

THE RELATIONSHIP OF THE BODY MASS INDEX AND WAIST CIRCUMFERENCE WITH BLOOD PRESSURE AT KARANG ASAM PUBLIC HEALTH CENTER SAMARINDA

Syella Chintya Dewi^{1*}, Muhammad Furqon², Danial³

¹ Medical Education Study Program, Medical School of Mulawarman University, Samarinda, Indonesia

² Internal Medicine Laboratory, Medical School of Mulawarman University, Samarinda, Indonesia

³ Public Health Laboratory, Medical School of Mulawarman University, Saamrinda, Indonesia

*E-mail: syellachintya@gmail.com

ABSTRACT

Hypertension is the most common cause of cardiovascular disease and it is a major problem in both developed and developing countries. Obesity is one of the main risk factors of hypertension. Hypertension and obesity are health problems which its prevalence is continues to increase in Indonesia. The anthropometric index that can be used to determine nutritional status are the body mass index (BMI) and waist circumference measurement. This study was an observational analytic with cross sectional method. The sample of this study was 275 respondent who were selected using the consecutive sampling method in Karang Asam public health center Samarinda. Data of this study were obtained from direct measurement of height, weight, waist circumference and blood pressure of respondent and data were analyzed by using chi square test. The result of statistical test showed that there was relationship between body mass index ($p = 0,000$; OR= 5,234 ; 95% CI= 3,090-8,865) and waist circumference ($p = 0,000$; OR=5,489 ; 95% CI= 3,233 – 9,318) with blood pressure. There was a significant relationship between body mass index and waist circumference with blood pressure at Karang Asam Public Health Center Samarinda.

Keywords: Body mass index, waist circumference, blood pressure

INTRODUCTION

The pattern of diseases in Indonesia is undergoing an epidemiological transition from infectious diseases that were initially a major health issue then it diverts to non-communicable diseases¹. One non-communicable disease that gets more attention is hypertension. Hypertension is the most common cause of cardiovascular disease and is a major problem in both developed and developing countries. Based on Riskesdas data, the prevalence of hypertension in Indonesia increased in 2018 to 34.1% compared to previous years, which was 25.8% in 2013 and 32.4% in 2016². Based on the results of Riskesdas 2013, there were 5 provinces in Indonesia with the highest prevalence of hypertension. East Kalimantan is the third with highest hypertension prevalence that is equal to 29.6%³.

Hypertension can be influenced by several factors which are broadly divided into 2: risk factors that can be modified and risk factors that cannot be modified. Risk factors that cannot be modified are age, gender and family history while risk factors that can be modified are lack of physical activity, excessive salt

consumption, alcohol consumption, smoking, stress and obesity. Obesity is a nutritional problem which prevalence continues to increase in Indonesia⁴.

Based on the results of Riskesdas in 2013, there were 15.4% of Indonesia's population who were obese⁵. The number continues to increase. The prevalence rate has increased again based on Riskesdas data in 2018 to be 21.8%². The Framingham Offspring Study states 78% of men and 64% of women with hypertension are caused by obesity. Thus, people who are overweight or obese have a greater risk for suffering from hypertension⁶.

In determining a person's nutritional status, it is necessary to have anthropometric measurements. One anthropometric index that can be used is the body mass index (BMI). Based on the results of previous studies conducted on body mass index, it has a linear relationship with blood pressure where systole and diastolic blood pressure increases in line with the increase of body mass index of a person⁷. Other studies which have similar results also support the findings^{8,9}. However, there are several other studies which are not in line with this research^{10,11}. The study stated that there was no significant relationship between body mass index and blood pressure.

Another indicator that can be used to determine a person's nutritional status is by measuring waist circumference. Based on the results of previous studies, it stated that there is a significant relationship between waist circumference with systolic and diastolic blood pressure¹². Several other previous studies have had the same results^{13,14}. However, there are several other studies that are not in line with these studies which in his research stated that there was no relationship between waist circumference with systolic and diastolic blood pressure^{15,16}.

Based on the description of this phenomenon and based on the inconsistency of the results, the researcher is interested in conducting a study of The Relationship of the Body Mass Index and Waist Circumference with Blood Pressure at Karang Asam Public Health Center Samarinda.

MATERIAL AND METHODS

This study was an observational analytic study with a cross-sectional approach. The study was conducted at the Karang Asam Public Health Center in Samarinda in April 2019. The population was all patients who came to the Karang Asam Public Health Center in Samarinda. The sample of this study was patients who came to do health checks at the Karang Asam Public Health Center in Samarinda whose age was over 18 years, as many as 275 respondents were selected using consecutive sampling. The data in this study were primary data obtained through direct measurements of height, weight, waist circumference and respondent's blood pressure and analyzed using the chi square test.

RESULT AND DISCUSSION

This research was conducted at the Karang Asam Public Health Center in Samarinda with 275 respondents. This study used primary data that was data taken directly through measurements of blood pressure, height, weight and waist circumference of respondents.

1. Respondent Characteristics

Table 1. Respondent Characteristics at Karang Asam Public Health Center Samarinda

Characteristics	N	%
Age		
< 40	179	65,1
≥40	96	34,9
Gender		
Pria	165	60,0
Wanita	110	40,0
BMI		
Obese	117	42,5
Non-Obese	158	57,5
Waist Circumference		
Obese	113	41,1
Non-Obese	162	58,9
Blood Pressure		
Hypertension	105	38,2
Non-Hypertension	170	61,8
Total	275	100,0

Table 1 shows that respondents in this study were dominated by respondents of age <40 years, that is 179 respondents (65.1%). Meanwhile, the distribution of respondents by gender is dominated by men, with 165 respondents (60%). Respondents in this study were found that majority was in the category of not obese as many as 158 respondents (57.5%), based on measurements of body mass index, and as many as 162 respondents (58.9%) did not suffer obesity based on measurements of waist circumference. Based on blood pressure measurements, it was obtained majority was in the category of not hypertension, as many as 170 respondents (61.8%).

Table 2. Distribution of Body Mass Index, Waist Circumference and Blood Pressure Based on Gender

Variabel	Pria		Wanita	
	N	%	N	%
BMI				
Obese	72	43,6	45	40,9
Non-Obese	93	56,4	65	59,1
Waist Circumference				
Obese	60	36,4	53	48,2
Non-Obese	105	63,6	57	51,8
Hypertension				
Hypertension	67	40,6	38	34,5
Non-Hypertension	98	59,4	72	65,5
Total	165	100	110	100

Table 2 shows the distribution of body mass index, waist circumference and blood pressure based on gender. In this study, the number of male respondents who were in the category of obesity based on BMI measurements were more than female respondents, which was 72 people (43.6%). Meanwhile, based on measurements of waist circumference, the number of female respondents who were obese were more than the number of male respondents which were as many as 53 people (48.2%). Based on research by al Hazza et al. (cited in Sebati et al., 2018), the prevalence of obesity can be found to be higher either in women or men because obesity can be influenced by various factors and one of them is the lifestyle factor of each individual¹⁷.

For blood pressure variables, the number of male respondents in the hypertension category is higher than the number of female respondents, 67 people (40.6%) of the population. This study is in line with previous studies which stated that the prevalence of hypertension in men is higher than in women. The study explained that this difference could be due to differences in biological factors between men and women. The biological factor in question is hormones in women that can provide a protective mechanism against increased blood pressure in women until they reach menopause. This hormone is an estrogen hormone that can protect blood vessels rather than damage¹⁷.

Table 3. Distribution of Body Mass Index, Waist Circumference and Blood Pressure Based on Age

Variabel	Age < 40		Age ≥ 40	
	N	%	N	%
BMI				
Obese	66	36,9	51	53,1
Non-Obese	113	63,1	45	46,9
Waist Circumference				
Obese	61	34,1	52	54,2
Non-Obese	118	65,9	44	45,8
Hypertension				
Hypertension	61	34,1	44	45,8
Non-Hypertension	118	65,9	52	54,2
Total	179	100	96	100

Table 3 shows the distribution of body mass index, waist circumference and blood pressure based on the age of respondents. In this study, it was found that the number of respondents who were obese based on BMI measurements and waist circumference majorly were ≥ 40 years of age. This is in line with previous research which states that the risk of central obesity increases in accordance with someone's age as the prevalence of obesity as someone gets older¹⁸. As we get older, the metabolic processes in the body will decrease. As you get older and move less actively, your body's muscle mass tends to decrease and fat levels in the body can increase. So that, if we do not balance it with a healthy lifestyle, there will be excess fat accumulation in the abdomen and increase the risk of central obesity¹⁹. Hence, the number of respondents included in the category

of hypertension was also found more in the age group ≥ 40 years, as many as 44 respondents (45.8%) of the population. This is in line with previous research conducted which states that the proportion of hypertension at age ≥ 40 years is higher than the proportion of hypertension at age < 40 years²⁰. As a result of the aging process, collagen fibers in the arteries and arterial walls increase so that the walls of the arteries will stiffen and harden thereby increasing the risk of hypertension²¹.

2. The Relationship between Body Mass Index and Waist Circumference with Blood Pressure

Table 4. The Result of Cross Tabulation of Body Mass Index and Waist Circumference with Blood Pressure

Variables	Blood Pressure						P Value	OR (95% CI)
	Hypertension		Non-Hypertension		Total			
	N	%	N	%	N	%		
BMI								
Obese	70	25,5	47	17	117	42,5	0,000	5,234 (3,090-8,865)
Non-Obese	35	12,7	123	44,8	158	57,5		
Waist Circumference								
Obese	69	25,1	44	16	113	41,1	0,000	5,489 (3,233-9,318)
Non- Obese	36	13,1	126	45,8	162	58,9		
Total	105	38,2	170	61,8	275	100		

Based on the analysis of the relationship between body mass index and blood pressure, the p value = 0,000 (OR = 5,234; 95% CI = 3,090-8,865) means that there is a significant relationship between body mass index and blood pressure at the Karang Asam Public Health Center in Samarinda. Respondents who have a body mass index ≥ 25 kg / m² or are categorized as obese have a 5.2 times greater risk of suffering from hypertension when compared to respondents who have normal weight. The results of this study are in line with previous studies that there is a linear relationship between body mass index and blood pressure^{22, 23}.

Based on the analysis of the relationship of waist circumference with blood pressure, the p value = 0,000 (OR = 5,489; 95% CI = 3,233 - 9,318) means that there is a significant relationship between waist circumference and blood pressure at the Karang Asam Public Health Center in Samarinda. Respondents who have a waist circumference of ≥ 90 cm in men and ≥ 80 cm in women have a risk of experiencing hypertension or high blood pressure 5.4 times greater than respondents who have a normal waist circumference size. This research is in line with previous studies that there is a linear relationship between waist circumference and blood pressure^{13, 24}.

Excessive weight or obesity is one of the factors that cause hypertension. There are several mechanisms in a person who is obese that can affect blood pressure. The mechanism is an increase in cardiac output and total blood vessel resistance along with an increase in a person's body weight²⁵. The increase in total peripheral resistance is due to an increase in sympathetic nervous system activity through stimulation of α_1 and β -adrenergic receptors by high levels of fat and carbohydrates in obese people²⁶. Increased leptin in obese people can increase the risk of hypertension. Leptin can penetrate the blood vessel barrier in the brain and into the arcuate nucleus and can result in increased activation of the sympathetic nervous system. Leptin has also been linked to a role in inhibiting the synthesis of nitric oxide and causing dysfunction in blood vessel endothelium²⁶. Another mechanism in someone who is obese that can affect blood pressure is angiotensin II and aldosterone levels which increase up to three times in obese sufferers²⁵. So that this will cause salt retention and increase the re-absorption of water by the kidney²⁶. These mechanisms will ultimately affect blood pressure and increase the risk of hypertension.

CONCLUSION

Based on the results of the study, it can be concluded that hypertension and obesity are mostly found in male who is ≥ 40 year old. There is a relationship between body mass index and waist circumference with blood pressure at the Karang Asam Public Health Center in Samarinda.

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