

ASSOCIATION BETWEEN VITAMIN D DEFICIENCY IN PREGNANCY AND LOW BIRTH WEIGHT NEONATES

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ABSTRACT

Background: Vitamin D deficiency and low birth weight (LBW) are both very common. Vitamin D deficiency is widespread among pregnant women globally due to factors like fetal growth, limited sunlight exposure, and insufficient dietary intake.

Objectives: Therefore, the aim of this study was to determine the association between low birth weight (LBW) and maternal vitamin intake. D deficiency.

Methods: This prospective cohort study was conducted in the department of obstetrics and gynecology of Lady Aitchison Hospital Lahore from April-2026 to June-2026. We included 60 pregnant patients who delivered their babies in the hospital at gestational age ≥ 36 weeks. At 32 to 34 weeks of gestation, venous blood samples were obtained and sent for vitamin D level measurements. We included 30 women who were vit. D-deficient and 30 women who were having adequate vitamin. D levels. All patients were followed till delivery, and after delivery, the neonatal birth weight was measured.

Results: The mean ages of mothers were 27.62 ± 4.31 and 28.06 ± 4.71 years ($p=0.67$). Mean gestational age was 38.1 ± 0.99 and 38.06 ± 1.11 weeks ($p=0.90$). Among the exposed group ($N=30$), 10 patients (33.3%) had low birth weight (LBW) infants, whereas in the unexposed group ($N=30$), only 3 patients (10.0%) had LBW infants [RR 1.80 (CI 1.16 to 2.8)] ($p=0.02$).

Conclusion: Vitamin D deficiency during pregnancy is significantly associated with a higher risk of giving birth to LBW babies. Therefore, there is a need to check vitamin D levels in early pregnancy and vitamin. D supplementation should be advised to mothers having vitamin. D deficiency.

Keywords: Vit. D deficiency, Low birthweight, Pregnancy.

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INTRODUCTION

Vitamin D deficiency is widespread among pregnant women globally due to factors like fetal growth, limited sunlight exposure, and insufficient dietary intake. Research indicates Asia has the highest rates of deficiency.¹ Despite being a tropical nation rich in

sunshine, Pakistan exhibits the highest rates of adult vitamin D deficiency in South Asia, affecting 73% of the population, with an average serum level of 17.93 ng/mL.² The condition predominantly affects pregnant women in Pakistan, who make up about 79.7% of those with inadequate vitamin D intake in the population.³

During pregnancy, particularly in the last trimester, changes in maternal vitamin D and calcium metabolism facilitate the transfer of up to 250 mg of calcium daily to the developing fetal skeleton, totaling approximately 25 to 30 g. The active form of vitamin D, 1,25-dihydroxyvitamin D, is crucial for regulating calcium and phosphorus levels in the blood.⁴ Serum levels of 1,25-dihydroxyvitamin D increase by 50% to 100% in the second trimester and rise to about 100% during the third trimester, compared to pre-pregnancy levels.⁵

During pregnancy, serum 25-hydroxyvitamin D (25(OH)D) is critically important since the fetus depends completely on the mother for this nutrient. Research indicates that vitamin D deficiency can result in negative health outcomes such as intrauterine death, low birth weight, preterm birth, gestational diabetes, and preeclampsia.⁶⁻⁸ Studies indicate that low Vitamin D levels during pregnancy and early childhood can adversely affect bone mineralization in women, which is closely linked to delivering low birth weight infants.⁶ Wang and colleagues identified a significant positive relationship linking maternal Vitamin D concentrations during pregnancy with the Vitamin D levels observed in newborns.⁹

The objective of this study was to determine the association of low birth weight (LBW) with maternal vit. D deficiency.

METHODS

This prospective cohort study was conducted in the department of obstetrics and gynecology of Lady Aitchison Hospital Lahore from April-2026 to June-2026. We included 60 pregnant patients who delivered their baby in the hospital at gestational age ≥ 36 weeks. We included patients with singleton pregnancy and who were booked in antenatal clinic between 12-16 weeks of gestation. While un-booked cases, and patients with known inherited disorders of calcium and vitamin D metabolism, and those with other causes of IUGR, including preeclampsia, oligohydramnios and fetal anomalies were excluded. Informed consent from each patient was obtained.

At 32 to 34 weeks of gestation, venous blood samples were obtained and sent for vitamin d level measurements. We included 30 women who were vit. D deficient and 30 women who were having adequate vit. D levels. All patients were followed till delivery, after delivery neonatal birth weight was measured. Babies having birth weight ≥ 2.5 Kg were labelled as having normal weight and those having < 2.5 Kg were labelled as having low birth weight (LBW). Data was analyzed using SPSS v.25. Relative risk (RR) was calculated to see the association between LBW and vit. D deficiency. RR of >1 was considered as significant association.

RESULTS

The patients in both groups had similar characteristics. The mean ages of mothers were 27.62 ± 4.31 and 28.06 ± 4.71 years ($p=0.67$). Average weights were 62.66 ± 14.52 kg and 66.36 ± 13.39 kg ($p=30$). Parity figures were 1.6 ± 0.66 and 1.63 ± 0.67 ($p=0.84$). Residing areas showed 36.7% urban, 16.7% suburban, and 46.7% rural in both groups ($p=0.76$). Social status was similar, with lower status at 20.0% and 30.0%; lower middle 26.7% and 20.0%; middle 16.7% and 20.0%; upper middle

20.0%; upper 10.0% and 6.7%; elite 6.7% and 3.3% ($p=0.91$). Mean gestational age was 38.1 ± 0.99 and 38.06 ± 1.11 weeks ($p=0.90$) (Table 1).

Among the exposed group ($N=30$), 10 patients (33.3%) had low birth weight (LBW) infants, whereas in the unexposed group ($N=30$), only 3 patients (10.0%) had LBW infants. The relative risk (RR) of LBW in the exposed group compared to the unexposed group was 1.80, with a 95% confidence interval (CI) of 1.16 to 2.8 ($p=0.02$) [Table 2].

Table 1. Baseline Patient's Characteristics.

	Exposed (N=30)	Unexposed (N=30)	P-value
Age (Years)	27.62±4.31	28.06±4.71	0.67
Weight (Kg)	62.66±14.52	66.36±13.39	0.30
Parity	1.6±0.66	1.63±0.67	0.84
Area of Residency (%)			
Urban	11 (36.7%)	9 (30.0%)	0.76
Sub-Urban	5 (16.7%)	7 (23.3%)	
Rural	14 (46.7%)	14 (46.7%)	
Social Status (%)			
Lower	06 (20.0%)	9 (30.0%)	0.91
Lower Middle	8 (26.7%)	6 (20.0%)	
Middle	5 (16.7%)	6 (20.0%)	
Upper Middle	6 (20.0%)	6 (20.0%)	
Upper	3 (10%)	2 (6.7%)	
Elite	2 (6.7%)	1 (3.3%)	0.90
Gestational Age at Delivery (weeks)	38.1±0.99	38.06±1.11	

Table 2. Comparison of Low Birth Weight (LBW) Frequency in Exposed and Unexposed Patients.

LBW	Exposed (N=30)	Unexposed (N=30)	RR (95% CI)	P-value
Yes	10 (33.3%)	3 (10.0%)	1.80 (1.16-	0.02
No	20 (66.7%)	27 (90.0%)	2.8)	

DISCUSSION

Vitamin D influences fetal growth through its role in calcium homeostasis and parathyroid hormone regulation. Limited research has been done on vitamin D levels in Pakistani mothers. Additionally, hypovitaminosis D and osteomalacia are commonly reported among pregnant women in South Asia.¹⁰ In a systematic review, numerous studies documented strong links between VDD and various adverse maternal and neonatal outcomes, including postpartum depression, pre-eclampsia, gestational diabetes, emergency cesarean sections, low birth weight, and small for gestational age (SGA).¹¹ Another meta-analysis confirmed that antenatal vitamin D deficiency increases the risk of low birth weight (OR = 2.39; $p = 0.008$), and vitamin D supplementation could help mitigate this risk.¹²

We found a significant correlation between LBW and maternal vit D. deficiency. Our results were similar to the results of Kumari et al., who reported LBW in 7.7% women with sufficient vit. D levels and in 34.5% women with insufficient vit. D levels.

In a Chinese cohort study, a nonlinear relationship was found between early maternal 25(OH)D levels and birth weight ($p < 0.01$). Birth weight rose by 69 g (95% CI: 38–122) for every 1 ng/mL increase in maternal 25(OH)D up to 20 ng/mL, beyond which it plateaued. The percentage of SGA infants varied across 25(OH)D quartiles, from 3.7% in the highest to 24.1% in the lowest quartile. Each 1-unit drop in plasma 25(OH)D was linked to a 19% rise in unadjusted SGA risk (OR 1.19, $p < 0.001$), and a 9% increase after adjustment (OR 1.08, $p = 0.009$). Using a multivariate model that considered clinical factors, the adjusted SGA risk due to vitamin D deficiency was 205% higher (OR 3.05, $p = 0.001$).¹³

A cohort study observed low birth weight (LBW) rates of 4.53% in the vitamin D deficiency group, 0.90% in the vitamin D insufficiency group, and 0.30% in the vitamin D sufficiency group (RR 15.12 for deficiency and 3.02 for insufficiency). After multivariate analysis, the adjusted RR was 15.03 for deficiency and 2.95 for insufficiency.¹⁴

A meta-analysis found that pregnant women with vitamin D deficiency had a notably higher risk of delivering low-birth-weight infants (OR = 5.52, $p = 0.02$) compared to those with sufficient vitamin D. Deficiency throughout pregnancy was associated with a greater incidence of neonatal LBW (OR = 12.58), but vitamin D levels measured only during the first (OR = 12.61), second (OR = 1.61), or third trimesters (OR = 1.65) did not show a significant link to LBW.¹⁵

Aji et al. conducted a study involving 183 pregnant Indonesian women to examine the relationship between vitamin D levels, anthropometric measurements, and genetic risk scores (GRSs). These GRSs were based on six vitamin D-related polymorphisms. They found that 25(OH)D levels in the third trimester had a significant ($p=0.004$) correlation with GRS. While GRS was not directly associated with anthropometric measures, the interaction between GRS and 25(OH)D affected head circumference ($p=0.030$). Specifically, neonatal head circumference under 35 cm was linked to lower 25(OH)D levels if the mother carried at least four risk alleles.¹⁶

The safety of vitamin D supplements and fortification has been demonstrated in some studies. Mothers using vitamin D supplementation (400–4000 IU/day) for 12–16 weeks showed reduced risks of preterm birth.¹⁷ It appears that vitamin D deficient mothers (25 Hydroxy Vitamin D < 30) have twice the chance of delivering SGA babies compared to mothers with adequate vitamin D levels.¹⁸

An investigation by the WHO has shown that micronutrients, including vitamin D, can increase birth weights by about 77 grams and reduce the probability of low birth weight by 25%.¹⁹

This study is limited by its small sample size and by its single-center design. Additionally, we did not investigate how maternal nutrition, supplement intake, or sunlight exposure might affect vitamin D status. We recommend that future research consider these factors.

CONCLUSION

Vitamin D deficiency during pregnancy is significantly associated with a higher risk of giving birth to LBW babies. Therefore, there is a need to check vitamin D levels in early pregnancy and vitamin D supplementation should be advised to mothers having vitamin D deficiency.

ETHICAL APPROVAL

Ethical approval of article was granted by the Ethics Committee of Lady Aitchison Hospital, Lahore, dated 20 November, 2024

AUTHOR'S CONTRIBUTIONS

AZ: Conceived idea, design, manuscript writing

MUN: Supervision, critical review, proof reading

All Authors: Approval of the final version of the manuscript to be published

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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