https://africanjournalofbiomedicalresearch.com/index.php/AJBR
Afr. J. Biomed. Res. Vol. 27(September 2024); 869-873

Research Article

"Estimation of Vitamin D Levels in Neonatal Cord Blood Sample & its Correlation with Maternal Vitamin D Levels During Pregnancy"

Dr Wajid Rana[1], Dr Jabeena Banoo[2], Dr Sharvil Dhar[3], Dr Ariba Afeeh[4]*, Dr Akhil Preet Kaur[5], Dr Aamil Haameem[6]

[1]Department of Pediatrics, Acharya Shri Chander College of Medical Sciences & Hospital
[2]Gynaecology Senior Resident, Department of Obstetrics and Gynaecology, SMGS Hospital.
[3,4,5] Department of Pediatrics, Acharya Shri Chander College of Medical Sciences & Hospital*
[6] Anesthesiology, Geisinger Medical Center Danville Pennsylvania USA

ABSTRACT

Background: high prevalence of Vitamin D deficiency has been observed in pregnant Indian women and their newborns, variation in the prevalence of Vitamin D during pregnancy has been observed from various parts of India which may be due to differences in the ethnicity, food habits, and geographical location. Maternal vitamin D deficiency has been shown to negatively impact the fetus, increasing the risks of intrauterine growth restriction, preeclampsia, gestational diabetes, and preterm birth. These conditions can significantly affect newborn health and development.

Aim & Objective: To find out the prevalence of vitamin D deficiency in newborns and Correlation of maternal and neonatal vitamin d levels.

Methods: The present study is a cross-sectional observational study conducted from July 2023 to September 2023 in the Perinatology section of Department of Pediatrics, at a tertiary care hospital of Jammu city. After selecting pregnant women of age 20 to 35 years with singleton term pregnancy, written informed consent was taken during antennal period and blood sample for vitamin D level was collected along with their routine lab investigations and was sent for estimating vitamin D levels. The samples of the new born were taken from cord blood and then were sent for vitamin D level.

Results: There was a positive correlation between the Vitamin D levels of the mother and the neonates at birth. 97.1% of the newborns born to the mothers with deficient levels of vitamin D had deficient vitamin D levels (p-value 0.02)

Conclusion: Vitamin D deficiency is widely prevalent in our region with 81.3% neonates having VDD. Vitamin D deficiency in the mothers is also widely prevalent. Vitamin D deficiency is more prevalent among the early terms as compared to the full terms. Vitamin D deficiency is more prevalent in the small for gestational age infants as compared to the appropriate for gestational age infants.

Relevance: Since there is a paucity of data in our setup and also because of long term complication of vitamin D deficiencies in neonates we decided to perform a study to evaluate the levels of vitamin D in neonates and correlating the neonatal vitamin D levels with the maternal levels.

***Author for correspondence: Email:** *aribaafeeh@gmail.com*

Receiving date: 10/07/2024 Acceptance date: 20/08/2024

DOI: https://doi.org/10.53555/AJBR.v27i1S.1278

INTRODUCTION

Vitamin D is an essential fat-soluble vitamin and a key modulator of calcium and bone metabolism. It also serves as a steroid hormone with various effects and plays essential roles in the proper functioning of multiple organ systems [2]. Adverse health outcomes such as preeclampsia, low birth weight, neonatal hypocalcemia, poor postnatal growth, bone fragility, and increased incidence of autoimmune diseases have been linked to low Vit D levels during pregnancy and infancy**.**

There are two main types of vitamin D: vitamin D2 (ergocalciferol) which comes from plants and some fish source, while vitamin D3 (cholecalciferol) is obtained from dietary sources or through the conversion of 7-dehydrocholesterol in the skin after exposure to ultraviolet B radiation. In liver cells 25-hydroxylation occurs while the second hydroxylation mainly occurs in the kidney by 1 α-hydroxylase to form 1,25-dihydroxyvitamin D, which is the biologically active form of vitamin D. Vitamin D in the form of 25(OH) crosses the placenta primarily during the last months of pregnancy to provide the major vitamin D requirements for the infant in the first few months of life**[15].**

1,25-dihydroxyvitamin D is crucial in controlling calcium levels by increasing calcium absorption in the intestines and secretion calcium from the skeleton. It has a range of effects on various organs. 1,25(OH)2D serves diverse roles in both the health and disease of the nervous system and is engaged in proliferation, differentiation, neurotropism, neuroprotection, neurotransmission, and neuroplasticity **[12]**. Substantial experimental evidence suggests that vitamin D is essential for regulating both the innate and adaptive immune systems. It improves the chemotaxis and phagocytosis by macrophages, and promotes the production of antimicrobial proteins like cathelicidin LL37, thereby enhancing innate immune responses [7].

Maternal vitamin D deficiency has been shown to negatively impact the fetus, increasing the risks of intrauterine growth restriction, preeclampsia, gestational diabetes, and preterm birth. These conditions can significantly affect newborn health and development [4]**.** Also in studies it has been seen that there is increased risk of rickets in infants of vitamin deficit mothers [1]

Studies have also shown that infants with low vitamin D levels in cord blood were at increased risk for respiratory infections in the first few months of life and recurrent wheezing in early childhood [6].

Breast milk alone does not contain enough vitamin D to meet infants' requirements, that's why vitamin D has to supplemented along with breastfeeding. The daily dosage of vitamin D for neonates as 400 units (ranging from 100 IU to 1000 IU), have been recommended **[8]**. Current evidence supports the AAP's recommendation of 400 IU/day as a safe and effective dose to prevent vitamin D deficiency and rickets in infants. However, vitamin D deficient infants may require higher doses to normalize levels.

Vitamin D deficiency in pregnant and lactating mothers is quite common, especially in developing countries**.** An inadequate diet during pregnancy and breastfeeding can lead to insufficient vitamin D levels in the breastmilk and their newborns [15]**.**

Although a high prevalence of Vitamin D deficiency has been observed in pregnant Indian women and their newborns, variation in the prevalence of Vitamin D during pregnancy has been observed from various parts of India which may be due to differences in the ethnicity, food habits, and geographical location.

Need for the study:

Since there is a paucity of data in our setup and also because of long term complication of vitamin D deficiencies in neonates we decided to perform a study to evaluate the levels of vitamin D in neonates and correlating the neonatal vitamin D levels with the maternal levels. This observational study will give us a clue whether there is deficiency of vitamin D in our neonates and by co relating their levels with maternal levels we will be able to decide whether pregnant mother of our region need extra vitamin D supplementation or not.

METHODOLOGY

The present study was conducted from July 2023 to September 2023 in thePerinatology section of Department of Pediatrics, at a tertiary care hospital of Jammu city. A total of 150 mothers in the age group of 25 to 35years with term pregnancy and no comorbid condition along with their neonates were enrolled in the study after taking informed consent. The blood samples for Vitamin D estimation were collected at the time of admission to delivery room along with routine blood samples. Umbilical cord blood samples were collected after delivery of the babies.

Inclusion Criteria:

Term neonates who are delivered at the hospital (inborn babies).

Maternal age 20 to 35yrs.

Exclusion criteria:

Preterm

Out born neonates

Mother with co morbidities (hypertension, diabetes, on medication like steroids, anti-epileptic drugs)

Refusal of parental consent

Design: It is a cross-sectional observational study. After selecting pregnant women of age 20 to 35 years with singleton term pregnancy, written informed consent was taken during antennal period and

Sample & sampling: After having ethical clearance by departmental & institutional ethical committee, blood sample for vitamin D level was collected along with their routine lab investigations and was sent for estimating vitamin D levels. The samples of the new born were taken from cord blood and then were sent for vitamin D level. During this study the methods for obtaining the respective values were as follows:

Vitamin D: by chemiluminescence microparticle immunoassay (CMIA) by abott architect.

TABLES:

In our study Out of a total of 150 neonates, 52% were males and 48% were females.

Table 1: Gender distribution of study neonates		
Gender	**Number**	**%**
Male	78	52
Female	72	48
Total	150	

In our study 68% were early term (37wks-38+6) while 31.3% were full term (39wks-40+6).

Table 2: GESTATION WISE DISTRIBUTION		
Gestation	**Number**	**%age**
EARLY TERM(37-38+6)	103	68.7
FULL TERM(39 - 40+6)	47	31.3
LATE TERM (41 - 41+6)	0	0
TOTAL	150	

Amongst the neonates, only 6 (4%)had sufficient levels, 122 (81.3 while 22 (14.7%) had insufficiency

Table 3 : VITAMIN D LEVELS IN STUDY NEONATES		
Vitamin D LEVEL (ng/ml)	**Number**	**%age**
DEFICENCY(<20)	122	81.3
INSUFFICENCY(21-29)	22	14.7
SUFFICENCY(>30)	6	4
TOXICITY(>150)	0	0
TOTAL	150	

Table 5. Birth Weight wise distribution of vitamin D deficiency in study neonates				
VITAMIN D DEFICENCY	AGA		SGA	
	NUMBER	%AGE	NUMBER	%AGE
PRESENT	84	77	38	92.7
ABSENT	25	23	3	7.3
	109		41	

Amongst the mothers, only 16 (10.7%) had sufficient levels of Vitamin D (>30 ng/ml). A total of 104 (69.3%) mothers had Vitamin D deficiency (<20 ng/ml), while 30 (20%) had insufficiency (21-30ng/dl).

Table 6: VITAMIN D (ng/ml) LEVELS IN STUDY MOTHERS		
VITAMIN D LEVEL (ng/ml)	**Number**	**%age**
DEFICENCY(<20)	104	69.3
INSUFFICENCY(21-29)	30	20

SUFFICENCY(>30)	16	10.7
TOXICITY(>150)	0	0
TOTAL	150	

Prevalence of vitamin D deficiency is 84.5%% in early term babies and 74.5% in full term neonates.

Table 7: Prevalence of Vitamin D (ng/ml) deficiency as per gestational age

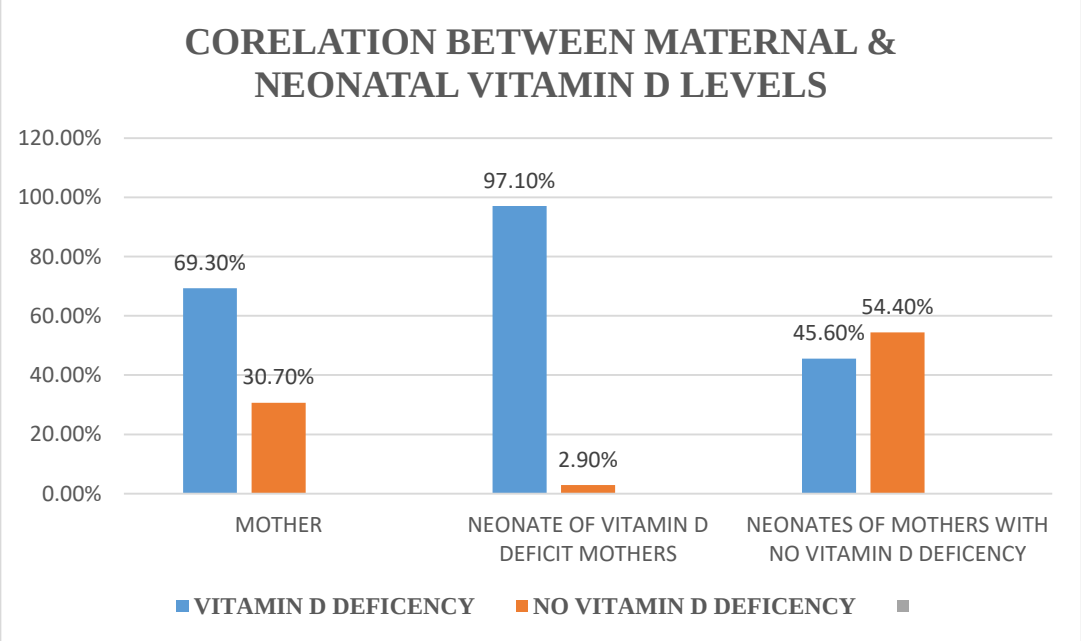
Gestational age	No.	Vitamin D deficiency	
		Number	%age
EARLY TERM	103	87	84.5
FULL TERM	47	35	74.5
Total	150	122	81.3

There was a positive correlation between the Vitamin D levels of the mother and the neonates at birth . 97.1% of the newborns born to the mothers with deficient levels of vitamin D had deficient vitamin D levels.(p-value 0.02)

Table 8: Correlation of vitamin D deficiency of mothers with neonates

Neonate	Mother				P-value
	Vitamin D Deficiency		No vitamin D Deficiency		
	No.	%age	No.	%age	
Vitamin D deficiency	101	97.1	21	45.6	0.02
No vitamin D deficiency	3	2.9	25	54.4	
Total	104	100	46	100	

***Statistically Significant (P-value<0.05) r=0.76 (High Positive Correlation)**



Discussion:

In the study among the total neonates, 52% were males and 48% were females. The number of early terms enrolled in the study was 68.7% (103 out of 150) and the percentage of full terms enrolled in the study was 31.3% (47 out of 150). The total prevalence of vitamin D deficiency in pregnant women in our study was 69.3%. Similar studies in INDIA by **S Sharma et al (2016)** & **Ravinder et al (2022)** show prevalence of 93.5% and 62% respectively.The total prevalence of vitamin D deficiency in neonates was 81.3%. Similar study conducted by **K. DEVARAJ NAIK et al** in Kerala INDIA, show prevalence of 94% deficiency in neonates**.**

In our study a comparison was drawn between the early terms and full terms also between small for gestation and appropriate for gestation age babies. Broadly, the prevalence of vitamin D deficiency was 84.5% in early terms and 74.5% in the full term neonates. Among SGA, the prevalence of vitamin D deficiency was 90.5% and 76.2% among the AGA.

Ergur A *et al., (*2009) conducted a study in turkey and found severe VDD in 27% and moderate VDD in 54% mothers. Severe VDD was found in 64.3% neonates and moderate deficiency in 32.6%.

Hossain N *et al.*, (2005) conducted a study to determine the prevalence of VDD in the Pakistani parturient and their new born and found that there was a high prevalence of vitamin D deficiency among both the mothers and their neonates. Significant correlations were observed between maternal and cord blood levels of 25-hydroxy vitamin D3.

Study from INDIA by **K. DEVARAJ NAIK et al** strong positive correlation between the vitamin D levels in maternal and cord blood (r=0.898; P <0.05). While comparing vitamin D levels of the mother with the neonates at birth in our study we found that there was a positive correlation between the vitamin D levels of the mother and the neonates. Among the 150 neonates studied, 104 mothers had vitamin D deficiency and 101 of these vitamin D deficit mothers neonates had vitamin D deficiency i.e. 97.1%; p-value 0.02 (p<0.05).

Conclusion:

In our study we measured vitamin D levels of neonates and their mothers. We concluded the following points from our study: Vitamin D deficiency is widely prevalent in our region with 81.3% neonates having VDD. Vitamin D deficiency in the mothers is also widely prevalent, among 150 mothers enrolled 69.3% were deficient. Vitamin D deficiency is more prevalent among the early terms as compared to the full terms (84.5% vs 74.5%). Vitamin D deficiency is more prevalent in the small for gestational age infants as compared to the appropriate for gestational age infants (90.5% vs 76.2%). There was a statistically significant correlation between the vitamin D levels of the mothers and their neonates at birth with 97.1% neonates of mothers with VDD having VDD. (p value<0.005; r=0.76).

Bibliography:

Akpede GO, Omotara BA, Ambe JP. Rickets and deprivation: a Nigerian study. *J R Soc Promot Health* 1999;119:216-22.

Aly H, Abdel-Hady H. Vitamin D and the neonate: an Update. *J Clin Neo* 2015;4(1):1-7.

Aly YF, El Koumi MA, Abdel R. Impact of maternal vitamin D status during pregnancy on prevalence of neonatal vitamin D deficiency. *Pediatr Rep* 2013;5(1):e6.

B W Hollis et al Evaluation of the total fetomaternal vitamin D relationships at term: evidence for racial differences. *J Clin Endocrinol Metab 1984 Oct;59(4):652-7.*

Burris HH, Van Marter LJ, McElrath TF, Tabatabai P, Litonjua AA, Weiss ST et al. Vitamin D status among preterm and full term infants at birth. *Pediatr Res* 2014;75:75-80.

Chaeuk Chung et al Vitamin D-Cathelicidin Axis: at the Crossroads between Protective Immunity and Pathological Inflammation during Infection. *Immune Netw. 2020 Apr; 20(2): e12*

Cranney A, Horsley T *et al.* effectiveness and safety of vitamin D in relation to bone health. *Evid Rep Technol Assess* 2007;158:1- 235.

Ergur AT, Berberoglu M, AtasayB, Siklar Z, Bilir P, Arsan S *et al.* Vitamin D Deficiency in Turkish Mothers and their Neonates and in Women of Reproductive Age. *J Clin Res Pediatr Endocrinol* 2009;1(6):266-69.

Fallahi M, et al(2016) Comparison of vitamin D level in preterm and term infant–mother pairs: a brief study. *Iran J Neonatol.* 2016;**7**(1):32–36

Fariba Aghajafari et al Association between maternal serum 25-hydroxyvitamin D level and pregnancy and neonatal outcomes: systematic review and meta-analysis of observational studies *BMJ* 2013; 346

Hochberg Z, Bereket A, Davenport M, Dekemarre-Van de Waal HA, De Schepper J, Levine MA *et al.* Consensus Development for the supplementation of Vitamin D in childhood and adolescence. *Horm Res* 2002;58:39-51.

K. DEVARAJ NAIK et al Cord Blood Vitamin D Levels of Term Neonates Indian Pediatr 2015;52: 75-76

Kaplan MM. Disorders of parathyroid glands and vitamin D. In: Gleicher N (ed). *Principles and Practice of Medical Therapy in Pregnancy (2nd ed). California: Appleton & Lange Company* 1992: 339-342.

M Mulligan et al Implications of vitamin D deficiency in pregnancy and lactation : Am J Obstet Gynecol. 2010 May; 202(5): 429.e1–429.

Mairead keily et al Vitamin D metabolite concentrations in umbilical cord blood serum and associations with clinical characteristics in a large prospective mother-infant cohort in Ireland *J Steroid Biochem Mol Biol 2017 Mar:167:162-168*

Sachan Alok at al High prevalence of vitamin D deficiency among pregnant women and their newborns in northern India *The American Journal of Clinical Nutrition Volume 81, Issue 5*

Shahada Rabbani etal 2021 Correlation between maternal and neonatal blood Vitamin D level: Study from Pakistan *Matern Child Nutr. 2021 Jan; 17(1): e13028.*

Zhang JY, Wang J, Hu S, Chen D, Lu Q, Wei R *et al.* Cord serum vitamin D in a South China birth cohort. *Asia Pac Clin Nutr* 2019:28(3):54