

WAIST-HIP RATIO AND BODY MASS INDEX AMONG PATIENTS WITH HYPERTENSION IN ACEH, INDONESIA

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ABSTRACT

Background: Hypertension is a chronic disease that can be associated with obesity and overweight. Measurement of waist-hip ratio (WHR) needs to be done to determine central obesity. This study aimed to analyze the waist-to-hip ratio and body mass index in among patients with hypertension.

Subjects and Method: This was a cross-sectional study conducted at Syiah Kuala University Hospital, Banda Aceh, from June to August 2021. A total of 40 hypertensive patients was selected at random. The dependent variables were WHR and body mass index (BMI). The WHR was measured by waist ruler. The BMI was measured by weight scale and stature meter. The data were analyzed by Chi-square and multiple logistic regression.

Results: There was not significant relationship between waist-to-hip ratio and hypertension (OR= 1.067; p= 0.942). Body mass index has not correlated with hypertension (OR= 0.99; 95% CI= 0.99 to 1.00; p=0.425) and it was statistically not significant.

Conclusion: Waist-to-hip ratio and body mass index not correlated among patients with hypertension.

Keywords: waist-hip ratio, body mass index, hypertension.

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BACKGROUND

Hypertension is one of the many public health problems that occur both in the world and in Indonesia. Hypertension is a non-communicable disease which is a risk factor for cardiovascular disease and stroke (Kemenkes, 2019). Based on the Data and Information Center of the Ministry of Health in 2017, cases of death from cardiovascular disease (45%) and stroke (51%) were caused by hypertension. WHO estimates that currently the global prevalence of hypertension is 22% of the total world population. In Indonesia, the results of Riskesdas 2018 show that the prevalence of hypertension in the population >18 years is

34.11%. This figure increased from 2007 which was 31.7%. Meanwhile, in Aceh the prevalence of hypertension reached 26.45% (Ministry of Health, 2019a) (Kemenkes, 2019a).

The risk factor for hypertension is obesity. Obesity as measured by Body Mass Index (BMI) is related to blood pressure. The risk for suffering from hypertension in obese people is almost 5 times higher than in people with normal weight (Aronow, 2017). An increase of 10% of body weight also increased 7 mmHg systolic blood pressure (Diaz, 2002).

An examination of nutritional status is an important part to assess the course of hypertension. The distribu-

tion of fat in the body is also an important risk factor in relation to hypertension. Indicators for measuring fat deposits, especially in the abdomen using the Waist to Hip Ratio (RLPP) measurement are important predictors of blood pressure (Nemesure et al., 2008; Li et al., 2019). This study aims to analyze body mass index and waist-hip ratio with the degree of hypertension in patients who have been diagnosed with hypertension.

SUBJECTS AND METHOD

1. Study Design

This was a cross sectional study conducted at Syiah Kuala University Hospital, Banda Aceh, from June to August 2021.

2. Population and Sample

The population in this study were all hypertensive patients who went to the Teaching Hospital of Syiah Kuala University. Sampling was carried out using accidental sampling technique to select patients who seek treatment and have been diagnosed with hypertension by doctors at the hospital.

Inclusion criteria included subjects aged 45-65 years, able to stand up straight (not stooped), had been diagnosed with hypertension and were willing to be respondents. The subjects used were 40 patients.

3. Study Variables

The dependent variables were degree of hypertension, the independent variables body mass index, waist-hip ratio.

4. Operational Definition of Variables

Hypertension degree is blood pressure which is divided into 3 categories, namely: 1) normal-high (systolic blood pressure 130-139 mmHg and or

diastolic 85-89 mmHg), 2) hypertension grade 1 (systolic blood pressure 140-159 mmHg and or diastolic 90-99, and 3) hypertension grade 2 (systolic blood pressure 160 and/or diastolic 100 mmHg).

Body mass index is a weight category by comparing weight and height. Data were obtained by measuring weight in kg divided by height squared in meters (kg/m²).

Waist-Hip Ratio is an indicator to determine abdominal obesity obtained by calculating the ratio between waist circumference (cm) and hip circumference (cm). Measurements were made using metlin to measure the waist and hip circumferences, then the waist circumference was compared to the hip circumference.

5. Instruments

The data were collected using a set of questionnaires and a list of demographic variables such as age, gender, domicile as well as the results of measurements of blood pressure, height, weight and waist and hip circumference.

6. Data Analysis

Univariate analysis was carried out to see the frequency and characteristics of the research subjects. While, bivariate analysis using the chi-square test to see the relationship between waist-hip ratio with degree of hypertension, and multivariate analysis using logistic regression to see the relationship between body mass index and degree of hypertension.

7. Research Ethics

The ethical clearance in this study was conducted at Medical School, Syiah Kuala University Hospital and was

declared ethical based on decree number 113/EA/FK-RSUDZA/2021.

RESULTS

1. Univariate Analysis

Univariate analysis included age, weight (kg), height (m), body mass index, and waist-hip ratio.

Table 1 showed mean of age (Mean= 53.70; SD= 5.72). The mean of

weight 73.92 (Mean= 73.92; SD= 11.80), mean of height (m) is 1.59 (Mean= 0.09; SD= 1.43). The mean of body mass index 29.45 (Mean= 29.45; SD= 4.55), mean of waist ratio 95.60 (Mean= 95.60; SD= 12.54) and hip ratio 104.65 (Mean= 104.65; SD= 11.40), also waist-hip ratio 0.91 (Mean= 0.91; SD= 0.07).

Tabel 1. Univariate analysis (continuous data) age, weight (kg), height (m), body mass index, and waist-hip ratio.

Independent Variables	N	Mean	SD	Min.	Max.
Age (Years)	40	53.70	5.72	45.00	65.00
Weight (Kg)	40	73.92	11.80	52.00	103.00
Height (m)	40	1.59	0.09	1.43	1.75
Body mass index	40	29.45	4.55	20.83	42.22
Waist ratio	40	95.60	12.54	55.00	123.00
Hip ratio	40	104.65	11.40	63.00	130.00
Waist-hip ratio	40	0.91	0.07	0.64	1.06

2. Bivariate Analysis

Bivariate analysis using the chi-square to see the relationship between waist-hip ratio with degree of hypertension.

Tabel 2 showed the subjects who had abnormal waist-hip ratio were 1.07

more at risk for developing grade 2 hypertension than people who had normal waist-hip ratio (OR= 1.07; p= 0.942).

Tabel 2. The relationship between waist-hip ratio and hypertension

Variable	Hypertension				OR	p
	Grade 1		Grade 2			
	N	%	N	%		
Waist-Hip Ratio					1.07	0.942
No	3	8.1	3	8.1		
Yes	15	40.5	16	43.2		

3. Multivariate Analysis

Multivariate analysis using logistic regression to see the relationship

between body mass index with degree of hypertension.

Table 3. Logistic regression analysis of the body mass index with degree of hypertension (Grade 1 dan Grade 2)

Independent Variables	OR	95% CI		p
		Lower limit	Upper limit	
Body mass index (BMI)	0.99	0.998	1.001	0.425
N Observation = 40				
-2 log Likelihood = 54.696				
Nagelkerke R ² = 0.022%				

Table 3 showed that menunjukkan bahwa there is no relationship between BMI and the degree of hypertension (grade 1 and grade 2) (OR= 0.99; 95%CI= 0.99 to 1.00; p=0.425).

DISCUSSION

Hypertension is the most common cause of death every year in the world with more than 30% of people with hypertension having a heart attack (myocardial infarction) (American Academy of Family Physicians, 2021). One of the factors that can play a role in the risk of hypertension is body mass index (BMI). Hypertension has categories based on systolic and diastolic values which are divided into high-normal, grade 1 and grade 2 hypertension (Unger et al., 2020). This study showed that respondents with obesity had more grade 1 and grade 2 hypertension, but statistical analysis showed no significant relationship between BMI and the degree of hypertension ($p > 0.050$).

In addition to BMI, health risk assessment can be calculated by the waist-to-hip ratio index. Waist-hip ratio is the proportion of fat stored in the body in the waist and hips. The value of this index is different between men and women with the benchmark value for men >0.90 and women >0.80 . If individuals pass this benchmark value, they will have a higher health risk of disease. This study found that male respondents with abnormal waist-hip ratio experienced the most hypertension grade 1 and grade 2 compared to respondents with normal waist-hip ratio index. Meanwhile, in female respondents, abnormal waist-hip ratio was found in obese BMI who

had grade 2 hypertension. However, the relationship between the two was not statistically significant ($p=0.425$).

Epidemiological studies have shown that there is a close relationship between hypertension, obesity, and impaired glucose and fat metabolism (Modan et al., 1985). In general, people with hypertension are obese and have metabolic disorders, so many obese people are found to have hypertension (Amanda and Martini, 2018). However, this obese condition occurs in conditions that are not the same for everyone. Hypertension is associated with obesity and the distribution of central body fat that occurs in the waist and hips. This is very dangerous as a risk factor for cerebrocardiovascular disease (Lapidus et al., 1989; Larsson et al, 1989; Welin, 1987).

The waist-hip ratio assessment has been used as a stronger indicator as a risk factor in determining the association with diseases such as heart attack (myocardial infarction), stroke, and premature death compared to the assessment using BMI (Lapidus et al., 1984).

Accumulation of fat in the abdomen occurs associated with endocrine disorders including glucose intolerance (Kissebah and Peiris, 1989), hypothalamo-pituitary adrenocortical hyperactivity, and impaired steroid hormone secretion (Hartz et al., 1984).

The variations of body mass index and waist-hip ratio in the subjects of this study occurred due to differences in muscle morphology and capillary density. Subjects with an abnormal waist-hip ratio index in this study had high blood pressure, namely grade 1

and grade 2 hypertension (in males) and grade 2 hypertension (in females).

The condition of muscle tissue in people with high waist-hip ratio has more type IIB muscle tissue, whereas type IIB consists of 20-30% having lower capillary density. Abnormal waist and hip circumference are known to be associated with peripheral insulin resistance and hyperinsulinemia (Bjorntorp, 1988). High waist-hip ratio values are associated with increased vascular system resistance, increased cardiac output, and stroke volume (Jern, 1992).

Differences in body fat accumulation differ by gender. Men have a high total body mass (lean mass) and bone mineral mass and lower fat mass than women. Women have more total adipose tissue than men.

This difference occurs due to the distribution of the network which is also different due to the gender factor. Males have more arm muscle mass, larger and stronger bone mass, less fat in the extremities and a lot of fat relative to the central distribution. Differences based on sex are also influenced by steroid hormones in men and women (WHO, 2011).

Therefore, it can be concluded that the waist-hip circumference ratio is not associated with the degree of hypertension and is not statistically significant. BMI is not associated with the degree of hypertension and is not statistically significant.

AUTHOR CONTRIBUTION

Sofia analyzed the results and discussions and reviewed the entire contents of the article. Nurjannah conducted a literature study and statistical analysis and reviewed the results. Ratna Idayati

collects respondent data and prepares draft articles.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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