

To assess serum vitamin D's influence on dental health in adults attending Teerthanker Mahaveer Dental College & Research Centre, Moradabad, Uttar Pradesh, India

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ABSTRACT

This cross-sectional study aimed to evaluate the impact of serum vitamin D on oral health among adults attending Teerthanker Mahaveer Dental College and Research Centre, Moradabad, Uttar Pradesh, India. A total of 78 adults aged 18–65 years were recruited through convenient consecutive sampling from the dental OPD. Clinical examination included assessment of dental caries experience using the DMFT index and gingival status using the Gingival Index, while serum 25(OH)D levels were estimated by ELISA and categorized as deficient, insufficient, or normal. Demographic data and oral hygiene practices were recorded using a structured questionnaire. Data were analyzed using IBM SPSS 24; descriptive statistics summarized sample characteristics, and Spearman's rank correlation assessed associations between vitamin D levels and oral health parameters, with $p < 0.05$ considered significant. The mean age of participants was 33.56 ± 8.90 years; males comprised 59% of the sample. The mean DMFT score was 2.33 ± 2.75 , indicating a moderate caries burden, and 80.8% of subjects exhibited some degree of gingival inflammation, with moderate gingivitis most prevalent. Statistically significant positive correlations were observed between serum vitamin D levels and DMFT ($r = 0.514$, $p = 0.001$), individual DMFT components, and particularly the Gingival Index ($r = 0.760$, $p = 0.001$). These findings suggest a strong relationship between vitamin D status and clinical markers of oral health in this hospital-based adult population. Within the limitations of the cross-sectional design, the study underscores the need to consider vitamin D assessment and optimization as part of comprehensive oral health strategies in Indian adults and highlights the importance of further longitudinal research to clarify causality.

Keywords: Vitamin D, 25-hydroxyvitamin D, DMFT index, Gingival Index, dental caries, gingivitis, oral health, adults, India, cross-sectional study.

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INTRODUCTION

Vitamin D is a fat-soluble vitamin essential for calcium and phosphate regulation, vital for healthy bones and teeth. It is synthesized in the skin through sunlight and obtained from foods such as fish, eggs, and fortified dairy products. Despite abundant sunlight, vitamin D deficiency is widespread globally and in India, contributing to several health issues, including poor oral health. Beyond bone health, vitamin D supports dental health by enhancing calcium and phosphorus absorption, promoting enamel mineralization, and maintaining bone density around teeth. It also modulates the immune response in the oral cavity, helping control harmful bacteria and reducing risks of gingivitis and periodontitis. Deficiency can therefore lead to cavities, gum inflammation, and tooth loss. In India, reduced sun exposure, pollution, lifestyle factors, and low intake of vitamin D-rich foods have made deficiency highly prevalent. Adults aged 18–65 years are particularly vulnerable due to busy lifestyles and dietary imbalances. Teerthanker Mahaveer Dental College & Research Centre, Moradabad, serves as an ideal site to study this relationship. A cross-sectional assessment of serum 25(OH)D levels and dental indices in adults can help establish the correlation between vitamin D status and oral health, generating valuable region-specific evidence.

MATERIALS AND METHOD:

This is cross-sectional study, conducted on the adults aged group 18-65 years attending TEERTHANKER MAHAVEER DENTAL COLLEGE & RESEARCH CENTRE, MORADABAD, UTTARPRADESH, INDIA. The study will consist of clinical examination and biochemical analysis. ➤ Clinical examination will include 2 different type of indices:-(1)DMFT INDEX (ANNEXURE III),(2) GINGIVAL INDEX (ANNEXURE IV)(3)Biochemical examination will include vitamin D measurement using ELISA. (ANNEXURE V)

Exclusion criteria

Individuals aged below 18 years and above 65 years.

Adult patients with apparent medical/oral conditions (excluding tooth decayed/loss/filled or periodontal disease)

Adult patients who refused to participate in the study.

Adult patients who are undergoing orthodontic treatment

History of vitamin D deficiency or supplementation in the last 6 months

Chronic illness or conditions affecting calcium metabolism (e.g., renal disease, parathyroid disorders)

Medications that influence calcium and vitamin D metabolism

Ethical approval and registration :

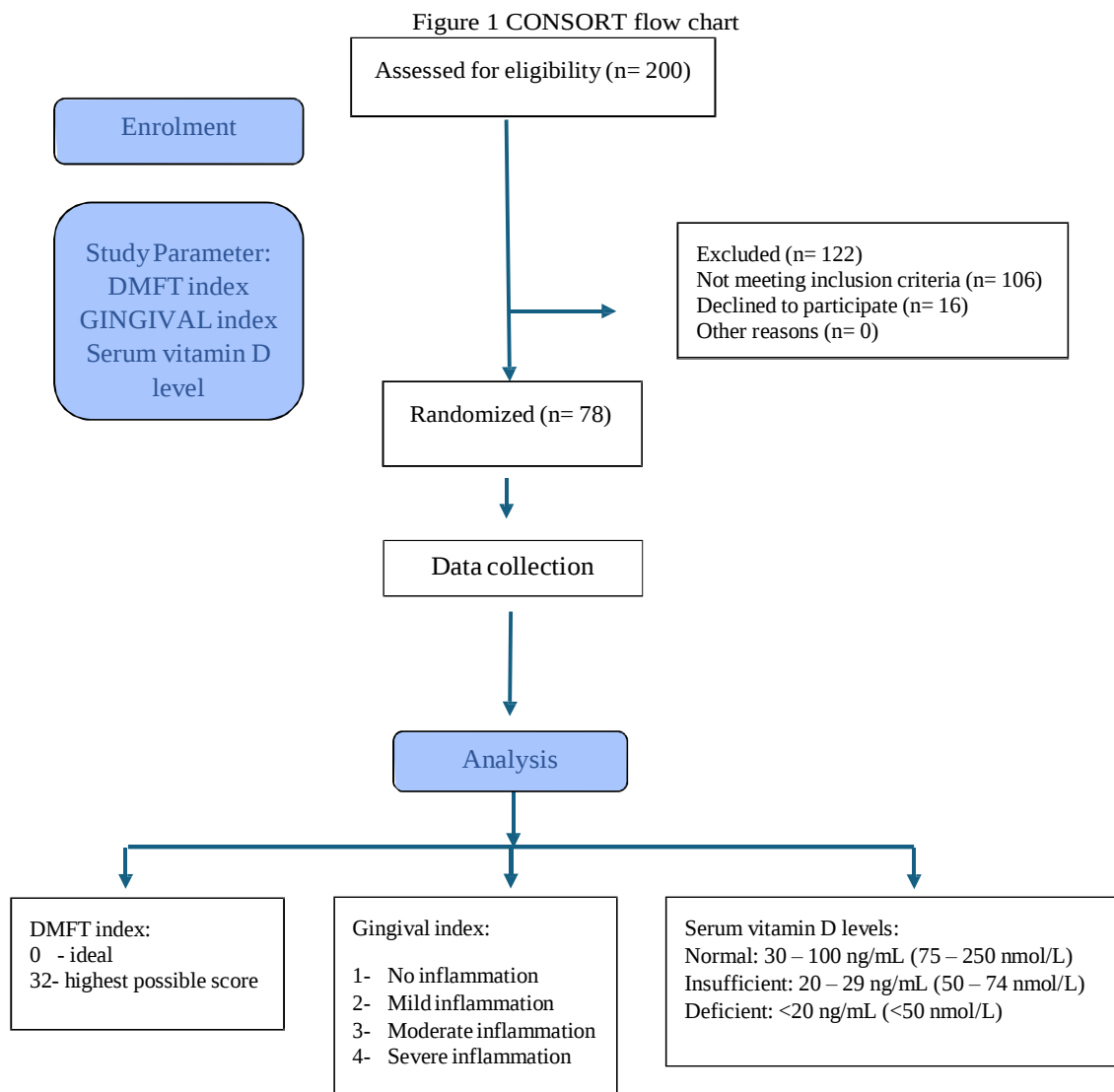
Ethical approval for this study was obtained from the Institutional Ethics Committee of Teerthanker Mahaveer Dental College and Research Centre, Teerthanker Mahaveer University, Moradabad (Reference No: TMDCRC/IEC/SS/24-25/PHD 02). The study protocol adheres to Helsinki Declaration principles. Written informed consent was secured from all 78 participants after providing detailed information sheets in English and Hindi. No study registration was required for this short cross-sectional audit. All participant data remains confidential per institutional guidelines.

SAMPLE SIZE:

The sample size for this cross-sectional study was estimated using the single-proportion formula $n = z^2 pq / d^2$, assuming a prevalence of 40%, ($p = 0.40$), with $q = 0.60$, 95% confidence level ($z = 1.96$), and an absolute precision of 3.6% ($d = 0.036$). The calculated value of approximately 71 was further inflated to compensate for anticipated non-response and exclusions, yielding a final required sample size of 78 adult participants.

Randomization & blinding

Adult patients aged 18–65 years attending the dental OPD and fulfilling the inclusion criteria will be recruited using convenient consecutive sampling until the required sample size of 78 is achieved. As this is an observational cross-sectional study without intervention, no randomization or allocation concealment is applicable. Blinding is not planned; examiners will perform standard clinical and biochemical assessments as per protocol.



Outcome measures:

Primary outcome measures include serum 25(OH)D levels (ng/mL, categorized as deficient <20, insufficient 20–29, normal ≥30) and clinical dental indices: DMFT (Decayed-Missing-Filled Teeth) score and Gingival Index (GI) score (0–3). Secondary measures encompass correlations between vitamin D status and oral health outcomes, adjusted for confounders like age, diet, and BMI. Statistical analysis:

Data were analyzed using IBM SPSS version 24. Normality was assessed via Shapiro-Wilk test; non-parametric tests

applied. Descriptive statistics (frequencies, means ± SD) summarized demographics, DMFT (mean 2.33 ± 2.75), Gingival Index, and vitamin D levels. Spearman's rank correlation assessed associations between vitamin D and oral health parameters (DMFT: $r=0.514$, $p=0.001$; GI: $r=0.760$, $p=0.001$), with $p<0.05$ deemed significant.

Result:

A total of 78 adult patients (mean age 33.56 ± 8.90 years) attending Teerthanker Mahaveer Dental College participated in this cross-sectional study.

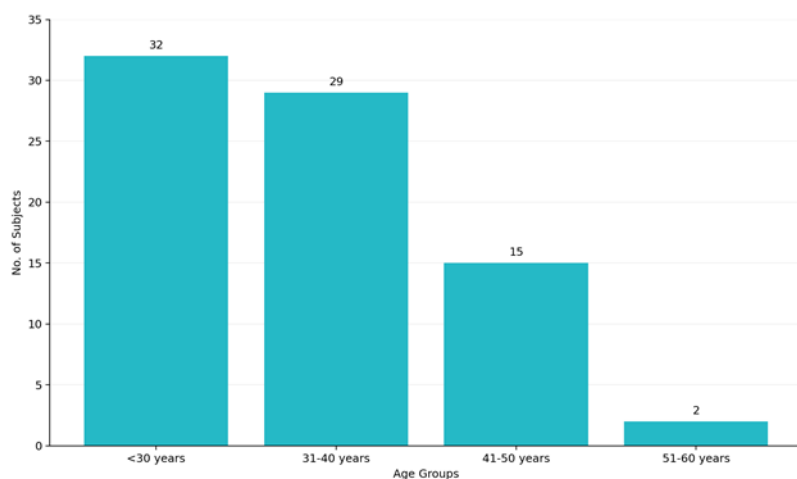


Figure 1: Age-wise Distribution of Study Subjects (n=78)

Demographic Characteristics

Table 1: Age Distribution (n=78)

Age Group	Frequency	Percentage
<30 years	32	41.0
31-40 years	29	37.2
41-50 years	15	19.2
51-60 years	2	2.6

Mean $\pm$ SD: 33.56 $\pm$ 8.90 years

Males predominated (59%, n=46) over females (41%, n=32). Graduates formed the largest educational group (44.9%, n=35), followed by 12th pass (26.9%, n=21). "Others" occupation (33.3%, n=26) and housewives (30.8%, n=24) were most common.

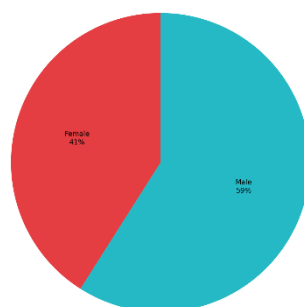


Figure 2: Gender-wise Distribution of Study Subjects (n=78)

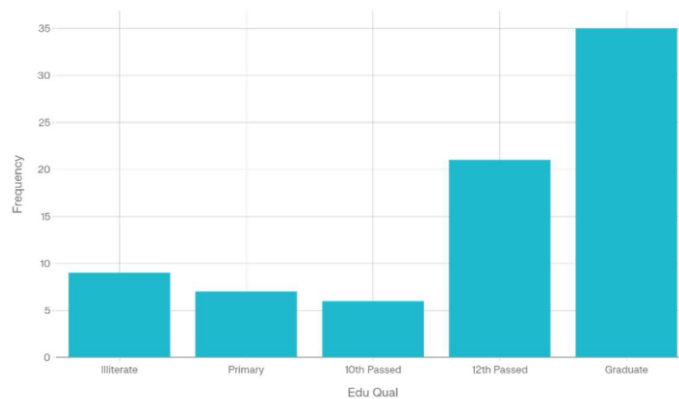


Figure 3: Educational Qualification Distribution of Study Subjects (n=78)

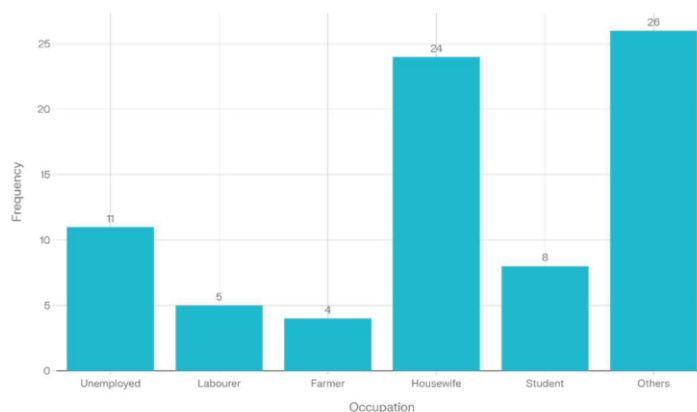


Figure 4: Occupational Distribution of Study Subjects (n=78)

Oral Health Practices

Toothbrush was the predominant aid (75.6%, n=59), followed by finger (11.5%, n=9). Toothpaste dominated materials (73.1%, n=57). Nearly half brushed twice daily (47.4%, n=37), 46.2% (n=36) once daily. Horizontal technique prevailed (65.4%, n=51). Most (56.4%, n=44) had prior dental visits.

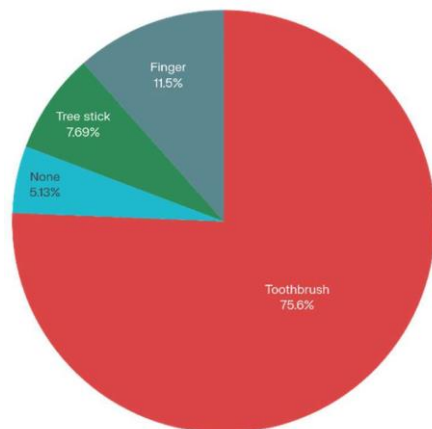


Figure 5: Oral Hygiene Aids Distribution (n=78)

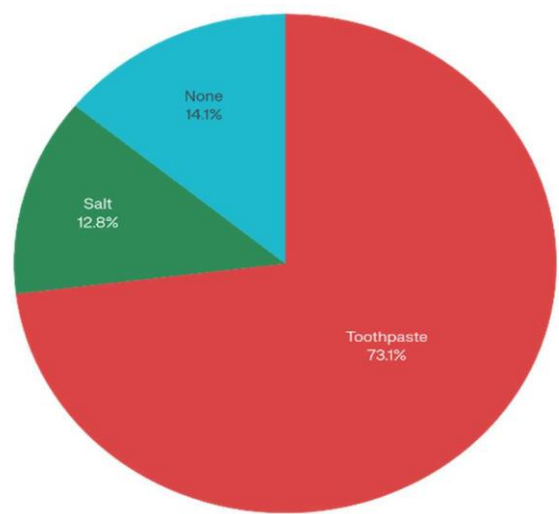


Figure 6: Oral Hygiene Materials Distribution (n=78)

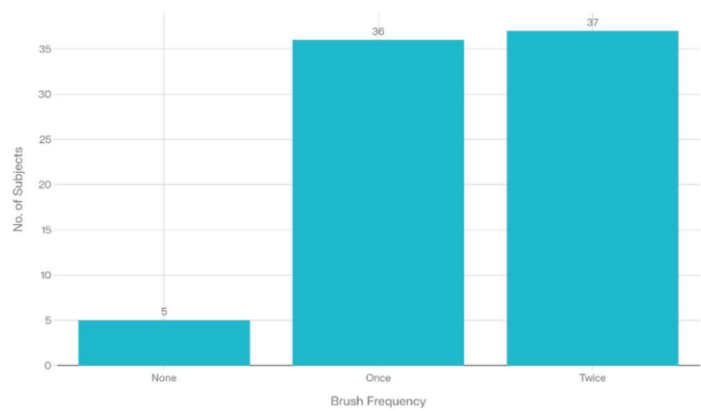


Figure 7: Frequency of Tooth Brushing (n=78)

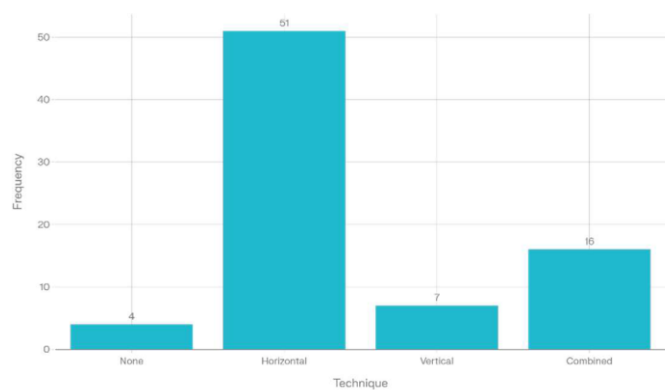


Figure 8: Brushing Technique Distribution (n=78)

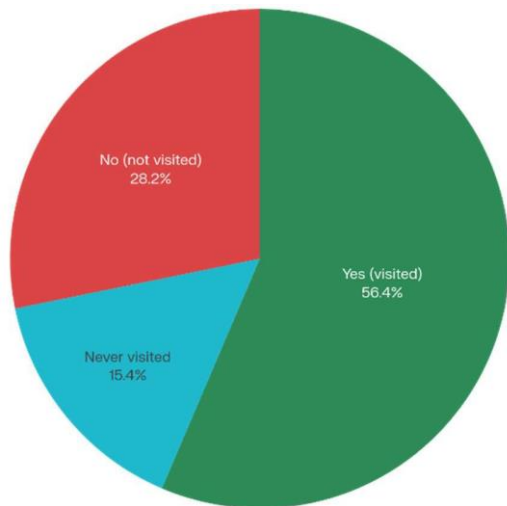


Figure 9: Dental Visit History (n=78)

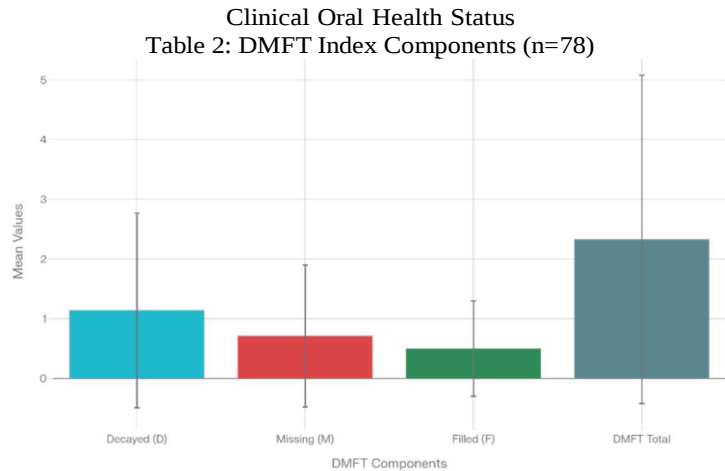


Figure 10: DMFT Index Components Mean Values (n=78)

Component	Mean	SD	Min-Max
Decayed (D)	1.14	1.63	0-7
Missing (M)	0.71	1.19	0-5
Filled (F)	0.50	0.80	0-3
DMFT Total	2.33	2.75	0-11

Table 3: Gingival Index Distribution (n=78)

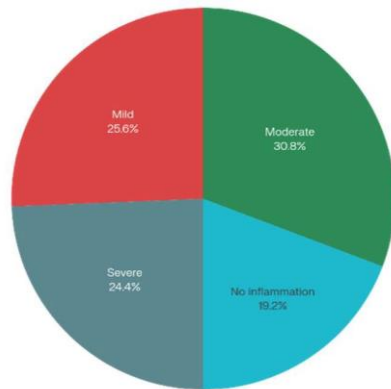


Figure 11: Gingival Index Distribution (n=78)

Category	Frequency	Percentage
No inflammation	15	19.2
Mild	20	25.6
Moderate	24	30.8
Severe	19	24.4

Moderate gingivitis was most prevalent (30.8%), indicating high gingival disease burden (80.8% affected).
Vitamin D and Oral Health Correlation

Table 4: Spearman Correlation between Vitamin D Levels and Oral Health Parameters (n=78)

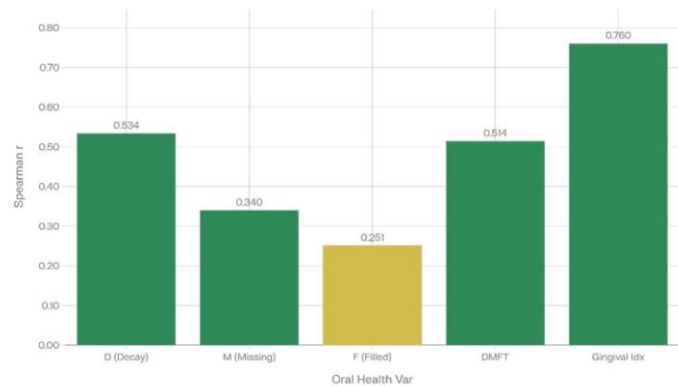


Figure 12: Correlation between Vitamin D Levels and Oral Health Parameters (n=78)

Variable	Correlation (r)	p-value
Decayed (D)	0.534	<0.001*
Missing (M)	0.340	0.002*
Filled (F)	0.251	0.026*
DMFT Total	0.514	<0.001*
Gingival Index	0.760	<0.001*

*Spearman correlation, ***p<0.001, *p<0.05

All correlations were positive and statistically significant. Strongest association observed between vitamin D levels and Gingival Index ($r=0.760$, $p<0.001$), followed by total DMFT ($r=0.514$, $p<0.001$). Decayed teeth showed moderate correlation ($r=0.534$, $p<0.001$).

Discussion:

This cross-sectional short study among 78 adults attending a dental hospital OPD found a moderate caries burden (mean DMFT 2.33 ± 2.75) and a high prevalence of gingival inflammation (80.8%), with moderate gingivitis being the most common category. These findings support the broader concept that oral diseases remain common in adults and may coexist with systemic nutritional factors such as vitamin D status, which is biologically plausible because vitamin D is linked with calcium-phosphate homeostasis (important for tooth mineralization) and immune modulation within the oral cavity.

A key observation of this study was a statistically significant association between vitamin D levels and oral health parameters, with the strongest correlation seen for Gingival Index (Spearman $r = 0.760$, $p < 0.001$), followed by total DMFT ($r = 0.514$, $p < 0.001$). This reinforces the continuing interest in vitamin D as a potential determinant of both caries and periodontal outcomes, as described in adult-focused reviews and systematic literature on vitamin D and oral health^{1,2,5,9,10}. Evidence from large population datasets has also highlighted the relevance of low vitamin D: Hung et al. reported that severe deficiency doubled the risk of dental caries in NHANES participants, emphasizing vitamin D sufficiency for prevention strategies¹¹. Similarly, Irfan et al. described vitamin D's role in calcium metabolism and anti-inflammatory actions, and linked deficiency with tooth decay, gingivitis, and periodontal disease.¹² Findings from case-control and observational literature further support associations between vitamin D deficiency and caries experience or related oral parameters, such as Alhelfi et al.¹³ and Swapna et al.^{14,16}.

However, the direction of correlation in the present dataset was positive (higher vitamin D values associated with higher DMFT/Gingival Index), which contrasts with the commonly reported inverse relationship where deficiency predicts worse oral health¹¹⁻¹⁶. This discrepancy may be explained by cross-sectional design limitations (no temporality), unmeasured/residual confounding (dietary pattern, BMI, sun exposure, tobacco use), or potential coding/measurement issues (e.g., vitamin D recorded as categories or ranks rather than raw concentrations). Additionally, the hospital-based convenience sample and short study duration may limit generalizability, and the study primarily assessed correlation rather than causal pathways. Future studies with larger community samples, standardized continuous 25(OH)D reporting, and multivariable modeling could clarify whether vitamin D acts as a protective factor for caries and gingival inflammation in this population, as suggested in contemporary literature.^{1,2,11,12}

Conclusion:

This cross-sectional study demonstrates significant positive correlations between serum vitamin D levels and oral health parameters among 78 adults (DMFT: $r=0.514$, $p<0.001$; Gingival Index: $r=0.760$, $p<0.001$), with moderate caries burden (DMFT 2.33 ± 2.75) and high gingivitis prevalence (80.8%). Findings highlight vitamin D's potential role in oral health maintenance, supporting routine screening and supplementation strategies in dental practice for Indian adults. Further longitudinal research is recommended.

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Nil

Conflicts of interest:

There are no conflict of interest.

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