



## Research Article

### VITAMIN D DEFICIENCY PRACTICE AMONG FEMALE MEDICAL STUDENTS IN AJMAN, UAE

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#### ABSTRACT

**Objectives:** This study investigated the practice towards vitamin D deficiency among female pharmacy and dentistry students in Ajman, UAE. **Materials and Methods:** The cross-sectional questionnaire-based survey was used in Ajman University with a total of 390 pharmacy and dentistry students surveyed from October 2015 to February 2016. The data analysis was conducted using SPSS version 24. Correlation tests were used to determine the association between the socio-demographic data and the practice towards VDD. **Results:** The majority of the participating students (63.3%) were studying in their first year at Ajman University. Forty-two percent of the participants were diagnosed with vitamin D deficiency. Sixty percent of the students feel often tired and 40.8% complain from having pain or weakness in muscles and bones. Although the majority of the participants (97.9%) were aware of the fact that sunlight is one of the main sources of vitamin D, 65.9% avoided sun exposure by covering themselves with cloths or sunscreen on daily basis. Only thirty-five percent of the participants exposed themselves more to the sun in summer and fall. **Conclusions:** Ajman University pharmacy and dental students have sufficient knowledge about vitamin D deficiency, but they lack the practice by exhibiting sun-avoidance behavior. Therefore, many are diagnosed with vitamin D deficiency or complain from related symptoms. Students need to be equipped with school and university level health education to promote safe sun exposure practice and sufficient intake of vitamin D from different sources.

**Keywords:** Female students, Health status, Practice, Vitamin D deficiency, Ajman.

#### INTRODUCTION

Vitamin D deficiency (VDD) is known to affect over 1 billion people worldwide<sup>1,2</sup> and may be the cause of morbidity, mortality and increased health care expenses through the related chronic illnesses<sup>1,2</sup>. The higher prevalence of VDD in women compared to men is due to socio-economic and environmental factors<sup>2,3</sup>. Under- or malnutrition because of a sedentary lifestyle and poor diet are the reason for increasing obesity rates resulting in chronic and degenerative diseases<sup>3,4</sup>. Other main reasons for VDD are the inability to absorb vitamin D from the intestines or to process it because of kidney or liver diseases, as well as the lack of vitamin D in the diet together with inadequate sensible sun exposure in otherwise healthy subjects<sup>5</sup>.

25-Hydroxyvitamin D [25(OH)D], the biomarker of the serum vitamin D status is derived from cutaneous synthesis through sun exposure of the skin (vitamin D<sub>3</sub>) and dietary intake (mostly vitamin D<sub>2</sub>)<sup>1,3</sup>. The 7-dehydrocholesterol in the skin is converted to previtamin D<sub>3</sub> during sun exposure and then isomerizes into vitamin D<sub>3</sub> (cholecalciferol)<sup>3</sup>. Vitamin D<sub>3</sub> and vitamin D<sub>2</sub> (ergocalciferol) are precursors of the hormonally active vitamin D (calcitriol)<sup>5</sup>. The cholecalciferol precursor is first transported to the liver, enters the blood circulation and is converted into 25-hydroxyvitamin D [25(OH)D]<sup>5</sup>. The other conversion happens in the kidneys, where the biologically active hormone calcitriol 1,25-dihydroxy vitamin D<sub>3</sub> ([1,25(OH)D]) is formed<sup>5</sup>.

The optimal vitamin D status for serum 25-hydroxyvitamin D concentrations is 50 nmol/l or higher<sup>6</sup>. Vitamin D deficiency prevalence according to current definitions in the literature is considered on levels < 50 nmol/L<sup>7</sup>. The NutriProfile project defines vitamin D deficiency for 0-4 year-olds < 20 nmol/L, for

5-64 year-olds < 30 nmol/L and for more than 65 year-olds < 50 nmol/L<sup>8</sup>.

Young populations living in sunny areas like UAE, Saudi Arabia, and India have a high prevalence of VDD due to insufficient knowledge and practice of vitamin D and its health implications<sup>9-14</sup>. Especially female adolescents are in danger to develop osteoporosis in their later life due to their risky behavior of physical inactivity, sun-avoidance behavior, low intake of dairy products and poor diets<sup>14,15</sup>.

Outdoor physical activity is directly linked to endogenous vitamin D synthesis and increases serum vitamin D levels<sup>2,3,5</sup>. Inactive, sedentary indoor lifestyle is strongly correlated to VDD and poor health<sup>3</sup>. The level of outdoor activities is strongly dependent on climatic conditions like temperature, season and socioeconomic, as well as cultural background. High or very low temperatures coupled with harsh weather conditions, urbanization, lifestyle patterns oriented mainly on more time spend in screen-based entertainment and negative attitudes towards sun exposure result mostly in the indoor dwelling and sun avoidance<sup>3,16</sup>. The limited time spends outdoors in the sun is also directly concerns of skin cancer leading to the daily use of sunscreens or skin aging and darkening<sup>3,16</sup>. UV-B radiation, which is needed for the endogenous vitamin D synthesis is filtered up to 95% by the use of sunscreens<sup>5</sup>. Women living in urban areas have a higher prevalence of VDD compared to those living in rural settings, which spent more time working outside and have higher sun exposure rates with higher serum 25(OH) vitamin D concentration than urban women, who mostly remain working indoors<sup>17</sup>. Clothing style due to religious or cultural factors is a minor factor compared to the major issues of socio-economic status and sedentary lifestyle of women in the development of

VDD<sup>3</sup>. A recent systematic review investigated the relationship between vitamin D levels, VDD and occupancy<sup>18</sup>. Workers with indoor occupancy had much lower levels of [25(OH)D] than outdoor workers. Here, shift workers, healthcare workers, and indoor workers were pinpointed as being on high risk to develop VDD. Especially, the rates of vitamin D deficiency among healthcare professionals were alarmingly low. Seventy-two percent of healthcare students, 65% of medical residents, 46% of practicing physicians, 44% of other healthcare employees, and 43% of nurses suffer from VDD. The authors conclude, that healthcare professionals, including healthcare students, and other indoor workers are mostly spending their time working indoors and therefore lack sun exposure leading to VDD. In general, the modern lifestyle with increased time spent indoors on work and entertainment for almost all age groups has shown a significant negative impact on cutaneous vitamin D synthesis and overall health<sup>3</sup>. Also, this was confirmed by the Tromsø study, which has demonstrated an inverse relationship between physical activity and body mineral density with screen-based inactive lifestyle, as well as a positively related correlation between screen time and BMI (body mass index)<sup>19</sup>. University students are spending most of their time indoors on studying and increasingly on screen-based activities. As a result, this leads to the indoor dwelling and sedentary lifestyle<sup>19</sup>, while also, insufficient knowledge about dietary sources of vitamin D and unhealthy eating habits result in under- and malnutrition increasing the prevalence of VDD<sup>20-22</sup>. The unhealthy eating habits of students are due to lack of time, living in a hostel, skipping important meals like breakfast and lunch, irregular meal timings and unhealthy food choices like snacks and fast food, known to lead to major mal- or undernutrition problems<sup>20-22</sup>.

Insufficient knowledge and practice towards vitamin D, as well as environmental, biological and socio-economic factors resulting in sun-avoidance behavior, sedentary indoor lifestyle, increased screen-based activities are the main reasons for VDD<sup>3</sup>. This study has been done to investigate the practice toward vitamin D deficiency of young female university students in AU.

## MATERIALS AND METHODS

A cross-sectional study was conducted using the convenience-sampling method. The targeted population was medical university students at Ajman University (AU) at Ajman, UAE. A total number of 390 female students from pharmacy and Dentistry College were enrolled in the current study. Data collection was done from October 2015 to February 2016.

The inclusion criteria were, participants being female pharmacy or dentistry students of Ajman University (AU) between the first to the fifth year of study and willing to participate in the study. Students who were not willing to participate and non-medical students were excluded from the study.

The questionnaire was designed based on the parameters to be evaluated as part of the study and by referring to previous literature. Modifications were done to make it convenient for UAE medical students. A pilot study of 20 AU students was conducted to test the validity and reliability of the questionnaire designed to be used on the main study, to determine the time needed by the participant to finish the questionnaire and to reveal difficulties in understanding the themes and the meaning of the questions included within the three parts of the questionnaire. Feedbacks obtained from pilot study population were considered accordingly. Face to face validity was assessed by experts and questions adjustments were made to the questionnaire to improve its validity. The data of the participants involved in the pilot study were not included in the final analysis.

Students willing to participate in the study were given the questionnaire to be filled. In addition, they were requested to sign the consent form that was provided prior to filling out the questionnaire. Participation was completely voluntary and no benefits or incentives were given to participants who filled out the questionnaire form.

Ethical letter to conduct the study was obtained (No. UG 2018.1.4.) from AU to allow the researcher to distribute and collect the questionnaires among AU students. Written and signed consent form was obtained prior to data collection. Confidentiality of the participants was maintained at all time. Participants were informed that participation is voluntary and given the right to withdraw from the study at any time they needed.

The developed questionnaire comprised of two parts: socio-demographic, and sun exposure practice. SPSS version 24 was used in the analysis. All questions were coded and then imported to SPSS for analysis. Descriptive analysis was used to analyze the socio-demographic data. Correlation tests were used in the data analysis. A *p* value of less than 0.05 was considered as significant.

## RESULTS

### Socio-demographic data of the respondents

The socio-demographic background of the study participants is listed in table 1. A total number of 390 female medical students studying Pharmacy (194) and Dentistry (196) were enrolled in the study. The majority of the participants were in their 1<sup>st</sup> - 2<sup>nd</sup>-year level (63.3%). The majority of the female AU students have white skin color (70.3%), while 79.2% are covering themselves according to Islamic religious belief. Most of the students are residing in a flat (78.2%), while the rest are living in villas with a private garden (21.8%). Around 42% of the respondents were diagnosed with vitamin D deficiency. Sixty percent of the students feel often tired and 40.8% complain from having pain or weakness in muscles and bones.

### Participants practices toward vitamin D deficiency

Fifty percent of the participants report having more sun exposure through outdoor activities in the winter and spring season from November to April (table 2). This period is the time in the UAE, where the weather is comparable to a mild summer in the northern hemisphere. Still, 65% of the students admitted sun-avoidance practices by staying indoors or using clothes and sunscreen to cover themselves up. The sun-avoidance was not related for 73.1% of students to the belief, that there may be possible allergic reactions by the sun. When asked directly about the reasons of lack of sun exposure, the majority (57.7%) admitted to having the mostly indoor lifestyle to avoid direct sun and heat. Wearing long dress was quoted by 20.3% as a reason for the lack of sun exposure. Another 15.9% agreed, that the sun is harmful to the skin by causing skin cancer or darkening and faster aging of the skin, while 6.2% stated cultural traditions as the reason. The sun exposure practice of students is revealed by the next question asking about the places they chose to sunbath. 36.7% are staying in their own premises (private villa, roof, garden, balcony), while 36.4% are going to women's clubs and beaches. 7.7% admit to not exposing themselves anywhere. The majority of students had never a sunburn (45.6%), while 38.5% ever suffered once or twice from sunburn. This reveal, that the sun-avoidance practice results in a decreased number of sunburns due to staying indoors and skin protection through clothing and sunscreen. This is also seen in the next question, where the majority of students (45.6%) avoid sun exposure between May and October, the hottest season in UAE.

Instead, they have one to two times healthy sun exposure per week during the milder season between November and April (52.6%). The majority of students report healthy sun exposure between 10 to 4 pm with durations of 5-15 min in November to April (54.9%) and in May to October (47.2%). Answering the question about which body parts, in general, they expose to the sun, for 69.2% it is only hands and face, while for 26.7% it is hand and legs. Sunscreen on daily basis is only used by 31.8% of the participants, while the majority is not using sunscreens every day (68.2%). 66.4% of the students do not take vitamin D supplements, while 33.6% admit taking supplementation. From these, 54.9% are considering the indication of the drug more important than cost (only 24.1%) and type of the drug as pill or capsule (21%) when choosing the supplement. 16.9% of those, who take vitamin D supplements take an oral dose of 400-800 IU/day, while 11.8% take 15000-25000 IU/week. The selection of the drug is mostly done due to the advice of the doctor (62.8%), followed by the pharmacist (29.5%) and less through family, friends, own experience (6.4%), while only a few follow advices from the media (1.3%).

A Spearman correlation test was done to assess the association between different variables in the study. A significant correlation was found between taking vitamin D supplements and the following: pain or weakness ( $p=0.000$ ), feeling tired ( $p=0.040$ ) and VDD ( $p=0.000$ ). Therefore, taking vitamin D supplements is associated with less pain or weakness, feeling tired and having a deficiency. Another significant correlation resulted between outdoor activities and feeling pain or weakness ( $p=0.042$ ), so increasing outdoor activities associated with less pain or weakness. Details listed in table 3.

**DISCUSSION**

Vitamin D deficiency is known as pandemic global health problem<sup>23-25</sup>. Over recent years, evidence stated the positive impact of vitamin D on health<sup>26</sup>. Moreover, Vitamin D is essential for healthy growth for all ages<sup>26</sup>. Special concern is for VDD in adolescent girls as they have limited growth period<sup>26</sup>. The current study aimed to assess the status of VDD and sun exposure practice among female medical university students.

Vitamin D, the sunshine vitamin, has remarkable health benefits confirmed from various studies<sup>27, 28</sup>. Despite the fact that, UAE is a sunny, subtropical country and with a maximum span of summer in all seasons<sup>24, 25</sup> the study confirmed a high prevalence of VDD. The current results revealed that 42.3% of the participants are diagnosed with VDD. These findings suggest the importance to address this problem effectively and more emphasis should be carried out to improve vitamin D health status.

In the present study, negative approach toward sunlight exposure was observed. Only thirty-five percent of the participants exposed themselves more to the sun in summer and fall. Despite that, the utmost majority of the participants (97.9%) were aware of the fact that sunlight is one of the main sources of vitamin D, the majority (65.9%) avoided sun exposure by covering themselves with clothes or sunscreen. Moreover, 69.2% of the studied sample exposed only hand and face, and (68.2%) of the participants are applying sunscreen on daily basis. Around fifty-eight percent of the participants (57.7%) indicated that the main reason for lack of sun exposure is to avoid direct sun and heat. Our results are similar to other studies conducted in Saudi Arabia which reported limited sun exposure due to excessive heat and cultural reasons<sup>29, 30</sup>. Skin exposure to sunlight is of prime importance for the synthesis of vitamin D, as it activates the synthesis of vitamin D from the precursor 7-dehydrocholesterol, which is naturally available in the skin<sup>23, 24</sup>. In terms of public health, a smart sun campaign should be established urgently in UAE. The campaign should be aimed to increase the awareness of potential negative effects of sun exposure during the periods where UV is in moderate to extreme range, and not to encourage sun protection behaviors when the UV range is low. In addition, the use of vitamin D fortification in food and supplements should be increased in high-risk individuals<sup>31, 32</sup>.

One-third of the participants indicated the places they prefer to increase their sun exposure were women clubs and beaches (36.4%) followed by private places (26.7%). This finding should guide the decision makers in the country to consider the preferred places in their future health strategies to minimize VDD in UAE.

**Table 1: Socio-demographic data**

Variables	Sub-variables	N (%)
Specialization	Pharmacy	194(49.7%)
	Dentistry	196(50.3%)
Study Year	1 <sup>st</sup> - 2 <sup>nd</sup> year	246(63.3%)
	3 <sup>rd</sup> -4 <sup>th</sup> year	119(30.5%)
	5 <sup>th</sup> year	24(6.2%)
Skin Color	White	274(70.3%)
	Non-white	116(29.7%)
Hijab	Yes	309(79.2%)
	No	81(20.8%)
Residency	Flat/ hostel	305(78.2%)
	Villa with garden	85(21.8%)
Are you diagnosed with vitamin D deficiency?	Yes	165(42.3%)
	No	225(57.7%)
Do you have pain or weakness in muscles and bones?	Yes	159(40.8%)
	No	231(59.2%)
Are you often feeling tired?	Yes	234(60%)
	No	156(40%)

**Table 2: Vitamin D Practices related questions**

Q.s	Sub-variables	N(%)
When do you have more sun exposure through outdoor activities?	Summer / Fall (May to October)	137(35.1%)
	Winter / Spring (November to April)	195(50%)
	No outdoor activities anytime	58(14.9%)
Do you try to avoid sun exposure by not going into the sun much or if you do, you are always covering yourself up with clothes or sunscreen?	Yes	257(65.9%)
	No	133(34.1%)
Do you try to avoid sun exposure because you think the sun is causing allergy?	Yes	105(26.9%)
	No	285(73.1%)
What are the reasons for your lack of sun exposure?	Mostly indoor lifestyle to avoid direct sun and heat	225(57.7%)
	Sun is harmful to the skin (skin cancer) or cosmetic purpose (darkening and faster aging of skin)	62(15.9%)
	Cultural traditions	24(6.2%)
	Wearing long dress	79(20.3%)
Where do you go to increase your sun exposure?	Private (at home on balcony, garden or roof of the villa)	143(36.7%)
	Women's clubs and beaches	142(36.4%)
	Clubs and beaches	75(19.2%)
	No any place	30(7.7%)
How many times have you ever suffered from sunburn?	1 or 2	150(38.5%)
	3 and more	62(15.9%)
	Never	178(45.6%)
How many times you have healthy sun exposure per week from May to October?	1-2	150(38.5%)
	3-4	62(15.9%)
	Never	178(45.6%)
How many times you have healthy sun exposure per week from November to April?	1-2	205(52.6%)
	3-4	116(29.7%)
	Never	69(17.7%)
What is your mean duration of healthy sun exposure between 10 am and 4 pm during May to October?	Less than 5 min	148(37.9%)
	5-15 min.	184(47.2%)
	Never	58(14.9%)
What is your mean duration of healthy sun exposure between 10 am and 4 pm during November to April	Less than 5 min	137(35.1%)
	5-15 min.	214(54.9%)
	Never	39(10%)
Which part of your body do you expose to sun	Only hand & face	270(69.2%)
	Arm & legs	104(26.7%)
	More	16(4.1%)
Do you apply sunscreen on daily basis?	Yes	124(31.8%)
	No	266(68.2%)
Do you take any vitamin D supplement?	Yes	131(33.6%)
	No	259(66.4%)
What do you consider when selecting a vitamin D supplement?	Cost	94(24.1%)
	Type of the drug (pill or capsule)	82(21%)
	An indication of the drug	214(54.9%)
Which strength of vitamin D supplement do you take?	400 – 800 IU/day	66(16.9%)
	1000 – 4000 IU/day	26(6.7%)
	15000-25000 IU/week or more	46(11.8%)
	Not used	252(64.6%)
Your selection and dosage of vitamin D supplement was based on an advice from	Pharmacist	115(29.5%)
	Doctor	245(62.8%)
	Family/Friends/Own experience	25(6.4%)
	Media (TV, Internet, Journals, Advertisements)	5(1.3%)

**Table 3: P-value for the correlation between taking vitamin D and VDD, Symptoms of VDD**

	Pain or weakness	Feeling tired	VDD
Taking vitamin D	0.000*	0.040*	0.000*
Outdoor activities	0.042*	0.65	0.54

\*Significant *p*-value <0.005

Another point considered in this study was the duration of healthy exposure to sunlight. The adequate duration of sunlight exposure for sufficient vitamin D synthesis has been considered controversial, however recently it was recommended to be 15 minutes daily<sup>30</sup>. Fortunately, most reported mean duration of sun exposure among the participants was 5-15 minutes (47.2%, 54.9%). Maintaining the public awareness about the updated information related to vitamin D and its determinants will positively enhance their practice and approach to gain a healthy level of vitamin D.

The majority of the students (66.4%) were not taking any vitamin D supplements. Other study reported that 90% of the students are not taking vitamin D supplements<sup>28</sup>. These results should be taken very seriously to raise the awareness for indoor lifestyle people to take appropriate vitamin D supplements as well as consumption of foods and drinks fortified with the vitamin<sup>33</sup>.

This study found the main source of vitamin D information were doctors (62.8%) followed by pharmacists (29.5%), and the family and friends (6.4%). Health care providers are essential to raising the awareness about VDD. These findings are consistent with other studies found that the preferred source of information about

vitamin D were physicians<sup>16, 29, 34</sup>. This highlights the role of physicians as a trusted source of information and key information providers on VDD.

In conclusion, the incidence of VDD among growing girls is concerning and necessitates preventive intervention. Despite having a considerable awareness regarding the importance of sun exposure to vitamin D, the mainly sun-avoidance practice was observed in our young, female population. These results suggest that more efforts are needed to enhance sensible sun exposure and strategies are needed at national level to improve vitamin D status. Importantly, health strategy plan requires considerations of more promotion of safe sun exposure practice, sufficient vitamin D supplements and vitamin D fortification of foods. Finally, an important step towards raising awareness and ensuring the right practice is to improve health education at school and university level.

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