

Original Research Article

Vitamin D status in 3-6-year-old children of Mananthavady ICDS block in Wayanad, Kerala, India

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ABSTRACT

Background: Despite plenty of sunlight, vitamin D deficiency has been reported in both urban and rural population in India. This study was conducted to estimate the prevalence of Vitamin D deficiency in children between 3-6 years of age group belonging to Mananthavady ICDS block of Wayanad and to identify the sociodemographic variables affecting its level.

Methods: This descriptive cross-sectional study was conducted from December 2014 to June 2015. 140 children were selected from 20 Anganawadis in Mananthavady ICDS block in Wayanad district of Kerala state by random methods. After taking relevant history and conducting detailed clinical examinations, blood samples were taken to assess 25(OH) Vitamin D, calcium, phosphorous and alkaline phosphatase levels. Statistical analysis was done using PASW software. Calculations of means were done using descriptive statistics and comparative analysis was done using independent T test.

Results: Out of the 140 children 51 belonged to tribal community. The mean 25(OH) Vitamin D level was 22.7ng/ml. 47.1% of the population had deficient, 35% insufficient and 17.9% adequate Vitamin D levels. There was no statistically significant difference in Vitamin D levels between children of tribal and non-tribal community. There was significant increase in Vitamin D levels during summer when compared to that of winter and autumn seasons.

Conclusions: There is a high prevalence of vitamin D deficiency among the rural children of 3-6-year age of Mananthavady ICDS block. The Vitamin D levels were almost equal between the tribal and non-tribal children. Vitamin D levels are significantly higher during summer when compared to other seasons.

Keywords: Rural, Tribal children, Vitamin D, Wayanad

INTRODUCTION

Vitamin D is a fat-soluble vitamin essential for bone growth and calcium absorption. It has been traditionally known as anti-ricketic factor or sunshine vitamin. Besides its pivotal role in calcium homeostasis and bone mineral metabolism, vitamin D endocrine system is now recognized to sub serve a wide range of fundamental biological functions in cell differentiation, inhibition of cell growth as well as immunomodulation. In India, despite plenty of sunlight both in urban and surprisingly

even in rural population, people may be vitamin D deficient which is paradoxical to conventional science as reported by Goswami Kochipillai et al in adult North Indian villagers.¹ Vitamin D deficiency is very common in all ages and both sexes in India.² There is now a vast body of evidence to suggest that vitamin D deficiency is a major factor in the pathology of at least 17 varieties of cancer as well as heart disease, stroke, hypertension, autoimmune diseases, diabetes, depression, chronic pain, osteoarthritis, osteoporosis, myopathies, birth defects, periodontal disease, and many other diseases. This is

beyond the conventionally known rickets and osteomalacia.^{1,3-7}

This study was done in Mananthavady ICDS block in Wayanad district with the help of ICDS project Mananthavady, which is the largest ICDS project in the district and includes 100% rural population, and significant proportion of which comes under the tribal community.

This study was conducted to estimate the prevalence of Vitamin D deficiency in children between 3-6 years of age group belonging to Mananthavady ICDS block of Wayanad and to compare the Vitamin D levels of tribal and non-tribal children. It also aimed to identify the relationship between socio demographic variables and Vitamin D levels.

METHODS

This Descriptive Cross-Sectional Study was conducted in 20 randomly selected Anganwadis belonging to Mananthavady ICDS block in Wayanad district. Wayanad was selected for the study because of the large proportion of rural and tribal population. Mananthavady ICDS was the largest ICDS in the district and entire population is rural. Anganwadis were visited from December 2014 to November 2015, spanning 40 days, i.e. 2 days for each Anganwadi. 7 randomly selected children from each Anganwadi between 3 and 6 years of age were included for the study. Sample size of 140 was decided using the formula $n = \frac{4pq}{d^2}$, after taking estimated prevalence as 40%. Children suffering from any acute infections during the study time were excluded.

20 Anganwadis were visited weekly providing 2 days for each. All the Anganwadis were visited with the help of CDPO from the local area. Data was collected with the help of the Anganwadi workers and other staff in Mananthavady ICDS project. Mothers and caretakers

were interviewed; children clinically examined, and blood samples taken for analysis. Blood samples collected were stored in ice lined carriers and sent for assessing the level after each visit. Blood samples were tested for serum calcium, phosphorous, alkaline phosphatase and 25(OH) vitamin D3 levels. A vitamin D level above 30ng/ml was taken as optimum, 21-29ng/dl was take as insufficient, less than 20 is take as deficient. A value less than 10 ng/dl was considered as severe deficiency.⁸

Statistical analysis

The collected data were entered in Microsoft Excel and PASW Statistics 18 software for windows. Calculations of means were done using descriptive statistics and comparative analysis was done using independent T test and checked for statistical significance using P value. Crosstab Chi square was used in places necessary.

RESULTS

Total 140 children were included in the study. The mean level of vitamin D was 22.7 ng/dl which was in the insufficient range. Sixty-six children were having a vitamin D level below 20 nanogram/dl resulting in a prevalence of Vitamin D deficiency as 47.1% among the study population. Only 25(17.9%) children had optimum levels of Vitamin D. Forty-nine (35%) had insufficient levels. Among the deficient group six children were having severe deficiency. Out of these six children four were belonging to tribal community.

The mean value of calcium, phosphorous and serum alkaline phosphatase were 9.1 (range 6.9 -12.37) mg/dl, 4.7 (range 2-8.9) mg/dl and 262.5 (range 122-542) IU/l respectively. There was no statistically significant difference in the mean value of vitamin D among different age groups, gender, socioeconomic status or community (Table 1).

Table 1: Vitamin D levels and socio demographic factors.

Population characteristic	category	Number N=140	Percentage %	Vitamin D level		P value	Significance
				Mean	Standard deviation		
Age group	3-4 years	97	69.3	22.4	9.2	0.5	Absent
	5-6 years	43	30.7	23.5	12.2		
Gender	Male	69	49.3	22.6	10.6	0.8	Absent
	Female	71	50.7	22.8	10.3		
community	Tribal	51	36.4	22.9	11.4	0.8	Absent
	Non-Tribal	89	63.6	22.6	9.8		
Socioeconomic status	BPL	82	58.6	23.2	11.7	0.4	Absent
	APL	58	41.4	22	8.4		

Majority of children (n=133;95%) gave the history of having sun exposure more than 1 hour per day. There was no significant difference in vitamin D levels and duration of sun exposure.

Association of Vitamin D and dietary habits: There was significant difference in Vitamin D levels (p=0.04)

between those who consume fish and those who do not eat at all. (Table 2).

Seasonal changes in Vitamin D level: There was difference in Vitamin D with respect to change in seasons. Samples collected during summer season yielded higher levels of Vitamin D which was statistically significant (P<0.001) (Table 3).

Table 2: Food habits and vitamin D levels.

Food item	Consumption status	Number of children	Mean vitamin D levels	P value	Significance
Egg	Yes	125	22.5	0.6	Absent
	No	15	24.4		
Fish	Yes	128	23.2	0.04*	Present
	No	12	16.9		
Milk	Yes	111	22.7	0.5	Absent
	No	29	22.9		

*P <0.05 is significant

Table 3: Season and vitamin D level.

Season	Number of children n=140	Percentage %	Mean vitamin D level	Standard deviation	P value
Winter	37	26.4	21	9.33	< 0.001
summer	62	44.3	27.4	11.33	
South west monsoon	41	29.3	17.2	6.2	

Significant at <0.001

Table 4: IYCN practices and vitamin D levels.

		No. of children n = 140	Mean vitamin D levels	Standard deviation	P value	Significance
Breast feeding duration	<1 year	11	20.67	6.5	0.7	Absent
	1-2 year	63	22.85	9.6		
	>2 year	66	23	11.7		
Introduction of complementary feeds	< 6 months		22.9	11.1	0.3	Absent
	≥6 months		22.1	8.2		
Vitamin D supplementation in infancy	Given		20.2	4.1	0.6	Absent
	Not given		22.8	10.5		

Table 5 Nutritional status and vitamin D levels.

parameter	Status	No. of children n = 140	Mean vitamin D level	Standard deviation	P value	significance
Weight for age	No PEM	79	22.4	10.2	0.7	Absent
	PEM present	61	23.1	10.7		
Weight for height	Wasting present	118	23.3	11.06	0.9	Absent
	wasting absent	22	21.2	6.2		
Height for age	Stunting present	96	22.7	10.7	0.4	Absent
	Stunting absent	44	22.8	9.9		

The relationship between Infant and Young Child Feeding (IYCN) practices and vitamin D levels: There was no significant association between Vitamin D levels and duration of breast feeding, age of introduction of complementary feeds or Vitamin D supplementation in infancy (Table 4).

The relationship between nutritional status and vitamin D levels: There was no significant relationship between Vitamin D levels and nutritional status (Table 5).

DISCUSSION

Majority of children studied had significantly low level of Vitamin D levels. Prevalence of Vitamin D deficiency in 3-6-year-old children of Mananthavady ICDS project is 47.1%. In a study by Basu et al conducted in Kolkata, prevalence of vitamin D deficiency in 1-5-year age group was 69.2%, mean average value to be 23 ng/ml.⁹ Prevalence of Vitamin D deficiency in present study is comparatively lower to this. Marwaha et al have shown that healthy school children in New Delhi had mean serum level of 12 ng/ml, and over 90% of children were vitamin D deficient which shows even much higher prevalence.¹⁰ Harinarayan et al's study in rural and urban children residing in the southern state of Andhra Pradesh report Vitamin D deficiency in 81.5% of urban male children and 76.5% in rural areas which is also comparatively poorer status compared to the present study.¹¹

Mean serum level of calcium in population studied by Basu et al was 9.5mg/dl. Mean Phosphorous level and alkaline phosphorous were 5mg/dl and 239 IU/L which is comparable to our study.⁹

Majority of the children in the study use to consume fish. Locally available varieties are mainly sardines which are rich in Vitamin D. Many people have domestic farmed poultry, so that the eggs consumed are pastured eggs and rich in Vitamin D, but only very few children eat egg on a regular basis. There was significant increase in Vitamin D levels in children who consume fish and those who do not. This is well described in other studies also.¹² There was no statistically significant difference in Vitamin D levels with regard to intake of milk and egg.

Children belonging to BPL family had mean Vitamin D level comparable to those who belong to APL family. It means that there is no much difference with respect to economic strata.

Level of Vitamin D changes with season, probably due to sunlight intensity and UV-B radiation. It was found that Vitamin D level was significantly higher in summer when compared to other seasons. In a study by Cole CR et al the mean \pm SD serum 25(OH)D levels measured during the winter, spring, summer, and autumn seasons were 24.8 \pm 8.5, 25.4 \pm 7.9, 27.3 \pm 5.7, and 27.9 \pm 8.4 ng/mL, respectively.¹³ Study enrolment during spring and

summer reduced the likelihood of vitamin D deficiency by ~20% (spring, OR: 0.85 [95% CI: 0.73-0.98]; P = .03; summer, OR: 0.82 [95% CI: 0.73-0.92]; P < .01). Data from the present study matches with that of Basu et al proving low Vitamin D level in winter (P = 0.002) and spring (P = 0.03) compared to summer.⁹ This study showed that Vitamin D levels were quite high during March and April when there is no rain and there is adequate sunlight. During June to August when southwest monsoon is in progress and as well as during December and January when winter is prevalent, vitamin D levels were found to be low.

CONCLUSION

Prevalence of Vitamin D deficiency in 3-6-year-old children in 20 randomly selected Anganwadis of Mananthavady ICDS project is 47.1%. Mean average Vitamin D level of the group of children studied is 22.7ng/ml. Vitamin D levels are significantly higher in those children who consume fish and in those children whose blood were taken during summer months. The Vitamin D levels were almost equal between the tribal and non-tribal children Vitamin D level does not significantly vary with other socio demographic variables in the study.

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