International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Chawla S et al. Int J Reprod Contracept Obstet Gynecol. 2025 Apr;14(4):1189-1194
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20250860

Original Research Article

Pilot study on ferritin and vitamin D3 levels in early pregnancy and it's correlation with fetal wellbeing

Sushil Chawla[1], C. H. Anupama[2], Devdatt Laxman Pitale[2]*, Sujata Narendra Jadhav[3]

[1]Department of Obstetrics and Gynecology, INHS Asvini, Mumbai, Maharashtra, India
[2]INHS, Kalyani, Vizag, Visakhapatnam, Andra Pradesh, India
[3]Department of Pathology, INHS, Asvini, Mumbai, Maharashtra, India

Received: 30 January 2025
Revised: 13 March 2025
Accepted: 15 March 2025

***Correspondence:**
Dr. Devdatt Laxman Pitale,
E-mail: dipu.pitale@gmail.com

ABSTRACT

Background: Overall fetal growth and development is influenced by the maternal nutrition status preconceptionally and in pregnancy. Very few studies have explored the roles of serum ferritin and vitamin D in fetal growth effectively. This pilot study aims to assess the serum Ferritin and vitamin D3 levels in early pregnancy and it's correlation with fetal wellbeing.
Methods: This observational study was conducted at the OBGYN department of tertiary care hospital from Dec 2022 to Dec 2023.A total of 295 pregnant women who satisfied the criteria were recruited. Primary outcome was to assess baseline maternal serum ferritin and Vitamin D3 levels in early pregnancy and secondary outcome to assess it's effects on fetal wellbeing.
Results: Vitamin D deficiency was detected in 21 percent (42) of the study participants and low serum ferritin levels in 20 percent (40) of the patients. Vit D deficiency was more common in primigravidas (15%) as compared to low serum ferritin seen in multigravidas (12.5%). Low Serum ferritin was seen in 15 patients with anaemia and even in 10 patients with Vit D deficiency. Preterm labour, Preeclampsia was seen in three patients. Low birth weight was seen only in 2 patients and the majority of these patients underwent uneventful normal vaginal delivery.
Conclusions: Currently limited evidence is available to explore the association of serum ferritin, vitamin D with fetal wellbeing. The present study emphasizes the need for bigger study to elucidate the causal relationship between low maternal serum ferritin and Vitamin D3 and adverse pregnancy outcomes.

Keywords: Ferritin, Fetal and Maternal outcome, Pregnancy, Vitamin D

INTRODUCTION

Overall development of fetus in utero is determined by various factors like expectant mother's nutrition both preconceptionally and during pregnancy. It is important to embark upon the pregnancy in a healthy and balanced diet state and same has to be maintained throughout the pregnancy.[1] Vitamin D, is an essential micronutrient produced by skin tissues through sunlight and obtained from edible sources like liver, egg yolk and dairy products.[2-4] Pregnant women are susceptible to vit D deficiency. Multiple factors like skin colour, adiposity, geography, dietary intake and vitamin supplements influence this deficiency.[5] Ferritin level is an indicator of iron stores in body and is correlated with iron deficiency anemia and angiogenesis.[6,7] Studies have shown that deficiency of vitamin D3 during early pregnancy can lead to anemia.

Thus, their role in pregnancy appears to be important. Available evidence is not clear about their association in poor outcomes of pregnancy such as small for gestational age (SGA), growth retardation and preterm risk.[8-10] The present study aimed to observe the ferritin as well as vit

D3 levels early in pregnancy in local population for its correlation with fetal wellbeing. Very few studies elaborate the roles of vit D3 during fetal growth effectively.[11] Limited evidence is available on need for Vit D3 treatment to prevent adverse pregnancy outcomes like preeclampsia, fetal growth effects. More robust trials are necessary to study this during pregnancy.[12]

The main aim of this study was to assess Ferritin and vit D3 levels in early pregnancy in local population and it's correlation with fetal wellbeing and to assess the baseline maternal health in terms of ferritin and vitamin D3 values in early pregnancy, effect of these determinants of maternal health on fetal wellbeing as secondary objectives.

METHODS

Study design

The present observational research was prospectively carried out at OBGYN department of a tertiary hospital INHS KALYANI from December 2022 to December 2023. The primary outcome was to study baseline ferritin and vitamin D3 in early pregnancy and maternal- fetal outcome in low ferritin and vitamin D3 was the secondary outcome.

Sample size

During the study period, pregnant women less than thirteen weeks consenting to participate in above study were included. Women with known disorders, bad obstetric history, more than thirteen weeks gestation and multi fetal gestation were excluded from the study.

Along with routine ANC profile investigations additional serum ferritin and vitamin D3 levels were checked in early pregnancy. During the course of study any unusual health conditions like preeclampsia, abruption, preterm labour for mother during subsequent ANC visits and low birth weight in new born if any was noted prospectively.

Measurement of ferritin and vitamin D3 (Independent variables) was done by standard laboratory methods. Birth outcome variables observed were average birth weight and low birth weight. Maternal obstetric outcomes like preeclampsia, abruption and preterm labour were observed during the study period.

Data obtained was analysed using principles of prospective observational analysis in percentage as statistical tool. Statistical descriptive analysis was done and results were tabulated in number (%) for parameters observed.

Helsinki declaration guidelines and ethics in practice were adhered to during study along with Institutional-ethics committee (IEC) clearance. The baseline levels of ferritin and vitamin D3 were observed including the birth outcomes. This study did not involve any intervention including supplementation in study participants.

RESULTS

From December 2022 until December 2023, 295 women in early pregnancy who satisfied necessary criteria were recruited. Due to unavoidable factors such relocation, transfers and loss of follow up, 200 women amongst them were observed as per the protocol. Statistical descriptive analysis was done and results were tabulated in number (%) for parameters observed.

Primary outcomes

The characteristics of study participants is shown in Table 1. Deficiency of Vitamin D3 was detected in 21 percent (42) of the study participants and serum ferritin levels were low in 20 percent (40) of the patients. It was common among primigravidas (15%) in comparison of low level of serum ferritin in multigravidas (12.5%). Such observations in the present study may be due to existing multiple factors like poorer nutritional status of women, myths and unhealthy habits related to food in society.

Secondary outcomes

Secondary outcomes in present study focused on maternal obstetric complications if any like preterm labour, abruption, preeclampsia, and birth weight of newborn both average birth weight and low birth weight as shown in below tables.

Serum ferritin, Vitamin D3 levels and pregnancy (Maternal effects)

Serum ferritin was observed with anemia in 15 patients with low levels of serum ferritin and even in 10 patients with vit D3 deficiency in pregnancy in present study. Preterm labour was seen in three patients with low serum ferritin which is a well-known complication in anemia complicating pregnancy especially in multiparous women. Preeclampsia, abruption and preterm labour was observed in three, two and one patient respectively with serum Vit D3 deficiency.

More robust case control studies are required to explore this association and significance of vit D3 deficiency in early pregnancy and adverse pregnancy outcomes. These conditions were comparable in the two groups but no any significant association with the high-risk factors could be observed in similar other studies as per the available research database.

Outcome of babies with deficiency of vitamin D3

Low-birth weight (LBW) was seen in 2 patients with vit D3 deficiency and majority of this patients underwent uneventful normal vaginal delivery. LSCS was performed only in indicated cases.

Table 1: The characteristics of the study participants and their serum ferritin and vitamin D3.

Age (N), parity (N)	Normal vitamin D level (%)	Vitamin D deficiency	Normal serum ferritin	Ferritin low
21-30 (180)	144 (72)	36 (18)	150 (75)	30 (15)
>30 (20)	14 (7)	06 (3)	10 (5)	10 (5)
Primi (160)	130 (65)	30 (15)	145 (72.5)	15 (7.5)
Multi (40)	28 (14)	12 (6)	15 (7.5)	25 (12.5)

Table 2: The maternal effects of low levels of ferritin and vitamin D3.

Variable	Vitamin D deficiency	Ferritin Low levels
Anemia<11 gm%	10	15
Preeclampsia	03	-
Abruption	02	-
Preterm Labour	01	03
Total	16	18

Table 3: The outcome of babies with maternal vitamin D deficiency (Fetal effects).

Birth weight /MOD	Total	Normal level (%)	Vitamin D deficient (%)
>2.5 Kg	190	150 (75)	40 (20)
<2.5 Kg	10	08 (4)	02 (1)
NVD	160	124 (62)	36 (18)
LSCS	40	34 (17)	06 (3)

DISCUSSION

Vitamin D3 is important to maintain effective calcium and thus strong bones in human body. It is necessary for the bones. As per Holick's classification, vitamin D level is<20 (ng/ml) is deficiency and 21 to 29 (ng/ml) is insufficiency.[13] In India iron-deficiency anemia (IDA) is common during pregnancy. Ferritin indicates the iron stores available in body. Greens, dates and nuts are primary sources of iron.[14] Vitamin D rich foods are very limited and may be insufficient to balance the demands in pregnancy.[15] More research and evidence is still lacking to support vitamin D3 supplements in pregnancy.

Deficiency of vitamin D3 in pregnancy may be associated with severe bone changes, adverse outcomes of pregnancy like preterm labour, preeclampsia and low birth weight in newborn baby.[17] Iron deficiency anemia (IDA) is one of the most commonly seen cause of nutritional deficiency in pregnant women in our country and is an important risk factor for developing anemia complicating high risk pregnancy especially in developing countries.

The currently available research database fails to show any significant differences in improvement of IDA during pregnancy with vitamin D medications and it also does not appear to improve serum ferritin levels in such cases.[18-20] More extensive and multicentric research is warranted for dietary modifications and vitamin D3 supplement in pregnancy. In tropical countries, the ready availability of sunshine appears to play a beneficial role as it is involved in vitamin D3 synthesis pathway. Skin tones like brown and darker skin may limit the rate of vitamin D synthesis when compared to those with lighter skin tone as melanin plays a protective role in such cases.[21-24] Evidence shows that appropriate time of the day to have the maximum benefit from ultraviolet radiation is about 10 in the morning to early noon and for approximately 10 to 30 minutes. New methods like consumption of fortified foods like milk, flour and butter also appears to play a beneficial role. However, a few studies have shown probable risk of developing poor out of pregnancy like premature birth as side effect of supplements.[25]

Very limited studies till date investigated probable association of maternal vitamin D3 with growth of fetus and fail to show the significant association between them and birth outcomes.[26,27] LBW was observed only in 2 patients of vit D3 deficiency. Majority of this patients underwent uneventful normal vaginal delivery. LSCS was performed only in indicated cases. Similarly, studies that focused mainly on the pregnancy outcome and birth weight also failed to show similar associations.[28-30] A recent cochrane review with similar aims and objectives showed inconclusive results and thus to some extent support the findings in present study.[31-33]

Only one study which was conducted by Judistiani et al, elucidated the association with fetal biometry during the final trimester. The present study observed limited association of vitamin D3 in early pregnancy and birth outcomes as well as fetal growth. It may suggest that levels of vitamin D3 in mother in early pregnancy is important to

development of fetus in utero but warrants further larger studies to confirm this role.[34] Anemia complicating pregnancy may cause LBW and growth retardation in utero.[35] In routine haemoglobin, ferritin can be incorporated for evaluation in pregnancy anemia.[36] vitamin D3 influences formation of blood cells and thus regulation of iron in human body.[37,38] In the current study serum ferritin was associated with anemia in 15 patients and even for 10 patients of vitamin D3 deficiency.

Ferritin is an important marker of inflammation. Excess levels of iron in our body causes oxidation stress and damages the endothelium, which may lead to etio-pathogenesis of preeclampsia. Increase in ferritin levels can also cause severe preeclampsia in such cases.[39] Vitamin D3 plays important role in immunity and functioning of placenta during pregnancy. Ferritin and vitamin D3 levels in early pregnancy and prediction of poor pregnancy outcomes like premature birth, abruption and preeclampsia has yet to be determined and this stresses on further research on these lines.[40,41]

In present study preterm labour was seen in three patients with low serum ferritin which is a well-known complication in anemia complicating pregnancy especially in multigravidas. Preeclampsia, abruption and preterm labour was observed in three, two and one patients respectively with serum vitamin D deficiency. A case–cohort study which was conducted by bodnar et al, shows a protective effect of sufficient vitamin D3 in pregnancy and preterm birth. This may probably justify a bigger clinical study for vit D3 supplements in pregnancy to avert adverse pregnancy outcomes as observed in the current study.[42]

Our study being observational and involved no intervention to pregnant women and newborn, thus fails to show a causal relation between low maternal ferritin and vit D3 levels during early pregnancy and poor outcomes. We need further research to study effects of vitamin D3, ferritin in early pregnancy with intrauterine fetal growth. The evidence on such effects in India is limited.

CONCLUSION

In pregnancy deficiency of vit D3 and iron are observed commonly especially in developing nations. Currently very limited evidence is available to explore association of fetal wellbeing and adverse pregnancy outcomes with it. The possibility of probable interaction between serum ferritin and vitamin D3 during pregnancy and adverse outcomes warrants further larger studies. The currently available evidence data base is not just sufficient to recommend vit D supplement in pregnant women. More multicentric research is needed prior to initiation of vitamin D3 medication in pregnancy as a preventive measure as noted in the current study.

Nevertheless, due to it's emerging global health problem early screening of serum ferritin with vitamin D3 deficiency in pregnancy is necessary to promote optimal feto-maternal health and wellbeing. The pregnant women should also be educated about the importance of balanced nutrition along with adequate consumption of vitamin D3 and iron during pregnancy and pre-pregnancy period for ensuring adequate maternal health and fetal wellbeing.

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

REFERENCES

1. Judistiani RTD, Gumilang L, Nirmala SA, Irianti S, Wirhana D, Permana I, et al. Association of Colecalciferol, Ferritin and Anemia among Pregnant Women: Result from Cohort Study on Vitamin D Status and Its Impact during Pregnancy and Childhood in Indonesia. Anemia. 2018;20:2047981.
2. Holick MF. The cutaneous photosynthesis of Previtamin D3: a unique Photoendocrine system. J of Invest Derm. 1981;77(1):51–8.
3. Carmeliet G, Dermauw V, Bouillon R. Vitamin D signaling in calcium and bone homeostasis: a delicate balance. Best Pract Res Clin Endocrinol Metab. 2015;29(4):621–31.
4. Kocylowski R, Lewicka I, Grzesiak M, Gaj Z, Sobanska A, Poznaniak J, et al. Assessment of dietary intake and mineral status in pregnant women. Arch Gynecol Obstet. 2018;3:89.
5. Man RE, Li LJ, Cheng CY, Wong TY, Lamoureux E, Sabanayagam C. Prevalence and determinants of suboptimal vitamin D levels in a multiethnic Asian population. Nutrients. 2017;9(3):25-8.
6. Coffman LG, Parsonage D, D'Agostino R, Torti FM, Torti SV. Regulatory effects of ferritin on angiogenesis. Proc of the Nat Acad of Sci of the United States of America. 2009;106(2):570–5.
7. Wei SQ, Qi HP, Luo ZC, Fraser WD. Maternal vitamin D status and adverse pregnancy outcomes: a systematic review and meta-analysis. J Matern Fetal Neonatal Med. 2013;26(9):889–99.
8. Miliku K, Vinkhuyzen A, Blanken LM, McGrath JJ, Eyles DW, Burne TH, et al. Maternal vitamin D concentrations during pregnancy, fetal growth patterns and risks of adverse birth outcomes. Am J Clin Nutr. 2016;103(6):1514–22.
9. Boyle VT, Thorstensen EB, Mourath D, Jones MB, McCowan LM, Kenny LC, et al. The relationship between 25-hydroxyvitamin D concentration in early pregnancy and pregnancy outcomes in a large, prospective cohort. Br J Nutr. 2016;116(8):1409–15.
10. Eggemoen AR, Jenum AK, Mdala I, Knutsen KV, Lagerlov P, Sletner L. Vitamin D levels during pregnancy and associations with birth weight and body composition of the newborn: a longitudinal multiethnic population-based study. Br J Nutr. 2017;117(7):985–93.

11. Allan KM, Prabhu N, Craig LC, McNeill G, Kirby B, McLay J, et al. Maternal vitamin D and E intakes during pregnancy are associated with asthma in children. Eur Respir J. 2015;45:54-8.
12. De-Regil LM, Palacios C, Lombardo LK, Peña-Rosas JP. Vitamin D supplementation for women during pregnancy. Cochrane Database Syst Rev. 2016;14;(1):8873.
13. Holick MF. Medical progress: vitamin D deficiency. N Engl J Med. 2007;357(3):266–81.
14. Benedik E. Sources of vitamin D for humans. Int J Vitam Nutr Res. 2021;92:733.
15. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, et al. Endocrine Society. Evaluation, treatment and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2011;96(7):1911-30.
16. Trilok Kumar G, Chugh R, Eggersdorfer M. Poor vitamin D status in healthy populations in India: a review of current evidence. Int J Vitam Nutr Res. 2015;85(4):185–201.
17. Mulligan ML, Felton SK, Riek AE, Bernal-Mizrachi C. Implications of vitamin D deficiency in pregnancy and lactation. Am J Obstet Gynecol. 2010;202:421–9.
18. O'Callaghan K, Tariq U, Gernand A, Tinajero M, Onoyovwi A, Zlotkin S, et al. Effect of Maternal Vitamin D Supplementation on Iron Status During Pregnancy. Curr. Dev. Nutr. 2020;4:1054.
19. Braithwaite VS, Crozier SR, D'Angelo S, Prentice A, Cooper C, Harvey NC, et al. The effect of vitamin D supplementation on hepcidin, iron status and inflammation in pregnant women in the United Kingdom. Nutrients. 2019;11:190.
20. Smith EM, Alvarez JA, Kearns MD, Hao L, Sloan JH, Konrad RJ, et al. High-dose vitamin D3 reduces circulating hepcidin concentrations: A pilot, randomized, double-blind, placebo-controlled trial in healthy adults. Clin Nutr. 2017;36:980–5.
21. Richard A, Rohrmann S, Quack Lotscher KC. Prevalence of vitamin D deficiency and its associations with skin color in pregnant women in the first trimester in a sample from Switzerland. Nutrients. 2017;9(3):367-9.
22. Amegah AK, Nsoh M, Ashley-Amegah G, Anaman-Togbor J. What factors influences dietary and non-dietary vitamin D intake among pregnant women in an African population. Nutrition. 2018;50:36–44.
23. Man RE, Li LJ, Cheng CY, Wong TY, Lamoureux E, Sabanayagam C. Prevalence and Determinants of Suboptimal Vitamin D Levels in a Multiethnic Asian Population. Nutrients. 2017;22;9(3):313.
24. Lowe NM, Bhojani I. Special considerations for vitamin D in the south Asian population in the UK. Therap Adv in Musculosk Dis. 2017;9(6):137–44.
25. De-Regil LM, Palacios C, Lombardo LK, Pena-Rosas JP. Vitamin D supplementation for women during pregnancy. Cochrane Database. 2013;2:34-9.
26. Lee DH, Ryu HM, Han YJ, Lee SW, Park SY, Yim CH, et al. Effects of serum 25-hydroxy-vitamin D and fetal bone growth during pregnancy. J of Bone Metab. 2015;22(3):127–33.
27. Morales E, Rodriguez A, Valvi D, Iniguez C, Esplugues A, Vioque J, et al. Deficit of vitamin D in pregnancy and growth and overweight in the offspring. Int J Obes. 2015;39(1):61–8.
28. Wierzejska R, Jarosz M, Kleminska-Nowak M, Tomaszewska M, Sawicki W, Bachanek M, et al. Maternal and cord blood vitamin D status and anthropometric measurements in term newborns at birth. Frontiers in Endocrinol. 2018;9:9.
29. Ong YL, Quah PL, Tint MT, Aris IM, Chen LW, van Dam RM, et al. The association of maternal vitamin D status with infant birth outcomes, postnatal growth and adiposity in the first 2 years of life in a multi-ethnic Asian population: the growing up in Singapore towards healthy outcomes (GUSTO) cohort study. Br J Nutr. 2016;116(4):621–31.
30. Eggemoen ÅR, Jenum AK, Mdala I, Knutsen KV, Lagerløv P, Sletner L. Vitamin D levels during pregnancy and associations with birth weight and body composition of the newborn: a longitudinal multiethnic population-based study. Br J Nutr. 2017;117(7):985-93.
31. Harvey NC, Holroyd C, Ntani G, Javaid K, Cooper P, Moon R, et al. Vitamin D supplementation in pregnancy: a systematic review. Health Technol Assess. 2014;18(45):1–190.
32. Perez-Lopez FR, Pasupuleti V, Mezones-Holguin E, Benites-Zapata VA, Thota P, Deshpande A, et al. Effect of vitamin D supplementation during pregnancy on maternal and neonatal outcomes: a systematic review and meta-analysis of randomized controlled trials. Fertil Steril. 2015;103(5):1278–88.
33. Lee DH, Ryu HM, Han YJ, Lee SW, Park SY, Yim CH, et al. Effects of serum 25-hydroxy-vitamin D and fetal bone growth during pregnancy. J of Bone Metab. 2015;22(3):127–33.
34. Judistiani RTD, Madjid TH, Irianti S, Natalia YA, Indrati AR, Ghozali M, et al. Association of first trimester maternal vitamin D, ferritin and hemoglobin level with third trimester fetal biometry: result from cohort study on vitamin D status and its impact during pregnancy and childhood in Indonesia. BMC Pregnancy Childbirth. 2019;19(1):112.
35. Suryanarayana R, Chandrappa M, Santhuram AN, Prathima S, Sheela SR. Prospective study on prevalence of anemia of pregnant women and its outcome: a community based study. J of Fam Med and Prim Care. 2017;6(4):739–43.
36. Khambalia AZ, Collins CE, Roberts CL, Morris JM, Powell KL, Tasevski V, et al. Iron deficiency in early pregnancy using serum ferritin and soluble transferrin receptor concentrations are associated with pregnancy and birth outcomes. Eur J Clin Nutr. 2016;70(3):358–63.
37. Malczewska-Lenczowska J, Sitkowski D, Surala O, Orysiak J, Szczepanska B, Witek K. The association between Iron and vitamin D status in female elite athletes. Nutrients. 2017;2:56-8.

38. Doudin A, Becker A, Rothenberger A, Meyer T. Relationship between serum 25-hydroxyvitamin D and red blood cell indices in German adolescents. Eur J Pediatr. 2018;177(4):583–91.
39. Khambalia AZ, Collins CE, Roberts CL, Morris JM, Powell KL, Tasevski V, et al. High maternal serum ferritin in early pregnancy and risk of spontaneous preterm birth. Br J Nutr. 2015;14:455-61.
40. Atia AH, Mohammed MA, Mohammed MF, Radwan MS. Association between vitamin D deficiency and serum ferritin and preterm labor: a case control study. IJMA. 2023;5(3):3100-5.
41. Wang D, Xiao C, Li H, Fan J. Serum ferritin and 25-hydroxyvitamin D levels as predictors for premature birth in pregnant women with preeclampsia. Med. 2023;102:635741.
42. Bodnar LM, Platt RW, Simhan HN. Early pregnancy vitamin D deficiency and risk of preterm birth subtypes. Obstet Gynecol. 2015;125(2):439-47.

Cite this article as: Chawla S, Anupama CH, Pitale DL, Jadhav SN. Pilot study on ferritin and vitamin D3 levels in early pregnancy and it's correlation with fetal wellbeing. Int J Reprod Contracept Obstet Gynecol 2025;14:1189-94.