

# Correlation of Maternal Vitamin D Deficiency with Neonatal Outcome in a Bangladeshi Tertiary Care Hospital

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## Abstract

**Background:** Vitamin D deficiency during pregnancy has been implicated in various adverse maternal and neonatal outcomes. This study aims to assess the prevalence of Vitamin D deficiency among pregnant women in Bangladesh and its association with neonatal and delivery outcomes.

**Methods:** This cross-sectional observational study was conducted at Chattogram Medical College Hospital and other private hospitals in Chattogram from January 2022 to June 2023. A total of 91 pregnant women who provided informed consent were enrolled. Data were collected on demographic details, obstetric history, lifestyle factors, supplementation of calcium and Vitamin D, delivery details, and neonatal outcomes.

**Result:** Of the participants, 65.93% had sufficient Vitamin D levels, while 34.07% were deficient. The majority of deliveries (46.15%) occurred between 39 to 40 weeks, predominantly through vaginal birth (69.23%). The incidence of PPH was higher in women with Vitamin D deficiency (25%) compared to those with sufficient levels (9.68%), although this did not reach statistical significance ( $p$ -value = 0.082). Neonatal outcomes showed 63.74% of neonates had no complications, with neonatal asphyxia (23.08%) being the most common issue observed.

**Conclusion:** While the association between Vitamin D deficiency and adverse outcomes such as PPH did not reach statistical significance, the study highlights the prevalence of Vitamin D deficiency and its potential impact on pregnancy outcomes. Further research is warranted to confirm these findings and possibly extend Vitamin D monitoring and supplementation as part of prenatal care protocols in Bangladesh.

**Keywords:** Vitamin D Deficiency, Pregnancy, Neonatal Outcomes, Postpartum Hemorrhage, Bangladesh

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## I. INTRODUCTION

Vitamin D, a secosteroid vital for human health, is synthesized in the skin through ultraviolet radiation and can also be absorbed from dietary sources such as fatty fish, fortified dairy products, and supplements (1,2). Beyond its well-known role in calcium absorption and bone health, Vitamin D influences numerous biological processes including immune function and cell growth. The hormone's pivotal role is particularly underscored during pregnancy, where it affects placental and fetal development (3). Globally, Vitamin D deficiency is a

prevalent issue, particularly among pregnant women, affecting approximately 40% of European pregnant women and similar rates are reported in the United States (4,5). This widespread deficiency highlights a significant public health issue, as low Vitamin D levels are associated with various maternal and fetal complications, including gestational diabetes, preeclampsia, and severe perinatal outcomes (6,7). In South Asia, the situation is similarly concerning, with studies indicating high prevalence rates of Vitamin D deficiency among pregnant women (8). This deficiency is largely influenced by geographical, dietary, and cultural factors that limit sun exposure and dietary intake of the vitamin. Specific data from Bangladesh are sparse, which limits understanding and management of Vitamin D deficiency impacts in this region. However, some regional studies suggest that maternal Vitamin D deficiency is notably prevalent and likely contributes to adverse neonatal outcomes (9,10). Research consistently links insufficient maternal Vitamin D levels with negative neonatal outcomes, such as low birth weight, preterm birth, and neonatal hypocalcemia (11). Studies indicate that newborns whose mothers had Vitamin D deficiency are also at a greater risk of developing long-term developmental challenges. A review by Websky et al. highlighted that Vitamin D plays a critical role during gestation, affecting not just physical but also potentially neurodevelopmental outcomes in children (5). The literature from other regions with similar socioeconomic conditions, such as parts of Africa and India, provides a valuable comparison, showing parallel trends in the prevalence of deficiency and associated risks. These studies underscore the global nature of the issue, yet also emphasize the variability in outcomes based on local dietary and environmental factors, which can influence Vitamin D metabolism (8,12). However, a major gap remains in comprehensive, region-specific research, especially in countries like Bangladesh. Most existing studies do not adequately address the local dietary habits, genetic factors, or environmental conditions that are crucial for understanding and addressing Vitamin D deficiency in pregnant women. The current global literature, while extensive, often fails to capture the nuanced implications of these local factors on maternal and neonatal health. Given the critical role of Vitamin D in pregnancy and the notable deficiency rates in Bangladesh, there is a compelling need for targeted research in this area. This study aims to fill the existing gaps by examining the specific impacts of maternal Vitamin D levels on neonatal outcomes within the Bangladeshi population. By focusing on a region-specific approach, this research will not only provide valuable insights into the local implications of Vitamin D deficiency but also guide public health policies and interventions tailored to the unique needs of the Bangladeshi population.

## II. METHODS

This cross-sectional observational study was conducted at Chattogram Medical College Hospital and other private hospitals in Chattogram from January 2022 to June 2023. The study enrolled 91 currently pregnant women who provided informed consent. Inclusion criteria were limited to pregnant women at any stage of pregnancy, while exclusion criteria encompassed those with planned or ongoing abortions and mothers with chronic diseases that could influence study outcomes. Data were collected using a structured sheet, capturing demographic details, obstetric history, lifestyle factors, supplementation of calcium and Vitamin D, delivery details, and neonatal outcomes. Key clinical measurements included serum Vitamin-D and calcium levels. The primary focus was to examine the association between maternal Vitamin-D deficiency and serum calcium levels with the incidence of primary Cesarean section and postpartum hemorrhage (PPH). Statistical analysis was planned to include descriptive and inferential statistics to assess the relationships between the variables. Ethical approval for the study was obtained from the institutional review boards of the involved hospitals.

## III. RESULTS

**Table 1:** Distribution of baseline characteristics among the participants (N=91)

Variables	Frequency	Percentage
<b>Age</b>		
<20	19	20.88%
20-29	56	61.54%
30-39	16	17.58%
<b>Occupation</b>		
Housewife	52	57.14%
Service Worker	27	29.67%
Student	12	13.19%
<b>Education Level</b>		
Illiterate	29	31.87%
Primary	22	24.18%
SSC	22	24.18%

HSC	11	12.09%
Graduate	7	7.69%
<b>Socioeconomic Status</b>		
Lower class	13	14.29%
Lower Middle Class	36	39.56%
Upper Middle Class	29	31.87%
Upper Class	13	14.29%
<b>Residence</b>		
Rural	54	59.34%
Urban	34	37.36%
Semi-Urban	3	3.30%

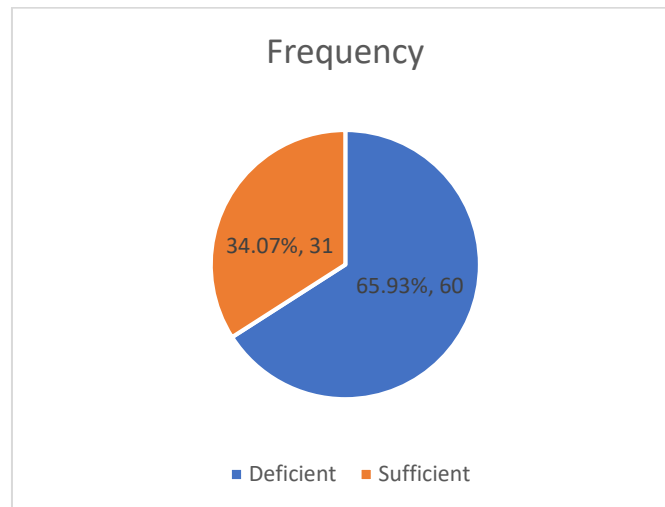
The age of participants predominantly ranged between 20 to 29 years, accounting for 61.54% of the study population, while those under 20 years represented 20.88%, and 17.58% were between 30 to 39 years. In terms of occupation, more than half of the participants (57.14%) were housewives, followed by service workers (29.67%), and a smaller portion were students (13.19%). Educational levels varied, with 31.87% of the participants being illiterate, 24.18% having completed primary education, an equal percentage (24.18%) had completed up to SSC (Secondary School Certificate), 12.09% up to HSC (Higher Secondary Certificate), and a minority (7.69%) were graduates. The socioeconomic status of the participants also showed variation, with 39.56% belonging to the lower-middle class, 31.87% to the upper-middle class, and roughly equal percentages falling into the lower class and upper class categories (14.29% each). The majority of participants resided in rural areas (59.34%), while 37.36% were from urban settings, and a minimal 3.30% from semi-urban areas.

**Table 2:** Distribution of participants by obstetric history and characteristics (N=91)

Variables	Frequency	Percentage
<b>Parity</b>		
Nulliparity	42	46.15%
Primipara	27	29.67%
2-3 parity	21	23.08%
>3 parity	4	4.40%
<b>Gravida</b>		
Primi gravida	37	40.66%
2nd Gravida	24	26.37%
3rd Gravida	21	23.08%
4th Gravida	8	8.79%
5th Gravida	1	1.10%
<b>Planning of Pregnancy</b>		
Planned	63	69.23%
Unplanned	28	30.77%
<b>Antenatal Checkup</b>		
Regular	52	57.14%
Irregular	38	41.76%
No Antenatal Care	1	1.10%
<b>Adverse Obstetric History</b>		
Yes	33	36.26%
No	58	63.74%

A significant portion of the cohort were nulliparous, making up 46.15%, followed by primipara at 29.67%, those with 2-3 parity at 23.08%, and a small fraction (4.40%) having more than three parities. In terms of gravida, 40.66% of the participants were experiencing their first pregnancy, and 26.37% were on their second. Those on their third and fourth pregnancies represented 23.08% and 8.79%, respectively, with a negligible 1.10% undergoing their fifth pregnancy. This distribution highlights the range of pregnancy experiences within the group. Regarding the planning of pregnancies, the majority (69.23%) reported that their pregnancies were planned,

whereas 30.77% were unplanned. This indicates a high level of intended pregnancies among the participants. Antenatal care attendance was high, with 57.14% having regular check-ups, though 41.76% attended irregularly and a minimal 1.10% reported receiving no antenatal care. Concerning adverse obstetric history, over a third of the participants (36.26%) reported having adverse obstetric outcomes in previous pregnancies, while the majority (63.74%) did not report such histories.



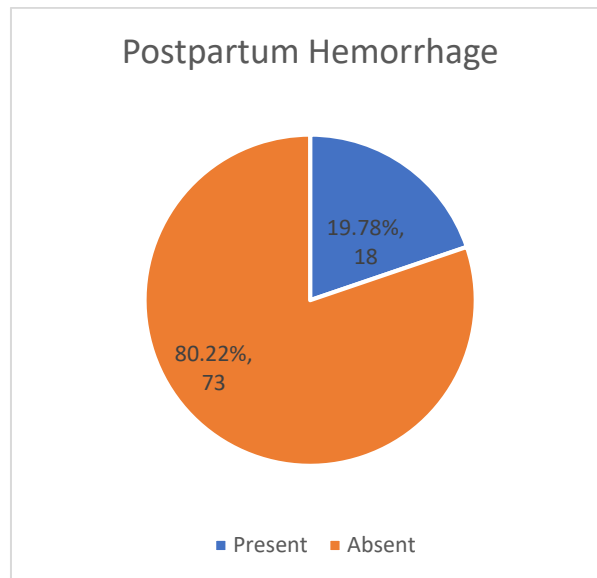
**Figure 1:** Distribution of serum vitamin D level among the participants (N=91)

The pie chart illustrates that 65.93% (60 participants) had sufficient levels of serum Vitamin D, whereas 34.07% (31 participants) were deficient.

**Table 3:** Distribution of participants by delivery details and complications (N=91)

Variables	Frequency	Percentage
<b>Time of Delivery</b>		
At 37-38 weeks	27	29.67%
at 39-40 weeks	42	46.15%
40-42 weeks	22	24.18%
<b>Mode of Delivery</b>		
Vaginal	63	69.23%
Cesarean Section	28	30.77%
<b>Delivery Complications</b>		
No	51	56.04%
Prolonged Labor	30	32.97%
Obstructed labor	8	8.79%
Preterm Labor	2	2.20%

In analyzing delivery details and complications among the 91 participants, it was found that the majority of deliveries occurred between 39 to 40 weeks, accounting for 46.15% of the cases. Deliveries at 37 to 38 weeks and 40 to 42 weeks were also fairly common, with frequencies of 29.67% and 24.18%, respectively. Most women in the study underwent vaginal delivery, comprising 69.23% of the participants, while Cesarean sections were necessary for 30.77%. This distribution indicates a predominant trend towards natural birth methods. Regarding delivery complications, more than half of the participants (56.04%) reported no complications. However, a substantial number experienced prolonged labor, representing 32.97% of the cohort. Obstructed labor was less common, occurring in 8.79% of cases, and preterm labor was rare, reported in only 2.20% of the instances.



**Figure 2:** Incidence of postpartum hemorrhage among the participants (N=91)

The chart shows that 19.78% (18 participants) experienced PPH, while a majority, 80.22% (73 participants), did not experience this complication.

**Table 4:** Distribution of neonatal outcome among the participants (N=91)

Variables	Frequency	Percentage
<b>Complications</b>		
No Complications	58	63.74%
Neonatal Asphyxia	21	23.08%
Congenital anomaly	2	2.20%
Very low birth weight	6	6.59%
Stillbirth	3	3.30%
Neonatal jaundice	1	1.10%
<b>Fetal Weight</b>		
< 2.5kg	22	24.18%
≥ 2.5-3.5kg	62	68.13%
> 3.5kg	7	7.69%

A majority of the newborns, 63.74%, did not face any complications at birth. However, neonatal asphyxia was the most common complication, affecting 23.08% of the newborns. Other less frequent complications included congenital anomalies and very low birth weight, each recorded in 2.20% and 6.59% of cases, respectively. The occurrence of stillbirths was noted in 3.30% of cases, and neonatal jaundice was reported in 1.10% of the newborns. Regarding fetal weight, there was a wide distribution, with 24.18% of the newborns weighing less than 2.5 kg, which suggests that nearly a quarter of the births were below the average birth weight. The majority of the newborns, 68.13%, had a birth weight in the range of 2.5 to 3.5 kg, which is considered within the normal range. A small proportion, 7.69%, were over 3.5 kg.

**Table 5:** Correlation of postpartum hemorrhage with serum vitamin D level (N=91)

Postpartum Hemorrhage	Serum Vitamin D Level				p-value
	Deficient (n=60)		Sufficient (n=31)		
	n	%	n	%	
Present	15	25.00%	3	9.68%	0.082
Absent	45	75.00%	28	90.32%	

Among those with Vitamin D deficiency (n=60), 25.00% experienced PPH, while in the Vitamin D sufficient group (n=31), PPH occurred in only 9.68%. Despite these differences, the p-value of 0.082 suggests that the correlation between Vitamin D levels and the incidence of PPH did not reach statistical significance in this sample.

**Table 6:** Correlation of neonatal outcome with serum vitamin D level (N=91)

Variables	Serum Vitamin D Level				p-value
	Deficient (n=60)		Sufficient (n=31)		
	n	%	n	%	
<b>Complications</b>					
No complication	35	58.33%	23	74.19%	0.451
Neonatal Asphyxia	14	23.33%	7	22.58%	
Congenital anomaly	2	3.33%	0	0.00%	
Low birth weight	5	8.33%	1	3.23%	
Stillbirth	3	5.00%	0	0.00%	
Neonatal jaundice	1	1.67%	0	0.00%	
<b>Fetal Weight</b>					
< 2.5kg	18	30.00%	4	12.90%	0.162
≥ 2.5-3.5kg	37	61.67%	25	80.65%	
> 3.5kg	5	8.33%	2	6.45%	

In the group with Vitamin D deficiency (60 mothers), 58.33% had no complications in their newborns, while 74.19% of mothers with sufficient Vitamin D levels (31 mothers) had newborns without complications, yielding a p-value of 0.451, indicating no statistically significant difference between the two groups. Neonatal asphyxia occurred in 23.33% of the deficient group and 22.58% of the sufficient group, congenital anomalies were present in 3.33% of the deficient group only, low birth weight was noted in 8.33% of the deficient group versus 3.23% in the sufficient group, stillbirths were reported in 5.00% of the deficient group only, and neonatal jaundice was reported in 1.67% of the deficient group only. In terms of fetal weight, 30.00% of newborns from the Vitamin D deficient group weighed less than 2.5kg, in comparison to 12.90% from the sufficient group, with a p-value of 0.162, which suggests a non-significant trend towards lower birth weights in Vitamin D deficient mothers. The majority of newborns weighed between 2.5 to 3.5kg, with 61.67% in the deficient group and 80.65% in the sufficient group. Only a small percentage of newborns weighed over 3.5kg in both groups (8.33% in the deficient group and 6.45% in the sufficient group).

#### IV. DISCUSSION

The current study presents notable findings concerning demographic and socio-economic distributions, obstetric history, Vitamin D levels, and various maternal and neonatal outcomes in a cohort of Bangladeshi pregnant women. This discussion integrates these findings with existing literature to illuminate similarities and differences, and to speculate on the implications of these observations. The demographic profile of our cohort shows a majority of women aged between 20 to 29 years, consistent with the findings of Zahan and Feng, which highlight similar age distributions among Bangladeshi women of reproductive age (13). The predominant status of participants as housewives and the varied educational attainment align with the socio-economic conditions described by the study of Rahman, where women's autonomy and educational status significantly influence pregnancy outcomes (14). In terms of obstetric history, the high proportion of nulliparity and planned pregnancies in our study are comparable to findings from other regional studies (8). Regular antenatal check-ups in over half of the cohort are encouraging, reflecting trends noted by Islam and Masud (2018) in their assessment of healthcare-seeking behaviour during pregnancy in Bangladesh (15). However, the significant number of participants with adverse obstetric histories highlights a critical area for enhanced prenatal care initiatives, a need that resonates across many South Asian countries where similar challenges persist. This underlines the importance of strengthening healthcare systems to improve maternal health outcomes region-wide (16). Our findings on Vitamin D status—where 65.93% of the women had sufficient levels—deviate somewhat from the higher deficiency rates reported in regional studies such as those by Islam et al. and Ahmed et al (17,18). This discrepancy might reflect variations in dietary habits, sunlight exposure, or possibly differences in socio-economic factors. The delivery outcomes detailed in our study—mostly full-term and vaginal deliveries—are similar to those observed in wider South Asian studies (9). In our study, the incidence of postpartum hemorrhage (PPH) was notably higher among women with Vitamin D deficiency, where 25% of women deficient in Vitamin D experienced PPH compared to

only 9.68% of those with sufficient Vitamin D levels. Although this association did not reach statistical significance (p-value = 0.082), the marked difference in incidence rates between the two groups points to a potential risk factor. This finding is particularly important, even though it is not statistically significant, because it aligns with trends reported by Stevenazzi et al., who also explored but did not confirm Vitamin D deficiency as a predictor of PPH (19). The level of difference here—more than double the incidence rate—suggests a possible clinical relevance that warrants further investigation into Vitamin D's role in maternal health outcomes, as also emphasized in broader analyses. Similarly, the correlation of neonatal outcomes with maternal Vitamin D levels in our study reveals intriguing but statistically non-significant trends. While there was no clear statistical significance in the differences observed, with p-values of 0.451 for neonatal complications and 0.162 for fetal weight, the direction of the trends indicates potential clinical concerns. For instance, Vitamin D deficient women were more likely to have neonates with complications and lower birth weights. Specifically, neonatal asphyxia appeared in 23.33% of neonates from Vitamin D deficient mothers compared to 22.58% from sufficient Vitamin D mothers, and low birth weight was observed in 8.33% of the deficient group versus 3.23% in the sufficient group. These findings resonate with those from Weinert et al., who reported that Vitamin D deficiency in pregnant women was linked to increased incidences of adverse neonatal outcomes such as neonatal hypoglycemia and small for gestational age neonates (20). Although our findings did not achieve statistical significance, the observed trends align with these prior studies, suggesting that even minor differences in Vitamin D levels could be clinically meaningful and might influence neonatal health outcomes. This underlines the importance of careful monitoring and possibly proactive management of Vitamin D levels in pregnant women to potentially improve neonatal health outcomes.

#### *Limitations of The Study*

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

### **V. CONCLUSION**

The findings from this study underscore the significant associations between demographic characteristics, Vitamin D levels, and various maternal and neonatal outcomes within a cohort of Bangladeshi pregnant women. Despite a majority displaying sufficient levels of Vitamin D, the distinct contrast in the incidence rates of postpartum hemorrhage between Vitamin D deficient and sufficient groups, although not statistically significant, suggests potential clinical importance. These trends, alongside the observed correlations with neonatal outcomes such as asphyxia and low birth weight, highlight the need for heightened attention to Vitamin D status among pregnant women. While our results did not always reach statistical significance, the consistent patterns observed call for further research to confirm these findings and to explore the underlying mechanisms. It is crucial for future studies to continue examining these relationships and for health policy makers to consider integrating Vitamin D monitoring and supplementation strategies into prenatal care protocols to potentially enhance maternal and neonatal health outcomes. This study contributes to the growing body of evidence that suggests maternal Vitamin D status is a key factor in the health of both mothers and their offspring, emphasizing the need for comprehensive healthcare strategies that address nutritional deficiencies among pregnant women in Bangladesh and similar contexts.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

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