



## Study of Serum 25-OH Vitamin D Levels in Term Neonates with Early Onset Sepsis in a Tertiary Care Hospital

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### ABSTRACT

Vitamin D is categorized as a fat-soluble vitamin that has a significant impact on the metabolism of calcium, the maintenance of appropriate calcium balance and the formation of bones. Recent investigations have indicated that vitamin D has immunomodulatory and antibacterial properties. Vitamin D plays a crucial role in the effective functioning of the innate immune system by stimulating the production of antimicrobial peptides in epithelial cells, neutrophils and macrophages. To find the relationship between serum 25-OH Vitamin D Levels in Term Neonates with Early Onset Sepsis in and to determine the possible association between neonatal 25-OH vitamin D levels and early onset sepsis in term neonates a Tertiary Care Hospital. The study was a descriptive epidemiological investigation conducted in a hospital setting. It utilised a cross-sectional design and involved two groups, namely cases and controls, for the purpose of comparison. The study group comprised of full-term newborns who exhibited clinical and laboratory indications of early onset sepsis infection and were admitted to the Special Newborn Care Unit (SNCU) within the first three days after birth. These newborns had a gestational age of more than 37 weeks. The study was carried out in the Department of Paediatrics, Burdwan Medical College and Hospital, from October 2021 to September 2022. There is a clear and notable correlation between levels of Vitamin D and different types of white blood cells. The data suggests that persons who lack sufficient Vitamin D are more prone to experiencing leucocytosis, whereas those who have an adequate amount of Vitamin D are less likely to develop this illness. This is corroborated by the computed p-value of 0.008\*, indicating a statistically significant correlation. Moreover, a significant proportion of persons (38.60%) who have a deficiency are classified as having leucocytosis, in contrast to those with insufficiency (64.90%) and sufficiency (69.20%). These findings emphasise the possible influence of Vitamin D levels on the number of leukocytes, indicating the need for more investigation into the processes that explain this connection and its clinical significance. The conclusions can be inferred from the data and interpretation of the present study, as reported and discussed in the previous sections. This study found that term newborns with early-onset sepsis (EOS) had significantly lower levels of neonatal vitamin D compared to healthy control infants who did not develop sepsis.

## INTRODUCTION

Vitamin D is categorized as a fat-soluble vitamin that has a significant impact on calcium metabolism, the maintenance of appropriate calcium balance and the mineralization of the skeletal system. Recent investigations have indicated that vitamin D has immunomodulatory and antibacterial properties. Vitamin D plays a crucial role in the effective functioning of the innate immune system by stimulating the production of antimicrobial peptides in epithelial cells, neutrophils and macrophages<sup>[1]</sup>.

Neonatal sepsis is defined as the presence of infection-related signs and symptoms, with or without the presence of bacteria in the bloodstream, occurring within the first month of life. It is a significant cause of life-threatening conditions and is considered a major factor contributing to death and morbidity in newborns..[2,3] Neonatal early onset of sepsis (EOS) is a serious and widespread sickness that is typically marked by respiratory distress, digestive abnormalities, cardiovascular disorders, cerebrovascular disorders, and/or blood disorders.

Neonatal sepsis is still one of the major causes of the neonatal morbidity and mortality<sup>[1,2]</sup>. Overall incidence of neonatal sepsis varies between 1 and 8 neonates per 1000 live births.

Neonatal sepsis is a term used to describe a widespread inflammation in the body that happens within the first four weeks of life due to an infection that is either suspected or confirmed. Early onset sepsis is characterised as a bloodstream infection occurring within 72 hours of birth. The condition is commonly linked to the transmission of bacteria from the mother and typically manifests as respiratory distress and pneumonia<sup>[2]</sup>.

Research has shown that a deficiency of vitamin D in expectant mothers is linked to negative outcomes for newborns, including being smaller than expected for their gestational age, being born prematurely, having impaired bone and tooth development and being at a higher risk for infectious infections<sup>[4]</sup>.

Vitamin D insufficiency has become a prominent global health issue. Even in the Indian context, it has been claimed that a majority of youngsters have this condition, despite the fact that sunshine is widely available. However, Neonatal sepsis remains a significant contributor to both the illness and death rates among newborns.

The available data on the correlation between vitamin D deficiency and early onset newborn sepsis is insufficient. There is a scarcity of literature on the relationship between vitamin D levels and early onset newborn sepsis. Further research is necessary to gain a more comprehensive grasp of this topic. The study aimed to investigate the potential correlation between the levels of 25 OH vitamin D in mothers and newborns and the occurrence of neonatal sepsis.

## MATERIALS AND METHODS

**Study Type and Design:** It was a hospital based descriptive epidemiological study with cross sectional design including 2 groups (cases and controls) for comparison

**Study Area:** In-patient Department of Paediatrics, Burdwan Medical College and Hospital

**Study Period:** One year: October 2021 - September 2022

**Study Population:** The study group consisted of term neonates with clinical and laboratory findings suggestive of early onset sepsis infection admitted to SNCU within the first three postnatal days of life who were >37 weeks of gestation. The control group consisted of neonates with no signs of clinical infection admitted to SNCU and LR. Total number of sample 120, Study group: 60 & Control group: 60.

### Inclusion Criteria:

- Study group: Infants with clinical and laboratory findings of EOS admitted to SNCU within 72 hours of life.
- Control group: Healthy infants with no signs of clinical infection admitted to SNCU within 72 hours of life.

### Exclusion Criteria:

- Congenital malformation, metabolic disease, small for gestational age (SGA), prematurity, twin neonates, use of antibiotic therapy at admission and age above 3 days.
- Exclusion criteria for mothers included malnutrition, metabolic or chronic disease and twin pregnancy, use of medications, chorioamnionitis and premature rupture of membranes and age less than 20 years or above 40 years

## RESULTS

Our study included 51 patients (42.5%) who were younger than 25 years, 64 patients (53.3%) who were between 25 and 30 years old and 5 patients (4.2%) who were older than 30 years (Table 1).

Within our research, a total of 16 patients, accounting for 13.3% of the sample, exhibited low birth weight (LBW), whereas the remaining 104 patients, constituting 86.7% of the sample, had a normal birth weight (BW).

Out of the individuals included in our study, 57 (47.5%) were found to have Deficiency, 37 (30.8%) had Insufficiency and 26 (21.7%) had Sufficiency.

In Maternal age (years), the (Mean±SD) of patients was 24.9±2.9. In Gestational age (weeks), the (Mean±SD) of patients was 38.5±1.2. In Birth weight

Table 1: Age group wise distribution of the mothers of the study participants (n = 120)

Parameters	Frequency	Percent
<b>Age group</b>		
<25 years	51	42.5
25-30 years	64	53.3
>30 years	5	4.2
Total	120	100.0
<b>Birth weight</b>		
LBW	16	13.3
Normal BW	104	86.7
Total	120	100.0
<b>Vitamin D level</b>		
Deficiency	57	47.5
Insufficiency	37	30.8
Sufficiency	26	21.7
Total	120	100.0

Table 2: Measures of central tendency for some of the important parameters (n = 120)

Parameters	Minimum	Maximum	Mean	SD
Maternal age (years)	20	32	24.9	2.9
Gestational age (weeks)	37	41	38.5	1.2
Birth weight (kg)	2.2	3.6	2.8	0.3
Total leukocyte count	2500	239000	15817	24155
Platelet count (/cumm)	60000	440000	203025	96049
C reactive protein (mg/L)	1	63	19.4	20.1
Vit D (ng/ml)	8.1	53.3	21.4	10.2

Table 3: Distribution of study participants according to leukocyte count and vitamin D level (n = 120)

Vitamin D (ng mL <sup>-1</sup> )	Leukocyte category (/cumm)			p-value
	Within normal range	Leucocytosis	Total	
Deficiency	22 38.60%	35 61.40%	57 100.00%	0.008*
Insufficiency	24 64.90%	13 35.10%	37 100.00%	
Sufficiency	18 69.20%	8 30.80%	26 100.00%	
Total	64 (53.3%)	56 (46.7%)	120 (100%)	

Table 4: Distribution of study participants according to platelet count and vitamin D level (n = 120)

Vitamin D (ng mL <sup>-1</sup> )	Platelet category (/cumm)		Total	p-value
	Within normal range	Reduced platelet count		
Deficiency	39 68.40%	18 31.60%	57 100.00%	0.002*
Insufficiency	32 86.50%	5 13.50%	37 100.00%	
Sufficiency	26 100.00%	0 0.00%	26 100.00%	
Total	97 (80.8%)	23 (19.2%)	120 (100%)	

Table 5: Distribution of study participants according to CRP level and vitamin D level (n = 120)

Vitamin D (ng mL <sup>-1</sup> )	CRP level (mg L <sup>-1</sup> )		Total	p-value
	Within normal range	Increased CRP levels		
Deficiency	7 12.30%	50 87.70%	57 100.00%	<0.0001
Insufficiency	27 73.00%	10 27.00%	37 100.00%	
Sufficiency	26 100.00%	0 0.00%	26 100.00%	
Total	60 (50%)	60 (50%)	120 (100%)	

(kg), the (Mean±SD) of patients was 2.8±0.3. In Total leukocyte count, the (Mean±SD) of patients was 15817±24155. In Platelet count (/cumm), the (Mean±SD) of patients was 203025±96049. In C reactive protein (mg/L), the (Mean±SD) of patients was 19.4±20.1. In Vit D (ng/ml), the (Mean±SD) of patients was 21.4±10.2.

There is a clear and important correlation between levels of Vitamin D and different types of white blood cells. The data suggests that those who have a deficiency of Vitamin D are more inclined to experience leucocytosis, whereas those who have insufficiency or sufficiency of Vitamin D are less susceptible to this illness. This is corroborated by the computed p-value of 0.008\*, indicating a statistically significant correlation. Moreover, the largest proportion of persons with a deficiency (38.60%) can be classified as having leucocytosis, as opposed to those with insufficiency (64.90%) and sufficiency (69.20%). The results emphasise the potential influence of Vitamin D levels on the number of white blood cells, emphasising the need for more investigation into the processes that explain this connection and its significance in clinical settings (Table 3).

Among the patients, 39 (68.40%) had a deficiency, 32 (86.50%) had an insufficiency and 26 (100.00%) had sufficient levels within the normal range (Table 4).

Among the individuals with reduced platelet count, 18 (31.60%) had a deficiency and 5 (13.50%) had an insufficiency.

The correlation between Vitamin D levels (measured in ng/ml) and Platelet count (measured in /cumm) was found to be statistically significant (p = 0.002\*) (Table 5).

Among the patients, 7 (12.30%) had a deficiency, 27 (73.00%) had an insufficiency and 26 (100.00%) had sufficient levels within the normal range.

Out of the individuals with reduced platelet count, 87.70% had deficiency and 27.00% had insufficiency. The statistical analysis revealed a significant association between Vitamin D levels (ng/ml) and Platelet category (cumm) with a p-value of less than 0.0001.

## DISCUSSION

The current study involved a sample of 120 infants, consisting of 60 infants diagnosed with sepsis and 60 infants without sepsis. The objective of the study was to investigate the relationship between their vitamin D levels and the occurrence of septicemia.

The bulk of the study participants' moms fell into the age category of 25-30 years (53.3%), followed by those under 25 years (42.5%). The study found that the percentage of male children was greater (55.8%). The prevalence of infants with low birth weight was 13.3%. The percentage of newborns delivered via caesarean section was marginally higher, at 51.7%.

Leucocytosis was seen in 46.7% of the individuals included in the study. Platelet count was decreased in 19.2% of the individuals included in the study. 16.7% of the study patients had a good culture report. 43.3% of the children were born during the winter season, which was the most common time of year for deliveries.

Vitamin D deficiency was observed in 47.5% of the study subjects, whereas vitamin D insufficiency was found in 30.8% of the instances. Cetinkya *et al.*<sup>[5]</sup> in 2014 found a positive correlation between vitamin D deficiency and early onset sepsis. Seliem *et al.*<sup>[6]</sup> in 2016 concluded that low neonatal vitamin D level was associated with EOS. The best cut off value of neonatal vitamin D for risk of sepsis was 14.4 ng dL<sup>-1</sup>.

Kanth *et al.*<sup>[7]</sup> in 2016 found that 25(OH)D levels in the study group were significantly lower compared with those in the control group. The majority (64.1%) of infants in the sepsis group had a mean 25(OH)D level >12 ng mL<sup>-1</sup>, which was statistically significant (p<0.05). Gamal *et al.*<sup>[8]</sup> in 2017 found cut off values <20ng/dl for neonatal 25-OH vitamin D for detection of neonatal sepsis.

There is a statistically significant difference in the average total leucocyte count between the patients and controls. There was a statistically significant disparity in the average platelet count between the patients and controls. There was a statistically significant disparity in the average CRP levels between the patients and controls.

The prevalence of leucocytosis was significantly greater among study participants who had a deficit of vitamin D (61.4%). This discovery exhibited statistical significance. The study participants with vitamin D insufficiency experienced a significant decrease (31.6%) in their platelet count. The statistical analysis revealed a significant finding with a p-value of less than 0.05.

The study participants with vitamin D insufficiency exhibited a significant increase (87.7%) in their CRP levels. The result of this study was deemed statistically significant, with a p-value of less than 0.05. The mortality rate was significantly greater in the cases (18.3%) compared to the control group (6.7%). The result of this study was deemed statistically significant, with a p-value of less than 0.05.

## CONCLUSION

Based on the findings and interpretation of the present study as presented and discussed in the previous sections the following conclusions can be

drawn: This study report significantly lower neonatal vitamin D levels in term infants with EOS compared to the healthy control who did not have sepsis.

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