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To Study the Prevalence of Vitamin D Deficiency in Third Trimester and Impact on Fetal and Maternal Outcome

[1]Dr.Mahak,[2]Dr Surabhi Tomar,[3]Dr Samrat Joshi, [4]Dr Anam Sarwar
[1]pg Resident, Department Of Obstetrics And Gynecology At Nims Medical College And Hospital, Jaipur
[2]professor, Department Of Obstetrics And Gynecology At Nims Medical College And Hospital, Jaipur
[3]associate Professor, Department Of Critical Care, At Nims Medical College And Hospital, Jaipur
[4]pg Resident, Department Of Obstetrics And Gynecology At Nims Medical College And Hospital, Jaipur

Corresponding Author: Dr Leena Saini, Professor, Department of Obstetrics and Gynecology at Nims Medical College and Hospital, Jaipur

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KEYWORDS

Vitamin D, Third Trimester, Impact on Fetal, Maternal Outcome

ABSTRACT:

Aim : To estimate the prevalence of vitamin D deficiency in third trimester and its association with feto-maternal outcome.

Material and Methods : This study was carried out on 200 pregnant women in their third trimester who were admitted for delivery to the Department of Obstetrics and Gynecology at NIMS Medical College and Hospital, JAIPUR. Participants were selected based on predefined inclusion and exclusion criteria. Comprehensive information was collected, including demographic details, medical and dietary history, menstrual and obstetric background, as well as any antenatal complications. Delivery-related data such as mode of delivery, birth weight, and APGAR scores were documented using a standardized proforma. Maternal blood samples were collected to assess serum vitamin D levels. Vitamin D deficiency was defined as serum 25(OH)D levels below 20 ng/ml, while levels between 20–30 ng/ml were considered indicative of insufficiency.

Results : A high prevalence of vitamin D deficiency (90%) was observed among the pregnant women included in the study. There was no statistically significant association between vitamin D status and socio-demographic variables. However, vitamin D deficiency was significantly associated with an increased incidence of maternal complications ($p = 0.0109$) and a higher rate of neonatal intensive care unit (NICU) admissions ($p = 0.0384$) compared to the non-deficient group.

Conclusion : Although this study found an association between hypovitaminosis D and higher rates of maternal complications, cesarean deliveries, and NICU admissions, it did not establish a causal link due to its observational design. Nevertheless, given that vitamin D supplementation is both affordable and accessible, routine screening and early intervention particularly during adolescence, the preconception period, or the first trimester should be considered to help reduce the risk of adverse maternal and neonatal outcomes.

INTRODUCTION

Pregnancy significantly increases the demand for vitamin D, essential for maternal calcium metabolism and fetal development. Calcitriol ($1,25(OH)_2D$) synthesis doubles during pregnancy, necessitating an adequate maternal supply of vitamin D (1). However, dietary intake contributes less than 10% of total vitamin D; the primary source is skin synthesis via UVB radiation, which is often insufficient due to limited sun exposure or increased melanin content (1,2).

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Vitamin D deficiency in pregnancy is associated with multiple adverse maternal and neonatal outcomes, including preeclampsia, gestational diabetes, preterm birth, bacterial vaginosis, and miscarriage (1,3). In neonates, low maternal vitamin D levels increase the risk of rickets, low bone mineral density, hypocalcemia, respiratory infections, asthma, type 1 diabetes, and neurodevelopment disorders such as schizophrenia (3,4).

Maternal 25(OH)D levels are the main determinant of neonatal vitamin D status, and deficiencies are more prevalent in winter months and among individuals with higher skin pigmentation or obesity (5). Obese women (BMI ≥ 30) are particularly at risk, with studies showing up to 61% having deficient vitamin D levels compared to 36% of women with normal BMI (5).

Vitamin D exists in two forms: D_2 (ergocalciferol) and D_3 (cholecalciferol), the latter synthesized in the skin. It undergoes hepatic conversion to 25(OH)D and renal hydroxylation to the active form, $1,25(OH)_2D$. This active form influences gene transcription via nuclear vitamin D receptors present in multiple tissues (2,6). Beyond bone health, vitamin D plays roles in immune regulation, insulin secretion, and cell differentiation (6).

Current prenatal supplements often contain insufficient amounts of vitamin D, and optimal supplementation doses (potentially up to 6000 IU/day) remain under debate (7). Given its critical role in fetal bone and lung development and neonatal immune health, addressing maternal deficiency is vital for both maternal and offspring well-being (8,9).

MATERIALS AND METHODS

The study was a hospital-based, analytical cross-sectional study conducted in the Department of Obstetrics and Gynecology at NIMS Medical College and Hospital, Jaipur. The study was carried out over a period of 18 months and included a total of 200 pregnant women admitted to the labor room in their third trimester for delivery, selected based on predefined inclusion and exclusion criteria.

INCLUSION CRITERIA:

1. Pregnant women with a gestational age of 28 weeks or more
2. Singleton pregnancies
3. Willingness to participate and provide informed consent

EXCLUSION CRITERIA:

Participants with a known history or clinical evidence of the following:

1. Thyroid, parathyroid, or adrenal disorders
2. Type 1 diabetes mellitus
3. Malabsorption syndromes, hepatic failure, or renal failure
4. Metabolic bone diseases
5. Multiple pregnancies
6. Gestational age less than 28 weeks

METHODS

A detailed history was obtained from each participant, including demographic details, past medical history, dietary habits, previous menstrual and obstetric history, as well as any antenatal complications. Delivery-related data such as mode of delivery, birth weight, APGAR scores, and NICU admission were documented using a structured proforma.

SAMPLE COLLECTION AND VITAMIN D ESTIMATION

At the time of delivery, 2 ml of maternal venous blood was collected for estimation of serum 25-hydroxyvitamin D [25(OH)D] levels to assess vitamin D status. The samples were centrifuged, and the serum was separated and stored at a temperature between 2°C to 8°C until analysis.

Vitamin D levels were measured using the chemiluminescence immunoassay (CLIA) method on the Advia Centaur XP analyser. Based on standard guidelines, vitamin D deficiency was defined as serum 25(OH)D levels <20 ng/ml, while levels between 20–30 ng/ml were classified as vitamin D insufficiency.

Additional investigations such as liver function tests (LFT), renal function tests (RFT), and serum calcium were performed as clinically indicated.

RESULT

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Table 1: Socio-demographic Characteristics of Study Participants (n = 200)

Variable	Category	Number (n)	Percentage (%)
Age (in years)	19–24	65	32.5 %
	25–34	125	62.5 %
	>35	10	5 %
BMI (kg/m²)	18.5–24.9	22	11 %
	25–29.9	168	84 %
	≥30	10	5 %
Education Level	Illiterate	3	1.5 %
	Primary School	5	2.5 %
	Middle School	5	2.5 %
	High School	20	10 %
	Higher Secondary	90	45 %
	Graduate	77	38.5 %
Occupation	Homemaker	139	69.5 %
	Physical laborer/Farmer	24	12 %
	Office work	37	18.5 %
Residence	Rural	60	30 %
	Urban	140	70 %
Socioeconomic Status*	Upper Class	4	2 %
(Modified Kuppuswamy)	Upper Middle	32	16 %
	Lower Middle	109	54.5 %
	Upper Lower	43	21.5 %
	Lower	12	6 %

The majority of participants were aged 25–34 years (62.5%), followed by 19–24 years (32.5%), and >35 years (5%). Most women had a BMI between 25–29.9 kg/m² (84%), with only 11% in the normal range (18.5–24.9 kg/m²) and 5% classified as obese (≥30 kg/m²). In terms of education, 45% had completed higher secondary education and 38.5% were graduates. A large proportion were homemakers (69.5%), while 18.5% were involved in office work, and 12% in physical labor or farming. Urban residents constituted 70% of the study population. According to the Modified Kuppuswamy Socioeconomic Scale, the largest group belonged to the lower middle class (54.5%), followed by the upper lower (21.5%) and upper middle (16%) classes.

Table 2: Prevalence of Vitamin D Deficiency in the Study Group (n = 200)

Vitamin D Levels (ng/ml)	Number (n)	Percentage (%)
Deficient (<20)	180	90 %
Insufficient (20–30)	12	6 %
Sufficient (>30)	8	4 %
Total	**200**	**100 %**

Among the 200 pregnant women included in the study, 90% (n = 180) were found to have Vitamin D deficiency (<20 ng/ml), while 6% (n = 12) had insufficient levels (20–30 ng/ml), and only 4% (n = 8) had sufficient Vitamin D levels(>30 ng/ml). These findings highlight a high prevalence of Vitamin D deficiency in the study population.

Table 3: Correlation of Maternal Complications with Maternal Vitamin D Levels

Maternal Complications	Deficient (n = 180)	Insufficient (n = 12)	Sufficient (n = 8)
No	95 (52.78%)	9 (75%)	8 (100.0%)
Yes	85 (47.22%)	3 (25%)	0 (0.0%)
			p value – 0.0109

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Maternal complications were reported in 47.22% of women with Vitamin D deficiency, compared to 25% in the insufficient group and none (0.0%) in the sufficient group. Conversely, 52.78% of Vitamin D–deficient women, 75% of those with insufficient levels, and 100% of those with sufficient levels had no complications during pregnancy. These findings suggest a trend toward fewer maternal complications with higher maternal Vitamin D levels, although statistical significance was not indicated in this data snippet.

Table 4: Distribution of Maternal Complications by Vitamin D Status

Maternal Complication	Deficient (n = 95)	Insufficient (n = 7)
Preterm	42 (44.21%)	3 (42.86%)
Anemia	22 (23.16%)	0 (0.0%)
GDM	11 (11.58%)	0 (0.0%)
Hypothyroidism	16 (16.84%)	0 (0.0%)
Cholestasis	18 (18.95%)	0 (0.0%)
Preeclampsia	7 (7.37%)	0 (0.0%)

Among women with Vitamin D deficiency (n = 95), the most common maternal complication was preterm delivery, affecting 44.21% of cases. This was followed by cholestasis (18.95%), hypothyroidism (16.84%), anemia (23.16%), gestational diabetes mellitus (11.58%), and preeclampsia (7.37%). In contrast, among those with insufficient Vitamin D levels (n = 7), only preterm delivery was reported (42.86%), while no other maternal complications were observed. These findings suggest a higher burden of maternal complications, particularly metabolic and hepatic, in Vitamin D–deficient pregnancies.

Table 5: Correlation of Birth Weight with Maternal Vitamin D Levels

Birth Weight	Deficient (n = 180)	Insufficient (n = 12)	Sufficient (n = 8)	p value
≥ 2.5 kg	132 (73.33%)	7 (58.33%)	8 (100.0%)	
1.5 – <2.5 kg	45 (25.00%)	5 (41.67%)	0 (0.0%)	
1 – <1.5 kg	3 (1.67%)	0 (0.0%)	0 (0.0%)	**0.6402**

Birth weight ≥ 2.5 kg was observed in 73.33% of neonates born to Vitamin D–deficient mothers, 58.33% in the insufficient group, and 100.0% in the sufficient group. Low birth weight (1.5–<2.5 kg) occurred in 25.00% of the deficient group and 41.67% of the insufficient group, while no cases were reported in the sufficient group. Very low birth weight (1–<1.5 kg) was noted in 1.67% of the deficient group only. Although a trend toward better birth weights with higher maternal Vitamin D levels was noted, the association was not statistically significant (p = 0.6402).

Table 6: Correlation of NICU Admission with Maternal Vitamin D Levels

NICU Admission	Deficient (n = 180)	Insufficient (n = 12)	Sufficient (n = 8)	p value
No	118 (65.56%)	10 (83.33%)	8 (100.0%)	
Yes	62 (34.44%)	2 (16.67%)	0 (0.0%)	**0.0384**

Journal of Chemical Health Risks
www.jchr.org
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NICU admission was required for 34.44% of neonates born to Vitamin D–deficient mothers, compared to 16.67% in the insufficient group and none (0.0%) in the sufficient group. Conversely, 65.56% of neonates in the deficient group, 83.33% in the insufficient group, and 100% in the sufficient group did not require NICU care. The difference was statistically significant (p = 0.0384), suggesting a potential association between higher maternal Vitamin D levels and reduced NICU admissions.

Table 7 : Reason for NICU Admission

Reason for NICU Admission	Number	Percentage (%)
Transient Tachypnoea of Newborn	17	26.56 %
Respiratory Distress Syndrome	12	18.75 %
Neonatal Hyperbilirubinemia	9	14.06 %
Neonatal Sepsis	5	7.81 %
Meconium Aspiration Syndrome	7	10.94 %
Feed Intolerance	5	7.81 %
Hypoglycemia	2	3.13 %
Perinatal Asphyxia	2	3.13 %
Pneumonia	2	3.13 %
Hypothermia	2	3.13 %
Grand Total	**64**	**100,00 %**

A total of 64 neonates required NICU admission. The most common reason was Transient Tachypnoea of the Newborn (TTN), accounting for 26.56% of cases, followed by Respiratory Distress Syndrome (18.75%) and Neonatal Hyperbilirubinemia (14.06%). Other indications included Meconium Aspiration Syndrome (10.94%), Neonatal Sepsis (7.81%), and Feed Intolerance (7.81%). Less frequent causes included Hypoglycemia, Perinatal Asphyxia, Pneumonia, and Hypothermia, each comprising 3.13% of NICU admissions. These findings highlight that the majority of admissions were due to respiratory-related complications.

DISCUSSION

A significant association was observed between maternal Vitamin D status and the occurrence of maternal complications. Complications were present in 47.22% of Vitamin D–deficient women, compared to 25% in the insufficient group and none in the sufficient group. Among these, preterm labor was the most prevalent complication, followed by cholestasis, hypothyroidism, and anemia. These findings are consistent with existing literature suggesting that Vitamin D deficiency during pregnancy is associated with various adverse outcomes, including preterm birth and preeclampsia. While the exact mechanisms remain under investigation, Vitamin D's role in modulating inflammatory responses and maintaining endothelial function may contribute to these associations.

This study underscores the high prevalence of Vitamin D deficiency among pregnant women in India, with 90% exhibiting serum 25(OH)D levels below 20 ng/ml. This finding aligns with previous research indicating widespread hypovitaminosis D in Indian pregnant populations. For instance, a research done by Ravinder SS et al (2022) found a 62% prevalence of Vitamin D deficiency in antenatal women (10). These consistent findings underscore the need for targeted public health interventions to address Vitamin D deficiency during pregnancy.

In terms of neonatal outcomes, a higher proportion of infants with normal birth weight (≥2.5 kg) were born to mothers with sufficient Vitamin D levels (100%) compared to those with deficient levels (73.33%). Although this trend did not reach statistical significance, it aligns with studies indicating that maternal Vitamin D supplementation is associated with increased birth weight . Furthermore, a significant association was found between maternal Vitamin D status and NICU admissions (p = 0.0384), with 34.44% of neonates born to Vitamin D–deficient mothers requiring NICU admission, compared to 16.67% in the insufficient group and none in the sufficient group. This finding is in line with research done by Singh M et al (2024) indicating that maternal Vitamin D deficiency is linked to increased neonatal morbidity (11) .

The sociodemographic profile of the study population revealed that despite a relatively high level of education and urban residency, Vitamin D deficiency was prevalent. This suggests that factors such as limited sun exposure, dietary habits, and lifestyle choices may play a more significant role in Vitamin D status than education or socioeconomic status alone. These findings are consistent with study done by Ravinder SS et al (2022) indicating

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that sun exposure is a significant predictor of serum 25(OH)D levels during pregnancy (10) .

Overall, this study underscores the critical need for routine screening and appropriate management of Vitamin D levels during pregnancy to potentially reduce the risk of adverse maternal and neonatal outcomes. Further large-scale, randomized controlled trials are warranted to establish definitive causal relationships and to develop evidence-based guidelines for Vitamin D supplementation in pregnant women.

REFERENCES

1) Holick MF. (2007). Vitamin D Deficiency. N Engl J Med.
2) Ross AC et al. (2011). Dietary Reference Intakes for Calcium and Vitamin D. Institute of Medicine
3)Wei SQ et al. (2013). Vitamin D and pregnancy outcomes. J Obstet Gynaecol Can.
4)Morales E et al. (2012). Maternal vitamin D status in pregnancy and risk of lower respiratory tract infections, wheezing, and asthma in offspring. Epidemiology.
5) Hyppönen E et al. (2001). Vitamin D deficiency in pregnant women and their offspring. Lancet.
6) Norman AW. (2008). From vitamin D to hormone D: fundamentals of the vitamin D endocrine system essential for good health. Am J Clin Nutr.
7) Hollis BW, Wagner CL. (2004). Assessment of dietary vitamin D requirements during pregnancy and lactation. Am J Clin Nutr.
8). Wagner CL et al. (2010). Vitamin D and its role during pregnancy in the development of asthma and allergic diseases. Clin Exp Allergy.
9) Kovacs CS. (2008). Calcium and bone metabolism during pregnancy and lactation. J Mammary Gland Biol Neoplasia.
10) Ravinder SS, Padmavathi R, Maheshkumar K, Mohankumar M, Maruthy KN, Sankar S, Balakrishnan K. Prevalence of vitamin D deficiency among South Indian pregnant women. J Family Med Prim Care. 2022 Jun;11(6):2884-2889. doi: 10.4103/jfmpc.jfmpc_1819_21. Epub 2022 Jun 30. PMID: 36119194; PMCID: PMC9480695.
11)Singh M, Shobhane H, Tiwari K, Agarwal S. To Study the Correlation of Maternal Serum Vitamin D Levels and Infant Serum Vitamin D Levels With Infant Birth Weight: A Single-Centre Experience From the Bundelkhand Region, India. Cureus. 2024 Sep 5;16(9):e68696. doi: 10.7759/cureus.68696. PMID: 39371764; PMCID: PMC11452918.