THE RELATIONSHIP OF PHYSICAL ACTIVITY AND SLEEP QUALITY TOWARD HYPERTENSION PREVALENCE IN SUMBERNGEPOH VILLAGE, MALANG, INDONESIA

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ABSTRACT

Hypertension is the highest among non-communicable diseases in Indonesia and the world, with prevalence showing an increase yearly. One of the determinants is having health-risk behaviors such as low levels of physical activity and sleep quality. These risk factors also have a relationship with hypertension in rural areas. This study aims to find the relationship between physical activity, poor sleep quality, and the prevalence of hypertension in Sumberngepoh, Lawang, Malang, Indonesia. This was a case-control study involving a population of Sumberngepoh Village residents older than 18 years old. The assessment of physical activity was measured using the Indonesian Ministry of Health's PTM cohort study questionnaire. The sleep quality was measured using the IFLS-5 questionnaire. Data analysis was performed using SPSS version 27 with univariate analysis using the Chi-square test with a significance value of <0.05. If the expected value was <5, Fisher's exact test was used. logistic regression test was employed for the multivariate analysis. The level of physical activity was significantly related to hypertension (p<0.05). However, the sleep quality was not significantly related to hypertension (p>0.05). Multivariate analysis showed that the level of physical activity was significantly related to hypertension, with an odds ratio of moderate to strenuous physical activity of 0.134. The prevalence of hypertension was significantly related to the level of physical activity in the age group more than 18 years old in Sumberngepoh, Lawang, Malang, Indonesia.

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INTRODUCTION

Hypertension is the most common non-communicable disease in Indonesia and around the world. Most hypertension patients do not experience any remarkable symptoms. However, it can reduce blood perfusion in human organs if the disease is not managed properly[1]. As a result, hypertension patients can experience several complications, such as stroke, heart failure, and kidney failure. The prevalence of hypertension also increases with age, with the highest prevalence found in the elderly group[2].

Hypertension is a threatening disease, but the prevalence trends in Indonesia tend to increase every year. According to Riskesdas (2018)[2], the prevalence of hypertension in 2007 reached 31.7% and increased by 34.1% in 2018. However, the prevalence of hypertension diagnosed by the doctor was only 8.36%, and those taking medication were 8.84%. Meanwhile, the prevalence of hypertension in East Java is higher than the prevalence of national hypertension, which was 36.32% in 2018. In our primary survey in Sumberngepoh Village, Lawang, Malang, Indonesia, we interviewed 30 respondents, and 44.4% of them had hypertension. Targeting at-risk groups is needed to reduce the disease's prevalence.

One of the determinants of hypertension is health risk behaviors such as lack of physical activity, poor sleep quality, unhealthy eating patterns, and coffee-drinking habits. These behaviors are also reported to cause high levels of hypertension in rural areas[3]. However, this behavior can be modified independently to prevent the incidence and progression of hypertension.

Doing physical activity refers to all movement, whether in one's spare time, traveling from one place to another, or as part of one's job. Ideally, humans do moderate intensity for 150-300 minutes per week or 75-150 minutes for strenuous intensity[4]. The benefits of these exercises include reducing peripheral resistance and sympathetic nerve activity and increasing the diameter of the lumen of the arteries[5]. Therefore, moderate to strenuous physical activity is a protective factor against hypertension[6].

Meanwhile, the relationship between sleep activity and the incidence of hypertension is still being debated. Nugroho et al's study (2020)[7] showed a significant relationship, but Li et al's study (2019)[8] did not show significant results. Sleep disorders can affect the incidence of hypertension through increased inflammatory mediators and sympathetic nerve activity. However, this sleep disorder can be subjective because the consideration is mostly based on the experience and quality of each individual[9].

Based on the above literature, we proposed the hypothesis there is a relationship between physical activity and sleep quality toward hypertension prevalence in Sumberngepoh Village, Malang, Indonesia. The aim of this study is to determine patient demographics and the relationship between the variables studied.

MATERIALS AND METHODS

This research was an analytic observational study using the case-control study method. The population was the residents of Sumberngepoh Village, Lawang District, Malang City, Indonesia aged ≥18 years. This research received approval from the Health Research Ethics

Committee (KEPK) Faculty of Medicine, Airlangga University, on February 20 2023 with letter number No.51/EC/KEPK /FKUA/2023.

The inclusion criteria for the case group were hypertension sufferers who were diagnosed based on the medical records of local health workers and had high blood pressure at the time of measurement by researchers (systolic ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg). The exclusion criteria for the case group are as follows: having a history of comorbid diseases such as diabetes mellitus, coronary heart disease, or stroke, and taking long-term sleeping pills or sedatives. On the other hand, the inclusion criteria for the control group were residents who had never been diagnosed with hypertension by a local health professional or whose blood pressure was normal at the time of measurement by the researchers (systolic pressure <140 mmHg and diastolic pressure <90 mmHg). The exclusion criteria for the control group was taking long-term sleeping pills or sedatives.

The sample size in this study used Fleiss et al (1980)[10] formula with a case group to control group ratio of 1:2. The minimum sample for the case group was 7 people, and the control group had 14 respondents. The sampling technique used a non-probability method, namely the consecutive sampling. Samples from the case group were collected from secondary data owned by local village health workers. Primary data were obtained through interviews according to questionnaires and by measuring blood pressure. The physical activity questionnaire used the 2018 Riskesdas cohort study questionnaire for PTM (Non-communicable Diseases)[11]. Answers from respondents were converted into METs (metabolic equivalents of tasks) and were grouped according to the level of physical activity. Meanwhile, the questionnaire for sleep quality used the 2014 Indonesian Family Life Survey (IFLS) questionnaire on Book IIIB page 23, section TRD[12]. Both of these questionnaires have been used extensively by national agencies for health administration and research.

The data was analyzed using SPSS version 27 and presented as descriptive and analytical data. The univariate analysis test used a Chi-square test with a significance value of <0.05. If the expected value < 5, we employed Fisher's exact test. Meanwhile, the multivariate analysis test used a regression logistic test with a significance value consideration of <0,05.

RESULTS

The total number of initial respondents was 32. However, in the hypertension case group, there was one sample included in the exclusion criteria due to having (having a history of comorbid diseases), so the total final sample was 31 respondents, with 11 respondents in the control group and 20 respondents in the case group.

Table 1 shows that most of the respondents are female. The age ranged from 31 to 100 years old, with a normal data distribution. The average age of the respondents was 53. Based on the level of education, most of the respondents had a low level of education, with the highest proportion being in the elementary school group (54.8%). Meanwhile, the highest proportion of occupation groups were laborers (mostly shuttlecock workers) (38.7%) and housewives (32.3%).

Table 1. Characteristics of Respondents

Variable	Frequency (n)	Percentage (%)
Gender		
Man	5	16.1%
Female	26	83.9%
Age		
<53 y.o	15	48.3%
>53 y.o	16	51.6%
Education Status		
Uneducated	2	6.5%
Elementary school	17	54.8%
Junior high school	9	29.0%
Senior high school	3	9.7%
Occupation		
Laborer	12	38.7%
Traders	3	9.7%
Housewives	10	32.3%
Unemployed	5	16.1%
Farmer	1	3.2%
Total	31	100%

Tabel 2. The Relationship of Physical Activity to Hypertension

Physical Activity	Normo-tension	Hyper-tension	P value
Mild	5 (25.0%)	8 (72.7%)	0.014
Moderate to Strenuous	15 (75.0%)	3 (27.3%)	
Total	20 (100.0%)	11 (100.0%)	

Table 2 shows that the proportion of hypertension in this study is higher in the group of mild-intensity physical activity (72.7%). Meanwhile, the proportion of non-hypertension patients was higher in the group of moderate-severe intensity physical activity (75.0%). The relationship between the level of physical activity and hypertension was significant (p <0.05).

Table 3. The Relationship of Sleep Quality to Hypertension

Sleep Quality	Normo-tension	Hyper-tension	P value
Good	8 (40.0%)	2 (18.2%)	0.202
Less	12 (60.0%)	9 (81.8%)	
Total	20 (100.0%)	11 (100.0%)	

Table 3 shows that the proportion of hypertension is higher in the group with less sleep quality (81.8%). However, the proportion of normotension was also higher in the group with less sleep quality (60.0%), while the relationship between sleep quality and hypertension was not significant (p>0.05).

Tabel 4. Multivariate Analysis of Physical Activity and Sleep Quality for Hypertension

Variable	OR	CI 95%	p-value
Physical activity	0.134	0.025 - 0720	0.02
Sleep Quality	2.526	0.360 – 17.729	0.351

Table 4 shows that it is only physical activity in the multivariate analysis test that has a significant relationship to hypertension, with an OR = 0.134 (95% CI 0.025 - 0.720). This means that respondents with moderate to strenuous physical activity have a 0.13 risk of suffering from hypertension compared to those with mild physical activity. In contrast, there was no significant relationship between sleep quality and hypertension.

DISCUSSION

This study shows a significant relationship between physical activity and hypertension, where moderate to strenuous activity levels have a lower risk of hypertension compared to mild activity

levels ($p<0.05$). The results of this study were in accordance with the previous one by Chasanah and Sugiman, 2022[13]. However, Istiana et al's study (2022)[14] had contradictory results between physical activity and hypertension. This was due to differences in research locations, research methods, and the characteristics of the respondents. One of the modifiable factors in hypertension is physical activity. Physical activity can affect neurohormonal and structural responses (decreasing norepinephrine and peripheral vascular resistance), thereby reducing the possibility of hypertension[5]. Increasing physical activity, especially exercise, will activate adaptive mechanisms by increasing endothelial function in producing NO (nitric oxide), inducing pro-angiogenic pathways by increasing VEGF (vascular endothelial growth factor) and angiopoietin and increasing insulin sensitivity by increasing glucose uptake. Blood pressure effects are significant[15].

In this study, there was no significant relationship between sleep quality and hypertension. This was in accordance with Li et al's study (2019)[8] which showed an insignificant relationship between sleep quality and hypertension in the age groups of 45-59 years and 60-79 years. Meanwhile, Nugroho et al's study (2020)[7] shows a significant relationship between sleep quality and hypertension in 1,164 respondents obtained from IFLS 5 secondary data.

Physiologically, there is a decrease in blood pressure by 10-20% during sleep, which can be referred to as "Nocturnal dipping" due to a decrease in sympathetic nerve activation[16]. Poor sleep quality can disrupt the circadian rhythm of blood pressure, so that nocturnal dipping decreases by around <10%. This condition increases sympathetic nerve activity and decreases parasympathetic activity in the nervous system, thereby increasing blood pressure. In addition, there is an increased risk of left ventricular hypertrophy and cerebrovascular disease[17,18]. Poor sleep quality also increases the hormone cortisol, the primary stress hormone, which can increase blood pressure[19]. Indirectly, sleep disturbances can also reduce leptin hormone levels and increase ghrelin hormone levels, thereby increasing hunger and appetite. This pathophysiology also increases the risk of obesity, which also increases the risk of hypertension[20].

Differences in research results can be due to the methods of evaluating sleep disturbances. Evaluation of sleep disorders also needs to consider quantitative aspects, such as sleep duration[21]. Sleep quality does not show a significant relationship with the incidence of hypertension if sleep duration is within normal limits[22]. This insignificant relationship was indeed due to the limited sample size in this study and the subjectivity of the respondents about their sleep quality.

The multivariate analysis only showed that physical activity had a significant relationship with hypertension. Physical activity is a protective factor in reducing the incidence of hypertension, including in those who have sleep problems. One study also shows similar results: the odd risk of hypertension in patients who have optimal physical activity is not as high as in those who have less physical activity (OR = 0.99 – 1.2)[23].

Even though sleep impairment causes increased sympathetic nerve activity, increased pro-inflammatory mediators, and reduced brain cognitive performance, doing ideal physical activity can reduce blood pressure. The

mechanisms are increasing baroreceptor sensitivity, increasing parasympathetic nervous activity, and helping to improve sleep time. Physical activity, on the other hand, can reduce sympathetic nerve activity[24]. Limitations in this study include a small sample size, so the results could not represent the true situation. The subjectivity of the respondents also affected the study results, as the questionnaire only assesses the current situation. Further research is needed to support this study's results by increasing the sample size and doing a re-interview on other days to gain optimal results.

CONCLUSION

The incidence of hypertension was significantly related to the level of physical activity in the age group >18 years in Sumberngepoh Village, Lawang, Malang, Indonesia.

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CONFLICT OF INTEREST

All Authors have no conflict of interest.

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AUTHOR CONTRIBUTION

All authors have contributed to all processes in this research, including preparation, data gathering and analysis, drafting, and approval for publication of this manuscript.

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