PREVALENCE OF VITAMIN D DEFICIENCY IN A POPULATION OF INDIAN WOMEN- A CALL FOR UNIVERSAL SUPPLEMENTATION?

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ABSTRACT

BACKGROUND

With improvement in serum vitamin D testing, there emerged an understanding that Vitamin D Deficiency (VDD) exists in sunny regions of the world where it was once thought to be a rare occurrence. In addition, new understanding on the deleterious effects of VDD on health has also grown over the last several years to include not only skeletal disorders, but cardiovascular disease, diabetes, cancer, infectious and autoimmune diseases.

The aim of the study was to examine the prevalence of Vitamin D Deficiency (VDD) among pregnant and non-pregnant women at a Multispecialty Hospital in Bengaluru, India.

MATERIALS AND METHODS

This is a retrospective chart review study. Charts belonging to all women who presented to Divakars Speciality Hospital from October 1, 2015, to November 1, 2016, were selected for initial review. Charts for all non-pregnant women who presented for a routine annual checkup and pregnant women in their 12th week of pregnancy were reviewed. All charts selected included serum 25 (OH) D levels that were obtained as part of routine care services. Charts of 213 pregnant women and 370 nonpregnant were reviewed. Serum 25 (OH) D levels for each patient were collected and entered into a Microsoft® Excel spreadsheet for analysis by physician researchers along with information regarding patient's age, employment status and education level. Serum 25 (OH) D level of 20.0 to <30.0 ng/mL was classified as vitamin D insufficiency and levels <20 ng/mL were classified as being vitamin D deficient. Data were compiled as percentages and means across population characteristics. Pearson's correlations were calculated to assess the correlation between 25 (OH) D levels and population parameters. A P value of <0.05 was considered statistically significant.

RESULTS

The mean age of the pregnant women and non-pregnant women was 29 and 43, respectively. Mean serum vitamin D level of pregnant women and non-pregnant women was 15.1 and 19.4, respectively. Ninety seven percent of pregnant women and 86% of non-pregnant women were vitamin deficient or insufficient. Vitamin D levels were not correlated to income or education in either pregnant women or non-pregnant women. Vitamin D levels were not correlated to age in pregnant women, but a correlation was found in non-pregnant women (r=0.223747; P=0.000014).

CONCLUSION

This study joins a significant number of previous studies in providing evidence of widespread VDD in south Asian populations. It underscores the need for vitamin D supplementation and fortification guidelines in India, especially considering the deleterious health effects of VDD.

KEYWORDS

Vitamin D Deficiency, India, Pregnant Women, Women, Income, Age, Education Level.

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BACKGROUND

The existence of vitamin D was deduced in 1922.[1] However, it was not until the 1930s that vitamin D was isolated and characterised.[2,3] It was at this time that its role in the regulation of calcium and phosphate and thereby growth and bone development were being explored.[4-6] For several decades, the focus of investigations into vitamin D's role in the body was that of growth and bone health. The prevailing wisdom during this time and up through the 1970s was that Vitamin D Deficiency (VDD) in south Asian populations was relatively rare. Researchers at this time inferred vitamin D status from the measurement of Alkaline Phosphatase (ALP).[7] More recent evidence has demonstrated that serum vitamin D levels may not be correlated with increased ALP as previously thought.[8,9]

With the introduction of commercial kit assays, the measuring of serum vitamin D levels became feasible, although initial work was hampered by a lack of reliability in testing. With improvement in serum vitamin D testing, there emerged an understanding that VDD exists in sunny regions of the world where it was once thought to be a rare occurrence.[10-12] Indeed, reports of widespread VDD in south Asian populations began to appear in the early 2000s.[13-17] Included in this evidence were reports, now more than 10 years old of widespread VDD in pregnant and postmenopausal women in India.[15,18] In addition to this new understanding of the prevalence of VDD in populations once thought impervious, new understanding on the deleterious effects of VDD on health has also grown over the last several years to include not only skeletal disorders, but cardiovascular disease, diabetes, cancer and infectious and autoimmune diseases.[19-25] A multitude of studies that link VDD to adverse perinatal outcomes have been published in recent years.[26-31]

Current literature provides insight into subpopulations at risk for VDD. In addition to risks associated with dietary deficits of vitamin D rich foods, individuals with limitations to sun exposure have been identified as having an increased risk for VDD.[12,32] Limitations to sun exposure in sunny regions have been linked to cultural clothing norms of extensive body covering and changes in lifestyle due to urbanisation resulting in fewer hours out-of-doors.[12,32] The last few years have revealed that certain genetic variants in the Vitamin D Receptor (VDR) gene can influence vitamin D levels and disease in these populations as well.[33-36]

The aim of this study was to explore the prevalence of VDD among pregnant and non-pregnant women at a Multispecialty Hospital in Bengaluru, India. This study provides further evidence that VDD is widespread among Indian women and explores population-based remedies.

MATERIALS AND METHODS

The charts of women who presented to the Divakars Speciality Hospital, Bengaluru, India, from October 1, 2016, to November 1, 2016, were reviewed. All pregnant women who presented to the hospital for prenatal care in their 12th week of pregnancy were considered. All non-pregnant women who presented for a routine annual checkup were selected. There were no criteria for exclusion, except if the women was already on vitamin D supplements, oral or injectable. Pregnant women's serum 25 (OH) D level was obtained during their 12th week of pregnancy as part of their routine prenatal care. Serum 25-hydroxy vitamin D (serum 25 (OH) D) was obtained for non-pregnant women that presented to the hospital clinic for an annual checkup as part of their routine care. All blood samples were processed at the Divakars Specialty Hospital. Serum 25 (OH) D was measured by chemiluminescent immunoassay. Serum 25 (OH) D level of 20.0 to <30.0 ng/mL was classified as Vitamin D Insufficiency (VDI) and levels <20 ng/mL were classified as Vitamin D Deficiency (VDD).

Patient's charts were retrospectively reviewed for serum 25 (OH) D test results that had been placed in each patient's permanent record. Serum 25 (OH) D levels for each patient were collected and entered into a Microsoft® Excel spreadsheet for analysis by physician researchers along with information regarding patient's age, employment status and education level. No patient identifiers were collected, thereby resulting in a de-identified dataset. The statistical analysis was carried out using Microsoft® Excel 2010. Data were compiled as percentages and means across population characteristics. Pearson's correlation was calculated to assess the correlation between 25 (OH) D levels and population parameters. A P value of <0.05 was considered statistically significant.

RESULTS

A total of 213 pregnant women and 370 non-pregnant women were enrolled in the study. The mean ages of the pregnant and non-pregnant women were 29 and 43, respectively. The mean serum vitamin D levels of the pregnant women and non-pregnant women were 15.1 ng/mL and 19.4 ng/mL, respectively (Table 1). Ninety-seven per cent of the pregnant women and 86% of non-pregnant women were vitamin deficient or insufficient (Table 1). Vitamin D levels were not correlated to income or education in either pregnant women or non-pregnant women (Table 2). Furthermore, they were not correlated to age in pregnant women, but a correlation was found in non-pregnant women ($r=0.223747$, $P=0.000014$) (Table 2).

Variable	Pregnant Women (n = 213)	Non-pregnant Women (n = 370)
Serum 25 (OH) D (ng/mL) Average	15.1	19.4

Pregnant Women				Non-Pregnant Women			
Percentage	Total #			Percentage	Total #		
3	7	> 30	sufficient	14	53	> 30	sufficient
16	34	20-30 count	insufficient	22	81	20-30 count	insufficient
81	172	< 20 count	deficient	64	236	< 20 count	deficient

Table 1. Serum 25 (OH) D Values for Pregnant and Non-pregnant Women

	Pregnant Women (n=213)			Non-Pregnant Women (n=370)			
Age category	<30	30<40		<30	30<40	40<50	>50
Total number by age category	134	79		37	89	154	90
Percentage of age category in population	63%	37%		10%	24%	42%	24%
Income category	High	Moderate		High	Moderate		
Total number by income category	27	186		117	253		
Percentage of income category in population	13%	87%		32%	68%		
Education category	Some	Graduate	Postgraduate	Nil	Some	Graduate	Postgraduate
Total number by education category	40	166	7	3	130	255	180
Percentage of education category in population	19%	78%	3%	1%	35%	69%	49%

Table 2. Population Parameters

DISCUSSION

Several prior studies have shed light on the widespread VDD in south Asian populations.[13-17] In India, the prevalence of VDD has been reported to fall between 70-100%. Among women, studies have reported a mean serum 25 (OH) D value of 9.28-23.4 ng/mL in pregnant women[37-39] and 8.8-25.3 ng/mL in non-pregnant women.[40,41] Among pregnant women, VDD has been found to be as high as 84%.[15] Like these previous studies, we found high VDD and insufficiency among otherwise healthy pregnant and non-pregnant women presenting at a women's health centre in India. The mean serum 25 (OH) D values for pregnant and non-pregnant women reported in this study agree with those reported in the literature. Furthermore, the VDD prevalence of 97% reported in this study, although higher than those reported in the literature for pregnant women falls within the range for vitamin D prevalence reported in India.

Factors such as age, race (non-white), high BMI, low education level and low income status have been reported to be associated with VDD.[42] Although, there are scarce data on the direct association between age, income category and education level and VDD in India, a study of healthy adults in Kashmir valley found no correlation between age and VDD.[43] In this study, we found that education level and income category were not predictors of VDD in pregnant and non-pregnant women; however, while age was not associated with VDD in pregnant women, we found that it was a predictor of VDD in non-pregnant women.

Vitamin D is synthesised on adequate exposure of skin to sunlight and can be obtained from dietary sources. In India, however, dietary habits and social, religious and cultural practices limit vitamin D synthesis and uptake. Cultural norms that dictate the covering of most body parts as well as limited outdoor activity preclude exposure to sunshine, while a diet low in calcium and vitamin D rich food sources reduces the ability of Indians to meet their dietary vitamin D needs.[12,32] Fortification of food sources as well as supplementation offer a means to address the situation in India. However, it has been nearly 7 years since Babus called for a "concerted national effort to implement policies and guidelines for vitamin D fortification and/or supplementation."[44] To many, such a lag in action has been frustrating. However, it is important to note that, while India lacks a vitamin D fortification food program, which could be a beneficial tool in combating widespread VDD, many countries with such programs fail to reach vitamin D sufficiency levels within their populations through these programs.[32] Furthermore, consensus on vitamin D supplementation guidelines have only been reached and published by the Endocrine Society of India within the last 18 months. Under these guidelines, The Endocrine Society of India recommends vitamin D supplementation of 400 International Units (IU) of vitamin D daily for infants, 600-1000 IU for children, 1000 IU for adolescents, 1000 IU for pregnant women after 12 weeks' gestation and 1000-2000 IU for adults.[45] When considering how to address the widespread VDD in Indian populations, it is important to deliberate on the cost associated with vitamin D supplementation. There are many appropriate formulations available on the Indian market today[46] and the yearly cost of a daily supplementation of 1000 IU would cost 120 rupees per year less than 2 US dollars.[47] In addition to the low cost, vitamin D supplementation is safe even in large doses.[47]

These findings should be interpreted in light of the following acknowledged limitation. Parathyroid Hormone (PTH) levels have been used to determine the appropriate cutoff level of serum 25 (OH) D to define VDD in a particular population.[48,49]

Limitation in this study was that the PTH levels of the study participants were not measured. This limitation notwithstanding the cutoff values we used in this study agree with those used in various studies of VDD in India.

CONCLUSION

Our study adds to the growing literature on the prevalence of VDD in India, especially in apparently healthy pregnant and non-pregnant women. Owing to the health effects of VDD and the high prevalence of VDD in India, we conclude that a state wide vitamin D supplementation initiative is required in India.

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