

## Prevalence of Vitamin D Deficiency and Its Related Factors Among University Students in Shiraz, Iran

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### ABSTRACT

**Backgrounds:** Vitamin D deficiency is a public health concern even in sunny areas, so we decided to assess the prevalence of vitamin D deficiency and its related factors among university students in Shiraz.

**Methods:** This cross-sectional study was carried out on 254 (128 male and 126 female) university students. Demographic questionnaires and a questionnaire on exposure to sun light and sun protection were completed by the participants. Serum 25OH-vitamin D was measured using a radioimmunoassay kit. Data analysis was done using Statistical Package for Social Sciences (SPSS) software # 16. A *P* value less than 0.05 was considered as significant.

**Results:** Mean  $\pm$  standard deviation (SD) of serum 25OH-vitamin D was  $49.29 \pm 12.87$  (nmol/l) and  $27.46 \pm 10.37$  (nmol/l) among male and female students, respectively. 51.2% of female students were vitamin D insufficient and 44% of them had vitamin D deficiency. Prevalence of vitamin D insufficiency and marginal status among male students were 49.5 and 48%, respectively. Serum vitamin D of female students was significantly less than the males ( $P < 0.001$ ). Serum vitamin D was negatively correlated to sun protection score ( $P < 0.001$ ,  $r = 0.50$ ), but there was no correlation between serum vitamin D and sun exposure.

**Conclusions:** Vitamin D deficiency especially among female students is alarmingly prevalent. Increasing use of sunscreen lotion and clothing style could be the main factors inhibiting endogenous vitamin D synthesis which results in its deficiency.

**Keywords:** Sun protection, university students, vitamin D status

### INTRODUCTION

Vitamin D deficiency is a global public health concern.<sup>[1]</sup> The most recognized importance of vitamin D is its key role in bone metabolism and skeletal health via calcium and phosphorus hemostasis.<sup>[2]</sup> Many recent studies indicate that vitamin D deficiency is related to the higher risk of chronic diseases such as coronary heart disease cardiovascular disease (CVD),<sup>[3]</sup> type 2

diabetes,<sup>[3,4]</sup> and metabolic syndrome.<sup>[5]</sup> Vitamin D has an effect on inflammation, the renin-angiotensin system regulation and blood pressure which contribute to CVD.<sup>[6]</sup>

Vitamin D is synthesized endogenously via the exposure of skin to sunlight.<sup>[7]</sup> Regarding the limited food sources of vitamin D, the main source of vitamin D is endogenous production by ultraviolet (UV) light.<sup>[8]</sup> Factors such as age, season, latitude, time of day, skin pigmentation, amount of skin exposed to sun light, and use of sunscreen can influence vitamin D synthesis.<sup>[9]</sup> Urbanization and less exposure to sunlight, because of social, geographical, and occupational reasons lead to low concentrations of vitamin D.<sup>[10]</sup>

In spite of the role of sunlight in vitamin D synthesis, recent studies indicate that the rate of vitamin D deficiency is also high in the sunny areas of the world, including the Middle East countries.<sup>[11]</sup> Although there is not plenty of investigation related to vitamin D status in Iran, the existing evidence shows that vitamin D deficiency is prevalent.<sup>[8,11-13]</sup> Regarding the mentioned issues we decided to assess the prevalence of vitamin D deficiency and its related factors among university students in Shiraz, Iran.

## METHODS

This cross-sectional study was carried out on 254 (128 male and 126 female) university students, randomly selected in dormitories of Shiraz University of Medical Sciences. Data gathering was done in May and June 2012. After explaining the study procedure and taking written consent, demographic questionnaire and a questionnaire on exposure to sun light and sun protection was completed by the participants. Exposure to sun light was reported as duration of time being outdoor in minutes per day. Sun protection was calculated as the sum of sunscreen, hat, long sleeve shirt, gloves, and veil usage (minimum = 0, maximum = 5).

Also 5 cc venous blood was drawn. The serum was separated after centrifuging the blood samples and preserved at a temperature of  $-80^{\circ}\text{C}$  until the final analysis. Serum 25OH-vitamin D was measured using a radioimmunoassay kit (IDS UK). Vitamin D status was categorized as follows: Less than 12 (nmol/l) severe deficiency, 12.01-25 deficiency, 25.01-50 insufficiency, 50.01-75 marginal status, and 75.01-150 sufficiency.<sup>[14]</sup> The study

protocol was approved by research ethics committee of Shiraz University of Medical Sciences.

Data analysis was done using Statistical Package for Social Sciences (SPSS) software #16. Independent samples *t*-test was used to compare quantitative variables and Chi-square test to compare qualitative variables between males and females. Correlations between serum vitamin D and sun protection score and sun exposure were assessed using Pearson correlation. A *P* value less than 0.05 was considered as significant.

## RESULTS

Two hundred fifty-four university students (128 male and 126 female) participated in this study. Table 1 shows that, mean  $\pm$  standard deviation (SD) of serum 25OH-vitamin D were  $49.29 \pm 12.87$  (nmol/l) among male students and  $27.46 \pm 10.37$  (nmol/l) among female students which is significantly less than males ( $P < 0.001$ ). Also the values of sun exposure and sun protection are shown in Table 1.

Table 2 shows that all of the female students wore long-sleeve shirt and 96.8% used sunscreen. Usage of sunscreen and long-sleeve shirt among male students was 23.4 and 32.8%, respectively. It is shown that wearing long-sleeve shirt, hat, veil, and sunscreen lotion are more common among females than males ( $P < 0.001$  for all).

It is shown in Figure 1 that 51.2% (CI 95%; 42.260.2%) of female students had vitamin D insufficiency and 44% (CI 95%; 3553%) of them were vitamin D deficient. Among male students prevalence of vitamin D insufficiency and marginal status were 49.5% (CI 95%; 40.5-5805%) and 48% (CI 95%; 3957%), respectively.

Results of Pearson correlation test showed that there was a significant negative correlation between serum vitamin D and sun protection score ( $P < 0.001$ ,  $r = 0.50$ ), but no correlation between serum vitamin D and sun exposure ( $P = 0.44$ ,  $r = 0.04$ ). After repeating the test for males and females separately just a significant correlation between sun exposure and serum vitamin D was found in male students.

## DISCUSSION

Results of this study indicated that more than half of female students were vitamin D insufficient and 44% vitamin D deficient. Although vitamin D status of male students was better than females, still about

**Table 1:** Age, vitamin D status, sun exposure, and sun protection of participants by gender

Gender Variables	Male (n=128)		Female (n=125)		P value
	Mean±SD	Min-Max	Mean±SD	Min-Max	
Age (year)	23.24±2.59	19-32	22.46±2.11	19-32	0.008*
BMI (kg/m <sup>2</sup> )	22.29±2.80	17.30-29.86	21.78±2.80	15.24-21.78	0.13*
25OH vitamin D (nmol/l)	49.29±12.87	24.75-75.92	27.46±10.37	14.44-75.23	0.001*
Sun exposure (h)	2.46±1.61	0.25-.00	2.12±1.00	0.25-5.00	0.04*
Sun protection	0.68±0.67	0-3	2.71±0.74	2-5	0.001**

\*Differences between males and females (independent samples *t* test). \*\*Differences between males and females (Mann-Whitney test), SD=Standard deviation

**Table 2:** Clothing style and sun protection of participants by gender

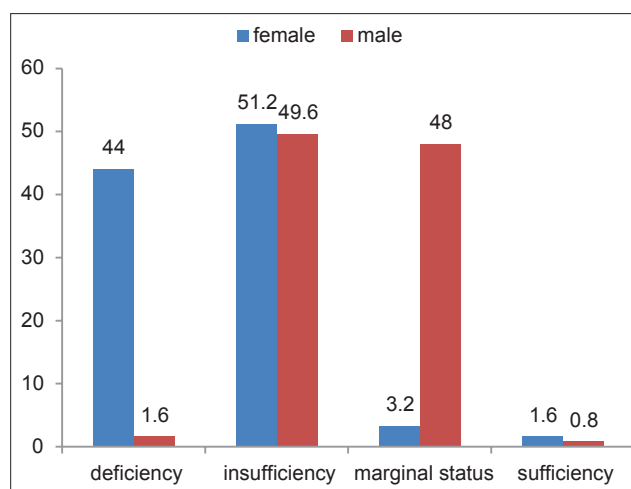
Gender	Male (n=128)		Female (n=125)		P value*
	Number	Percent	Number	Percent	
Sunscreen	30	23.4	121	96.8	0.001
Long-sleeve shirt	42	32.8	125	100	0.001
Hat	16	12.5	15	12.2	0.95
Gloves	0	0	15	12.2	0.001
Veil	0	0	61	49.6	0.001

\*Differences between males and females (Chi-square test)

half of them had vitamin D insufficiency and 48% were in marginal status. It is obvious that despite living in a sunny city, vitamin D status of participants, both males and females is compromising.

The results of similar studies in different part of Iran are in agreement with ours<sup>[8,11-13]</sup> Prevalence of vitamin D deficiency among 11-69 year old men and women was reported equal to 67 and 84.5% during the summer by Kashi *et al.*, in Sari.<sup>[12]</sup> Rahnavard *et al.*, found 68.8% of Iranian men as vitamin D insufficient.<sup>[15]</sup> Also studies in our neighbor countries with similar climate and clothing style showed almost the same results. Al Anouti *et al.*, reported the mean serum vitamin D of university students in Abu Dhabi as 20.9 ± 14.9 nmol/L for females and 27.3 ± 15.7 nmol/L for males.<sup>[16]</sup> In a study by Alshishtawy in Oman, almost half of the child bearing women were found to have serum vitamin D less than 37.5 nmol/L.<sup>[17]</sup> Vitamin D deficiency and insufficiency in Karachi was reported by Mansoor *et al.*, equal to 69.9 and 21.1%, respectively.<sup>[18]</sup>

There was a negative correlation between serum vitamin D and sun protection, but no correlation with sun exposure in our study. Also we found a significant deference between males and females' vitamin D status. As there is no vitamin D fortified



**Figure 1:** Vitamin D status of participants by gender

food stuff in the region, exposure to sun light is the main way to take adequate vitamin D. It seems that the increased use of sunscreen lotion and clothing style of Iranian female are the main reason for high prevalence of vitamin D deficiency.

In a similar study by Moy in Malaysia a tropical country which is sunny all year round, vitamin D status was negatively correlated with sun protection and positively with sun exposure.<sup>[19]</sup> In Moy's study, sun exposure was defined as duration of time being exposed to direct sunlight but we consider it as the time being outdoor. As exposure of bare skin to direct sunlight is needed for vitamin D synthesis, considering different definition for sun exposure has led to different results. Also Moy reported lower vitamin D levels among female participants comparing to males, and related it to their clothing style, use of umbrella, and avoiding the sun which is in agreement with our findings. In Turkey, one of our neighbors, Hatun *et al.*, reported the high prevalence of poor vitamin D status. They reported that this finding is partly due to type of dressing and

time being outdoors which is related to the cultural factors and lifestyle of the participants.<sup>[20]</sup>

## CONCLUSIONS

Vitamin D deficiency especially among female students is alarmingly prevalent. Increasing use of sunscreen lotion and clothing style could be the main factors, inhibiting endogenous vitamin D synthesis. Also absence of vitamin D fortified foods in Iran market is another shortcome. Regarding the importance of vitamin D status in calcium absorption and prevention of osteoporosis and its correlation to obesity and chronic diseases such as cardiovascular, diabetes, and metabolic syndrome prevention of vitamin D deficiency is a public health concern.

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