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The Relationship Between Sleep Patterns and Physical Activity with Changes in Blood Pressure Among Hypertensive Patients

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Hipertensi merupakan salah satu masalah kesehatan kronis yang masih menjadi perhatian utama di Indonesia. Kondisi ini sering dipengaruhi oleh gaya hidup, seperti pola tidur yang tidak teratur dan kurangnya aktivitas fisik, yang dapat meningkatkan tekanan darah dan memperburuk fungsi sistem kardiovaskular. Penelitian ini bertujuan untuk mengetahui hubungan antara pola tidur dan aktivitas fisik terhadap perubahan tekanan darah. Metode yang digunakan adalah pendekatan kuantitatif dengan desain *cross-sectional*. Sampel terdiri dari penderita hipertensi berusia ≥18 tahun yang dipilih melalui teknik *simple random sampling*. Instrumen penelitian meliputi kuesioner *Pittsburgh Sleep Quality Index* (PSQI), *Global Physical Activity Questionnaire* (GPAQ), dan alat pengukur tekanan darah. Analisis data dilakukan dengan uji *chi-square*. Hasil menunjukkan bahwa 51,6% responden memiliki pola tidur baik dan 48,4% buruk sedangkan 60% melakukan aktivitas ringan dan 40% sedang. Terdapat hubungan yang sangat signifikan antara pola tidur dan aktivitas fisik terhadap perubahan tekanan darah (p=0,000). Kesimpulan: Pola tidur dan aktivitas fisik berpengaruh signifikan terhadap tekanan darah. Temuan ini dapat menjadi dasar bagi program promosi kesehatan di Puskesmas untuk mendorong intervensi gaya hidup sehat pada penderita hipertensi.

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The Relationship Between Sleep Patterns and Physical Activity with Changes in Blood Pressure Among Hypertensive Patients

Hypertension is one of the chronic health problems that remains a major concern in Indonesia. This condition is often influenced by lifestyle factors, such as irregular sleep patterns and lack of physical activity, which can elevate blood pressure and worsen cardiovascular function. This study aims to examine the relationship between sleep patterns and physical activity with changes in blood pressure. A quantitative approach with a cross-sectional design was used. The sample consisted of hypertensive patients aged ≥18 years, selected using a simple random sampling technique. Research instruments included the Pittsburgh Sleep Quality Index (PSQI), the Global Physical Activity Questionnaire (GPAQ), and a blood pressure monitor. Data were analyzed using the chi-square test. Results showed that 51.6% of respondents had good sleep quality, while 48.4% had poor sleep quality; 60% engaged in light physical activity and 40% in moderate activity. A highly significant relationship was found between sleep patterns and physical activity with changes in blood pressure (p=0.000). Conclusion: Sleep patterns and physical activity significantly affect blood pressure. These findings can serve as a foundation for health promotion programs at community health centers to encourage healthy lifestyle interventions for individuals with hypertension

Introduction

Hypertension is one of the leading causes of death in the world and is known as the "silent killer" because it often does not show obvious symptoms and causes serious complications such as stroke, kidney failure, and heart disease (Tutoli et al., 2021). In Indonesia, although the prevalence of hypertension shows a decrease from 34.1% (Riskesdas 2018) to 30.8% (SKI 2023) (Health Development Policy Agency, 2023). The incidence rate remains high, especially in the Central Jakarta area which reaches 39.05% (Purwaningtyas et al., 2023). Data from the Senen Health Center recorded 3,499 cases of hypertension throughout 2024, indicating the need for a more comprehensive approach in handling it. Risk factors for hypertension are divided into two categories, namely those that cannot be controlled such as age and genetics, and those that can be modified such as diet, smoking habits, alcohol consumption, sleep patterns, and physical activity (Sembiring, 2024). Two aspects of lifestyle that are often overlooked but have a significant influence on blood pressure are sleep patterns and physical activity. Sleep disorders can increase stress hormones such as cortisol and adrenaline, which trigger vasoconstriction and increased blood pressure (Purnamasari & Kurniawati, 2024). Meanwhile, lack of physical activity contributes to decreased elasticity of blood vessels and increased peripheral resistance (Abdurrosidi et al., 2021).

A number of previous studies have examined the relationship between sleep patterns and blood pressure, as well as physical activity to hypertension separately. However, there are still limited studies that simultaneously examine these two variables in a single framework of analysis of changes in blood pressure. This research is here to fill this gap with an integrative approach that combines the two main lifestyle variables of sleep patterns and physical activity in one analysis model. The novelty of this study lies in the use of standardized instruments such as *the Pittsburgh Sleep Quality Index* (PSQI) and *the Global Physical Activity Questionnaire* (GPAQ), which increase the validity of the results and make a scientific contribution to the development of promotive and preventive strategies. The main objective of this study was to analyze the relationship between sleep patterns and physical activity on changes in blood pressure in hypertensive patients. Researchers believe that a non-pharmacological approach through lifestyle modification has great potential in stabilizing blood pressure and preventing

complications, so the results of this study are expected to be the basis for more effective and sustainable health interventions.

Method

This finding was realized through a quantitative study accompanied by *a cross-sectional design* conducted at the Senen Health Center, Central Jakarta. The population of this study included 2,137 hypertensive patients. From this population, as many as 95 patients were selected as research samples using *the simple random sampling* method , based on the inclusion criteria, namely ≥18 years old and who were willing to become respondents. The instruments adopted on these findings include *the Pittsburgh Sleep Quality Index* (PSQI) on sleep patterns, where a score of <5 is categorized as a good sleep pattern and >5 as a poor sleep pattern. In addition, the *Global Physical Activity Questionnaire* (GPAQ) was also used for physical activity, accompanied by the category of light physical activity < 600 MET, moderate physical activity ≥ 600 - < 3000 MET 3, and heavy physical activity: ≥ 3000 MET. Data analysis was realized univariate to understand demographic data and the distribution of research variables, as well as bivariate by utilizing *the Chi-Square* test to identify the relationship between these variables.

Research Results

Table 1. Age Frequency Distribution

Age Group	Frequency	Percentage (%)
18 – 40 Years	14	14.7
41 – 60 Years	50	52.6
>60 Years	31	32.6
Total	95	100

Based on the data presented in the table above, the majority of respondents were in the age group of 41 to 60 years, which accounted for 52.6% of the total sample.

Table 2. Gender Frequency Distribution

Gender	Frequency	Percentage (%)
Male – Male	29	30.5
Women	66	69.5
Total	95	100

Based on the data presented in the table above, the majority of respondents were women, with a total of 66 people (69.5%), while male respondents were 29 people (30.5%).

Table 3. Job Frequency Distribution

Employment Status	Frequency	Percentage (%)
Not Working/IRT	62	65.3
Work	33	34.7
Total	95	100

Based on the data presented in the table above, the majority of respondents are Non-Employed / Housewives (IRT), with a total of 62 people (65.3%). Meanwhile, only 33 respondents (34.7%) were employed.

Table 4. Educational Frequency Distribution

Education	Frequency	Percentage
No School	3	3.2
SD	18	18.9
SMP	19	20.0
High School/Vocational School	47	49.5
D3	3	3.2
S1	4	4.2
S3	1	1.1
Total	95	100

Based on the data presented in the table above, the most common level of education among respondents were high school/vocational school graduates, accounting for 49.5% of the total respondents.

Table 5. Frequency Distribution of Marriage Status

Marital Status	Frequency	Percentage (%)
Unmarried	7	7.4
Married	88	92.6
Total	95	100

Based on the data presented in the table above, most of the respondents, namely 92.6% are married, while only 7.4% of respondents are unmarried.

Table 6. Frequency Distribution of Sleep Patterns

Sleep Pattern Categories	Frequency	Percentage (%)
Good	49	51.6
Bad	46	48.4
Total	95	100

Based on the data presented in the table above, the distribution between good and bad sleep patterns shows an almost even balance. As many as 51.6% of respondents reported having good sleep patterns, while another 48.4% experienced poor sleep patterns.

Table 7. Frequency Distribution of Physical Activity

Physical Activity Categories	Frequency	Percentage (%)
Light Activity	57	60.0
Strenuous Activity	38	40.0
Total	95	100

Based on the data presented in the table above, the majority of respondents, namely 60%, were only involved in light activities, while the other 40% did physical activity with moderate intensity.

Table 8. Blood Pressure Frequency Distribution

Blood Pressure Categories	Frequency	Percentage (%)
No Hypertension	42	44.2
Hypertension	53	55.8
Total	95	100.0

Of the total 95 respondents involved in this study, it was identified that as many as 53 people (55.8%) had hypertension, while 42 people (44.2%) were classified as not experiencing hypertension.

Table 9. The Relationship between Sleep Patterns and Changes in Blood Pressure

Sleep Patterns	No Hypertension	Hypertension	Total
Good	8	41	49
Bad	34	12	46
Total	42	53	95

Based on the results of the data analysis that has been carried out, there is an interesting relationship between sleep patterns and blood pressure among the respondents studied. Of the total 49 respondents who had good sleep patterns, a total of 41 individuals (88.7%) were diagnosed with hypertension, while only 8 individuals (16.3%) did not have hypertension. On the other hand, of the 46 respondents who showed poor sleep patterns, the majority, namely 34 people (73.9%), had blood pressure in the normal category (not hypertension), while 12 people (26.1%) had hypertension.

Table 10. Results of *Chi*-Square *Test* of Sleep Patterns with Changes in Blood Pressure

Statistical Test	Value	df	Sig. (2-sided)
Person Chi-Square	31,900	1	0.000
Continuity Correction	29,608	1	0.000
Likelihood Ratio	34,002	1	0.000
Fisher's Exact Test	-	-	0.000
Linear-by-Linear Association	31,564	1	0.000
N of Valid Cases	95		

Based on the results of data analysis carried out on 95 respondents, it was found that there was a significant relationship between sleep patterns and blood pressure. The results of the *Chi-Square* test showed a *Pearson Chi-Square* value of 0.000 ($p < 0.05$), showing a statistically significant relationship between the two variables. Only a small fraction of the group had poor sleep patterns that showed normal blood pressure.

Table 11. The Relationship between Physical Activity and Changes in Blood Pressure

Physical Activity	No Hypertension	Hypertension	Total
Lightweight	6	51	57
Medium	36	2	38
Total	42	53	95

Based on the results of data analysis, it shows that most of the respondents involved in mild physical activity have hypertension, with a percentage of 89.5%. On the other hand, the majority of respondents who undergo physical activity in the moderate category tend to have normal blood pressure, with a proportion of 94.7%.

Table 12. Results of *Chi-Square* Test of Physical Activity with Changes in Blood Pressure

Test Type	Value	df	Sig. (Asymp. Sig. 2-sided)
Pearson Chi-Square	65.553	1	0.000
Continuity Correction	62.183	1	0.000
Likelihood Ratio	76.390	1	0.000
Fisher"s Exact Test	-	-	0.000
Linear-by-Linear Association	64.863	1	0.000
N of Valid Cases	95		

Based on the results of data analysis carried out on 95 respondents, it was found that there was a significant relationship between physical activity level and blood pressure. The results of the *Chi-Square* test showed a *Pearson Chi-Square* value of 0.000 ($p < 0.05$), indicating that a statistically significant relationship was found between the two related variables. Thus, it can be said that a person's level of physical activity has a significant influence on the condition of his blood pressure.

Discussion

Analysis of characteristics by age

The results of the statistical test showed that the majority of respondents in this finding were between 41-60 years old, which was 50 people (52.6%) out of a total of 95 respondents. These findings are in line with several previous studies. For example, Tamamilang et al. (2018) *found* that the majority of respondents aged 46–55 years (42.3%) in the study on age and physical activity were against hypertension. Furthermore, Numaryati & Kaswari (2020) reported that the > age group of 65 years had the highest proportion (45%) of the total 20 respondents in a study on the effectiveness of DASH dietary counseling. The findings of Liambo et al. (2021) also show that individuals aged > 45 years have a higher risk of feeling high blood pressure than those aged 18–44 years.

In general, individuals over the age of 40 actually experience an increase in blood pressure. This phenomenon can be explained by the physiological processes that occur, where the arteries experience stiffness and thickening as a result of *arteriosclerosis*. This condition results in the heart having difficulty pumping blood, because the arteries that pass through cannot expand properly (Widyanto & Triwibowo, 2021). Therefore, increasing education about stress

management, healthy diet, and increasing physical activity among this age group plays a crucial role as a promotive and preventive measure against hypertension.

Analysis of characteristics by gender

The results of the statistical test showed that the majority of respondents were women (69.5%). These findings are consistent with the research of Maskanah et al. (2019), which also reported the majority of female respondents (82.1%), as well as the study of Affandi (2022) which showed a female percentage of 71.7%.

In menopausal women, a decrease in the hormone estrogen and an increase in androgens triggers various changes in the body. This activates the system *renin-angiotensin* and increase hormones *angiotensin II* and *endotelin*, which causes the blood vessels to narrow (Widiatmika, 2015). Therefore, health interventions aimed at women with a gender-based approach are urgently needed, such as education on heart health, stress management, increased physical activity, and regular blood pressure monitoring in primary health care facilities.

Job-Based Characteristics Analysis

The results of the statistical test showed that the majority of respondents did not work or had the status of housewives (65.3%). These findings are in line with the findings of Abdurrosidi et al. (2021), Ekaningrum (2021), and Akbar et al. (2020), which also show that the majority of hypertension sufferers come from the non-working group.

Both non-working and non-working individuals can statistically experience weight gain, which contributes to an increase in blood fat levels, or what is known as *Hyperlipidemia*. This condition can result in decreased blood circulation, which in turn reduces blood flow. This decrease in blood flow can lead to a buildup of athermose plaque in the blood vessels, potentially resulting in narrowing of the blood vessels (*Aterosclerosis*). As a result, the heart pump works faster and blood pressure increases (Medical, 2019). Therefore, it is crucial for this group to maintain physical fitness through regular light to moderate physical activity, such as walking, cleaning, or morning exercises, to help stabilize blood pressure and prevent further complications.

Analysis of characteristics based on education

The results of the statistical test showed that the majority of respondents had the last high school/vocational education (49.5%). These findings are consistent with studies by Simanjuntak & Hasibuan (2022), Eliani et al. (2022), and Gaol & Simbolon (2022), which both found that the majority of hypertension patients have a secondary level of education.

Higher levels of education are associated with a better understanding of hypertension and the complications that may arise as a result. This encourages individuals to be more actively seeking information about ways to control and prevent hypertension. However, having a high level of education is not enough, as is being treated with proactive behavior and full awareness of hypertension control. Thus, individuals will be better able to take real actions in daily life in the management of hypertension conditions real actions in daily life to manage hypertension conditions effectively (Tawangharjo & Grobogan, 2018). Therefore, a responsive health communication strategy and educational materials that are in accordance with public understanding are needed to encourage real action and improve overall health.

Analysis of Characteristics Based on Marital Status

The results of the statistical test showed that the majority of respondents in this study were married, namely 88 people (92.6%). These findings are in line with the findings of Widiyaningsih (2021), research at the Karang Kitri Health Center, as well as studies by Utama, Sari, & Ningsih (2021), which also showed that most hypertension sufferers are married individuals. After entering married life, relationships in the household can often be stressful, especially for women, who tend to rely more on emotions in dealing with situations. This is caused by various problems and unfulfilled expectations regarding their husbands, children, or even themselves. This dissatisfaction can lead to feelings of disappointment, sadness, anger, as well as various other emotions (Khansa et al., 2023).

Therefore, health education and promotion programs in primary services should not only target physical aspects, such as diet and physical activity, but should also include psychological aspects, such as stress management, relaxation techniques, and couples counseling. This comprehensive approach is very important so that hypertension control efforts can be more effective and sustainable.

Analysis of characteristics based on sleep patterns

The results of the statistical test on sleep patterns were divided into 2 categories with the results obtained by the majority of respondents showing poor sleep patterns, with a total of 46 respondents (48.4%), while 49 respondents (51.6%) had good sleep patterns. This finding is similar to research conducted by Purnamasari and Kurniawati (2024) showing that the distribution between good and bad sleep patterns is almost balanced. The results of the study found a significant relationship between sleep patterns and the incidence of hypertension. Related results are in line with the findings by Madeira et al (2019) that almost all elderly people as many as 33 people (78.6%) have disturbances in their sleep patterns. In the study, Devi et al (2019) also showed that 50% or 15 people have increased sleep pattern disorders.

Lack of rest time and sleep pattern disruptions, including disruption of the NREM and REM cycles, can trigger an increase in stress hormones such as norepinephrine and cortisol, leading to narrowing of blood vessels and increased blood pressure. Long-term sleep disorders also disrupt circadian rhythms and activate the sympathetic nervous system continuously. Poor sleep patterns, insomnia, and sleep apnea also contribute to hypertension. Therefore, adequate and quality sleep is important to keep blood pressure stable (Subagiartha et al., 2024). Therefore, health promotion in primary services such as health centers needs to emphasize the importance of sleep management, including education on healthy sleep routines, reducing the use of devices before bed, and stress management. This approach is expected to help control blood pressure and improve the quality of life of people with hypertension.

Analysis of characteristics based on physical activity

The results of the statistical test showed that the majority of respondents (60%) had mild physical activity, which is at risk for hypertension, according to the findings of Sabila & Sari (2023), Karim et al. (2018), and Sumarni et al. (2019). Physical activity plays an important role in controlling blood pressure, because lack of movement can increase heart rate, heart workload, and the risk of obesity that triggers hypertension. People with hypertension are recommended to do light exercise such as brisk walking, gymnastics, or cycling for 30–60 minutes, five times a week, as well as strength training 2–3 times a week. Exercise should be adapted to physical conditions and accompanied by warm-up and cooling to prevent injury (Triyanto, 2014).

Therefore, it is emphasized that the low physical activity of respondents needs attention in controlling hypertension. Passive lifestyles are often overlooked as a risk factor. Educational and motivational interventions, such as joint gymnastics, counseling at posbindu, and the role of health cadres, are considered effective in encouraging physical activity, especially in adults and the elderly. The integration of physical activity in the daily routine is expected to help control blood pressure and prevent complications.

Characteristic analysis Based on Blood Pressure

The results of the statistical test showed that the majority of respondents (55.8%) had high blood pressure. This is in line with the findings of Nasution (2024) which shows that physical activity and sleep patterns are significantly related to hypertension. Other research by Wedri et al. (2021) and Mohd Luthfi (2017) also supports the relationship between physical activity and sleep quality and blood pressure.

Changes in blood pressure are a crucial indicator in evaluating an individual's cardiovascular health condition. Blood pressure can fluctuate due to a variety of factors, including physical activity, sleep patterns, stress levels, age, weight, and high-sodium food consumption. An increase in blood pressure usually occurs when the blood vessels are narrowed or when the volume of blood pumped by the heart increases, which causes the workload of the heart to become heavier. In addition, an imbalance between the sympathetic and parasympathetic nervous systems can interfere with the normal regulation of blood pressure (Sari et al., 2022). Therefore, continuous education is needed through regular counseling, family involvement, and community-based healthy lifestyle promotion to increase awareness of blood pressure control and reduce hypertension rates and their complications.

The results of bivariate analysis showed a very significant relationship between sleep patterns and physical activity on changes in blood pressure in people with hypertension. Respondents with poor sleep patterns tended to have higher blood pressure than those with good sleep patterns, although the percentage difference was less striking. This is in line with the findings of Purnamasari & Kurniawati (2024), who explain that sleep disorders can increase

stress hormones such as cortisol and adrenaline, trigger vasoconstriction, and contribute to increased blood pressure.

On the other hand, physical activity shows a stronger influence. Respondents who only did light physical activity had a much higher prevalence of hypertension than those who did moderate physical activity. These findings support the studies of Abdurrosidi et al (2021) and Makawekes et al (2020), which emphasize the importance of activity intensity in maintaining vascular elasticity and lowering peripheral resistance. This study fills a gap from previous studies that tended to examine sleep patterns and physical activity separately. With an integrative approach and the use of standardized instruments such as PSQI and GPAQ, the results of this study have strong validity and make a scientific contribution to the development of promotive and preventive strategies for hypertension in primary health services.

Conclusion

This study shows that there is a significant relationship between sleep patterns and physical activity on changes in blood pressure in people with hypertension. Respondents with poor sleep patterns and light physical activity tended to have higher blood pressure than those who had good sleep patterns and did moderate physical activity. These findings confirm that these two aspects of lifestyle together have an effect on blood pressure stability. Therefore, the management of hypertension is not enough only through pharmacological approaches, but it needs to be accompanied by lifestyle interventions that include improved sleep patterns and physical activity. The results of this study are expected to be the basis for health promotion programs in primary services, such as health centers, to design more comprehensive and sustainable education and intervention strategies in efforts to prevent and control hypertension.

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