



Study of Vitamin-D Levels in Exclusively Breastfed Babies in a Hospital of South India

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ABSTRACT

Exclusive breastfeeding is recommended up to 6 months of age with all its beneficial effects on child survival. Globally as many as 1.45 million lives are lost due to suboptimal breastfeeding in developing countries. WHO analysis of childhood deaths has listed suboptimal breastfeeding as one of the most important shared risk factors and estimated that 1.3 million deaths can be prevented in 42 high mortality countries by increasing the level of breastfeeding amongst infants. The increase in the practice of breastfeeding associated with the belief that "breast is best" and that breast milk does not require supplementation because it is a baby's "perfect food" may lead to decreased 25-hydroxy vitamin D(25-OHD) intake from other sources and thereby causing rickets. The prevalence of hypovitaminosis D in exclusively breastfed infants was found to be 82%, 52% and 20% from UAE, Pakistan and China respectively but there is a paucity of data from India regarding the same.

KEYWORDS :

INTRODUCTION:

Exclusive breastfeeding is recommended up to 6 months of age with all its beneficial effects on child survival. The new born infant born to a vitamin D replete mother is protected from vitamin D deficiency for the first few months of life as 25-OHD crosses the placenta readily and neonatal levels approximate two thirds maternal serum concentrations. Serum 25-OHD has a half-life of approximately 3 weeks, thus providing some protection against vitamin D deficiency for the first two months even if the young infant does not receive vitamin D, whereas an infant who is exclusively breast-fed and who gets minimal sunlight exposure or an infant who is on a non fortified milk the risk of developing vitamin D deficiency rickets by 4-6 months of age is very high.

It has been estimated that breast milk from a vitamin D replete mother contains between 20 and 60 IU/l of vitamin D and hence adequate intake of vitamin D cannot be met with human milk as the sole source of vitamin D in a breastfeeding infant.

Since there is a paucity of data from India regarding Vitamin D status of their mothers and their new born infants this study was undertaken to identify the prevalence of subclinical hypovitaminosis D in exclusively breastfed babies and their mothers in a tertiary care hospital.

Aim of the Study

1. To study the serum Vitamin D levels among the exclusively breast fed babies.
2. To determine the serum Vitamin D levels among their lactating mothers.
3. to study the correlation between the Vitamin D levels of exclusively breast fed babies and their mothers.
4. To determine the prevalence of subclinical hypovitaminosis D among exclusively breast fed babies and their mothers.

Subjects and Methods

Study Design : Descriptive study
Place of the Study : Shadan Hospital, Hyderabad.
Period of the Study : June 2014 to January 2016
Study Population : All exclusively breast fed healthy term babies with birth weight > 2.5 kg who are less than 6 months of age and their mothers.

Inclusion Criteria :

1. Infants who are exclusively breastfed less than 6 months of age and their mothers.

Exclusion Criteria:

1. Infants who are not exclusively breast fed.
2. Infants on vitamin D, Multivitamin or any other supplementation (Calcium, Phosphorus).
3. Mothers who are receiving Vitamin D, Calcium or other mineral supplementation.
4. Infants suffering from any illness.
5. Mothers suffering from any illness.

Methodology:

This was a descriptive study conducted in a tertiary care hospital in Hyderabad. The sample frame included healthy term babies on exclusive breast feeding, who were attending the immunisation clinic and their mothers who consented to the study during the period June 2014 to January 2016.

ENROLMENT OF STUDY PARTICIPANTS:

The calculated sample size for an anticipated prevalence of Vitamin D deficiency of 80% to fall within 10 percent of true prevalence with 95% confidence was 128. However because of logistic constraints it was planned to enrol 37 infants and 37 mothers dyads.

The inclusion criteria was infants who are exclusively breastfed and who are less than 6 months of age and their mothers. Infants and mothers who were on Vitamins and mineral supplementation were not included in the study. Mothers and infants who had other illnesses were not included in the study.

Institutional ethical committee approval was obtained. After taking written informed consent from the mothers all relevant informations were recorded in the prestructured questionnaire.

Data regarding the sociodemographic details like education, occupation and income were obtained. Details regarding the mode of feeding of infants, supplementation of any Vitamin or Calcium to infants, supplementation of any Vitamin or Calcium to infants, mothers intake of Calcium & Vitamin D supplementation during lactation were enquired. Anthropometric measurements such as length, weight and head circumference of the infants were measured. Clinical examination of the mother and infant to rule out systemic illness and status was classified as per the modified kupuswamy scale of classification (92013).

Blood (4ml) was drawn from both the mother and infant for estimation of 25 (OH) D3 9(Vitamin D).

Estimation was done using VIDAS Total KIT. The measurement range extends from 8.1 ng/ml UPTO 126NG/ML. Values below the lower limit of the measurement range are reported as <8.1ng/ml. Values above the upper limit of the measurement range are reported as <126.0ng/ml.

As per the Endocrine Society Clinical Guidelines 2011

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

Statistical analysis:

Statistical analysis was done by using Chi-square test, One way Anno-va f-test and student Independent t-test. Correlations were studied using Karl Pearson correlation coefficient.

Results

1. INFANTS VITAMIN D STATUS :

Infants Vitamin D Status	Number of Infants	%
Deficient	34	91.8
Insufficient	3	8.2
Total	37	100

Tab. 1. Infants Vitamin D Status

Inference:

Among the 37 infants studied, 34 (91.8%) were deficient of Vitamin D and 3(8.2%) were insufficient of Vitamin D.

2. MOTHERS VITAMIN D STATUS:

Infants Vitamin D Status	Number of Infants	%
Deficient	29	78.3
Insufficient	8	21.7
Total	37	100

Tab. 2. Infants Vitamin D Status

Inference:

Among the 37 mothers studied, 29 (78/3%) were deficient of vitamin D and 8 (21.7%) were insufficient of Vitamin D.

3. INFANTS AGE DISTRIBUTION:

Age (in months)	No. of Babies	%
0-1 month	5	13.5
1-2 months	16	43.2%
2-3 months	9	24.3%
3-4 months	5	13.5%
4-5 months	2	5.4%
Total	37	100.00

Tab 3. Infants Age distribution

Inference:

Among the 37 infants studied, 5(13.5%) infants were Between the age of 0-1 month, 16 (43.2%) infants were Between the age of 1-2 months, 9(24.3%) infants were Between the age of 2-3 months, 5(13.5%) infants were Between the age of 3-4 months, 2(5.4%) infants were Between the age of 4-5 months.

4. INFANTS AGE AND VITAMIN D LEVELS

AGE	MEAN Vit D ng/ml	SD	One way ANOVA F-Test/t-test
0-1 month	12.58	5.68	F=1.16 p=0.34 not significant
1-2 months	10.75	3.84	
2-3 months	10.14	2.66	
3-4 months	14.04	4.03	
4-5 months	9.45	9.45	

Tab.4 Infants Age and Vitamin D Mean

Inference:

Among the 37 infants studied, 12.58ng/ml is the mean Vitamin d level of the infants between the age of 0-1 month, 10.75ng/ml is the mean vitamin D level of the infants between the age of 1-2 months, 10.14 ng/ml is the mean Vitamin D level of the infants between the age of 2-3 months, 14.04ng/ml is the mean Vitamin D level of the infants between the age of 3-4 months, 9.45ng/ml is the mean Vitamin D level of the infants between the age of 4-5 months. There is no association between the age of infant and the mean Vitamin D levels (P=0.34, not significant).

5. INFANTS GENDER DISTRIBUTION:

Gender	No. of Babies	%
Male	18	48.6%
Female	19	51.4%
Total	37	100.0%

Tab 5. Infants Gender Distribution

Inference: Among the 37 in fants studied, 19 (51.4%) were female and 18 (48.6%) were male infants.

6. GENDER DISTRIBUTION AND VITAMIN D LEVELS

Sex	Mean Vit D ng/ml	SD	One way ANOV A F-test/t-test
Male	10.67	3.42	F=0.83 P=0.40 not significant
Female	11.75	11.75	

Inference:

The mean Vitamin D level of the male infants is 10.67ng/ml and that of female infants is 11.75ng/ml. there is no association between the gender of the infants and the mean Vitamin D levels. (P=0.40 and is not significant).

DISCUSSION:

In our study we have included all exclusively breastfed infants < 6 months of age and their mothers. Male and female distribution was almost equal (48.6% - male infants, 51.4%- female infants). In our study the youngest age was 15 days and the oldest age was 4 months 25 days. 18.9% of the mothers were vegetarian and the remaining 81.1% of them were on mixed diet. Regarding the socioeconomic status 29.7% of them belongs to Upper lower socioeconomic group, 64.9% of them belongs to lower middle class 5.4% of them belongs to lower socioeconomic group. None of them were from upper and upper middle socioeconomic group.

STATUS OF VITAMIN D:

In our study 78.3% of the mothers were Vitamin D deficient and 21.7% of the mothers were vitamin D insufficient. Regarding the Vitamin D status of the infants, we found that 91.9% of the infants were Vitamin D deficient and 8.1% of the infants were Vitamin D insuffi- cient.

Vandhana Jain et al had reported 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. In their study they have included infants with Vitamin D supplementation and mothers with Calcium and Vi- tamin D supplements. This study was conducted in AIIMS New Delhi.

They mentioned that in Asian women reduced outdoor activity, pig- mented skin and excessive clothing were responsible for hypovita- minosis D.

Atiq M, Suria A et al conducted a study to evaluate Vitamin D status of health breastfed Pakistani infants and their nursing mothers.[1] In their study 55% of the infants and 45% of the mothers had very low Serum Vitamin D levels. Bus the study was conducted predominant- ly among the upper socio economic class and with both mothers and infants being supplemented with Vitamin D.

Infants who are exclusively breastfed but who do not receive sup- plemental Vitamin D or adequate sunlight exposure are at high risk of developing Vitamin D deficiency and rickets. Infants with darker pigmentation are at greater risk of Vitamin D deficiency due to the increased melanin pigmentation which prevents the absorption of ultraviolet rays. There is also decreased Vitamin D content in the milk

from mothers who are themselves deficient.

Many of the studies were from Muslim population in whom the practice of purdah might have played an important role. The only study to comment on serum 25 OHD concentration in pregnant and lactating non Muslim women living in the tropics is from New Delhi.

Agarwal N, Faridi MM et al conducted the study which reveals 25 OH Vitamin D levels of infants (n=97) were 11.55 +/- 7.17 ng/ml at 10 weeks and 16.96 +/- 13.33 ng/ml at 6 months.[2] They concluded exclusively breastfed infants and their mothers are Vitamin D deficient, hence the need to improve the Vitamin D status.

MEAN 25 OHD LEVEL

In our study the mean serum 25 OHD concentration in mothers were 14.41ng/ml and infants were 11.22ng/ml. So there is a definite positive correlation between the maternal and infants Vitamin D levels. The infant's vitamin D level 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 +/- 9.3ng/ml and cord blood mean serum Vitamin D levels were 8.4 +/- 5.7 ng/ml.[3] But this study was done under rural and urban population which also concludes by saying high prevalence of significant hypovitaminosis D was seen among pregnant women and their infants.

VITAMIN D STATUS OF THE MOTHERS AND SOCIOECONOMIC STATUS

Leila Shirazi, Martin Almquist et al reported that there was no strong association between socioeconomic status and serum levels of Vitamin D.[3] But in our study we found that the mean Vitamin D levels of mothers belonging to lower socioeconomic status is lower than the mean Vitamin D levels of mothers belonging to the other socioeconomic statuses.

CORRELATION BETWEEN MATERNAL & INFANT VITAMIN D LEVEL

The most important finding in our study is the unexpectedly high prevalence of hypovitaminosis D among lactating mothers and their babies. The physiologic relevance of the finding is substantiated by the positive correlation with the exclusively breast fed infant's 25OHD level.

Similar study conducted in UAE by Dawodu A et al reveals the mean serum 25 OHD concentration in mothers were 8.6ng/ml and infants were 4.6 ng/ml.[4] Since this study was done in UAE it was done in Muslim population. It is a known fact the Muslim women wear purdah, not getting exposed to enough sunlight which also plays a vital role in the synthesis of Vitamin d. this could be the reason for the mean Vitamin d level of mothers to be 8.6ng/ml and infants mean Vitamin D level to be 4.6ng/ml in contrast to our study of mother's mean Vitamin D level of 14.41 ng/ml and infant's mean Vitamin D level of 11.22ng/ml. Thus in both the studies there is a definite positive correlation between the mother and infant Vitamin D level.

A similar correlation was also seen by Seth A et al.[6] where they showed a high prevalence of Vitamin D deficiency in lactating mothers and their exclusively breastfed infants.

Hypovitaminosis D and osteomalacia among pregnant and lactating South Asian women have been widely reported. Many studies were from United Kingdom and Norway where the already low availability of overhead sun is compounded for hypovitaminosis D among lactating women.

A Cochrane review done in 2002 concluded that there is limited data available regarding maternal Vitamin D requirements during pregnancy and lactation. Mothers should be advised to have adequate sunlight exposure to increase their Vitamin D levels. This will in turn help to increase the fetal Vitamin D levels.

It is important to note that women with increased skin pigmentation or who have little exposure to sunlight are at additional Vitamin D supplements, especially during pregnancy and lactation.

Hypovitaminosis D is an emerging public health problem. It is prevalent

in all over the world even in the people living in the tropical regions. In India hypovitaminosis D is highly prevalent. It is in fact equally prevalent both in North and South India. Our study was done in Hyderabad, South India in a limited population of mothers and their infants. In our study all Vitamin D deficient cases were asymptomatic. Some more larger studies may be needed to assess the magnitude of the problem in this part of the country.

In view of the positive correlation between the Vitamin D status of the mother and exclusively breastfed infants, improving the Vitamin D levels of the mothers may also improve the Vitamin D levels of the infants.

Larger studies and meta analysis should be conducted to confirm the finding of the present study.

The findings of our study indicate that urgent steps need to be taken to implement a program and consider Vitamin D fortification of foods, like milk which is commonly consumed by the pregnant and lactating women and their infants.

Mothers should also be encouraged to get adequate sunlight exposure. All those measures will go a long way in preventing hypovitaminosis D in this vulnerable segment of the population.

CONCLUSIONS

1. Hypovitaminosis D is highly prevalent in Hyderabad though a tropical zone
2. It is prevalent in all segments of population (all socioeconomic group, mothers consuming vegetarian or non vegetarian diet).
3. There is no association between the gender, age and weight of the infant and the mean Vitamin D levels.
4. There is a significant, substantial positive correlation between the mean Vitamin D level of the mothers and their exclusively breastfed infants.

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