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## Prevalence of Vitamin D Deficiency and Insufficiency among Healthcare Professionals in Hospital Setting at Altitude of over 1300 m: Tehran-Iran; Logman Hakim Hospital

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### Abstract

**Background:** Vitamin D (VD) deficiency is a pandemic issue in the world. It causes adverse health effects in the at-risk and healthy subjects. One of the available sources of VD is ultraviolet of the sunbeam. Iran is placed at the sunshine area, and its deficiency or insufficiency is seemed to be unexpected. Healthcare professionals are the first line of the health service system. Their workplaces and working times may be supported as the risk factors in the development or aggregated VD deficiency. The aim of the study was to assess the status of a VD level in serum among healthcare professionals in the hospital setting.

**Material and methods:** The study was performed by health care professionals in Loghman Hakim general teaching hospital in the winter season. VD level in serum was determined to the recommended manufacturer.

**The results:** In total, 193 health care professionals were included in setting hospital within the study. The mean age was  $34.8 \pm 8.6$  SD years (Median=33, Mod=30). Sex distribution was female, 66% and male, 34%. The mean of the VD level in serum was  $11.31 \pm 9.1$  SD ng/ml. The frequency of VD value below the normal set point was 95% of focus population. Of those, VD deficiency was found in 65% of total subjects. The middle age groups had a noticeable frequency VD deficiency.

**Conclusion:** The study showed that substantially of a healthcare professional were at risk of Vitamin D deficiency. Women, who make up the considerable country's body of health organizations, are at higher risk of Vitamin D deficiency. They are requiring specific attention as at-risk people.

**Keywords:** Vitamin D deficiency; Healthcare professional

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### Introduction

Vitamin D (VD) is a lipid-soluble vitamin. It is also exceptionally synthesized by the human. The sources of VD are provided through sunlight exposure and fortified diet. The ergocalciferol (diet) and cholecalciferol (skin, Human) are the principal sources of VD. VD is known as homeostasis bone hormone. Recently, new extra-skeletal functions have been defined for it. VD has the rules in the physiologic functions, immunomodulatory effects, viral and bacterial infections, prevention in reducing the risk of some cancers and cardiovascular disease [1,2]. However, it has played a role in the respiratory diseases and pulmonary function and atopic condition. Moreover, the improved level of

deficiency leads to better performance in physical and cognitive function in humans. Global VD deficiency is the pandemic in the world. Improvement VD deficiency has been beneficial effects on the outcome of pregnancy and child-bearing females and the post-menopausal quality of life [3]. The aim of the study was to assess the status of vitamin D level in serum among healthcare professionals in the hospital setting.

### Material and Methods

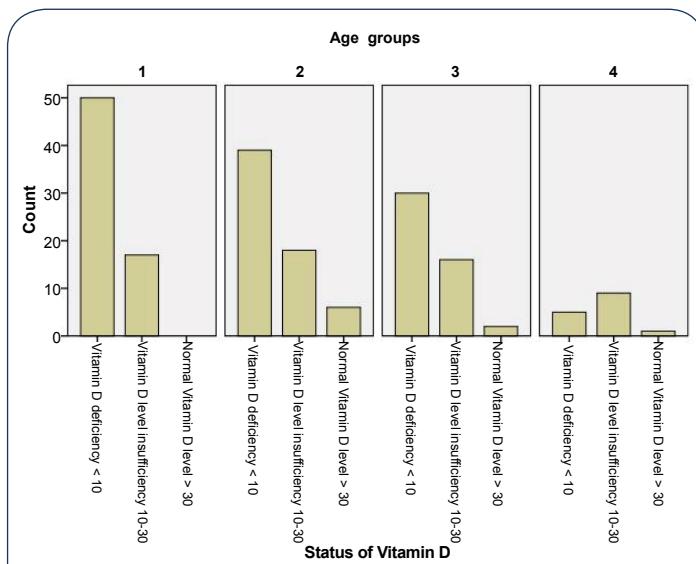
The study was a descriptive cross-sectional study. It finalized in the Shahid Beheshti University of Medical Sciences (SBUMS), Loghman Hakim general teaching hospital since February 2015.

The setting of the study was performed in among healthcare professionals within the Loghman Hakim hospital. The building of the hospital is old-aged. It's found in 45 years ago. Its altitude was up to 1300 m. The study set in the winter season. Inclusion criteria consisted of healthcare professionals in the hospital setting and consent to follow the study. All the participations rejected from the study if had active cancer, sarcoidosis, hyperkalemia disorders, pregnancy, breath feeding period, gastric surgery, chronic kidney diseases, chronic diseases and dietetic Mellitus. Furthermore, taking the history of using medications presented as vitamin D supplements, Phenobarbital, Orlistat, ionized. VD assisted with a Cobas kit of total 25-hydroxyvitamin D (made in Roche Diagnostics GmbH). The method of measurement was Immulite Electrochemiluminescent assayed. Cut off the point values of VD in serum was deficiency level; 10, insufficient; 10-30 and suffices; >30 ng/ml.

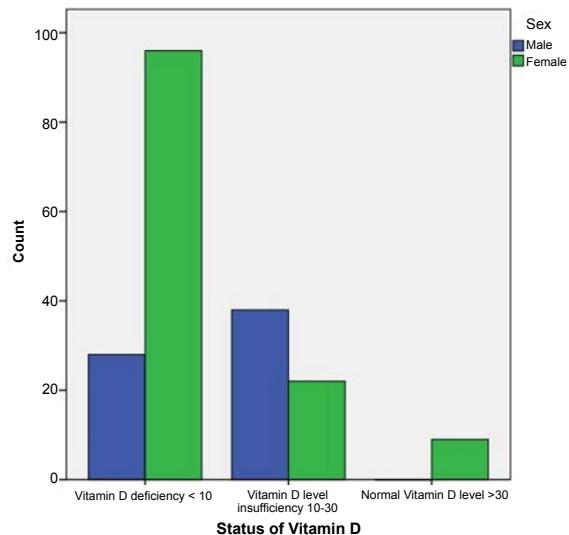
Variables of the study were gathered by SPSS analyzing program version 22. The normality of the scale variable was documented with the Kolmogorov-Smirnov and Shapiro-Wilk tests. Parametric test carried out by compare of means that included One sample T-test, Independent sample T-test and general linear model for Univariate analysis. The relations between data were performed by association measures of Pearson and Spearman correlations. The causal effects were assumed with linear regression. The significance level was set in through study at  $P<0.05$ .

## Results

A total of 193 healthcare professionals participated in the study. Sex distribution was females 127 (66%) and males 66 (34%). They ranged between 25-58 years. The mean age  $\pm$  SD was  $34.8 \pm 8.6$  years with (Mode=30). The age divided into the four groups; class I, 35% (20-29), class II, 33% (30-39), class III, 25% (40-49) and class IV, 8% (50-59). **Figure 1** reveals the relation of age classes with VD abnormalities in the serum. The VD level below the standard set point was considerable among younger age class respect to the older subset. The meaning of VD value recorded  $11.3 \pm 9.1$  SD ng/ml, and it ranged from 3-70 ng/ml (Median=8). Status of VD categories consisted of deficiency 64%, insufficient 31% and standard level 5%, respectively. One-sample T test showed significant values in the VD level ( $P<0.001$ ), and One-way ANOVA test and post hoc test(Tamhane) indicated the relevant difference between VD abnormality of sample population subsets ( $P<0.001$ ). **Figure 2** displays the relation sex with VD status. Females' sex frequency was significantly in the younger age groups. It may be due to the marked distribution of the female sex in the class, I and II. The mean of VD measured was lower in the female than male sexes in spite of larger sample size. **Figure 3** presents the means of the VD levels between genders. Equal variance does not assume, and there were not statistically significant differences between VD levels and sex ( $P=0.16$ ). A weak correlation was presented between measured VD levels with age ( $r=0.3$ ,  $P=0.001$ ), and reverse weak correlation disclosed between VD in serum with sex ( $r=-0.3$ ,  $P<0.001$ ). Linear regression indicated a significant association presented between serum VD values and age classes ( $p=0.001$ ). The Skin color index (SKI) reveals the different stages of skin pigmentation, the higher



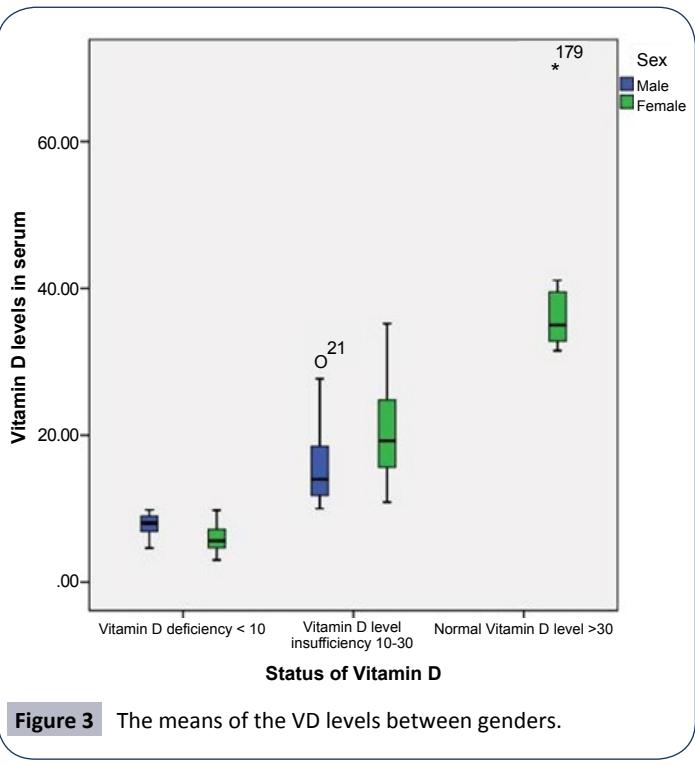
**Figure 1** Distribution of status of VD abnormalities respect to age classes.



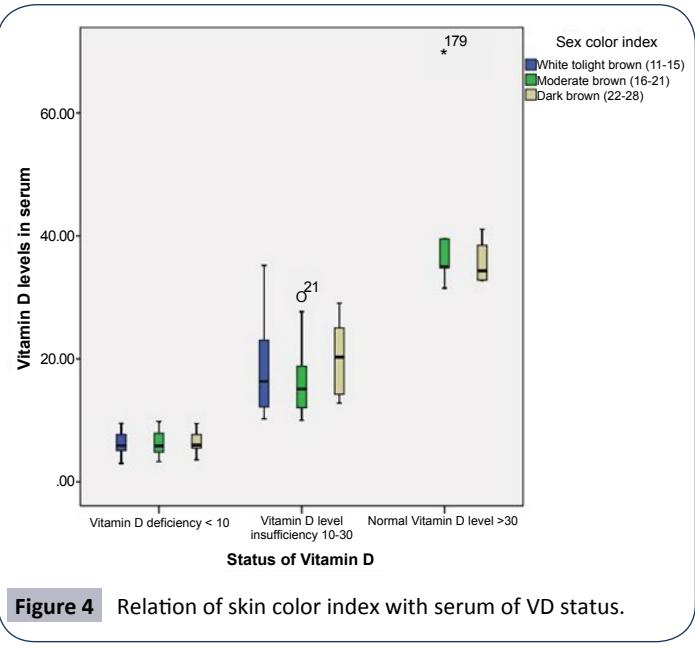
**Figure 2** Status of VD levels in the serum of sample study with sex.

score associated with deep pigmentation. The frequency of the SKI focus population included moderate brown (16-21) 55%, white to light brown (11-15) 27% and dark brown (22-28) 18%, respectively. **Figure 4** manifests the relation of SKI with the serum of VD status. The means of serum VD approximately was overall higher in the more score pigmented skin of subjects' population. There was no significant differentiation between sex with SKI ( $\chi^2>0.6$ ). Our study indicated that frequency of entire SKI percentage was higher in female than male subsets. **Figure 5** reflects the gender status with colour skin. The ANOVA test was performed between VD in serum with age classes and SKI and no meaningful difference was found ( $P \geq 0.5$ ). Linear regression presented significant association between VD levels with age groups, sex and jobs ( $P<0.03$ ).

The hospital personal attendants participated in the study that included nursing 42%, staff 25%, workers 18%, directory



**Figure 3** The means of the VD levels between genders.



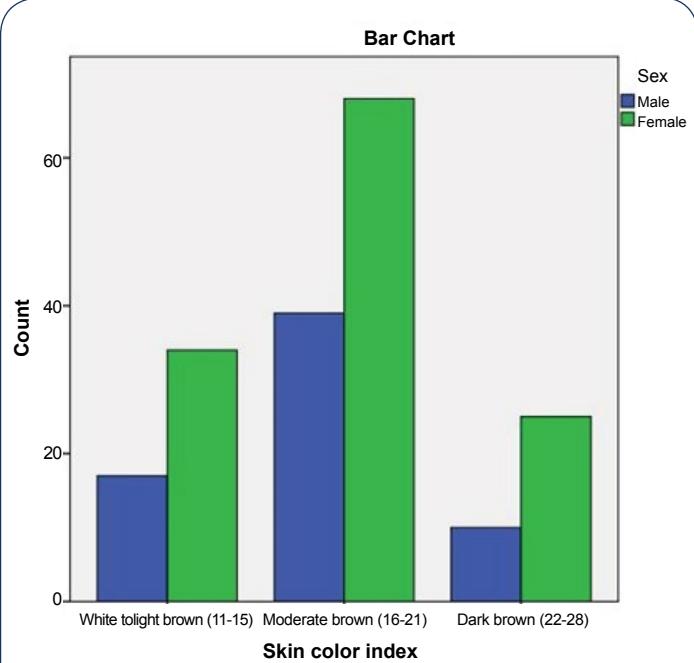
**Figure 4** Relation of skin color index with serum of VD status.

personals 13% and physician 3%, respectively. **Figure 6** shows the position of the healthcare in the hospital organization respect to measured VD levels. The VD level below the standard point was detected among entire jobs in hospital organization setting. It was more relevant to the nursing than other job subsets. The hospital of the study has an old-age building structure and is deprived of sunshine rays. The study determined significant differences between VD and Jobs ( $P=0.001$ ), and Tamhane test was also meaningful statistically ( $P=0.01$ ).

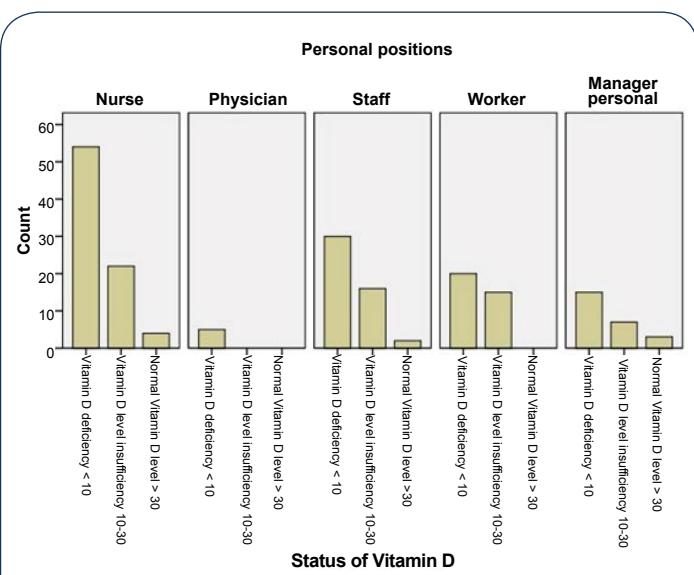
## Discussion

Health care worker and professionals are one of the noticeable

populations at-risk of diseases and the first line in the public health service system. Increased knowledge of subjects and providing of safety in the workplaces are the principal health policy. VD is the sunshine hormone. It has distinctive functions in homeostasis bone metabolism and extra-skeletal roles. The current concept considers in the various populations during the recent decade. This outlook is potentiated and supported the advantage of VD level in the preventive medicine for at-risk subjects [4]. Natural and the essential providing VD route is the skin synthesis. 90% of VD production provides from sunlight [5]. Ultraviolet-beam (UV) of sunshine has a potential photo-conversion reaction on the exposed skin. It can produce cholecalciferol (Vitamin D3) from 7-dehydrocholesterol [6]. Vitamin D3 and D2 diet is hydroxylated



**Figure 5** The genders status with color skin.



**Figure 6** The position of the healthcares in the hospital organization respect to measured VD levels.

in the liver and produced the 25-hydroxy vitamin. In the final stage, is converted to the active hormone of the 1-25 hydroxyvitaminD by the kidneys. The parathyroid hormone regulates the synthesis process. The power of VD skin synthesis was related to aging, pigmentation, and angle of sun-exposure and sunscreen style of subjects [7]. However, healthcare professionals have usually indoor – work shift.

VD deficiency was relevant for healthcare professionals. It reported in Qatar personals 97% and among the Indian, 94% [6]. The prevalence of the VD deficiency and insufficiency in the target population was 64% and 31%, respectively. Age of the sample population was young and detected with a frequency of 68% under 40 years. The current study revealed rising age-old had an inverse ratio with the production capacity of VD in the skin [7]. Elderly subjects were greater than twofold decrease their skin's synthesis capacity [8]. There was inverse direction between VD abnormalities in the aging process in our study resulting and disagreed with a recent issue. In addition, the female sex of focus population was significant in the sample study and has the susceptible condition for pregnancy. The child required VD should be received early store from the mother (two-third) and then from diets and skin sunlight exposure [9]. VD level lower than standard may affect the family of the healthcare professionals.

The relation between sex differences in the status of VD is a new concept, and the independence investigations have been rarely carried out [10,11]. A few study suggested that significant VD abnormality in female sex [11,12]. The outcome of the study may be under the influence of socioeconomic, age and lifestyle. Furthermore, the females are a dominant sex group of job among the healthy system service of Iran. Sunscreen style of healthcare personals study is defined based on the governmental policy and different from other healthcare professionals in the world. There is controversy about the induced level of VD deficiency respect to regular sunscreen style of subjects as photo protective. Evaluation in the European population revealed sunlight was exposing of 18% of body surface area without sunscreen for 15 minutes per day/two or three times per week is enough for providing VD requirement [7]. Some reports believe the protective effect of the style. They concluded that the restrictive control conditions have been reduced VD level synthesis [12]. Likewise, numerous reports showed the lack of or low association between style and sun exposure [13,14]. UV has three wavelength ranges, UVA 315-400 nm, UVB 280-315 nm and UVC 100-280 nm. All the UVC and

approximately 90% of UVB absorbs with the atmosphere (CO<sub>2</sub>, O<sub>2</sub>, Ozone, and water vapour). Total UV reaches the earth's surface includes UVA and little UVB components. Global solar UV Index (UVI) reflects UV radiation at the earth's surface. The following factors affect the optimal UV radiation, latitude, altitude, cloud cover, ozone and ground reflection. They are effective in the skin's capacity in the production of VD. Tehran is placed at a latitude of (Degs N) 35.44, longitude (Degs E) 41.15. The altitude of the study setting took place at 1300 m with the mild-continental claimant. Increased altitude raised 4% UV for each 300 m and closer to the equatorial regions associated with highly UV radiation [15]. The Tehran averaged UV-Index is the difference between weak (3-4) to moderate (5-6). The ozone level measurement showed that the Tehran ozone level has been at since 2011 year lower than WHO guideline measurement during 2000-2003 [16].

Tehran is a metropolitan city, and ambient air pollution is the claim for urban and the serious health problem. It is one of the air pollutant cities in Iran. It has a few healthy days in a year. Tehran's pollutants cause over 4500 deaths annually [17]. Vehicle's emissions and particle matter are the predominate sources. Carbon monoxide (CO) and sulfur (SO<sub>2</sub>) [18] are the main pollutants in the air. Atmospheric density air pollutants may be one of the causal factors and also questionable in reducing UV-sunlight irradiations on the capacity skin synthesis of VD. The climate and air quality of Isfahan city are approximately the same Tehran. The Isfahan study revealed independent and the inverse relation between air clean quality and VD levels of subject [19].

Healthcare professionals are work-shift and indoor-worker. The study reported 10-20% fewer average solar UV radiation doses received by indoor-workers [16,20]. Moreover, indoor-daytime workers are susceptible to decreased VD level than a reference point [21]. In conclusion: VD deficiency and insufficiency were noticeable on the health care professionals of focus population. It marked in the female sex middle age group. The health service-system population should be considered at supervisory attention. Detection and improved of VD abnormality can be led to raising working performance and may be preventive effects in at-risk subjects.

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