

Association of Serum Vitamin D3 Levels with Severity of Acne Vulgaris: A Prospective Cross-Sectional Study

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**Abstract**

**Background:** Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit with multifactorial etiology. Emerging evidence suggests that vitamin D3, owing to its immunomodulatory and anti-inflammatory properties, may influence acne severity.

**Aim:** To evaluate the association between serum vitamin D3 levels and severity of acne vulgaris.

**Materials and Methods:** This prospective cross-sectional study included 90 patients with acne vulgaris attending the dermatology outpatient department of IGIMS, Patna, over one year. Acne severity was graded using the Global Acne Grading System (GAGS). Serum vitamin D3 levels were measured and correlated with acne severity.

**Results:** Vitamin D3 deficiency was significantly more common in patients with moderate to severe acne. Mean serum vitamin D3 levels showed an inverse correlation with acne severity.

**Conclusion:** Lower serum vitamin D3 levels are significantly associated with increased severity of acne vulgaris. Vitamin D3 assessment may be considered as an adjunct in acne evaluation.

**Keywords:** Acne vulgaris, Vitamin D3, GAGS, Cross-sectional study

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**Introduction**

Acne vulgaris is a persistent inflammatory condition of the pilosebaceous unit, primarily impacting teenagers and young adults, and can considerably diminish quality of life [1].

Acne is a common skin problem that needs a full evaluation because of how common it is and how it affects people's mental health [2].

Acne's pathophysiology is complex, encompassing follicular

hyperkeratinization, augmented sebum production, colonization by Cutibacterium acnes, and inflammation [3–5].

Vitamin D is a fat-soluble secosteroid hormone with established roles in immune regulation, keratinocyte differentiation, and modulation of inflammatory responses [6,7]. Hypovitaminosis D has been implicated in several inflammatory and autoimmune skin disorders, including psoriasis, atopic dermatitis, and acne vulgaris [8,9]. Several observational studies

have reported lower serum vitamin D levels in patients with acne compared with healthy individuals [10–12].

Vitamin D receptors are expressed in sebocytes and keratinocytes, and vitamin D has been shown to suppress C. acnes–induced inflammatory cytokine production [13,14]. Considering the high prevalence of vitamin D deficiency in the Indian population and limited data correlating vitamin D status with acne severity, this study was undertaken to evaluate the association between serum vitamin D3 levels and severity of acne vulgaris [15].

## Materials and Methods

### Study Design and Setting

This hospital-based prospective cross-sectional study was carried out in the Department of Dermatology at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India, over a period of one year from January 2024 to December 2024. The study was conducted in accordance with ethical standards for biomedical research involving human participants.

### Sample Size Determination

The sample size was estimated based on previous literature reporting a high prevalence of vitamin D deficiency among acne patients. Assuming an expected prevalence of 60%, with a confidence level of 95% and a margin of error of 10%, the calculated minimum sample size was 92. Considering feasibility and patient availability during the study period, 90 participants were enrolled.

### Sampling Method

Patients were recruited using consecutive sampling. All eligible patients presenting to the dermatology outpatient department during the study period and fulfilling inclusion criteria were invited to participate until the required sample size was achieved.

### Study Participants

#### Inclusion Criteria

- Patients aged 15–35 years
- Clinically diagnosed cases of acne vulgaris
- Willingness to provide written informed consent

For participants below 18 years of age, assent was obtained along with parental/guardian consent.

#### Exclusion Criteria

- Current or recent (within past 3 months) vitamin D supplementation
- Pregnancy or lactation
- Known endocrine disorders (e.g., thyroid dysfunction, polycystic ovarian syndrome, diabetes mellitus)
- Chronic inflammatory or autoimmune diseases
- Use of systemic corticosteroids, retinoids, or immunosuppressive therapy in the preceding 3 months
- Patients with known hepatic or renal impairment

#### Clinical Assessment

A detailed clinical history was obtained including duration of acne, dietary habits, sunlight exposure, cosmetic use, and family history of acne. General physical and dermatological examinations were performed in all patients.

Acne severity was assessed using the Global Acne Grading System (GAGS). The face, chest, and upper back were evaluated according to standard GAGS methodology. Each anatomical region was assigned a factor based on surface area, and lesion types were graded numerically. The global score was calculated by summing local scores. Acne severity was categorized as:

- Mild
- Moderate
- Severe

All assessments were performed by a single dermatologist to minimize inter-observer variability.

#### Anthropometric Measurements

Height and weight were measured using standardized calibrated instruments. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m<sup>2</sup>).

### Laboratory Investigations

After an overnight fasting period of 8–10 hours, approximately 5 mL of venous blood was collected under aseptic precautions.

Serum was separated by centrifugation and analyzed on the same day.

Serum 25-hydroxyvitamin D [25(OH)D] levels were measured using a chemiluminescence immunoassay (CLIA) method in the institutional central laboratory, following manufacturer guidelines and internal quality control protocols.

Vitamin D status was categorized as follows:

- Deficient: <20 ng/mL
- Insufficient: 20–30 ng/mL
- Sufficient: >30 ng/mL

All laboratory analyses were performed in a blinded manner without knowledge of acne severity grading.

### Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of IGIMS, Patna (Approval No: ). Written informed consent was obtained from all participants prior to enrollment.

Confidentiality of patient data was strictly maintained.

### Statistical Analysis

All collected data were systematically entered into Microsoft Excel and subsequently analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean  $\pm$  standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. The normality of continuous data distribution was evaluated using the Shapiro–Wilk test. Differences in mean serum vitamin D3 levels among the various acne severity categories were analyzed using one-way analysis of variance (ANOVA), followed by appropriate post hoc testing for multiple comparisons when statistically indicated. The strength and direction of the association between serum vitamin D3 levels and acne severity scores were determined using Pearson's correlation analysis. A two-tailed p-value of <0.05 was considered statistically significant.

### Results

#### Demographic Characteristics

The mean age of participants was  $22.8 \pm 4.6$  years. Females constituted 52.2% of the study population. Table 1 summarizes the demographic distribution of the study population.

**Table 1. Demographic Profile of Study Participants**

Variable	Number (n=90)	Percentage (%)
Male	43	47.8
Female	47	52.2

#### Severity of Acne

Table 2 shows that moderate acne was the most common presentation.

**Table 2. Distribution of Acne Severity (GAGS)**

Severity	Number of Patients	Percentage (%)
Mild	28	31.1
Moderate	36	40.0
Severe	26	28.9

**Serum Vitamin D3 Levels**

Assessment of serum vitamin D3 levels revealed a high prevalence of vitamin D deficiency among patients. Vitamin D status categories are summarized in Table 3.

**Table 3. Serum Vitamin D3 Status**

Vitamin D Status	Number	Percentage (%)
Deficient	54	60.0
Insufficient	22	24.4
Sufficient	14	15.6

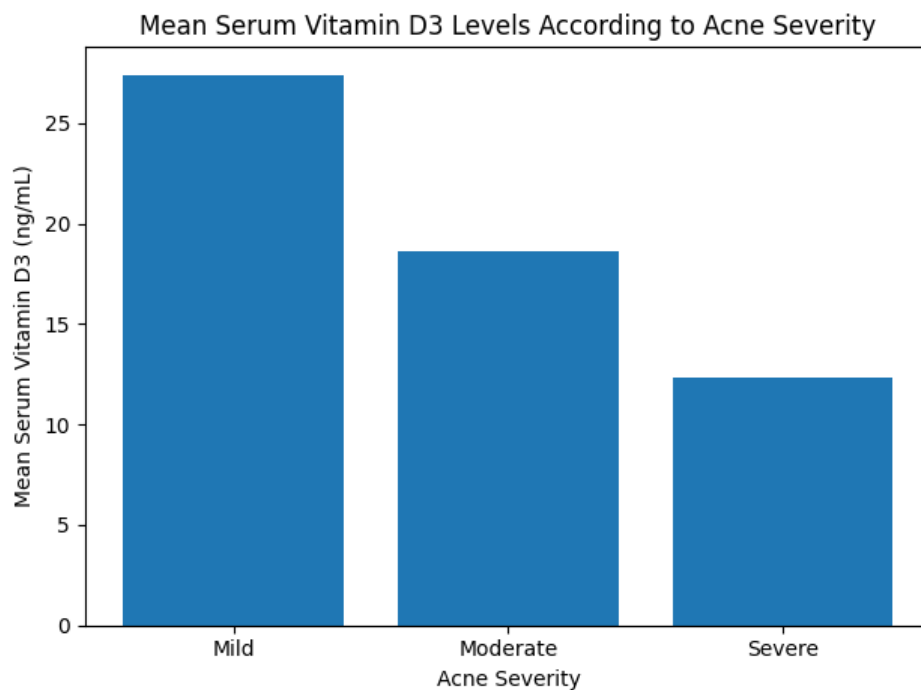
**Association Between Serum Vitamin D3 Levels and Acne Severity**

A statistically significant inverse association was observed between acne

severity and serum vitamin D3 levels. Mean vitamin D3 levels progressively decreased from mild to severe acne cases (Table 4). This relationship is illustrated in Figure 1.

**Table 4. Association of Vitamin D3 Levels with Acne Severity**

Acne Severity	Mean Vitamin D3 (ng/mL)
Mild	27.4 ± 5.2
Moderate	18.6 ± 4.8
Severe	12.3 ± 3.9



**Figure 1. Mean serum vitamin D3 levels according to acne severity**

**Discussion**

The present study demonstrates a significant inverse association between

serum vitamin D3 levels and the severity of acne vulgaris. Patients with moderate and severe acne showed markedly lower

vitamin D3 levels compared with those with mild disease. These findings are consistent with previous studies reporting a similar association [16,17].

Vitamin D plays an important role in modulating innate and adaptive immune responses. Deficiency of vitamin D may exacerbate acne by enhancing inflammatory pathways, increasing cytokine production, and impairing antimicrobial peptide expression [18,19]. The immunological role of vitamin D in maintaining skin homeostasis has been well documented [20,21].

Environmental factors such as reduced sun exposure, dietary habits, and lifestyle changes may contribute to widespread vitamin D deficiency, particularly in adolescents and young adults [22]. Some interventional studies have reported improvement in acne severity following correction of vitamin D deficiency, although evidence remains limited [23,24].

The limitations of this study include its cross-sectional design and absence of a control group. Longitudinal and interventional studies are required to establish a causal relationship between vitamin D deficiency and acne severity [25].

## Conclusion

Serum vitamin D3 levels are significantly lower in patients with more severe acne vulgaris. Routine assessment of vitamin D status may help in comprehensive management of acne patients.

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