

ORIGINAL ARTICLE*Is Education on Healthy Lifestyles Related to Vitamin D and Calcium Sufficiently Happening in Medical Schools: A Peek Through Medical Students*

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Abstract:

Background: Vitamin D and calcium are crucial for health and wellness, yet even educated individuals often overlook their importance and potential side effects. This research study aimed to assess the understanding and behavioral practices towards vitamin D and calcium deficiency among premedical and preclinical students. **Material & Methods:** A cross-sectional study was done for premedical and preclinical students at a medical university. The survey questions focused on vitamin D and calcium deficiency, their sources, dietary supplements, and adverse effects. The statistical analysis was done using IBM SPSS Statistics version 26. **Results:** A total of 104 students participated in the survey. 53 (51.0%) were premedical students, and 51 (49%) were pre-clinical year students. The student's overall knowledge and understanding of the deficiency and importance of vitamin D and calcium in bone health were adequate. 42.3% of the students reported having bone, joint, and back pain. **Conclusions:** The study's results show that most students had good knowledge about calcium and vitamin D, but there were gaps in understanding of lifestyle habits like daily requirements, sources, and behavioral practices. Knowing about vitamin D and calcium is not enough; how we inculcate these lifestyle habits in our daily practice is equally important. Thus, the study highlights the need for improving the understanding of the importance of these micronutrients and lifestyle practices among students. The study recommends medical universities customize teaching strategies to emphasize nutritional topics and organize community outreach programs involving students to benefit all.

Keywords: Vitamin D, Calcium, Deficiency, Medical students, Knowledge

Introduction:

Vitamins, minerals, and other micro and macronutrients are integral to food items. Calcium and Vitamin D are two of the most important micronutrients that work as building blocks in the construction of a healthy bone and, indeed, a healthy body. Calcium is critical for the function and integrity of muscles, the nervous system, blood, and bones. Decreased calcium levels can reduce bone density and cause osteoporosis leading to fragile bones that are susceptible to fractures. In addition to conditions like rickets, osteomalacia, osteoporosis, and renal and liver failure that can exacerbate it, low levels of vitamin D can also lead to decreased bone mass.^[1] The relationship between low vitamin D levels and the emergence of several chronic illnesses, including cancer, diabetes, hypertension, and cardiovascular disease, has not received enough attention. Serum vitamin D levels are inversely proportional to the development of these chronic disorders.^[2] The immune cells contain vitamin D receptors, which determine the immunity status. A negative association has been observed with vitamin D levels, respiratory infections, and auto-immune diseases.^[3] It is believed that at least 50% of the world's population is deficient in vitamin D.^[4] Though the daily requirement of vitamin D can be met through a proper diet and adequate sun exposure, the prevalence of vitamin D deficiency is high for several reasons, like poor dietary habits, inadequate sun exposure due to cultural restrictions, dark skin, aging, pregnancy, etc.^[5] Hypocalcaemia typically arises from a lack of vitamin D or magnesium, hypoparathyroidism, impaired absorption of calcium, critical illness, or the use of specific drugs.^[6] Calcium supplementation may be beneficial for certain individuals with improper calcium metabolism and those with high calcium requirements but consume very little calcium in their diet. For example, in pregnant women, calcium supplementation may decrease the chance of developing pre-eclampsia.^[7] A modest daily calcium

intake, in conjunction with vitamin D, can reduce the risk of fractures in individuals at risk for osteoporosis.^[8] Health awareness about healthy lifestyles and nutrition is important to prevent chronic diseases. A primary health care physician needs to be well educated to counsel his or her patients on these aspects of nutrition and wellbeing. Though nutrition is part of the medical curriculum, it has been overlooked, and many surveys conducted for medical students indicate insufficient knowledge of the essentiality and understanding of these vital nutrients.^[9] Most medical students lack calcium and vitamin D primarily because of improper eating habits brought on by long study hours, a lack of nutritious food options for those living in hostels, the culture of eating fast food, and limited exposure to sunlight.^[10] Nutrition education provided by some medical colleges is inadequate and outdated.^[11] A national strategy to integrate nutrition across the curriculum, backed by teaching faculty and medical school leadership, is necessary to keep up with evolving methods of education and training. Pedagogies that prioritize active learning models that target competencies like hands-on community involvement, small group interactions, and culinary activities have demonstrated encouraging outcomes. Medical students' perceptions of their eating habits and confidence in diet and exercise counselling increased as a result of innovative preventive medicine and nutrition training.^[12] This research study aimed to assess the understanding and behavioural practices towards vitamin D and calcium and their deficiency among premedical and preclinical students.

Material and Methods:

This was an observational, cross-sectional study using a survey or questionnaire. The pre-medical and pre-clinical students at the medical university were chosen to participate in the study. A self-administrated online questionnaire was utilized to collect the research data during a period from January 2023 to May 2023. The survey questions focused on vitamin D and calcium deficiency, their sources, daily requirements, dietary supplements and adverse effects. There were 15 questions related to vitamin D deficiency, while there were 9 questions about calcium. The questionnaire was derived from various studies and modified based on the suitability of the present study. The survey questionnaire was given to 10 students and two faculty members to evaluate their understanding of the language, the complexity of words, the content, and the suitability of the questions used for the study undertaken. Data collection: Survey questionnaires were prepared using Google Forms and sent to MD1,

MD2, and MD3 students (premedical and pre-clinical) through their college emails. Instructions were given with the consent of the participants at the beginning of the study: not to open personal accounts to fill out the form, and no repetition in answering the question was allowed. Also, it was ensured that the survey was completed within the timeline determined. The survey form was prepared in a manner that no one except the designer could edit. The data was collected as an Excel sheet for statistical analysis using SPSS software.

Exclusion: Clinical-year students were excluded from the study. Data analysis: The data obtained were analyzed using IBM's Statistical Package for Social Sciences version 22 (IBM Corp., 2013). IBM SPSS Statistics for Windows, Version 22.0. (Armonk, NY: IBM Corp.) Descriptive data was presented as frequency and percentage. The chi-squared test was used to determine the significant difference in knowledge, awareness, and perception towards vitamin D and calcium deficiency among students of different educational years.

Results:

Table 1: General characteristics of participants

	Variables		N (%)
Year of education	Premedical	MD1	53 (51.0%)
		MD2	32 (30.8%)
	Preclinical	MD3	19 (18.3%)
		Total	104 (100%)
Gender		Female	91 (87.5%)
		Male	13 (12.5%)

The total number of participants in this study was 104. Participants in this study varied in age from 17 to 22 years, with a mean age of 19. Female students were predominant in this study accounting for 91 (87.5%). Equal distribution of students between premedical and preclinical students as shown in Table 1. Table 2 summarizes the knowledge level of the premedical and preclinical students regarding vitamin D. The results showed that preclinical students appeared to have a substantial amount of information regarding the importance of vitamin D and its association with rickets 66 (63.5%). All students were aware that the sun is an essential source of vitamin D, but with concern about fully covering the body, only 44 (42.3%) of the students were aware that sunlight may not reach the body and may affect the production of vitamin D. About the sunscreen use, only 30(28.9%) were aware that it might interfere with the formation of vitamin D within the skin. Preclinical students had a better understanding of full body coverage and how the use of sunscreen can affect vitamin D formation in the body. The difference was statistically significant, as shown in Table 2. Most of the

students 80 (76.9%) knew about food-rich sources of vitamin D. Regarding the amount of time for exposure to the sun, 69(66.4%) of the respondents stated correctly. The majority were not aware of the

association of Vitamin D with other diseases like cancer, cardiovascular diseases, hypertension, and diabetes mellitus.

Table 2: Responses to the knowledge statements related to vitamin D and calcium among students

Variables	Year of education			Total	P value
	MD1	MD2	MD3		
Is vitamin D produced by the body?					
Correct	24 (36.4%)	26 (39.4%)	16 (24.2%)	66(63.5%)	0.001
Incorrect	17 (65.4%)	6 (23.1%)	3 (11.5%)	26(25%)	
Unsure	12 (100%)	0 (0%)	0 (0%)	12(11.5%)	
Do you think that sun exposure is an important source of vitamin D?					
Correct	53 (51.0%)	32(30.8%)	19(18.3%)	104(100%)	-
Incorrect	0 (0%)	0 (0%)	0 (0%)	0(0%)	
How much time is needed to spend under sun every day to get enough Vit D?					
Correct	30 (43.5%)	24(34.8%)	15(21.7%)	69(66.4%)	0.445
Incorrect	12(60.0%)	5 (25.0%)	3(15.0%)	20(19.2%)	
Unsure	11(20.75%)	3(9.37%)	1(5.26%)	15(14.4%)	
Do you think that complete body coverage with clothes (including face and hands) leads to vitamin D deficiency?					
Correct	8 (18.2%)	23(52.3%)	13(29.5%)	44(42.3%)	0.000
Incorrect	33 (76.7%)	6 (14.0%)	4 (9.3%)	43(41.3%)	
Unsure	12 (70.6%)	3 (17.6%)	2 (11.8%)	17(16.4%)	
Does sunblock /sunscreen interfere with vitamin D formation inside the skin?					
Correct	2 (6.7%)	17(56.7%)	11(36.7%)	30(28.9%)	0.000
Incorrect	40 (74.1%)	10(18.5%)	4 (7.4%)	54(51.9%)	
Unsure	11 (55.0%)	5 (25.0%)	4 (20.0%)	20(19.2%)	
What is the normal level of vitamin D in the serum?					
Correct	33 (48.5%)	22(32.4%)	13(19.1%)	68(65.4%)	0.807
Incorrect	20 (55.5%)	10(27.8%)	6 (16.7%)	36(34.6%)	
Which of the foods is/are rich sources of vitamin D?					
Correct	38 (47.6%)	27(33.8%)	15(18.6%)	80(76.9%)	0.688
Incorrect	15 (62.5%)	5 (20.8%)	4 (16.7%)	24(23.1%)	
Which of the following diseases /disorders are caused by vitamin D deficiency?					
Cancer	1 (50.0%)	0 (0.0%)	1 (50.0%)	2(1.9%)	0.192
Rickets	28 (42.4%)	22 (33.3%)	16 (24.2%)	66 (63.5%)	
Osteomalacia	17 (60.7%)	9 (32.1%)	2 (7.1%)	28(26.9%)	
Cardio-vascular disease	5 (83.3%)	1 (16.7%)	0 (0.0%)	6(5.8%)	
Diabetes mellitus	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0%)	
Hypertension	2 (100.0%)	0 (0.0%)	0 (0.0%)	2(1.9%)	
What is the normal level of calcium in the human serum?					
Correct	29 (44.6%)	23 (35.4%)	13 (20.0%)	65 (62.5%)	0.118
Incorrect	24 (61.5%)	9 (23.0%)	6 (15.5%)	39 (37.5%)	

*Chi-square test, *P<0.05 level (2 tailed)

Table 3: Responses to the Awareness statements related to vitamin D and calcium among students

Variables	Year of education			Total	P value
	MD1	MD2	MD3		
Have you ever heard about vitamin D deficiency?					
Yes	52 (51.0%)	32(31.4%)	18(17.6%)	102(98.1%)	0.417
No	1 (50.0%)	0 (0.0%)	1 (50.0%)	2 (1.9%)	
Do you think that vitamin D is essential part of our daily diet?					
Yes	53 (51.0%)	30 (30%)	18.3(17%)	100(96.2%)	0.086
No	0 (0%)	2 (50.0%)	2 (50.0%)	4(3.8%)	
Why do you think vitamin D is important?					
Important for calcium metabolism and bone health	34 (45.3%)	26(34.7%)	15(20%)	75(72.1%)	0.179
Its deficiency can cause certain diseases	19 (65.5%)	6 (20.7%)	4(13.8%)	29(27.9%)	
Is there any relation between Vitamin D and Calcium levels					
Yes	36 (42.4%)	31 (36.5%)	18(21.1%)	85(81.7%)	.001
No	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0.0%)	
I don't know	17 (89.5%)	1 (5.3%)	1 (5.3%)	19(18.3%)	
Do you think that calcium is important for human body?					
Yes	53 (51.0%)	32 (30.8%)	19(18.3%)	104(100%)	
No	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0.0%)	
Have you heard about the term osteoporosis?					
Yes	50 (51.0)	31 (30.8)	19 (18.3)	100(96.2%)	.528
No	3 (75.0%)	1 (25.0%)	0 (0.0%)	4(3.8%)	
Do you think that dairy products are a good source of calcium?					
Yes	52 (52.50%)	30 (30.30%)	17 (17.20%)	99(95.20%)	.288
No	1 (20%)	2 (40%)	2 (40%)	5(4.80%)	

*Chi-square test,*P<0.05 level (2-tailed)

The awareness level was high among both premedical and preclinical year students ranging from 81 -98%. 72.1% knew vitamin D is important for calcium

metabolism and bone health and only 29(27.9%) were aware of its deficiency causing certain diseases. (Table 3)

Table 4: Responses to the practice statements related to vitamin D and calcium among students

Variables	Year of education			Total	P value
	MD1	MD2	MD3		
Have you ever got your vitamin D level checked?					
Yes	11 (50.0%)	7 (31.8%)	4 (18.2%)	22(21.6%)	.992
No	42 (51.2%)	25(30.5%)	15(18.3%)	82(78.4%)	
I don't know	0 (0%)	0 (0%)	0 (0%)	0(0%)	
Have you ever been taken/prescribed vitamin D supplements?					
Yes	10 (55.6%)	5 (27.8%)	3 (16.7%)	18(17.3%)	.912
No	43 (50.0%)	27(31.4%)	16(18.6%)	86(82.7%)	
I don't know	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0.0%)	
Are you suffering from joint, leg, and back pain?					
Yes	27 (61.4%)	9 (20.5%)	8 (18.2%)	44(42.3%)	.119
No	26 (43.3%)	23(38.3%)	11(18.3%)	60(57.7%)	
Have you ever been fractured before?					
Yes	8 (44.4%)	7 (38.9%)	3 (16.7%)	18(17.3%)	.712
No	45 (52.3%)	25(29.1%)	16(18.6%)	86(82.7%)	
Have you ever undergone for bone mineral density test?					

Yes	3 (60.0%)	1 (20.0%)	1 (20.0%)	5(4.8%)	.865
No	50 (50.5%)	31(31.3%)	18(18.2%)	99(95.2%)	
How often do you consume dairy products?					
Once a week	8 (47.1%)	6 (35.3%)	3 (17.6%)	17(16.4%)	.482
Twice a week	4 (36.4%)	2 (18.2%)	5 (45.5%)	11(10.6%)	
Thrice a week	14 (53.8%)	7 (26.9%)	5 (19.2%)	26(25.0%)	
Everyday	25 (53.2%)	16(34.0%)	6 (12.8%)	47(45.2%)	
Don't consume it	2 (66.7%)	1 (33.3%)	0 (0.0%)	3(2.8%)	
Have you ever been prescribed calcium supplements?					
Yes	8 (61.5%)	2 (15.4%)	3 (23.1%)	13(12.5%)	.437
No	45 (49.5%)	30(33.0%)	16(17.6%)	91(87.5%)	

*Chi-square test, *P<0.05 level (2 tailed)
 22(21.6%) of students checked for their vitamin levels. 18(17.3%)of them were prescribed Vitamin D and 13(12.5%) students with calcium supplements.5(4.8%) undergone for bone mineral density. Only 47 (45.2) % consumed dairy products every day 44 (42.3%) of students experienced joint, leg, and back pain, and18(17.3%) got fractured as shown in Table 4.

Discussion:

Vitamin D and calcium are essential micronutrients that the body requires for the proper functioning of the various organs in the human body. Every one of us needs to be aware of the source and benefits of all the micronutrients so that they are consumed properly and adequately. Medical schools have the responsibility of educating and providing sufficient knowledge to future health doctors regarding these important nutrients like calcium, vitamins, etc, and healthy lifestyles to the medical students to make them eligible to counsel their patients effectively. Some studies have highlighted the gap in inculcating and executing nutritional topics adequately in the broader medical curriculum, leaving medical students underprepared for nutritional counselling for their patients in the future.^[13] In our study, most of the students (96.2%) knew about vitamin D and calcium as essential micronutrients and their deficiency, leading to certain diseases. A study done in Saudi Arabia showed that out of 186 participants, 95 (51.3%) had good knowledge regarding vitamin D and 90 (48.7%) had poor knowledge.^[14] However, premedical students (36.4%) had less knowledge about vitamin D being produced within the body. Premedical students knew that vitamin D is produced in the body by sun exposure but were not aware of the mechanism of its production within the body.^[15] The Middle Eastern countries are abundantly sunny, and despite that, the prevalence of vitamin D deficiency is largely seen in these countries.^[16] Exposure to the sun for

around midday, is quiet enough for vitamin D synthesis.^[17]69 (66.3%) students knew about the sun exposure time in our study. Our study showed better knowledge of sun exposure time in comparison to students from the University of Jordan as75.6%of the participants did not know the best time to be exposed to the sun for cutaneous production of vitamin D. ^[18] Sufficient vitamin D supply mostly relies on fortified foods or dietary supplements due to the inadequate levels of vitamin D in natural foods. ^[19]65.4% of students were aware of the normal serum level of vitamin D in them. 76.9% of the students in our study were aware of the dietary foods that are rich in vitamin D. Routine check-up for vitamin D levels is not mandatory for everyone. However, testing is important for certain populations like people who work indoors for a long time, patients with gastrointestinal and kidney disorders, and people whose cultural beliefs or climatic conditions entail them to be fully clothed and whose dietary habits include little or no dairy (which is vitamin D-fortified), are supposing vitamin D-deficient and should be tested. Several studies have mentioned the influence of clothing and the status of serum vitamin D levels. ^[1,20,21] Preclinical students (83.7%) had sufficient knowledge about the inadequate synthesis of vitamin D due to the full clothing of the body. In our study, only 22 (21.1%) of the students got their vitamin D levels checked, which is less than the study conducted by Asma et al (36.9%).Vitamin D supplementation is important to maintain normal levels and also to prevent chronic disease caused by its deficiency. Only 12% of the participants were recognized to have vitamin D deficiency and prescribed vitamin D supplementation in a study done by Alkindi T. et al. This could be because of a lack of awareness and proper guidelines for vitamin D supplementation. In our study, 17.3% of students were advised for vitamin D supplements for vitamin D deficiency.^[22] It is a well-established fact that a deficiency of vitamin D can lead to rickets, osteomalacia, and osteoporosis. Over the past few years, researchers have uncovered several new potential roles for vitamin D in different tissues and organs of the body.

approximately 5–30 min to arms and legs, particularly

Hence, its deficiency will not just affect the skeletal system but can also lead to several chronic diseases in the body.^[23] 90.4% of students in our study knew about the bone disorders caused by vitamin D deficiency. Only 9.6% of students knew that vitamin D deficiency can cause other chronic diseases.^[24] Calcium and vitamin D are interdependent. Calcium absorption and serum concentration are dependent on the body's vitamin D level.^[25] Many of the premedical students (32%), when compared to preclinical students, did know about the relationship between calcium and vitamin D. Calcium and vitamin deficiency cause bone and joint pain. In adults, chronic deficiency of these two nutrients can lead to osteomalacia and osteoporosis, resulting in decreased bone mass and fractures. 44 (42%) of the students in the present study had experienced bone, joint, and leg pain.^[26] In the past, 18 (17.3%) students had a history of fractures. Most of the students had knowledge of serum calcium levels of 65 (62.5%), and regarding the source of calcium, dairy products are a rich dietary source of calcium. 99(95.2%). Despite knowledge about the dietary sources for calcium and vitamin D only 47 (45.2%) of the students in our study consumed dairy products daily.^[27] Inadequate dietary supplements could be the reason for bone, joint, and leg pains among the students in our study. As mentioned above various studies highlight significant gaps in adequate information and knowledge among medical students at various universities. This is due to the varied and inconsistent integration of nutritional topics into the curriculum. Traditional didactic lectures, as used in most medical schools, may not be an effective teaching

strategy on their own. Incorporating interactive teaching and learning approaches, practical skills, research, and health promotion events into medical training can effectively address nutritional education gaps.^[28]

Limitations:

Numerous additional studies on vitamin D and calcium awareness have been carried out; nevertheless, we think that further investigations on vitamin D and calcium sensitivity are still required because of the information gap found. The sample size collected was small; this factor may affect the findings. Increasing the sample size to include more students from different colleges could increase the likelihood of making an appropriate statistical prediction.

Conclusion:

The study's findings indicate that while most participants had adequate knowledge of calcium and vitamin D, there were gaps in understanding daily requirements, sources, and behavioral practice. The study emphasizes the importance of properly integrating and implementing nutritional topics into the medical curriculum throughout medical training. Incorporating a variety of new teaching-learning strategies, professional development activities, and community educational outreach programs that primarily focus on lifestyle modification, healthy eating habits, and vitamin D screening can fully prepare students for the realities of clinical practice.

Sources of supports: Nil

Conflicts of Interest: Nil

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