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RELATIONSHIP BETWEEN SLEEP QUALITY AND BLOOD PRESSURE STATUS IN UNDERGRADUATE NURSING STUDENTS

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ABSTRACT
Hypertension is a noncommunicable disease (NCD) that is a major cause of global mortality with a significant prevalence. Poor sleep quality, commonly experienced by students due to academic stress, contributes to hypertension. The purpose of this study is to analyze the relationship between sleep quality and blood pressure status in undergraduate nursing students. The research design was prospective, longitudinal study included 207 undergraduate nursing students in their third, fifth, and seventh semesters at Muhammadiyah University of Surakarta, selected through stratified random sampling. Data were collected in two phases (September - November) using the Pittsburgh Sleep Quality Index (PSQI) questionnaire which had been tested for validity and reliability (Cronbach's Alpha > 0.70) and a digital sphygmomanometer. Analysis used the Generalized Estimating Equation (GEE) with α=0.05. The results showed that most students experienced poor sleep quality in stage 1 (71%) with (45.4%) experiencing prehypertension and in stage 2 (70%) with (51.7%) experiencing prehypertension. There was a significant relationship between sleep quality and blood pressure (Wald $x^2 = 75.72$; $p < 0.001$) with a B coefficient value of -2.185, which resulted in an odds ratio (OR) of 0.113. This indicates that respondents with poor sleep quality were 8 to 9 times more likely to experience higher blood pressure compared to those with good sleep quality. This study proves that poor sleep quality can increase the risk of hypertension in college students.

Keywords: blood pressure; college students; sleep quality

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INTRODUCTION

Noncommunicable diseases (NCDs) are a national concern because they are one of the leading causes of death worldwide (Melizza et al., 2020). Every year, NCDs cause more than 36 million deaths in people under the age of 60, especially those related to cardiovascular disease. Cardiovascular disease occurs due to disruption of the heart and blood vessel system (Reviansyah et al., 2022). One such disease is high blood pressure, also known as hypertension (Faradila et al., 2020). Blood pressure is a measure of the pressure generated by blood flow in the arteries to pump blood throughout the body to reach all tissues in the human body (Subagiartha et al., 2024). Blood pressure plays an important role in the body's circulatory system. However, not all individuals have blood pressure within the normal range, which can cause problems such as hypertension or high blood pressure and hypotension or low blood pressure (Jaleha et al., 2023). A person is considered to have hypertension if their blood pressure exceeds normal blood pressure, which is systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg (WHO, 2023).

Hypertension is a major focus of the government, as this disease is prevalent among the population and has the potential to develop into more serious conditions (Rahayu et al., 2024). The global prevalence of hypertension is estimated to be around 1.13 billion people. A total of 333 million sufferers are in developed countries, while the other 639 million live in developing countries. In developing countries, the highest prevalence is in Africa, reaching 46%, while in Indonesia the prevalence reaches around 34.1% (WHO, 2023). Hypertension or high blood pressure is still one of the leading causes of death in Indonesia. In its development, this disease no longer only affects the

elderly due to degenerative processes, but is also increasingly found in productive age groups (Kholifah et al., 2021). Among people aged 18-39 years, 7.3% have hypertension, while a significant 23.4% of the same age group have prehypertension (Kemenkes RI, 2018). In Central Java, 37.57% of people aged >15 years have hypertension (Dinkes Jateng, 2021). Based on the results of the Indonesian Health Survey (SKI), blood pressure measurements show that 10.7% of people aged 18-24 years have hypertension, and there is an increase of 17.4% in the 25-34 age group, indicating that on average one in five young adults has high blood pressure (Kemenkes, 2023).

Hypertension is also known as the silent killer, because many people with hypertension are unaware of its main causes and its symptoms are rarely noticeable (Ratri et al., 2022). Imbalances in blood pressure, whether too high (hypertension) or too low (hypotension), can potentially cause serious complications (Ellison et al., 2021). Hypertension is strongly associated with the risk of cardiovascular disease, stroke, and kidney disease (Fekadu et al., 2020). Uncontrolled hypertension can increase the risk of stroke by up to seven times, increase the likelihood of congestive heart failure by six times, and increase the risk of heart attack by three times (Joko Tri Atmojo, Lilik Hanifah, 2020). Managing hypertension remains a complex challenge, given that this condition is influenced by various factors in the context of life (Badjuka et al., 2025). Controlling and maintaining normal blood pressure is very important for the health of organs, especially the heart.

Hypertension is generally more common in the elderly, but over time, more and more cases of hypertension are being found in adolescents (Cahyadi et al., 2024). Most causes of hypertension are related to lifestyle, where poor sleep quality can affect blood pressure and trigger severe sleep disorders associated with this condition (Rosyid et al., 2025). Sleep disorders characterized by poor sleep quality can cause increased sleep fragmentation, decreased sleep efficiency, and daytime sleepiness (Trisnowiyanto et al., 2024). Sleep quality is an individual's ability to maintain good sleep and feel satisfied with their sleep (Faradila et al., 2020). The recommended sleep duration for adults is between 7 and 9 hours per night (Hirshkowitz et al., 2015). This duration range is considered ideal for maintaining physical and mental health and optimizing organ function. In addition, sleep quality is also important to ensure that rest is maximized (Shang et al., 2021).

Sleep difficulties are common among young adults, including college students, with many students falling asleep during class due to insufficient sleep. Globally, sleep disorders range from 15.3% to 39.2%. In Indonesia, data shows that most adolescents and young adults experience poor sleep quality, reaching 63%. In Central Java Province, approximately 60% to 70% of students experience serious sleep disorders (Zurrahmi et al., 2021). Poor sleep quality among students is influenced by busy class schedules, heavy workloads, unsupportive environments, and additional activities that cause fatigue and ultimately make it difficult for them to sleep (Nurlan et al., 2022). Students must maintain good sleep quality to prevent diseases at a young age. Lack of sleep causes students to think more slowly, experience memory loss, and have difficulty concentrating. If this continues to occur on a daily basis, it can impact students' learning abilities and reduce their chances of achieving academic success. This condition can also hinder the body's recovery process, making the body more prone to fatigue and increasing the risk of non-communicable diseases such as hypertension, heart disease, and decreased immune function (Ningsih et al., 2023). It is hoped that this study will increase students' knowledge about the importance of maintaining good sleep quality, thereby helping to control blood pressure and overall health. The purpose of this study was to analyze the relationship between sleep quality and blood pressure status in undergraduate nursing students.

METHOD

This study used a prospective longitudinal design to assess changes in sleep quality and blood pressure among students over time. A total of 207 students in their 3rd, 5th, and 7th semesters were

selected using stratified random sampling so that each semester group was proportionally represented, with the exclusion criterion being respondents with a history of hypertension. Data collection was conducted in two stages, in September and November, allowing for continuous monitoring of the respondents' conditions. At each stage, respondents were asked to complete the Pittsburgh Sleep Quality Index (PSQI) questionnaire to assess sleep quality and undergo blood pressure measurements using a digital sphygmomanometer in the morning to ensure more consistent results.

The Pittsburgh Sleep Quality Index (PSQI) questionnaire consists of 19 questions which are then grouped into 7 main assessment components, namely subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and dysfunction in daytime activities. The seven components are assessed using a 0-3 scale, then added up to a total score ranging from 0-21. A score ≤ 5 indicates good sleep quality, while a score >5 indicates poor sleep quality. The instrument was tested for reliability with a Cronbach's Alpha value of 0.83 (>0.70), indicating that the instrument is suitable for use. The Omron Type HEM-7121J digital sphygmomanometer with serial number 202410050791V1 used in this study was calibrated at BPAFK Surakarta with order number 25.083/LAB.038 and declared fit for use on February 19, 2025. Blood pressure classification in this study used the JNC 7 guidelines to determine the blood pressure status of students. Data analysis was performed using the Generalized Estimating Equation (GEE) method to examine the relationship between sleep quality and blood pressure, taking into account repeated measurements in the same individuals. The entire statistical analysis process applied a significance level (α) of 0.05 as the basis for determining statistically significant results. This study is expected to provide a comprehensive overview of sleep quality patterns and their implications for blood pressure among undergraduate nursing students at Muhammadiyah University Surakarta. This study has obtained ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, UMS, and has been declared feasible to be carried out with the number: No. 5721/B.1/KEPK-FKUMS/VI/2025.

RESULT

Table 1.
Respondent characteristics (n= 207)

Respondent characteristics	f	%
Age		
18 - 20	131	63
21 - 23	76	37
Gender		
Female	177	85.5
Male	30	14.5
Semesters		
Semesters 3	63	30.4
Semesters 5	72	34.8
Semesters 7	72	34.8

The characteristics of the respondents in table 1 show that most respondents were aged 18–20 years, accounting for 131 individuals (63%). Based on gender, the majority of respondents were female, with 177 individuals (85.5). In terms of semester level, respondents were mostly in semester 5 and semester 7, each consisting of 72 individuals (34.8%), followed by semester 3 with 63 individuals (30.4%). These findings indicate that the respondents were predominantly young adults, female, and distributed relatively evenly across semesters 5 and 7. Based on table 2, sleep quality in stage 1 shows that the majority of respondents had poor sleep quality, with 147 respondents (71.0%), which decreased slightly in stage 2 to 145 respondents (70.0%), while good sleep quality increased from 60 respondents (29%) to 62 respondents (30%). Blood pressure status also changed, with the normal category decreasing from 44.9% to 40.1%, while prehypertension increased from 45.4% to 51.7%. The proportion of stage 1 hypertension remained relatively stable from 7.2% to 7.7%, and stage 2 hypertension decreased from 2.4% to 0.5%.

Table 2.
Variable Analysis (n=207)

Variables	Stage 1		Stage 2	
	f	%	f	%
Sleep Quality				
Good	60	29	62	30
Poor	147	71	145	70
Blood Pressure Status				
Normal	93	44.9	83	40.1
Prehypertension	94	45.4	107	51.7
Stage 1Hypertension	15	7.2	16	7.7
Stage 2 Hypertension	5	2.4	1	0.5

Table 3.
Relationship Between Sleep Quality and Blood Pressure (n=414)

Variabel	B (estimate)	SE	Wald x^2	p-value	OR (e^B)	95% Cl
Sleep Quality (Poor vs Good)	-2.185	0.251	75.72	< 0.001	0.113	0.07-0.18

Based on Table 3, using the GEE analysis test, it can be seen that sleep quality has a significant relationship with blood pressure with a value of (Wald $x^2 = 75.72$; $p < 0.001$). The B coefficient value of -2.185 produces an OR value of 0.113, which means that respondents with poor sleep quality are approximately 8 to 9 times more likely to be in the higher blood pressure category compared to respondents who have good sleep quality (OR <1 indicates an increased risk).

DISCUSSION

Characteristics of nursing students

Based on the univariate analysis the characteristics of respondents in stages 1 and 2 were most respondents were aged 18 - 20 years, totaling 131 individuals (63%), while those aged 21 - 23 years accounted for 76 individuals (37%). This is in line with previous research, which found that 56.3% were aged 18–20 and 43.7% were aged 21–23. These ages reflect the typical ages of university students (Hayeeteh et al., 2023). In terms of gender, the majority of respondents were female, with 177 individuals (85.5%), whereas males comprised 30 individuals (14.5%). Regarding semester level, most respondents were from semester 5 and semester 7, each consisting of 72 individuals (34.8%), followed by semester 3 with 63 individuals (30.4%). These findings indicate that the respondents were predominantly early adults, female, and enrolled in middle to final semesters.

Sleep Quality

The results of the study show that most respondents had poor sleep quality in stage 1 (71%) and stage 2 (70%). These findings are in line with previous studies which state that more than 60% of students experience sleep disorders due to academic workload and stress (Zurrahmi et al., 2021). This condition is reinforced by the respondents' statements when filling out the questionnaire, where many admitted to having difficulty sleeping due to doing assignments, studying late into the night, overthinking, anxiety, playing games, and consuming coffee before bed. These factors are common triggers that can prolong sleep latency and decrease sleep efficiency according to the PSQI.Excessive smartphone use and stress can trigger insomnia in students (Ningsih et al., 2023). This is relevant to the findings of this study, given that several respondents cited gaming and overthinking as the main reasons for their difficulty sleeping. Additionally, caffeine consumption, such as coffee, can increase sympathetic nervous system activity, thereby hindering the relaxation process before sleep, as explained (Hirshkowitz et al., 2015). The poor sleep quality experienced by respondents is a consequence of academic, psychological, behavioral, and stimulant consumption factors.

Blood Pressure

This study shows changes in blood pressure distribution between stage 1 and stage 2, where the normal category decreased from 44.9% to 40.1%, while the prehypertension category increased

from 45.4% to 51.7%. These results are consistent with previous studies that found that college students and young adults are prone to increased blood pressure due to unhealthy lifestyles, including lack of sleep, stress, and irregular physical activity (Atmojo et al., 2020; Jaleha et al., 2023). Increased blood pressure at a young age needs to be addressed as it is the beginning of the process of developing hypertension later in life. The students in this study were in the young adult age range (18–23 years), where blood pressure is greatly influenced by lifestyle, academic workload, lack of sleep, caffeine consumption, and psychological stress. The surge in prehypertension found indicates an early risk of cardiovascular health disorders even though the subjects had no history of hypertension (WHO, 2023).

The Relationship Between Sleep Quality And Blood Pressure Status

Analysis using GEE shows that sleep quality has a significant relationship with blood pressure ($p < 0.001$). An OR value of 0.113 indicates that respondents with poor sleep quality have an 8–9 times greater risk of being in the higher blood pressure category compared to respondents with good sleep quality. These findings are consistent with studies stating that poor sleep quality is associated with increased blood pressure in adolescents and adults (Faradila et al., 2020; Subagiartha et al., 2024; Widya Kusumaningrum, 2020). Physiologically, poor sleep quality causes activation of the sympathetic nervous system and increased levels of stress hormones such as cortisol, which can trigger vasoconstriction and increased blood pressure. This is consistent with the theory that chronic sleep disturbance can increase the risk of hypertension through neuroendocrine and inflammatory dysregulation (Shang et al., 2021). When students experience sleep deprivation due to assignments, anxiety, overthinking, gaming, or consuming coffee before bed, the body does not get optimal recovery. As a result, blood pressure remains high in the morning and can trigger prehypertension or early-stage hypertension. The results of this study are also consistent with international studies showing that sleeping less than 7 hours per day and poor sleep quality are associated with increased blood pressure in young adults.

CONCLUSION

Based on the results of the Generalized Estimating Equation (GEE) analysis, sleep quality was found to have a significant relationship with blood pressure (Wald $x^2 = 75.72$; $p < 0.001$). The B coefficient value of -2.185 produces an OR value of 0.113, which means that respondents with poor sleep quality are approximately 8 to 9 times more likely to be in the higher blood pressure category compared to respondents who have good sleep quality. This study proves that poor sleep quality can increase the risk of hypertension in college students.

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