

## Original Research Article

# A CROSS SECTIONAL STUDY TO ASSESS THE ASSOCIATION OF VITAMIN D AND QUALITY OF SLEEP IN MEDICAL STUDENTS

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## ABSTRACT

**Background:** Sleep is an important parameter for the maintenance many of the normal physiological processes. World wide sleep insufficiency has risen to alarming levels. Academic stress and clinical responsibilities make medical students more prone for sleep deprivation. Since Vitamin D is intricately associated the process of sleep there could be a probable link between poor sleep quality and vitamin D levels which was examined in this study.

**Material and Methods:** 79 phase 1 medical students were recruited to the study after taking their informed consent. The sleep quality was assessed with a self administered questionnaire; Pittsburgh Sleep Quality Index and a score of more than 5 indicated poor sleep. Serum Vitamin D level was also assessed and were categorized into vitamin D deficient (<20 ng/dl), insufficient (20-29.9 ng/dl) and sufficient ( $\geq$ 30 ng/dl) groups. The correlation between sleep quality score and vitamin D levels the subjects was done using Spearman's rank correlation coefficient.

**Results:** Mean Vitamin D level in the study sample was 22.96 +/- 8.7 with only 12.7% having sufficient vitamin D levels.70.9% of the participants were poor sleepers with a mean sleep quality index of 7.20+/-2.9. Spearman's Correlation Coefficient done to determine the correlation between vitamin D and sleep quality showed a very weak positive correlation with a value of 0.094 which was not statistically significant( $p=0.412$ ).

**Conclusion:** The participants showed a high prevalence of low vitamin D levels. The percentage of participants with poor sleep quality index was higher in all categories of vitamin D levels. However, we could not find any correlation between poor sleep quality and vitamin D levels. A larger samples with more objective methods to assess sleep quality might give more insights to this.

**Key Words:** Sleep quality, vitamin D, medical students.

## INTRODUCTION

Sleep is a physiological process in which the brain is relatively inactive and responds preferably to internal stimuli. Many of the metabolic activities slow down during sleep, where as some get activated. Secretion of many hormones such as growth hormones, melatonin, thyroid hormone increases during sleep. Although overall cerebral blood flow decreases, metabolism and blood flow increases in certain regions of brain such as limbic

system and visual association areas. The role of sleep in memory ,growth, cognition and immune function is well known and many functions of its remain to be elucidated.<sup>[1]</sup> Hence sleep deprivation has serious physiological consequences. Increased screen time and stressful academic or work atmosphere has led sleep insufficiency to an epidemic level affecting about one third of the global population.<sup>[2]</sup>

Medical students who undergo the toughest curriculum are under constant academic stress.

Apart from these, they have clinical duties which are often irregular. Hence they are more prone for sleep deficiencies.<sup>[3]</sup> Previous studies have shown that medical students experience sleep deficiencies than non medical students,<sup>[4-7]</sup> and general population.<sup>[8-10]</sup> A meta analysis done in 2023 by Binjibr, M.A. et al showed a pooled prevalence of sleep insufficiency of 55.64% ; with an average sleep duration of 6.5 h per night in medical students.<sup>[11]</sup> The quality of sleep i.e how well you sleep also a indicator of good sleep. Sleep latency, awakenings, sleep efficiency are the parameters determining sleep quality. A study conducted among medical students in Greece found that 52.4% of medical students reported poor sleep quality.<sup>[12]</sup> In India, half of the medical students suffer from poor sleep quality.<sup>[13,14]</sup>

Vitamin D; a fat soluble vitamin has triggered curiosity in many researchers because of its role in various physiological processes which were revealed only in the past few decades. Many are still under investigation too. One such area is it's role in sleep. Various sleep disorders are associated with vitamin D deficiency. A study conducted on subjects diagnosed with insomnia revealed that all participants had deficient levels of vitamin D. The majority of these individuals were younger adults, suggesting a strong correlation between vitamin D deficiency and sleep quality.<sup>[15]</sup> Similar association is revealed in a study done in stroke patients.<sup>[16]</sup> Vitamin D deficiency is closely associated with obstructive sleep apnoea.<sup>[17]</sup> Hence there could be a plausible association between vitamin D level in blood and sleep quality.

There are various mechanisms proposed to explain the link between Vitamin D and sleep. Vitamin D and sleep are sun light dependent which suggests a possible connection between two. Moreover, Vitamin D and the enzymes involved in its metabolism are expressed in regions of brain which control sleep. Melatonin a hormone involved in sleep regulation and circadian rhythm is Vitamin D dependent too.

Medical students exhibit high prevalence of vitamin D deficiency.<sup>[18,19]</sup> Considering the role of Vitamin D in sleep, it is highly important to assess the association between two. We could find only a single study done in 150 medical students comparing the sleep duration and vitamin D level which showed a positive correlation.<sup>[20]</sup> This study examined only the duration of sleep not the quality. We could not find any study finding the association between quality of sleep and vitamin D levels which is a lacunae to be addressed.

Given the high prevalence of sleep disorders among medical students, addressing vitamin D levels could be a beneficial strategy. Ensuring sufficient vitamin D intake, whether through diet, sunlight exposure, or supplementation, could potentially improve their sleep quality and overall well-being.

**Objective:** To determine correlation between vitamin D levels (serum 25-hydroxyvitamin D) and sleep quality among medical students.

## MATERIALS AND METHODS

This was a cross-sectional study conducted among 79 phase 1 medical students. Sample size was calculated using prevalence of sleep disorders in vitamin D deficiency among adolescents (P=62.5%, CL=95%). The ethical clearance from the institution was obtained and the students were recruited by simple random sampling method. The procedure was explained to them and consent was taken prior to the study. A brief clinical history and evaluation was done and demographic profiles (age, sex) and BMI were recorded. Known cases of sleep disorders, obese subjects were excluded from the study.

Serum vitamin D levels were determined by CLIA technology after obtaining informed consents. Vitamin D levels were grouped into deficient (<20 ng/dl), insufficient (20-29.9 ng/dl) and sufficient subclasses ( $\geq$ 30 ng/dl).

Sleep quality was assessed using a self administered questionnaire; Pittsburgh Sleep Quality Index (PSQI) by which 7 components of sleep such as waking and sleeping time, sleep efficiency, sleep latency, sleep disturbances, daytime performance could be evaluated. Each component was scored 0-3 according to severity, summing up a total of 21 points. A total score of more than 5 indicated poor sleep.

### Statistical Analysis

The data was entered in Excel sheets. The proportion of sleep quality was calculated. Spearman's correlation coefficient was used to estimate the association between sleep quality and Vitamin D levels.

## RESULTS

A total of 79 students with age varying from 18 to 22 years with a mean age of 19.72 were involved in the study. 65.8 % of the participants were females. [Table 1]

### Vitamin D status of the participants

Mean Vitamin D level in the study sample was 22.96 +/- 8.7. Out of the total participants, 40.5% of students were vitamin deficient, 46.8% had insufficient Vitamin D levels while only a marginal 12.7% had sufficient vitamin levels which is depicted in Table 2.

### Sleep quality score

Mean sleep score of the sample was 7.20 +/- 2.9. Poor sleep quality among females was higher with a percentage of 78.8% and 55.5 % of males had poor sleep quality. Altogether 70.9% of the participants were poor sleepers and only 29.1 % had good sleep.

### Correlation between vitamin D and sleep quality score

High prevalence of hypovitaminosis and poor sleep quality was seen in the study participants. Hence the strength of Correlation between Vitamin D with

PSQI was analyzed using Spearman's Correlation Coefficient which showed a very weak positive correlation with a value of 0.094. This was not statistically significant with a p value of 0.412 as shown in Table 4.

**Table 1: Demographic details of the participants**

	Females	Males	Total
Number	52	27	79
Mean age	19.63+/-0.9	19.88+/-0.9	19.72+/-0.9
BMI	22.31+/-3.0	21.92+/-3.6	22.1954+/-3.16

**Table 2: Distribution of participants in various vitamin D level category**

	Deficient Vitamin D	Insufficient Vitamin D	sufficient vitamin D
Total	40.5%	46.8%	12.7%
Females	34.6%	50%	15.4%
Males	51.9%	40.7%	7.4%

**Table 3: Distribution of Sleep quality score in the subjects**

PSQI	0-5	6-10
Total number	23	56
Females	11	41
Males	12	15

**Table 4: Correlation between vitamin D and sleep quality score among the participants**

	Total (n=79)	PSQI		Correlation Coefficient	P value
		0-5 (n=23)	6-10 (n=56)		
Vitamin D	22.96 +/- 8.7	23.01+/-4.8	22.94+/-8.05	0.094	0.412

## DISCUSSION

This study involved a total of 79 students with the mean age being 20 years. Individuals with known cases of sleep disorders and those classified as obese were excluded from the study to ensure a more homogeneous sample. The quality of sleep was assessed using Pittsburgh Sleep Quality questionnaire and compared with their vitamin D levels.

Our study did not show any significant correlation with Vitamin D levels and sleep quality. Therefore, based on this data, we cannot conclude that Vitamin D levels have any meaningful impact on sleep quality.

A study done by Gunduz et al. yielded similar results. In their study too, Pittsburgh Sleep Quality Index (PSQI) was used and quality of sleep was assessed and they found no significant difference in the Pittsburgh Sleep Quality Index (PSQI) total score between the Vitamin D-deficient group and the Vitamin D non-deficient group among women.<sup>[21]</sup>

Vitamin D deficiency is said to be associated with sleep disorders, sleep duration, nocturnal awakenings, and sleep quality issues. But there are studies, which have shown contrary results. (22,23) Salepci B et al, used Polysomnography to assess the quality of sleep in patients with Obstructive Sleep Apnoe syndrome(OSA). They also assessed the Vitamin D levels in these patients. Though majority of their patients were found to be Vitamin D deficient, the deficiency was present regardless of

OSA status/severity.<sup>[24]</sup> This again was contrary to several published findings. They explained that the Vitamin D level deficiency could be attributed to seasonal variation, sun exposure and several other confounding factors which were not considered or eliminated before collecting samples.

A Systematic Review and Meta-Analysis done by Qi Gao et al showed that the results were inconsistent across various studies in relation to association of Vitamin D and Sleep.<sup>[25]</sup> Whilst several observational studies showed a correlation between the two, it has to be noted that only the sleep duration was considered rather than sleep quality. Moreover, an obvious heterogeneity existed in these studies which cannot be ignored. The heterogeneity was mainly in the difference of assessment of sleep and grouping criteria for Vitamin D.<sup>[26,27,28]</sup>

There are studies that have shown that dietary supplementation of Vitamin D has had an influence in the sleep.<sup>[28,29,30,31]</sup> Yet again the sleep duration has been assessed rather than the sleep quality. Their diet included several other nutrients rather than Vitamin explicitly and also calorie count intake was correlated to sleep duration.

A randomized controlled trial by A.U. Larsen showed vitamin D fail to produce any significant improvement in sleep. Yet again the sleep quality was not assessed.

Another study comparing the effects of vitamin D and sun exposure affecting sleep could find the association between vitamin D and sleep only in the low sun exposure group. This shows that the effect

of vitamin D on sleep may be due to some complex pathways involving the sun exposure.<sup>[32]</sup> In our study we could not analyse the effect of sun exposure which would have revealed a more promising results.

There are very few studies that reported significant associations between vitamin D levels and sleep quality. But these studies have not assessed the sleep quality. These studies have also not eliminated various confounding factors such as lifestyle, age, and comorbidities, which may mask or confound the potential effects of vitamin D.

Sleep is regulated by multiple factors, including circadian rhythms, neurotransmitters, and hormones, which may overshadow any potential effects of vitamin D. In other words it is a complex process. Vitamin D's primary functions are related to bone health and immune regulation, rather than sleep regulation. How the population responds to vitamin D supplementation or deficiency may vary greatly. All this put together it brings to light the complexity of these relationships and suggests that other factors may influence sleep quality maybe the reason why it is difficult to ascertain or establish a significant correlation between vitamin D and sleep.

Most of the studies that were done were cross-sectional, so they cannot establish a causal association between Vitamin D and Sleep quality. More well-designed, robust studies with a larger sample size is needed to clarify the relationship between vitamin D and sleep. Investigations should be done to understand the molecular mechanisms underlying vitamin D's potential effects on sleep which may provide valuable insights. More objective tests for sleep quality also could be considered. Further research which uses more precise methods for evaluating sleep patterns and involve a larger study group than a self-rated questionnaire may be necessary to explore these dynamics in more depth.

To understand if Vitamin D supplementation helps improve sleep quality research should focus on specific populations, with sleep disorders, to identify potential subgroups that may benefit from vitamin D supplementation. These type of studies should be done as high-quality cohort studies and well-designed randomized controlled trials so as to to verify this relationship and to determine the effect of vitamin D supplementation in unhealthy sleep therapy.

## CONCLUSION

The findings of this study suggest a concerning prevalence of vitamin deficiency and poor sleep quality among the student population. The analysis shows that there is a very weak and statistically insignificant correlation between Vitamin D levels and sleep quality as measured by the PSQI. Future research could explore larger sample sizes or other

factors that may influence sleep quality to gain clearer insights into this relationship.

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