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Investigating Vitamin D-3 Deficiency among Pregnant Women at a Local Tertiary Hospital

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Abstract

Background: Vitamin D deficiency is a pervasive issue globally, particularly among pregnant women, and is linked to various adverse health outcomes. This study investigates the prevalence and characteristics of Vitamin D-3 deficiency among pregnant women in a tertiary care setting in Dhaka, Bangladesh, and explores the association with demographic and clinical factors. **Material & Methods:** This retrospective observational study was conducted at Uttara Adhunik Medical College and Hospital, Dhaka, over 12 months from January to December 2020. The study included 60 pregnant women suspected of Vitamin D deficiency based on clinical symptoms. Data on age, gravidity, parity, comorbidities, and serum Vitamin D levels were collected and analyzed using descriptive statistics and bivariate correlation analysis. **Results:** The majority of participants were aged between 26 and 35 years (45.00%), with a high prevalence of Vitamin D deficiency (86.67%). The common comorbidities observed were hypothyroidism (20.00%), preeclampsia (15.00%), and diabetes (13.33%). Bivariate correlation analysis showed no significant associations between Vitamin D levels and demographic factors such as age, parity, and gravidity. **Conclusions:** Vitamin D deficiency is highly prevalent among pregnant women at the studied hospital in Dhaka, Bangladesh, and is associated with significant comorbidities. These findings underscore the need for targeted public health interventions to address Vitamin D deficiency in this population, including supplementation and dietary education, to improve pregnancy outcomes.

Keywords:- Vitamin D Deficiency, Pregnancy, Bangladesh, Comorbidities, Public Health Interventions.

INTRODUCTION

Vitamin D, a fat-soluble vitamin primarily obtained through sunlight exposure and dietary intake, plays a crucial role in maintaining human health by regulating calcium metabolism and bone homeostasis. Its significance extends beyond bone health, influencing immune function and cellular proliferation.[1] During pregnancy, the demand for vitamin D increases due to its critical roles in fetal development and maternal health. Vitamin D deficiency during this period is associated with several adverse outcomes

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including preeclampsia, gestational diabetes, and poor fetal growth outcomes, underscoring the importance of maintaining adequate levels throughout gestation.[2] Despite the widespread understanding of vitamin D's benefits, deficiency remains prevalent among pregnant women globally, particularly in regions with limited sunlight exposure due to geographical location or cultural practices.[3] Studies have shown varying prevalence rates, with one systematic review indicating that vitamin D deficiency in pregnant women in developing countries ranges from 51.3% to 100%, linked with adverse maternal and neonatal health outcomes.[4] This is exacerbated in South Asia, where despite abundant sunshine, cultural and environmental factors contribute significantly to widespread deficiency.[5] In Bangladesh, a country characterized by its conservative dressing norms and indoor lifestyle, vitamin D deficiency is notably prevalent among different population segments, including pregnant women. Research indicates that a substantial proportion of Bangladeshi women of reproductive age, regardless of socio-economic status, suffer from hypovitaminosis D.[6,7] A study conducted among premenopausal women in both rural and urban areas showed a shifted distribution of serum 25-hydroxyvitamin D (25-OHD) towards the lower limit of the normal range, with even higher prevalence during lactation.[6] Further, a cross-sectional study among pregnant rural women revealed that 17.3% had vitamin D deficiency, and 47.2% had insufficiency, with risk factors including nulliparity and anaemia.[7] Pharmacokinetic studies in Dhaka have evaluated the response to high-dose vitamin D3 supplementation, finding it effective in raising maternal and cord blood 25-OHD concentrations to sufficient levels without causing hypercalcemia, suggesting a potential public health strategy to mitigate deficiency impacts.[8] Additionally, the use of high-dose vitamin D3 in the third trimester has been studied to assess its safety and efficacy, showing significant improvements in maternal and neonatal vitamin D status, further supporting supplementation's role during pregnancy.[9] The persistence of vitamin D deficiency despite known adverse effects calls for integrated public health strategies, including supplementation, fortification of foods, and targeted health education. These interventions are crucial in countries like Bangladesh, where traditional lifestyles and dietary patterns do not adequately provide for vitamin D needs.[10] Given the existing data and ongoing concerns, this study aims to investigate the incidence and characteristics of vitamin D-3 deficiency among pregnant women at a tertiary center hospital in Dhaka, Bangladesh. By understanding these local dynamics, we can better tailor interventions that address the specific needs and challenges of this population, ultimately improving maternal and fetal health outcomes in the region.

MATERIAL AND METHODS

This retrospective observational study was conducted at Uttara Adhunik Medical College and Hospital, Dhaka, Bangladesh, over a 12-month period from January 2020 to December 2020. The study population consisted of pregnant women who attended the hospital during the specified period and were suspected of having vitamin D deficiency based on clinical symptoms such as bone pain,

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muscle weakness, or fatigue. Hospital records provided a source of data for identifying potential participants. The inclusion criteria were hospital records of pregnant women who were suspected of vitamin D deficiency during their routine clinical assessment. Exclusion criteria included women who had been previously diagnosed with vitamin D deficiency or were receiving treatment for the same. A total of 60 participants were included in the study following a thorough review of medical records to ensure compliance with the inclusion and exclusion criteria. Data extracted included demographic information, clinical data, and laboratory results pertaining to vitamin D levels. The primary outcome measure was the incidence of vitamin D-3 deficiency, defined by serum 25-hydroxyvitamin D levels below 20 ng/mL. The study adhered to ethical standards and patient confidentiality.

RESULTS

The age distribution of the participants showed that the majority were between 26 and 35 years old, accounting for 45.00% of the sample. Those aged 25 years or younger comprised 41.67%, while participants between 36 and 45 years old represented 10.00%. A smaller fraction 3.33%, were older than 55 years. The Mean±SD age of the participants was 28.81±7.68 years.

In the study of 60 pregnant women, 41.67% were experiencing their first pregnancy, 26.67% their second, 15.00% their third, 11.67% their fourth, and 3.33% were on their fifth pregnancy.

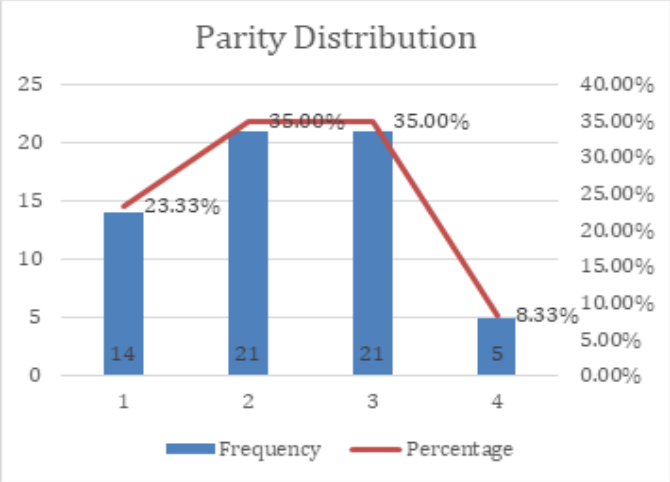

Figure 1: Distribution of parity among the participants (N=60)

In terms of parity among the participants, 23.33% had one previous birth, 35.00% each had two or three previous births, and 8.33% had four previous births.

Regarding comorbidities, hypothyroidism was present in 20.00% of the participants, making it the most common complication, followed by preeclampsia in 15.00%, and diabetes in 13.33%. [Table 3]

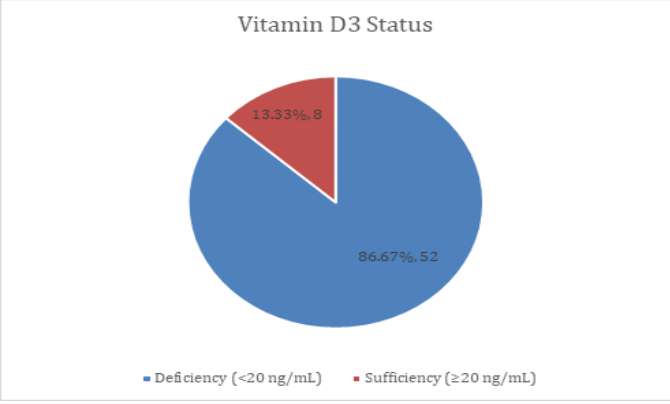

Figure 2: Distribution of Vitamin D3 status among the participants (N=60)

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The Vitamin D3 status of the participants showed that a vast majority, 86.67%, had vitamin D deficiency (levels below 20 ng/mL), while only 13.33% maintained sufficient levels (20 ng/mL or above).

The bivariate correlation analysis among relevant variables for the 60 participants revealed no significant associations. The correlation between age and parity was weak (Pearson correlation = 0.114) and not statistically significant (p = 0.384). Similarly, the correlation between age and gravida was slightly higher (Pearson correlation = 0.168) but still not significant (p = 0.198), indicating little to no relationship between a woman's age and the number of pregnancies she has had. Parity and gravida showed a weak correlation (Pearson correlation = 0.183) without reaching statistical significance (p = 0.161), suggesting that higher pregnancy counts do not strongly correlate with higher birth counts in this population. Additionally, the relationship between parity and Vitamin D3 levels was also negligible (Pearson correlation = -0.076) and not statistically significant (p = 0.569). Lastly, Vitamin D3 levels showed a very weak and non-significant negative correlation with age (Pearson correlation = -0.065, p = 0.622) and a weak and non-significant positive correlation with gravida (Pearson correlation = 0.123, p = 0.355). [Table 4]

Table 1: Age distribution of the participants (N=60)

Age	Frequency	Percentage
≤25	25	41.67%
26-35	27	45.00%
36-45	6	10.00%
>55	2	3.33%
Mean±SD	28.81±7.683	

Table 2: Distribution of Gravida among the participants (N=60)

Gravida	Frequency	Percentage
1	25	41.67%
2	16	26.67%
3	9	15.00%
4	7	11.67%
5	2	3.33%

Table 3: Distribution of comorbidities among the participants (N=60)

Other Complications	Frequency	Percentage
Hypothyroidism	12	20.00%
Preeclampsia	9	15.00%
Diabetes	8	13.33%

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Table 4: Bivariate correlation among relevant variables in the current population (N=60)

Correlations		**Age**	**Parity**	**Gravida**	**Vitamin D3**
Age	Pearson Correlation	1	0.114	0.168	-0.065
	Sig. (2-tailed)		0.384	0.198	0.622
Parity	Pearson Correlation	0.114	1	0.183	-0.076
	Sig. (2-tailed)	0.384		0.161	0.569
Gravida	Pearson Correlation	0.168	0.183	1	0.123
	Sig. (2-tailed)	0.198	0.161		0.355
Vitamin D3	Pearson Correlation	-0.065	-0.076	0.123	1
	Sig. (2-tailed)	0.622	0.569	0.355	

DISCUSSION

The age distribution and pregnancy-related characteristics of our cohort, with a majority of participants aged between 26 and 35 years (45.00%), align with global reproductive demographics but reveal a distinct trend in Bangladesh where a significant proportion (41.67%) are 25 years or younger. This demographic characteristic underscores a pattern of early childbearing compared to trends in more developed regions, such as the United States and Europe, where childbearing at an older age is more common.[11] The presence of participants aged over 55, though small (3.33%), is unusual and may indicate late maternal age pregnancies which have been associated with higher risks of adverse pregnancy outcomes.[12] This highlights the broad range of maternal ages and its implications on pregnancy and prenatal care in different sociocultural contexts. Our findings of high vitamin D deficiency (86.67%) among pregnant women in Dhaka are particularly concerning when compared to global statistics. For instance, studies in Southeast China and Iran have reported lower prevalence rates of vitamin D deficiency at 28.6% and 27%, respectively.[13,14] The extremely high deficiency rate in our study could be attributed to geographic, dietary, cultural factors, and lifestyle practices prevalent in South Asia that limit sunlight exposure, which is a primary natural source of vitamin D. This deficiency is alarming as it is linked to several adverse pregnancy outcomes, such as preeclampsia, gestational diabetes, and potentially increased susceptibility to infections, which were also prominent comorbidities observed in our study cohort (hypothyroidism at 20.00%, preeclampsia at 15.00%, and diabetes at 13.33%).[15] The comorbidity profile suggests a complex interplay of nutritional and metabolic disorders during pregnancy, highlighting the significant role vitamin D plays beyond bone health, including its effects on endocrine and immune functioning. For instance, the prevalence of hypothyroidism, which is the most common complication in our study, is notably higher than in other regions like the United States where hypothyroidism prevalence in pregnant women is about 2-3%.[16] This could indicate potential regional disparities in dietary iodine and selenium intake, which are crucial for thyroid function, compounded by vitamin D deficiency. The bivariate correlation analysis in our study showed no significant relationships among age, parity, and gravidity, which contradicts

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findings from other studies that suggest older maternal age is often associated with higher parity due to cumulative reproductive opportunities over time.[17] This indicates unique reproductive patterns in the Bangladeshi context, possibly influenced by cultural, educational, and healthcare factors that encourage earlier and more frequent pregnancies. Additionally, the weak correlation between parity and gravidity and their lack of strong correlation with vitamin D levels challenge some assumptions about the influence of multiple pregnancies on health outcomes. It may suggest that regardless of the number of pregnancies or births, all women are equally at risk of vitamin D deficiency due to overriding environmental or dietary factors. Moreover, the correlation between vitamin D levels and gravidity, although weak, hints at slightly higher vitamin D levels with increased pregnancies, possibly due to greater healthcare engagement or supplement use during later pregnancies. In summary, the profound vitamin D deficiency observed in our study underscores a significant public health issue within the Bangladeshi population, particularly among pregnant women. This deficiency not only correlates with numerous maternal comorbidities such as hypothyroidism, preeclampsia, and gestational diabetes but also raises concerns about potential long-term health impacts on both mothers and their offspring. The alarmingly high rates of deficiency highlight the critical need for targeted nutritional interventions that include widespread vitamin D supplementation and the fortification of common foods. Educational programs specifically designed to address the unique dietary and lifestyle factors contributing to this deficiency in Bangladesh are essential. These programs should particularly focus on young women, who represent a substantial segment of the reproductive population and are at a pivotal stage for intervention. Additionally, further research is imperative to dissect the complex interrelations of genetic, environmental, and socio-economic factors that contribute to the high prevalence of vitamin D deficiency. Understanding these factors will aid in developing tailored public health strategies that effectively mitigate this widespread deficiency and improve maternal and neonatal health outcomes in Bangladesh.

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. The retrospective nature of the current study further limited the sample size.

CONCLUSIONS

In conclusion, this study has highlighted a significant public health concern regarding the prevalence of vitamin D deficiency among pregnant women in Dhaka, Bangladesh. With 86.67% of participants displaying deficient levels, the implications for maternal and neonatal health cannot be overstated. The associations observed between vitamin D deficiency and various comorbidities, including hypothyroidism, preeclampsia, and diabetes, underscore the necessity for urgent and targeted interventions. Addressing this deficiency through comprehensive strategies involving supplementation, dietary improvements, and health education is paramount. Our findings strongly advocate for

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the implementation of public health policies that ensure adequate vitamin D levels in pregnant women to enhance both maternal and fetal outcomes. Further research should focus on identifying the specific barriers to adequate vitamin D levels and developing culturally appropriate interventions that can effectively address this widespread health issue in Bangladesh.

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