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Original Research Article

# Evaluation of vitamin D status in antenatal patients attending OPD at a tertiary care centre

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ABSTRACT

**Background:** Vitamin D deficiency during pregnancy is a worldwide epidemic. Studies have reported a prevalence that ranges from 18-84%, depending on country of residence, season and local clothing customs. Furthermore studies have shown that pregnancy alone is a risk factor for vitamin D deficiency particularly among women living at high altitudes.Vitamin D deficiency in pregnancy is associated with increased risk of pre eclampsia, gestational diabetes mellitus, preterm birth, small for gestational age infants, impaired fetal skeletal formation and bone mineral density (BMD).

**Aim:** Aim of our study is to assess vitamin D levels in antenatal patients in first trimester attending OPD at a tertiary care centre.

**Materials and Methods**: It is a cross-sectional study that was conducted in department of OBG at SGRD, Sri Amritsar. All participants meeting inclusion criteria were enrolled for the study and written informed consent was taken. Serum sample of the eligible primigravida was taken at time of recruitment, centrifuged and stored at -70 degrees for assessment of serum 25 hydroxy-vitamin D level.

**Results**: A high prevalence of vitamin D deficiency was observed in our study population where only 18.8% had adequate levels of vitamin D while 81.2% of the participants had vitamin D deficiency (69% were insufficient and 12.2% were severe deficient), and none of the participants was having vitamin D toxicity. The deficiency was equally high in all age groups of study participants irrespective of their area of residence. The mean serum calcium in severe deficient and adequate group was 7.97±0.61 and 9.22 ±0.63 respectively (p=0.001). Similarly mean serum phosphorus levels in severe deficient and adequate group is 3.03±0.79 and 3.60±0.63 respectively (p=0.001). Maternal education, socioeconomic status, obesity, serum calcium and serum phosphorus levels were significantly associated with severe vitamin D deficiency.

**Conclusion**: Vitamin D deficiency is highly prevalent among pregnant women who participated in our study, which raises concern about the health consequences for the mother and the offspring.



## 1. Introduction

In the early 1900s, vitamin D, also referred to as "the sunshine vitamin" or "the bone vitamin," was known as calciferol.[1] It is also referred to as a “hormone” instead of a vitamin since practically all human cells have vitamin D receptors (VDR), which are particular receptors that indicate a cell’s need for vitamin D in order to operate.[2] This vitamin is fat soluble and comes in two forms: vitamin D2 ergocalciferol, which comes from plants, and vitamin D3 cholecalciferol, which comes from animals.[3] Contrary to popular belief, vitamin D insufficiency should not be an issue in tropical nations like India, where the bulk of the population enjoys year-round access to sunlight, deficiency of vitamin D is not expected, but it is not true. Increasing urbanization in our country results in poor outdoor activity and also the

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environmental pollution, coupled with skin shade, may further compound this problem.[4] During pregnancy, it is more critical to ensure vitamin D adequacy for the health of mother as well as offspring. Vitamin D deficiency during pregnancy has been associated with increased risk for negative pregnancy outcomes, including preeclampsia, gestational diabetes mellitus, primary caesarean section, vaginosis, lower birth weight, reduced infant size and impaired bone development.[5,6]

## 2. Materials and Methods

It was a cross-sectional study that was conducted in department of Obstetrics and Gynaecology at a tertiary care centre, Sri Amritsar. All participants who fulfilled inclusion criteria were enrolled for the study from antenatal OPD. A written informed consent was taken from all participants. Detailed history was recorded including complete demographic details, dietary history, past medical history. The serum vitamin D levels were done using VITROS 5600 integrated system. Vitamin D levels were categorized according to Figure 1.

### *2.1. Inclusion criteria*

Primigravida with singleton live pregnancy upto 12 weeks of gestation attending ANC clinic.

### *2.2. Exclusion criteria*

1. History of intake of drugs interfering with calcium and vitamin D metabolism like anticonvulsants, corticosteroids, thiazides, rifampin and cholestyramine.
2. Known history of medical disorders of thyroid, parathyroid, adrenal, or collagen disorder, hepatic or renal dysfunction, metabolic bone disease, type 1 diabetes and fat malabsorption syndromes like sprue, cystic fibrosis and Crohn disease.

### *2.3. Multiple pregnancy*

A total of 336 pregnant women were enrolled in the study. All consecutively registered primigravida who were sure of dates, had no medical history of thyroid disorders etc, attending the antenatal clinic at a tertiary care centre, were included in the study between 1st January 2023 and 31 March 2024. Gestational ages of the subjects were confirmed with best obstetric estimates using definite menstrual history and first trimester ultrasonography scan and all procedures involving human subjects were approved by the Institutional Ethics Committee. A written informed consent was taken from the recruited subjects. Upon meeting the inclusion and exclusion criteria, a thorough obstetric history and examination was conducted for each enrolled participant. Serum sample of the eligible primigravida was taken at time of recruitment, centrifuged, and stored at -70 degrees for assessment of serum 25-hydroxy-vitamin D level. Serum 25(OH) D level was estimated using VITROS 5600 integrated system according to manufacturer's instructions using enhanced chemiluminescence method. Serum calcium titers were estimated using Arsenazo 111 – VITROS. Serum phosphorus levels were also done using Phosphomolybdate reduction – VITROS.

### *2.4. Statistical analysis*

Data was statistically analyzed using the Statistical Package for Social Sciences version 28 (SPSS).Serum level of vitamin D was classified according to Figure 1, as severe VDD (serum 25(OH)D level of < 10ng/ml, vitamin D insufficiency (serum 25(OH)D level of 11–32 ng/ml), and vitamin D adequacy (serum 25 (OH)D level of 32–100 ng/ml. All the variables were entered into the main analyses and were found to be normally distributed. ANOVA test was employed to observe significant mean difference between three groups. The qualitative data between two groups were compared using Chi-square test/Fisher exact test. The correlation between maternal haemoglobin, serum phosphorus, serum calcium, and serum 25-hydroxy-vitamin D was performed using Pearson's correlation. Univariate and multinomial logistic regressions were applied to identify the risk factors for vitamin D. Socioeconomic factors have been evaluated by modified Kuppuswamy scale.

**Table 1:** Distribution of study participants on the basis of serum vitamin D levels

| S. Vitamin D (ng/mL | No. of cases | %age |
|---|---|---|
| <10 (severe deficient) | 41 | 12.2 |
| 11-32 (inadequate) | 232 | 69.0 |
| 32-100 (adequate) | 63 | 18.8 |
| >100 (toxicity) | 0 | 0 |
| **Total** | 336 | 100.0 |

Among study participants, only 63(18.8%) participants) had adequate vitamin D levels, while 41(12.2%) participants were having severe deficiency of vitamin D, 232 (69%) participants had insufficient vitamin D levels while none of the study participants had vitamin D toxicity.(Tables 1 and 2)

In our study population as mean BMI increased above normal range (WHO Asian guidelines), vitamin D levels decreased, specifically, participants with severe vitamin D deficiency had a higher mean BMI in the pre-obese range, while those with adequate vitamin D levels had a mean BMI within the normal range. The statistical analysis showed that these results were significant, with a p-value of 0.001. (Table 3)

| Stage | Serum 25(OH)D | Maternal adverse effects | Newborn infant adverse effects |
|---|---|---|---|
| Severe deficiency | <10 ng/mL | Increased risk of preeclampsia, calcium malabsorption, bone loss, poor weight gain, myopathy, higher parathyroid hormone levels | Small for gestational age, neonatal hypocalcemia, hypocalcemic seizures, infantile heart failure, enamel defects, large fontanelle, congenital rickets, rickets of infancy if breastfed |
| Insufficiency | 11–32 ng/mL | Bone loss, subclinical myopathy | Neonatal hypocalcemia, reduced bone mineral density, rickets of infancy if breastfed |
| Adequacy | 32–100 ng/mL | Adequate calcium balance, parathyroid hormone levels | None, unless exclusively breastfed |
| Toxicity | >100 ng/mL | Hypercalcemia, increased urine calcium loss | Infantile idiopathic hypercalcemia |

Serum 25(OH)D: Serum 25 hydroxyvitamin D

**Figure 1:**

**Table 2:** Showing association vitamin D levels with dietary habits

| Diet | No. of participants (n) | Vitamin D (ng/ml) <10 Severe deficient | | 11-32 Insufficient | | 32-100 Adequate | |
|---|---|---|---|---|---|---|---|
| | | No. | %age | No. | %age | No. | %age |
| **Nonveg** | 50 | 6 | 12.00 | 25 | 50.00 | 19 | 38.00 |
| **Veg** | 286 | 35 | 12.24 | 207 | 72.38 | 44 | 15.38 |
| **Total** | 336 | 41 | 12.20 | 232 | 69.05 | 63 | 18.75 |

p-value (Chi square)= 0.001

**Table 3:** Showing stages of vitamin D deficiency and mean BMI

| Vitamin D (ng/ml) | BMI | |
|---|---|---|
| | Mean | SD |
| **<10 Severe deficient** | 25.10 | 6.24 |
| **11-32 Insufficient** | 24.80 | 3.81 |
| **32-100 Adequate** | 21.38 | 2.17 |
| **p-value (Anova Test)** | 0.001 | |

**Table 4:** Association of vitamin D levels with level of education

| Education Status | Mean Vitamin D level ng/mL | +SD |
|---|---|---|
| Graduate | 24.72 | +4.25 |
| Intermediate/Diploma | 25.59 | +4.38 |
| High School | 23.84 | +3.25 |
| Middle School | 23.61 | +3.54 |
| Primary School | 9.62 | +4.21 |
| Illiterate | 10.52 | +3.88 |
| p-value | 0.001 | |

**Table 5:** Showing vitamin D levels in different socioeconomic classes

| Socio economic status | No. of cases | Vitamin D (ng/ml) <10 Severe deficient | | 11-32 Insufficient | | 32-100 Adequate | |
|---|---|---|---|---|---|---|---|
| | | No. | %age | No. | %age | No. | %age |
| **Upper class** | 20 | 0 | 0.00 | 5 | 25.00300 | 15 | 75.00 |
| **Upper middle** | 208 | 9 | 4.33 | 153 | 73.56 | 46 | 22.12 |
| **Lower middle** | 78 | 13 | 16.67 | 58 | 74.36 | 7 | 8.97 |
| **Upper lower** | 21 | 12 | 57.14 | 4 | 19.05 | 5 | 23.81 |
| **Lower** | 9 | 7 | 77.78 | 2 | 22.22 | 0 | 0.00 |
| **Total** | 336 | 41 | 12.20 | 232 | 69.05 | 63 | 18.75 |

p-value (Chi square) = 0.001

In our study, when we compared vitamin d levels in upper and lower class. We discovered that among the upper class participants, 75% exhibited adequate vitamin D levels, while 25% had insufficient levels. Conversely, within the lower class, 77.78% were severely deficient, 22.2% had insufficient levels, and none had adequate vitamin D levels. Importantly, this contrast between the two classes was determined to be statistically significant, with a p-value of 0.001.(Table 5)

## 3. Discussion

In our study, out of 336 study participants, only 63 participants had adequate vitamin D levels while rest of the participants were found to be vitamin D deficient, 232 participants had insufficient vitamin D levels and 41 participants were having severe deficiency of vitamin D, indicating a high prevalence of vitamin D deficiency in our study participants. In a study conducted by S Sharma et al.[7] did a study on 418 primigravida reported a strikingly high prevalence of vitamin D deficiency during pregnancy, with 93.5% of participants being affected. Among these, 59% had insufficient levels, indicating a potential risk of progressing to severe deficiency without intervention.

Alok et al. studied 207 pregnant women and discovered that 84% were deficient in vitamin D, with a mean serum 25(OH) level below the recommended threshold.[8]

Dasgupta et al. focused on 50 pregnant women in the North-Eastern part of India and found that 42% had vitamin D deficiency, with 14% having insufficient levels during their first trimester.[9]

Al Ajlan et al. examined 515 pregnant women in their first trimester and found that 26.2% were deficient, 68.0% were insufficient, and only 3.5% had sufficient levels of vitamin D.[10]

Similarly, Vandevijvere et al. concluded that out of 1311 pregnant women, 74.1% were vitamin D insufficient, 44.6% were deficient, and 12.1% were severely deficient.[11]

These studies collectively highlight the widespread prevalence of vitamin D deficiency among pregnant women, emphasizing the need for monitoring and intervention to mitigate its adverse effects on maternal and fetal health.

### *3.1. Diet*

In our study, the dietary habits of the participants were predominantly vegetarian, with 286 (85.12%) adhering to this dietary preference, while 50 (14.88%) were non-vegetarians. Among the non-vegetarians, 38 (11.3%) preferred chicken, and 12 (3.6%) preferred fish.

We investigated the relationship between dietary habits and vitamin D levels among the participants and found notable disparities. Among vegetarians, a striking 85.37% were severely deficient in vitamin D, whereas among non-vegetarians, only 14.63% exhibited severe deficiency. This discrepancy was statistically significant, with a p-value of 0.001. The reason behind this significant difference is attributed to the fact that non-vegetarian sources such as chicken and fish are rich in vitamin D compared to the relatively poorer vegetarian sources.

These findings align with those of Dasgupta et al. who similarly concluded that a strong association exists between a vegetarian diet intake and significantly low serum vitamin D levels.[9] This underscores the importance of considering dietary habits, particularly the inclusion of vitamin D-rich foods, in addressing deficiencies among pregnant women.

### *3.2. BMI*

In our study, the maximum number of participants, 120 (35.7%), were classified as pre-obese, followed by 99 (29.5%) with a BMI within the normal range, 79 (23.5%) overweight, 30 (8.9%) obese, and 8 (2.4%) underweight, according to WHO Asian guidelines. The mean BMI was calculated to be 24.19 ± 4.17. We investigated the association between BMI levels and vitamin D levels among participants and found that as BMI levels increased, vitamin D levels decreased significantly. Participants with severe vitamin D deficiency had a higher mean BMI in the pre-obese range, while those with adequate vitamin D levels had a mean BMI within the normal range. Statistical analysis revealed these results to be significant, with a p-value of 0.001.[12]

In a study by Vandevijvere et al.[11] in 2012 involving 1311 pregnant women, they concluded that the risk of vitamin D deficiency (defined as 25-(OH)D <20 ng/ml)

significantly increased with increase in BMI. Similarly, Zhang et al.[13] reported comparable findings, noting that the number of women with raised BMI, was significantly higher in the vitamin D insufficient/deficient group compared to the sufficient group (20.71 vs. 21.09; $p < 0.001$).

These findings collectively suggest a significant association between higher BMI levels and an increased risk of vitamin D deficiency among pregnant women.

### *3.3. Education*

In our study, we observed a diverse distribution of educational levels among the 336 participants. The majority, comprising 119 (30.95%) participants, held diplomas, while 92 (27.38%) had completed high school, 31 (9.23%) had education up to middle school, 55 (16.37%) were graduates, and 14 (4.17%) were illiterate.

Upon investigating the relationship between maternal education levels and serum vitamin D levels, we found a significant correlation. Specifically, as maternal education levels increased, there was a corresponding rise in serum vitamin D levels among participants (p=0.001). These findings are consistent with those of S Sharma et al.,[7] who similarly concluded that an increase in maternal education correlates with a decrease in the frequency of severe vitamin D deficiency and an increase in the frequency of adequate vitamin D levels ($p < 0.01$). Additionally, Vandevijvere et al.[11] also noted that the risk of vitamin D insufficiency was significantly lower for more educated women.

Furthermore, Arkkola et al.[14] investigated the impact of nutrition during pregnancy on maternal and fetal growth and development. They found a positive correlation between healthy food choices and maternal education, suggesting that higher education levels are associated with fewer incidences of deficiencies, including vitamin D deficiency.

These collective findings emphasize the importance of education in promoting healthier behaviors and outcomes during pregnancy, including the maintenance of adequate vitamin D levels.

### *3.4. Socioeconomic status*

In our study, when participants were distributed according to the modified Kuppuswamy scale,[15] we found significant differences in vitamin D levels between the upper and lower socioeconomic classes.(Table 5) Among the upper-class participants, 75% exhibited adequate vitamin D levels, while 25% had insufficient levels. In contrast, within the lower class, 77.78% were severely deficient, 22.2% had insufficient levels, and none had adequate vitamin D levels. This disparity between the two classes was statistically significant, with a p-value of 0.001, indicating a higher prevalence of vitamin D deficiency in the lower class compared to the upper class study participants. Similarly, in a study conducted by S Sharma et al.[7] in 2016 involving 418 primigravida, participants were distributed according to the modified Kuppuswamy scale. They observed that as socioeconomic status increased, the frequency of severe vitamin D deficiency decreased. This aligns with our findings and underscores the influence of socioeconomic status on vitamin D levels among pregnant women.

## 4. Conclusion

In the present study, result showed high prevalence of vitamin D deficiency among study participants irrespective of age and area of residence l. The influencing factors that have affected serum vitamin D status of a pregnant patients in our study include socioeconomic status, dietary habits, and obesity and education level of mother. Illiterate participants were more severely deficient compared to the educated ones. A better educational level correlates with better living conditions and thus may indirectly improve the quality of the diet during pregnancy. However, the data associated with risk factors of VDD during pregnancy are really scanty. This study vitamin D status which is throws light on factor during pregnancy. Such a high prevalence of vitamin D in pregnancy raises concern about the health consequences for the mother and the offspring. In our study, all the deficient pregnant women were advised to consume vitamin D rich diet, and in severe deficient women vitamin D supplements (2000IU) were advised along with calcium supplements.

## 5. Source of Funding

None.

## 6. Conflict of Interest

None.

## References

1. Ross AC, Taylor CL, Yaktine AL, Valle HBD. Committee to review dietary reference intakes for vitamin D and calcium. *Food Nut Board*. 2011;22:35–111.
2. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab*. 2011;96(7):1911–30.
3. Holick MF. High prevalence of vitamin D inadequacy and implications for health. *Mayo Clin Proc*. 2006;81(3):353–73.
4. White JH. Vitamin D signaling, infectious diseases, and regulation of innate immunity. *Infect Immun*. 2008;76(9):3837–43.
5. Bikle D. Nonclassic actions of vitamin D. *J Clin Endocrinol Metab*. 2009;94(1):26–34.
6. Chisty SSJ, Das D. Vitamin D in pregnancy - an overview. *J Obstet Gynaecol Barpeta*. 2014;1(1):17–23.
7. 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.
8. 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(5):1060–4.
9. Dasgupta A, Saikia UK, Sarma D. Status of 25(OH)D levels in pregnancy: A study from the North Eastern part of India. *Indian J*

*Endocrinol Metab*. 2012;16(2):405–7.
10. Al-Ajlan A, Al-Musharaf S, Fouda MA, Krishnaswamy S, Wani K, Aljohani NJ, et al. Lower vitamin D levels in Saudi pregnant women are associated with higher risk of developing GDM. *BMC Pregnancy Childbirth*. 2018;18(1):86.
11. Vandevijvere S, Amsalkhir S, Oyen HV, Moreno-Reyes R. High prevalence of vitamin D deficiency in pregnant women: a national cross-sectional survey. *PLoS One*. 2012;7(8):e43868.
12. Kumaratne M, Early G, Cisneros J. Vitamin D Deficiency and Association With Body Mass Index and Lipid Levels in Hispanic American Adolescents. *Glob Pediatr Health*. 2017;4:2333794X17744141.
13. Zhang Q, Zhang C, Wang Y, Zhao J, Li H, Shen Q, et al. Relationship of maternal obesity and vitamin D concentrations with fetal growth in early pregnancy. *Eur J Nutr*. 2022;61(2):915–24.
14. Arkkola T, Uusitalo U, Pietikäinen M, Metsälä J, Kronberg-Kippilä C, Erkkola M, et al. Dietary intake and use of dietary supplements in relation to demographic variables among pregnant Finnish women. *Br J Nutr*. 2006;96(5):913–20.
15. Kumar BR, Dudala SR, Rao AR. Kuppuswamy's socio-economic status scale-a revision of economic parameter for 2012. *Int J Res Dev Health*. 2013;1(1):2–4.

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