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THE EFFECTS OF SLEEP PATTERNS ON BLOOD PRESSURE STUDENTS OF AL-AZHAR SUPERIOR HIGH SCHOOL MEDAN

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Abstract

The habit of staying up late and insufficient sleep among adolescents is often caused by academic stress and the use of electronic devices. This disturbed sleep pattern can inhibit the physiological process of naturally lowering blood pressure at rest, thus increasing the risk of cardiovascular disease at a young age. This study aims to analyze thadolee relationship between sleep patterns, sleep quality, and blood pressure in students at Al-Azhar Medan Superior High School. This study uses a quantitative approach with an observational design. The research sample consisted of 50 students from Al-Azhar Medan Superior High School who were randomly selected. Sleep quality data was obtained by completing questionnaires, while blood pressure data was measured directly with a sphygmomanometer. The data analysis was univariate and bivariate with a chi-square ($\alpha = 0{,}05$). The results showed that the majority of respondents had a good sleep quality of 78.0% (39 students) and a poor sleep quality of 22.0% (11 students). The blood pressure distribution of the respondents included the Normal/Optimal category of 46.0% (23 students), prehypertension of 32.0% (16 students), and first degree hypertension of 22.0% (11 students). The results of the bivariate analysis showed a significant relationship between sleep quality and blood pressure (p-value $= 0{,}012 < 0{,}05$). Students with poor sleep quality sigtended to have an increase in blood pressure up to the category of grade 1 hypertension (54.5%). In students at Al-Azhar Superior High School Medan, there was a significant relationship between sleep patterns/quality and blood pressure. The introduction $\alpha = 0{,}05$p-value $= 0{,}012 < 0{,}05$ of sleep hygiene and good sleep time management is necessary to prevent high blood pressure at a young age.

Keywords: sleep quality, sleep patterns, adolescents, blood pressure, high blood pressure.

1. Introduction

Sleep patterns are one of the factors that play a role in the cause of obesity. Many studies have shown that people who regularly lack sleep can experience fatigue, irritability, and lack of concentration. They are also at higher risk of cancer, depression, and anxiety. Sleep duration may be an important regulatory factor in metabolism (Suryati et al., 2024). In a fast-paced modern society, sleep patterns are often disrupted by factors such as work stress, environmental disturbances, or unhealthy lifestyle habits. This can cause people to have sleep problems or chronically lack sleep, which in turn can negatively affect their mental well-being. Many studies have shown that lack of sleep or poor sleep can cause an increased risk of developing mental health conditions such as depression and anxiety.

Also, the opposite of poor sleep patterns is the importance of maintaining healthy and consistent sleep patterns. Adequate sleep duration, good sleep, and consistency in sleep patterns can provide strong support for good mental health. Studies also show that people with good sleep patterns tend to have better mental well-being and a lower risk of developing mental illness.

In today's modern era, adolescents often struggle to maintain their sleep time. Many adolescents are trapped in routines that shorten their sleep time. Factors such as academic requirements, activities, social media, and the use of electronic devices contribute to a decrease in the quality and duration of sleep among adolescents. Research by Meldrum, Jackson, Archer, and Blanfort (2018) on 7,958 middle and high school students in America found data that 37.46% of these adolescents had a sleep time of less than 7 hours per day. Research by Sofiah, Rachmawati, and Setiawan (2020) on 243 adolescents aged 15 to 19 in Martapura reported that up to 94.7% of these adolescents had poor sleep quality (Zain and Hanif, 2023).

Blood pressure readings are an indicator used to assess the cardiovascular system along with a pulse examination. Blood pressure readings can be measured using two methods, namely the direct method, which involves inserting a cannula or needle into a blood vessel connected to a pressure gauge, and the second indirect method, a method using a sphygmomanometer (Hidayat & Uliya, 2012). Blood pressure measurement is an important clinical skill for caregivers. The potential for poor errors can interfere with the management of measurements if not all procedures performed are careful (Wallymahmed, 2008). Blood pressure usually decreases in normal sleep (about 10–20% is still considered normal) compared to consciousness, due to a decrease in sympathetic activity during sleep (Lumantow et al., 2016).

Adolescents with higher-than-normal blood pressure are at a higher risk of suffering from coronary artery disease or heart failure as adults. Some of the factors that play a role in the onset of hypertension are risk factors that cannot be controlled, as well as risk factors that can still be controlled. Ancestry, race, gender, and age are risk factors that cannot be controlled. At the same time, lifestyle habits related to high blood pressure risk, such as lack of exercise, smoking, sleep quality, obesity, alcohol, stress, and diet, are still risk factors that can be controlled. (Junidar et al., 2025).

2. Literature review

Good sleep quality in adolescents:

Sleep patterns are one of the important aspects that determine the quality of a person's physical and mental health, especially during adolescence. A good sleep pattern depends not only on the duration or length of sleep time, but also includes adequate sleep quality, regular sleep habits, and a consistency of daily sleep schedule (Suryati et al., 2024; Junidar et al., 2025). For adolescents, optimal sleep quality is characterized by the ease of falling asleep, resting during sleep without frequent waking, and feeling refreshed and energized in the morning.

Good sleep quality has various positive effects on adolescents' bodies and minds. In terms of cognitive function, quality sleep plays an important role in the process of memory consolidation, improving memory, and forming a good level of concentration when participating in learning activities at school (Suryati et al., 2024). Emotionally and mentally, adolescents with regular sleep patterns and quality tend to have better emotional stability, optimal mental health, and a lower risk of experiencing mental health problems such as stress, depression, and anxiety (Junidar et al., 2025).

On the other hand, poor sleep quality in adolescents – which is mostly triggered by the use of electronic devices, excessive social media activities, and academic demands – can lead to various metabolic disorders and a reduction in immunity (Junidar et al., 2025). Therefore, maintaining sleep hygiene such as limiting screen use before bed, creating a comfortable room environment, and getting used to regular sleep and wake time daily is key to creating a good sleep pattern for adolescents.

Definition of blood pressure:

Blood pressure is the force or pressure generated by the blood circulation against the walls of arterial blood vessels when the heart pumps blood in the body (Siti, 2018). Blood pressure readings are measured in millimeters of mercury (mmHg) and consist of two main components, namely systolic pressure (pressure when the heart contracts when pumping blood) and diastolic pressure (pressure when the heart muscle is at rest between beats) (Nurhaliza et al., 2021). Blood pressure measurement is an important indicator for assessing the condition of a person's cardiovascular system (Wahyu et al., 2019). Usually, blood pressure readings are in the range of 120/80 mmHg. If blood pressure rises or falls significantly outside of normal, it indicates a disruption of the body's circulatory function (Pebrianti & Astuti, 2021; Yulianti, 2020).

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Factors that affect abnormal blood pressure:

A person's blood pressure can fluctuate and become abnormal due to various factors (both hypertension and hypotension). According to several studies, these factors are divided into two main categories (Suma, 2018; Fitriani et al., 2022):

1. Non-modifiable factors:
   Age: With age, the elasticity of arterial blood vessels decreases, so there is a risk of an increase in blood pressure (Kurnia et al., 2019).
   Gender & Genetics: Hormonal factors and family history of hypertension also influence the risk of blood pressure deviations (Suma, 2018; Kurnia et al., 2019).

2. Modifiable factors:
   Sleep quality and patterns: Lack of sleep or irregular sleep duration can trigger increased activity of sympathetic nerves and stress hormones, which have a direct impact on blood pressure spikes (Fitriani et al., 2022).
   Lifestyle and eating habits: Excessive salt (sodium) consumption, smoking habits, lack of physical activity, and consumption of alcoholic beverages can worsen blood vessel function (Suma, 2018; Rahmayani & Sulaiman, 2021).
   Stress level: Emotional stress triggers the release of the hormones adrenaline and cortisol, which lead to narrowing of blood vessels and an increased heart rate (Rahmayani & Sulaiman, 2021).
   Body mass index (obesity): Being overweight increases the load on the heart when pumping blood to all body tissues (Fitriani et al., 2022).

Association of good sleep patterns with normal blood pressure:

Regular and high-quality sleep patterns play a very important role in maintaining the functioning of the body's organs, especially the cardiovascular system. Physiologically, blood pressure values naturally drop by 10% to 20% in normal sleep conditions compared to the waking state (Lumantow et al., 2016). This drop in blood pressure is caused by reduced activity of the sympathetic nervous system when the body is at rest, so the load on the heart when pumping blood is not as high as during active activity. Therefore, the adequacy of sleep duration and quality play a direct role in maintaining the stability of blood pressure.

On the other hand, poor sleep patterns – such as sleeping too late (staying up late), insufficient sleep duration, or poor sleep quality – can interfere with the natural blood pressure lowering mechanism at night. This condition keeps the body and nervous system active, which ultimately triggers an increase in blood pressure. In adolescence, changes in sleep patterns are often triggered by high school demands, school activities, and the burden of homework, which shortens daily rest time (Saifudin, 2012).

The problem of sleep disorders in the adolescent age group is also a worldwide problem. The World Health Organization (WHO, 2011) reports that the prevalence of sleep disorders among adolescents is quite high. The continuous and chronic lack of sleep can increase the risk of various health problems, including increased blood pressure or high blood pressure at a young age (Nugroho, 2016). Therefore, implementing consistent sleep patterns, sufficient sleep duration (8–9 hours per night), and good sleep quality are very important preventive measures to keep blood pressure within normal limits.

Blood pressure monitor:

The instrument used to measure blood pressure is called a sphygmomanometer or sphygmomanometer. This instrument measures systolic and diastolic blood pressure to determine the condition of a person's cardiovascular system. Generally, sphygmomanometers are divided into two types, namely manual sphygmomanometers slee(aneroids or mercury) and digital sphygmomanometers. Manual sphygmomanometers require a stethoscope to hear Korotkoff sounds, while digital sphygmomanometers work automatically with pressure sensors, making them easier for healthcare professionals and the public to use (Zuhdi et al., 2020).

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In research, the use of a calibrated sphygmomanometer is very important so that the results of blood pressure measurements are accurate and reliable. The accuracy of the measuring instrument affects the quality of the data obtained, making the results of the study more valid (Nugroho et al., 2021).

Types of blood pressure disorders:

Abnormal blood pressure levels in a person can be divided into two main conditions, namely hypertension (high blood pressure) and hypotension (low blood pressure) (Yazid & Harjoko, 2011). These two conditions reflect a disruption of the circulatory system and the work of the heart organ.

High blood pressure is a condition in which a person's blood pressure is consistently above the normal limit, namely the systolic value reaches 140 mmHg or more and/or the diastolic value reaches 90 mmHg or more (JNC 7, 2003; Yazid & Harjoko, 2011). High blood pressure is often referred to as "The Silent Killer" or hidden killer, as it usually does not cause typical symptoms in the early stages and therefore sufferers often do not notice it (Yazid & Harjoko, 2011). Although it is more common in old age, hypertension today also occurs in adolescence, due to poor sleep quality, family history and excessive nutritional value (Shaumi & Achmad, 2019). If chronic hypertension is not treated early, it can trigger serious complications such as coronary heart disease, stroke, and heart failure in adulthood.

Hypotension (low blood pressure) Hypotension is a physiological condition in which blood pressure readings are below the normal range and are generally characterized by systolic pressure below 90 mmHg and diastolic pressure below 60 mmHg (Yazid & Harjoko, 2011). This condition results in a reduction in blood flow and oxygen supply to vital organs, especially the brain. Hypotension sufferers usually experience symptoms such as dizziness, blurred vision, weakness, and loss of consciousness (fainting). Hypotension can be triggered by various factors, such as dehydration, bleeding, impaired effects of the medication, and lack of physical activity.

3. Research Methods

This study uses a quantitative research method with the aim of determining the relationship between sleep patterns and blood pressure in students at Al-Azhar Superior High School Medan. The research was conducted by collecting data on the sleep patterns and quality of the respondents, as well as the results of blood pressure measurements.

The respondents in this study included 50 students from Al-Azhar Superior High School Medan. The observed characteristics of the respondents included age, gender, and class. The respondents consisted of students aged 15, 16, and 17 and came from several classes of Superior XII.

The sleep pattern data was obtained by filling out questionnaires about the sleep habits and quality of the respondents. The observed components included sleep time, effective sleep duration, sleep latency or the time needed to fall asleep, frequency of waking up at night, and subjective sleep quality. Based on these results, the sleep quality of the respondents was categorized into good and poor sleep quality.

The blood pressure data was obtained by measurements with a blood pressure monitor or sphygmomanometer. The measurement results were then grouped into the categories normal/optimal, prehypertension/elevated and grade 1 hypertension.

"The data obtained were then analyzed using univariate and bivariate analyses. Univariate analysis was used to describe respondents' characteristics, sleep patterns, sleep quality, and blood pressure classification in the form of frequency and percentage. In addition, bivariate analysis was performed to determine the relationship between sleep quality and blood pressure using the chi-square statistics test with a significance level of $\alpha = 0.05$. The test results were declared significant when the p-value was below 0.05.

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4. Results and discussion

RESULTS

Table 1. Demographics of Respondents to Al-Azhar Superior High School Students in Medan

Demographics	Frequency(n)	Percentage (%)
Age		
15 years	2	4,0%
16 years	14	28,0%
17 years old	34	68,0%
Gender		
Male	30	60,0%
Female1	20	40,0%
Classes		
XII UG A	12	24,0%
XII UG B	8	16,0%
XII UG C	4	8,0%
XII UG D	7	14,0%
XII UG E	8	16,0%
XII UG F	6	12,0%
XII UG G	5	10,0%
Total	**50**	**100,0%**

Source: Data 2026

Based on Table 1, the majority of respondents belonged to the age group of 17 years, namely 34 people (68.0%), 30 people (60.0%) were male, and the largest proportion of classes came from XII UG A, up to 12 people (24.0%).

Table 2. Overview of Respondents' Sleep Patterns and Quality Components

Components of sleep pattern	Frequency(n)	Percentage (%)
Bedtime		
Normal (<23.00 WIB)	28	56,0%
Staying up late (≥23.00 WIB / late bedtime)	22	44,0%
Effective sleep duration		
Good (>7 hours)	21	42,0%
Sufficient (6–7 hours)	24	48,0%
Less (<6 hours)	5	10,0%
Sleep latency (time it takes to fall asleep)		

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Fast (<15 minutes)	29	58,0%
Moderate (15−30 minutes)	18	36,0%
Extended (>30 minutes)	3	6,0%
Frequency of nocturnal awakenings		
Never	12	24,0%
Rare (1−2 times a week)	33	66,0%
Frequently (>2 times a week)	5	10,0%
Subjective sleep quality		
Excellent	8	16,0%
Good	31	62,0%
Bad	8	16,0%
Very bad	3	6,0%
Total	**50**	**100,0%**

Source: Primary data processed, 2026

Based on Table 2, most respondents started sleeping before 23.00 WIB (56.0%), had an effective sleep duration of 6–7 hours (48.0%), had a sleep latency of < 15 minutes (58.0%), and rated their subjective sleep quality generally in the "good" category (62.0%).

Table 3. Distribution of blood pressure classification and sleep quality

Category variables	Frequency(nwo)	Percentage (%)
Blood pressure classification		
Normal/Optimal (<120/80 mmHg)	23	46,0%
Prehypertension / increased (120−129/<80 mmHg)	16	32,0%
Hypertension grade 1 (≥130/80 mmHg)	11	22,0%
Categories: Final Sleep Quality		
Good sleep quality (good/excellent score)	39	78,0%
Poor sleep quality (poor/very poor score)	11	22,0%
Total	**50**	**100,0%**

Source: Data 2026

Based on Table 3, it can be seen that 23 respondents had normal/optimal blood pressure, 16 people (32.0%) had prehypertension, and 11 people had grade 1 hypertension (22.0%). Overall, 39 people (78.0%) were in the good sleep quality category and 11 people (22.0%) had poor sleep quality.

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Table 4. Results of the analysis of the relationship between sleep quality and blood pressure in students

Sleep quality	Blood pressure			Total n (%)	p-value
	Normal / Optimal n (%)	Prehypertension n (%)	Grade 1 high blood pressure n (%)		
Good	21 (53,8%)	13 (33,3%)	5 (12,8%)	39 (100,0%)	0,012
Bad	2 (18,2%)	3 (27,3%)	6 (54,5%)	11 (100,0%)	
Total	**23 (46,0%)**	**16 (32,0%)**	**11 (22,0%)**	**50 (100,0%)**	

Source: 2026 data (chi-square test, alpha = 0.05)

Based on the results of the Chi-Square Statistical Test in Table 4, a p-value of 0.012 ($p < 0.05$) was determined, showing a significant relationship between sleep quality and blood pressure among students at Al-Azhar Medan Superior High School. Students with poor sleep quality tended to have an increase in blood pressure towards grade 1 hypertension, which was 6 people (54.5%), compared to students with good sleep quality, who were predominantly in the normal blood pressure range of 21 people (53.8%).

DISCUSSION

The results of this study showed that the majority of students at Al-Azhar Medan Superior High School had quite good sleep quality (78.0%), but some students (22.0%) had poor sleep quality and stage 1 hypertension. Based on the chi-square statistic, it was found that there was a significant relationship between the quality of sleep pattern and the stability of blood pressure ($p = 0.012$). Physiologically, the activity of the sympathetic nervous system decreases when a person sleeps in deep sleep, followed by a decrease in heart rate and peripheral blood vessel resistance. This mechanism naturally lowers blood pressure by about 10% to 20% (nocturnal dipping) (Lumantow et al., 2016). In students with sleep disorders, such as staying up late (up to 23.00 WIB) and sleeping for less than 6 hours, this natural drop in blood pressure does not occur. As a result, the sympathetic nervous system remains overly stimulated, triggering the release of the hormones cortisol and adrenaline, leading to a narrowing of blood vessels (vasoconstriction) and an increase in blood pressure above normal (Fitriani et al., 2022). Academic demands, extracurricular activities, and the use of electronic devices (devices) before bedtime in adolescents are the dominant factors that trigger a reduction in effective sleep duration and slower sleep latency. These results are consistent with previous studies showing that adolescents with poor sleep quality have a higher risk of fluctuations in systolic and diastolic blood pressure, which can increase the risk of cardiovascular disease early on if it is chronically long (Zain & Hanif, 2023; Shaumi & Achmad, 2019). Therefore, sleep hygiene interventions and regular rest management are highly recommended for students to maintain optimal cardiovascular health.

5. Conclusions and proposals

Conclusion

From the results of a study conducted on 50 students at Al-Azhar Superior High School Medan, it was found that sleep quality is related to students' blood pressure. The results of the chi-square test showed a p-value of 0.012, which means that the results are significant as they are below 0.05. Out of the 50 respondents, 39 students had good sleep quality, while 11 students had poor sleep quality. In terms of blood pressure, 23 students had normal blood pressure, 16 students had prehypertension, and 11 students had stage 1 hypertension

Looking at the results, students with good sleep quality are more likely to have normal blood pressure. At the same time, students with poor sleep quality are more likely to be included in the category of grade 1 hypertension. From this study, it is clear that good sleep patterns are important because they are related to students' blood pressure.

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Suggestions

For students, sleep time should be paid more attention to and the habit of staying up late should be reduced. The number of tasks, school activities, or the use of gadgets should not make sleep time too short. Adequate and regular sleep can also help the body get a good rest.

For the school, it is hoped that it can provide students with a simple education about the importance of sleep patterns and health. For future research, the research can be conducted with a larger number of respondents and also look at other factors related to blood pressure such as diet, physical activity, and stress.

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