

## Original Research Article

DOI: <https://dx.doi.org/10.18203/2349-3291.ijcp20210116>

# Prevalence of vitamin d deficiency and its correlation with anthropometric measurements in neonates in a tertiary care center: a cross sectional study

Ashvini Anbalagan\*, Nalini Aswathaman, N. S. Raghupathy

Department of Pediatrics, Aarupadai Veedu Medical College and Hospital, Pondicherry, India

Received: 13 November 2020

Accepted: 07 January 2021

**\*Correspondence:**

Dr. Ashvini Anbalagan,

E-mail: ashvini.anbalagan10@gmail.com

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## ABSTRACT

**Background:** Globally hypovitaminosis D is highly prevalent among all population unsparing pregnant mothers. Maternal hypovitaminosis has negative implications on growing fetus. In India, only limited data is available on prevalence of neonatal vitamin D level. Hence this study was done to estimate the prevalence of cord blood vitamin D levels and its relation with anthropometric measurements in newborns.

**Methods:** A cross sectional study was conducted in a tertiary care center on 30 newborns. Cord blood 25 OHD levels and anthropometric measurements were taken. Data were analyzed statistically.

**Results:** Among 30 newborns, 10%, 43% and 46% of babies had vitamin D deficiency (<12 ng/ml), insufficiency and sufficiency respectively. 23% were low birth weight. 43% of low-birth-weight babies had statistically significant (p value<0.0001) hypovitaminosis D. No correlation found between vitamin D status and other anthropometric measurements.

**Conclusions:** Prevalence of hypovitaminosis D has negative implications on birth weight which needs further studies.

**Keywords:** Vitamin D deficiency, Newborn, Cord blood, Anthropometry

## INTRODUCTION

Vitamin D or sunshine vitamin is a fat-soluble vitamin and a prohormone essential for calcium homeostasis. Deficiency of vitamin D manifests as rickets in growing children and osteomalacia in adults.<sup>1</sup>

Prevalence of Hypovitaminosis D is high worldwide varying between 30-90% in adults and 84-100% in children. Prevalence of hypovitaminosis D among pregnant and lactating mother are 42-74% and 70-81% respectively in India.<sup>2</sup>

It is very essential to prevent maternal vitamin D deficiency as the growing fetus and neonate depends on maternal circulating 25-hydroxyvitamin concentrations.

Maternal hypovitaminosis D adversely affect anthropometric parameters, skeletal mineralization, immune modulation in early infancy, increased risk for asthma and type 1 diabetes in later life.<sup>3</sup>

Major causes of vitamin D deficiency are attributed to skin pigmentation, sun exposure, dietary intake, socio-cultural practices and obesity apart from maternal vitamin D deficiency, defects in vitamin D metabolism low calcium intake, intestinal malabsorption and genetic variation in babies.<sup>2,4</sup>

Adequate sun exposure in tropical region is considered as exposing skin (arms and face area) to sunlight without applying sunscreen for half an hour between 10 am to 2 pm every day to avoid hypovitaminosis D.<sup>5</sup>

The AAP recommends sera concentration of more than 32 ng/ml in pregnant mothers for optimal growth and development of the newborn.<sup>6</sup>

Infants who are exclusively breastfed are at great risk of vitamin D deficiency. Even though neonates receive routine vitamin D supplementation of 400 1U as per AAP recommendation, the prevalence of vitamin D deficiency is still high in newborns especially preterm neonates in studies conducted in north India.<sup>7,6</sup>

Due to the limited neonatal data, IAP recommended a consensual guideline in the year 2017 with vitamin D concentration of <12 ng/ml as deficient, 12-20 ng/ml as insufficient and >20 ng/ml as sufficient.<sup>9</sup> Whereas the US endocrine society defines serum levels of 25(OH)D less than 20 ng/ml, 21-30 ng/ml and >30 ng/ml as deficiency, insufficiency and sufficiency respectively.<sup>10</sup>

Various studies suggests that cord blood serum concentration of vitamin D is directly correlated with maternal levels and cord blood concentrations may be even higher.<sup>11</sup>

This study aims to estimate the prevalence of vitamin D deficiency in cord blood of neonates in a tertiary care center and to correlate it with anthropometric parameters in them.

## METHODS

This study was done as a cross sectional study in the department of Paediatrics in Aarupadai Veedu Medical College and Hospital, in Puducherry, South India with duration of 4 months from May 2020 to August 2020.

After institute ethical committee clearance and parental consent, we included 30 newborns irrespective of their gestational age and excluded those infants with major

congenital anomalies requiring cardiopulmonary support. 4 ml of umbilical cord blood sample was collected immediately. Serum was separated and stored at-20 C till processing for 25OHD. Analysis was done by automated chemiluminescent immunoassay using DiaSorin liaison equipment.

Cut off of 25 OH vitamin D levels <12 ng/ml was considered deficient, 12-20 ng/ml as insufficient and >20 ng/ml as sufficient (IAP guidelines 2017).

Maternal and neonatal data were recorded using a proforma and anthropometric measurements were recorded within 24 hours of life.

Weight of the baby was measured using electronic weighing scale with accuracy of  $\pm 5$  gm. Length was measured using infantometer with accuracy of 0.1cm.

Head circumference and chest circumference was measured using flexible, non-stretchable measuring tape with accuracy 0.1 cm.

Routine supplementation of vitamin D 400 1U units was given to all neonates.

Data were analysed statistically using SPSS statistical software version 23 and p value of <0.05 was taken as statistically significant.

## RESULTS

Among 30 newborns, 10% of babies had vitamin D deficiency based on IAP consensual guidelines 2017.

According to US endocrine society cut off, prevalence of vitamin D deficiency was found to be 53% in contrast to the prevalence by IAP guidelines which was only 10%.

**Table 1: Distribution on prevalence of vitamin D deficiency**

Vit D level (ng/ml)	N	%	Mean	SD	Median	Min	Max
<12	3	10	11	1.05	11.4	9.8	11.8
12-20	13	43	16.37	2.63	16.69	12	19.7
>20	14	47	29.01	7.14	26.24	22.65	42.5

**Table 2: Comparison on prevalence of vitamin D deficiency using various guidelines**

Vitamin D status	IAP guideline (%)	US endocrine society (%)
Deficiency	10	53
Insufficiency	43	33
Sufficient	47	14

**Table 3: Baseline data**

Parameters		Number (N)	N %	Mean	SD	P
Gestational age (weeks)	Late pre-term	3	10.0	18.02	1.23	0.468
	Early term	21	70.0	20.76	9.75	
	Full term	6	20.0	24.92	4.81	

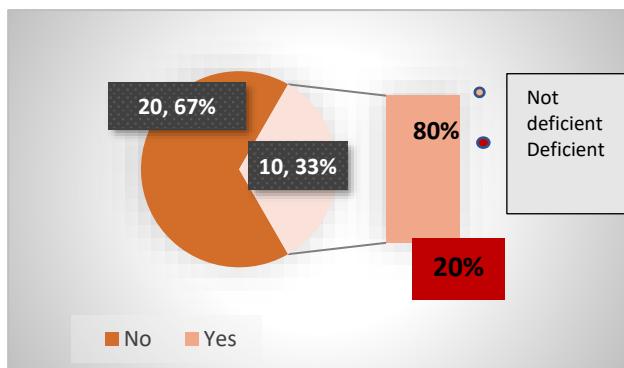
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Parameters	Number (N)	N %	Mean	SD	P	Parameters
<b>Gravida</b>	Primi	13	43.3	21.77	7.67	0.806
	Multi	17	56.7	20.97	9.44	
<b>Maternal illness</b>	Nil	20	66.7	23.83	8.57	0.021
	Anemia	1	3.3	12.20	n/a	
	GDM	3	10.0	15.82	3.68	
	Hypothyroidism	4	13.3	13.59	3.27	
<b>Maternal sun exposure</b>	PIH	2	6.7	24.47	10.92	0.162
	Poor	3	10.0	14.68	2.35	
	Adequate	27	90.0	22.05	8.73	
<b>Gender</b>	Male	10	33.3	22.19	9.03	0.476
	Female	20	66.7	20.88	8.56	

In this study, 10% of babies were late pre-term, 70% were early term and 20% were full term gestation. There was no statistical difference in vitamin D level across various gestational age ( $p=0.468$ ). There was no difference in vitamin D level between primi and multi mothers with mean values of  $21.77\pm7.67$  and  $20.97\pm9.44$  ng/ml respectively ( $p=0.806$ ). Out of 30 babies, 10% of babies had poor maternal sun exposure with mean vitamin d level of  $14.68\pm2.35$  ng/ml. No statistical difference was observed between adequate maternal sun exposure and cord blood vitamin D levels ( $p$  value=0.162).

**Table 4: Distribution based on maternal illness.**

Parameters	N	Mean vit D (ng/ml)	S.D.	P
<b>Maternal illness</b>	No	20	23.83	8.59
	Yes	10	16.29	6.31



**Figure 1: Distribution based on maternal illness.**

In 67% of newborns with whose mothers had no illness, the mean vitamin D level was  $23.83\pm8.59$  ng/ml and 33% of newborns whose mothers had illness, the mean value of vitamin D level was  $16.29\pm6.31$  ng/ml which was statistically significant ( $p$  value 0.021).

In 30 newborns, 7 were low birth weight (23%) and 23 were normal birth weight (77%). Out of 7 low birth weight babies, 3 babies had vitamin D deficiency which corresponds to 43% of low-birth-weight babies ( $p$  value

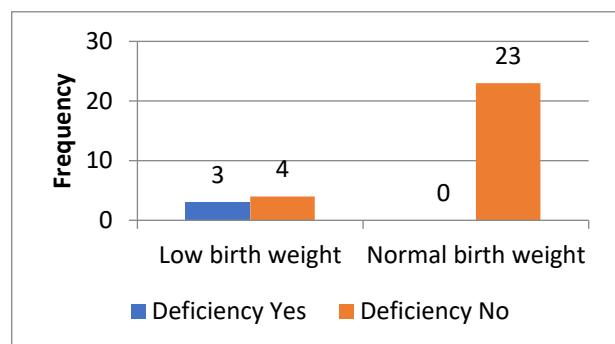
$<0.0001$ ). There is no correlation between length and head circumference of babies with vitamin D level.

**Table 5: Correlation of vitamin D level with anthropometric measurements.**

Cord blood vit D	Birth weight	Length	HC
Pearson correlation	0.272	-0.200	-0.280
P value	0.146	0.289	0.134

**Table 6: Distribution of birth weight in relation to vitamin D deficiency.**

Weight	Deficiency		Total	P
	Yes	No		
Low birth weight	3	4	7	
Normal birth weight	0	23	23	<0.0001
Total	3	27	30	



**Figure 2: Distribution of birth weight in relation to vitamin D deficiency.**

## DISCUSSION

Vitamin D deficiency is the most common nutritional deficiency that often goes undiagnosed. Vitamin D deficiency is common in infancy due to factors such as maternal hypovitaminosis D, decreased dietary intake, decreased cutaneous synthesis, increasing rate of

exclusive breast feeding. Screening and routine supplementation of pregnant mothers is controversial.<sup>12</sup> We studied the prevalence of hypovitaminosis D in newborns by testing the cord blood sample. We included 30 newborns irrespective of their gestational age who all belonged to low socioeconomic status, 10, 43 and 47% of babies had vitamin D deficiency ( $<12$  ng/ml), insufficiency and sufficiency respectively based on IAP consensual recommendation with a mean value of 21.63 ng/ml.

A study conducted by Devaraj et al on 50 newborns in Kerala, 94 % of them had vitamin D deficiency based on the cutoff of US endocrine society. If we had considered US endocrine society cutoff, the prevalence of vitamin D deficiency was 53% in our study which is still lower compared to Devaraj et al study.<sup>13</sup>

In our study, 43% of mothers were primi and 57% multi gravida. There was no statistically significant effect of cord blood vitamin D level in relation to obstetric score among them, with mean values of  $21.77 \pm 7.67$  and  $20.97 \pm 9.44$  ng/ml among primi and multigravida respectively (p value=0.806).

Similar results were found in the study done by Kocher et al where he studied 255 newborns and found no association between obstetric score and maternal age with cord blood vitamin D status.<sup>4</sup>

We studied the effect of maternal sun exposure and maternal illness on cord blood vitamin D. Daily sun exposure was assessed by taking a detailed history of the daily exposure and the type of clothing worn. There was no statistically significant difference among them.

Pregnancy related ailments such as anemia, GDM, PIH, hypothyroidism was included in maternal illness. 67% babies of whose mothers had no illness had higher mean value of  $23.83 \pm 8.59$  ng/ml compared to 33% babies whose mothers had illness with lower mean vitamin D level of  $16.29 \pm 6.31$  ng/ml (p value 0.021). Similar results were given in the meta-analysis done by Thorne et al.<sup>14</sup>

Sachan et al studied cord blood and maternal 25-hydroxyvitamin D level with sun exposure, daily calcium intake (dietary plus supplemental), and intact parathyroid hormone (PTH) concentrations. Cord blood Vitamin D level was statistically lower among urban population as compared to rural population (p value<0.001).<sup>15</sup>

In this study on cord vitamin D levels and anthropometric parameters correlation, 77% of newborns had normal birth weight and 23% were low birth weight. Among the low-birth-weight newborns, 43% neonates had vitamin D deficiency which was statistically significant (p value<0.0001) whereas there was no such correlation between vitamin D levels with normal birth weight.

There was no statistically significant correlation between length, head circumference and vitamin D levels.

Wierzejska et al studied maternal and cord blood vitamin D levels and its implication on anthropometry in term newborns which had a prevalence of 50% vitamin D deficiency and no correlation of cord blood vitamin D with anthropometry.<sup>11</sup>

A systematic review and meta-analysis by Thorne-Lyman et al also stated there was no association between vitamin D deficiency on neonatal outcomes. Similar results were given by Kocher et al.<sup>4,14</sup>

Although the percentage of vitamin D deficiency neonates with low birth weight was considerable, the other determinant factors of low birth weight such as maternal age, maternal nutrition were not analyzed in this study.

### Limitations

The main limitation of this study was small sample size and we did not measure the maternal vitamin D status. Another limitation was that we did not measure PTH, calcium, and phosphorus values correlating with vitamin D.

### CONCLUSION

This study showed significant prevalence of vitamin D deficiency in cord blood even in a tropical region. There is no statistically significant correlation between hypovitaminosis D and anthropometry. However, considering the limitations of this study, need for further studies with larger sample size are required to find out better neonatal implications and outcomes.

### Recommendations

It is practically difficult to screen all mothers for vitamin D status. Categorizing the high-risk mothers and screening the neonate with cord blood helps in prompt treatment apart from routine supplementation for the infant-mother dyad which can improve the neonatal outcomes.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Anbalagan A, Aswathaman N, Raghupathy NS. Prevalence of vitamin d deficiency and its correlation with anthropometric measurements in neonates in a tertiary care center: a cross sectional study. *Int J Contemp Pediatr.* 2021;8:295-9.