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Research Article

Blood vitamin D levels in a sample population from Eastern India: A pilot study

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Abstract

Background: Vitamin D deficiency (VDD) has been found to be highly prevalent in the general population in recent times. Especially, in tropical countries like India, this deficiency state is very common. Although studies from different parts of India have documented high prevalence of VDD in the population, such studies are very rare from Eastern India. We therefore undertook this pilot study to document the vitamin D status of a sample Eastern Indian population.

Patients and methods: this was a hospital based observational cross-sectional epidemiological study. Adult patients coming to the medicine indoor and/or outdoors of a tertiary care medical college were screened and included in the study. Patients with liver disease, kidney disease or malabsorption syndromes were excluded. Blood vitamin D (25-OH Vitamin D) was assessed by CMIA (Chemiluminescent Microparticle Immunoassay) according to Vitamin D standardization program. Standard statistical methods were used.

Results and analysis: We had a total of 80 patients in our study. The male: female ratio was 3:7. 69% of the study population belonged to middle age group (30—60 years). In all age groups except under—20 year group, females outnumbered males. 47.5% of the subjects (n=38) had frank vitamin D deficiency (≤20 ng/ml), 40% had vitamin D in the 'insufficient' range (>20—30 ng/ml). Female subjects had more prevalence of VDD with 53% having frank VDD and 39% having insufficiency. In the male subset (n=24), 75% (n=18) had either VDD or insufficiency. The 30—40 year age group had the highest prevalence of VDD (58.8%); 50% of subjects above 60 years of age had frank VDD.

Conclusion: VDD is highly prevalent in the Eastern Indian population. Certain sections of the population like females and middle aged adults are more susceptible to this problem.

Keywords: Vitamin D, gender, India, prevalence, deficiency

1. Introduction

Vitamin D (VD) is long known as an essential nutrient and its deficiency causes rickets and/or osteomalacia. This vitamin is synthesized by action of sunlight on human skin. It was long thought that in tropical countries, due to abundant sunlight, vitamin D deficiency (VDD) will not occur. However, in recent times, this concept has been challenged. Vitamin D deficiency has been found to be highly prevalent in tropical countries in recent times. In a study from Kashmir, India, it was seen that more than 70% males and more than 90% females were having VDD[1]. Other Indian studies have also documented similar VDD in the population[2]. The exact cause of this widespread VDD is not known till now. Similar prevalence of VDD has been documented from other sunny regions of the world too[3].

In recent times, it has been seen that the effect of VD goes much beyond its role in calcium metabolism. Different acute and chronic diseases have been linked to VDD. For example, diabetes, one of the rising epidemics of modern world, has been linked to VDD[4]. VD may have some immune-modulatory properties; hence VDD may cause aberrant immune activation and a systemic inflammatory state which may predispose to diabetes[4]. Also, some forms of malignancy have been found to be aggravated in VD deficient state[5].

Studies concerning VDD are very rare from Eastern India. There was a recent study from Kolkata which showed very high levels of VDD. However, that study was done with only doctors as study subjects[6]. Studies in the general population are very rare. However, diseases like diabetes and malignancy are on the rise in this part of the country. Since VDD has been linked to these chronic illnesses, the accurate estimation of the VDD status of the population is very important. Hence, we undertook this small pilot study in a sample population of Eastern India to find the VD status of the subjects. We aimed to do an epidemiological study to find the relation of VDD with different demographic variables.

2. Patients and methods

This was a hospital-based observational cross-sectional study conducted in a tertiary care medical college of Eastern India from 1st February, 2014 to 15th June 2014. Adult patients coming to the medicine outdoors and/or admitted in the medicine wards were included in the study after proper consent. Simple random sampling method was used to choose the patients for the study. Institutional ethical committee approved the study. Patients with chronic liver disease, renal disease, congenital vitamin D metabolic disorder, malabsorption syndromes, cholestasis or those receiving multivitamin supplements in the last two months were excluded from the study. Blood vitamin D level (25-OH Vitamin D) was measured by CMIA (Chemiluminescent Microparticle Immunoassay). The machine and kit used was Cobas e411, Architect Plus. The blood, after collection, was sent immediately for assay to the laboratory.

Normal range considered:
≤20 ng/ml: deficient
>20—30 ng/ml: insufficient
> 30 ng/ml: sufficient

The assay was standardized according to the international vitamin D standardization program (VDSP). VDSP is an international collaborative effort to standardize the laboratory measurement of vitamin D status. We only used kits which obeyed this standardization.

2.1 Statistical methods: The data was arranged in Microsoft Excel worksheet and analysed using standard statistical software like MedCalc or GraphPad, which are available online for free. The data is expressed as number/percentage. To test 2×2 contingency tables, Fisher's exact test was used with 2-tailed correction. $P<0.05$ was considered significant.

3. Results

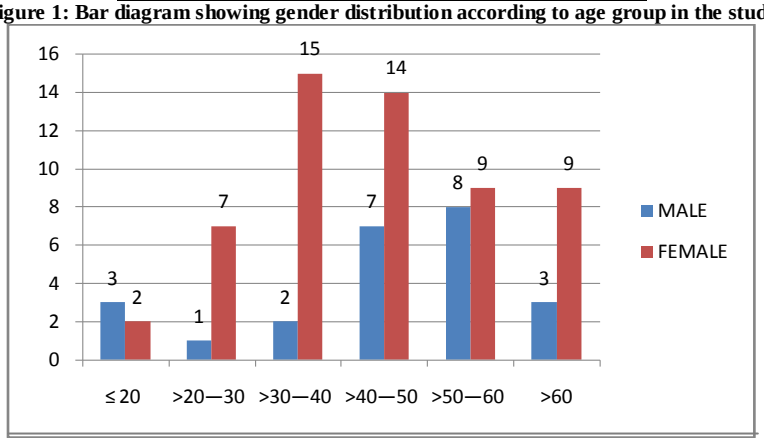
We had a total of 80 patients in our study. Initially we selected 92 patients but some did not consent to the study and some others were excluded based on exclusion criteria as specified above.

The male: female ratio in our study was 3:7. As table 1 show, the majority of the study population belonged to the 30—60 year age group (n=55; 68.8%). 15% of the patients belonged to the above—60 age group. As figure 1 shows, in all the age groups, females outnumbered males except the under—20 age group.

Table 1: Table showing the age distribution of our study population

Age group	Number	Percentage
≤ 20 years	5	6.25
>20—30	8	10
>30—40	17	21.25
>40—50	21	26.25
>50—60	17	21.25
>60	12	15

Figure 1: Bar diagram showing gender distribution according to age group in the study



As table 2 shows, 38 of the patients (47.5%) had vitamin D levels ≤20 ng/ml. so, by standard criteria, they had frank deficiency of vitamin D. 40% of the subjects had vitamin D level in the insufficient range and only 10 patients had sufficient vitamin D levels.

Table 2: Table showing the vitamin D levels in the study population

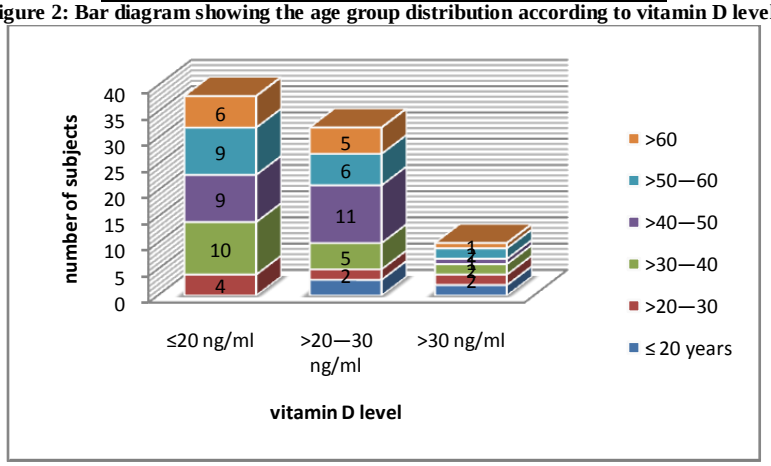
Vitamin D level	Number	Percentage
≤20 ng/ml	38	47.5
>20—30 ng/ml	32	40
>30 ng/ml	10	12.5

As table 3 shows, females had significantly more prevalence of vitamin D deficiency. Out of 56 female subjects, 30 (53.6%) had frank deficiency, as opposed to 8 out of 24 males (33%) (p=0.14 by Fisher's exact test, 2-tailed). Altogether, out of 56 females, only 4 (7.1%) had sufficient vitamin D levels. For male subjects, this figure was 6 (25%). Thus, prevalence of sufficient vitamin D level in females was significantly lower compared to males (p=0.058).

Table 3: Table showing vitamin D levels according to gender

Vitamin D level	Male	Female
≤20 ng/ml	8	30
>20—30 ng/ml	10	22
>30 ng/ml	6	4
Total	24	56

Figure 2: Bar diagram showing the age group distribution according to vitamin D levels



Age group wise analysis showed that (figure 2) the 30—40 year age group had the highest prevalence of frank Vitamin D deficiency with 58.8% of the subjects in that age group having vitamin D levels ≤20 ng/ml. Both in the above—60 age group and the 20—30 year age group, 50% of the subjects had Vitamin D deficiency. The under-20 age group had no one with vitamin D levelsbelow 20 ng/ml.

In subjects ≤50 years (n=51), 45.1% had Vitamin D deficiency (VDD) while in subjects above 50 years of age (n=29), 51.7% had VDD.

4. Discussion

In our small pilot study, we found significantly high level of VDD. In a study from Kashmir, it was seen that 76% of male and 94% of female subjects had VDD[1]. In our study, 53% of female and 33% of male subjects had frank VDD. Another 39 % of the female and 42% of the male subjects had VD insufficiency. So, our data is comparable to this Kashmir study. In a Kolkata study, it was seen that 92.5% of the subjects had severe VDD[6]. In our study, this percentage was 47.5%. However, in that Kolkata study, the subjects were all doctors, who mostly stayed indoors. In contrast, our study population was varied and many of them were labourers or farmers and thus had more sun exposure per day. Similar high levels of VDD have been found in studies conducted in South or West India too[7,8].

VDD has been reported from different parts of the world. In a study from USA, the African-Americans were found to have significantly high prevalence of VDD[9]. In china too, during the winter season, the prevalence of vitamin D insufficiency (<30 ng/mL) was 84% in males and 89% in females[10]. However, in India, studies conducted even in summer showed significant VDD. Thus, besides sunlight exposure, other factors must be responsible for VDD in Indians. Excess skin melanin has been theorized as a cause by some authors. A study conducted in northern India showed a significant fall in VD concentrations in winter but even in summer, 82.5% of the study subjects had VDD[11]. Our study was conducted over a short period. Hence such seasonal variations have not been recorded.

In our study, 53% of the female subjects had frank VDD and another 39% had VD insufficiency. This female preponderance of VDD has been found in other studies too. In a study from Belgium, 44.6% of pregnant women were found to be VD deficient. This was in spite of oral supplementation which many were taking[12]. Another study from south India showed a VDD prevalence of 76% in women of reproductive age and 70% in post-menopausal women[13]. In India, due to socio-cultural and religious reasons, many women are made to spend their entire life indoors. This causes lack of sun exposure. Also, women in India often suffer from malnutrition. This may be reason for increased prevalence of VDD in Indian women. However, the prevalence of VDD in Indian men is also quite high. For example, a study from Varanasi involving only men showed the prevalence of VDD to be 58%[14]. In our study, 75% of the male subjects had either VDD or insufficiency.

In our study, 41% of the male subjects and 39% of the female subjects had VD insufficiency. Although this is not as serious as frank VDD, still it needs therapy. VD insufficiency has been found to be associated with weakness, growth retardation and increased risk of malignancy[15]. And also, without treatment many of these patients may convert to frank VDD in the long run.

In our study, we found that VDD was present in all age groups except the under—20 age group. The sample size is too small to draw any conclusions. In a study from Delhi, in 2008, it was seen that the prevalence of VDD in adolescent female (mean age 12.3 years) was 90.8%[16]. Thus, all age groups are susceptible to this health problem. The NHS data (2001—6) from USA also showed that VDD prevalence was the highest in age group 19—30 for males and 31—50 for females[17]. In our study, prevalence of VDD was highest in 30—40 year age group with 58.8%, closely followed by 20—30 year age group with 50%. Hence, the middle adult age group is the most susceptible to this problem. In our study, 50% of the adults above 60 years had frank VDD and another 41.7% had insufficiency. Such high levels of VDD at this age group have been documented in other studies too[18]. This may predispose to falls, fractures, weakness, cognitive dysfunction or even cardiovascular diseases in the elderly. Hence, VDD in elderly needs immediate treatment.

5. Conclusion

Vitamin D deficiency is an important public health problem in our country. Like other parts of the country, this is equally prevalent in Eastern India too. Further multi-centric studies are needed to characterise the extent of this problem in our population. Preventive measures like food fortification with vitamin D may be a viable option and needs to be discussed.

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