RELATIONSHIP OF BODY MASS INDEX AND BLOOD PRESSURE IN FACULTY OF MEDICINE STUDENTS OF YARSI UNIVERSITY

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Abstract

Blood pressure is one of the signs to know the existence of Non-communicable Chronic Disease. Blood pressure changes can be affected by increased body weight and genetic factors. This study aims to determine the relationship between body mass index and blood pressure in students of the medical faculty of YARSI university class of 2016-2017. This study was conducted with a cross-sectional analytical descriptive approach. The population in this study were students of the YARSI University School of Medicine class of 2016-2017. The sample was chosen by a simple random sampling method and it should meet the inclusion criteria. Data retrieval is done by measuring blood pressure, weight and height. Kolmogorov Smirnov was used to analyze the data. The results of the Kolmogorov Smirnov statistical test show that there is a correlation between body mass index and blood pressure (P-value = 0.000). This study shows that there is a correlation between body mass index and blood pressure in YARSI University Medical School student.

Keywords: Body Mass Index, Obesity, Blood Pressure, Hypertension

1 PENDAHULUAN

Changes in the pattern of modern human life that is running rapidly have a big impact on human health, the results of WHO (2013) show that as many as 27.6% of the world's population or 985 million people suffer from hypertension, with a ratio of 50 64% in men and 49.36% in women. Of these, 65.85% of them are in developing countries. Blood pressure is a sign to find out how likely a non-communicable chronic disease / NCD (chronic non-communicable disease) is likely to occur and may be related to body mass index (BMI). According to Supariasa, (2012), body mass index (BMI) is a simple measuring tool for monitoring the nutritional status of adults related to excess and underweight. The overall mechanism of association between obesity and hypertension is not fully understood, but it is known that neuroendocrine roles (one of which is the activation of the Renin-Angiotensin-Aldosterone system), increased sympathetic activity, and this coincides with increased insulin resistance due to obesity.

An increase in the body mass index in developing countries shows an increase in the category of overweight to obesity. This is influenced by changes in lifestyle and dietary patterns (Bixby et al., 2019). Obesity which can then cause Obstructive Sleep Apnea and subsequently activates the sympathetic nervous system also contributes to an increase in blood pressure (Bailey, K & Ferro-luzzi, 1995, Narkiewicz, 2006; Re, 2009; Cai, 2013; Chaudhury et al., 2017). Then this is supported by the opinion of Nurmalina & Velley, (2011) which states that obesity is a major factor (flexible) that affects blood pressure and also the development of hypertension. This is also added by the opinion of Dobner & Kaser, (2018) Fat that accumulates in adipose tissue has atherogenic properties (total cholesterol, lipoprotein fractions, and triglycerides) which can trigger an inflammatory process in the vascular In addition to hypertension, an increase in body mass index will increase the individual. to be at risk for infection.

Fitriana, Lipoeto, N, & Triana, (2013) said that adolescents with a hereditary history of hypertension have a 7.67 times greater risk of developing hypertension, while obese adolescents also appear to have a 12.32 times greater tendency to develop hypertension. The prevalence of hypertension in Indonesia according to riskesdas 2013 at age ≥ 18 years was 26.5%, while in other studies the figure was 43.9% (WHO, 2015). Kristantio, J and Halim, (2019) have a significant relationship between body mass index and blood pressure, this is evidenced by the body mass index of a person who has a history of hypertension which is very influential. Furthermore, it is explained that in to avoid problems related to blood pressure, it is necessary to maintain and understand a healthy lifestyle and regulate the body mass index.

The prevalence of overweight and obesity in adolescents worldwide has increased widely, can persist into adulthood, and tends to lead to non-communicable chronic disease / NCD (a chronic disease that cannot be transmitted). Research in 1975 between the ages of 5-19 years found 4% overweight and 1% obese, while in 2016 18% were overweight and 14% obese (124 million children and adolescents) (Bibiloni, Pons, & Tur, 2013).

Hypertension is often defined as a condition in which systolic blood pressure is more than 120 mmHg and diastolic pressure is more than 80 mmHg (Ardiansyah, 2012). Research conducted by the International Diabetes Institute (2010) in Hong Kong shows that the risk of hypertension begins to increase in someone with a BMI of around 23 kg / m2 and the risk increases with the increase in BMI. This study aims to determine the relationship.

2 **METODE PENERAPAN** This study is a descriptive-analytic study with a cross-sectional research design. The population in this study were students of the Faculty of Medicine, YARSI University Class 2016-2017. The samples taken in this study were students of the Faculty of Medicine, Yarsi University Class 2016-2017 who had inclusion criteria (Students of the Faculty of Medicine, YARSI Angkata University 2016-2017, aged 18 years, and willing to become respondents and exclusion criteria (Students who had incomplete data). or have filled in informed consent but was not present at the time of sampling) Samples were taken using simple random sampling. Body mass index criteria used the WHO Asia Pacific Year 2000. Blood pressure criteria used JNC VII while the criteria for hypotension were sourced from the NHLBI. Blood pressure collection methods used ACC / AHA 2017.

3 HASIL DAN KETERCAPAIAN SASARAN

The results of calculations to see the body index mass of YARSI medical students have several categories ranging from under the normal size, normal, overweight, obesity level 1, and obesity level 2 can be seen in Table 1 below:

Tabel 1. Gambaran Indeks Massa Tubuh pada Mahasiswa Fakltas Kedokteran Universitas YARSI

Kategori	Indeks Massa Tubuh Angkatan 2016 dan 2017										Total	
	UNDERWEIGHT		NORMAL		OVERWEIGHT		OBESITAS *GRADE* 1		OBESITAS *GRADE* 2			
	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)
2016	8	3,69	36	16,59	16	7,37	20	9,22	24	11,06	104	47,93
2017	13	5,99	39	17,97	19	8,76	23	10,60	19	8,76	113	52,07
Total	21	9,68	75	34,56	35	16,13	43	19,82	43	19,82	217	100

Based on data collection that has been done, it was found that most of the respondents had a body mass index above normal as many as 121 people (55.77%); consisting of overweight 35 people (16.13%); obesity grade I 43 people (19.82%) and obesity grade II 43 people (19.82%). Based on the sampling, it was also found that 75 people (34.56%) of YARSI University medical faculty students, Class 2016-2017 had a body mass index within the normal range. Then to know the blood pressure in YARSI medical students can be seen in Table 2 below:

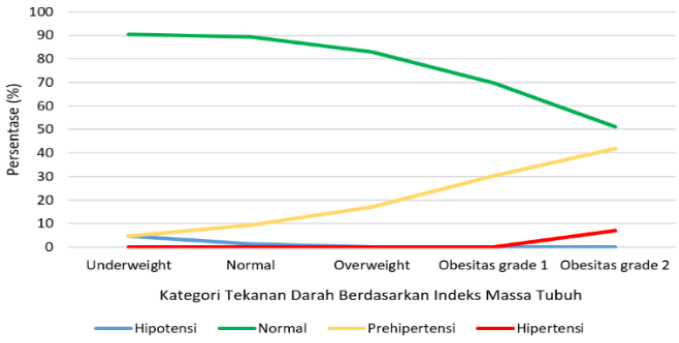
Tabel 2. Gambaran Tekanan Darah pada Mahasiswa Fakltas Kedokteran Universitas YARSI Angkatan 2016-2017

Kategori	Tekanan Darah Angkatan 2016 dan 2017								Total	
	NORMAL		PREHIPERTENSI		HIPERTENSI		HIPOTENSI			
	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)	Jumlah (n)	Persentase (%)
2016	79	36,41	24	11,06	0	0,00	1	0,46	104	47,93
2017	88	40,55	21	9,68	3	1,38	1	0,46	113	52,07
Total	167	76,96	45	20,74	3	1,38	2	0,92	217	100

In this study, it was found that most of the YARSI University medical faculty students of 2016-2017 as many as 167 people (76.96%) had blood pressure in the normal range, the remaining 45 people (20.74%) were included in the prehypertension category, 3 people (1.38%) had hypertension, and 2 people (0.92%) were categorized as hypotension. After knowing each body mass index and blood pressure in the research sample, namely YARSI medical students, then an analysis will be carried out about the relationship between the two. The results of the analysis of the relationship between the two are shown in table 3 below:

Tabel 3. Analisis Hubungan Indeks Massa Tubuh dan Tekanan Darah pada Mahasiswa Fakltas Kedokteran Universitas YARSI Angkatan 2016-2017

KATEGORI			Tekanan Darah				Total
			NORMAL	PREHIPERTENSI	HIPERTENSI	HIPOTENSI	
Indeks Massa Tubuh	UNDERWEIGHT	Jumlah	19	1	0	1	21
		% dari Indeks Massa Tubuh	90,5	4,8	0,0	4,8	100,0
	NORMAL	Jumlah	67	7	0	1	75
		% dari Indeks Massa Tubuh	89,3	9,3	0,0	1,3	100,0
	OVERWEIGHT	Jumlah	29	6	0	0	35
		% dari Indeks Massa Tubuh	82,9	17,1	0,0	0,0	100,0
	OBESITAS *GRADE* 1	Jumlah	30	13	0	0	43
		% dari Indeks Massa Tubuh	69,8	30,2	0,0	0,0	100,0
	OBESITAS *GRADE* 2	Jumlah	22	18	3	0	43
		% dari Indeks Massa Tubuh	51,2	41,9	7,0	0,0	100,0
Total		Jumlah	167	45	3	2	217
		% dari Indeks Massa Tubuh	77,0	20,7	1,4	0,9	100,0



Gambar 1. Grafik Hubungan Indeks Massa Tubuh dan Tekanan Darah pada Mahasiswa Fakultas Kedokteran Univeristas YARSI Angkatan 2016-2017

Table 3 and Figure 1 show the analysis of the relationship between body mass index and blood pressure in students of the Faculty of Medicine, YARSI University, Class 2016-2017. Based on the relationship between obesity and blood pressure, it was found that 3 people (7%) in the grade 2 obesity category had hypertension, and 45 people (20.7%) of all respondents had prehypertension. This study also found that cases of hypertension at 18-22 years old only occurred in the grade 2 obesity category.

Overall, there were 45 people with prehypertension (20.7%), including 1 person (2.22%) from the underweight group, 7 people (15.56%) from the normal category, 6 people (13, 33%) came from the overweight group, 13 people (28.89%) came from the grade 1 obesity category, and 18 people (40%) came from the grade 2 obesity category. normal blood, including 19 people (11.38%) in the underweight category, 67 people (40.12%) in the normal category, 29 people (17.37%) in the overweight category, 30 people (17.96%) in the normal category. Obesity grade 1, and 22 people (13.17%) in the category of obesity grade 2. Based on the test results obtained a value of $p = 0.000$ or $p < 0.05$ so that there is a significant relationship between body mass index and blood pressure.

DISCUSSION

Fitriana et al., (2013) said that obesity is one of the factors that can increase the risk of developing hypertension. This study proves that body mass index and blood pressure have a significant relationship, this is based on the finding of the value of $p = 0.000$ and it is also found that an increase in body mass index above normal also increases the occurrence of an increase in blood pressure by 4.7 times greater. This study is by research conducted by Yu, Lin, Huang, Lin, & Zhu, (2016) in the Fujian area near the sea with a cross-sectional method of 3343 respondents, who stated that there was a relationship between BMI and blood pressure ($p < 0.05$). Based on 81 (37.33%) people who had a body mass index above normal (overweight, obese grade 1, and obesity grade 2), it was found that 37 (45.68%) of them had prehypertension and 3 (3.7%) people among them have hypertension. This is consistent with the study by Purohit et al (2015) in India of 138 medical students who found a significant correlation between BMI and blood pressure with $p = 0.000$, both with systolic and diastolic blood pressure.

Kotsis et al., (2010), DeMarco V, Aroor A, & Sowers J, (2014) and Cabandugama, P, Gardner, M, & Sowers, J, (2017) say that the relationship between obesity and hypertension is based on an increase in activation of the sympathetic nervous system. DeMarco V et al., (2014) said that in obese individuals who are accompanied by an increase in blood pressure, there is an

increase in the activation of the sympathetic nervous system, whereas in obese individuals without an increase in blood pressure there is an emphasis on the sympathetic nervous system. This activation that occurs in the sympathetic nervous system occurs in various tissues, including the heart, kidneys, and skeletal muscle, accompanied by baroreflex dysfunction, resulting in changes in blood pressure. A person's body mass index has a but not very significant relationship with his blood pressure. Further disclosed that the relationship includes systolic and diastolic blood pressure (Ulumuddin & Yhuwono, 2018).

Another thing that contributes to the pathogenesis of hypertension, namely endothelial dysfunction, is in conjunction with increasing evidence showing the significance of the association of endothelial dysfunction in the pathogenesis of obesity-related hypertension. Nardina, E, (2018) states that someone who has an obese body mass index often experiences high blood pressure (hypertension). Obesity causes an inflammatory state (vascular and systemic) leading to endothelial dysfunction. Insulin resistance, low adiponectin, high plasma leptin, increased plasma glucose, and free fatty acids are conditions that indicate inflammation. A series of pathways signaled by insulin are ordered to work as an effect of inflammation and uncontrolled endothelial growth causing endothelial dysfunction to lead to hypertension (Kotsis et al., 2010). Rahmatillah, Susanto, & Nur, (2020) explain that body mass index does not have a significant relationship with both systolic and diastolic blood pressure. However, for someone who has a history of hypertension between body mass and systolic blood pressure has a relationship. Furthermore, he stated that even though there is no relationship, it is better to pay more attention to body mass index to avoid any illness or other health problems that will arise.

Kotsis et al., (2010) and Cabandugama, P et al., (2017) also said that in several studies it was found that there was an increase in the activity levels of plasma renin, plasma angiotensinogen, angiotensin II and aldosterone with obesity in humans. Several mechanisms are also responsible for RAAS (Renin-Angiotensin-Aldosterone System) activation. It is known that the RAAS mechanism plays an important role in the pathogenesis of hypertension (Arendse et al., 2019). Renin secretion by the kidneys seems to increase due to induced changes in intrarenal physical pressure, which is initiated by the accumulation of fat around the renal medulla as well. Due to the true histological picture, the changes that cause compression of the medulla, cause a decrease in filtrate flow in the loop of Henle, thereby prolonging the time for sodium reabsorption. This event will then be detected by the macula densa as a decrease in sodium concentration in the distal tubule, resulting in renin secretion through tubuloglomerular feedback. DeMarco V et al., (2014) also said the same thing that obesity can activate RAAS resulting in changes in blood pressure. The expression of RAAS components and the increased expression and secretion of angiotensiogens in adipose tissue in obese conditions play a role in local RAAS activation at the time of adipose tissue dysfunction. Also, increased circulating aldosterone may be involved in the development of hypertension in obese individuals. This is because obesity can be followed by an increase in plasma aldosterone levels and soluble factors derived from adipose tissue which can stimulate adrenal aldosterone secretion. Endothelial dysfunction and increased vascular smooth muscle reactivity are also implicated in aldosterone-induced modulation of vascular remodeling.

Large number of students with increased blood pressure may also be due to a family history of hypertension. This is as stated by Kazim S, Salman M, Zubairi A, Afzal, & Ahmad, (2008) that in children with hypertensive parents also found an increase in blood pressure and body mass index.

The increase in blood pressure due to this genetic influence causes essential hypertension. In this study, the history of hypertension is biased due to misinformation from respondents who think that there is no offspring of hypertension in their family, silent hypertension, or misunderstanding in filling out the questionnaire. As hypertension is known as the silent killer, it is a disease with no recognized symptoms but suddenly causes strokes and cardiovascular attacks that can occur during fire fighting (Kim et al., 2019). Then added the opinions of Kembuan, Kandou, & J., (2016) in obese patients there is an increase in the work of the heart to pump blood. The greater the body mass, the more blood supply is needed to supply oxygen and nutrients to body tissues. This results in the volume of blood circulating through the blood vessels increasing so that the pressure on the artery walls becomes greater. Further researchers are advised to educate in advance about the questionnaire that will be given so that there is no misunderstanding or not filling in any part of the questionnaire

4 KESIMPULAN

Based on the results of the analysis that has been carried out, it is revealed that there is a significant relationship between body mass index and blood pressure in students of the Faculty of Medicine, YARSI University class of 2016-2017. In connection with the results of this study, the researchers suggest that students who are sampled and not carry out a healthy lifestyle, for example by exercising regularly, implementing a balanced nutritional pattern, and controlling body weight, especially for individuals with overweight or high blood pressure, whether it has happened nor is it at risk of happening. Researchers suggest that further researchers be able to expand the scope of research and look at other factors such as daily salt intake which of course also affects blood pressure, looking at physical activity, and sedentary behavior so that it can be increasingly useful in gaining insight into the health sector.

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