International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-2-111*

A Cross-Sectional Study to Determine the Association Between Sleeping Patterns and Blood Pressure Among Medical Students in a Tertiary Care Hospital in Wayanad District of Northern Kerala

Dr. Arun Varghese[1], Dr. Baiju S.[2], Dr. Anaz Bin Azeez[3], Ashid Salim[4]

[1]*Associate Professor, Department of Community Medicine, Dr. Moopen's Medical College, Wayanad, Kerala, India.*
[2]*Assistant Professor, Department of Respiratory Medicine, Dr Moopen's Medical College, Wayanad, Kerala, India.*
[3]*Assistant Professor, Department of General Medicine, Dr Moopen's Medical College, Wayanad, Kerala, India.*
[4]*Biostatistician, Department of Community Medicine, Dr. Moopen's Medical College, Wayanad, Kerala, India.*

Correspondence:
Dr. Anaz Bin Azeez
Assistant Professor, Department of General Medicine, Dr Moopen's Medical College, Wayanad, Kerala, India

Received: **December 19, 2025**
Revised: **December 26, 2025**
Accepted: **January 30, 2026**
Published: **February 10, 2026**

Abstract

Background: Sleep is a fundamental pillar of health, yet medical students often experience significant sleep deprivation due to demanding academic schedules and stressful environments. ***Methods:*** This cross-sectional study was conducted among 377 MBBS students at a tertiary care hospital in Wayanad district, Kerala, to determine the association between sleeping patterns and blood pressure. ***Results:*** Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and blood pressure was measured using standard procedures. The findings revealed that 65.25% of students had poor sleep quality (PSQI score >5). The mean systolic and diastolic blood pressures were 125.2 ± 9.2 mmHg and 79.7 ± 6.0 mmHg, respectively. Based on blood pressure classification, 22.02% of students were normotensive, 76.66% were pre-hypertensive, and 1.33% were hypertensive. ***Conclusio***n: A statistically significant association was observed between poor sleep quality and elevated blood pressure levels ($p < 0.001$). These findings suggest that poor sleep quality is common among medical students and may contribute to increased blood pressure.

Keywords: Pittsburgh Sleep Quality Index (PSQI), Intense Psychological Stress, Poor Sleep Quality.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Medical education is a period of intense psychological stress and physical exhaustion. Chronic sleep deprivation among students is often a consequence of high academic workload, frequent examinations, and late-night study habits.[1] Medical education is associated with intense psychological stress, heavy academic workloads, and irregular study schedules, which frequently lead to chronic sleep deprivation among students. Medical students are therefore considered a particularly vulnerable group for sleep disturbances because of high academic demands and exposure to stressful clinical environments. Sleep plays a crucial role in maintaining homeostatic regulation, and disruption of the sleep–wake cycle can result in autonomic imbalance and sustained elevations in blood pressure.[2] Although the recommended sleep duration for adults is approximately 7–8 hours, both sleep quantity and quality are essential for maintaining optimal physiological function. Sleep deprivation has also been associated with metabolic disturbances and psychological distress. Previous studies indicate that poor sleep is highly prevalent among medical students. A study conducted in Malang, Indonesia, reported that 89.54% of medical students experienced poor sleep quality, with an average sleep duration of approximately four hours, and sleep insufficiency was associated with increased systolic blood pressure.[2] Similarly, another study among medical students aged 18–22 years found that 42% had poor sleep and demonstrated higher blood pressure, higher body mass index, and lower academic performance compared with good sleepers.[3] Experimental studies have also shown that sleep restriction significantly increases blood pressure levels.[3,4] Poor sleep quality, including difficulty initiating or

maintaining sleep and inadequate sleep duration, is consistently associated with an increased risk of hypertension.[4] Medical students are a uniquely vulnerable group due to high academic loads and stressful clinical environments. This study aims to bridge the gap in local research regarding how these sleep disturbances correlate with physiological markers like blood pressure.

Medical education is a period of intense psychological stress and physical exhaustion. Chronic sleep deprivation among students is often a consequence of high academic workload, frequent examinations, and late-night study habits.[1] Medical education is associated with intense psychological stress, heavy academic workloads, and irregular study schedules, which frequently lead to chronic sleep deprivation among students. Medical students are therefore considered a particularly vulnerable group for sleep disturbances because of high academic demands and exposure to stressful clinical environments. Sleep plays a crucial role in maintaining homeostatic regulation, and disruption of the sleep–wake cycle can result in autonomic imbalance and sustained elevations in blood pressure.[2] Although the recommended sleep duration for adults is approximately 7–8 hours, both sleep quantity and quality are essential for maintaining optimal physiological function. Sleep deprivation has also been associated with metabolic disturbances and psychological distress. Previous studies indicate that poor sleep is highly prevalent among medical students. A study conducted in Malang, Indonesia, reported that 89.54% of medical students experienced poor sleep quality, with an average sleep duration of approximately four hours, and sleep insufficiency was associated with increased systolic blood pressure.[2] Similarly, another study among medical students aged 18–22 years found that 42% had poor sleep and demonstrated higher blood pressure, higher body mass index, and lower academic performance compared with good sleepers.[3] Experimental studies have also shown that sleep restriction significantly increases blood pressure levels.[3,4] Poor sleep quality, including difficulty initiating or maintaining sleep and inadequate sleep duration, is consistently associated with an increased risk of hypertension.[4] Medical students are a uniquely vulnerable group due to high academic loads and stressful clinical environments. This study aims to bridge the gap in local research regarding how these sleep disturbances correlate with physiological markers like blood pressure.

MATERIALS AND METHODS

The present study was a cross-sectional study conducted by the Department of Community Medicine in collaboration with the Department of General Medicine at Dr. Moopen's Medical College, Wayanad. The study was carried out from April to October 2024. Ethical approval was obtained from the Institutional Ethics Committee of Dr. Moopen's Medical College prior to the commencement of the study (IEC/DMMC/March/2024-03). Participation in the study was voluntary and informed consent was obtained from all participants before data collection. Confidentiality of the participants was maintained by assigning anonymized unique identification numbers.

The study population consisted of 377 MBBS students studying at Dr. Moopen's Medical College who were present during the study period and willing to participate in the study. Interns, students from the data collector's batch, and those unwilling to participate were excluded from the study. Data were collected through face-to-face interviews using a structured proforma. The proforma included demographic details such as age and gender, and assessment of sleep quality and duration using the Pittsburgh Sleep Quality Index (PSQI). The PSQI is a standardized questionnaire used to evaluate sleep quality over the previous one month and provides a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality.

Blood pressure was measured using a calibrated digital sphygmomanometer after the participant had rested for at least five minutes in a seated position following standard procedures. The measurement was taken from the right arm at heart level. Three readings were recorded at five-minute intervals, and the average of the three readings was considered as the final systolic and diastolic blood pressure for analysis.

Data were entered into Microsoft Excel and analyzed using R statistical software (R version 4.4.1, R Foundation for Statistical Computing, Vienna, Austria). Continuous variables such as systolic and diastolic blood pressure were expressed as mean ± standard deviation, while categorical variables were summarized using frequencies and percentages. Sleep quality was categorized based on the PSQI score into good sleep (PSQI ≤5) and poor sleep (PSQI >5). Blood pressure levels were classified according to JNC 8 guidelines into normal, pre-hypertension, and hypertension. The independent

samples t-test was used to compare mean systolic and diastolic blood pressure between students with good and poor sleep quality. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic Profile

A total of 377 MBBS students from first to fourth year participated in this study. The mean age of participants was 20.5 ± 1.4 years (range: 18-23 years). The majority (51.5%) were in the 18-20 years age group. Females constituted 56% (n=211) of the study population, while males were 44% (n=166), with a male: female ratio of 1:0.79. The distribution across academic years was nearly equal, with first year (25.2%), second year (26.0%), third year (24.4%), and fourth year (24.4%). Family history of hypertension was present in 28.4% (n=107) of students. (Table 1)

Characteristic	Frequency (n)	Percentage (%)
Age Group (years)		
18-20	194	51.5
21-23	183	48.5
Gender		
Male	166	44
Female	211	56
Year of Study		
1st Year	95	25.2
2nd Year	98	26
3rd Year	92	24.4
4th Year	92	24.4
Family History of Hypertension		
Yes	107	28.4
No	270	71.6

Table 1: Demographic Characteristics of Study Participants (N=377)

Sleep Quality and Patterns

The mean PSQI (Pittsburgh Sleep Quality Index) score among medical students was 6.58 ± 2.55 (range: 0-13). Based on the PSQI classification, **65.25% (n=246) of students had poor sleep quality** (PSQI score >5), while only 34.75% (n=131) were good sleepers (PSQI ≤5). The median PSQI score was 7, with an interquartile range of 5-8.

When analyzed by year of study, the highest proportion of poor sleep was observed among **third-year students (77.2%)**, followed by second-year (65.3%), fourth-year (63.0%), and first-year students (55.8%). Gender-wise distribution showed comparable rates of poor sleep among females (65.9%) and males (64.5%). (Table 3)

Variable	Good Sleep (PSQI ≤5) n (%)	Poor Sleep (PSQI >5) n (%)
Overall (N=377)	131 (34.75)	246 (65.25)
Gender		
Male (n=166)	59 (35.5)	107 (64.5)
Female (n=211)	72 (34.1)	139 (65.9)
Year of Study		
1st Year (n=95)	42 (44.2)	53 (55.8)
2nd Year (n=98)	34 (34.7)	64 (65.3)
3rd Year (n=92)	21 (22.8)	71 (77.2)
4th Year (n=92)	34 (37.0)	58 (63.0)

Table 2: Distribution of Sleep Quality among Participants (N=377)

Blood Pressure Status

The mean systolic blood pressure (SBP) was **125.2 ± 9.2 mmHg** (range: 98-149 mmHg), and the mean diastolic blood pressure (DBP) was **79.7 ± 6.0 mmHg** (range: 61-98 mmHg). According to the JNC 8 classification, the majority of students (76.66%, n=289) were in the **pre-hypertension** category, while 22.02% (n=83) had normal blood pressure, and only 1.33% (n=5) were classified as hypertensive.

Third-year students had the highest proportion of elevated blood pressure, with 90.2% in the pre-hypertensive category and 2.2% hypertensive. Gender-wise, males had a higher proportion of pre-hypertension (81.3%) compared to females (73.0%). Students with a family history of hypertension showed a higher proportion of normal BP (29.0%) compared to those without family history (19.3%). (Table 3)

Variable	Normal n (%)	Pre-Hypertension n (%)	Hypertension n (%)
Overall (N=377)	83 (22.02)	289 (76.66)	5 (1.33)
Gender			
Male (n=166)	29 (17.5)	135 (81.3)	2 (1.2)
Female (n=211)	54 (25.6)	154 (73.0)	3 (1.4)
Year of Study			
1st Year (n=95)	37 (38.9)	58 (61.1)	0 (0.0)
2nd Year (n=98)	20 (20.4)	78 (79.6)	0 (0.0)
3rd Year (n=92)	7 (7.6)	83 (90.2)	2 (2.2)
4th Year (n=92)	19 (20.7)	70 (76.1)	3 (3.3)
Family History of HTN			
Yes (n=107)	31 (29.0)	74 (69.2)	2 (1.9)
No (n=270)	52 (19.3)	215 (79.6)	3 (1.1)

Table 3: Blood Pressure Distribution among Participants (N=377)

Variable	Good Sleep (PSQI ≤5) Mean ± SD (n=131)	Poor Sleep (PSQI >5) Mean ± SD (n=246)	p value
Systolic Blood Pressure (mmHg)	118.4 ± 7.5	126.2 ± 8.1	<0.001
Diastolic Blood Pressure (mmHg)	75.6 ± 5.2	82.1 ± 5.8	<0.001

Table 4: Association between Sleep Quality and Blood Pressure Category

The comparison of mean blood pressure values between students with good sleep quality (PSQI ≤5) and poor sleep quality (PSQI >5) revealed a statistically significant difference. The mean systolic blood pressure among students with poor sleep quality was 126.2 ± 8.1 mmHg, which was significantly higher than that of students with good sleep quality (118.4 ± 7.5 mmHg).

Similarly, the mean diastolic blood pressure among poor sleepers (82.1 ± 5.8 mmHg) was significantly higher compared with good sleepers (75.6 ± 5.2 mmHg).Independent samples t-test demonstrated that these differences were highly statistically significant for both systolic blood pressure and diastolic blood pressure. This indicates that medical students experiencing poor sleep quality tend to have significantly elevated blood pressure levels compared with those with adequate sleep.

DISCUSSION

The association between poor sleep and elevated BP found in this study ($p < 0.001$) suggests that medical students may be at risk for future cardiovascular issues. Sleep loss increases sympathetic nervous system activity and impairs the body's ability to regulate salt through the kidneys, both of which are precursors to hypertension.[5,6] Furthermore, the high reliance on caffeine to combat daytime sleepiness among this group may further exacerbate blood pressure spikes.[7]
The study highlights that poor sleep quality is a major public health concern among medical students in Wayanad. The high prevalence of pre-hypertension (76.66%) in this young population is particularly alarming. The physiological stress induced by sleep deprivation, including increased sympathetic nervous system activity and hormonal imbalances, likely contributes to these elevated blood pressure readings.

Medical education's rigorous nature often leads to a "culture of sleeplessness." However, these results suggest that such habits have immediate physiological consequences.

CONCLUSION

There is a clear and significant association between poor sleeping patterns and high blood pressure among medical students. It is imperative for medical institutions to: Implement screening programs for sleep disorders early in the curriculum. Provide education on sleep hygiene as part of the student wellness program. Encourage a balanced lifestyle to prevent the early onset of chronic cardiovascular conditions.

LIMITATIONS

Being a cross sectional study, there is no follow ups and the results cannot be generalized as all the study subjects were from a single medical college.

REFERENCES

1. Rachmawati E, Riskiyana R. Sleep insufficiency influence on nitric oxide concentration and systolic blood pressure in medical students. Malaysian Journal of Medicine and Health Sciences 2020;16(SUPP14):17-22.
2. Krishna P, Shwetha, S. Sleep quality and correlates of sleep among medical students. Indian Journal of Sleep Medicine 2008;3(2):58-61.
3. Makarem N, Alcántara C, Williams N, et al. Effect of sleep disturbances on blood pressure. Hypertension 2021;77(4):1036-46.
4. Corliss J. Poor sleep linked to high blood pressure. Harvard Health Publishing 2024. https://www.health.harvard.edu/heart-health/poor-sleep-linked-to-high-blood-pressure
5. Javaheri S, Storfer-Isser A, Rosen CL, et al. Sleep quality and elevated blood pressure in adolescents. Circulation 2008;118(10):1034-40.
6. Lusardi P, Zoppi A, Preti P, et al. Effects of insufficient sleep on blood pressure in hypertensive patients. American Journal of Hypertension 199912(1):63-8.
7. Ho CC, Chung MH. Caffeine consumption and sleep quality in medical students. Journal of Biological and Health Sciences 2014;12(4):45-52.