

BMI/A IS ASSOCIATED TO BLOOD PREASURE AMOUNG 11 CLASS STUDENT IN MAN 4 JAKARTA

Adella Atmaji¹, Asa Azkatu Razaq², Moesijanti Y.E. Soekatri^{3*}

¹Nutrition Department, Diploma III of applied Nutrition Program, Health Poltekkes Ministry of Health of Jakarta II, Jl.Hang Jebat III Blok F/3, Gunung village, Sub-district of Kebayoran Baru, South Jakarta, 12120

²Nutrition Department, Bachelor In applied Nutrition Program, Health Poltekkes Ministry of Health of Jakarta II, Jl. Hang Jebat III Blok F/3, Gunung village, Sub-district of Kebayoran Baru, South Jakarta, 12120

³Indonesian Nutrition Association (PERSAGI). Grand Centro no. B2, Kodam Raya Bintaro street, Pesanggrahan, South Jakarta 12320

*E-mail: moesijanti@yahoo.com

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ABSTRACT

Overweight and central obese in Indonesia are increasing. The 2018 basic health research showed the prevalence of central obese at the age of 15 years was 31.0%. The prevalence of hypertension in Indonesia is 34.1%. The purpose of this study was to describe the body mass index according to age (BMI/A) and the ratio of waist-hip circumference (WHR) to blood pressure in class XI MAN 4 Jakarta. The study used a descriptive approach with a cross sectional design. The sampling method used a proportional systematic random sampling formula and the number of samples representing each department was determined by the stratified random sampling formula. The research was conducted on at MAN 4 Jakarta on 52 students of class XI for the academic year 2021/2022 aged 16-17 years. While the primary data collected were sample characteristics used interview , body mass index by age used microtoise tools and weight scale, waist-hip ratio, and blood pressure. Results: BMI/A most of the subjects had good nutritional status 63.5%, WHR most of the subjects were in the no-risk category 61.5%, most of the subjects had normal blood pressure 76.9%. There was no significant relationship between age, gender, family history of hypertension and waist-to-hip-ratio circumference (WHR) to blood pressure ($p>0,05$) and to a significant relationship between body mass index by age (BMI/A) to blood pressure ($p<0,05$). Conclusion: There is a normal blood pressure tendencies are common those who had a body mass index by age (BMI/A) are overweight or obese and waist-to-hip-ratio circumference (WHR) are at risk.

Keywords: *Body Mass Index by Age, Waist Hip RatioCircumference, Blood Pressure*

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INTRODUCTION

The health problems of degenerative diseases associated with blood pressure in health services are still high. In addition, public awareness to control blood pressure is still low. Blood pressure is the push of blood on the walls of arteries as the heart pumps blood outwards to flow throughout the body (1). Blood pressure is said to be normal when systolic blood pressure ≤ 120 mmHg and diastolic blood pressure ≤ 80 mmHg (2).

Basic health research in 2018 showed that adolescents already have high blood pressure called hypertension. A teenager is said to be hypertensive when systolic blood pressure values ≥ 120 mmHg and diastolic > 80 mmHg (2). Hypertension causes many losses, such as eye damage, kidney failure, to paralysis due to attacks on the brain (3). Whereas a person is said to be hypotension when the systolic blood pressure value is ≤ 90 mmHg and the diastolic blood pressure is ≤ 60 mmHg (4). Hypotension results in life-threatening problems because it greatly affects the blood flow that transports nutrients and oxygen throughout the body, especially the heart and brain (5). World Health Organization (WHO) 2018 informed that around 1.13 billion people in the world have hypertension. This means that 1 in 3 people are diagnosed with hypertension. It is estimated that by 2025 there will be 1.5 billion people who will have hypertension, and an estimated 10.44 million people will die from hypertension which continues to increase accompanied by its complication disease (6). Basic health research in 2018 showed that the prevalence of Indonesian hypertension reached 34.1%. This figure is an increase of 8.3% from the 2013 basic health research report which previously reached 25.8%. The prevalence of hypertension in DKI Jakarta province reached 33.43% (7). In addition, the prevalence of hypertension in children in Indonesia reached 14.84% (7).

There are various risk factors that affect blood pressure. Being overweight is one of the factors that influence the occurrence of hypertension. Anthropometric examinations are used to assess nutritional status, such as overweight or obese. Nutritional status indicators related to blood pressure and used as determinants of obese include body mass index and waist-hip-to-ratio circumference (8).

The first sign of the occurrence of degenerative diseases is hypertension that can appear due to overweight or obese. It is estimated that 60-70% of hypertension is caused due to overweight or obese. Increased obese can increase the risk of hypertension. As the main culprit, hypertension can result in cardiovascular diseases, such as stroke, heart disease, and kidney failure that can be life-threatening (9). Basic health research in 2018 showed that the prevalence of central obese at the age of ≥ 15 years reached 31.0% (7). Meanwhile, according to basic health research in 2013, the prevalence of central obese reached 26.6%. This translates to a 4.4% increase in the prevalence of central obese from 2013 to 2018 (7). Basic health research in 2018 showed that the proportion of central obese in the population aged ≥ 15 years in DKI Jakarta reached 41.9% and the prevalence of hypertension in school children in Indonesia reached 14.84%.

waist-hip-to-ratio circumference (WHR) is one of the anthropometric methods to describe central obese related to blood pressure. In addition, waist-hip-to-ratio circumference (WHR) is more sensitive in determining the distribution of body fat and identifying the risk of cardiovascular disease. The measurement tool used in measurements using the waist-hip-to-ratio circumference (WHR) is *a meterline* or tape meter with an accuracy of 0.1 cm (10).

Body mass index (BMI) is the most commonly used method for assessing the nutritional status of obese. According to research conducted by Cao *et al* in 2012 said the body mass index (BMI) has a strong relationship with blood pressure (11). Another study conducted by Angesti in 2017 in adolescents aged 13-18 years showed a significant relationship between nutritional status based on BMI/A and hypertension. There was a 3.51 times risk of developing hypertension in subjects who had more nutritional status compared to subjects who had normal nutritional status. In addition, a literature review of Hypertension Risk Factors in Adolescents conducted by Shaumi *et al* in 2019 stated that excess body mass index has a relationship to an increased risk of hypertension. Meanwhile, research conducted by Maryani in 2013 said the body mass index (BMI) was less sensitive in determining central obese (10).

Given the sensitivity of measuring the waist-hip-to-ratio circumference in identifying

central obese to blood pressure, it is necessary to conduct other studies using adolescent samples. In addition, given the differences in the strength of measuring body mass index in obese and central obese to blood pressure, it is necessary to conduct deeper research on the application of anthropometric measurements to identify the relationship of obese and central obese to blood pressure.

Based on the background description above, the researcher intends to conduct a study with the title "Overview of Body Mass Index According to Age (BMI/A) and Waist-Hip-To-Ratio Circumference (WHR) to Blood Pressure in Class XI MAN 4 Jakarta" The author chose MAN 4 Jakarta as the research location because there have been no anthropometric and blood pressure measurement activities carried out previously and no related studies have been conducted in class XI MAN 4 Jakarta students. In addition, MAN 4 Jakarta does not have a school cafeteria and is in a strategic location so it has easy access to buy food.

RESEARCH METHODS

This study was descriptively conducted using a cross-sectional approach conducted at MAN 4 Jakarta with a total of 52 samples, the size of the research sample was determined through the *estimassi formula of the proportion of sampling* and which met the inclusion and exclusion criteria. On the first day, anthropometric data collection was carried out and the second day of clinical data collection was carried out. The types of data taken include primary data and secondary data of primary data, namely sample characteristics data, nutritional status data based on BMI/A index using anthropometry, waist-hip-to-ratio circumference data using meterline and clinical data, obtained using a mercury *sphygmanometer*, while the secondary data is the name of class XI MAN 4 Jakarta students who are used as the population and an overview of the research site.

RESULTS AND DISCUSSION

Based on the data obtained from the results of research on class XI MAN 4 Jakarta students by interviewing, the characteristics of the subject as presented in the following table were obtained:

Table 1. Characteristic Samples

Assessment Aspects	n	%
Age		
16 years	24	46,2
17 years	28	53,8
Entire	52	100,0
Gender		
Man	19	36,5
Woman	33	63,5
Entire	52	100,0
Family History of Hypertension		
None	39	75,0
Exist	13	25,0
Entire	52	100,0

Based on Table 1 most of the subjects were 17 years old with a percentage of 53.8%, while the remaining 46.2% were 16 years old with a dominant female gender of 63.5% and 36.5% were male. Older people with hypertension increase sodium levels in the cells belonging to their offspring. This being a genetic alsan affects the risk of hypertension. Based on the data obtained, 75.0% of the subjects had no history of hypertension and 25.0% of the subjects had a history of hypertension.

Table 2. BMI/A, WHR, and Blood Pressure

Assessment Aspects	n	%
BMI/A		
Usual	33	63,5
No-normal	19	36,5
WHR		
Not risky	32	61,5
Risky	20	38,5
Blood pressure		
Usual	40	76,9
No-normal	12	23,1

Data collection of body mass index according to age is carried out by measuring weight and height then calculating BMI/A and determining nutritional status refers to the

Regulation of the Minister of Health of the Republic of Indonesia number 2 of 2020 concerning child anthropometric standards.

There are two factors that affect nutritional status, namely direct factors and indirect factors. Direct factors that affect nutritional status are the consumption rate of macronutrients and genetics, while indirect factors that affect nutritional status are factors of nutritional knowledge, dietary habits, and economics (12). Results of anthropometric measurements most samples had a normal BMI/A of 63.5% and another 36.5% had an no normal BMI/A. Subjects with BMI/A undernutrition, overnutrition and obese fall into the no normal category, while subjects with good nutritional status fall into the normal category.

Waist-hip-to-ratio circumference (WHR) is one of the anthropometric methods for determining central obese seen from the accumulation of fat on waist-hip-to-ratio circumference. In addition, measuring the waist-hip-to-ratio circumference is one of the measuring instruments to see whether there is a risk of degenerative diseases in a person, such as stroke, blood pressure, heart, and kidney failure (13). Most subjects 61.5% had an riskless WHR and another 38.5% were at risk. In addition, the blood pressure measurement results of 76.9% had normal blood pressure and 23.1% had no normal blood pressure. Subjects with blood pressure above or below 120/80 fall into the category of no normal.

Table 3. Results of Waist Circumference and Hip Circumference Analysis

Waist-To-Hip-Ratio Circumference	n	Min	Max	\bar{x}	SD
Waist Circumference	52	51	101	70,04	10,74
Hip Circumference	52	54	108	80,79	11,91
WHR	52	0,76	0,98	0,86	0,05

Based on Table 3, from 52 study subjects obtained the value of the results of measuring waist circumference, namely a minimum of 51 cm and a maximum of 101 cm with an average value of 70.04 cm and a standard deviation of 10.74. The value of the results of the measurement of hip circumference, which is a minimum of 54 cm and a maximum of 108 cm with an average value of 80.79 cm and a standard deviation of 11.91. Meanwhile, the minimum hip waist circumference ratio (WHR) value is 0.76 cm and the

maximum is 0.98 cm with an average value of 0.86 cm and a standard deviation of 0.05.

Table 4. Relationship between Age, Gender, Family History of Hypertension, BMI/A and WHR on Blood Pressure

Assessment Aspects	Blood pressure				Chi-Square
	Usual		No-normal		
	n	%	n	%	
Age					
16 Years	15	37,5	9	75,0	0,45
17 Year	25	62,5	3	25,0	
Gender					
Man	13	32,5	6	50,0	0,31
Woman	27	67,5	6	50,0	
Family History of Hypertension					
None	30	75,0	9	75,0	1.00
Exist	10	25,0	3	25,0	
BMI/A					
Usual	30	75,0	3	25,0	0,004
No normal	10	25,0	9	75,0	
WHR					
Not risky	27	67,5	5	41,7	0,17
Risky	13	32,5	7	58,3	

*No normal = malnutrition, overweight & obese

Based on Table 4, it is known that the value of *chi-square* analysis regarding the relationship between age and blood pressure, namely $p = 0.45$ ($p > 0.05$) so that H_0 was accepted H_a was rejected and showed that there was no significant relationship between age and blood pressure. As we get older, the physiological state of the body changes like a buildup of collagen in the muscle layer, causing the thickening of the arterial walls to become narrower and the elasticity reduced causing the arteries to become stiff. This causes the blood that is accommodated through the blood vessels to slow down and decrease so that the blood pressure of systole increases. Increasing age leads to disruption of the renin-angiotensin-aldosterone system, an increase in peripheral plasma concentrations and the occurrence of glomerulosclerosis resulting in an increase in vasoconstriction so that blood pressure increases (14).

The results of *the chi-square* analysis showed that there was no significant relationship between gender and blood pressure, namely $p = 0.31$ ($p > 0.05$). This result is in accordance with Jonah's research (2021) that gender is not related to blood pressure $p = 0.84$ ($p > 0.05$) (15). The difference in male and female hormones becomes an irreversible factor. Women who are still in the fertile period routinely experience the coming of the month protected by the hormone estrogen which plays a role in increasing *High Density Lipoprotein* (HDL) levels. High levels of HDL protect the occurrence of the atherosclerosis process. Atherosclerosis is a condition of fat metabolism disorder that causes lipoprotein hardening of the arterial walls so that there is a thickening of the blood vessel walls. However, it is still necessary to pay attention to other factors that affect gender to blood pressure (16).

The relationship between family history of hypertension and blood pressure resulted in a p value = 1.00 ($P > 0.05$) so there was no significant relationship. The results of this study are not in line with the results of Angesti's research (2017) the history of family hypertension in Adolescents class XI SMA Sejahtera 1 Depok has a close relationship with the incidence of hypertension in adolescents (p value = 0.005) and the results of the OR value test in adolescents who have a family history of hypertension of 3,884. This value shows that adolescents who have a family history of hypertension have a 3.9 times greater risk of developing hypertension (17). Adolescents with hypertension without a family history of hypertension can be caused by parenting factors and eating habits, one of which is a high-sodium diet (18).

The results of *the chi-square* analysis showed that there was a significant relationship between BMI /A and blood pressure, namely $p = 0.004$ ($p < 0.05$). This result is in line with research conducted by Theodorus (2020) so that this shows H_0 is rejected and H_a is accepted. Excess nutritional status or obese indicates a high carbohydrate composition and the accumulation of triglyceride fats which are the initial process of atherosclerosis as a factor in the occurrence of hypertension (19). Obese people experience a decrease in adiponectin which causes a decrease in insulin sensitivity related to endothelial dysfunction. Endothelial dysfunction leads to increased stiffness in the arteries as well as

increased vasocontraction which then leads to hypertension. In addition, increased renal sympathetic nerve activity, insulin resistance, and hyperactivity of the renin angiotensin system lead to an increase in sodium reabsorption in the kidneys which has an effect on increasing blood pressure (20).

The relationship between WHR and pressure with blood pressure resulted in a value of $p = 0.17$ ($P > 0.05$) so there was no significant relationship. The results of this study are not in line with the study by Nanang (2018) which showed that there was an influence between WHR and blood pressure $p = 0.01$ and $p = 0.043$ ($p < 0.05$). A strong association regarding the waist-hip-to-ratio circumference to the incidence of hypertension occurs due to the accumulation of fat in the abdominal area which affects the decrease in adiponectin levels. Adiponectin is a hormone that acts on biological activity against the metabolism of glucose, fat and affects the occurrence of insulin resistance. Decreased levels of adiponectin cause a decrease in insulin sensitivity which affects endothelial dysfunction, namely changes in the function of endothelial cells that line and maintain the flexibility of all vascular systems. The occurrence of endothelial cell dysfunction results in increased stiffness in arterial and venous blood vessels (21).

CONCLUSION

Based on the results of the bivariate analysis, it can be concluded that there is a relationship between BMI/A to blood pressure and there is no relationship between WHE, age, gender, and family history of hypertension to blood pressure. Related to the results of the study, namely subjects who have high blood pressure tend to be found in many those who have a body mass index according to age (BMI/A) with more nutritional status and waist-hip-to-ratio circumference (WHR) that is at risk, it is necessary to conduct nutrition education for students on how to make the body have normal nutritional status by applying balanced nutrition, routinely monitoring body weight every day, exercise regularly according to the condition of the body, and apply the contents of my plate as an effort to prevent before high blood pressure occurs.

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