

Research Article

Assessment of Vitamin D Deficiency in Lactating Women Attending a Tertiary Care Hospital

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Received: 13.05.26, Revised: 14.06.26, Accepted: 15.07.26

ABSTRACT

Background: Vitamin D deficiency is a major public health concern affecting women of reproductive age worldwide. Lactating women are particularly vulnerable because of increased maternal nutritional demands and inadequate dietary intake, which may adversely affect both maternal health and breast milk vitamin D content. Early identification of vitamin D deficiency is essential for preventing maternal osteomalacia, osteoporosis, and impaired infant skeletal development.

Objectives: To assess the prevalence of vitamin D deficiency among lactating women attending a tertiary care hospital and to evaluate its association with demographic, nutritional, and biochemical parameters.

Materials and Methods: This prospective observational study was conducted at the Department of Obstetrics and Gynaecology, ESIC Medical College, Kalaburagi, from November 2022 to October 2023. A total of 100 lactating women were enrolled after obtaining informed consent. Demographic details, dietary habits, sunlight exposure, anthropometric measurements, and obstetric history were recorded. Serum 25-hydroxyvitamin D [25(OH)D], calcium, phosphorus, alkaline phosphatase, haemoglobin, and other relevant biochemical parameters were estimated. Vitamin D status was classified according to the Endocrine Society guidelines. Statistical analysis was performed using SPSS version 25.0, and a p-value <0.05 was considered statistically significant.

Results: The mean age of participants was 27.1 ± 3.9 years. Vitamin D deficiency (<20 ng/mL) was observed in 58% of women, while 24% had insufficiency and only 18% had sufficient vitamin D levels. Vitamin D deficiency was significantly associated with lower sunlight exposure ($p=0.012$), vegetarian diet ($p=0.041$), higher BMI ($p=0.026$), prolonged lactation ($p=0.048$), lower serum calcium ($p=0.003$), and lower hemoglobin levels ($p=0.014$). No significant association was observed with maternal age.

Conclusion: Vitamin D deficiency is highly prevalent among lactating women attending a tertiary care hospital. Routine screening of high-risk mothers, nutritional counseling, adequate sunlight exposure, and appropriate vitamin D supplementation should be incorporated into postpartum care to improve maternal and infant health outcomes.

Keywords: Vitamin D Deficiency, Lactating Women, Postpartum, Serum 25-Hydroxyvitamin D, Sunlight Exposure, Maternal Nutrition.

INTRODUCTION

Vitamin D is a fat-soluble secosteroid hormone that plays a vital role in calcium and phosphorus metabolism, skeletal mineralization, immune regulation, and maintenance of maternal and infant health. The primary source of vitamin D is cutaneous synthesis following exposure to ultraviolet B (UVB) radiation, while dietary intake contributes only a limited proportion of total body stores. Despite abundant sunshine in many tropical countries, vitamin D deficiency remains a widespread nutritional disorder affecting all age groups, including pregnant and lactating women (1,2).

Lactation is associated with increased maternal calcium and vitamin D requirements due to transfer of calcium into breast milk for infant skeletal growth. Maternal vitamin D status directly influences breast milk vitamin D concentration and consequently affects infant vitamin D stores. Infants exclusively breastfed by vitamin D-deficient mothers are at increased risk of hypovitaminosis D, nutritional rickets, delayed growth, and impaired bone mineralization (3,4).

Globally, vitamin D deficiency affects nearly one billion individuals, with particularly high prevalence reported in South Asian countries. In India, studies have demonstrated that 50–

90% of apparently healthy adults have inadequate vitamin D levels despite adequate sunlight availability. Contributing factors include limited sun exposure, darker skin pigmentation, cultural clothing practices, vegetarian diet, urban lifestyle, obesity, and low dietary calcium intake (5,6).

Maternal vitamin D deficiency has also been associated with muscle weakness, osteomalacia, osteoporosis, fatigue, postpartum depression, impaired immune function, and increased susceptibility to infections. Several studies have demonstrated significant correlations between vitamin D deficiency and adverse maternal as well as neonatal outcomes, highlighting the need for early identification and intervention (7,8).

Routine screening for vitamin D deficiency during pregnancy and lactation is not universally practiced in many developing countries. Furthermore, data regarding vitamin D status among lactating women in southern India remain limited. Understanding the prevalence and associated risk factors can help formulate preventive strategies including nutritional education, supplementation, and lifestyle modification.

Therefore, the present study was undertaken to assess vitamin D deficiency among lactating women attending a tertiary care hospital and to evaluate its association with maternal demographic, nutritional, and biochemical characteristics.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based prospective observational study was conducted in the Department of Obstetrics and Gynaecology in collaboration with the Department of Biochemistry at ESIC Medical College, Kalaburagi, Karnataka, India. The study was carried out over a period of one year from November 2022 to October 2023. The study aimed to assess the prevalence of vitamin D deficiency among lactating women attending the postnatal outpatient department (OPD) and immunization clinic of the tertiary care hospital.

Study Population

A total of 100 lactating women fulfilling the eligibility criteria were enrolled consecutively during the study period after obtaining written informed consent.

Sample Size

The study included 100 lactating women, selected by convenient consecutive sampling during the study period.

Inclusion Criteria

- Lactating women aged 18–40 years.
- Mothers within six months postpartum.
- Women exclusively or predominantly breastfeeding.
- Women willing to participate and provide written informed consent.

Exclusion Criteria

- Women with chronic liver disease, chronic kidney disease, malabsorption syndrome, thyroid or parathyroid disorders.
- Women receiving vitamin D supplementation (>400 IU/day) within the preceding three months.
- Women on medications affecting vitamin D metabolism such as corticosteroids, anticonvulsants, or antitubercular drugs.
- Women with metabolic bone disease or known endocrine disorders.
- Women unwilling to participate.

Data Collection

After obtaining informed consent, a detailed history was obtained using a structured proforma. Information collected included:

- Maternal age
- Parity
- Educational status
- Socioeconomic status
- Occupation
- Body Mass Index (BMI)
- Duration of lactation
- Dietary habits (vegetarian/non-vegetarian)
- Daily calcium intake
- Sunlight exposure (hours/day)
- Physical activity
- Use of vitamin supplements
- Medical and obstetric history

A complete general physical examination and systemic examination were performed.

Laboratory Investigations

Venous blood samples (5 mL) were collected under aseptic precautions.

The following investigations were performed:

- Serum 25-hydroxy Vitamin D [25(OH)D]
- Serum calcium
- Serum phosphorus
- Serum alkaline phosphatase (ALP)
- Serum albumin
- Serum parathyroid hormone (PTH) (where indicated)
- Hemoglobin estimation

Serum 25(OH)D concentration was measured using a chemiluminescent immunoassay (CLIA).

Classification of Vitamin D Status

Vitamin D status was classified according to the Endocrine Society Clinical Practice Guidelines:

Serum 25(OH)D Level	Interpretation
<20 ng/mL	Vitamin D Deficiency
20–29 ng/mL	Vitamin D Insufficiency
≥30 ng/mL	Vitamin D Sufficiency

Outcome Measures

Primary Outcome

- Prevalence of vitamin D deficiency among lactating women.

Secondary Outcomes

- Association between vitamin D status and maternal demographic characteristics.
- Correlation of vitamin D levels with BMI, dietary habits, parity, duration of lactation, and sunlight exposure.
- Relationship between vitamin D deficiency and biochemical parameters including serum calcium, phosphorus, ALP, and hemoglobin.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY, USA).

- Continuous variables were expressed as mean ± standard deviation (SD).
- Categorical variables were presented as frequency and percentage.
- Student's t-test or one-way ANOVA was used to compare continuous variables between groups.

are summarized below.

- Chi-square test or Fisher's exact test was used for categorical variables.
- Pearson's correlation coefficient was used to assess the relationship between serum vitamin D levels and continuous variables.
- A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee of ESIC Medical College, Kalaburagi, prior to commencement of the study. Written informed consent was obtained from all participants before enrollment, and confidentiality of participant information was maintained throughout the study.

RESULTS AND OBSERVATIONS

A total of 100 lactating women attending the postnatal outpatient department and immunization clinic of ESIC Medical College, Kalaburagi, were enrolled in the study. The demographic profile, vitamin D status, biochemical parameters, and factors associated with vitamin D deficiency

Table 1. Age Distribution of Study Participants (N = 100)

Age Group (Years)	Number	Percentage (%)
18–24	38	38.0
25–29	42	42.0
30–34	15	15.0
≥35	5	5.0
Total	100	100.0

Observation: Most participants (42%) were between 25 and 29 years of age, followed by 18–24 years (38%).

Table 2. Distribution According to Body Mass Index (BMI)

BMI (kg/m ²)	Number	Percentage (%)
Underweight (<18.5)	8	8.0
Normal (18.5–24.9)	54	54.0
Overweight (25–29.9)	28	28.0
Obese (≥30)	10	10.0
Total	100	100.0

Observation: More than half (54%) of the women had a normal BMI, while 38% were overweight or obese.

Table 3. Duration of Lactation

Duration	Number	Percentage (%)
<2 months	18	18.0
2–4 months	46	46.0
>4–6 months	36	36.0
Total	100	100.0

Observation: Nearly half (46%) of the participants were between 2 and 4 months postpartum.

Table 4. Serum Vitamin D Status

Vitamin D Status	Serum 25(OH)D (ng/mL)	Number	Percentage (%)
Deficient	<20	58	58.0
Insufficient	20–29	24	24.0
Sufficient	≥30	18	18.0
Total		100	100.0

Observation: Vitamin D deficiency was observed in 58% of lactating women, while only 18% had sufficient vitamin D levels.

Table 5. Mean Biochemical Parameters

Parameter	Mean ± SD
Serum Vitamin D (ng/mL)	19.8 ± 8.1
Serum Calcium (mg/dL)	8.6 ± 0.7
Serum Phosphorus (mg/dL)	3.7 ± 0.6
Serum Alkaline Phosphatase (IU/L)	156.8 ± 38.4
Hemoglobin (g/dL)	10.9 ± 1.3

Observation: The mean serum vitamin D level was below the recommended sufficiency level, indicating a high prevalence of hypovitaminosis D.

Table 6. Vitamin D Status According To Daily Sunlight Exposure

Sunlight Exposure	Deficient	Insufficient	Sufficient	Total	p-value
<30 minutes/day	34	10	4	48	
30–60 minutes/day	18	10	8	36	
>60 minutes/day	6	4	6	16	0.012

Observation: Vitamin D deficiency was significantly more common among women with less than 30 minutes of daily sunlight exposure ($p < 0.05$).

Table 7. Association between Dietary Habit and Vitamin D Status

Dietary Habit	Deficient	Insufficient	Sufficient	Total	p-value
Vegetarian	40	14	8	62	
Mixed Diet	18	10	10	38	0.041

Observation: Vitamin D deficiency was more prevalent among vegetarian mothers compared to those consuming a mixed diet.

Table 8. Association between BMI and Vitamin D Deficiency

BMI Category	Deficient	Non-deficient	Total
Normal	28	26	54
Overweight/Obese	28	10	38
Underweight	2	6	8
Total	58	42	100

$p\text{-value} = 0.026$

Observation: Vitamin D deficiency was significantly higher among overweight and obese women compared with those having normal BMI.

Table 9. Association between Duration of Lactation and Vitamin D Deficiency

Duration of Lactation	Deficient	Non-deficient	Total
<2 months	8	10	18
2–4 months	26	20	46
>4–6 months	24	12	36
Total	58	42	100

p-value = 0.048

Observation: Vitamin D deficiency increased with increasing duration of lactation and was highest among mothers breastfeeding for more than four months.

Table 10. Factors Associated with Vitamin D Deficiency

Variable	Vitamin D Deficient (n=58)	Non-deficient (n=42)	p-value
Mean Age (years)	26.9 ± 3.8	27.4 ± 4.1	0.521
BMI (kg/m ²)	25.6 ± 3.4	23.2 ± 2.9	0.018
Daily Sunlight Exposure (minutes)	24.8 ± 12.3	47.6 ± 16.8	<0.001
Haemoglobin (g/dL)	10.6 ± 1.2	11.3 ± 1.1	0.014
Serum Calcium (mg/dL)	8.4 ± 0.6	8.9 ± 0.5	0.003

Observation: Women with vitamin D deficiency had significantly higher BMI, lower sunlight exposure, lower serum calcium, and lower haemoglobin levels compared with non-deficient women.

DISCUSSION

The present study evaluated vitamin D status among 100 lactating women attending a tertiary care hospital and demonstrated a high prevalence of vitamin D deficiency (58%), with an additional 24% having vitamin D insufficiency. These findings emphasize that hypovitaminosis D continues to be a significant nutritional problem among postpartum women despite abundant sunlight availability in India. The majority of participants were between 25 and 29 years of age, which is consistent with the common reproductive age group reported in similar Indian studies (9,10). Maternal age was not significantly associated with vitamin D deficiency, suggesting that environmental and lifestyle factors may play a more important role than chronological age.

The prevalence of vitamin D deficiency observed in the present study is comparable to findings reported by Sahu et al. and Sachan et al., who documented vitamin D deficiency in more than half of pregnant and lactating women in India (6,11). Similar observations have also been reported by Dawodu and Wagner, who described vitamin D deficiency as a global maternal health issue affecting both developed and developing countries (12).

One of the most important findings of this study was the significant association between reduced sunlight exposure and vitamin D deficiency. Women exposed to sunlight for less than 30 minutes daily had significantly lower vitamin D levels than those with longer exposure. Since cutaneous synthesis

contributes nearly 80–90% of total vitamin D production, inadequate sunlight exposure remains one of the strongest determinants of vitamin D deficiency (2,12).

Vegetarian diet was significantly associated with lower vitamin D levels in the present study. Natural dietary sources of vitamin D are mainly animal-based foods such as fish, egg yolk, and fortified dairy products. Vegetarian mothers may therefore have lower dietary vitamin D intake unless supplementation or fortified foods are consumed (13).

The present study also demonstrated significantly higher vitamin D deficiency among overweight and obese women. Vitamin D is sequestered within adipose tissue, reducing its bioavailability in circulation. Similar observations have been reported in previous epidemiological studies demonstrating an inverse relationship between body mass index and serum vitamin D concentration (14).

Longer duration of lactation was associated with lower vitamin D levels in our study. Continuous transfer of calcium and vitamin D into breast milk increases maternal nutritional demands, especially when dietary intake and supplementation are inadequate. Similar findings have been reported by Hollis and Wagner, who emphasized the importance of maternal vitamin D supplementation during breastfeeding (15).

Biochemically, vitamin D-deficient women had significantly lower serum calcium and hemoglobin levels compared with non-deficient women. Vitamin D enhances

intestinal calcium absorption, and deficiency may lead to reduced calcium availability and secondary hyperparathyroidism. Previous studies have similarly demonstrated lower serum calcium concentrations among women with vitamin D deficiency (1,15).

The findings of the present study support recommendations advocating routine nutritional counselling, adequate sunlight exposure, consumption of vitamin D-rich foods, and postpartum vitamin D supplementation in high-risk women. These preventive strategies may improve maternal health while simultaneously enhancing neonatal vitamin D status through breast milk. Strengths: The study prospectively evaluated biochemical and clinical determinants of vitamin D deficiency using standardized laboratory methods.

Limitations: The study was conducted at a single tertiary care centre with a relatively small sample size. Seasonal variation in vitamin D levels, dietary calcium intake, and infant vitamin D status was not evaluated. Multicenter studies with larger populations are required for broader generalisation.

Overall, the present study highlights the substantial burden of vitamin D deficiency among lactating women and reinforces the importance of routine screening and preventive strategies during the postpartum period.

CONCLUSION

Vitamin D deficiency was highly prevalent among lactating women attending the tertiary care hospital, with more than half of the participants demonstrating deficient serum vitamin D levels. Deficiency was significantly associated with inadequate sunlight exposure, vegetarian diet, higher body mass index, prolonged lactation, lower serum calcium, and lower haemoglobin levels. These findings underscore the need for routine screening of high-risk lactating mothers, nutritional counselling, promotion of adequate sunlight exposure, and timely vitamin D supplementation as part of postpartum care. Early identification and intervention may improve maternal health and optimise vitamin D status in breastfed infants.

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