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ORIGINAL ARTICLE

# The relationship between stress levels and sleep quality on blood pressure among medical student

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**ABSTRACT**

Hypertension, often termed a "silent killer" due to its asymptomatic nature, is a chronic condition that significantly elevates the risk of cardiovascular mortality. This cross-sectional study aimed to investigate the correlation between perceived stress levels, sleep quality, and blood pressure among medical students at Universitas Prima Indonesia in class 2021. This study used a cross-sectional observational design. A purposive sample of 56 medical students was recruited based on the predefined inclusion and exclusion criteria. Data were collected using the Perceived Stress Scale-10 (PSS-10) to assess stress levels, Pittsburgh Sleep Quality Index (PSQI) to evaluate sleep quality, and a digital sphygmomanometer to measure blood pressure. The findings revealed that the majority of respondents (75%) reported moderate stress levels, 66.1% had poor sleep quality, and 82.1% exhibited normal blood pressure. These results suggest a correlation between perceived stress, sleep quality, and blood pressure among medical students at Universitas Prima Indonesia, Class 2021.

**Keywords:** stress, sleep quality, blood pressure, medical student

## Introduction

Hypertension is a chronic condition characterized by persistently elevated blood pressure, making it a leading risk factor for cardiovascular diseases and a significant cause of global mortality. Often referred to as the "silent killer," hypertension is frequently asymptomatic and is thus commonly diagnosed at an advanced stage.[1] Blood pressure, the force exerted by blood against the walls of blood vessels, is elevated in hypertensive individuals due to increased cardiac output and/or peripheral resistance.[2] Systolic blood pressure, which reflects blood pressure during ventricular contraction, and diastolic blood pressure, which reflects blood pressure during ventricular relaxation, have established normal ranges. Data from the 2014 Sample Registration System (SRS) revealed a high prevalence of hypertension in Indonesia, particularly among the elderly.[1] Hypertensive complications are the fourth leading cause of death across all age groups, highlighting the substantial disease burden associated with this condition. The rapidly increasing prevalence of hypertension in developing countries including Indonesia poses a pressing global health challenge.[3–5]

Hypertension is a multifactorial condition. The risk factors for hypertension can be categorized into two main groups: non-modifiable and modifiable. Non-modifiable factors include age, sex, race, ethnicity, and genetics. In contrast, modifiable factors include obesity, excessive salt intake, excessive alcohol

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consumption, smoking, caffeine consumption, insufficient rest, poor stress management, and physical inactivity.[6–9] Medical students frequently experience significant stress in their daily lives due to their numerous academic responsibilities. To meet nationally established competency standards, medical students must possess adequate competencies in the clinical, theoretical, and practical domains.[10] High levels of stress are prevalent among medical students, coinciding with the multitude of demands placed on them throughout their studies.[11,12] A variety of stressors, both in daily life and academic activities, can contribute to increased stress levels in students. Medical students commonly experience poor sleep quality.[13]

Previous studies have yielded inconsistent findings regarding the relationship between sleep quality, stress levels, and blood pressure. While a study[14] have confirmed a link between sleep quality and blood pressure, these findings contradict those of Lontoh and Gunawan[15] who reported no such association. Furthermore, research on medical students has yielded mixed results. While a study[16] found a relationship between stress levels and blood pressure around exam time, another study[17] did not detect significant differences among medical students at Universitas Yarsi. Given these conflicting findings, this study aimed to analyze the relationship between stress levels, sleep quality, and blood pressure among medical students at Universitas Prima Indonesia.

## Method

This cross-sectional observational study aimed to examine the relationship between stress levels, sleep quality, and blood pressure among medical students at Universitas Prima, Indonesia, in class 2021. This study was conducted at the Faculty of Medicine, Dentistry, and Health Sciences, Universitas Prima Indonesia, from April 1 to June 30, 2024. The study population comprised all medical students from the 2021 class at Universitas Prima, Indonesia. A purposive sampling technique was employed based on predefined inclusion and exclusion criteria. A total of 56 respondents were included in the study, which was calculated using the Slovin formula.

Data were collected using three instruments: (1) the Perceived Stress Scale-10 (PSS-10) to measure stress levels, (2) the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and (3) a digital sphygmomanometer (Omron) to measure blood pressure. Descriptive analysis was conducted to characterize the study participants and describe the distribution of the variables. Inferential analysis using Spearman's correlation was used to examine the relationships between stress levels, sleep quality, and blood pressure. The results are presented in tables and graphs for better interpretation.

## Results

A demographic analysis of the 56 medical students participating in this study revealed that the majority were 21 years old (48.2%), followed by 20 years old (37.5%). A smaller proportion of participants were aged 22 (10.7%) and 23 years (3.6%). Females constituted the majority of the sample (71.4 %), while males accounted for 28.6% of the sample. Consequently, the study sample was predominantly composed of 21-year-old female students.

The research findings indicated that the majority of respondents (75.0%, or 42 individuals) experienced moderate levels of stress. The remaining 25.0% (n = 14) reported high levels of stress. Overall, these data suggest that the majority of the students in this study experienced a moderate degree of stress. Regarding sleep quality, the survey results show that 66.1% (37 individuals) reported poor sleep quality. The remaining 33.9% (19 individuals) reported good sleep quality. These findings indicate a significant prevalence of poor sleep quality among the majority of the students in the study.

Blood pressure measurements revealed that the majority of the respondents (46 individuals, 82.1%) had normal blood pressure. The remaining 10 participants (17.9%) were in the elevated category. These findings suggest that most students in the study sample maintained normal blood pressure levels, although a non-negligible proportion exhibited blood pressure readings approaching prehypertensive levels.

Spearman's rank correlation analysis was conducted to examine the relationship between stress levels and blood pressure among students. The results indicate a significant positive correlation between the two variables (see Table 2). Spearman's rank correlation coefficient of 0.592 suggests a moderate relationship between stress levels and blood pressure, indicating that higher stress levels were associated with higher blood pressure. The significance level ($p < 0.05$) confirmed that the relationship was statistically significant.

Table 1. Characteristics of subject (n=56)

| Characteristics | n | % |
|---|---|---|
| Gender | | |
| Female | 40 | 28.6 |
| Male | 16 | 71.4 |
| Age (years) | | |
| 20 | 21 | 37.5 |
| 21 | 27 | 48.2 |
| 22 | 6 | 10.7 |
| 23 | 2 | 3.6 |
| Stress level | | |
| Moderate | 42 | 75.0 |
| Severe | 14 | 25.0 |
| Sleep quality | | |
| Good | 19 | 33.9 |
| Poor | 37 | 66.1 |
| Blood pressure | | |
| Normal | 46 | 82.1 |
| High normal | 10 | 17.9 |

Table 2. Spearman's rank test result

| Risk factor | Blood pressure | | R | p |
|---|---|---|---|---|
| | Normal | High normal | | |
| Stress level | | | | |
| Moderate | 40 (71.4) | 2 (3.6) | 0.592 | 0.000 |
| Severe | 6 (10.7) | 8 (14.3) | | |
| Sleep quality | | | | |
| Good | 14 (25.0) | 5 (8.9) | - 0.158 | 0.244 |
| Poor | 32 (57.1) | 5 (8.9) | | |

The analysis revealed a negative correlation between sleep quality and blood pressure, with a correlation coefficient (r) of -0.158. This negative correlation suggests that as sleep quality decreases, blood pressure tends to increase slightly. However, this relationship was very weak. A significance test at the 5% level yielded a p value of 0.244. The p-value was greater than 0.05, indicating that the negative correlation between sleep quality and blood pressure was not statistically significant. Therefore, it can be concluded that there is insufficient empirical evidence to support the claim that sleep quality significantly influences blood pressure in the student population sampled in this study.

## Discussion

Blood pressure, a critical indicator of cardiovascular health, is influenced by various physiological and environmental factors. According to the literature, normal blood pressure is generally considered to be below 120/80 mmHg.[18] The results of this study indicated that the majority of students had blood pressure within the normal range, suggesting lifestyle and health behaviors that are generally supportive of heart health. However, a significant proportion (17.9%) of respondents had elevated blood pressure. This condition warrants serious attention, given its potential to develop into hypertension. Various risk factors, including age, sex, lifestyle, and obesity, have been identified as contributing to elevated blood pressure.[6–9] Particularly, in the student population, academic stress, unhealthy dietary habits, and physical inactivity may serve as potential triggers for increased blood pressure.[19]

The research findings revealed a significant correlation between stress levels and blood pressure among medical students. As stress levels increased, so too does systolic blood pressure also increased. This positive correlation was supported by a correlation coefficient (R) of 0.592 for systolic blood pressure, indicating a direct relationship between the two variables. Medical students are frequently subjected to substantial academic and non-academic pressure, leading to elevated stress levels. The demanding nature of

medical education, characterized by rigorous academic standards and a broad scope of competencies, creates a highly stressful environment.[20] Although academic stress is a primary contributor to hypertension among medical students, other life stressors also play a significant role. The combination of academic and non-academic pressure can create chronic stress, which increases the risk of various health problems, including hypertension. This aligns with Alwhaibi et al.'s[21] finding that stress is prevalent among medical students because of the demanding nature of their studies.

Data analysis in this study did not reveal a significant correlation between sleep quality and blood pressure among medical students. Although the majority of respondents reported poor sleep quality, the distribution of blood pressure within the normal and slightly elevated categories did not demonstrate a statistically significant difference. A weak negative correlation between the two variables suggests a trend contrary to general expectations; however, this finding was not statistically robust.

These findings contrast with those of several previous studies that reported a positive association between poor sleep quality and elevated blood pressure. For instance, Sari et al.[14] found that sleep disturbances such as insomnia and sleep apnea contribute to blood pressure dysregulation. However, the results of this study align more closely with those of Lontoh and Gunawan[15] who did not find a significant relationship between these two variables. Differences in findings across studies can be attributed to various factors including sample characteristics and differing contextual environments.

While no strong direct relationship between sleep quality and blood pressure was found in this study, poor sleep quality remains a significant health concern for medical students. Sleep disturbances can negatively affect various aspects of health, including cognitive function, mood, and academic performance. Therefore, efforts to improve students' sleep quality, such as stress management programs, sleep hygiene education, and provision of adequate sleep facilities, should remain a priority.[22,23]

## Conclusion

This study found that the majority of medical students at Universitas Prima Indonesia experienced moderate levels of stress attributed to academic pressures and daily life demands. Despite a significant proportion of students reporting poor sleep quality, their blood pressure levels remained within normal and slightly elevated ranges. A significant correlation was found between stress levels and blood pressure, but no such correlation was found between sleep quality and blood pressure. It is recommended that students improve their stress management techniques and sleep quality to maintain overall health. Universities should consider implementing support programs, such as workshops or training sessions, stress management, and the importance of quality sleep. Future research should expand the study population and include additional variables that may influence students' BP.

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