E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/15.02.126

Association Between Maternal Vitamin D Levels and Cord Blood pH in Term Neonates: A Case-Control Study

Dr. Panchanan Das[1], Dr. Gautam Medhi[2], Dr. Manish R Ratan[3]
[1]*PROFESSOR, DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY, GAUHATI MEDICAL COLLEGE AND HOSPITAL*
[2]ASSOCIATE PROFESSOR, DEPARTMENT OF PAEDIATRICS.GAUHATI MEDICAL COLLEGE AND HOSPITAL
[3]POST GRADUATE TRAINEE, DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY, GAUHATI MEDICAL COLLEGE AND HOSPITAL, GUWAHATI, ASSAM.
Corresponding Author: Dr. Manish R Ratan

Abstract
Background: Maternal vitamin D deficiency has been increasingly recognized as a modifiable risk factor influencing neonatal outcomes. Cord blood pH is a critical parameter indicating neonatal acid-base status and potential perinatal hypoxia.

Objective: To evaluate the association between maternal serum vitamin D levels in the third trimester and cord blood pH values in term neonates.

Methods: A case-control study was conducted involving 80 pregnant women (40 with neonates showing signs of HIE and 40 healthy controls). Maternal serum vitamin D was measured during the third trimester. Cord blood pH was assessed at delivery.

Results: The correlation analysis indicates a statistically significant relationship between maternal vitamin D levels and cord blood pH. Pearson's correlation coefficient ($r = 0.399$, $p < 0.001$) and Spearman's rank correlation ($r = 0.356$, $p = 0.001$) suggest a moderate positive correlation, meaning that lower maternal vitamin D levels are associated with lower cord blood pH, indicative of fetal acidosis. Since the p-value < 0.05, the results confirm that maternal vitamin D levels and cord blood pH are significantly correlated.

Conclusion: Low maternal serum vitamin D levels are associated with neonatal acidosis. This highlights the importance of maintaining adequate maternal vitamin D during pregnancy.

Introduction
Vitamin D, a fat-soluble vitamin, is essential in calcium and phosphate metabolism and is increasingly recognized for its role in fetal development and neuroprotection. The

presence of vitamin D receptors (VDRs) in placental and fetal tissues indicates its importance in vascular function, immune tolerance, and cellular resilience.

Cord blood pH reflects neonatal acid-base status at birth and can indicate fetal distress. Emerging evidence suggests maternal vitamin D deficiency may impair placental function and fetal oxygenation, contributing to perinatal acidosis. This study investigates the association between third-trimester maternal vitamin D levels and cord blood pH in term neonates.

Methods

This prospective case-control study was conducted at Gauhati Medical College and Hospital. A total of 80 term pregnant women were enrolled, divided into:
- Cases (n=40): Mothers whose neonates showed clinical features of perinatal hypoxia or Hypoxic Ischemic Encephalopathy (HIE), including low APGAR scores, abnormal Sarnat staging, or NICU admission.
- Controls (n=40):Mothers of neonates without signs of hypoxia or HIE, with normal APGAR scores and no need for NICU admission.

Maternal blood samples were collected in the third trimester for 25(OH)D measurement using chemiluminescent immunoassay.

Vitamin D status: Deficient <20 ng/mL; Sufficient >30 ng/mL.

Cord blood was collected at delivery and analyzed for pH using a blood gas analyzer. Data were analyzed using SPSS v25. Pearson correlation and t-tests were used; $p < 0.05$ was considered significant.

Results (Summary)

The correlation analysis indicates a statistically significant relationship between maternal vitamin D levels and cord blood pH. Pearson's correlation coefficient ($r = 0.399$, $p < 0.001$) and Spearman's rank correlation ($r = 0.356$, $p = 0.001$) suggest a moderate positive correlation, meaning that lower maternal vitamin D levels are associated with lower cord blood pH, indicative of fetal acidosis.

Among neonates with cord blood pH <7.2, 33 (82.5%) were born to mothers with vitamin D levels <20 nmol/L, while only 7 (17.5%) had vitamin D levels >20 nmol/L. In contrast, among neonates with cord blood pH >7.2, only 18 (45%) had maternal vitamin D deficiency, whereas 22 (55%) had sufficient vitamin D levels.

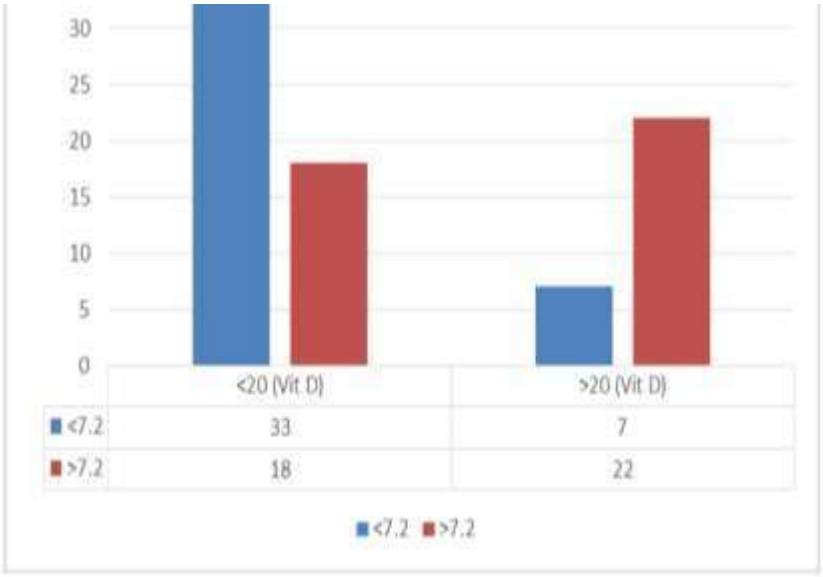


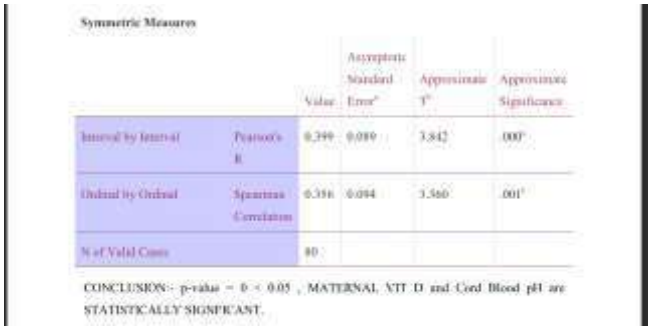
FIGURE: Association between "Maternal Vitamin D" Levels and "Cord Blood pH"

These results indicate a strong association between maternal vitamin D deficiency and fetal metabolic acidosis. The findings suggest that low maternal vitamin D levels may contribute to placental insufficiency, impaired fetal oxygenation, and poor neonatal adaptation, increasing the risk of hypoxic-ischemic encephalopathy (HIE).

Discussion

This study shows a significant association between low maternal vitamin D and neonatal acidosis. Vitamin D promotes placental vascular development and antioxidant defenses. Deficiency can impair oxygen transfer to the fetus, leading to lower cord pH and potential hypoxic injury.

These results suggest maternal vitamin D sufficiency may improve fetal resilience against labor stress and hypoxia. While association is established, causal inference needs further validation via interventional trials.



Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	0.299	0.089	3.842	.000[c]
Ordinal by Ordinal	Spearman Correlation	0.316	0.084	3.560	.001[c]
N of Valid Cases		80			

CONCLUSION:- p-value = 0 < 0.05 , MATERNAL VIT D and Cord Blood pH are STATISTICALLY SIGNIFICANT.

Conclusion

Maternal vitamin D deficiency is significantly associated with low cord blood pH in neonates, suggesting increased risk of perinatal acidosis. Routine antenatal screening and correction of vitamin D deficiency could improve neonatal outcomes. Further studies are needed to confirm causality.

Bibliography

1. Bodnar LM, Simhan HN. Vitamin D may be a link to black-white disparities in adverse birth outcomes. Obstet Gynecol Surv. 2010.

2. Thorne-Lyman A, Fawzi WW. Vitamin D during pregnancy and maternal, neonatal and infant health outcomes: a systematic review and meta-analysis. Paediatr Perinat Epidemiol. 2012.

3. Wagner CL, et al. Vitamin D and its role during pregnancy in maternal and fetal health. Nutrients. 2012.

4. Brannon PM, Picciano MF. Vitamin D in pregnancy and lactation in humans. Annu Rev Nutr. 2011.

5. Holick MF. Vitamin D deficiency. N Engl J Med. 2007.

6. Aghajafari F, et al. Association between maternal serum 25-hydroxyvitamin D level and pregnancy and neonatal outcomes. BMJ. 2013.

7. Lopez M, et al. Relationship between vitamin D deficiency and perinatal asphyxia in term neonates. Neonatology. 2015.