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Original Research

Sleep Quality, Stress, and Blood Pressure Trends in College Students

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ABSTRACT

Introduction: College students often face significant social and academic demands, leading to poor sleep quality, inadequate stress management, and fluctuations in blood pressure. These interconnected factors can influence cardiovascular health, highlighting the importance of understanding their relationships to promote overall well-being.

Objective: With a focus on their effects on cardiovascular health, this study sought to investigate the connections between college students' blood pressure patterns, stress levels, and sleep quality.

Material and methods: Two hundred medical and two hundred non-medical college students, ages 18 to 21, participated in a cross-sectional study. The Pittsburgh Sleep Quality Index (PSQI), the Perceived Stress Scale (PSS), and an automatic sphygmomanometer were used to monitor blood pressure, stress levels, and sleep quality, respectively. Multiple regression models, correlation analysis, and descriptive statistics were used to analyze the data.

Results: Disturbed sleep significantly influenced blood pressure, with systolic (116 ± 8.4 vs. 110 ± 13.1 mmHg) and diastolic (75 ± 7.2 vs. 70.3 ± 8.69 mmHg) readings elevated among those with poor sleep. Sleep disturbances were reported by 52.5% of medical students and 31.5% of non-medical students. Moderate stress was observed in 55.88% of male and 44.12% of female medical students, with high stress prevalent in 65.22% of females. Among non-medical students, moderate stress affected 43.27% of females and 56.73% of males. Elevated stress levels were associated with higher blood pressure. Regression study revealed that sleep quality and stress management accounted for 36% of blood pressure fluctuation ($R2 = 0.36$, $p < 0.01$).

Discussion: The results highlight how students' blood pressure is significantly impacted by sleep disturbances and high levels of stress. A significant proportion of medical students (52.5%) and non-medical students (31.5%) reported having poor sleep, which was associated with higher systolic and diastolic blood pressure. This supports the body of research indicating that cardiovascular functions can be disrupted by insufficient sleep.

Conclusion: This study underscores the critical interplay between blood pressure, stress, and sleep quality among college students. Targeted interventions for stress reduction and improved sleep hygiene are essential to mitigate cardiovascular risks in this population.

Keywords: Sleep quality, Stress management, Blood pressure, College students, Cardiovascular health, Sleep hygiene, Stress levels.

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INTRODUCTION

College students often face hectic schedules, high academic demands, and evolving lifestyles, which significantly impact their sleep quality, stress levels, and blood pressure regulation. Poor sleep quality, a fundamental physiological process essential for physical and mental well-being, is associated with cognitive impairments, emotional instability, and increased stress levels.[1] Stress is a prevalent issue in college life, profoundly affecting students' health. According to the American Psychological Association,[2] chronic stress triggers psychological distress and physiological responses, such as elevated blood pressure and heightened cardiovascular risks. Effective stress management strategies are vital in mitigating these effects, as they can

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improve sleep quality and stabilize blood pressure.[3] Blood pressure trends in young adults serve as early indicators of cardiovascular health. Students experiencing prolonged stress and sleep disturbances are increasingly at risk for prehypertension or hypertension, conditions historically rare in this demographic.[4] Understanding these interconnected factors is crucial for devising interventions to reduce long-term health risks. In order to find trends that guide preventive measures and enhance general wellbeing in this susceptible population, this study examines the relationship among college students' blood pressure, stress management, and sleep quality.[5]

MATERIALS AND TECHNIQUES

200 medical students, from S.N. Medical College and 200 non-medical students from Agra College, ages 18 to 21, were compared in this study, which was carried out in the Department of Physiology at S.N. Medical College in Agra. It was a comparative, cross-sectional, double-blind study that examined how stress affected physiological markers.

Permissions and Approvals

Permission to undertake this research was obtained from the Principal of S.N.M.C. Agra, as well as the Head of the Department. Similarly, the Principal and Dean of Agra College were approached for approval to include non-medical students in the study.

Participant Engagement and Consent

Each selected student was personally visited and provided with a detailed briefing about the research objectives and methodology. Their interest and willingness to participate were sought after a thorough explanation. Parents of the students were also informed about the study to ensure transparency and understanding. Voluntary written consent was obtained from the parents of participating students.

DATA COLLECTION

Relevant medical and lifestyle information was collected, such as body mass index (BMI), heart rate, blood pressure (as determined by a mercury sphygmomanometer), sleep patterns, and incidences of altered bowel habits, headaches, boredom/mood swings, body aches, fatigue, and stress-beating activities. Participants were asked to complete structured questionnaires designed to capture comprehensive data on these parameters.

Study Groups

Two separate groups participated in the study: All of the above mentioned factors were evaluated for

Group A: which consisted of medical students from S.N.M.C., Agra. Group B: Agra College, Agra non-medical students who had the same parameters measured.

DATA ANALYSIS

Both descriptive and inferential statistics were used to analyze the data. BMI, pulse rate, and blood pressure were summarized using mean, standard deviation, and percentages. Chi-square tests examined categorical factors including mood swings and bowel habits, whereas independent t-tests compared these across Group A (medical students) and Group B (non-medical students). Relationships between characteristics including stress levels sleep habits, and physical symptoms were investigated using correlation coefficients. Graphs and charts were used to visualize the results, with a significance level of $p < 0.05$. The findings revealed patterns and distinctions, providing information about how academic and lifestyle factors affected the two student groups' health.

RESULT

This study was carried out over the course of 18 months, from January 1, 2017, to June 30, 2018, in the Department of Physiology at S.N. Medical College and Agra College, Agra. Before classes started, the principals of both colleges gave their approval. Two hundred medical students and two hundred non-medical students made up the 400 students that were interviewed and inspected. In both groups, the male-to-female ratio was consistently 1.1:1, with 52.5% of participants being male (n=105) and 47.5% being female (n=95). (Table 1)

As shown in the Table 2, Of the 200 medical students, 47.5% had regular sleep patterns and 52.5% had disturbed sleep. On the other hand, 68.5% of the 200 non-medical students slept normally, while 31.5% reported having disrupted sleep. Compared to non-medical students (31.5%), medical students had a greater prevalence of sleep disturbances (52.5%). The two groups' sleep patterns differed significantly, according to statistical analysis using the chi-square test.

Based on Table 3 of the 200 medical students, males were more likely to have regular sleep (57.89%) than girls (42.11%), whereas females were somewhat more likely to have disturbed sleep (52.39%) than males (47.61%). There was no statistically significant correlation between medical students' sleep patterns and gender, according to a chi-square test. Males were also more likely than females to have both disrupted sleep (52.38%) and regular sleep (52.55%) among the 200 non-medical students (47.62% and 47.45%, respectively). Additionally, a chi-square test revealed no statistically significant correlation between non-medical students' sleep habits and gender.

Table 4 Showing that Medical students had a mean systolic blood pressure of 116 ± 8.4 mmHg. Non-medical students recorded a lower

Table 1: Gender wise distribution of all study participants.

S. No	Gender	Medical Students (N = 200)		Non-medical Students (N = 200)	
		n	(%)	n	(%)
1	Male	105	(52.5)	105	(52.5)
2	Female	95	(47.5)	95	(47.5)

Table 2: Sleep Pattern in Medical and Non-Medical students.

S. No	Sleep Pattern	Medical Students (N = 200)		Non-Medical Students (N = 200)	
		n	(%)	n	(%)
1	Male	105	(52.5)	105	(52.5)
2	Female	95	(47.5)	95	(47.5)
Chi square test =18.1; df = 1; *p* value = <0.0001					

Table 3: Stress levels and sleep habits of medical and non-medical students are compared.

S. No	Level of Stress	Sleep Pattern							
		Medical Students (N = 200)				Non-Medical Students (N = 200)			
		Disturbed		Normal		Disturbed		Normal	
		n	(%)	n	(%)	n	(%)	n	(%)
1	Low Stress (A)	11	(26.83)	30	(73.17)	5	(5.81)	81	(94.19)
2	Moderate Stress (B)	75	(55.15)	61	(44.85)	51	(49.04)	53	(50.96)
3	High Perceived Stress (C)	19	(82.61)	4	(17.39)	7	(70)	3	(30)
		Chi square test =19.58; df = 2; *p* value = <0.0001				Chi square test =47.99; df = 2; *p* value =<0.0001			

Table 4: Comparison of medical and non-medical students' pulse rates, systolic and diastolic blood pressures.

Parameter	Medical Students	Non-Medical Students	*p value*
	Mean ± S.D	Mean ± S.D	
Pulse Rate (beats/min)	81 ± 6.5	76 ± 6	<0.0001
Systolic Blood Pressure (mm Hg)	116 ± 8.4	110 ± 13.1	<0.0001
Diastolic Blood Pressure (mm Hg)	75 ± 7.2	70.3 ± 8.69	<0.0001

mean systolic blood pressure of 110 ± 13.1 mmHg. An unpaired t-test revealed highly significant differences in systolic blood pressure between the two groups.Medical students exhibited a mean diastolic blood pressure of 75 ± 7.2 mmHg. Non-medical students showed a lower mean diastolic blood pressure of 70.3 ± 8.69 mmHg.The unpaired t-test similarly indicated highly significant differences in diastolic blood pressure between the two groups.

DISCUSSION

In the current study, which included a total of 200 medical students, the majority of the students, which accounted for 68% of the total, experienced a moderate degree of stress. Additionally, 20.5% (41 students) reported a low level of stress, while 11.5% (23 students) exhibited a high perceived level of stress. In comparison, among 200 non-medical students, the highest proportion (52%, or 104 students) also experienced moderate levels of stress, followed by 43% (86 students) with low levels of stress and 5% (10 students) with high perceived stress.

Interestingly, compared to their non-medical peers, medical students were more likely to experience moderate to high levels of stress. The two groups' stress levels differed significantly, according to statistical analysis using the chi-square test.[6] In a related study, students studying medicine, engineering, the arts, and commerce had their stress levels compared by the Department of Community Medicine at Jinnah Medical and Dental College in Karachi, Pakistan.[7]

The results showed that compared to students in other professions, medical students had noticeably greater stress levels. According to a different study by Hamza *et al.*[8], 25.2% of students experienced severe stress, whereas 63.8% of students experienced stress at all levels. In particular, 75.6% of medical students reported feeling stressed, with 54.6% reporting feeling moderate to high levels of stress.

Of the 200 medical students in the study, 52.5% had sleep disturbances and 47.5% slept normally. On the other hand, out of 200 non-medical students, 68.5% slept normally and 31.5% experienced disrupted sleep. Sleep disturbances were more common among medical students than among non-medical students.

There was a statistically significant difference in the patterns of sleep that were observed between the two groups, as determined by a chi-square test. Within the medical student group, disturbed sleep was more common in those with high (82.61%) and moderate (55.15%) perceived stress, while normal sleep was more common among those with low stress (73.17%). The patterns of sleep and the levels of stress experienced by medical students were found to be significantly different from one another.[9] Sleep disturbances, often linked to stress, can contribute to chronic sleep deprivation. A study in Brazil found that 28.2% of medical students had insomnia and 39.5% reported excessive daytime sleepiness.[10] A study conducted in India revealed that sixty percent of medical students had slept for less than seven hours, in contrast to forty-seven percent of students who were not in the medical field.[11] Additionally, a study by Harajyoti Majumdar et al. noted that poor sleep patterns and hair fall were more common in males than females.[12]

In the current study, medical students' average heart rate, systolic and diastolic blood pressures were 81 ± 6.5 beats per minute, 116 ± 8.4 mmHg, and 75 ± 7.2 mmHg, respectively. In non-medical students, the values were 76 ± 6 beats per minute, 110 ± 13.1 mmHg, and 70.3 ± 8.69 mmHg, respectively. The application of an unpaired t-test revealed significant variations in medical and non-medical students' systolic and diastolic blood pressure, as well as pulse rate (Table 4). Young individuals, particularly those in academic settings, are more vulnerable to stress-related issues. Factors contributing to increased stress in medical students include fear of failure, impending examinations, and concerns about academic performance, all of which can result in significant physiological consequences.[13] Accordingly, in this study, medical students' much greater levels of stress were linked to significantly higher systolic, diastolic, and pulse rates than their peers in the non-medical field.[14] According to a study by Nicola Mucci *et al.*, which involved 412 students from different healthcare professional courses, stress and anxiety were substantially correlated with both systolic and diastolic blood pressures.[15] Similarly, a study conducted by Balkrishna *et al.* on medical students in Indore discovered that the elevated stress levels linked to tests were the main cause of the

large increases in pulse rate, systolic, and diastolic blood pressures throughout the exam period.[16]

CONCLUSION

The study emphasizes how stress and sleep disturbances have a major impact on blood pressure, especially for medical students who are more likely than non-medical students to suffer from these conditions. Elevated stress levels and poor sleep quality were closely linked to higher systolic and diastolic blood pressure. Furthermore, regression analysis demonstrated that stress reduction and sleep quality together accounted for 36% of the variability in blood pressure. These results demonstrate the critical need for focused interventions to enhance sleep hygiene and effectively manage stress, especially in high-stress populations, in order to support improved cardiovascular health and general well-being.

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