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PROFILE OF VITAMIN D DEFICIENCY IN MANGALORE

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ABSTRACT

Recent studies, reporting the prevalence of vitamin D deficiency (VDD) worldwide prompted us to assess the vitamin D status in various age groups and gender. Data of 771 subjects, who got their vitamin D levels checked at KMC Hospital, Ambedkar circle, Mangalore, were analyzed. 60% of the subjects were vitamin D deficient while only 20% had sufficient levels. The percentage of subjects with vitamin D deficiency (VDD) was highest in the age group of 21-30. The relative insufficiency was more prevalent in the age group of 1-10. The subjects with sufficient vitamin D levels belonged to the age group of 1-10 and surprisingly so even in the age group of >70 years. Males and females seem to be equally affected by this deficiency. The present study shows that vitamin D deficiency is prevalent in all age groups which needs public health intervention. However the normal range of vitamin D obtained is 17.65 - 19.56 which questions the prevalence of VDD in Mangalore.

KEY WORDS: **Vitamin D,VDD, 25-hydroxyvitamin D, Prevalence.**

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INTRODUCTION

Vitamin D has, in the recent years, captured the attention as an important determinant of health. In India vitamin D deficiency (VDD) has been reported in all age groups including toddlers, schoolchildren, pregnant women, adult males and females residing in rural and urban areas [1, 2, 3.] In the past, most of the research focused on how vitamin D acts in kidneys, intestines and skeleton to help control the flow of calcium into and out of the bones through the blood stream. More recent studies reveal the broader impact this important micronutrient has on total health. The discovery that most tissues and cells in the body have a vitamin D receptor (VDR) has provided new insight into the function of this vitamin. In its role as a hormone, vitamin D binds to receptors in cells throughout the body to influence the expression of over 1,000 genes in a number of important processes. Of great interest is the role it can play in decreasing the risk of many chronic illnesses, including common cancers, autoimmune diseases, infectious diseases and cardiovascular diseases[4,5] . There is increasing evidence that VDD might be an important determinant in the pathogenesis of CVD, hypertension congestive heart failure and cancer. A study by Zittermann *et al*[6] has reported that the risk of cardiovascular diseases increases in people living at higher altitudes. Estimated prevalence of coronary heart diseases is also high in urban India. It is suggested that high prevalence of coronary artery disease in urban population when compared to the rural population could be due to VDD secondary to environmental pollution linked block in UV rays.The high prevalence of CVD in renal failure is linked with low levels of vitamin D metabolites[7,8,9]. Epidemiologic studies indicate that levels of 25-hydroxyvitamin D below 20ng/ml are associated with 30-50% increased risk of colon, prostate and breast cancer [10,11,12] . Although there is no consensus on the optimal levels of 25-hydroxyvitamin D as measured in serum, VDD is defined by most experts as a 25-hydroxyvitamin D level of less than 20 ng /ml. Level of 21-29 ng/ml can be considered to indicate relative insufficiency of vitamin D and a level of 30ng/ml or greater as sufficient[13, 14, 15, 16] . Although vitamin D deficiency has been documented as a frequent problem in studies of young adults, elderly persons and children in other countries, there are limited data on the prevalence of this nutritional deficiency among various age groups in our country. VDD in Indians has several implications, but there has been no systematic efforts till date directed towards finding the importance of the widespread VDD in our country. The present study is an attempt to address this issue and identify which age group of people are maximally affected by VDD and its implications based on the preliminary data collected from Kasturba Medical College Hospital Ambedkar Circle (KMCH AC).The experimental design is a retrospective study which is able to estimate the prevalence of VDD in a place like Mangalore which has adequate sunlight.

The objectives of the study were to

i) To determine the distribution of vitamin D in various age groups and gender

ii) To establish the normal range of vitamin D in asymptomatic individuals.

MATERIALS AND METHODS

Study design was a hospital based retrospective study carried out on subjects who attended the KMC Hospital Ambedkar Circle (KMCH AC) . Case sheet of any person who got his vitamin D levels checked over a period of six months (cases from July 2012- December 2012) were included in the study. This amounted to a sample size of 771. Out of these only 172 subjects had normal biochemical profile (other than vitamin D) and were taken as controls.The data collection was done from KMC Laboratory Services – Clinical Biochemistry section, of KMCH AC, Mangalore. Vitamin D(25-hydroxyvitamin D) was assayed in the Laboratory by Enzyme Electro Chemiluminiscence Immuno Assay (ECLIA) using Elecys 2010 analyser and reagent kits from Roche Diagnostics.

Statistical analysis

Kruskal Wallis test was used to compare the median and the inter quartile range across the age groups followed by α adjusted Mann Whitney U test for pair wise comparison between the age groups (Table 1 and Figure 1). t- test was used to compare the mean values between males and females. Chi-squared test was used to check for association of age groups with deficiency, insufficiency and sufficiency states of vitamin D levels.

RESULTS

Vitamin D values of 771 subjects (256 males and 515 females) were evaluated. The inter quartile range of the vitamin D levels of the various age groups is presented in Table 1. Figure 1 depicts the interquartile ranges and median. Median values of vitamin D levels are highest in the age group of 1-10 and lowest in the age group of 21-30. Comparison of mean vitamin D levels of the males and females is given in Table 2. As shown in the table, there is no significant difference in the mean values between the two sexes. The percentage of subjects with vitamin D deficiency/, insufficiency/ and sufficiency are given in Table 3. Fig 2 depicts the percentage of distribution of the subjects in the three groups & fig 3 shows the vitamin D status in the various age groups.

Table1

Inter quartile range of vitamin D levels in various groups

Age group	Median (IQR)
1-10	24.8(15., 31.7)
11-20	14.0 (10.5, 23.4)
21-30	12.0 (8.2, 18.3)
31-40	17.0 (10.9, 26.4)
41-50	16.0 (11.1, 27.2)
51-60	17.7 (11.1, 27.3)
61-70	18.4 (10.4, 29.6)
>70	21.1 (10.0, 35.4)

Table 2

Vitamin D levels in males and females

Sex	N	Mean ±SD
Males	256	21.94 ± 14.35
Females	515	20.45 ±14.81

P value=0.183

TABLE 3
Deficiency, Insufficiency & sufficiency levels of vitamin D

Age Group	Deficiency N (%)	Insufficiency N (%)	Sufficiency N (%)
1-10	33 (39)	27 (32)	24 (29)
11-20	44 (71)	9 (14)	10 (15)
21-30	94 (78)	14 (12)	12 (10)
31-40	65 (63)	22 (21)	17 (16)
41-50	75 (60)	24 (20)	24 (20)
51-60	75 (59)	26 (20)	26 (21)
61-70	46 (55)	20 (24)	18 (21)
>70	32 (15)	10 (15)	24 (35)
TOTAL	464 (60)	152 (20)	155 (20)

(N= number of samples)

In the present study, 60% of the total samples analyzed were vitamin D deficient (fig 2). Deficiency is wide spread and seen in all age groups. Maximum deficiency is seen among subjects belonging to the age group of 21-30 followed by the age group of 11-20. Age group of 1-10 is at the maximum risk of developing VDD with 32% of the subjects falling in the 'insufficient' category. More than a quarter of the samples analyzed in the age groups of 1-10 and >70 show sufficient vitamin D levels. Of the 771 samples analyzed, 172 were in the control group. The median value of vitamin D levels was analyzed to establish the normal range for asymptomatic individuals. 95% confidence interval for median value of this group is 17.65 - 19.56. Approximately 90% of the subjects in the control group had Vitamin D levels less than 21ng/ml.

DISCUSSION

From the results of the present study, it is evident that subjects in the age group of 21-30 are maximally affected by this deficiency. The second most affected age group is 11-20. A study in Boston [17] reported that 24% of 307 adolescents recruited during an annual physical examination were vitamin D deficient (25-(OH)D <15 ng/ml) and 14% were severely vitamin D deficient (< 8 ng/ml). People living near the equator, who are exposed to sunlight without sun protection have robust levels of 25-hydroxyvitamin D (>30ng/ml). VDD is common when most of the skin is shielded from the sun. Studies in Saudi Arabia, the United Arab Emirates, Australia, Turkey, India and Lebanon, have shown 30-50% of the children and adults with 25-hydroxyvitamin D levels under 20ng/ml[18]. A study by Balasubramanian *et al* [18] has shown that severe VDD was present in adolescent girls when compared to the toddlers belonging to a similar socio-economic group presenting with rickets/ osteomalacia. A study done by Gordon *et al*[16] also reports the high prevalence of VDD in US adolescent boys and girls. Marwaha *et al* [19] have reported low vitamin D levels in school children (6-16yrs) from the low socio-economic region as compared to high socio-economic status. Goswami etal [20] have shown that vitamin D is significantly low in healthy adults in Delhi as compared to the western countries.

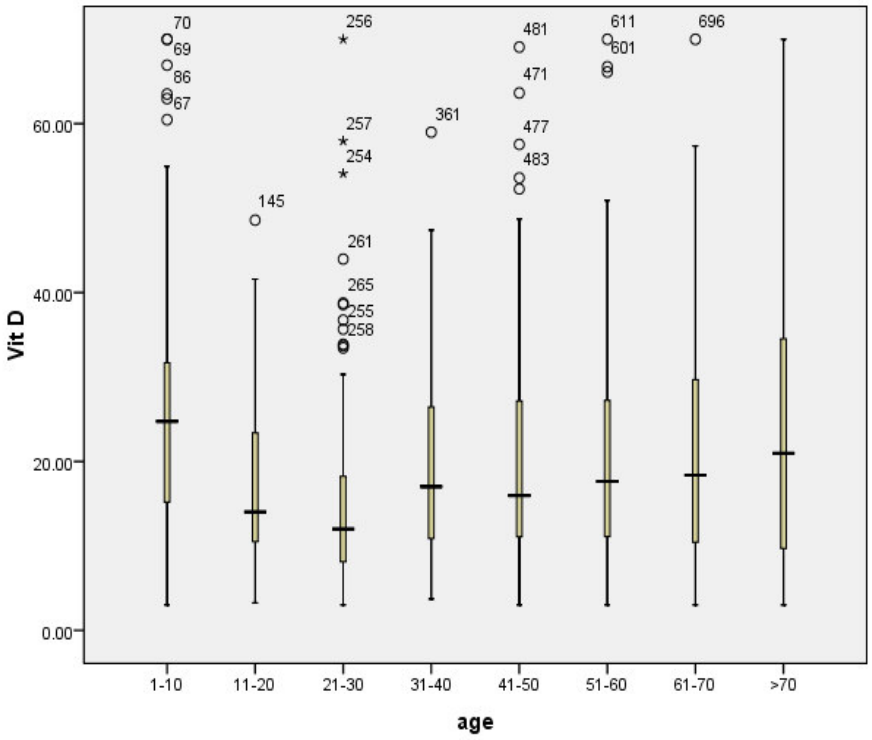

Figure 1
Box plot depicting the ranges of vitamin D according to age groups

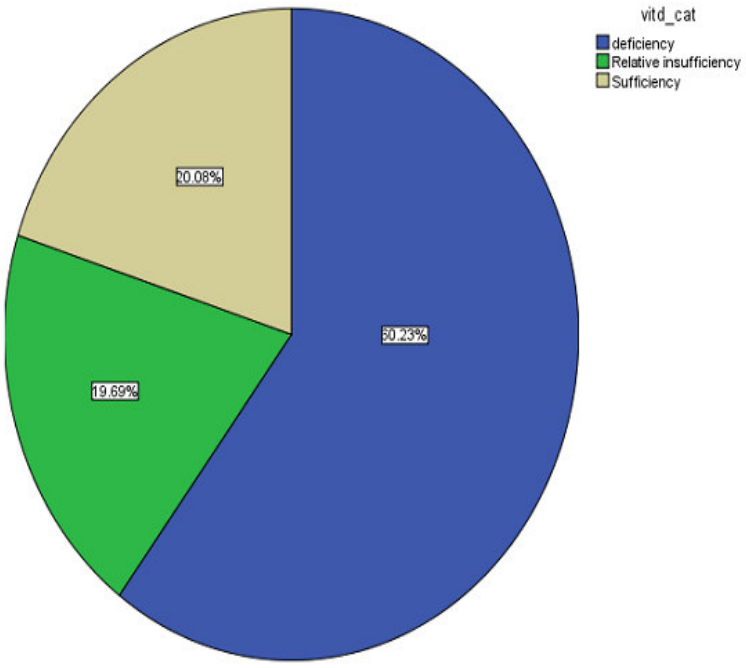

Figure 2
Depicts the percentage of population in the 3 groups

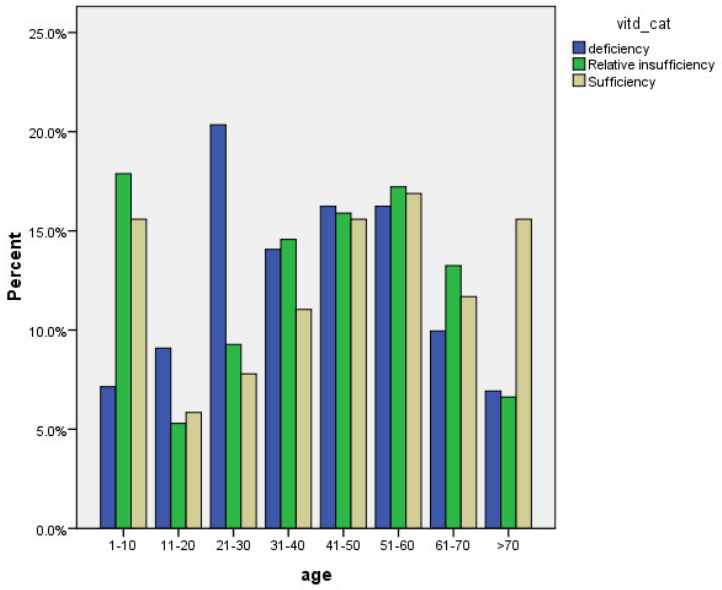

Figure 3
Distribution of vitamin D status according to the age groups

Low levels of vitamin D in the present study could be attributed to increasing urbanization that has resulted in poor outdoor activity and greater atmospheric pollution coupled with skin pigmentation. Indian diet, which is largely vegetarian, could also be one of the reasons. An unexpected finding in the study was the relatively higher proportion of samples with sufficient vitamin D levels in the age group of >70. This could probably be due to the vitamin D supplements as advised by the physicians, their adherence to a daily routine which involves regular exercise, nutritious food and other traditional practices leading to adequate sun exposure. We did not find any significant difference in the mean vitamin D levels between males and females implying that this deficiency affects both men and women alike. This finding is in contradiction with a study done by Harinarayan *etal*[21] which shows VDD in 70% of the women and 44% of the men in the rural population *ie* women are more affected by this deficiency when compared to men. This difference was not appreciated in our study probably because of unequal sample size. An association of VDD with Type 2 Diabetes mellitus anemia and thyroid dysfunction has been supported by studies done by Pittas *et al* [22],Scragg *etal*[23] ,Zittermann *etal*[7], and Watson *et al* [24] . Sudha *etal* [25] have also reported vitamin D deficiency in subclinical hypothyroidism . Available evidence suggests that serum 25 hydroxy vitamin D concentrations between 36-40 ng/ml are desirable. A target of >30ng/ml for optimal health is supported by several experts [25,26,27] .The normal range obtained for the asymptomatic subjects in the present study is 17.65 - 19.56ng/ml. Connie *et al*[28] report that the normal range is broad at 10-55 ng/ml. However the lower limit of the normal range can vary among populations from as low as 8ng/ml to 15ng/ml. The recent recommendations from the Institute of Medicine states that 25-hydroxyvitamin D levels higher than 20ng/ml are adequate. In addition, it has concluded that serum concentrations above 30ng/ml are not consistently associated with an increased benefit. It has also stated that serum vitamin D levels of 20ng/ml cover the requirement of at least 98% of the population [29]. Our findings of the normal range for the population supports the study of Muhammad *et al* [30] . The normal range obtained needs to be validated by analysis of a larger population. If this range holds good, the reported paradox of the prevalence of VDD in a region with adequate sunshine like Mangalore may be nullified.

CONCLUSION

In our study VDD is prevalent in both the sexes and in all the age groups.We observed a high prevalence of this deficiency in the age group of 21-30. Approximately 90% of the subjects in the control group had vitamin D levels < 21 ng/ml *ie* they were vitamin D deficient.This finding questions the functional relevance of 25(OH)D measurement. This needs to be validated by analyzing a larger population. Awareness should be created amongst the public on the implication of the nutritional deficiency of this vitamin

CONFLICT OF INTEREST

Conflict of interest declared none

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