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Vitamin D Status in Children of South Chennai, Tamil Nadu, India.

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ABSTRACT

India is a tropical country and yet there is widespread vitamin D deficiency among our infants and children. Our study was conducted to assess the Vitamin D status and the prevalence of hypovitaminosis in children in and around south Chennai. This cross sectional study was conducted in 45 children from the newborn period to 18 years of age. Under strict aseptic precautions 2 ml of blood was taken from each child and serum levels of 25(OH) D levels were measured by the direct ELISA method. Statistical analysis was done by using chi-square test, one way anova f-test and student independent t-test. Among the 45 children studied, 66.7% had normal vitamin D levels and 33.3% had hypovitaminosis D (P value < 0.05). There was no statistically significant association between factors like gender, diet, literacy status, socioeconomic status, anthropometric parameters and vitamin D levels. There is a high prevalence of hypovitaminosis D amongst apparently healthy children and adolescents. Hence, awareness needs to be created regarding the benefits of direct sunlight exposure. Further studies are needed to consider the need for vitamin D fortification of food products.

Keywords: Vitamin D, Vitamin D status in children, Hypovitaminosis D, Vitamin D deficiency in children.

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INTRODUCTION

India is a tropical country receiving ample sunlight throughout the year. Hence, it is generally believed that Vitamin D deficiency is uncommon in our children. However a few studies from our country have shown that Vitamin D deficiency is widely prevalent amongst Indian children [1]. In the recent years, a few studies from our country have shown that vitamin D deficiency is present in all age groups including neonates, toddlers, school children, pregnant women and adults, residing in rural as well as urban areas [2, 3]. A study from Delhi measured serum 25 hydroxy vitamin D (25(OH) D) in apparently healthy subjects and showed that significant hypovitaminosis D was present in up to 90 per cent of them [4]. Several factors like skin pigmentation, inadequate exposure to sunlight, genetic factors and socioeconomic status influence vitamin D metabolism [1]. This may explain the high prevalence of vitamin D deficiency in India despite its sunny climate. The beneficial effects of vitamin D supplementation in improving skeletal health starts from the fetus and continues throughout childhood, adolescence and adulthood [4]. Besides, vitamin D receptors have been found to be present in more than 30 different tissues including the pancreas, myocardium, lymphocytes etc. This widespread distribution of vitamin D receptor signifies the important role of vitamin D in humans. Vitamin D is an important mediator of calcium homeostasis. In addition, it also has important immunomodulatory, antimicrobial and antiproliferative actions. Recently, rickets caused by vitamin D deficiency is resurging in many developed countries. While vitamin D is critical for calcium homeostasis, current studies also highlight the role of vitamin D deficiency in diseases other than metabolic bone disorders. Studies have shown that vitamin D deficiency can lead to serious problems like hypocalcemic seizures and increased risk of respiratory tract infections in neonates and infants [5].

High prevalence of Vitamin D deficiency in healthy newborns, infants, young children and adolescents has been reported worldwide in the past few years. However, data amongst Indian children is scarce. This prompted us to investigate the Vitamin D status in healthy Indian children.

MATERIALS AND METHODS

This cross sectional study was conducted over a 1 year period from November 2011 – November 2012. Forty five children from the newborn period to 18 years of age admitted in the Pediatric ward and in whom the parents have given consent were included in the study.

Children with systemic illness, endocrine disorders, and children on long term drug therapy like antiepileptic drugs, anti-tuberculosis drugs, antifungal drugs and antiretroviral drugs were excluded from the study.

In this study we also tried to determine the association between vitamin D levels and demographic factors like age, gender, diet pattern and socioeconomic status.

The details of the study were explained and informed consent was obtained from the parents or their guardian. Proforma containing demographic details, anthropometric measurements and examination findings was used. Under strict aseptic precautions, 2 ml of blood was taken, centrifuged and stored in -20^0 Celsius and analyzed at the completion of the study. The ELISA kit was expensive and hence we had to store the samples and analyze them together at one point of time. Serum 25 (OH) D was analyzed by direct ELISA kit (Immun diagnostik, Germany). The assay utilizes the competitive ELISA technique with a selected monoclonal antibody binding to 25 (OH) D. A dose response curve of the absorbance unit (optical density, OD) and vitamin D concentration that was provided in the kit was used (Figure 1). Vitamin D level of the sample was determined from the curve.

As per the Endocrine Society Clinical Guidelines 2011

Vitamin D insufficiency is defined as a 25(OH) D level of 21–29 ng/ml (52.5– 72.5 nmol/L) [6].

Vitamin D deficiency is defined as a 25(OH) D level below 20 ng/ml (50 nmol/L) [6].

Normal vitamin D level is >30 ng/ml.

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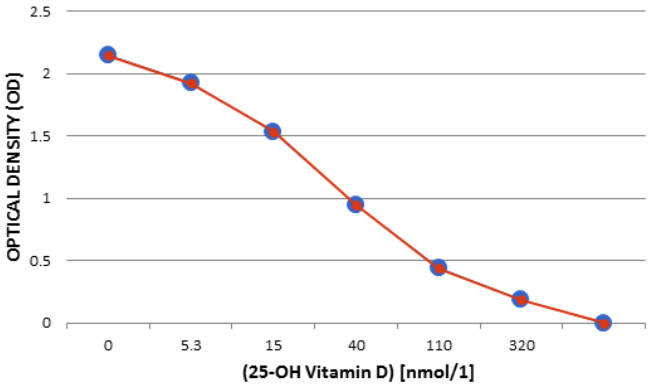
Hypovitaminosis D is vitamin D insufficiency and vitamin D deficiency.

Statistical analysis was done by using chi-square test, one way annova f-test and student independent t-test.

Figure 1: Optical Density and Vitamin D Concentration



RESULTS

Among the 45 children in the study group, 30(66.7%) of them had normal vitamin D levels of >30 ng/ml and 15(33.3%) of them had low levels of vitamin D. Of the 15 children who had low levels of vitamin D, 10(22.2%) had vitamin D in deficiency level and 5 (11.1%) had Vitamin D in the insufficiency level. Of the 45 children studied, 18 children in the age group < 5 years had a mean vitamin D level of 34.28 ng/ml, 9 children in the age group of 6-10 years had mean value of 32.97 ng/ml and 18 children in the age group 11 -18 years had a mean value of 26.95 ng/ml(Table 2). This shows that as the age of the children increases, the vitamin D level decreases. The P value is 0.03 which is significant.

In this study of 45 children, 30 of them were males and 15 of them were females. The mean vitamin D levels in males and females were 31.08 and 31.12 ng/ml respectively, with a P value of 0.99 which is not significant.

In this study majority of the children were non- vegetarians. The association between dietary pattern and vitamin D levels was insignificant with P value 0.25.

This study showed that there was no statistically significant correlation between educational status, socioeconomic status and vitamin D levels (Table 3).

Table 1: Vitamin D Concentration and Optical Density

25-OH Vitamin D[nmol/1]	OD
0	2.146
5.3	1.927
15	1.538
40	0.952
110	0.44
320	0.187

Table 2: Age and Vitamin D Levels

	No of Children	Mean (Vitamin D level ng/ml)	SD	One way ANOVA F-test	P value
<5 yrs	18	34.28	7.70	F=3.72	
6 -10 yrs	9	32.97	10.40		**P=0.03**
11-18 yrs	18	26.95	7.98		

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Figure 2: Age and Vitamin D Levels

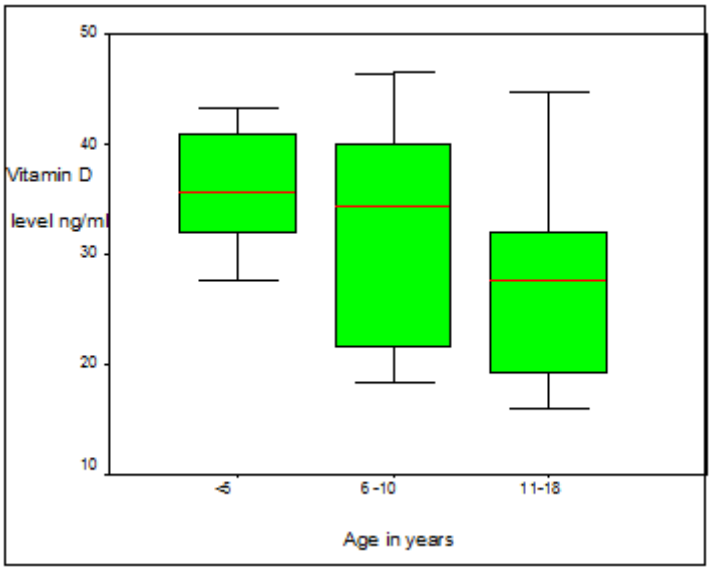

Table 3: Association between Demographic Variables and Vitamin D Levels

Demographic Variables		Vitamin-D levels						Total	Chi square test	P value
		Deficient		Insufficient		Normal				
		n	%	n	%	n	%			
	<5 yrs	0	0.0%	3	16.7%	15	83.3%	18		
	6 -10 yrs	2	22.2%	1	11.1%	6	66.7%	9	χ^2=10.5	P=0.03
	>10 yrs	8	44.4%	1	5.6%	9	50.0%	18		
Sex	Male	5	16.7%	5	16.7%	20	66.7%	30		
	Female	5	33.3%	0	0.0%	10	66.7%	15	χ2=3.76	P=0.15
Diet	Vegetarian	1	11.1%	0	0.0%	8	88.9%	9		
	Non vegetarian	9	25.0%	5	13.9%	22	61.1%	36	χ2=2.70	P=0.25
Education	Illiterate	5	27.8%	3	16.7%	10	55.6%	18		
	10th std	1	11.1%	0	0.0%	8	88.9%	9		
	12th std	2	22.2%	2	22.2%	5	55.6%	9	χ2=5.91	P=0.66
	Degree	2	25.0%	0	0.0%	6	75.0%	8		
	Professional	0	0.0%	0	0.0%	1	100.0%	1		
Income	< Rs.2500	5	33.3%	3	20.0%	7	46.7%	15		
	Rs.2500 -5000	1	9.1%	2	18.2%	8	72.7%	11		
	Rs.5001 -10000	4	30.8%	0	0.0%	13	69.2%	17	χ2=7.87	P=0.13
	>Rs.10000	0	0.0%	0	0.0%	2	100.0%	2		

DISCUSSION

This study showed that there is a high prevalence of vitamin D deficiency in children of all age groups. Among the 45 children in the study group, 30(66.7%) of them had normal vitamin D levels and 15(33.3%) of them had low levels of vitamin D. A multicentric study done in US among children aged 1-11 years, showed a high prevalence of vitamin D deficiency [7]. The study done in Boston by Catherine M Gorden et al also showed that vitamin deficiency was 24% and vitamin D insufficiency was 42% in their study group [8]. In our country sunlight is in plenty but the exposure to it is not adequate due to various reasons.

Bener A et al revealed that the prevalence of vitamin D deficiency in Qatari children <5 years of age was 9.5%, 5-10 years was 28.9%, 11-16 years was 61.6% [9]. Our study showed that none of the children <5 years had vitamin D deficiency. In our study the prevalence of vitamin D deficiency in children between 5 to 10 years was 22.2% and it was 44.4% among children 11-18 years of age. Both the studies showed that vitamin D deficiency was more among older children.

The study done in Iran by Razzaghy-Azar M et al showed that 34% of the boys, and 66% of the girls had vitamin D deficiency [10]. In our study 16.7% of the boys and 33.3% of the girls had vitamin D deficiency. Both studies showed that vitamin D deficiency was more among girls than boys. This may be due to the fact that boys play more outdoor games and hence are more exposed to sunlight compared to girls.

In our study majority of the children were non- vegetarians and there was no association between the dietary pattern and vitamin D levels was insignificant.

Marwaha et al study showed vitamin D deficiency in children from the upper socioeconomic status of New Delhi, India was 10.7% and among children from the lower socioeconomic status it was 12.4% [2]. Our study showed that there was no statistically significant correlation between educational status, socioeconomic status and vitamin D levels.

CONCLUSION

Our study shows that there is a high prevalence of hypovitaminosis D among apparently healthy children and adolescents. Hence, awareness needs to be created regarding the need for direct sunlight exposure for preventing this deficiency [11]. Further studies will guide us regarding the need for vitamin D fortification program in our country.

Conflict of interest declared none.

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