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Survey Analysis of the Correlation Between Physical Activity and Hypertension Incidents at the Car Free Day Event on Ijen Street, Malang City

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A B S T R A C T

This study aims to analyze the correlation between physical activity and the incidence of hypertension in Malang City. The method in this study was carried out with a quantitative descriptive approach. The respondents were 52 people; the majority were women (82.7%) and most of them were students (25%). Based on the calculation of the Body Mass Index (BMI), as many as 61.54% of respondents are classified as obese. The average physical activity of the respondents was 912.92 MET (moderate category), with average blood pressure of 157.38 mmHg (systolic) and 88.33 mmHg (diastolic). The results of the Pearson correlation test showed a significant correlation between physical activity and systolic (p = 0.000) and diastolic (p = 0.006) blood pressure.

INTRODUCTION

Hypertension is one of many serious global health problems and is the leading cause of death in the world. According to the WHO (2019), about 22% of the world's population suffers from hypertension, but only less than a fifth have control of the condition. In fact, the WHO estimates that by 2025, about 29% of the world's adult population will develop hypertension. In Indonesia, Riskesdas data in 2018 shows that there are more than 63 million cases of hypertension with a death rate of more than 427 thousand people. At the regional level, East Java Province ranks sixth with a prevalence of hypertension of 36.3% (Ministry of Health of the Republic of Indonesia, 2019). Hypertension is classified as a non-communicable disease that is often referred to as a "silent killer" because it generally does not show obvious symptoms, but can cause serious complications such as stroke (10.9%), heart failure (5%), and kidney damage (2%) if not treated properly (Anggraeni, 2012 in Hasrianto et al., 2018). Some of the factors that cause hypertension are divided into two groups, namely factors that cannot be controlled including age, gender, and heredity, and factors that can be controlled include obesity, smoking habits, excessive salt and alcohol consumption, and lack of physical activity (Triyanto, 2014).

Physical activity has a great effect on blood pressure. Individuals who are less physically active usually have a higher heart rate, which means the heart has to work harder to pump blood. This condition causes increased pressure on the artery walls and leads to high blood pressure (Harahap, 2017). Furthermore, lack of physical activity also increases a person's likelihood of developing obesity, which is an important risk factor in the development of hypertension. In Malang City, hypertension is recorded as the disease with the second highest number of sufferers. Data from the Central Statistics Agency (2019) states that in that year, there were 13,102 hypertensive patients. This number shows that hypertension is a crucial health problem in the city of Malang.

Various studies have been carried out to find out the relationship between physical activity and hypertension. Research by Iswahyuni (2017), Nurman and Suardi (2018), and Herawati (2020) shows that there is a meaningful relationship between low physical activity and increased risk of hypertension. However, several other studies such as those conducted by Hajar (2010), Agustina and Raharjo (2015), and Dewi Kurniasih (2017), showed different results, namely the absence of a significant correlation between physical activity and hypertension incidence. These differences in results show that there are still inconsistencies in scientific findings regarding the relationship between physical activity and hypertension. Based on the above, this study was carried out to analyze the correlation between physical activity and hypertension in Malang City. This research is expected to contribute to the development of science, as well as become a reference for promotive and preventive efforts in the management of hypertension at the local and national levels.

LITERATURE REVIEW

Hypertension as a Global Public Health Issue

Hypertension is a major non-communicable disease and a leading risk factor for cardiovascular morbidity and mortality worldwide. According to the World Health Organization (WHO), hypertension affects more than one billion people globally and is often referred to as a "silent killer" due to its asymptomatic nature. Persistent high blood pressure increases the risk of heart disease, stroke, and kidney failure. In Indonesia, the prevalence of hypertension continues to rise, influenced by lifestyle changes, urbanization, and limited physical activity.

Physical Activity and Its Role in Blood Pressure Regulation

Physical activity is widely recognized as an effective non-pharmacological intervention for preventing and managing hypertension. Regular physical activity improves cardiovascular function, enhances blood vessel elasticity, and reduces peripheral resistance, leading to lower blood pressure levels. The American Heart Association recommends at least 150 minutes of moderate-intensity aerobic activity per week to maintain cardiovascular health. Studies have consistently shown that individuals with higher levels of physical activity tend to have lower systolic and diastolic blood pressure compared to sedentary individuals.

Sedentary Lifestyle and Hypertension Risk

A sedentary lifestyle has been identified as a significant risk factor for hypertension. Prolonged inactivity contributes to obesity, poor metabolic health, and increased vascular resistance, all of which are associated with elevated blood pressure. Urban populations, in particular, are more likely to adopt sedentary behaviors due to modern work environments and transportation systems. Research indicates that reducing sedentary time and increasing daily movement can significantly lower the risk of developing hypertension.

Car Free Day as a Public Health Intervention

Car Free Day (CFD) programs are urban initiatives designed to reduce air pollution while promoting physical activity among the public. These events provide safe and accessible spaces for walking, jogging, cycling, and other recreational activities. Previous studies suggest that CFD events can encourage community participation in physical activity, increase public awareness of healthy lifestyles, and contribute to improved cardiovascular health outcomes. In Indonesia, CFD events such as those held on Ijen Street in Malang City have become popular weekly activities that attract diverse age groups.

Relationship Between Physical Activity During CFD and Hypertension

Engagement in physical activity during CFD events may have both immediate and long-term effects on blood pressure. Acute physical activity can temporarily reduce blood pressure through post-exercise hypotension, while regular participation can lead to sustained improvements in cardiovascular health. Survey-based studies have shown that individuals who actively participate in CFD activities tend to report better health indicators, including lower blood pressure levels. However, the extent of this relationship may vary depending on factors such as age, duration of activity, intensity, and pre-existing health conditions.

Research Gap and Study Significance

Although numerous studies have explored the relationship between physical activity and hypertension, limited research specifically examines this correlation within the context of public events like Car Free Day in Indonesia. Additionally, there is a lack of localized data focusing on Malang City, particularly on Ijen Street as a prominent CFD location. Therefore, this study aims to fill this gap by analyzing survey data to better understand how physical activity during CFD contributes to hypertension prevention and control in the local population.

METHODOLOGY

This study is a quantitative study with an analytical survey approach. This approach was chosen because it allowed researchers to examine the relationship between physical activity variables and hypertension prevalence at a single time of measurement, without intervention. The purpose of this study is to examine whether there is a significant correlation between the level of physical activity of the community and hypertension in Malang City. The research was carried out during the November 2024 period in Malang City, East Java Province. Malang City was chosen as the research location because it has a diverse population in terms of age, occupation, and lifestyle, which has the potential to affect physical activity patterns and hypertension incidence. In addition, based on data from the Health Office, the prevalence of hypertension in this region is quite high, so it is interesting to study further.

The population of this study is the entire adult population, namely those who are 8 years old and above and domiciled in Malang City. The sampling technique was carried out purposively by considering the inclusion criteria, namely respondents must be at least 18 years old, have lived in Malang City for at least one year, and are willing to fill out questionnaires and take blood pressure tests. Respondents who were pregnant or had a history of other chronic diseases that could significantly affect blood pressure were not included in the sample.

Data collection is carried out with those that have been tested first to ensure their validity and reliability. The questionnaire consists of three main parts, namely demographic data (age, gender, occupation, and obesity status), physical activity level, and blood pressure data. Physical activity was measured by a modified GPAQ test according to the local context. Respondents are categorized as active if the physical activity value shows moderate to severe results with a standard of above 150 minutes per week, in accordance with guidelines from WHO. Meanwhile, blood pressure was measured directly using a digital sphygmomanometer in a quiet sitting condition. Hypertension is classified based on the criteria of JNC 8, namely systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg.

The data that has been collected is analyzed using statistical software. Univariate analysis aimed to describe the general characteristics of respondents, while bivariate analysis was carried out with a correlation test to analyze the relationship between physical activity level and hypertension incidence. The significance level used was 5% ($p<0.05$), which means that the results were statistically significant if the p-value was less than 0.05. Through this method, it is hoped that the research can provide a clear picture of the extent to which physical activity plays a role in reducing the risk of hypertension among urban communities, especially in Malang City.

RESEARCH RESULT

The univariate analysis in this study was carried out to describe the characteristics of respondents without generalizing the findings (Sugiyono, 2020). The total number of respondents was 52 people with hypertension who lived in Malang City. The characteristics analyzed included gender, occupation, obesity status, blood pressure, and physical activity level. Based on gender, the majority of respondents were women, namely 43 people (82.7%), while men amounted to 9 people (17.3%).

Table 1. Analysis of Respondent Characteristics on Gender Aspects

Gender	Frequency (f)	Percentage (%)
Meeting	43	82,7 %
Male	9	17,3 %
Total	52	100 %

In terms of work, the most respondents were students (25%), followed by housewives (21.15%), and employees and non-workers at 17.31%, respectively. The rest are traders (7.69%), self-employed (7.69%), and civil servants (3.85%).

Table 2. Analysis of Respondents' Characteristics on Work Aspects

Jobs	Frekuensi (f)	Persentase (%)
Students	13	25.00%
IRT	11	21.15%
Employee	9	17.31%
Not Working	9	17.31%
Merchant	4	7.69%
Self-employed	4	7.69%
Civil Servant	2	3.85%
Total	**52**	**100 %**

Judging from the anthropometry aspect, the average weight of the respondents was 62.52 kg, with the lowest weight being 45 kg and the highest 93 kg. The average height is 153.98 cm, with a range between 143 cm to 168 cm. Based on the calculation of the Body Mass Index (BMI), as many as 32 respondents (61.54%) were classified as obese, while 20 respondents (38.46%) were not obese. The classification of obesity refers to the criteria of Anugroho (2016).

Table 3. Analysis of Respondents' Characteristics on the Obesity Aspect

Aspects	Frequency (f)	Percentage (%)
Obesity	32	61,54 %
Non-obese	20	38,46 %
Total	52	100 %

The average blood pressure of the respondents was obtained as a result of the average systolic blood pressure was 157.38 mmHg, while the diastolic was 88.33 mmHg. The lowest systolic value is 140 mmHg and the highest is 199 mmHg, while the diastolic ranges from 57 mmHg to 122 mmHg. Based on the classification of hypertension severity, most of the respondents (61.54%) experienced mild hypertension, 23.08% were classified as moderate hypertension, and 15.38% suffered from severe hypertension.

Table 4. Classification of Hypertension in Respondents

Classification	Frequency (f)	Percentage (%)
Mild Hypertension	32	61,54 %
Moderate Hypertension	12	23,08 %
Severe Hypertension	8	15,38 %
Total	52	100 %

For the physical activity aspect, the average activity of the respondents was 912.92 MET (Metabolic Equivalent Task). The lowest level of physical activity was recorded at 179 MET and the highest was 4067 MET. The classification of activities showed that the majority of respondents were in the category of moderate activity (50.00%), followed by light activity (46.15%), and only 3.85% with heavy activity.

Table 5. Classification of Physical Activity in Respondents

Classification	Frequency (f)	Percentage (%)
Light Physical Activity	24	46,15 %
Moderate Physical Activity	26	50,00 %
Strenuous Physical Activity	2	3,85 %
Total	52	100 %

Bivariate analysis is used to test for correlations or causal relationships between independent variables using the chi-square test or correlation analysis by comparing observed frequencies with expected frequencies. In this study, bivariate analysis was used to examine the correlation between hypertension and physical activity in the city of Malang.

Table 6. Correlation Analysis of Physical Activity and Hypertension in Malang City

Variabel	R	R2	Equation of a Line	p-value
Systolic Blood Pressure	-0,474	-0,224	Systolic blood pressure (Y) = 4742.593 – 24.333 * Physical Activity (X)	0,000 < 0,05
Diastolic Blood Pressure	-0,377	-0,142	Diastolic blood pressure (Y) = 3039.507 – 24.076 * Physical Activity (X)	0,006 < 0,05

Based on Table 6, there is a negative correlation between physical activity and blood pressure, both systolic and diastolic. This can be known based on the value of the correlation coefficient (R) which has a negative value on both variables. In systolic blood pressure, an R value of -0.474 was obtained. Furthermore, an R^2 value of -0.224 indicates that about 22.4% of the variation in systolic blood pressure can be explained by variations in physical activity. The resulting regression equation is: Systolic blood pressure (Y) = 4742,593 – 24,333. Physical Activity (X). A p-value of 0.000 < 0.05 indicates that there is a significant correlation between the two variables.

At diastolic blood pressure, an R value of -0.377 was obtained. Furthermore, an R^2 value of -0.142 indicates that about 14.2% of diastolic blood pressure variations can be explained by physical activity. The regression equation is: Diastolic blood pressure (Y) = 3039.507 – 24.076. Physical Activity (X). With a p-value of 0.006 < 0.05, it also indicates that there is a significant correlation between the two variables

DISCUSSION

The results showed that the majority of respondents with hypertension in Malang City were women (82.7%), with the largest group of workers coming from students (25%) and housewives (21.15%). These findings are in line with Khansa's (2023) research which also found the dominance of female respondents in hypertension cases. Tumanggor et al. (2022) explain that the risk of hypertension in women increases after menopause due to a decrease in the hormone estrogen, which previously played a role in protecting blood vessels. In addition, Maskanah et al. (2019) emphasized that gender is a factor that affects the incidence of hypertension, with a higher tendency for male physical activity than for women (Khasanah, 2022). The type of work also affects the risk of hypertension, where work with minimal physical activity such as college and IRT can increase the risk. Susanti (2020) and Nurdzikrillah (2022) emphasized that low daily activity, unhealthy eating habits, and stress can be supporting factors for hypertension. This is also supported by Anggraini et al. (2018) who found that most people with hypertension are housewives. In addition, obesity is also an important factor in the incidence of hypertension. In this study, 61.54% of respondents were obese. Putra (2015) stated that obesity can cause hypertension either directly through increased cardiac output and indirectly through the activation of the RAAS system which increases blood volume and pressure.

In terms of blood pressure levels, most of the respondents experienced mild hypertension (61.54%), according to the WHO classification (2013), and supported by the findings of Sinaga (2022) which showed many cases of systolic and diastolic blood pressure in the stage 1 hypertension range. The physical activity of the respondents was dominated by the moderate (50%) and low (46.15%) categories, with only a few being strenuous (3.85%). Karim's research (2018) shows that moderate physical activity still has a tendency to experience hypertension, indicating the importance of intensity and consistency in exercising. Statistical analysis of the results of the study can indicate a significant negative correlation between physical activity and systolic ($r = -0.474$; $p = 0.000$) and diastolic ($r = -0.377$; $p = 0.006$) blood pressure. These findings support the theory of Manuntung (2018) which states that physical activity can reduce heart rate and cardiac workload, as well as the opinion of Sari (2018) who states that moderate to heavy physical activity can prevent hypertension complications. Sinaga (2022) and Wedri (2021) also found a significant negative correlation between physical activity and blood pressure, confirming the importance of physical activity as a non-pharmacological intervention in controlling hypertension in the community.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study on *Survey Analysis on the Correlation Between Physical Activity and Hypertension in Malang City*, it can be concluded that the majority of respondents are women (82.7%) and most of them work as students (25%). More than half of the respondents (61.54%) were classified as obese based on BMI. The average physical activity of the respondents was in the moderate category (912.92 MET), while the average blood pressure was recorded at 157.38 mmHg for systolic and 88.33 mmHg for diastolic. Through the Pearson correlation test, a *p-value* value of 0.000 for systolic blood pressure and 0.006 for diastolic blood pressure was obtained, which showed that there was a relationship between the level of physical activity and hypertension in respondents in Malang City. Based on these findings, it is recommended that people, especially those with hypertension, do not consider this condition as commonplace and trivial. Physical activity, both in the form of exercise and daily activities, needs to be increased as a preventive measure to keep blood pressure stable.

ADVANCED RESEARCH

For future researchers, it is important to conduct a broader study by including other variables such as genetic factors, diet, stress, smoking or alcohol consumption habits, obesity, and environmental aspects, in order to increase deeper knowledge about the factors that cause hypertension, especially in the pre-elderly and elderly age groups.

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