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# Vitamin D Deficiency and its Associated Predictors among Patients Visiting Primary Health Care Center

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**Abstract:** Vitamin D can be made through exposure to sun in the skin. About 90% of vitamin D is made in the skin through the stimulation of UV sunlight whereas the remaining 10% of vitamin D is provided through dietary supplementations. The study objectives were to determine the frequency of vitamin D deficiency among a sample of patients who visited health center at Jordan University of Science and Technology and to identify predictors for vitamin D deficiency. This was a cross-sectional study and included 123 participants. Data was collected through a questionnaire and a blood sample was collected from each participant in case he agreed to participate in the study. Study findings showed that the frequency of vitamin D deficiency was 30.9% and vitamin D insufficiency was 47.2%. Gender was significantly associated with vitamin D deficiency ($p = 0.000$) and females were more likely to develop vitamin D deficiency. No significant associations were observed between vitamin D status and other study variables including blood group ($p = 0.603$), educational level ($p = 0.156$), monthly income ($p = 0.344$), sun exposure ($p = 0.061$) and family history of vitamin D deficiency ($p = 0.653$).

**Key words:** Vitamin D, vitamin D deficiency, vitamin D insufficiency, sun exposure, stimulation

## INTRODUCTION

Vitamin D can be made through exposure to sun in the skin (Holick *et al*., 2011). According to a study by Mahmoud and Ali (2014), about 90% of vitamin D is made in the skin through the stimulation of UV sunlight whereas the remaining 10% of vitamin D is provided through dietary supplementations.

Vitamin D has multi-biologic functions as including immune modulations which enhance cellular immunity as well as phagocytic capacity of macrophages (Yang *et al*., 1993; Villamor, 2006; Raubenheimer and Noffke, 2011).

From an epidemiological point of view, it has been shown that the deficiency or insufficiency of vitamin D is widely spread among US population, mainly because of inadequate dietary intake, sedentary life styles and reduced sun exposure (Weng *et al*., 2007; Wascker and Holick, 2013; Mahmoud and Ali, 2014).

Vitamin D deficiency is considered a prevalent health problem and has impacts on about 1 billion people (Holick, 2010). It is also considered as an important burden of disease because the effects of vitamin deficiency include skeletal disorders, rickets in children and osteomalacia in adults (Holick *et al*., 2011). Other impacts of vitamin D includes a wide range of non-skeletal disorders, examples include multiple sclerosis, Cardiovascular Diseases (CVD), diabetes and all-cause mortality (Autier *et al*., 2014).

There is a debate concerning the deficiency of vitamin D levels since vitamin D level <20 ng $mL^{-1}$ is considered as a deficiency while vitamin D level under 30 ng $mL^{-1}$ is viewed as insufficient (Ross *et al*., 2011; Wacker and Holick, 2013). Other studies considered vitamin D levels above 50 or 75 ng $mL^{-1}$ to be optimal (Lips, 2007; Weng *et al*., 2007; Holick *et al*., 2011).

**Study objectives:** The main objectives of the present study were to determine the frequency of vitamin D deficiency among a sample of patients who visited health center at Jordan University of Science and Technology and to identify predictors for vitamin D deficiency.

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## MATERIALS AND METHODS

**Study design and setting:** This study was a cross-sectional and conducted at Health Center-Jordan University of Science and Technology.

**Study sample:** A total of 123 participants agreed to participate in the present study.

**Data collection:** Data from participants was collected through filling a questionnaire in which demographic and general characteristics of participants were recorded. For each participant, a blood sample was collected to analyze for vitamin D and blood grouping.

**Statistical analysis:** SPSS version 20 was used to analyze the data. Data was represented as frequencies, percentages, means and standard deviations. Significance was tested using $\chi^2$-test and considered at alpha level <0.05.

## RESULTS

**General characteristics of participants:** Table 1 shows the general characteristics of participants. The mean age was 28.77±14.22 years. Vitamin D level was 19.05±14.33 ng $mL^{-1}$. About 28% of participants were males. The most prevalent blood group was A (29.3%), O (25.2%) whereas blood groups B and AB were equally distributed (5.7%). The majority of participants (78%) had educational level less than bachelor degree. About 54% of participants had monthly income >500 JD. Sun exposure was reported by the majority of participants (76.4%) to be <7 h. About 37% of participants had family history of vitamin D deficiency. Vitamin D status included deficiency (30.9%), insufficiency (47.2%) and normal (14.6%).

**The relationship between vitamin D status and study variables:** As it can be seen from Table 2, gender is significantly associated with vitamin D status (p = 0.000) and females are more likely to develop vitamin D deficiency. We tested the possibility that blood group may play a role in developing vitamin D deficiency. The testing of this possibility did not show a significant association between blood group and vitamin D deficiency. Our results did not show a significant relationship between educational level and vitamin D deficiency (p = 0.156). Monthly income was not significantly associated with vitamin D status (p = 0.344). The trend observed that more cases with vitamin D deficiency were observed among participants with lower monthly income.

Table 1: General characteristics of participants

| Variables | Values |
|---|---|
| Age (M±SD) years | 28.77±14.22 |
| Vitamin D concentration (M±SD) | 19.05±14.33 |
| **Gender (N, %)** | |
| Male | 34 (27.6%) |
| Female | 89 (72.4%) |
| **Blood group (N, %)** | |
| A | 36 (29.3%) |
| B | 7 (5.7%) |
| AB | 7 (5.7%) |
| O | 31 (25.2%) |
| Missing | 42 (34.1%) |
| **Educational level (N, %)** | |
| Less than bachelor | 96 (78%) |
| Bachelor and more | 27 (22%) |
| **Monthly income (N, %) Jordanian Dinar** | |
| ≤500 | 57 (46.3%) |
| >500 | 66 (53.7%) |
| **Sun exposure (N, %)** | |
| Never | 1 (0.8%) |
| <7 h | 94 (76.4%) |
| 7-14 h | 20 (16.3%) |
| >14 h | 8 (6.5%) |
| **Family history (N, %)** | |
| Yes | 45 (36.6%) |
| No | 78 (63.4%) |
| **Vitamin D status (N, %)** | |
| Deficiency | 38 (30.9%) |
| Insufficiency | 58 (47.2%) |
| Normal | 18 (14.6%) |
| Missing | 9 (7.3%) |

Table 2: The relationship between vitamin D status and study variables

| | Vitamin D status | | | | | | |
|---|---|---|---|---|---|---|---|
| | Deficiency | | Insufficiency | | Normal | | |
| Variables | N | % | N | % | N | % | p-values |
| **Gender** | | | | | | | |
| Male | 1 | 2.6 | 30 | 51.7 | 2 | 11.1 | 0.000 |
| Female | 37 | 97.4 | 28 | 48.3 | 16 | 88.9 | |
| **Blood group** | | | | | | | |
| A | 11 | 34.4 | 19 | 59.4 | 2 | 6.1 | 0.603 |
| B | 1 | 20.0 | 4 | 80.0 | 0 | 0.0 | |
| AB | 3 | 42.9 | 3 | 42.9 | 1 | 14.3 | |
| O | 9 | 31.0 | 14 | 48.3 | 6 | 20.7 | |
| **Educational level** | | | | | | | |
| Less than bachelor | 6 | 23.1 | 13 | 50.0 | 7 | 26.9 | 0.156 |
| Bachelor and more | 32 | 36.4 | 45 | 51.1 | 11 | 12.5 | |
| **Monthly income** | | | | | | | |
| ≤500 | 22 | 40.0 | 25 | 45.5 | 8 | 14.5 | 0.344 |
| >500 | 16 | 27.1 | 33 | 55.9 | 10 | 16.9 | |
| **Sun exposure time** | | | | | | | |
| Never | 1 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0.061 |
| <7 h | 22 | 25.9 | 48 | 56.5 | 15 | 17.6 | |
| 7-14 h | 9 | 45.0 | 9 | 45.0 | 2 | 10.0 | |
| >14 h | 6 | 75.0 | 1 | 12.5 | 1 | 12.5 | |
| **Family history of vitamin D deficiency** | | | | | | | |
| Yes | 15 | 38.5 | 19 | 48.7 | 5 | 12.8 | 0.653 |
| No | 23 | 30.7 | 39 | 52.0 | 13 | 17.3 | |

Sun exposure was not significantly associated with vitamin D status (p = 0.061). The trend observed implies that with decreased exposure hours to sun, vitamin D deficiency was more likely to develop. Family history of vitamin D deficiency was not associated significantly with vitamin D status (p = 0.653).

## DISCUSSION

The present study was conducted to determine the frequency of vitamin D deficiency among a sample of patients who visited health center at Jordan University of Science and Technology and to identify predictors for vitamin D deficiency.

The results of our data showed that vitamin D deficiency was 30.9% while vitamin D insufficiency was 47.2%. Taken together, vitamin D problems were 78.1%. These findings are in line with other studies including those studies that showed the deficiency or insufficiency of vitamin D is widely spread among US population (Weng *et al*., 2007; Wacker and Holick, 2013; Mahmoud and Ali, 2014). Our results are also consistent with the study by Abdel-Wareth *et al*. (2013) who found that the prevalence of vitamin D insufficiency was 84% in males and 89% in females in winter and the prevalence of vitamin D deficiency was 30% in males and 46% in females.

Testing predictors of vitamin D deficiency revealed that gender was significantly associated with vitamin D deficiency ($p = 0.000$). Females were more likely to develop vitamin D deficiency. These findings agree with that by Abdel-Wareth *et al*. (2013) who found that the prevalence of vitamin D insufficiency was more in females compared with males.

The other factors were not associated significantly with vitamin D deficiency ($p>0.05$). We think that the number of study participants is limited and more participants are required to generalize the results.

## CONCLUSION

The frequency of vitamin D deficiency is 30.9% and vitamin D insufficiency is 47.2%. Vitamin D deficiency was associated significantly with gender ($p = 0.000$).

## RECOMMENDATION

We recommend including more participants to generalize our findings.

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