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Prevalence of Vitamin D Deficiency Among Medical Students and Its Correlation With Fatigue and Stress: A Cross-Sectional Study

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Abstract

Introduction:: Vitamin D plays a vital role in calcium homeostasis, immunity, and neuromuscular functioning. Medical students are prone to deficiency due to reduced sun exposure and increased indoor academic activity. Emerging evidence suggests that Vitamin D deficiency may contribute to fatigue and stress, which are common yet under-recognized concerns in medical education.

Aim and Objectives:

- To estimate the prevalence of Vitamin D deficiency among MBBS students.
- To assess the levels of fatigue and stress among participants.
- To examine the correlation between Vitamin D levels and fatigue and stress scores.

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Methods: A cross-sectional study was conducted among MBBS students at a tertiary care teaching hospital. Participants were selected via simple random sampling. Serum 25(OH)D levels were measured using chemiluminescent immunoassay. Fatigue was assessed using the Chalder Fatigue Scale, and stress levels were evaluated using the Perceived Stress Scale (PSS-10). Data were analyzed using SPSS version 26. Chi-square test and Pearson correlation were applied, and $p < 0.05$ was considered statistically significant.

Results: Out of 150 participants, 72 (48%) were found to have Vitamin D deficiency (<20 ng/mL). The mean fatigue score among deficient students was 21.3 ± 4.2, significantly higher than non-deficient peers (17.8 ± 3.6, $p < 0.001$). Similarly, the mean PSS score was also higher among Vitamin D-deficient individuals (22.5 ± 5.1 vs 18.9 ± 4.3, $p = 0.002$). A significant negative correlation was found between Vitamin D levels and both fatigue ($r = -0.42$, $p < 0.01$) and stress scores ($r = -0.36$, $p < 0.01$).

Conclusion: The study highlights a high prevalence of Vitamin D deficiency among medical students, with a significant correlation with increased fatigue and stress levels. Early screening, lifestyle modification, and awareness are recommended to address this emerging concern in student health.

Keywords: Vitamin D Deficiency, Medical Students, Psychological Stress.

INTRODUCTION

Vitamin D, traditionally recognized for its role in bone metabolism and calcium-phosphate balance, has recently gained attention for its broader physiological significance, including roles in immune modulation, neuromuscular function, and psychological well-being [1]. Vitamin D deficiency is a growing public health concern globally and is especially prevalent in South Asian countries, including India, where despite ample sunlight, lifestyle patterns lead to suboptimal sun exposure [2].

Medical students, due to their rigorous academic schedules and predominantly indoor lifestyle, represent a vulnerable population at risk of hypovitaminosis D. Several studies report high rates of Vitamin D deficiency among young adults, including those pursuing higher education in health sciences [3]. At the same time, fatigue and psychological stress are increasingly being recognized as common yet overlooked challenges faced by medical students. Chronic fatigue can impact academic performance, mental health, and overall quality of life [4].

Emerging research has begun to establish associations between Vitamin D status and non-skeletal manifestations, including fatigue, mood disorders, and stress-related symptoms [5]. However, data specific to Indian medical students remains limited. Understanding this correlation is crucial for early intervention and preventive strategies.

Objectives of the Study:

1. To determine the prevalence of Vitamin D deficiency among MBBS students.
2. To evaluate the fatigue and stress levels among the study participants.
3. To assess the correlation between serum Vitamin D levels and fatigue and stress scores.

Methodology

Study Design and Setting

A cross-sectional observational study was conducted among undergraduate MBBS students of F.H. Medical College and Hospital, Agra, Uttar Pradesh, over a period of 4 months.

Study Population

All MBBS students from first to final year who consented to participate were included. Students with known chronic illness, on Vitamin D supplementation in the past 3 months, or with psychiatric comorbidities were excluded.

Sample Size Calculation

Based on previous studies indicating a prevalence of Vitamin D deficiency among medical students ranging from 40%–60% [3], a mid-value of 50% was taken for sample size estimation:
$n = Z^2 * p * (1-p) / d^2$
$Z = 1.96$ (95% CI), $p = 0.5$, $d = 0.08$
Resulting in a required sample size of 150.

Sampling Technique

Simple random sampling was employed using the student roll list as the sampling frame.

Data Collection Tools

- **Vitamin D Testing**: Serum 25(OH)D using chemiluminescent immunoassay.
- **Fatigue**: Chalder Fatigue Scale (11 items).
- **Stress**: Perceived Stress Scale (PSS-10).

Classification of Vitamin D:

- Deficient: <20 ng/mL
- Insufficient: 20–29 ng/mL
- Sufficient: ≥30 ng/mL

Statistical Analysis

SPSS v26 used. Descriptive statistics, Chi-square test, t-test, and Pearson correlation. $p < 0.05$ was considered statistically significant.

Results

A total of 150 MBBS students participated in the study. The mean age of participants was 20.9 ± 1.8 years, with 58.7% females and 41.3% males. Among them, 72 students (48%) were found to be Vitamin D deficient (<20 ng/mL), 30% were insufficient (20–29 ng/mL), and only 22% had sufficient Vitamin D levels (≥30 ng/mL), as shown in Table 1. This indicates a significant burden of Vitamin D inadequacy in this population.

The mean fatigue scores were found to be highest among the deficient group (21.3 ± 4.2), followed by the insufficient group (19.5 ± 3.9), and lowest in the sufficient group (17.8 ± 3.6), with the differences being

statistically significant ($p < 0.001$). Similarly, stress scores were also significantly elevated among Vitamin D-deficient students (22.5 ± 5.1) compared to those with sufficient Vitamin D (18.9 ± 4.3), as depicted in Table 2.

Correlation analysis (Table 3) demonstrated a moderate negative correlation between serum Vitamin D levels and both fatigue ($r = -0.42$, $p < 0.01$) and stress scores ($r = -0.36$, $p < 0.01$), confirming that lower Vitamin D levels are associated with higher fatigue and stress.

Table 1: Distribution of Participants Based on Serum Vitamin D Status (n = 150)

Vitamin D Status	Frequency (n)	Percentage (%)
Deficient (<20 ng/mL)	72	48.0%
Insufficient (20–29 ng/mL)	45	30.0%
Sufficient (≥30 ng/mL)	33	22.0%

Table 2: Comparison of Mean Fatigue and Stress Scores Based on Vitamin D Status

Vitamin D Status	Mean Fatigue Score ± SD	Mean PSS Score ± SD
Deficient (<20 ng/mL)	21.3 ± 4.2	22.5 ± 5.1
Insufficient (20–29 ng/mL)	19.5 ± 3.9	20.1 ± 4.6
Sufficient (≥30 ng/mL)	17.8 ± 3.6	18.9 ± 4.3

Table 3: Correlation Between Serum Vitamin D Levels and Fatigue/Stress Scores

Variable	Pearson's Correlation (r)	p-value
Vitamin D vs. Fatigue Score	-0.42	<0.01

Vitamin D vs. Stress Score	-0.36	<0.01

Discussion

This study revealed a high prevalence (48%) of Vitamin D deficiency among medical students. Students with Vitamin D deficiency had significantly higher fatigue and stress scores.

Our results align with Kumar et al. [1] who reported a 53.2% deficiency among Indian medical students. Similarly, Riaz et al. [2] in Pakistan found 46% deficiency. Nowak et al. [3] demonstrated higher fatigue in Vitamin D-deficient students. The observed negative correlation with stress is supported by studies suggesting Vitamin D's regulatory effect on the HPA axis [5].

Limitations: Cross-sectional design, single-center, sun exposure not measured.

Recommendations: Routine screening, lifestyle interventions, and awareness campaigns.

Conclusion

This study demonstrates a significant burden of Vitamin D deficiency among medical students and its association with increased fatigue and stress. Early screening and preventive strategies are necessary to safeguard student health and performance.

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