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Study on Prevalence of Vitamin D Deficiency Among Newborns And Their Mothers in Jharkhand

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Abstract
Background: *Vitamin D deficiency is an important health problem in pregnant women and their infants. The present study evaluated serum 25-hydroxyvitamin D3 [25(OH)D3] concentrations in healthy term newborns and their mothers.*
Objective: *To measure serum levels of 25(OH)D3, Parathormone, Inorganic Phosphate, Calcium, Albumin, and Alkaline Phosphatase in healthy term newborns and their mothers and to establish correlation between mother's and their newborn's vitamin D status.*
Material and method: *Ninety-five healthy term newborns and their mothers were included in the cross sectional study between July 2014 and July 2015. Sampling was done by systematic random sampling. Maternal and cord blood samples were taken to measure levels of 25(OH)D3, Parathormone, Inorganic Phosphate, Calcium, Albumin, and Alkaline Phosphatase.*
Results and discussion: *Mean maternal serum 25(OH)D3 was 16.2 ± 6.7 ng/mL, and cord blood 25(OH)D was 13.6 ± 6.7 ng/mL. Seventy-four mothers (77.9%) had hypovitaminosis-D. Seventy-nine newborns (83.1%) had hypovitaminosis D. There was a significant ($r=0.8; P<0.001$) correlation between maternal and cord blood vitamin D levels which indicates that risk factors for infant vitamin D deficiency includes maternal deficiency in vitamin D.*
Conclusion: *A high prevalence of physiologically significant hypovitaminosis D among pregnant women and their newborns was observed. Vitamin D supplementation campaigns which should cover pregnant women and the newborn to prevent maternal and perinatal vitamin D deficiency should be implemented especially in risk areas.*
Keywords: *cord blood, hypovitaminosis D, maternal serum, prevalence.*

I. Introduction

Vitamin D refers to a group of closely related compounds which act as a precursor for the formation of their active metabolite, 1,25-dihydroxycholecaciferol. The main source of Vitamin D for humans is Vitamin D3 through its synthesis in the skin, which undergoes further hydroxylation in liver and kidney. Vitamin D plays a critically important role in calcium and phosphate homeostasis which in turn facilitates other essential processes such as bone mineralization, contraction of muscles, nervous system activities, and cellular function. Apart from the well established role in calcium homeostasis, Vitamin D also plays a role in control of hormone secretion, immune dysfunction, cell proliferation and differentiation.

1.1: Vitamin D and Neonates: The newborn serum 25(OH)D3 concentrations rely on maternal Vitamin D status. The active form of Vitamin D i.e. 1,25- dihydroxycalciferol does not cross the placenta. Hence during the intrauterine development, the fetus is entirely dependent on the mother for an adequate supply of 25(OH)D3, which is believed to cross the placenta. It is converted to its active form 1,25- dihydroxycalciferol in the decidual cells of the placenta. Low maternal Vitamin D levels result in low neonatal Vitamin D level which may result in congenital rickets, hypocalcemic seizures, low bone mineral content, increased risk of infections, higher risk of developing diabetes mellitus, asthma and atopy in later life etc. In general, breast-milk is thought to be a relatively poor source of Vitamin D, making maternal Vitamin D status during pregnancy important for Vitamin D status of the child during early infancy.

1.2: Serum Levels of Vitamin D: In the absence of well defined age-specific reference range, definitions of vitamin D sufficiency, insufficiency, and deficiency in infants and children are taken to be the same as those in adults.

Table 1: Vitamin D Status Based on Serum 25(OH)D3Level [Endocrine Society[1]]

Vitamin D Status Grading	Serum 25 (OH) D Level
Deficient	<50 nmol/L (<20 ng/mL)
Insufficient	50-75 nmol/L (20-30 ng/mL)
Sufficient	>75 nmol/L (>30 ng/mL)
Intoxication	>374 nmol/L (150 ng/mL)

Deficiency level:
We classified hypovitaminosis D based on the measurement of serum 25(OH)D3 concentration as follows:
Mild hypovitaminosis D: 10-20 ng/mL;
Moderate hypovitaminosis D: 5-10 ng/mL;
Severe hypovitaminosis D: <5 ng/mL.

II. Methods

Ninety-five term newborns admitted to Rajendra Institute of Medical Sciences, Ranchi and their mothers were included in this cross-sectional study during the period of July 2014 to July 2015 after approval from Institutional Ethics Committee, Rajendra Institute of Medical Sciences, Ranchi. Sampling was done by systematic random sampling in which every 3rd subject was included.

Blood from mothers was drawn under non fasting condition by venepuncture under aseptic precautions just prior to delivery and was immediately sent to the Department of Biochemistry for biochemical analysis. Umbilical cord venous blood was sampled similarly. Both the samples were centrifuged and serum was collected. Sera were assayed for alkaline phosphatase, ionized calcium, inorganic phosphate, albumin, Vitamin D and PTH level.

Serum Vitamin D level and serum Parathyroid hormone level were estimated by chemiluminescent immunoassay. Serum ionized calcium level was measured by ion selective electrode method. Serum inorganic phosphate and serum albumin level were measured by colorimetric method on autoanalyzer.
Statistical analysis was conducted by using SPSS for Windows software (version 20; SPSS, Chicago, IL). Microsoft Word and Microsoft Excel have been used to generate graphs, tables etc.

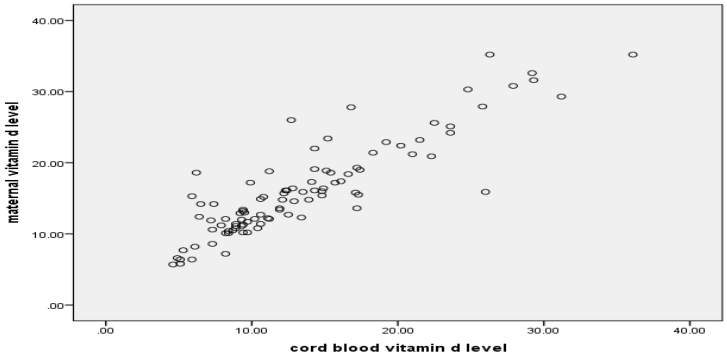
III. Results

In the present study, the mean cord blood vitamin D level of the newborn was 13.56 ± 6.67 ng/ml. Vitamin D deficiency was seen in 79 newborns who accounted for 83.1% of the study population.
The mean maternal vitamin D level was 16.2 ± 6.72 ng/ml. Vitamin D deficiency was seen in 74 mothers who accounted for 77.9% of the study population.

Table 2: Vitamin D Status of Neonates and Their Mothers

Vitamin D level	Neonatal		Maternal	
	No. of cases	% of total cases	No. of cases	% of total cases
≤5 ng/ml (severe hypovitaminosis D)	2	2.1%	0	0%
>5ng/ml to ≤10ng/ml (Moderate hypovitaminosis D)	34	35.79%	9	9.5%
>10ng/ml to ≤20ng/ml (Mild hypovitaminosis D)	43	45.26%	65	68.4%
>20ng/ml to ≤30ng/ml (insufficient Vitamin D)	14	14.73%	15	15.8%
>30ng/ml (Sufficient Vitamin D)	2	2.1%	6	6.3%

In the present study the maternal Vitamin D correlated strongly with the newborn's Vitamin D status with a correlation coefficient, r value = 0.887 with a p-value <0.001.



Graph 1: Correlation of Mother's Vitamin D Status with Newborn's Vitamin D Status

IV. Discussion

This study showed a high prevalence of vitamin D deficiency in newborns and their mothers which is consistent with previous similar studies done in India and elsewhere. Vitamin D deficiency is a major health problem across all age groups in India and has assumed epidemic proportions despite India being a tropical country with adequate sunshine[2-4].

In the present study vitamin D deficiency was seen in 79 newborns who accounted for 83.1% of the study population. The mean cord blood 25-(OH) D level was 13.56 ± 6.67 ng/ml. In a study done by Sachan et al[5] in Lucknow, 95.7% newborns had hypovitaminosis D and the mean cord blood 25(OH)D in neonates was 8.4 ± 5.7ng/mL. A similar study done by Pradeep Kumar et al[6] in Bangalore showed hypovitaminosis D in 83% newborns and a mean cord blood vitamin D level as 12.8 ± 8.5 ng/mL. All the studies point towards alarmingly high prevalence of hypovitaminosis D in newborns.

The maternal vitamin D level was 16.2 ± 6.72 ng/ml. Vitamin D deficiency was seen in 74 mothers out of 95 cases who accounted for 77.9% of the study population. The Sachan et al study[5] puts the prevalence of maternal hypovitaminosis D at 66.7% (with cutoff to define hypovitaminosis D at <15 ng/ml). The mean maternal serum 25(OH)D was 14 ± 9.3 ng/mL. The Pradeep Kumar et al[6] study showed mean (SD) maternal vitamin D level as 16.3 (10.3) ng/mL while 70.7% mothers had hypovitaminosis-D. The present study shows higher prevalence of maternal hypovitaminosis D compared to other studies. The mean maternal vitamin D level is however in accordance with the other studies.

In the present study the maternal Vitamin D correlated strongly with the newborn's Vitamin D status with a correlation coefficient (r value) 0.887 with a p-value <0.001. In the Sachan et al study[5] also the maternal serum 25(OH)D showed a strong positive correlation with cord blood 25(OH)D (r value - 0.79; p value - 0.001). The Pradeep Kumar et al[6] study also showed a significant (r=0.6; P<0.001) correlation between maternal and cord blood vitamin D levels. This strong positive correlation of maternal vitamin D level with cord blood Vitamin D level has also been well documented internationally. A study done in Egypt showed that maternal serum 25(OH)D3 strongly correlated with cord blood 25(OH)D3 (r=0.89, P=0.01)[7]. In a similar study done in Greece a strong correlation was observed between maternal and infant 25(OH)D concentrations (r = 0.626, P < 0.001)[8]. In a study done in Australia, there was close correlation between maternal and neonatal 25-OH D levels (correlation coefficient = 0·74, *P*< 0·001)[9].

Table 3: Comparison of Present Study with Other Studies

Characteristic	Sachan et al study	Pradeep et al study	Present study
Neonatal hypovitaminosis D prevalence	95.7%	83%	83.1%
Mean cord blood Vitamin D level	8.4 ± 5.7 ng/ml	12.8 ± 8.5 ng/ml	13.56 ± 6.67 ng/ml
Maternal hypovitaminosis D prevalence	66.7%	70.7%	77.9%
Mean maternal Vitamin D level	14 ± 9.3 ng/ml	16.3 ± 10.3 ng/ml	16.2 ± 6.72 ng/ml
Correlation between maternal and newborn Vitamin D level	Strong positive correlation r = 0.79 p < 0.001	Significant positive correlation r = 0.6 p < 0.001	Strong positive correlation r = 0.887 p < 0.001

The present study is in accordance with similar studies and points towards the fact that the newborn's vitamin D status depends on maternal vitamin D status during pregnancy.

V. Conclusion

The present study points towards a high prevalence of Vitamin D deficiency among newborns and their mothers in Jharkhand. This study also points towards the fact that the high level of newborn's hypovitaminosis D may be correctable by correction of maternal hypovitaminosis D. Vitamin D supplementation campaigns which should cover pregnant women and the newborn to prevent maternal and perinatal vitamin D deficiency should be implemented especially in high risk areas.

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