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Descriptive Study of Body Mass Index (BMI), Waist and Blood Pressure in Students of Doctor Education Study Program, Faculty of Medicine Universitas Sriwijaya

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Abstract

Introduction : The Descriptive Study about Body Mass Index (BMI), Waist Circumference and Blood Pressure on Medical Students in Medical Faculty of Universitas Sriwijaya**.** Body mass index (BMI) is a measurement indicator recommended by WHO to identify the nutritional status of an individual.

Methods: Body weight and height measurements were taken to calculate the value of body mass index (BMI), measurement of waist circumference and measurement of blood pressure on students at the Faculty of Medicine Universitas Sriwijaya class of 2016. The value of BMI in the category of overweight and obesity is most at the age of 20-21 years (20.6%) and in female (14%). The value of waist circumference in the abnormal category is most at the age of 20-21 years in men (5.3%) and women (11.81%). The value of blood pressure that has pre-hypertension and first degree hypertension is in students aged 20-21 years (20.2%) and most in men (14%).

Results: The blood pressure values included in the pre-hypertension and first-degree hypertension categories were most on the BMI values in the overweight and obese categories (18.8%) and in the waist circumference in the medium and large categories (13.81%). The distribution of research subjects based on BMI and waist circumference that exceeds the normal value is most at the age of 20-21 years and in women. The distribution of research subjects based on blood pressure that experienced pre-hypertension and first degree hypertension was most at the age of 20-21 years and in men.

Conclusion : The distribution of research subjects based on blood pressure that experienced pre-hypertension and first degree hypertension at most in the value of BMI and waist circumference that exceeds the normal value.

Keywords: Body mass index (BMI), waist circumference, blood pressure.

Introduction

Body Mass Index (BMI) is used as an indicator of measurement that is often done to identify nutritional status in normal or abnormal categories in an individual.[1-2] According to the *World Health Organization* in 2011 nutritional status based on body mass index is classified into 4 categories, namely underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29 , 9 kg/m^2) and obesity (> 30 kg/m^2). Although BMI measurement is the most frequently used indicator to identify nutritional status, a better way is to identify the distribution of intraabdominal fat (visceral fat) which is a factor associated with an increased risk of developing metabolic syndrome.[3-4] The best indicator to determine the distribution of intraabdominal fat (visceral fat) is by measuring the *waist circumference* (WC) or waist circumference.[5]

The prevalence of obesity in men is 11% while in women it is 15% (WHO, 2016). Meanwhile, the prevalence of obesity was 14.8% in 2013 to 21.8% in 2018.[6] The *World Health Organization (WHO)* in 2011 stated that as many as 1 billion people in the world suffer from hypertension and it is estimated that it will increase every year. Riskesdas in 2018 states that the prevalence of hypertension in Indonesia in the age group > 18 years has increased from 25.8% in 2013 to 34.1% in 2018.

Previous research conducted by Bawazier in 2019 on medical students at the University of Indonesia found that the prevalence of hypertension was 29.6% with an average BMI value of 26 kg/m^2 caused by a bad lifestyle and minimal physical activity. The same study conducted by Nguyen in the 20 year age group found a prevalence of hypertension (BP > 140/90 mmHg) of 55.3% in men and 43.45% in women with BMI value > 25 kg/m^2.[7-8] Research on the identification of body mass index values, waist circumference and blood pressure in students is needed because students have a high enough risk of suffering from overweight, obesity and hypertension.

Methods

The research to be conducted is a descriptive observational study with *a cross sectional* design. The research took place from June 2019 to December 2019. This research was conducted at the Faculty of Medicine, Sriwijaya Madang and Bukit Besar Universities. The sample in this study were students of PSPD Faculty of Medicine, Sriwijaya University, class of 2016 who met the inclusion and exclusion criteria. The method of sampling in this study is to use total sampling. With this, sampling is done by making the population a sample that meets the inclusion criteria.

The data collected in the form of primary data, namely data taken directly from the research subject by measuring height, weight, waist circumference and blood pressure three times. The measurement data that has been collected is processed manually and presented in the form of tables and percentages, then analyzed by univariate.

Results

General Characteristics of Research Subjects

The general characteristics of research subjects in this study consisted of age and gender. Table 1 shows the distribution of study subjects by gender. From the 228 research subjects, 167 people (73.2%) were women and 61 people (26.8%) were men. This study shows that the research subjects are more female than male.

Table 2 shows the distribution of study subjects by age. Most of the research subjects were in the 20-21 years age group (86.9%). There were 7 students (3%) students in the 18-19 age group and 23 students (10.1%) students in the 22-23 year age group.

Table 1. Distribution of Research Subjects by Gender (N = 228)

Gender	Research Subject	
	N	(%)
Female	167	73,2
Male	61	26,8
Total	228	100

Table 2. Distribution of Research Subjects by Age (N = 228)

Gender	Research Subject	
	N	(%)
18-19	7	3,0
20-21	198	86,9
22-23	23	10,1
Total	228	100

Distribution of Research Subjects Based on BMI, Age and Gender

Distribution data of research subjects based on BMI obtained from measurements of height and weight. Table 3 shows the distribution data of study subjects based on BMI and age. In the 18-19 years age group, there were 2 people (0.9%) in the thin category; 4 people (1.8%) normal and 1 person (0.4) is obese, in the age group of 20-21 years, there were 25 people (11.0) in the thin

category; 126 people (55.3%) in the normal category; 18 people (7.9%) were in the overweight category and 29 people were obese (12.7%), in the 22-23 year age group there was 1 person (0.4%) in the thin category; 15 people (6.6%) in normal category; 2 people (0.9%) were in the overweight category and 5 people (2.2%) were obese.

Table 3. Distribution of Research Subjects based on BMI and Age (N = 228)

Age	IMT				Total n (%)
	Thin	Normal	Over Weight	Obesity	
	n (%)	n (%)	n (%)	n (%)	
18-19	2 (0.9)	4 (1.8)	0 (0.0)	1 (0.4)	7 (3.1)
20-21	25 (11.0)	126 (55.3)	18 (7.9)	29 (12.7)	198 (86.8)
22-23	1 (0.4)	15 (6.6)	2 (0.9)	5 (2.2)	23 (10.1)
Total	28 (12.3)	145 (63.6)	20 (8.8)	30 (15.4)	228 (100.0)

From the measurement results, it was found that students of class 2016 who had BMI scores in the category of overweight and obesity were the most in the 20-21 year age group (20.6%). Data on the distribution of research subjects based on BMI and gender are presented in Table 4. Data for women found that 26 people (11.4%) were in the wasting category, 109 people (47.8%) were classified as normal; 16 people (7%) were in the overweight category and 16 people (7%) were in the obese category. Distribution of BMI in men, there were 2 men (0.9%) in the thin category; 31 people (13.6%) were classified as normal; 9 people (3.9%) were in the overweight category and 19 people (8.3%) were obese.

From the measurement results, it was found that students of class 2016 who had BMI scores in the category of overweight and obesity were mostly women (14%).

Table 4. Distribution of Research Subjects based on BMI and Gender (N = 228)

Gender	IMT				Total n (%)
	Thin	Normal	Over Weight	Obesity	
	N (%)	n (%)	n (%)	n (%)	
Female	26 (11.4)	109 (47.8)	16 (7.0)	16 (7.0)	167 (73.2)
Male	2 (0.9)	31 (13.6)	9 (3.9)	19 (8.3)	61 (26.8)
Total	28 (12.3)	140 (61.4)	25 (11.0)	35 (15.4)	228 (100.0)

Distribution of Research Subjects Based on Waist Circumference, Age and Gender

Table 5 shows the distribution data of study subjects based on waist circumference and age. Men in the 18-19 age group found 2 people (0.9%) in the normal waist circumference category and 1 person (0.4%) including the large waist circumference category, in the 20-21 year age group 33 people (14.47%) were included. normal waist circumference category; 13 people (5.7%) were in the medium category and 7 people (3.07%) were included in the large waist circumference category, In the 22-23 year age group, 3 people (1.31%) were included in the normal waist circumference category and 2 people (0.9%) were included in the large waist circumference category.

Table 5.Distribution of Research Subjects by Waist Circumference and Age (N = 228)

Age (years)	Waist Circumference			Total n (%)
	Normal	Midle	High	
	n (%)	n (%)	n (%)	
Male				
18-19	2 (0.9)	0 (0.0)	1 (0.4)	3 (1.31)
20-21	33 (14.47)	13 (5.7)	7 (3.07)	53 (23.24)
22-23	3 (1.31)	0 (0.0)	2 (0.9)	5 (2.2)
Female				
18-19	4 (1.75)	0 (0.0)	0 (0.0)	4 (1.75)
20-21	118 (51.75)	16 (7.01)	11 (4.81)	145 (63.57)
22-23	14 (6.14)	2 (0.9)	2 (0.9)	18 (7.9)
Total	174 (76.32)	31 (13.6)	23 (10.08)	228 (100.0)

Data on the distribution of research subjects based on the waist circumference of women is also presented in table 9. In the 18-19 age group, 4 people (1.75%) were in the normal category, in the 20-21 year age group there were 118 people (51.75%) in the normal category; 16 people (7.01%) were in the moderate category and 11 people (4.81%) were included in the large waist circumference, in the 22-23 year age group there were 14 people (6.14%) in the normal category; 2 people (0.9%) are in the medium category and 2 people (0.9%) are in the large waist circumference category.

From the measurement results, it was found that the 2016 class of students who had the most abnormal waist circumference values at age 20-21 years in male (8.77%) and female (11.82%).

Data on the distribution of research subjects based on waist circumference and gender are presented in Table 6. There were 38 male students (16.67%) with a normal waist circumference (<90 cm) and 10 people (4.38%) with a large waist circumference (> 102 cm)

Data on the distribution of research subjects based on the waist circumference of women obtained 136 people (59.65%) with normal waist circumference (<80 cm), and 13 people (5.7%) with large waist circumference (> 88 cm).

Table 6. Distribution of Research Subjects Based on Waist Circumference and Gender (N = 228)

Gender	Waist Circumference			Total n (%)
	Normal	Midle	High	
	n (%)	n (%)	n (%)	
Male	38 (16.67)	13 (5.7)	10 (4.38)	61 (26.75)
Female	136 (59.65)	18 (7.9)	13 (5.7)	167 (73.25)
Total	174 (16.32)	31 (13.6)	23 (10.08)	228 (100.0)

From the measurement results of waist circumference in the abnormal category based on gender, it was found that there were more women (13.6%) than men.

3.1.4 Distribution of Research Subjects Based on Blood Pressure, Age and Gender

Data on research subjects based on blood pressure and age in medicine faculty of Unsri students class of 2016 are presented in Table 7. In the 18-19 year age group, 5 people (2.2%) were found with normal blood pressure; 1 person (0.4%) had pre-hypertension and 1 person (0.4%) who included grade 1 hypertension, 20-21 years age group found 152 people (66.67%) with normal blood pressure; 29 people (12.7%) who had pre-hypertension and 17 people (7.5%) including grade 1 hypertension, age group 22-23 years found 17 people (7.5%) in normal condition; 5 people (2.2%) had pre-hypertension and 1 person (0.4%) was included in grade 1 hypertension. Based on

the data obtained, the most experienced pre-hypertension and grade 1 hypertension were in the 20-21 year age group (20.2%) .

Table 7.Distribution of Research Subjects by Blood Pressure and Age (N = 228)

Age	Tekanan Darah				Total n (%)
	Normal	Pre-hypertension	HT Grade 1	HT Grade 2	
	n (%)	n (%)	n (%)	n (%)	
18-19	5 (2.2)	1 (0.4)	1 (0.4)	0 (0.0)	7 (3.1)
20-21	152 (66.67)	29 (12.7)	17 (7.5)	0 (0.0)	198 (86.8)
22-23	17 (7.5)	5 (2.2)	1 (0.4)	0 (0.0)	23 (10.1)
Total	174 (76.3)	35 (15.4)	19 (8.3)	0 (0.0)	228 (100.0)

*HT = Hypertension

Table 8 shows the data of the study subjects based on blood pressure and gender. There were 29 men (12.7%) with normal blood pressure; 14 people (6.1%) had pre-hypertension and 8 people (7.9%) were categorized as grade 1 hypertension, whereas in women, 145 people (63.6%) had normal blood pressure; 21 people (9.2%) had pre-hypertension; and 1 person (0.4%) included in grade 1 hypertension. Based on the blood pressure data obtained, men (14%) experienced pre-hypertension and grade 1 hypertension the most.

Table 8. Distribution of Research Subjects Based on Blood Pressure and Gender (N = 228)

Gender	Blood Pressure				Total n (%)
	Normal	Pre-hypertension	HT Grade 1	HT Grade 2	
	n (%)	n (%)	n (%)	n (%)	
Male	29 (12.7)	14 (6.1)	18 (7.9)	0 (0.0)	61 (26.8)
Female	145 (63.6)	21 (9.2)	1 (0.4)	0 (0.0)	167 (73.2)
Total	174 (76.3)	35 (15.4)	19 (8.3)	0 (0.0)	228 (100.0)

*HT = Hypertension

Distribution of Research Subjects Based on Blood Pressure and BMI

Data on research subjects based on blood pressure and BMI are presented in Table 9. In the wasting category, 27 people (11.8%) had normal blood pressure and 1 person (0.4%) had pre-hypertension. In the normal category, there were 135 people (59.2%) with normal blood pressure, 9 people (3.9%) had pre-hypertension and 1 person (0.4%) included grade 1 hypertension. In the overweight category, there were 8 people (3.5%) with normal blood pressure, 9 people (3.9%) had pre-hypertension and 3 people (1.3%) included grade 1 hypertension. In the obesity category, there were 4 people (1.8%) with normal blood pressure; 16 (7%) had pre-hypertension and 5 (6.6%) had grade 1 hypertension.

Table 9. Distribution of Research Subjects Based on Blood Pressure and BMI (N = 228)

IMT	Blood Pressure				Total n (%)
	Normal	Pre-hypertension	HT Grade 1	HT Grade 2	
	n (%)	n (%)	N (%)	n (%)	
Thin	27 (11.8)	1 (0.4)	0 (0.0)	0 (0.0)	28 (12.3)
Normal	135 (59.2)	9 (3.9)	1 (0.4)	0 (0.0)	145 (63.6)
Over weight	8 (3.5)	9 (3.9)	3 (1.3)	0 (0.0)	20 (8.8)
Obesity	4 (1.8)	16 (7.0)	5 (6.6)	0 (0.0)	35 (15.4)
Total	174 (76.3)	35 (15.4)	19 (8.3)	0 (0.0)	228 (100.0)

*HT = hypertension

Based on the data obtained, it was found that the BMI scores in the 2016 batch of FK Unsri students were in the category of overweight and obesity, many of which experienced an increase in blood pressure.

Distribution of Research Subjects Based on Blood Pressure and Waist Circumference

Data of research subjects based on blood pressure and waist circumference of men are presented in Table 10 and women in Table 11. Based on the data obtained, the value of waist circumference in men is in the normal, medium and large category, there are 10 people (4.3%) who experience pre-hypertension and 18 people (7.91%) were categorized as grade 1 hypertension. Based on the data obtained, it was found that the value of waist circumference in women in the normal, medium and large categories, there were 3 people (1.2%) who had pre-hypertension and 1 person (0.4%) with moderate and large waist circumference included in the category of grade 1 hypertension.

Table 10. Distribution of Research Subjects Based on Blood Pressure and Male Waist Circumference (N = 61)

Waist Circumference	Blood Pressure				Total n (%)
	Normal n (%)	Pre-Hypertension n (%)	HT Grade 1 n (%)	HT Grade 2 n (%)	
	Laki-laki				
Normal	30 (13.16)	8 (3.5)	8 (3.5)	0 (0.0)	46 (20.17)
Midle	1 (0.4)	1 (0.4)	3 (1.31)	0 (0.0)	5 (2.2)
High	2 (0.9)	1 (0.4)	7 (3.1)	0 (0.0)	10 (4.38)
Total	33 (14.46)	10 (4.3)	18 (7.91)	0 (0.0)	61 (26.75)

*HT = Hypertension

Table 11. Distribution of Research Subjects Based on Blood Pressure and Female Waist Circumference (N = 167)

Waist Circumference	Blood Pressure				Total n (%)
	Normal n (%)	Pre-hypertension n (%)	HT Grade 1 n (%)	HT Grade 2 n (%)	
	Perempuan				
Normal	135 (59.25)	1 (0.4)	0 (0.0)	0 (0.0)	136 (59.65)
Midle	17 (7.5)	1 (0.4)	0 (0.0)	0 (0.0)	18 (7.9)
High	11 (4.9)	1 (0.4)	1 (0.4)	0 (0.0)	13 (5.7)
Total	163 (71.65)	3 (1.2)	1 (0.4)	0 (0.0)	167 (73.25)

*HT = Hypertension

Discussion

In this study, the results showed that students of the Faculty of Medicine, Universitas Sriwijaya class 2016 based on age were mostly in the 20-21 years age group (86.9%) and and in women (73.2%). The results showed that BMI among Faculty of Medicine Unsri students class of 2016 were included in the overweight and obese category, although they remained dominant in the normal category for both boys and girls. These results are in accordance with data obtained by Riskesdas in 2013 in the city of Palembang which shows that at the age of> 18 years there is an increase in the prevalence of obesity from 2010 to 2013 by 16.7%. Research by Bawazier et al., (2019) and Hastuti et al., (2017) also obtained the same results regarding the measurement of BMI in young adults. This is consistent with research conducted by Hastuti et al.[9] One of the causes is the intake of food that is consumed excessively without doing physical activity which will cause a buildup of calories in the body.

Lifestyles that are less physically active in students can result in an imbalance between energy storage in the form of fat synthesis (lipogenesis) and energy expenditure in the form of fat breakdown (lipolysis), so that it can lead to weight gain.[10-11] The results showed that the distribution of waist circumference that exceeded the normal value based on age in Faculty of Medicine Unsri students class of 2016 was mostly in the 20-21 year age group, both male and female. Data on the distribution of research subjects based on male waist circumference, it was found that 23 people (10.08%) were included in the abnormal category and 31 people (13.6%) were women. This is consistent with research conducted by Guimares et al.Years and Hastuti et al., 2017 at the age of > 18 years. The results of measurements of waist circumference and BMI have the same tendency. Waist circumference that exceeds the normal value is caused by an increase in the accumulation of visceral fat in the body that occurs in overweight and obese individuals. Previous research conducted by Azis also had similar results. The results of the study are also in accordance with the research conducted by Pan in a population with a BMI value of ≥25 kg/m^2 having a waist circumference> 90 cm in men and > 80 cm in women.[12-13]

The results of research on the value of blood pressure based on age were obtained by students of the Faculty of Medicine, University of Sriwijaya, class of 2016 with an age range of 18-23 years, many of whom had pre-hypertension compared to hypertension. Hastuti, Rahmawati and Suriyanto in 2018 obtained similar results that at the age of 18-25 years, the prevalence of pre-hypertension was higher than the prevalence of hypertension.[14] Previous research conducted by

Bawazier also found that the high prevalence in pre-hypertension was supported by examining lipid profiles and kidney function tests.

Age is closely related to the structure and function of blood vessels and the heart. As we get older, there will be a decrease in elasticity and relaxation of smooth muscle from blood vessels which will increase cardiac output and peripheral resistance so that blood pressure will increase.[15] In this study, it was found that the prevalence of pre-hypertension was more than hypertension which was probably due to the relatively young age. . This study found that the prevalence of increased blood pressure in men is greater than in women. This is consistent with previous research conducted by Nguyen and Hastuti et al. This is probably because men are more often exposed to the risk of increased blood pressure, one of which is physical activity such as exercise.[16]

The value of waist circumference and BMI can be influenced by food intake that is not properly maintained along with physical activity which can increase the risk of cardiovascular disease.[17] Physical activity, such as exercise, of course, must be accompanied by maintaining food intake so that you do not experience a weight that exceeds the normal value and can also improve the health status of an individual.

Research Limitations

The limitation of this study is that there is no assessment of the concentration of lipid profiles in research subjects and the use of the IPAQ questionnaire to assess physical activity in research subjects.

Conclusion

Based on research that has been carried out on students of the Sriwijaya University Medical Faculty Medical Education Study Program, the following conclusions are obtained Research subjects were found most in the age group 20-21 years (86.9%) and in women (73.2%). Research subjects based on BMI in the category of overweight and obesity were found in the age group 20-21 years (20.6%) and in women (14%). Research subjects based on waist circumference were found in the age group of 20-21 years in men (8.77%) and women (11.82%) who were included in the abnormal category and more women (13.6%) than men. Research subjects based on blood pressure were found in the age group 20-21 years who were included in the category of pre-hypertension and grade 1 hypertension (20.2%) and more men (14%) than women. Blood pressure

values included in the pre-hypertension and grade 1 hypertension categories were found in the BMI values in the overweight and obese category (18.8%). The value of blood pressure included in the pre-hypertension category and grade 1 hypertension is found in the value of men's waist circumference in the medium and large category (12.21%) and waist circumference of women (1.6%).

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