Vitamin D Deficiency among Female Nurses of Children's Medical Center Hospital and Its Related Factors

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Abstract- Vitamin D deficiency is one of the most preventable challenges worldwide. The aim of this study was to determine the prevalence of vitamin D deficiency among female nurses working at Children's Medical Center Hospital in Tehran, Iran, due to the risk factor of being a notably long period indoors and the fact that their health status may have consequences on the process of patients' treatment. A total of 114 female nurses who were at least 20 years old entered the study voluntarily, and a questionnaire was applied to collect information on lifestyle and other factors associated with vitamin D deficiency. A sample of blood was taken to measure 25-hydroxyvitamin D (25-OHD) and cut off value to indicate deficiency was considered below 10ng/ml, and the amounts of 10-29ng/ml were declared insufficient. The mean of 25-OHD was 11.7±9.3ng/ml. A total of 79 subjects (69.3%) had a deficient level of vitamin D, 28 subjects (24.6%) had an insufficient level and only 7 subjects (6.1%) had sufficient level of vitamin D. The deficiency was more noticeable in the age group of 26-35 years old. Prevalence of vitamin D deficiency had a significant correlation with younger subjects (P<0.001). There was no significant association among other factors such as body mass index (BMI), health status complications, regular exercise, and duration of sun exposure. High prevalence of vitamin D deficiency in the study population leads to emphasise the need to screen health care workers for vitamin D levels.

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Introduction

Food supplementing with vitamin D reduced the prevalence of rickets, but vitamin D deficiency still remains as one of the most prevalent diseases among adults worldwide especially in developing countries (1). Vitamin D deficiency may result in osteopenia, osteoporosis, osteomalacia, muscle weakness, and increased risk of fractures in adults. Previous studies have shown that vitamin D also has effects on other organ systems. It has an important role in cell growth regulation, thus, may be influential in cancer prevention. Vitamin D is important in renin level that controls blood pressure. It has been reported that there is an association between vitamin D level and diabetes mellitus type I, cardiovascular diseases, multiple sclerosis, rheumatoid arthritis and other autoimmune diseases. It has been also pointed out that vitamin D deficiency may be linked to leading causes of death (1-3).

Humans acquire vitamin D through sun exposure and ingesting food containing or supplemented by vitamin D. There are very few nutrients that have enough vitamin D innately so the most important source of vitamin D is sunlight exposure (4,5). Therefore, it seems safe to assume that inadequate sunlight exposure, air pollution, winter season, and clothing style are risk factors for vitamin D deficiency. Adding vitamin D to food is not a usual strategy to prevent its deficiency in developing areas like Iran (6-8).

Serum concentration of 25-hydroxyvitamin D (25-

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OHD) is considered to be the most reliable and sensitive measure of overall vitamin D status in the body and thus can be used to determine whether a person has vitamin D insufficient values or not (3).

A review observing vitamin D status worldwide has reported that vitamin D deficiency is common in Middle-East and has associations with clothing style and skin covering (9). Arabi *et al.,* observing the prevalence, risk factors and outcomes of vitamin D deficiency in developing countries reported the prevalence of vitamin D deficiency 30-90% in developing countries (10). It has come to attention that a high proportion of healthy appearing adults have insufficient levels of vitamin D serum level even in tropical areas such as Iran and Saudi Arabia (11,12).Studies conducted in Iran has shown high prevalence of vitamin D deficiency .(13-15)

The current study was conducted to investigate the prevalence of vitamin D deficiency among female nurses of one of the most important pediatrics hospitals in Tehran, Iran. Nurses as a subgroup of health care providers are in direct contact with patients more than other subgroups, and their health status would influence their patients' condition. The diseases due to vitamin D deficiency will lower the quality of nurses' work. Also, nurses spend most of their time indoors and away from direct sun exposure. So it seems reasonable to say that they are at increased risk to develop vitamin D deficiency.

Materials and Methods

Study population and area

A total of 136 healthy nurses working in Children's Medical Center Hospital in Tehran, a relatively sunny city in Iran, entered this cross-sectional study voluntarily to be approached and screened for eligibility. Subjects needed to be female and aged >20 years. The exclusion criteria were suffering from a known disease of the liver, kidney and gastrointestinal system, bone metabolic diseases, malignancies, intestinal malabsorption, pregnancy, breastfeeding, medications influencing fat absorption and vitamin D metabolism, history of immobility for at least one week and type1 diabetes. Finally, 22 participants were found not to be suitable and were excluded. Therefore, 114 nurses were selected for the study. Medical Ethics Committee of the Tehran University of Medical Science approved the protocol and subjects were enrolled in the study when they gave voluntary informed consent according to the Declaration of Helsinki. Those who decline to participate in the study were excluded.

Vitamin D measures and its methodology

A venous blood sample was taken from participants over a 2-week period at October 2011 in central laboratory of the hospital. Serum was separated by centrifuging of blood samples and preserved at a temperature of -20 Celsius degrees until final analysis. The serum 25-OHD level was assessed with an EIA (enzyme immunoassay) using a kit (immunodiagnostic systems: ids, Tyne & Wear, UK) that utilizes a horseradish peroxidase-labeled avidin to develop a concentration of 25-OHD. Assay precision was evaluated at three control levels. Intra-assay and inter-assay coefficient of variation range for 25-OHD were 5.3-6.7% and 4.6-8.7% in the order mentioned. Vitamin D insufficiency and deficiency were defined as 25-OHD values of 10-29 ng/mL and <10 ng/mL respectively.

Data management and statistical analysis

The subjects were asked to complete a questionnaire at the time of blood sampling. It is administrated to assess information about age, weight, height, duration of sun exposure in the previous month (less than 30 minutes/day; 30-60 minutes/day; 60-120 minutes/day; more than 120 minutes/day), the mean of weekly physical activity (Yes; No according to world health organization (WHO) recommendation) and self-reported health status (excellent; good; fair; poor).

Body mass index (BMI) was calculated as weight divided by the square of height (kg/m2). BMI value of ≤ 25 kg/m2 was considered as normal (healthy) and > 25 kg/m2 was considered as abnormal (overweight and obese).

Data were analyzed with SPSS software (version 17.0). Mean ± SD was used to describe descriptive statistics. Chi-square was used to test the existence of an association between vitamin D levels and cofactors. *P*-value <0.05 was defined as statistically significant.

Results

In total 114 healthy female nurses, the mean serum 25-OHD level was 11.7 ± 9.3 ng/mL. The mean age and body mass index (BMI) of nurses were 35.6 ± 8.7 years (range 21-54) and 24.4±4.2 kg/m2, respectively.

The total prevalence of vitamin D insufficiency and deficiency among study population were 24.6% and 69.3%, respectively and only 6.1%, of subjects, were normal (Figure 1).

Vitamin D serum levels in younger female age groups were less than older age-groups (P<0.001) which declares a significant correlation between vitamin D

deficiency and younger age-groups. Figure 2 shows 95, 50 and 5 percentiles of vitamin D according to age.

About 36% of the study population had BMI>25 kg/m2 (obese and overweight). 57% of individuals reported having a good or excellent health status. Most of the study population (83.3%) said that they don't have regular physical activity. The current study showed that 82.5% of participants has a duration of sun exposure less than 60 minutes per day in the previous month. In the present study, BMI, self-report health status, performing the regular physical activity and duration of sun exposure were not significantly different between subjects with vitamin D deficiency and those who had normal vitamin D serum level. The association between demographic data and vitamin D deficiency were evaluated in the study population (Table 1).

Table 1- Characteristics of study population and prevalence rate (%) of vitamin D deficiency

Characteristics		N* (%)	Prevalence rate (%)	*P* value **
Age groups	21-25	16(14%)	68.7%	0.001
	26-30	26(22.8%)	76.9%	
	31-35	18(15.8%)	72.2%	
	36-40	19(16.7%)	78.9%	
	41-45	17(14.9%)	76.4%	
	46-50	11(9.6%)	54.9%	
	51-55	7(6.1%)	14.2%	
Body Mass Index (BMI)	BMI<=25	72(63.2%)	65.2%	0.1
	BMI>25	42(36.8%)	76.1%	
Self-report health status	Excellent	9(7.9%)	88.8%	0.6
	Good	56(49.1%)	69.6%	
	Fair	46(40.4%)	65.2%	
	Poor	3(2.6%)	66.6%	
Performing regular physical activity	Yes	19(16.7%)	57.8%	0.4
	No	95(83.3%)	71.5%	
Duration of sun exposure in minutes daily	<30	53(46.5%)	66%	0.18
	30-60	41(36%)	73.1%	
	60-120	18(15.8%)	77.7%	
	>120	2(1.8%)	0%	

*N indicates sample size.

***P* value < 0.05:statistically significant

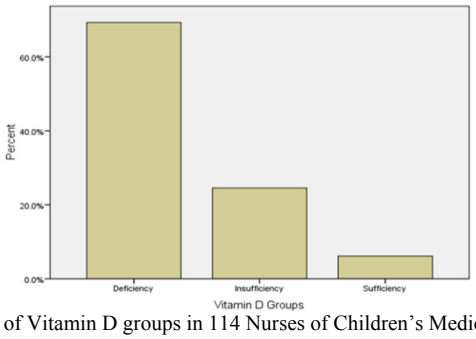

Figure 1. Frequency of Vitamin D groups in 114 Nurses of Children's Medical Center Hospital

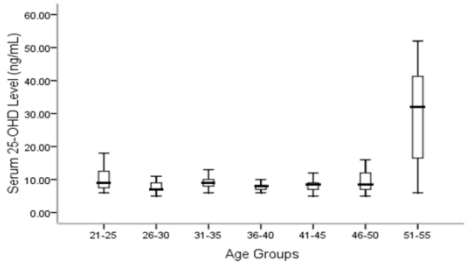

Figure 2. Median, 5 and 95 percentile of vitamin D level in variable age groups

Discussion

The prevalence of vitamin D deficiency was 69.3% in this study group, and 24.6% of female nurses had insufficient levels of vitamin D. These findings are consonants with other published data on Iran although beyond middle-east we have a better situation (6-8, 13-15). The population of this study was healthy and educated adults, and it seems the status of vitamin D may be worse in general population especially in high-risk groups.

The present study showed that vitamin D deficiency is more prevalent in the younger population. This finding is in agreement with some other studies in our country. A study performed in Tehran observing a total of 1210 persons has reached the decision that there was a high percentage of vitamin D deficiency in the study population, and younger ones were at greater risk. Also, a significant association between vitamin D deficiency and calcium intake was reported (13). Another study observing a total of 1111 persons in Isfahan, a sunny centrally-located city in Iran showed that the prevalence of vitamin D deficiency was higher in women and younger populations and in autumn-winter (14). The high prevalence of vitamin D deficiency (55.7%) in 21-35 years old group results into not achieving their peak bone mass, and they would be susceptible to osteoporosis and pathologic fractures in the future. Also, they are in their reproductive years, and mothers with vitamin D deficiency will have children liable to vitamin D deficiency and its complications. The lower rate of vitamin D deficiency in older age groups may be the result of higher consumption of multivitamin and vitamin D injection (with shorter half-life) in these age groups that has become popular and usual in our country in recent years. Furthermore, it seems that older population tends to eat and live healthier.

This study like Mansoor *et al.,* (16) and Larijani *et al*., (13) shows no association between BMI and vitamin D deficiency. But this could have been the result of normal BMI in the majority of the present study population. Fortunately, we only had 6 nurses with obesity. Also, vitamin D deficiency has a more relevant with total body fat percentage, and anthropometric indices like BMI is not a suitable index for measuring it. The exact association between vitamin D level and obesity is still unknown.

Although many researchers have shown the important role of sunlight exposure in vitamin D synthesis, investigations in areas near the tropics showed a high prevalence of vitamin D deficiency in their population (11,12,16). In 2011, a high prevalence of vitamin D insufficiency and deficiency -totally 94.7%- was reported from Zahedan, a sunny city in the southeast of Iran (15). The current study is conducted in Tehran, a city with an average of 8 hours sunlight daily. Though there was no association of importance between sunlight exposure and vitamin D levels in our study, still 82.3% of individuals with vitamin D deficiency and 82.1% individuals with vitamin D insufficiency had less than 60 minutes sunlight exposure daily. Furthermore, a clothing style that is inevitable because of law, air pollution that prevents enough UV to transmit through, and applying sunscreen creams are important factors. Nurses have an occupation that keeps them majority indoors, so it is reasonable to take safe sun exposure into consideration in this group. The sampling has taken place at sunny days of autumn, thus, the prevalence of vitamin D deficiency may be higher and more desperate on cloudy winter days.

Although there was no correlation between vitamin D levels and regular physical activity (30 minutes per day for 5 days per week according to WHO recommendation), there was a high prevalence of not performing regular physical activity among our study population (83.3%). We expected a much higher rate of physical activity among the health care workers who are more knowledgeable about it, but results were disappointing. It seems mandatory to explain advantages of routine exercise for nurses and physicians who are themselves responsible for other's health status to somehow.

Due to financial restrictions, we were unable to evaluate nurse's health status more scientifically by using laboratory data and only asked them to self-report their opinion of their health status. For more significant results there should be an evaluation of blood pressure, lipid profile and fast blood glucose in a greater population.

Finally, according to the major role of nurses in the process of treatment and impact of their health status on patients' condition we suggest a screening program for vitamin D levels in health care workers in other medical centers as one of the necessities, thus the individuals with deficiency would be identified and treatment could be started at the same time. As it was mentioned above, there are few nutrients that have enough vitamin D innately, but the strategy of supplementing foods with vitamin D has not been widely performed in Iran, yet. We advise supplementing bread, milk, yogurt, and other

dietary with this vitamin. Consumption of multivitamins is another key to solving this problem.

There is limitation in sunlight exposure due to cultural and law situation in Iran, thus it seems that we should try to increase sunlight duration to have better quantity versus low quality and achieve higher levels of vitamin D. Distribution of free milk enriched with vitamin D among nurses, facilitating access to vitamin D for individuals with vitamin D deficiency, generating brochures to inform health care workers of vitamin D and carrying out classes to lifestyle modification, all are our recommendations in purpose to help to increase the average of vitamin D level in population.

References

1. Holick MF. Vitamin D deficiency. N Engl J Med 2007;357(3):266-81.
2. Thomas KM, Lioyd-Jones DH, Thadhani RI, et al. Hypovitaminosis D in medical inpatients. N England J Med 1998;338(12):777-83.
3. Holick MF. Sunlight and vitamin D for bone health and prevention of autoimmune diseases,ancers, and cardiovascular disease. Am J Clin Nutr 2004;80(6 Suppl):1678S-88S.
4. Bouillon R. Vitamin D: From photosynthesis, metabolism, and action to clinical applications. In: DeGroot LJ, Jameson JL, editors. Endocrinology. 4th ed. Philadelphia: WB Saunders; 2001: 1009-28.
5. Bouillon R, Carmeliet G, Daci E, et al. Vitamin D metabolism and action. Osteoporos Int 1998;8(Suppl 2):S13-9.
6. Moussavi M, Heidipour R, Aminoroaya A. Prevalence of Vitamin D deficiency in Isfahan high school students in 2004. Horm Res 2005;64(3):144-8.
7. Shahla A, Charehsaz S, Talebi R, et al. Vitamin D deficiency in young females with musculoskeletal complaints in Urmia, Northwest of Iran. Iran J Med Sci 2005;30(2):88-90.
8. Salek M, Hashemipour M, Aminorroaya A, et al. Vitamin D deficiency in pregnant women and their newborns in Isfahan, Iran. Exp Clin Endocrinol Diabetes 2008;116(6):352-6.
9. Lips P. Worldwide status of vitamin D nutrition. J Steroid Biochem Mol Biol 2010;121(1-2):297-300.
10. Arabi A, El Rassi R, El-Hajj Fuleihan G. Hypovitaminosis D in developing countries_prevalence,risk factors and outcomes. Nat Rev Endocrinal 2010;6(10):550-61.
11. Azizi F, Raiszadeh F, Mir Said Ghazi A. Vitamin D deficiency in a group of Tehran population. Res Med 2000;4:291-303.
12. Fonesca V, Tongia R, el-Hasmi M, et al. Exposure to sunlight and vitamin D deficiency in Saudi Arabian women. Postgrad Med J 1984;60(707):589-91.
13. Hashemipur S, Larijani B, Adibi H, et al. Vitamin D deficiency and causative factors in population of Tehran. BMC Public Health 2004;4(1):38.
14. Hovsepian S, Amini M, Aminorroaya A, et al. Prevalence of vitamin D deficiency among adult population of Isfahan City, Iran. J Health Popul Nutr 2011;29(2):149-55.
15. Kaykhaei MA, Hashemi M, Narouie B, et al. High prevalence of vitamin D deficiency in Zahedan, southeast Iran. Ann Nutr Metab 2011;58(1):37-41
16. Mansoor S, Habib A, Ghani F, et al. Prevalence and significance of vitamin D deficiency and insufficiency among apparently healthy adults. Clin Biochem 2010;43(18):1431-5.