Profile of Body Mass Index (BMI) with the Incidence of Hypertension in Adolescents Aged 18-24 Years at the Pakis Health Center in Surabaya

Lailatul Jannah[1]
Dra Dorta Simamora[2]
Indah Widyaningsih[3]
Medical Education Study Program, Faculty of Medicine
Wijaya Kusuma University Surabaya
Department of Biomedicine and Biomolecular Research FK UWKS[2]
Clinical Pathology Section[3]
Jl. Dukuh Kupang Barat XXI/25 Surabaya East Java
Correspondence author email: elalailatul24@gmail.com
Phone: 081806670021

Abstract

Hypertension is the leading cause of premature death worldwide, so it is often called the "Silent Killer" because patients do not show early symptoms or signs of hypertension. Body Mass Index (BMI) is one of the factors that influence the incidence of hypertension. The purpose of this study was to determine the relationship between body mass index profile and the incidence of hypertension in adolescents aged 18-24 years at Pakis Health Center Surabaya. The research method used Analytical correlation with Cross Sectional approach. The results of the Spearman Correlation test obtained a significant value of 0.01 level (2-tailed), namely p value = 0.000 < α (0.05), so the research hypothesis is accepted with a correlation coefficient (rs) = 0.337. The conclusion is that there is a relationship between body mass index profile and the incidence of hypertension in adolescents aged 18-24 years at Pakis Health Center Surabaya with the strength of the relationship between variables being moderate or strong enough.

Keywords: *Hypertension; Body Mass Index; Pakis Health Center Surabaya; Adolescents*

Profil Indeks Massa Tubuh (IMT) dengan Kejadian Hipertensi Pada Remaja Usia 18-24 Tahun di Puskesmas Pakis Surabaya

Abstrak

Hipertensi merupakan penyebab utama terjadinya kematian dini di seluruh dunia, sehingga sering disebut dengan "Silent Killer" karena penderita tidak menampakkan gejala awal ataupun tanda terjadinya hipertensi. Indeks Massa Tubuh (IMT) merupakan salah satu faktor yang berpengaruh terhadap kejadian hipertensi. Tujuan penelitian ini untuk mengetahui hubungan antara profil indeks massa tubuh dengan kejadian hipertensi pada remaja usia 18-24 tahun di Puskesmas Pakis Surabaya. Metode penelitian menggunakan analitik korelasi dengan pendekatan Cross Sectional. Hasil dari uji Korelasi Spearman didapatkan nilai signifikan 0.01 level (2-tailed) yaitu p value = 0,000 < α (0,05) maka

hipotesis penelitian diterima dengan nilai koefisien korelasi (r_{s}) = 0,337. Kesimpulan ada hubungan profil indeks massa tubuh dengan kejadian hipertensi pada remaja usia 18-24 tahun di Puskesmas Pakis Surabaya dengan kekuatan hubungan antar variabel moderat atau cukup kuat.

Kata Kunci: *Hipertensi; Indeks Massa Tubuh; Remaja; Puskesmas Pakis Surabaya*

INTRODUCTION

Hypertension is the leading cause of premature death worldwide, so it is often called the "Silent Killer" because patients do not show early symptoms or signs of hypertension (Siregar, 2022). According to the Joint National Committee (JNC) VII, hypertension is defined as systolic blood pressure of more than 140 mmHg, while diastolic blood pressure is more than 90 mmHg (Dina et al., 2022). High blood pressure or hypertension is also a health problem for the whole world because it can increase diseases such as heart disease, kidney failure, stroke, disability and even death (Berek et al., 2020). It can be known that a family history of hypertension shows a high risk of cardiometabolic diseases such as overweight, obesity and hypertension in adolescents. In addition to genetic factors, the environment also affects hypertension. Especially unhealthy diets such as excessive salt consumption and insufficient sleep quality (Kurnianto et al., 2021).

Adolescence is the process of transitioning from child to adult which causes lifestyle, habits, and metabolic changes in the adolescent body to be different from children or adults. Therefore, disease patterns in adolescents are different from younger children. This change in lifestyle makes adolescents vulnerable to various diseases, one of which is hypertension (Siswanto et al., 2020). Adolescent age according to the National Population and Family Planning Agency (BKKBN) has an age limit of 10-24 years and is not married. In contrast, the United Nations (UN) states that the vulnerable age of adolescents is from 15-24 years. So that WHO 2016, unites the terminology between the two, which includes adolescents from the age of 10-24 years (Yunalia et al., 2022).

The prevalence of hypertension in developed countries such as the United States is known to be higher in men than in women, estimated at 33.8% with a ratio of 34.8% men and 32.8% women (Knowledge et al., 2021). In 2014, the prevalence of hypertension was high at the age of 18 years and above, which was 22% and continues to increase (Efendi et al., 2022). Patients with hypertension in East Java in 2018 aged 18-24 years were 36.32%. Based on the results of Riskesdas by the Ministry of Health 2018, it states that adolescents over 18 years old who suffer from hypertension increased to 34.1%, whereas previously in 2013 it was 25.8%. This shows that in Indonesia the incidence of hypertension has increased from 2013 to 2018 (Susanto, 2020).

Body Mass Index (BMI) is one of the factors that influence the incidence of hypertension. This Body Mass Index is a simple and effective tool used to monitor nutritional status in adults aged 18 years and over. In using BMI, it cannot be applied to pregnant women. This measurement is mainly related to undernutrition and overnutrition status (Siahaan & Naution, 2020). IMT calculation according to Irianto, is defined as body weight (kilogram) divided by height, namely meters squared (kg/m2) (Isfaizah & Widyaningsih, 2021).

From the above background, researchers are interested in conducting research on the Relationship between Body Mass Index Profile and Hypertension in Adolescents aged 18-24 years at Pakis Health Center Surabaya.

Research Objectives

The purpose of this study was to determine the relationship between the incidence profile of hypertension and body mass index in adolescents aged 18-24 years at Pakis Health Center Surabaya.

Research Hypothesis

The hypothesis that researchers have in this study is that there is a relationship between body mass index profile and the incidence of hypertension in adolescents aged 18-24 years at Pakis Health Center Surabaya.

MATERIAL AND METHODS

The research method is a scientific method used by researchers by paying attention to data, objectives, and uses before conducting research, so as to get a picture of what will be studied in order to achieve the objectives of the research (Ahyar et al., 2020). The research conducted here used the correlation analytic method. To prove whether there is a relationship between one variable and another. By using a Cross Sectional approach which is carried out simultaneously or once at the same time (Adiputra et al., 2021). The dependent variable (blood pressure of hypertensive patients) and the independent variable (Body Mass Index).

The sample of this study used nonprobability sampling, namely purposive sampling by looking at several considerations of the sample, namely the criteria set by the researcher (inclusion and exclusion criteria). The predetermined sample is all adolescents aged 18-24 years with hypertension who go to the Pakis Surabaya Health Center who meet the criteria of the researcher.

Inclusion Criteria :
1. Medical record data of all adolescent patients aged 18-24 years with hypertension who go to Pakis Health Center Surabaya.
2. Patients who have complete medical records in the form of name, age, gender, address, occupation, and blood pressure measurements.
3. Patients who have BMI (Body Mass Index) measurements which include body weight and height.
4. Primary Hypertension.

Exclusion criteria :
1. Patients under 18 years or over 24 years, pregnant women, and athletes or sportsmen.
2. Patients who do not have complete medical records.
3. Secondary Hypertension.

The data obtained from the patient's medical record was then entered in the table. Processed using a computer application to analyze statistical data, namely the Statistical Program for Social Science or SPSS with version 29. Data processing in this study used the Spearman Correlation test to find the relationship between the two groups of data obtained using an ordinal scale. Spearman Correlation test formula on samples> 30:

$$z = rs\sqrt{n-1}$$

Description:
z = calculated z value
rs = Spearman correlation coefficient
n = number of research samples

The following table is to determine the interpretation results using the De Vaus Version correlation coefficient according to the 2019 General Course Academic Implementation Lecturer Team.

Table 1. Interpretation of De Vaus Version Correlation Coefficient 2019

Coefficient	Relationship Strength
0,00	No relationship
0,01-0,09	Relationship is less meaningful
0,10-0,29	Weak relationship
0,30-0,49	Moderate relationship
0,50-0,69	Strong relationship
0,70-0,89	Very strong relationship
>0,90	Near perfect relationship

Source: Interpretation of Correlation Coefficient De Vaus Version 2019

RESULTS

Data collection in this study using purposive sampling technique according to the inclusion and exclusion criteria set by the researcher. Secondary data collection from this study was taken from the results of Medical Records of hypertensive adolescent patients aged 18-24 years who came to the Pakis Surabaya Health Center for treatment.

Through the results of Medical Records, it is known that all adolescent patients aged 18-24 years at Pakis Surabaya Health Center are 181 people. 57 of them suffer from hypertension. Thus based on the researcher's inclusion criteria, the number of samples is 57 people.

Data obtained based on the results of the patient's Medical Record were collected, then grouped based on gender, age, hypertension classification, and BMI. The collected data was analyzed to see the relationship of the two variables using SPSS windows version 29.

Table 2. Gender of Hypertension Adolescent Patients at Pakis Health Center Surabaya

Gender	Amount(n)	Percent
Men	32	(56,14%)
Women	25	(43,86%)
Total	57	(100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

The table above shows that there are 57 adolescent patients with hypertension. Most of them are male, namely 32 people (56.14%). There were 25 women (43.86%).

Table 3. Characteristics of Hypertension Adolescent Patients at Pakis Surabaya Health Center Based on Age

Age	Amount(n)	Percent
18 years old	5	(9%)
19-20 years old	13	(23%)
21-22 years old	16	(28%)
23-24 years old	23	(40%)
Total	57	(100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

Based on table 3 above, it is known that of the 57 adolescent hypertensive patients, the highest number of patients was in the age range of 23-24 years, totaling 23 people (40%). Furthermore, in adolescents aged 21-22 years, totaling 16 people (28%). In adolescents aged 19-20 years, there were 13 people (23%), and 18 years of age amounted to 5 people (9%).

Table 4. BMI of Hypertensive Adolescent Patients at Pakis Health Center Surabaya

Category	Amount(n)	Percent
Underweight	5	(9%)
Normal	12	(21%)
Overweight	18	(32%)
Obesity	22	(39%)
Total	57	(100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

Based on 57 data of hypertensive adolescent patients, there were 5 people (9%) who had underweight (below normal). Patients with

normal BMI amounted to 12 people (21%). Furthermore, patients with BMI who have overweight amounted to 18 people (32%). Patients with obese BMI amounted to 22 people (39%).

Table 5. Characteristics of Hypertensive Adolescent Patients at Pakis Surabaya Health Center in BMI Category Based on Age

Age	Category				Total
	Under weight	Normal	*Overweight*	Obesity	
18 Years old	-	3 (5%)	2 (4%)	-	5 (9%)
19-20 Years old	1 (2%)	6 (11%)	6 (11%)	-	13 (23%)
21-22 Years old	1 (2%)	1 (2%)	8 (14%)	6 (11%)	16 (28%)
23-24 Years old	-	5 (5%)	2 (4%)	14 (25%)	23 (40%)
Total	2 (4%)	15 (26%)	18 (32%)	20 (35%)	57 (100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

Based on Table 5 above, it is known that out of 57 hypertensive adolescent patients aged 18 years have a normal BMI category of 3 people (5%), and overweight 2 people (4%). Adolescents aged 19-20 years have IMT underweight 1 person (2%), normal 6 people (11%), and overweight 6 people (11%). Teenagers aged 21-22 years have a BMI of underweight 1 person (2%), normal 1 person (2%), overweight 8 people (14%), and obese 6 people (11%). Teenagers aged 23-24 years have a normal BMI of 5 people (9%), overweight 2 people (4%), and obese 14 people (25%).

Table 6. Hypertension in Adolescent Patients at Pakis Health Center Surabaya

Category	Amount(n)	Percent
Hypertension 1	51	(89%)
Hypertension 2	6	(11%)
Total	57	(100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

Based on table 6, it can be seen that out of 57 adolescent hypertensive patients, 51 people (89%) had grade 1 hypertension. Patients who experienced grade 2 hypertension were 6 people (11%).

Table 7. IMT Interpretation with Blood Pressure Interpretation

IMT interpretation	Hypertension Interpretation		Percent
	Hypertension 1	Hypertension 2	
Underweight	4 (7%)	1 (2%)	5 (9%)
Normal	11 (19%)	1 (2%)	12 (21%)
Overweight	16 (28%)	2 (4%)	18 (32%)
Obesity	20 (35%)	2 (4%)	22 (39%)
Total	51 (89%)	6 (11%)	57 (100%)

Source: Medical Records of Pakis Surabaya Health Center Year 2022

Based on table 7 shows 57 adolescent hypertensive patients seen based on the relationship of IMT interpretation with the interpretation of the degree of hypertension. Samples with grade 1 hypertension amounted to 51 people (89%), 4 people (7%) who had IMT with underweight, 11 people (19%) had IMT normal weight, 16 people (28%) had IMT overweight, and 20 people (35%) had IMT obese weight. Samples with grade 2 hypertension amounted to 6 people (11%), it was known that 1 person (2%) had an underweight BMI, 1 person (2%) had a normal weight BMI, 2 people (4%) had an overweight BMI, and 2 people (4%) had an obese BMI.

Data Analysis

Table 8. Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
IMT	,157	237	,000	,951	237	,000
Incidence Hypertension	,271	237	,000	,911	237	,000

a. Lilliefors Significance Correction

If the data amounted to more than 30, the Kolmogorov-Smirnov test was performed. Based on the data in table 1.1, it is known that the value of BMI, p = 0.000 (data is not normally distributed). The test results show the incidence of hypertension, p = 0.000 (data is also not normally distributed), because the data is not normally distributed, using the Spearman Rank Test.

Table 9. Spearman Rank Test

			IMT	Incidence Hypertension
Spearman's rho	IMT	Correlation Coefficient	1,000	,337**
		Sig. (2-tailed)	.	,000
		N	237	237
	Incidence Hypertension	Correlation Coefficient	,337**	1,000
		Sig. (2-tailed)	,000	.
		N	237	237

**. Correlation is significant at the 0.01 level (2-tailed).

It can be seen that based on the results of the Spearman Correlation Test analysis, the p value = 0.000 means that there is a relationship between body mass index profile and the incidence of hypertension in adolescents aged 18-24 years at Pakis Surabaya Health Center. The strength of the relationship between variables is moderate or strong enough with a correlation coefficient (rs) = 0.337.

DISCUSSION

Based on the results of processing medical record data of hypertensive patients at Pakis Surabaya Health Center with a data collection period of 1 year, namely from January 1 to December 31, 2022, it was found that the total number of hypertensive adolescent patients was 57 people. Male adolescent hypertensive patients were 32 people (56.14%), and female adolescent hypertensive patients were 25 people (43.86%). Based on the medical record data obtained, most of the male respondents from this study had a history of smoking habits. This is a factor in increasing blood pressure. Just as reported by Everet and Zajacova in 2023, in their research which found that hypertension occurs more in men than women due to different lifestyles. For example, in men who have a habit of smoking.

According to Hakim AF et al., (2022), From the results of his research it is known that there are 24 respondents (53.33%) who have a history of smoking experiencing hypertension. As a result of smoking too often, smoking can increase blood pressure significantly. It is thought that because there is nicotine in cigarettes, and cigarette smoke contains Carbon Monoxide (CO) so that it can attract red blood cells more strongly than oxygen. Furthermore, this will cause a decrease in the capacity of red blood cells that carry oxygen to the heart and other tissues. Then the same opinion was conveyed by P2PTM Kemenkes RI (2022), that the incidence of an increase in systolic blood pressure in men was 2-3 times more risky than women.

Another cause of hypertension, which is more prevalent in males, is due to androgen hormones, resulting in a higher increase in blood pressure compared to females. Gender can cause hypertension in adolescents, possibly influenced by hormonal mechanisms that can affect blood pressure. (Siswanto et al., 2020).

Based on the results of this study, the number of adolescent patients with the highest age range is known in the age range of 23-24 years, totaling 23 people (40%). Furthermore, in adolescents aged 21-22 years, totaling 16 people (28%). In adolescents aged 19-20 years,

totaling 13 people (23%), and 18 years of age totaling 5 people (9%).

Based on the results of medical records obtained in the age group results, it can be seen that age can affect the incidence of hypertension, this opinion is in line with Atmojo et al., (2020), who said that increasing age can cause the structure of blood vessels to narrow and the walls of blood vessels to become stiff, then increased blood pressure occurs.

Another factor that is also known based on these medical records is the level of stress that occurs. Just like research according to Shaumi and Achmad 2019, said that stress has a special effect on the incidence of hypertension in adolescents. A person who experiences stress symptoms such as feelings of pressure, fear, sadness, tense conditions, feeling guilty. This stimulates the kidneys to produce adrenal hormones so that it can stimulate the heart to pump blood faster and stronger, causing an increase in blood pressure. If the condition lasts for a long time, and is not treated immediately, it can cause hypertension.

Based on the results of data collected from a total of 57 adolescent hypertensive patients, it was found that hypertensive patients who had BMI with underweight amounted to 5 people (9%), normal BMI amounted to 12 people (21%), BMI with overweight amounted to 18 people (32%), and obese BMI amounted to 22 people (39%).

It is known from the results of the medical records obtained that BMI can affect the occurrence of hypertension. This is the same as Nina Widyasari's research in 2021, which states that as many as 65% of the risk factors for hypertension in women occur, and as many as 78% in men are related to obese BMI. The heavier a person's body, the more blood supply is needed to oxidize body tissues. Someone who has hypertension with obesity, the body requires higher heart pumping power and circulating blood volume than someone who has hypertension with normal body weight IMT (Hidayah et al., 2022).

In this study, it is known that many adolescents tend not to maintain a good diet, and trigger an increase in blood pressure. For example, consuming a lot of high sodium foods such as: fried foods, fast food, processed foods, because sodium can cause hypertension. The more the amount of sodium in the body, it can cause an increase in plasma volume and cardiac output so that blood pressure increases (Fira Mardianti1, Dewi Rachmawati2, 2020).

Based on the results of the data that has been collected, there are 51 adolescent patients (89%) who experience grade 1 hypertension, this is almost the entire total of 57 adolescent patients, while those who experience grade 2 hypertension are 6 adolescents (11%). From these results it can be seen that in this study many adolescents experienced grade 1 hypertension compared to grade 2 hypertension.

Based on the results of medical records, it is known that genetic factors are quite influential in the incidence of hypertension. Just like the opinion according to Kurnianingsih et al,. (2019), explain that genetic factors occur if a child has a parent who has hypertension, it can have a higher risk for the child to experience hypertension as an adolescent. If both parents, namely father and mother, experience hypertension, then the risk of hypertension occurring in the teenager is 50%, while if only one of the two parents has hypertension, the risk of hypertension is 30%.

The relationship between the interpretation of the BMI profile and the interpretation of the degree of hypertension is known that the sample with grade 1 hypertension amounted to 51 people (89%), then 4 people (7%) who had underweight BMI, hypertensive patients with low BMI were thought to be due to consuming high salt foods such as: processed foods, fried foods, high carbohydrate foods. 11 people (19%) had normal weight BMI, 16 people (28%) had overweight BMI, and 20 people (35%) had obese BMI. Conversely, the sample with grade 2 hypertension amounted to 6 people (11%), then

1 person (2%) had an underweight BMI, 1 person (2%) had a normal weight BMI, 2 people (4%) had an overweight BMI, and 2 people (4%) had an obese BMI.

From the results of the study above, most hypertensive adolescent patients at Pakis Surabaya Health Center in 2022 had BMI with obese body weight and suffered from grade 1 hypertension. This is supported by the results of the Rank Spearman analysis test conducted by researchers, the results obtained a p value of 0.000, then if the p value < α (0.05) which means there is a relationship between the incidence profile of hypertension and body mass index in adolescents aged 18-24 years at Pakis Surabaya Health Center. This study is in accordance with the results of other studies conducted by Melliya et al., (2023), the results of the study also obtained a p value = 0.000, which means that this study is accepted and there is a relationship between the incidence of BMI and blood pressure in hypertensive patients at the Heart Poly of Husada Utama Surabaya Hospital.

In this study, the correlation coefficient (rs) = 0.337 was obtained, then when viewed in the De Vaus 2019 Version Correlation Coefficient Interpretation table, it has a moderate or fairly strong relationship between variables in hypertensive adolescent patients aged 18-24 years at Pakis Surabaya Health Center. In addition, the value of r is positive. Just like the opinion expressed from research in China says that, there is a positive relationship between BMI and the incidence of hypertension. Every 1 kg/m2 increase in BMI can cause an increase in blood pressure of 1.7 mmHg in men and 1.4 mmHg in women (Isfaizah & Widyaningsih, 2021).

In someone who has IMT overweight and obesity can increase blood pressure. This is because the increase in body weight makes the amount of fat in the body more and more. If this overweight and obesity occurs for a long time, it can affect the amount of oxygen and blood flow that will carry oxygen throughout the body. Therefore, there is an enlargement of the blood vessels, so blood pressure also increases. Excess weight can lead to additional fat tissue and increased blood flow. The occurrence of increased blood pressure can also be caused by an increase in heart rate and reduced blood vessel capacity to transport blood (Kartika et al., 2021). This research has passed the Ethical Approval No.16/SLE/FK/UWKS/2023, dated February 14, 2023.

CONCLUSION

1. From the results of the study there were 22 people (39%) adolescents aged 18-24 years at Pakis Surabaya Health Center who had an obese body mass index experiencing hypertension.
2. From the results of the study, almost all hypertensive adolescents aged 18-24 years at Pakis Surabaya Health Center experienced grade 1 hypertension, namely 51 people (89%).
3. There is a fairly strong relationship between Body Mass Index Profile and the incidence of hypertension in adolescents aged 18-24 years at Pakis Surabaya Health Center, with a p value of 0.000 and the strength of the correlation coefficient (rs) = 0.337.

ADVICE

1. For Health Workers

It is hoped that health workers will always conduct counseling with interesting methods, screening and education for hypertensive and non-hypertensive patients in order to prevent the occurrence of disease or even get worse so that it causes complications.

2. For Further Researchers

It is hoped that future researchers will utilize the results of this study as additional literature with the same variables and may include other variables related to body mass index such as diabetes mellitus.

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