

## Original Research Article

# Vitamin D status in exclusively breast-fed infants and their mothers

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### ABSTRACT

**Background:** India, despite being a tropical country has widespread vitamin D deficiency across all age groups. Present study was conducted to estimate the prevalence of subclinical hypovitaminosis D in exclusively breastfed infants and their mothers and also to study the correlation between the Vitamin D levels of these infants and their mothers.

**Methods:** This cross-sectional study was conducted in 37 exclusively breastfed infants aged 6 months and below and their mothers. Under strict aseptic precautions 2 ml of blood was taken from each infant and mother 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.

**Results:** In present study, authors found that 78.3% of the mothers were Vitamin D deficient and 21.7% of the mothers were Vitamin D insufficient. Among the infants, authors found that 91.9% of the infants were Vitamin D deficient and 8.1% of the infants were Vitamin D insufficient. The association between dietary pattern and socio-economic class and mean maternal vitamin D levels was found to be statistically significant ( $p < 0.05$ ).

**Conclusions:** There is a high prevalence of hypovitaminosis D amongst exclusively breastfed infants and their mothers. Hence, public awareness needs to be created regarding the benefits of sunlight exposure. Vitamin D fortification of food products and routine Vitamin D supplementation program for antenatal and lactating mothers and their young infants may be able to address this emerging public health problem in our country.

**Keywords:** Hypovitaminosis D, Vitamin D, Vitamin D deficiency in mothers and infants, Vitamin D status in infants

## INTRODUCTION

India, despite being a tropical country has widespread vitamin D deficiency across all age groups. In fact, hypovitaminosis D has emerged as a significant public health problem in the recent times. A few studies from our country have shown that Vitamin D deficiency is widely prevalent in all age groups including neonates, and their mothers.<sup>1,2</sup> Several factors like skin pigmentation, inadequate exposure to sunlight, genetic factors and socioeconomic status influence vitamin D metabolism.<sup>3</sup> This may explain the high prevalence of

vitamin D deficiency in India, despite being a tropical country. The beneficial effects of vitamin D in improving skeletal health start from the fetus and continue throughout childhood and into adulthood.<sup>4</sup>

Studies from several countries report a high prevalence of vitamin D deficiency among women of child-bearing age, during pregnancy and lactating mothers. Infants who are exclusively breastfed but who have not had adequate sunlight exposure and infants with darker pigmentation are at increased risk of developing vitamin D deficiency.<sup>5</sup> This is likely to have adverse

consequences for the women, the fetus and growing infants and the children. Reduced maternal vitamin D levels have shown to be associated with increased risk of preeclampsia, and gestational diabetes mellitus and low birth weight neonate.<sup>6-8</sup>

However, there is limited information about vitamin D status in lactating mothers and their breastfed infants. Hence, authors planned to estimate the prevalence of subclinical hypovitaminosis D in exclusive breastfed infants and their mothers and also to study the correlation between the Vitamin D levels of these infants and their mothers.

**METHODS**

This cross-sectional study was conducted over a 1-year period from June 2014 to July 2015 in a tertiary care hospital.

**Inclusion criteria**

Thirty-seven exclusively breastfed infants aged 6 months and below and their mothers attending the Pediatric OPD or admitted in the ward and in whom consent was obtained were included in the study.

**Exclusion criteria**

Children with systemic illness, endocrine disorders, and children on vitamin D supplement and mineral supplementation were excluded from the study.

The details of the study were explained, and informed consent was obtained from the mother. A pre-structured proforma containing demographic details and examination findings was used. Under strict aseptic precautions, 2 ml of blood was drawn, centrifuged and stored in -200 Celsius and analyzed at the completion of the study. The ELISA kit was expensive and hence authors had to store the samples and analyze them together at a single point of time. Serum 25 (OH) D was estimated using the VIDAS Total KIT ref 30463, lot 1004205180.

**Table 1: Endocrine society clinical guidelines 2011.<sup>9</sup>**

Status	25-(OH) Vitamin D
Deficient	<20 ng/ml
Insufficient	20-29 ng/ ml
Sufficient	30-100 ng/ml
Potential toxicity	>100 ng/ml

Hypovitaminosis D is vitamin D insufficiency and vitamin D deficiency. The institutional ethical committee approval was obtained. Statistical analysis was done by using the chi-square test and the one-way ANOVA f-test and the student independent t-test.

**RESULTS**

A cross sectional study on the Vitamin D status of 37 exclusively breast-fed infants and their mothers was done. It was found that 78.3% of the mothers were Vitamin D deficient and 21.7% of the mothers were Vitamin D insufficient.

Among the infants, it was found that 91.9% of the infants were Vitamin D deficient and 8.1% of the infants were Vitamin D insufficient.

In this study the mean serum 25 OHD concentrations in mothers was found to be 14.41ng/ml and among infants it was found to be 11.22 ng/ml.

Among the 37 infants in the study group, 18(48.6%) were males and 19 (51.4%) were females. The youngest infant was 15 days old and the oldest was 4 months 25 days. Largest proportion (43.2%) of the infants was in the age group of 1-2 months and the smallest proportion (5.4%) was in the age group of 4-5 months. The age group and sex distribution of the infants is given in Table 2.

**Table 2: Age and sex distribution of the children.**

Age in months	Sex		Total n (%)
	Male n	Female n	
0-1	2	3	5 (13.5)
1-2	7	9	16 (43.2)
2-3	7	2	9 (24.3)
3-4	1	4	5 (13.5)
4-5	1	1	2 (5.4)
Total	18	19	37

In the study, it was found that mothers in the age group of 18-20 years had a higher mean vitamin D level (18.20 ng/ml) than mothers in the age group of 26-30 years (13.08 ng/ml) and this was found to be statistically significant (p=0.05).

In this study majority of the mothers were non-vegetarians (81.1%) and had higher vitamin D levels. The association between dietary pattern and mean vitamin D levels was found to be statistically significant (p <0.05).

The respondents were divided into socio-economic groups based on the modified Kuppaswamy’s scale of SES. Majority of them (64.9%) belonged to lower middle class, followed by (29.7%) to upper lower class and (5.4%) to lower class.

Mothers belonging to the lower class had a lower levels of vitamin D than mothers from upper lower class and this difference was found to be statistically significant (p=0.05). The details are given in Table 3.

**Table 3: Association between socio-demographic characteristics and mean Vitamin D levels in mothers.**

Particulars		Mean serum 25-(OH) D ng/ ml	SD	One-way ANOVA F-test/ t-test
Mother's age in years	18 - 20	18.20	7.39	F=3.66 p=0.05* significant
	21 - 25	17.88	5.60	
	26 - 30	13.08	4.70	
Mother's diet	Mixed	15.50	5.32	t=3.06 p=0.001*** significant
	Vegetarian	8.77	0.73	
Socio economic status	Lower	11.25	7.00	F=3.65 p=0.05* significant
	Lower middle	12.82	5.54	
	Upper lower	17.59	5.69	

**Table 4: Association between socio-demographic characteristics and mean Vitamin D levels in infants.**

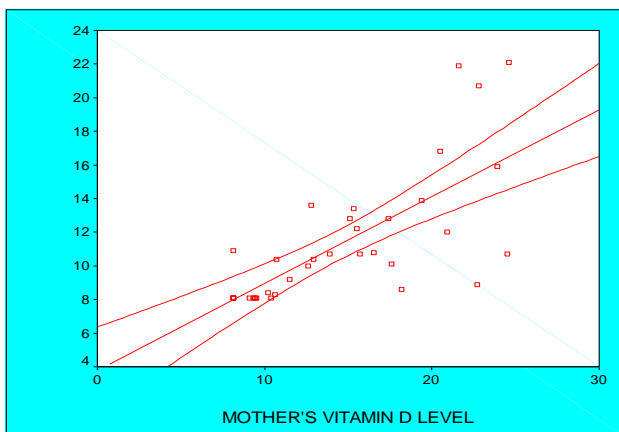
Particulars		Mean serum 25-(OH) D ng/ ml	SD	One-way ANOVA F-test/ t-test
Age (months)	0-1	12.58	5.68	F=1.16 p=0.34
	1-2	10.75	3.84	
	2-3	10.14	2.66	
	3-4	14.04	4.03	
	4-5	9.45	9.45	
Sex	Male	10.67	3.42	F=0.83 p=0.40
	Female	11.75	11.75	

This study showed no statistically significant association between the age and gender of the infants and vitamin D levels.

**Table 5: Correlation between mother's Vitamin D level and infant's Vitamin D level.**

Particulars	Mean serum 25-(OH) D ng/ ml	SD	Karl Pearson correlation coefficient
Mother's Vitamin D level	14.41	5.47	r=0.73 P=0.001***
Baby's Vitamin D level	11.22	3.89	

In this study, it was found that there was a significant, substantial, positive correlation between the mothers and infants vitamin D level score (r=0.73, P=0.001).



**Figure 1: Scatter plot with regression estimate.**

The Scatter plot shows the significant, positive, substantial correlation between mother and infants Vitamin D level.

**DISCUSSION**

This study showed that there is a high prevalence of vitamin D deficiency among exclusively breast-fed infants and their mothers. In present study, it was found that 78.3% of the mothers were Vitamin D deficient and 21.7% of the mothers were Vitamin D insufficient. Among the infants, it was found that 91.9% of the infants were Vitamin D deficient and 8.1% of the infants were Vitamin D insufficient. This may be due to changing lifestyles, urbanization and excessive clothing leading to inadequate sunlight exposure across populations. It is expected that the vitamin D content of human milk is related to the lactating mother's vitamin D status.<sup>10</sup>

Balasubramaniam et al also reported that Vitamin D deficiency is highly prevalent in exclusive breastfed infants in Chennai.<sup>11</sup> Jain et al conducted a study in New Delhi among healthy breastfed term infants at 3 months and their mothers and they reported that 66.7% of infants and 81.1% of mothers were Vitamin D deficient and 19.8% of infants and 11.6% of mothers were insufficient.<sup>12</sup> Another study which was conducted among pregnant woman and their newborns in North India done by Sachan A et al also observed the mean serum Vitamin D levels of mothers were 14 ng/ml and cord blood mean serum Vitamin D levels were 8.4 ng/ml.<sup>13</sup>

Similar study conducted in UAE by Dawodu et al revealed a mean serum 25 OH D concentration in

mothers as 8.6 ng/ml and in infants as 4.6 ng/ml. This study was done in UAE in a Muslim population. It is a known fact the Muslim women wear purdah and do not get exposed to enough sunlight which also plays a vital role in the synthesis of Vitamin D. This could be the reason for their low mean Vitamin D levels.<sup>14</sup> In present study, it was found that mothers belonging to the lower class had lower levels of vitamin D than mothers from upper lower class and this difference was found to be statistically significant. Similar observations were made by Marwaha et al.<sup>15</sup>

In present study the mean serum 25 OH D concentration in mothers were 14.41ng/ml and infants were 11.22ng/ml. Authors found a significant positive correlation between the maternal and infants Vitamin D levels. Seth et al reported a high prevalence of vitamin D deficiency both among the lactating mothers (47.8%) and their exclusively breastfed infants (43.2%). They also found that vitamin D status of mothers and their infants were closely correlated.<sup>16</sup> Similar observations were made by Soumya et al.<sup>17</sup>

A Cochrane review in 2016 concluded that limited data is available regarding maternal Vitamin D requirements during pregnancy and lactation, despite the fact that maternal Vitamin Deficiency has been documented in a number of studies. In view of positive correlation between vitamin D status of the mothers exclusively breastfed infants, it has been suggested that improving the Vitamin D levels of the mothers may improve the Vitamin D levels of the infants.<sup>18</sup>

## CONCLUSION

Present study shows that there is a high prevalence of hypovitaminosis D among exclusively breastfed infants and their mothers in Chennai, though in a tropical zone. It was found that there was a significant, positive correlation between mothers and their infant's vitamin D levels. Hence, public awareness needs to be created regarding the need for sunlight exposure for preventing this deficiency.<sup>19</sup> Vitamin D fortification of food products and routine Vitamin D supplementation program for the antenatal and lactating mothers and their young infants<sup>20</sup> may be able to address this emerging public health problem in our country.

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