

**TO STUDY THE PREVALENCE OF VITAMIN D LEVELS IN NEWBORNS AS  
ASSESSED FROM CORD BLOOD****\*<sup>1</sup>Dr. Gurpreet Kaur Dhillon, <sup>2</sup>Dr. Sunil Kumar Rai, <sup>3</sup>Dr. Harpreet Singh Dhillon and <sup>4</sup>Dr. Shibu Sasidharan**<sup>1</sup>MD (Paediatrics), Reader, Department of Paediatrics, 166 Military Hospital, Jammu.<sup>2</sup>MD (Paediatrics), INHS Asvini, Mumbai.<sup>3</sup>MD (Psychiatry), Reader, Department of Psychiatry, 166 Military Hospital, Jammu, India.<sup>4</sup>MD, DNB, MNAMS, Asst. Prof (Anaesthesiology), HOD, Dept of Anaesthesiology & Critical Care Level III Hospital, Goma.**\*Corresponding Author: Dr. Gurpreet Kaur Dhillon**

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**ABSTRACT**

**Background:** An observational epidemiological study was undertaken to study the prevalence of vit D levels in newborns as assessed from cord blood. **Methods:** This was an observational study done on 569 patients to study the prevalence of vit D levels in newborns. The data for this observational study included cord blood samples from the placental end during peripartum period. The primary objective of this project was to assess the vitamin D levels in cord blood. **Results:** Results showed median 25(OH)D level was 12.22 ng/mL, mean 13.529, SD = 3.794, max=27ng/mL, min=7.9 ng/mL. Vitamin D deficiency was found in 94.00% of newborn participants and 5.99 % had Vitamin D insufficiency as per classification by US Endocrine Society. **Conclusion:** None of the newborns, irrespective of gender, had sufficient levels of Vitamin D as per classification by US Endocrine Society.

**KEYWORDS:** Vitamin D deficiency, Cord blood, Newborn.**INTRODUCTION**

Vitamin D is a fat-soluble secosteroid, 1,25 dihydroxy vitamin D [1,25(OH) 2D] and is required for calcium and phosphorous homeostasis, bone mineralization and skeletal growth contributing for overall musculoskeletal growth. Vitamin D and its metabolites are hormones and hormone precursors rather than vitamin, as they can be synthesized endogenously in the proper biological settings.<sup>[1]</sup> There are multiple sources<sup>[2,3]</sup>, of vitamin D, plants- fresh and sun dried mushroom, animal- cod liver oil, egg yolk, Salmon, tuna etc., supplements and sunlight. (Exposure of human skin to UVB radiation in the wavelength of 290-315nm). The amount of vitamin D production depends on the angle of incident sun light and thus on the latitude, season and time of the day.<sup>[3]</sup> One Minimal Erythema Dose (MED) of exposure i.e. the minimal dose of sunlight causing pink coloration of skin for few hours after exposure raises the vitamin D levels equivalent to oral intake of 10,000 to 25,000 IU of vitamin D2.<sup>[4,5]</sup> Other factors affecting the vitamin D production via skin depends on pigmentation, aging, and topical application of sunscreen cream.<sup>[3]</sup> Vitamin D deficiency is prevalent in India in spite of tropical country with abundant sunshine during most of the year. The prevalence of vitamin D deficiency is 50-90 % in the Indian subcontinent and is attributed to low dietary calcium along with skin color and changing lifestyle.<sup>[6]</sup> The status of vitamin D in pregnant women are on an

average lower than equivalent non-pregnant women's levels which may be partly explained by increased fetal demands for vitamin D.<sup>[7]</sup> Through trans-placental route circulating vitamin D from the mother reaches to the developing fetus.<sup>[8]</sup> The circulatory vitamin D is converted to its active form by an enzyme 1  $\alpha$ -hydroxylase, contained within the placenta.<sup>[9,10]</sup> Maternal vitamin D status depends on consumption, absorption and metabolism of dietary vitamin D, which significantly affect the fetal vitamin status.<sup>[11,12]</sup> Vitamin D deficiency (VDD) in pregnant women places them at risk for various complications such as gestational diabetes, preeclampsia, and caesarean section.<sup>[13,14]</sup> Multiple neonatal complications such as neonatal hypocalcemia, impaired growth, decreased bone mineral density, skeleton deformity, seizures and low birth weight are associated with low vitamin D levels in pregnancy.<sup>[4]</sup> Deficient calcium intake has been shown to be the cause in a large proportion of childhood rickets in India and other tropical countries<sup>[15,16]</sup> and contribute to adolescent osteomalacia. Recent studies also suggest association of vitamin D with cancer, cardiovascular disease, diabetes and immunity, however enough high quality evidence is still lacking to support a cause-and-effect relationship.<sup>[17]</sup> This study was undertaken to study the prevalence of levels of vitamin D in newborns from samples taken from the cord blood.

**MATERIALS AND METHODS**

**Study design**

Observational epidemiological Study.

**Inclusion criteria**

1. Healthy pregnant women and their newborn.

**Exclusion criteria**

1. Known history or evidence of Rheumatoid arthritis, Thyroid, Parathyroid, Adrenal diseases, Hepatic or Renal failure.
2. Pregnancy losses, spontaneous abortion and still birth are excluded.
3. Twin/triplet were excluded because of their high risk of PTB, LBW, LSCS.<sup>[18]</sup>
4. Metabolic bone disease.
5. Type 1 diabetes and malabsorption diseases.

**METHODOLOGY**

A total of 569 individuals were recruited into the study group after applying inclusion and exclusion criterion. The data for this observational study included cord blood samples taken during peri-partum period, maternal and neonatal medical records data were collected from birth register and ANC card diary from Hospital. The primary objective of this project was to assess the vitamin D status in cord blood. The 25(OH)D levels as per US endocrine society classification as per Table 1.

**Table 1: Classification of Vitamin D levels as per US endocrine society in Neonates.**

<i>AS PER US ENDOCRINE SOCIETY CLASSIFICATION<sup>1</sup></i>	
DEFICIENCY	≤ 20 ng/ml
INSUFFICIENCY	< (21-29) ng/ml
SUFFICIENCY	>30 ng/ml
TOXICITY	>150 ng/ml

Vitamin D deficiency is defined as serum levels of 25(OH)D less than 20 ng/dL whereas 21- 29 ng/dL is considered to be insufficient by US Endocrine Society. The cut off levels for the classifications of vitamin D sufficiency/insufficiency and potentially toxic levels of vitamin D are primarily based on bone-related outcomes. The current definition of vitamin D deficiency and insufficiency is not appropriate (based on bone-related disorder) as other health outcomes needs to be taken into account which may get affected due to insufficient Vitamin D levels.<sup>[19]</sup>

**OBSERVATIONS AND RESULTS**

**Cord blood vitamin D levels**

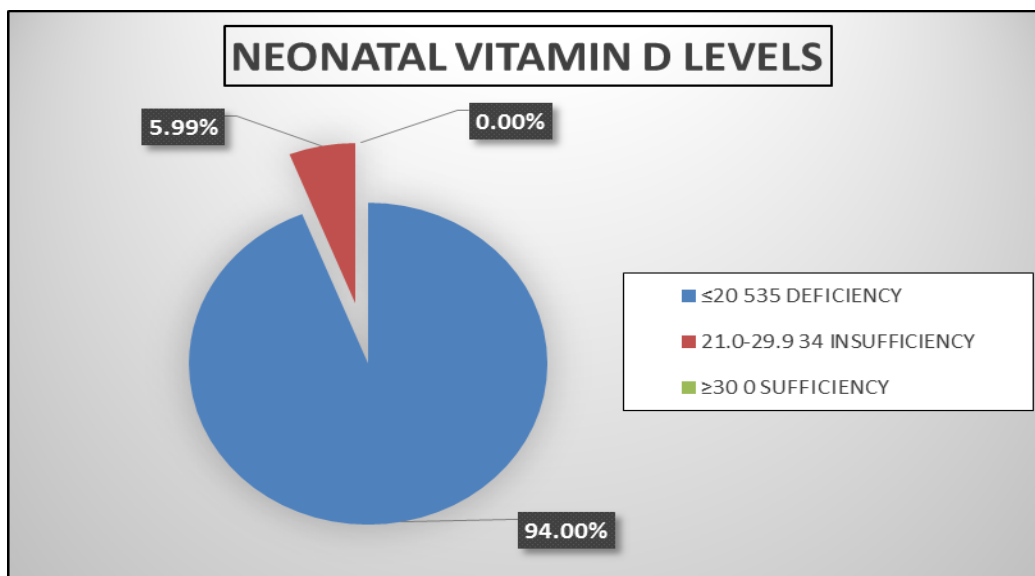
Cord blood serum 25(OH)D concentrations were expressed in ng/ml. We determined the percentage of 25(OH)D and the prevalence of Vit D deficiency in the newborns (Table 2).

**Table 2: Vitamin D level and the prevalence of vitamin D deficiency in newborns (n=569).**

RANGE (ng/ml)	FREQUENCY	INFERENCE	PERCENTAGE
≤20	535	DEFICIENCY	94.00%
21.0-29.9	34	INSUFFICIENCY	5.99%
≥30	0	SUFFICIENCY	0.00%

Our data showed that the median 25(OH)D level was **12.22 ng/mL**, mean **13.529**, SD – **3.794**, max-**27ng/mL**, min-**7.9 ng/mL**, with **94.00%** of newborn participants

having Vit D deficiency and **5.99 %** having Vit D insufficiency.



**Figure 1: Vitamin D level and the prevalence of vitamin D deficiency in newborns.**

### Vitamin D levels in Male Neonates

The levels of vitamin D in male newborns is shown in Table 3.

**Table 3: Vitamin D level and the prevalence of vitamin D deficiency in male newborns (n=317).**

RANGE (ng/ml)	FREQUENCY	INFERENCE	PERCENTAGE
≤20	291	DEFICIENCY	<b>91.7%</b>
21.0-29.9	26	INSUFFICIENCY	<b>8.2 %</b>
≥30	0	SUFFICIENCY	<b>0.00%</b>

Out of 569 samples, 317 were males with median 25(OH)D level = **12.22 ng/mL**, mean = **13.60**, SD = **3.805**, max=**27ng/mL**, min=**7.9 ng/mL**. **91.7%** of male newborn participants had Vit D deficiency and **8.2 %** had Vit D insufficiency.

### Vitamin D levels in Females Neonates

The levels of vitamin D in male newborns is shown in Table 4.

Out of 569 samples, 252 were females with median 25(OH)D level = **12.3 ng/mL**, mean = **13.44**, SD = **3.776**, max=**27ng/mL**, min=**8.2 ng/mL**. **93.6%** of female newborn participants had Vit D deficiency and **6.34 %** had Vit D insufficiency

**Table 4: Vitamin D level and the prevalence of vitamin D deficiency in female newborns (n=252).**

RANGE (ng/ml)	FREQUENCY	INFERENCE	PERCENTAGE
≤20	236	DEFICIENCY	<b>93.6%</b>
21.0-29.9	16	INSUFFICIENCY	<b>6.34 %</b>
≥30	0	SUFFICIENCY	<b>0.00%</b>

### DISCUSSION

A total of 569 cord blood samples were collected and analyzed for 25(OH)D levels. In present study, none of the neonates(n=569) had sufficient 25(OH)D (≥ 30ng/ml) as per US Endocrine Society Classification of

**Vitamin D deficiency**. Results showed that the median 25(OH)D level was **12.22 ng/mL** with Vit D deficiency in **94.00%** and Vit D insufficiency in **5.99%**. We have compared our study with findings of the other related studies in table no.4.

**Table 4: Comparative chart of studies on Neonatal 25(OH)D levels**

	Bowyers et al	Sachan et al	Karras et al	Yu et al	Present study
'n'	901	117	60	1071	569
Deficiency	11%	95.7%	70%	36.3%	94.00%
Insufficiency	29%	-	21.6%	47.8%	5.99%
Sufficiency	60%	-	8.3%	15.9%	0%
Mean		8.4	24.5	23.5	13.52
Median	24.5	-	15.9	22.4	12.22
Range (max-Min)	(6.8-98)	-		(11.5-51.1)	(7.9-27)
SD	-	5.7	13.6	6.2	3.794

**1. Bowyer's et al<sup>[9]</sup>** - Bowyer's et al conducted a study to determine the prevalence of Vitamin D deficiency in neonates and measured the serum Vitamin D levels in Cord (at delivery). They found out that 98 of 901(11%) neonates were deficient in Vitamin D (<25nmol/l or 10ng/ml). The findings of this study were different from our study in which we found Vit D deficiency in **94.00%** of newborns which could be attributed to defining criteria for Vit D deficiency in cord blood is < 10 ng/ml in Bowyer's study against <20 ng/ml in present study.

**2. Sachan et al<sup>[13]</sup>** - Sachan et al conducted a study in Northern India(Lucknow-UP), to determine the prevalence of Osteomalacia and Hypovitaminosis D in Pregnant women and cord blood. They included 117 cord

blood samples and observed high prevalence of Hypovitaminosis D(<20ng/ml) with mean of **8.4ng/ml**, **95.7%** neonates were deficient in Vitamin D. These findings corroborated with findings in our study.

**3. Karras et al<sup>[20]</sup>** - Karras et al conducted a study with the primary aim to determine serum (mothers) and umbilical cord (neonates) concentrations of all vitamin D forms [single-hydroxylated [25(OH)D<sub>2</sub>,25(OH)D<sub>3</sub>], double-hydroxylated [1 $\alpha$ ,25(OH)2D<sub>2</sub>, 1 $\alpha$ ,25(OH)2D<sub>3</sub>], epimers [3-epi-25(OH)D<sub>2</sub>, 3-epi-25(OH)D<sub>3</sub>]], in a Northern Greece cohort of pregnant women at term and their neonates. The sample size included 60 pairs of Caucasian mothers and their neonates. Majority of neonates and mothers were deficient in Vitamin D with

mean value of 15.9±13.6 ng/ml and 17.9± 13.2 ng/ml respectively.

**4. Yu et al<sup>[21]</sup>** - A prospective Cohort Study, conducted in Shanghai by Yu et al with a birth cohort of 1071 infants to estimate the prevalence of Vitamin D in cord blood and maternal blood. They found that **36.3%(388)** were having 25(OH)D < 20ng/ml (Deficient) and **84.1%(900)** had <30ng/ml 25(OH)D(Insufficient).

A high prevalence of Vit D insufficiency and deficiency in newborns is observed in the studies of Sachan et al (95.7%), Karras et al(91.6%) and Yu et al (84.1%). These findings are similar to our study(99.99%) which affirms that Vit D deficiency is a major health problem.

#### CONFLICTS OF INTEREST

All authors have none to declare.

#### CONCLUSION

1. All the neonates (100%) were deficient in Vitamin D, (mean-13.5ng/ml and SD of 3.7 ng/ml).
2. There is no significant difference in the vitamin D levels of male and female neonates.
3. Vitamin D deficiency and insufficiency are common in neonates as measured in their cord blood in my study population. Our findings may help to increase awareness of these problems and promote the Vitamin D supplementation to neonates.

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