International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Sharmin SN et al. Int J Reprod Contracept Obstet Gynecol. 2025 Jul;14(7):2118-2123
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20251956

Original Research Article

Measurement of serum vitamin D levels among the pregnant women

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Received: 19 May 2025
Accepted: 17 June 2025

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ABSTRACT

Background: Vitamin D deficiency during pregnancy has been implicated in adverse maternal and neonatal outcomes, including preterm labor. However, study on serum vitamin D status among pregnant women remains limited in the local context. This study aimed to assess the serum vitamin D levels among pregnant women presenting in labor and to explore associations with sociodemographic, behavioral, and obstetric factors.
Methods: A descriptive type of cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, Bangladesh Medical University (BMU), Dhaka, from July 2023 to June 2024. A total of 64 pregnant women aged 18-40 years in labor were enrolled, Data were collected using a semi-structured questionnaire. Serum 25(OH) vitamin D levels were measured using the Atellica IM assay. Statistical analysis was performed using SPSS version 26 with significance set at $p \leq 0.05$.
Results: The mean age of participants was 34.86±9.64 years. Most women were housewives (40.6%) and had completed primary, secondary, or higher secondary education (each 28.1%). Approximately 65.6% were primiparous, 45.3% were at 37-38 weeks of gestation, and 25.0% reported pregnancy complications. While 71.9% received vitamin D supplements, 34.4% had low intake of dairy/fish, and 89.1% had ≤30 minutes of daily sun exposure. The BMI assessment showed 29.7% were overweight and 20.3% obese. Vitamin D insufficiency was observed in 90.6% of participants. Significant associations were found between serum vitamin D levels and parity ($p = 0.000$) as well as gestational age ($p = 0.000$).
Conclusions: Vitamin D insufficiency is highly prevalent among pregnant women in labor, particularly in primiparas and those with preterm labor. Findings highlight the need for targeted nutritional interventions and routine vitamin D screening during antenatal care.

Keywords: Fetal outcomes, Gestational complications, Maternal health, pregnancy, Socio-demographic factors, Vitamin D status

INTRODUCTION

Vitamin D, a fat-soluble secosteroid hormone, plays an essential role in calcium and phosphorus metabolism and is vital for bone mineralization and musculoskeletal health. Beyond skeletal functions, vitamin D modulates immune replies and inflammatory pathways, conducive to maternal and fetal well-being all through pregnancy.[1,2] Upholding optimal vitamin D levels in gestation is critical not only for maternal bone integrity but also for fetal skeletal growth and immune programming.[3,4] Despite its reputation, vitamin D deficiency is a global public health alarm, mainly among pregnant women.[5] Its prevalence differs significantly across regions and populations due to varied factors such as geographic location, sun exposure, skin pigmentation, dietary intake, cultural practices, and socioeconomic status.[6,7]

In South Asia, and mainly in Bangladesh, this problem is exacerbated by low dietary diversity, nominal consumption of vitamin D-fortified foods, and clothing customs that decrease sunlight exposure.[8,9] Bangladeshi women of reproductive age face a high problem of vitamin D inadequacy, often combined by poverty, poor nutritional literacy, and limited access to antenatal supplementation programs.[10,11] Several studies have shown that maternal vitamin D deficiency is related with opposing obstetric consequences such as preeclampsia, gestational diabetes, low birth weight, preterm labor, and improved rates of cesarean delivery.[12-13] Moreover, neonatal complications such as hypocalcemia, impaired bone growth, and rickets have been associated to suboptimal maternal vitamin D status.[14]

Global and regional research has decorated various predictors of maternal vitamin D deficiency, with young maternal age, low parity, progressive gestational age, high body mass index (BMI), and inadequate intake of vitamin D-rich food.[19,20] Sociocultural restrictions and urbanization trends more control physical activity and sun exposure in pregnant women in South Asia.[15-16] In Bangladesh, even though a few studies have observed vitamin D deficiency in the over-all population, data exactly focused on pregnant women during labor persist limited.[18]

In light of these findings, the present study aims to assess the serum vitamin D levels among pregnant women presenting in labor and to explore the associations with sociodemographic, behavioral, and obstetric factors. By providing an in-depth understanding of these associations, the study aims to contribute to the body of evidence on the factors influencing maternal vitamin D status and to inform public health strategies for the prevention and management of vitamin D deficiency in pregnancy.

METHODS

A descriptive type of cross-sectional study was conducted in the Department of Obstetrics and Gynaecology at the BMU, Dhaka, over a 12-month period from July 2023 to June 2024. The study population included singleton pregnant women aged 18 to 40 years admitted in labor.

A purposive sampling technique was used to select sample based on the inclusion criteria considering a 10% non-response rate, totaling 64 respondents.

Data were collected using a pretested semi-structured questionnaire that captured socio-demographic, obstetric, anthropometric, and laboratory information. Gestational age was determined based on the last menstrual period and confirmed by ultrasonography.

Following informed written consent, 5 ml of venous blood was collected from each participant using aseptic technique. The samples were transferred into red-top tubes, allowed to clot, and centrifuged at 4400 rpm for 10–15 minutes to separate serum. The serum samples were analyzed on the same day or stored at -20°C until analysis. Measurement of serum 25-hydroxyvitamin D [25(OH)D] levels were performed at the BMU Laboratory, Dhaka, using the fully automated Atellica IM Vitamin D Total assay. Serum vitamin D levels were expressed in ng/ml and categorized as deficient (≤20 ng/ml), insufficient (20-29 ng/ml), or sufficient (≥30 ng/ml).

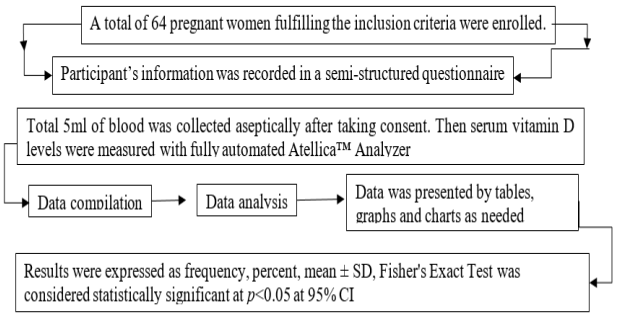

Figure 1: Data processing plan.

All data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize the data. Differences in mean serum vitamin D levels were analyzed using the Results were expressed as frequency, mean±SD Fisher's Exact Test, 1 cell (25.0%) has expected count less than 5 was considered statistically significant. A p value of ≤0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Review Board of BMU. All information was used solely for research purposes.

RESULTS

A descriptive type of cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, BMU, Dhaka, to assess the serum vitamin D levels among the 64 pregnant women.

Table 1 shows most participants 37.5% were between 18 and 30 years of age, with a mean age of 34.86 ± 9.64 years. Educational attainment was relatively balanced across primary 28.1%, secondary 28.1%, and higher secondary or above 28.1%, while 15.6% had no formal education. Most respondents were housewives 40.6%, followed by those in service 21.9%, and 29.7% reported engagement in other occupations. In terms of monthly family income, nearly half 46.9% belonged to households earning between BDT 20,000-40,000, while 37.5% had an income above BDT 40,000, and 15.6% earned below BDT 20,000.

Table 2 illustrates among the respondents, the majority were primiparous women 65.6%, while 34.4% were multiparous. Nearly half of the participants, 45.3% were at 37-38 weeks of gestation, and 43.8% were at 39-40 weeks, with only 10.9% beyond 40 weeks. One-quarter of the women 25.0% reported experiencing pregnancy-related complications. Additionally, a substantial proportion

71.9% had received vitamin D supplementation during pregnancy, while 28.1% had not received vitamin D supplementation during pregnancy, while 28.1% had not.

Table 1: Socio-demographic characteristics of the respondents (n = 64).

Age group in years	Frequency	Percent
18-30	37	37.5
31-40	27	29.7
Mean±SD	34.86±9.643	
Educational status		
No formal education	10	15.6
Primary	18	28.1
Secondary	18	28.1
Higher secondary and above	18	28.1
Occupation		
Housewife	26	40.6
Service holder	14	21.9
Business	5	7.8
Other	19	29.7
Monthly family income (in BDT)		
<20,000	10	15.6
20,000-40,000	30	46.9
>40,000	24	37.5
Total	64	100.0

Table 2: Distribution of the respondents by pregnancy status (n=64).

Parity	Frequency	Percent
Primipara	42	65.6
Multipara	22	34.4
Gestational age (in weeks)		
37-38 weeks	29	45.3
39-40 weeks	28	43.8
>40 weeks	7	10.9
Complications		
Yes	16	25.0
No	48	75.0
Vitamin D supplementation		
Yes	46	71.9
No	18	28.1
Total	64	100.0

Figure 2 displays 28.1% of the respondents reported having one or more comorbid conditions, whereas 71.9% had no reported comorbidities during pregnancy.

Table 3 presentations only 26.6% of respondents reported consuming a balanced diet including dairy products and fish, while 34.4% had a low intake of such foods and 7.8% followed a predominantly vegetarian diet. In terms of sunlight exposure, which influences vitamin D synthesis, a small proportion of participants reported adequate daily sun exposure, with only 10.9% spending more than 30 minutes outdoors. The majority reported limited exposure of 30 minutes or less, indicating potential risk for vitamin D deficiency.

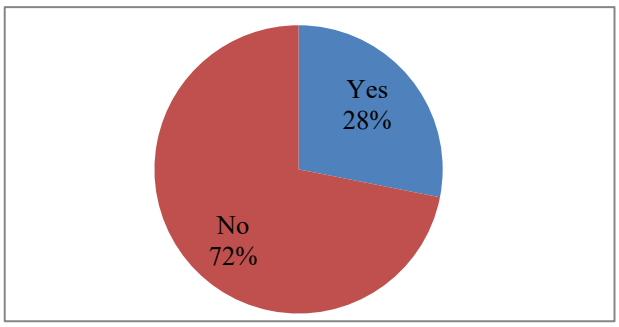

Figure 2: Distribution of the respondents by co-morbidities.

Table 3: Distribution of the respondents by behavioral factors.

Behavioral factors	Frequency	Percent
Balanced diet including dairy products and fish	17	26.6
Predominantly vegetarian	5	7.8
Low intake of dairy/fish	22	34.4
Daily sun exposure less than 15 minutes	5	7.8
15 minutes	4	6.3
30 minutes	4	6.3
More than 30 minutes	7	10.9
Total	64	100.0

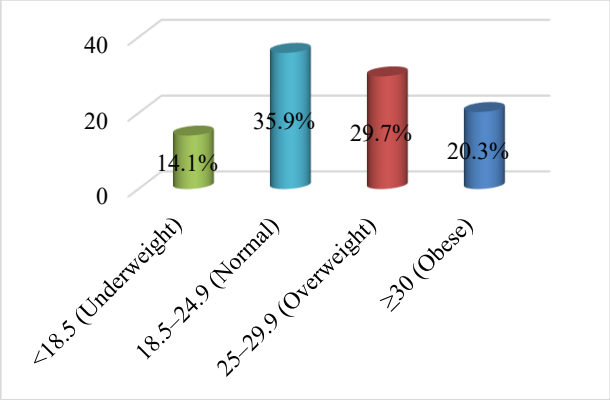

Figure 3: Distribution of the respondents by BMI status (n=64).

Figure 3 demonstrations among the respondents, 35.9% had a normal BMI, while 29.7% were overweight and 20.3% were obese. A smaller proportion, 14.1%, were classified as underweight. These findings indicate that over half of the participants had a BMI above the normal range during pregnancy.

Table 4 shows there was a significant association between parity and serum vitamin D level (p=0.000).

Table 4: Association between parity and serum vitamin D level.

Parity	Serum vitamin D level		P value
	Insufficient	Sufficient	
Primipara	42	0	0.000f
Multipara	16	6	
Total	58	6	64

*Fisher's Exact Test, 1 cell (25.0%) has expected count less than 5

Table 5: Association between gestational age and serum vitamin D level.

Serum vit. D level	Gestational age in weeks		P value
	<40	>40	
Insufficient	57	1	0.000[f]
Sufficient	0	6	
Total	57	7	64

*Fisher's Exact Test, 1 cell (25.0%) has expected count less than 5

Table 5 shows there was significant association between gestational age and serum vitamin D level (p=0.000).

DISCUSSION

This study explored serum vitamin D levels among pregnant women presenting in labor and examined their associations with various sociodemographic, behavioral, and obstetric factors. The findings revealed a high prevalence of vitamin D insufficiency and deficiency, which aligns with earlier studies conducted in Bangladesh and other South Asian countries.[8,9,18,22]

The present study found that maternal age was significantly associated with serum vitamin D levels, with younger women (<25 years) more likely to be deficient. This finding is consistent with previous research suggesting that younger pregnant women may have poorer dietary habits and less awareness about prenatal nutrition, including vitamin D intake.[20,24] In contrast, some studies have found no significant association between maternal age and vitamin D levels, suggesting that the relationship may be influenced by cultural, geographic, and behavioral factors.[21]

Socioeconomic status, as indicated by monthly income and educational level, also showed significant associations with vitamin D status in this study. Women from lower-income households and those with lower educational attainment had higher rates of vitamin D deficiency. This supports earlier evidence from Bangladesh and other low- and middle-income countries, where limited access to vitamin D-rich foods, reduced health literacy, and suboptimal antenatal care contribute to poorer maternal nutritional status.[10,11,19] Education may play a pivotal role in shaping dietary choices and encouraging supplement use during pregnancy.[25]

Limited sun exposure emerged as another significant factor affecting vitamin D status, consistent with several studies from Bangladesh, India, and the Middle East.[8,15,16] Cultural practices, including wearing clothing that covers most of the body and staying indoors during the day, likely reduce the cutaneous synthesis of vitamin D in these populations.[9,24] Moreover, urban living environments and concerns about pollution and heat often lead to reduced outdoor activity among pregnant women.[26]

Dietary habits, especially the intake of fish and dairy products, were significantly associated with serum vitamin D levels. Pregnant women who consumed these items regularly were less likely to be deficient, echoing earlier research emphasizing the protective role of dietary sources of vitamin D in regions where sun exposure may be insufficient.[10,11,27]

Parity was also associated with vitamin D levels, with primiparous women more likely to be deficient, consistent with previous studies.[21] This may be due to increased nutritional awareness or better adherence to supplementation in women with prior pregnancy experiences. Additionally, gestational age appeared to influence vitamin D levels, with lower levels observed in women presenting at later stages of pregnancy, which is also reported in earlier studies.[22,23] This could be due to increased fetal demand for calcium and vitamin D in the third trimester.

While vitamin D supplementation during pregnancy was associated with improved serum levels, a substantial proportion of women in this study were not receiving any supplementation. This finding highlights a gap in prenatal care practices and underlines the need for enhanced implementation policy and healthcare provider awareness about the importance of routine vitamin D screening and supplementation.[3,13,28]

This study has numerous limitations. Initially, the cross-sectional design restricts the ability to establish fundamental associations between vitamin D status and the associated sociodemographic, behavioral, and obstetric factors. Then, the study was conducted in specific healthcare facilities, which may boundary the generalizability of the results to the wider population of pregnant women in Bangladesh. Dietary intake and sun exposure data were self-reported and thus subject to recall and writing bias. Lastly, possible confounders such as genetic factors, seasonal differences were not measured, which may have influenced the outcomes.

CONCLUSION

This study highlights a high prevalence of vitamin D deficiency among pregnant women in labor, emphasizing the need for greater awareness and proactive monitoring of maternal vitamin D levels. The findings suggest that sociodemographic, behavioral, and obstetric factors significantly influence vitamin D status during pregnancy.

Addressing these determinants through targeted interventions such as nutritional counseling, supplementation programs, and promotion of safe sun exposure can play a vital role in improving maternal and fetal health outcomes. Integrating vitamin D screening into routine antenatal care may be instrumental in mitigating pregnancy-related complications associated with deficiency, particularly in resource-limited settings like Bangladesh.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sharmin SN, Das TR, Fatema J, Rahman I, Noor F, Islam S, et al. Measurement of serum vitamin D levels among the pregnant women. Int J Reprod Contracept Obstet Gynecol 2025;14:2118-23.