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**Original Research Article**

# Vitamin D status in pregnant women and their newborns in a tertiary care hospital

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## ABSTRACT

**Background:** In the recent years there has been an increased understanding of the role that vitamin D plays in regulation of cell growth, calcium absorption and immunity and its impact on the developing fetus and maternal health is of significant concern. This study aims at evaluating the Vitamin D status in pregnant women and their newborns.
**Methods:** A cross sectional study was done on 100 pregnant females according to inclusion and exclusion criteria. At the time of delivery, maternal blood was collected, and newborn samples were taken from newborn side of umbilical cord and sent for analysis.
**Results:** The prevalence of Vitamin D deficiency has been found to be 85% of pregnant females and 91% of the newborns. Only 5% of pregnant females and 1% of the newborns showed Vitamin D sufficiency. Maternal and newborn vitamin D levels show a positive correlation. Mean maternal and newborn Vitamin D levels were found to be 16.78±7.04 ng/mL and 11.29±5.75 ng/ml.
**Conclusions:** Vitamin D deficiency is highly prevalent among pregnant women in north India. Low maternal vitamin D levels lead to vitamin D deficiency in the newborns also.

**Keywords:** Newborn, Pregnant female, Vitamin D

## INTRODUCTION

Vitamin D is an important vitamin in the body. The impact of vitamin D deficiency on the developing fetus and maternal health is of significant concern. Because 25-hydroxy Vitamin D crosses the placenta, fetal and cord blood levels of the newborn Vitamin D status correlate with the mother levels of Vitamin D.[1]

Vitamin D can be synthesized in sufficient amounts by most vertebrates on adequate exposure of the skin to sunlight (UVB rays). Skin synthesis of Vitamin D depends mainly on factors like age, degree of skin pigmentation and amount of UVB radiation reaching the earth surface. The term vitamin D refers to compounds Vitamin $D_3$ (cholecalciferol) or vitamin $D_2$ (ergocalciferol). Vitamin $D_3$ is produced in the skin on exposure to sunlight. Vitamin D (both forms $D_3$ or $D_2$) is a pro-hormone which requires two hydroxylations to finally attain its biologically active form-1,25dihydroxy Vitamin D or $1,25(OH)_2D$. It is released in blood, where it binds to vitamin D binding protein (VDBP) and reaches its target tissues to exert its endocrine functions through the vitamin D receptor (VDR). During pregnancy, the placenta is probably the most prominent site for extra renal activation of Vitamin D. Because the half-life of $1,25\text{-}(OH)_2D$ is only several minutes, the more accurate assessment of an individual's Vitamin D status is determined through measurement of 25-OH-D which has a half-life of about three weeks.

Vitamin D deficiency prevails in epidemic proportions all over the Indian subcontinent, with a prevalence of 70%-100% in the general population.[2] In a population that already has a high prevalence of Vitamin D deficiency and poor dietary calcium intake, the problem is likely to worsen during pregnancy because of active trans placental transport of calcium to developing fetus. Vitamin D status of these mothers correlated well with their neonates and their exclusively breastfed infants.

Vitamin D deficiency in pregnancy has been shown to lead to significant pregnancy complications like preeclampsia, gestational diabetes, intrahepatic cholestasis of pregnancy, periodontal disease and high caesarean rates.[3-5] Vitamin D deficiency is also associated with bacterial vaginosis in pregnant women.

Gestational Vitamin D deficiency also has adverse effects on neonatal health including small for gestational age fetus, low birth weight, neonatal hypocalcaemia seizures, delayed skeletal development, etc.[6,7] For the majority of women who are deficient in Vitamin D, treatment for 4-6 weeks, either with cholecalciferol 20,000 IU a week or ergocalciferol 10,000 IU twice a week, followed by standard supplementation, is appropriate.

For women who require short-term repletion, 20,000 IU weekly appears to be safe and effective treatment of Vitamin D deficiency. A daily dose is likely to be appropriate to maintain subsequent repletion (1000 IU daily).[8]

There is no data to support routine screening for Vitamin D deficiency in pregnancy in terms of health benefits or cost effectiveness. As the test is expensive, offering it to all at risk women may not be cost effective compared to offering universal supplementation, particularly as treatment is regarded as being very safe.

## METHODS

The present study was conducted in Department of Obstetrics and Gynaecology, Government Medical College, Jammu for a period of one year (November 2015 to October 2016). 100 pregnant females admitted for delivery were selected randomly according to inclusion and exclusion criteria.

***Inclusion criteria***

- Primigravida with full term singleton pregnancy.

***Exclusion criteria***

- Pregnant women with pre-existing thyroid disorders, parathyroid or calcium metabolism disorders or who took medications that interfere with calcium or vitamin D metabolism such as diuretics or calcium channel blockers, women suffering from bone, renal, adrenal and gastrointestinal disorders and other chronic or current medical illness or with history of ATT or anti-epileptic drugs intake.

After informed consent was obtained, information regarding exposure to sunlight, education and socio-economic status was also noted Blood samples was collected from all the subjects prior to delivery or during early labor. Newborn blood samples were collected from the newborn's side of severed umbilical cord at time of delivery.

About 2ml blood sample was collected in a plain test tube without any anti-coagulant and was then stored in refrigerator until analysis. Vitamin D deficiency is defined as 25(OH) D <20 ng/ml, Vitamin D Insufficiency as 21-29 ng/ml and sufficiency as ≥30 ng/ml (according to Endocrine Society).

At the end of the study, all the data collected was compiled and analyzed using appropriate statistical tests. A prevalence of <0.05 is considered as statistical significance.

## RESULTS

The present study was conducted in100 pregnant females and their newborns and following results were obtained. Maximum number of females (65%) belonged to the age group of 21-25 years. The mean age was 24.20±3.29 years. Prevalence of hypovitaminosis D in this age group is 93.84%. In the age group ≤20 years, 100% females had Hypovitaminosis D. Females with age >30 years, 66.66% had vitamin D deficiency and 33.33% had sufficient levels (Table 1).

**Table 1: Maternal age and vitamin D status.**

| Age group (in years) | Number of females N (%) | Maternal vit D levels (ng/ml) | | | Prevalence of hypovitaminosis D (95% CI) |
|---|---|---|---|---|---|
| | | <20 (%) | 20-30 (%) | >30 (%) | |
| ≤20 | 12 (12%) | 8 (66.66%) | 4 (33.33%) | 0 | 100% (77.91-100) |
| 21-25 | 65 (65%) | 57 (87.69%) | 4 (6.15%) | 4 (6.15%) | 93.84% (85.82-98.01) |
| 26-30 | 20 (20%) | 17 (85%) | 2 (10%) | 1 (5%) | 95% (77.72-99.75) |
| >30 | 3 (3%) | 2 (66.66%) | 0 | 1 (33.33%) | 66.66% (13.2-98.33) |
| Total | 100 (100%) | 85 | 10 | 5 | 95% (89.27-98.15) |

*For the purpose of analysis categories of Vit. D<20 ng/ml and Vit. D 20-30 ng/ml are clubbed together.

**Table 2: Residence and maternal vitamin D status.**

| Residence | Number of females N (%) | Maternal vit D levels (ng/ml) | | | Prevalence of hypovitaminosis D (95% CI) |
|---|---|---|---|---|---|
| | | <20 (%) | 20-30 (%) | >30 (%) | |
| Urban | 61 (61%) | 50 (81.96%) | 7 (11.47%) | 4 (6.55%) | 93.44% (84.94-97.88) |
| Rural | 39 (39%) | 35 (89.74%) | 3 (7.69%) | 1 (2.565%) | 97.43% (88-99.87) |
| Total | 100 (100%) | 85 (85%) | 10 (10%) | 5 (5%) | 95% (89.27-98.15) |

*For the purpose of analysis categories of Vit. D<20 ng/ml and Vit. D 20-30 ng/ml are clubbed together.
p value=0.3739 by Mantel-Haenszel chi square test (not significant).

**Table 3: Maternal education and vitamin D status.**

| Educational status | Number of females N (%) | Maternal vit D levels (ng/ml) | | | Prevalence of hypovitaminosis D (95% CI) |
|---|---|---|---|---|---|
| | | <20 (%) | 20-30 (%) | >30 (%) | |
| Uneducated | 6 (6%) | 5 (83.33%) | 1 (16.66%) | 0 | 100% (60.7-100) |
| Up to 10$^{th}$ | 56 (56%) | 53 (94.64%) | 2 (3.57%) | 1 (1.78%) | 98.21% (91.51-99.91) |
| 10$^{th}$ to 12$^{th}$ | 28 (28%) | 19 (67.85%) | 6 (21.42%) | 3 (10.71%) | 89.28% (73.55-97.2) |
| Above 12$^{th}$ | 10 (10%) | 8 (80%) | 1 (10%) | 1 (10%) | 90% (59.65-99.5) |
| Total | 100 (100%) | 85 | 10 | 5 | 95% (89.27-98.15) |

*For the purpose of analysis categories of Vit. D<20 ng/ml and Vit. D 20-30 ng/ml are clubbed together.
Extended Mantel-Haenszel chi square for linear trend = 4.27. p-value (1 degree of freedom) = 0.03868 (significant).

**Table 4: Reported exposure to sunlight and maternal vitamin D status.**

| Exposure to sunlight (in hours) | Number of females N (%) | Maternal vit D levels (ng/ml) | | | Prevalence of hypovitaminosis D (95% CI) |
|---|---|---|---|---|---|
| | | <20 (%) | 20-30 (%) | >30 (%) | |
| <1 | 35 (35%) | 33 (94.28%) | 1 (2.85%) | 1 (2.85%) | 97.14% (86.71-99.86) |
| 1-2 | 57 (57%) | 45 (78.94%) | 8 (14.03%) | 4 (7.01%) | 92.98% (83.94-97.73) |
| >2 | 8 (8%) | 7 (87.5%) | 1 (12.5%) | 0 | 100% (68.77-100) |
| Total | 100 (100%) | 85 (85%) | 10 (10%) | 5 (5%) | 95% (89.27-98.15) |

*For the purpose of analysis categories of Vit. D<20 ng/ml and Vit. D 20-30 ng/ml are clubbed together.
Extended Mantel-Haenszel chi square for linear trend = 0.42. p-value (1 degree of freedom) = 0.5161 (not significant).

**Table 5: Maternal and neonatal vitamin D levels.**

| Neonatal vitamin D levels (ng/ml) | Number of babies N (%) | Maternal vit D levels (ng/ml) | | | Prevalence (95% CI) |
|---|---|---|---|---|---|
| | | <20 (%) | 20-30 (%) | >30 (%) | |
| <20 | 91 (91%) | 85 (93.40%) | 6 (6.59%) | 0 | 100% (96.76-100) |
| 20-30 | 8 (8%) | 0 | 4 (50%) | 4 (50%) | 50% (18.41-81.59) |
| >30 | 1 (1%) | 0 | 0 | 1 (100%) | 0% (0.0-95) |
| Total | 100 (100%) | 85 (85%) | 10 (10%) | 5 (5%) | 95% (89.27-98.15) |

**Table 6: Maternal and neonatal vitamin D status.**

| Vitamin D levels (ng/ml) | No. of pregnant females | Prevalence (95% CI) | No. of newborns | Prevalence (95% CI) |
|---|---|---|---|---|
| <20 (Deficiency) | 85 | 85% (76.98-91.02) | 91 | 91% (84.13-95.52) |
| 20-30 (Insufficiency) | 10 | 10% (5.19-17.1) | 8 | 8% (3.785-14.62) |
| >30 (Sufficiency) | 5 | 5% (1.85-10.73) | 1 | 1% (0.050-4.832) |
| Total | 100 | | 100 | |

61% of the females belonged to urban area and 39% from rural area. It was observed that women from rural areas are more deficient in Vitamin D as compared to the urban females. Out of the 39 rural women, 35(89.74%) were found to have Vitamin D deficiency, 3(7.69%) had insufficiency and only one woman (2.565%) had sufficient levels of Vitamin D. Out of the 61 urban women, 50 (81.96%) were found to have Vitamin D deficiency, 7 (11.47%) had insufficiency and only 4 woman (6.55%) had sufficient levels of Vitamin D.

Mean maternal Vitamin D levels amongst the rural and the urban women is 14.75±6.30 ng/mL and 18.08±7.23 ng/mL respectively. Prevalence of hypovitaminosis D is

97.43% amongst the rural females as compared to93.44% among the urban women (Table 2).

56% females had attained formal education up to 10th class, 6% were uneducated and Only 10% had attained education above 12th class. Mean maternal Vitamin D levels amongst the different educational groups were calculated and found as follows- Uneducated-12.88±6.99 ng/ml; Up to 10th class-14.86±4.77 ng/ml; 10th to 12th class-20.77±8.94 ng/ml and above 12th class-18.70±7.34 ng/ml. Prevalence of hypovitaminosis D was maximum amongst the illiterate females 100% (Table 3). Significant association was found between maternal education and vitamin D status (p-value=0.03).

57 females (57%) had reported an exposure to sunlight only for 1-2 hours in a day. Only 8% females had exposure more than 2 hours. It was observed that females with minimum hours of exposure to sunlight (<1hour) were most deficient in Vitamin D, i.e. 94.28%. Mean maternal vitamin D level is15.19±5.43 ng/mL in such females. Amongst the females who had reported sunlight exposure of more than 2 hours, 87.5% had deficient levels of vitamin D. Prevalence of hypovitaminosis D amongst the group of females with 1-2 hours reported exposure to sunlight, which includes maximum number of females, is 92.98% (Table 4).

In the present study, prevalence of vitamin D deficiency has been found in 85% of the pregnant females. 10% females had vitamin D insufficiency and only 5% females had sufficient levels of Vitamin D (Table 5 and 6). Prevalence of hypovitaminosis D i.e. taking together vitamin D deficiency and insufficiency is 95%. Mean maternal vitamin D level is 16.78±7.04 ng/ml.

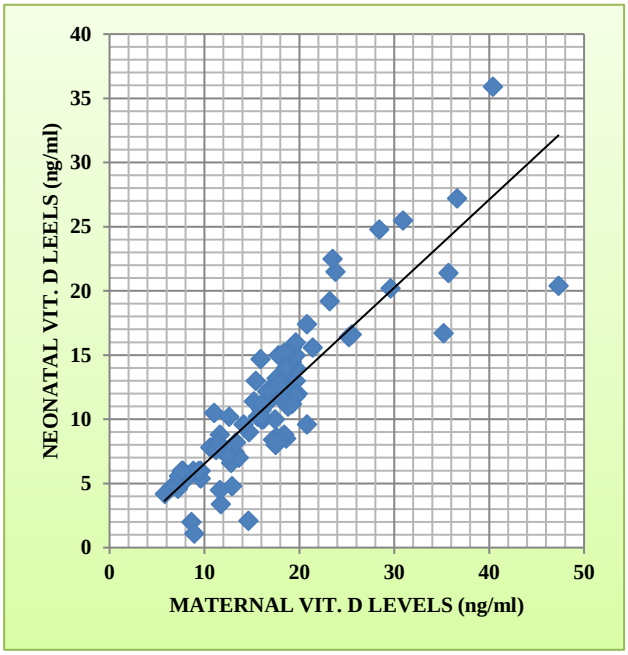


**Figure 1: Correlation between maternal and neonatal vitamin D levels.**

Prevalence of Vitamin D deficiency amongst the newborns is 91, 8% had vitamin D insufficiency and only 1% had sufficient levels of vitamin D. Mean newborn vitamin D level is 11.29±5.75 ng/ml. All the Vitamin D deficient mothers i.e. 85%, delivered babies who were Vitamin D deficient. A positive co-relation was found between the maternal and neonatal vitamin D levels (Figure 1).

## DISCUSSION

The mean age in present study was 24.20±3.29 years which was comparable to study conducted by Sharma et al.[9] where mean age was 23±5.85 years. Females ≤ 20 and ≥30years had prevalence of hypovitaminosis D of 100% and 66.66% respectively, which was similar to study by Al Faris NA where prevalence of vitamin D deficiency in younger females was 53.2% and 38.2% in older females.[10] However, no significant association was found between maternal age and vitamin D status as concluded by Sharma et al.[9]

61% females belonged to urban areas and 39% to rural areas. Vitamin D deficiency was found more amongst the rural pregnant females (89.74%). Prevalence of hypovitaminosis D was higher in rural females. Association of maternal Vitamin D status and residence was not found to be statistically significant in present study which was comparable to Study conducted by Sachan et al where mean maternal vitamin D levels in the urban and rural women did not differ significantly.[11]

56% female had attained formal education up to 10th class and only 10% above 12th class. 6% of females were uneducated. Prevalence of hypovitaminosis D among the illiterate females was 100%**.** Significant association was found between maternal education and vitamin D status (p-value=0.03) in present study which was comparable to study by Sharma et al.[9] who found that amongst the illiterate women prevalence of hypovitaminosis D was 95.74%.

57% females reported an exposure to sunlight for 1-2 hours in a day. No significant correlation was found between vitamin D status and sunlight exposure in present study. On the contrary in present study prevalence amongst the group who received sunlight for maximum time i.e. >2 hours were highest. This may possibly explained by the fact that actual hours of exposure to sunlight could not by calculated accurately by any means and moreover in present study authors have documented the hours of exposure as reported by the subjects which cannot be exact. Also, pigmented skin, excessive clothing and air pollution may interfere with Vitamin D synthesis on exposure to sunlight. Al Faleh et al in a study in Saudi Arabia found no association between maternal Vitamin D levels and level of sun exposure.[12] In present study prevalence of Maternal and Neonatal vitamin D deficiency was 85% and 91% respectively which was comparable to study by Sachan et

al (84%), Halicioglu et al (90.3%) and Wuertz C et al (94%) respectively.[11,13,14] A positive correlation was found between maternal and neonatal vitamin D levels.

## CONCLUSION

Vitamin D deficiency is highly prevalent among pregnant women in north India. Low maternal Vitamin D levels lead to vitamin D deficiency in the newborns also. There is no data to support routine screening for Vitamin D deficiency in pregnancy in terms of health benefits or cost effectiveness. As the test is expensive, offering it to all at risk women may not be cost effective compared to offering universal supplementation, which is regarded as being very safe and may help in preventing vitamin D deficiency and its consequent complications.

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## REFERENCES

1. Greer FR. 25 hydroxy Vitamin D: Functional outcomes in infants and young children. Am J Clin Nutr. 2008;88(2):529S-33S.
2. Gupta R, Gupta. Vitamin D deficiency in India: prevalence, causalities and interventions. Nutrients. 2014;6(2):729-75.
3. Robinson CJ, Alanis MS, Wagner CL, Hollis BW, Johnson DD. Plasma 25-OH Vitamin D levels in early onset severe preeclampsia. Am J Obstet Gynaecol. 2010;203(4):366.
4. Zhang C, Qiu C, Hu FB, David RM, Van Dam RM, Bralley A, et al. Maternal 25-OH Vitamin D concentration and the risk of gestational diabetes mellitus. PLoS One. 2008;3:e3753.
5. Scholl TO, Chen X, Stein P. Maternal vitamin D status and delivery by cesarean. Nutrients. 2012;4(4):319-30.
6. Bodnar LM, Simhan HN, Powers RW, Frank MP, Cooperstein E, Roberts JM. High prevalence of vitamin D insufficiency in black and white pregnant women residing in the Northern United States and their neonates. J Nutr. 2007;137(2):447-52.
7. Agarwal N, Arya SC. Vitamin D3 levels in pregnant women and newborns at a private tertiary care hospital in Delhi, India. Int J Gynecol Obstet. 2011;113:240-1.
8. Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. Mayo Clin Proc. 2010;85:752-7.
9. Sharma S, Kumar A, Prasad S, Sharma S. Current scenario of vitamin D status during pregnancy in North Indian population. J Obstet Gynaecol India. 2016;66(2):93-100.
10. Al-Faris NA. High prevalence of vitamin D deficiency among pregnant Saudi women. Nutrients. 2016;8(2):77.
11. Sachan A, Gupta R, Das V, Agarwal A, Awasthi PK, Bhatia V. High prevalence of vitamin D deficiency among pregnant women and their newborns in northern India. Am J Clin Nutr. 2005;81:1060-4.
12. AlFaleh KM, Al-Manie AM, Al-Mahmoud HF, Al-Razqan HM, Al-Mutlaq AB, Al-Rumaih SA, et al. Prevalence of Vitamin D deficiency in Saudi newborns at a tertiary care center. Saudi Med J. 2014;35(2):178-82.
13. Halicioglu O, Aksit S, Koc F, Akman SA, Albudak E, Yaprak I, et al. Vitamin D deficiency in pregnant women and their neonates in spring time in western Turkey. Paediatr Perinat Epidemiol. 2012;26(1):53-60.
14. Wuertz C, Gilbert P, Baier W, Kunz C. Cross-sectional study of factors that influence the 25-hydroxyvitamin D status in pregnant women and in cord blood in Germany. Br J Nutr. 2013;110(10):1895-902.

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