseases. Regarding sources of vitamin D, 94.45% of the students knew that sunlight is an important natural source. However, only 19.69% correctly stated that minimum of 10-20 minutes sunlight exposure is required for adequate vitamin D synthesis. Nearly half of the students (51.97%) believed that complete covering of body including face and hands could lead to vitamin D deficiency. About three-fourth of

the students (72.44%) correctly stated that vitamin D is present in many food sources. However their knowledge about vitamin D rich foods is low. The participants indicated oily fishes (55.12%), milk and milk products (37.01%), vegetables (67.72%), chicken and duck eggs (31.49%), meat (49.61%), fruits (73.23%), and cereals (62.20%) as vitamin D rich food sources. The participants' knowledge about daily dose of vitamin D intake for children and adults was also weak as their answer varied from 200 IU to 1000 IU, while only 15.75% correctly stated 600 IU as the daily recommended dose (Figures 1-3).

Table 1: Statements regarding knowledge about consequences of vitamin D deficiency

Statement	Students' responses		
	Yes	No	Don't know
Have you heard of vitamin D?	n=124 (97.64%)	n=3 (2.36%)	-
Do you think vitamin D deficiency can lead to bone and joint pains?	n=102 (80.31%)	n=9 (7.09%)	n=12 (9.45%)
Which of the following is/are related to vitamin D deficiency	Number of students answered yes		
i.	Cardiovascular disorders: n=39 (30.71%)		
ii.	Diabetes Mellitus: n=21 (16.54%)		
iii.	Depression: n=42 (30.07%)		
iv.	Certain type of cancers: n=33 (25.98%)		
v.	Infectious diseases: n=36 (28.35%)		
vi.	Certain autoimmune diseases: n=30 (23.62%)		
vii.	Rickets: n=57 (44.88%)		

Table 2: Statements regarding knowledge about sources of vitamin D

Statement	Students' responses		
	Yes	No	Don't know
Do you think that sun exposure is an important source of vitamin D?	n=120 (94.45%)	n=5 (3.94%)	n=2 (1.57%)
How much time do you need to spend in the sun to get sufficient vitamin D			
Less than 10 minutes	n=16 (12.60%)		
10 to 20 minutes	n=25 (19.69%)		
1 hour	n=24 (18.90%)		
2 hours	n=7 (5.51%)		
I don't know	n=55 (43.31%)		
Do you think complete covering of body (including hands and face) with cloths lead to vitamin D deficiency	n=66 (51.97%)	n=33 (25.98%)	n=24 (18.90%)

Do you think we get vitamin D from food items?	n=92 (72.44%)	n=4 (3.15%)	n=32 (25.20%)
Which of the following is/are rich sources of vitamin D	Number of students answered yes		
i.	Meat: n=63 (49.61%)		
ii.	Oily fishes such as Solomon: n=70 (55.12%)		
iii.	Vegetables like Carrot and Beetroot: n=86 (67.72%)		
iv.	Cereals such as rice and wheat: n=79 (62.20 %)		
v.	Milk and milk products: n=47 (37.01 %)		
vi.	Chicken and Duck eggs: n=40 (31.49%)		
vii.	Fruits like orange, apple, and grapes: n=93 (73.23%)		
Which of the following is the correct recommended daily dose of vitamin D for children and adults?	No of students answered yes		
i.	200 IU (international unit): n=15 (11.81%)		
ii.	400 IU: n=38 (29.92%)		
iii.	600 IU: n=20 (15.75%)		
iv.	800 IU: n=7 (5.51%)		
v.	1000 IU: n=25 (19.69%)		

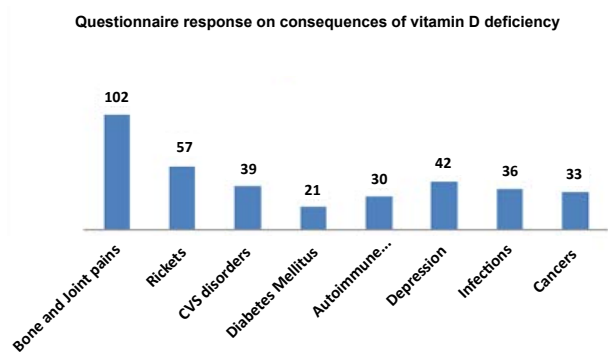


Figure 1: Questionnaire response on consequences of vitamin D deficiency

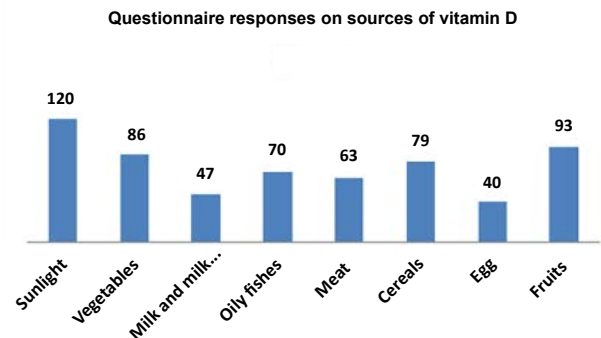


Figure 2: Questionnaire response on vitamin D sources

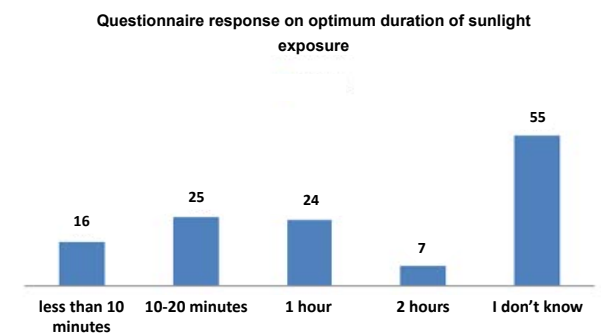


Figure 3: Questionnaire responses on duration of sunlight exposure

DISCUSSION

The current study assessed the knowledge and awareness about vitamin D sources, daily dietary intake of vitamin D, and consequences of vitamin D deficiency among pre-medical year students of Oman Medical College. Almost all the students (97.64%) of the study group had heard of vitamin D. Similar studies conducted by Arora et al. and Audrey et al. revealed that 98% and 99.5% of the participants were aware of vitamin D respectively [16,17].

Vitamin D plays a vital role in maintenance of calcium and phosphorus metabolism and bone homeostasis. The long term vitamin D deficiency could lead to musculoskeletal disorders such as bones and joint pains, osteoporosis, osteomalacia, and rickets in children. Majority of our participants (80.31%) correctly knew that vitamin D deficiency could lead to bone and skeletal disorders. The present findings are slightly lower in percentage but consistent with the study conducted by Lhamo et al. where 94% of the students responded correctly for the same question [18]. Recent studies have found higher prevalence of systemic disorders such as autoimmune disorders, diabetes mellitus, cardiovascular disorders, cancers, mental disorders, and infectious diseases in vitamin D deficiency states [6,18]. In our study, we found lack of this knowledge among 70-80% of the participants. In line with this finding, several studies have also showed lack of knowledge among majority of the participants [18,19].

With regard to knowledge of vitamin D sources, most of the students (94.45%) responded with sunlight exposure as the major source of vitamin D. However, only 19.69% of the students had correct knowledge that minimum of 10-20 minutes per day sun exposure is required for adequate synthesis of vitamin D. A similar study conducted by Khan on Omani female university students also reported that majority of the students (90.6%) knew that sunlight exposure is a major source of vitamin D and most of them did not know about duration of sun exposure required to get enough vitamin D [19]. Nearly fifty percent of the students did not know that covering of hands and face during sun exposure will affect the vitamin D synthesis. Studies conducted in the Middle Eastern countries found out covering of hands and face by females because of their social culture is the major risk factor of vitamin D deficiency [11,12,20].

In the present study, as in many previous studies, we observed that students' knowledge regarding dietary sources of vitamin D was insufficient [21-23]. Among the food products, fishes like Salmon, cod liver oil, egg yolk, milk and milk products are proved to be rich in vitamin D. The students responded with wide range of answers for a question asked about vitamin D rich food sources. Only 55.12% of the students stated correctly that oily fishes like Salmon are rich in vitamin D, while milk products and eggs are chosen by 37.01% and 31.49% students respectively.

The question on daily recommended dose of vitamin D revealed that students have lack of knowledge as they chose answers varied from 200 IU to 1000 IU, while only 15.75% of the students rightly said 600 IU is the daily recommended allowance of vitamin D for adults and children. A study conducted by Khan also showed similar findings [19].

CONCLUSION

The present study identified a lack of knowledge and awareness about importance of vitamin D among the study group. They have an inadequate knowledge about consequences of vitamin D deficiencies, vitamin D rich dietary sources, recommended daily intake, and the importance of optimum sunlight exposure. The knowledge deficit among medical students would awake medical teachers to design training modules to increase awareness about importance of vitamin D among medical students at an early stage of their training. This would help the students to adopt themselves and create awareness among the public to have a good healthy life.

REFERENCES

1. Al-Kindi MK. Vitamin D status in healthy Omani women of childbearing age: study of female staff at the Royal Hospital, Muscat, Oman. *Sultan Qaboos Univ Med J* 2011; 11:56.
2. Alshishtawy MM. To be or not to be exposed to direct sunlight: Vitamin D deficiency in Oman. *Sultan Qaboos Univ Med J* 2011; 11:196.
3. Ovesen L, Brot C, Jakobsen J, et al. Food contents and biological activity of 25-hydroxyvitamin D: A vitamin D metabolite to be reckoned with? *Ann Nutr Metab* 2003; 47:107-13.
4. Ginde AA, Mansbach JM, Camargo CA, et al. Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the Third national health and nutrition examination survey. *Arch Intern Med* 2009; 169:384-90.
5. Reis JP, Von Mühlen D, Miller ER, et al. Vitamin D status and cardiometabolic risk factors in the United States adolescent population. *Pediatrics* 2009; 124:371-9.
6. Holick MF. Vitamin D deficiency. *N Engl J Med* 2007; 357:266-81.
7. Christakos S, Dhawan P, Ajibade D, et al. Mechanisms involved in vitamin D mediated intestinal calcium absorption and in non-classical actions of vitamin D. *J Steroid Biochem Mol Biol* 2010; 121:183-7.
8. Chapuy MC, Schott AM, Garnero P, et al. Healthy elderly French women living at home have secondary hyperparathyroidism and high bone turnover in winter. EPIDOS Study Group. *J Clin Endocrinol Metab* 1996; 81:1129-33.
9. Del Valle HB, Yaktine AL, Taylor CL, et al. Dietary reference intakes for calcium and vitamin D. National Academies Press 2011.
10. Chen TC, Chimeh F, Lu Z, et al. Factors that influence the cutaneous synthesis and dietary sources of vitamin D. *Arch Biochem Biophys* 2007; 460:213-7.
11. Elsammak MY, Al-Wossaibi AA, Al-Howeish A, et al. High prevalence of vitamin D deficiency in the sunny Eastern region of Saudi Arabia: a hospital-based study. *East Mediterr Health J* 2011; 17.
12. Muhairi SJ, Mehairi AE, Khouri AA, et al. Vitamin D deficiency among healthy adolescents in Al Ain, United Arab Emirates. *BMC public health*. 2013; 1:33.
13. Vanlint SJ. Vitamin D and adult bone health in Australia and New Zealand: A position statement. *Med J Aust* 2005; 182:281-5.
14. Saadi HF, Dawodu A, Afandi BO, et al. Efficacy of daily and monthly high-dose calciferol in vitamin D-deficient nulliparous and lactating women. *Am J Clin Nutr* 2007; 85:1565-71.
15. Matsuoka LY, Ide L, Wortsman J, et al. Sunscreens suppress cutaneous vitamin D3 synthesis. *J Clin Endocrinol Metab* 1987; 64:1165-8.
16. Arora H, Dixit V, Srivastava N, et al. Evaluation of knowledge, practices of vitamin D and attitude toward sunlight among Indian students. *Evaluation*. 2016; 9.
17. Audrey SA, MAA PR, Ghazi HF, et al. Knowledge regarding Vitamin D among private university students in Malaysia. *Ann Nutr Disord Ther* 2014; 1.
18. Lhamo Y, Chugh PK, Gautam SR, et al.

- Epidemic of vitamin D deficiency and its management: Awareness among Indian medical undergraduates. *J Environ Pub Health* 2017; 2017.
19. Khan N. Attitudes and behavior towards sunlight exposure and knowledge about Vitamin D among Omani female university students. *EC Nutr* 2017; 8:35-42.
 20. Boland S. A baseline assessment of university students' vitamin D knowledge. *Electronic Thesis and Dissertation Repository* 2013; 1504
 21. Deschasaux M, Souberbielle JC, Partula V, et al. What do people know and believe about vitamin D? *Nutrients* 2016; 8:718.
 22. Kotta S, Gadhvi D, Jakeways N, et al. Test me and treat me-attitudes to vitamin D deficiency and supplementation: A qualitative study. *BMJ Open* 2015; 5:007401.
 23. Babelghaith SD, Wajid S, Al-Zaaqi MA, et al. Knowledge and practice of vitamin D deficiency among people lives in Riyadh, Saudi Arabia: A cross-sectional study. *Biomed Res* 2017; 28:3114-8.