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Assessment of Vitamin D Knowledge and Awareness among Female Students of Applied Medical Sciences Faculty, Umm Al-Qura University

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Background: Despite the numerous functions of vitamin D, there are still billions of people worldwidewho have vitamin D deficiency or insufficiency, and the highest prevalence is in the Middle East, mostly females.
Aim of The Study: This study aimed to assess the knowledge and behaviors of applied medical science female students regarding vitamin D. Participants and methods: A cross- sectional study was conducted at the Faculty of Applied Medical Sciences- Umm Al-Qura University. An electronic questionnaire was assigned for (156) students from female section and chosen from an age group (18-22 years) to assess their vitamin D knowledge and attitudes. Data analysis was done using the Statistical Package of the Social Science (SPSS) version 20, using frequency and chi-square test. A p-value less than or equal to 0.05 was considered significant.
Results: About 57% of the students were not aware that the overuse of sunscreen could block the ultraviolet rays from reaching the skin, thus decreased production of vitamin D. The overall knowledge of the students about vitamin D sources (fortified milk, mushrooms and eggs) was decent.

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Conclusion: the students had a good background of vitamin D functions, sources, and deficiency symptoms but wasn't reflected on their behavior, this gap between their knowledge and their lifestyle must be filled through health education for better health.

Keywords: Vitamin D; knowledge; deficiency; awareness.

1. INTRODUCTION

Vitamin D is a fat-soluble vitamin functioning as a prohormone with multiple roles, including hormone and immune modulation, antitumor and anti-inflammatory effects [1,2]. It is essential to lower heart diseases by regulating blood pressure in the kidney [3], preventing the development of cancer by decreasing cancer cell growth, reducing angiogenesis which is the formation of tumor blood vessels and inducing apoptosis that refers to programmed cell death or cellular suicide. It is worth mentioning that dietary calcium is not absorbed efficiently without the presence of vitamin D. Optimal vitamin D levels are necessary to increase the efficiency of calcium absorption. Without adequate vitamin D, the body absorbs no more than 10% to 15% of dietary calcium. In the vitamin D–sufficient state, the intestinal calcium absorption increases to 30% to 40% [4].

Humans can synthesize vitamin D3 at sufficient ultraviolet exposure, also known as cholecalciferolin their skin [5]. However, only vitamin D3 is produced in skin, made from 7-dehydrocholesterol through the exposure to ultraviolet B (UVB) radiation. Then, it enters the blood circulation and is bound to vitamin D binding protein (DBP) where it is hydroxylated to cholecalciferol (vitamin D3) via the liver. After that,it is converted by the kidney to form 1,25-dihydroxyvitamin D, also known as calcitriolwhich is the active compound of vitamin D [6,7]. Vitamin D is also obtained by consuming dietary sources such as fatty fish, cod liver oil, organ meat, egg yolks, fortified milk, mushrooms and yeast [8].

Billions of people worldwide have Vitamin D deficiency or insufficiency [9]. In general, ahigh prevalence of vitamin D deficiency might be associated with various different issues, such as in dark skin;the cutaneous synthesis of vitamin D is low due to high skin melanin content, which leads to low vitamin D synthesis, or due to aging. The use of sunscreen or limited sunlight exposure and heavily veiled women, which is very common especially in the Middle East, could be considered as reasons behind the uppermost prevalence of vitamin D deficiency [10]. The problem is familiar in healthy Saudi adults. It is more obvious in females and especially in the younger age groups, due to traditional clothes, whichare intended to cause avoidance of sunlight, and insufficient dietary consumption that might be the main reasons [11]. Furthermore, high rates of obesity worldwide and low vitamin D intake may also contribute to this deficiency problem [9]. Vitamin D deficiency shows a small association with season worldwide, compared to sunny countries. Less deficiency rates were observed in countries with extended winters; this is probably related to the fortification of food that is consumed, eating fatty fish and regular use of vitamin D supplements [12]. In conclusion, to prevent the deficiency we must confirm that UV radiation is adequate, and vitamin D fortified food is available as much as possible.

2. SUBJECTS AND METHODS

2.1 Selection of the Sample

Across-sectional study was conducted at Umm AL-QuraUniversity's Applied Medical Sciences during fall months (September to December 2018). One hundred and fifty-six (156) students were assigned only from female section and chosen from one age group (18-22), About 65 students from the total sample were tested their Vit. D level in the serum recently before starting collecting data, those students were used as a positive sample to compare their levels with their knowledge about vitamin D sources and their habits. Those students were classified as the Vitamin D levels as:

2.2 Data Collection

2.2.1 Questionnaire

An electronic questionnaire was conducted in Arabic language containing the following:

2.2.1.1 Personal information

It included the subject's age, major, marital status, and phone number.

2.2.1.2 Nutritional assessment and history

It included weight and height to calculate BMI individually. The result was classified as WHO

Vitamin D level				
Deficiency	**Insufficient**	**Sufficient**	**Optimal**	**Upper level**
37	14	5	8	1

reference for body mass index [13]. Also, previous and recent vitamin D level test, family history of vitamin D deficiency and any medical condition including (intestinal disorder, diarrhea) were collected.

2.2.1.3 Life style

It included smoking, barriers to sun exposure (hot weather, humid weather), whether the subject likes sunlight exposure, using food supplements, or consuming vitamin D fortified milk, oily fish or codfish.

2.2.1.4 Personal knowledge

It included the subject's knowledge about the importance of vitamin D on health, awareness of vitamin D deficiency, information sources about vitamin D, groups at highest risk for vitamin D deficiency, vitamin D deficiency reasons, symptoms related to vitamin D deficiency, health problems related to vitamin D deficiency, dietary sources of vitamin D, appropriate time for sun exposure , time spent under sunlight, time to get sunlight, parts of the body to be exposed to sunlight, effect of sunblock on vitamin D status, how enough is sunlight through window enough to get vitamin D, physical activity in Saudi Arabia a reason of vitamin D deficiency, hijab as a barrier to get enough sunlight, vitamin D dose to treat vitamin D deficiency and Calcium importance to people with vitamin D deficiency.

2.3 Biochemical Assessment

2.3.1 Criteria of vitamin D status

From the According to Holick [4] Vitamin D status in relation to 25 (OH) D concentrations is considered as follows:

I. Deficiency: Less than or equal (20) ng/mol or (50) nmol/L.
II. Insufficiency: More than (21 – 29) ng/mol or (50 – 72) nmol/L.
III. Sufficiency: More than (30 – 150) ng/mol or (75 – 374) nmol/L.

2.4 Statistical Analysis

Statistical analysis was performed by using computer statistical package for social science (SPSS) version 20. Data was presented as frequency and percentage; comparisons were performed using chi-square test. A p-value less than or equal to 0.05 was considered significant.

3. RESULTS

According to Table 1 with respect to the nutritional assessment of the participants, (62.8%)of the subjects have normal weight while(1.9 %)of them are obese class II (35-39.9).The subjects who tested vitamin D were (41.7%), while more than (58.3%) of them did not test it. (67.3%) of the subjects' families have vitamin D deficiency whereas (5.1%) of them have normal vitamin D levels.

In Table 2, the participants' general knowledge about vitamin D illustrates that all subjects (100%) think that vitamin D is essential for their health. The most common source of participants' knowledge about vitamin D was the academic lectures (64.1%) while (6.4%) of subjects, their source of information about vitamin D is from books. All of the subjects think that vitamin D deficiency found mostly in females. Less than half of the subjects (47.4%) think insufficient exposure to sunlight is the main cause of vitamin D deficiency while (12.2%) of them think inadequate intake of the recommended amount of vitamin D the cause of vitamin D deficiency.

Results in Table 3 showed 48.7% of the subjects suggest that the best timing of the exposure to the sun is from 8-10 am and 2-4 pm while 17.9% of them suggest that the best time is from 8-10 am and 12-3 pm. The percentage of the subjects suggestingthe total minutes you should be exposed to the sun is 5-10 minutes daily, which is equal to55.1% while 3.8% of them suggest that less than 5 minutes is the total number of minutes you should be exposed to the sun daily. With regard to the times a person should be exposed to the sun,49.4% of subjects suggest it isthree to four times a week while 8.35% of them suggest once a week is enough. In addition, the percentage of the participants who selected arms, legs and neck, as the parts that should be uncovered when exposing to the sun was (88.5%). On the other hand, only three persons (1.9%) selected neck and legs separately.

Table 1. The nutritional assessment of the participants

Parameter		No.	%
BMI	Underweight	32	20.5%
	Normal weight	98	62.8%
	Overweight	15	9.6%
	Obese class I	8	5.1%
	Obese class II	3	2%
Have you tested your vitamin D level?	Yes	65	41.7%
	No	91	58.3%
Total		156	100%
Is there anyone in your family who has vitamin D deficiency?	Yes	105	67.3%
	No	8	5.1%
	I don't know	43	27.6%
Have you been diagnosed with any of the following diseases?	Osteoporosis	1	0.6%
	Diabetes	2	1.3%
	Heart disease	1	0.6%
	Other	11	7.1%
	Healthy	141	90.4%
Do you suffer from any condition related to intestinal?	Yes	18	11.5%
	No	138	88.5%
Do you suffer from diarrhea recently?	Yes	10	6.4%
	No	146	93.6%

Table 2. The participants' general knowledge about vitamin D

Question	Answer	No.	%
Do you think that vitamin D is essential for your health?	Yes	156	100%
	No	0	0
Have you heard about vitamin D deficiency?	Yes	152	97.4%
	No	4	2.6%
What is your source of information about vitamin D?	Books	10	6.4%
	Lectures	100	64.1%
	Social Media	46	29.5%
Vitamin D deficiency found mostly in:	Male	0	0
	Females	156	100%
What do you think is the cause/are the causes of vitamin D deficiency?	Insufficient exposure to sunlight	74	47.4%
	Inadequate intake of the recommended amount of vitamin D	19	12.2%
	Having a dark skin tone	0	0
	All the above	63	40.4%
What is /are the symptom/s related to Vitamin D deficiency?	Depression	3	1.9%
	Muscle weakness	1	0.6%
	Bone pain	16	10.3%
	Fatigue	10	6.4%
	All the above	126	80.8%
Do you know what are the problems associated with vitamin D deficiency?	Yes	97	62.2%
	No	59	37.8 %
What are the nutritional sources of vitamin D?	Tuna	12	7.7%
	Eggs	7	4.5%
	Mushrooms	3	1.9%
	Fortified milk	31	19.9%
	All of the above	103	66.0%
	Others...	12	7.7%
What is the RDI of vitamin D?	500 IU	86	55.1%
	600 IU	0	0%
	700 IU	70	44.9%

Table 3. The participants' general knowledge about sun light

Question	Answer	No.	%
When is the best timing to the exposure to the sun?	From 8-10 am and 2-4 pm	76	48.7%
	From 6-8 am and 2-4 pm	52	33.4%
	From 8-10 am and 12-3 pm	28	17.9%
How many minutes should you be exposed to the sun daily?	Less than 5 minutes	6	3.8%
	5-10 minutes	86	55.2%
	15-30 minutes	57	36.5%
	More than 30 minuets	7	4.5%
How many times should you be exposed to the sun?	Everyday	66	42.3%
	Three to four times a week	77	49.4%
	Once a week	13	8.3%
What are the parts that you should not cover when you are exposing to the sun?	Arms	12	7.7%
	Legs	3	1.9%
	Neck	3	1.9%
	All of the above	138	88.5%
Does the overuse of sunscreen products affect vitamin D deficiency?	Yes	67	42.9%
	No	89	57.1%
Is the sunlight passing through the glass suitable for vitamin D synthesis?	Yes	29	18.6%
	No	127	81.4%
Do you think the lack of sun exposure is the reason?	Houses' design	6	3.8%
	Lack of public open areas	86	55.1%
	Both	64	41.1%
What is the recommended dose of vitamin D3 to treat vitamin D deficiency?	50000 IU of vitamin D3 once a week for 6-8 weeks	68	43.6%
	60000 IU once a week for 8 weeks	19	12.2%
	5000 IU once a week for 10 weeks	31	19.9%
	8000 IU per day for 6 months	12	7.6%
	None of above	26	16.7%

The vitamin D level in participants was compared with the daily living habits as shown in Table 4.The number of participants who do not smoke is 27 with vitamin D deficiency and 6 have an optimal vitamin D levels(p = 0.653). All participants with vitamin D deficiency and only 7participants have optimal vitamin D level. Most participants with vitamin D deficiency (20 participants) and participants with optimal vitamin D level (5 participants) did not like sun exposure (p = 0.151).

Table 5 presents the vitamin D Level in participants with their general knowledge about vitamin D. The most participants with vitamin D deficiency (33 participants) and participants with optimal vitamin D level (7 participants) thought that the symptoms of vitamin D deficiency are depression, muscle weakness, bone pain and fatigue (p = 0.790). Calcium supplements being unnecessary for everyone in the treatment of vitamin D deficiency was the thinking of 23 participants with vitamin D deficiency and 5 participants with optimal vitamin D level(p = 0.666)

Table 6 illustrates the relation between vitamin D levels in participants with their general knowledge about sunlight. 19 participants with vitamin D deficiency suggest that the appropriate time for exposure to the sun is 5-10 minutes while 4 participants with optimal vitamin D level thought that the appropriate period is 15-30 minutes (p = 0.335). We found that 20 participants with vitamin D deficiency and 3 participants with optimal vitamin D level suggested that the number of times they should be exposed to sunlight is three to four times per week (p = 0.447). All participants who have optimal vitamin D levels and 30 participants with vitamin D deficiency thought that the sunlight passing through the glass is not suitable for the synthesis of vitamin D (p = 0.432). In addition, 31 participants with vitamin D deficiency and 6 participants who have optimal vitamin D levels said that the lack of exposure to sunlight is due to houses' design and lack of public open areas (p = 0.772).

4. DISCUSSION

This study explored the knowledge, awareness and practice of female students in the Faculty of Applied Medical Sciences in UQU, Saudi Arabia regarding vitamin D. In our study, there were numbers of limitation such as the high cost of vitamin D blood test, which was the cause of our inability to apply it on all the participants and

Table 4. Vitamin D Level in participants and their some daily living habits

Question	Answer	Vitamin D level					P. value
		Deficiency	Insufficient	Sufficient	Optimal	Upper level	
How often do you smoke?	Never	27	12	5	6	1	.653
	I stopped smoking	2	0	0	0	0	
	Once or twice	4	0	0	1	0	
	Sometimes	4	2	0	0	0	
Is hot weather and high humidity prevents you from getting exposed sunlight?	Yes	37	13	5	7	1	.340
	No	0	1	0	1	0	
Do you like being exposed to sunlight?	Yes	17	7	5	3	0	.151
	No	20	7	0	5	1	
Do you take any supplements?	Yes	21	6	4	5	0	.471
	No	16	8	1	3	1	
Do you drink vitamin D fortified milk?	Yes	8	4	3	1	1	.136
	No	29	10	2	7	0	
Do you eat cod fish or take fish oil?	Yes	2	1	2	0	0	.079
	No	35	13	3	8	1	

Table 5. The relation between D Levels in participants and their general knowledge about vitamin D

Question	Answer	Vitamin D level					P. value
		Deficiency	Insufficient	Sufficient	Optimal	Upper level	
What is your source of information about vitamin D?	Book	3	1	0	2	0	.560
	Lectures	22	10	4	6	1	
	Social Media	12	3	1	0	0	
Have you heard of vitamin D deficiency?	Yes	37	14	5	7	1	.124
	No	0	0	0	1	0	
What do you think is the cause/are the causes of vitamin D deficiency?	Insufficient exposure to sunlight	17	6	4	5	0	.798
	Inadequate intake of the recommended amount of vitamin	3	1	0	0	0	
	Having a dark skin tone	0	0	0	0	0	
	All the above	17	7	1	3	1	
What is /are the symptom/s related to Vitamin D deficiency?	Depression	0	0	0	1	0	.790
	Muscle weakness	1	0	0	0	0	
	Bones pain	1	1	0	0	0	

Question	Answer	Vitamin D level					P. value
		Deficiency	Insufficient	Sufficient	Optimal	Upper level	
	Fatigue	2	1	1	0	0	
	All the above	33	12	4	7	1	
Do you know what are the problems associated with vitamin D deficiency?	Yes	27	11	4	7	1	.882
	No	10	3	1	1	0	
What are the nutritional sources of vitamin D?	Tuna	6	0	0	2	0	.139
	Eggs	2	0	0	0	0	
	Mushrooms	0	0	0	1	0	
	Fortified milk	9	0	0	1	0	
	All of the above	20	14	5	4	1	
	Others...	6	0	0	2	0	
What is the RDI ofvitamin D?	500 IU	22	11	2	3	1	.267
	600 IU	0	0	0	0	0	
	700 IU	15	3	3	5	0	
Are calcium supplements necessary for everyone in the treatment of vitamin D deficiency?	Yes	14	8	2	3	0	.666
	No	23	6	3	5	1	
What is the recommended dose of vitamin D to treat vitamin D deficiency?	50000 IU of vitaminD3 once a week for6-8 weeks	16	7	4	4	1	.891
	60000 IU once aweek for 8 weeks	6	1	0	0	0	
	5000 IU once aweek for 10 weeks	8	3	0	1	0	
	8000 IU per day for6 months	3	0	0	1	0	
	None of the above	4	3	1	2	0	

Table 6. The relation between vitamin D Levels in participants and their general knowledge about sunlight

Question	Answer	Vitamin D level					P. value
		Deficiency	Insufficient	Sufficient	Optimal	Upper level	
When is the best timing to the exposure to the sun?	From 8-10 am and 2-4 pm	19	3	4	1	1	.139
	From 6-8 am and 2-4 pm	10	7	1	3	0	
	From 8-10 am and 12-3 pm	8	4	0	4	0	
Does the overuse of sunscreen products affect vitamin D deficiency?	Yes	9	7	3	5	0	.111
	No	28	7	2	3	1	
How many times you should expose to the	Less than 5 minutes	0	2	0	1	0	.335

Question	Answer	Vitamin D level					P. value
		Deficiency	Insufficient	Sufficient	Optimal	Upper level	
sun?	5-10 minutes	19	9	2	2	1	
	15-30 minutes	17	3	3	4	0	
	More than 30 minuets	1	0	0	1	0	
How many times should you be exposed to the sun?	Everyday	14	7	0	4	0	.447
	Three to four times a week	20	5	5	3	1	
	Once a week	3	2	0	1	0	
	Twice per month	0	0	0	0	0	
What are the parts that you should uncover when you are exposing to the sun?	Arms	6	0	1	0	0	.426
	Legs	0	0	0	1	0	
	Neck	1	0	0	0	0	
	All of the above	30	14	4	7	1	
Do you think the lack of sun exposure is the reason of vitamin D deficiency?	Houses' design	3	0	1	1	0	.772
	Lack of public open areas	3	0	0	1	0	
	Both	31	14	4	6	1	
Is the sunlight passing through the glass suitable for vitamin D synthesis?	Yes	7	1	0	0	0	.432
	No	30	13	5	8	1	

forced us to rely on the recent analysis conducted by the participants before. This represented 65 out of 156 students.

The study findings demonstrated that most of the students have a high knowledge with regard to vitamin D sources and importance. In a similar study, the highest percentage of knowledge about vitamin D was (97.4%) in a survey of university students [14]. Vitamin D related knowledge in United Kingdom was (56%) which was conducted on UK adult population [15].

In this study, it was found the main sources of students' knowledge were the academic lectures (64.1%). In contrast, the studies conducted in the United Kingdom [15] and Saudi Arabia [16] point out that the main source of information was social media, while (29.5%) of the subjects in our research took their information form social media. In another study, the researchers emphasize that social media lack the accuracy of vitamin D information. On the other hand, only (6.4%) of the subjects consider books as a source of information [15].

It is essential to highlight the importance of developing strategies to improve education to public to ensure that accurate information is delivered to the public. All participants think that femalesare at risk of vitamin D deficiency; (47.4%) of the participants think that insufficient sun exposure is the main cause of vitamin D deficiency. This is in an agreement with a similar study in Saudi Arabia [16].

The application of a sunscreen with an SPF reduces the capacity of the skin to produce vitamin D 3 so the overuse of sunscreen products can affect vitamin D level and lead to deficiency [17]. However, we found a lack of knowledge among the students in this point particularly. When they were asked "Does the overuse of sunscreen products affect vitamin D deficiency? 67 students said "Yes" and89 students said "No".

In another survey the recommended dose of vitamin D3 to treat vitamin D deficiency is 50,000 IU of vitamin D2 or vitamin D3 once/week [18]. These results were in agreement with our results obtained when we asked the students about the recommended dose of vitamin D3 to treat vitamin D deficiency. 68 of them answered 50000 IU of vitamin D3 once a week for 6-8 weeks; 19 students chose 60000 IU once a week for 8 weeks, whereas 31 students answered 5000 IU once a week for 10 weeks.

5. CONCLUSION

In this research, we measured the knowledge of applied medical sciences female students in Umm Al-Qura University about vitamin D. We found a gap between their knowledge and their behavior and lifestyle since they were well educated about vitamin D importance, sources, and deficiency but they did not apply that knowledge in their everyday practices.

CONSENT

It is not applicable.

ETHICAL APPROVAL

This research was approved by Clinical Nutrition Department, Applied Medical Sciences Faculty, Umm AlQura University.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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