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Correlations between Body Mass Index (BMI) and Occurance of Metabolic Syndrome on Patients in Hospital Internal Medicine Clinic

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ABSTRACT

Body Mass Index (BMI) is the index used to classify and score overweight and obesity. An imbalance between energy intake and expenditure may cause the accumulation of fat in the body, which affects the BMI value. BMI is used to detect metabolic syndrome, which is a collection of symptoms that can increase the risk of non-communicable diseases such as type 2 diabetes mellitus (T2DM) and cardiovascular disease. This study aims to determine the correlations between BMI and the incidence of metabolic syndrome at the internal medicine clinic Anutapura Hospital, Palu. This research was an analytic observational study with a cross-sectional approach. The samples were 96 patients and ATP III criteria was used in the assessment of metabolic syndrome. Individuals were declared metabolic syndrome if they met 3 out of 5 criteria, namely increased waist circumference, blood pressure, fasting plasma glucose (FPG), triglyceride levels, and decreased HDL levels. Data analysis used a chi-square test. It obtained a *p*-value = 0.001 with the results that showed a correlation between BMI and the incidence of metabolic syndrome at the internal medicine clinic, Anutapura General Hospital, Palu. There were correlations between BMI and waist circumference ($p = 0.000$), blood pressure ($p = 0.003$), triglycerides ($p = 0.000$), and HDL ($p = 0.000$). There were no correlations between BMI and FPG levels ($p = 0.531$). There is a correlation between BMI and the incidence of metabolic syndrome in the internal medicine clinic Anutapura Hospital, Palu.

KEYWORDS: Body mass index, metabolic syndrome, ATP III, diabetes mellitus, obesity.

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I. INTRODUCTION

Body mass index (BMI) is an index used to classify and assess overweight and obesity. BMI assessment uses body weight (kg) divided by the square of height (m^2)[I]. The national BMI classification is divided into 5 categories, namely underweight (<17.0 kg/m^2), mild underweight (17.0-18.4 kg/m^2), normal (18.5-25.0 kg/m^2), mild obesity (25.1-27.0 kg/m^2) and severe obesity (>27 kg/m^2)[I]. In Indonesia in 2018 adults who were overweight were around 13.6% and obese were 21.8%. In Palu City, 13.92% and 16.11% were obese. The percentage of women who are overweight is 16.06% and obesity is 29.83%[II].

BMI can be used to detect metabolic syndrome. Metabolic syndrome is defined as a collection of symptoms of metabolic disorders of the body, namely dyslipidemia, central obesity, hyperglycemia, and hypertension. Metabolic syndrome is not a disease but rather describes a collection of various metabolic risk factors associated with non-communicable diseases[III-IV].

Normal BMI has a very high negative predictive value (NPV) to rule out metabolic syndrome conditions. BMI > 25 kg/m^2 has a specificity of 94% and sensitivity of 53% for metabolic syndrome. A BMI of 27 kg/m^2 is ideal for identification of metabolic syndrome.3 The prevalence of metabolic syndrome in Indonesia in adolescents is 6.93%, while in those over 15 years of age it is around 12.5%[IV].

The underlying etiology of metabolic syndrome is excessive food consumption, high-energy fast food, physical inactivity, and genetics[V]. The core of metabolic syndrome is the accumulation of adipose tissue and tissue dysfunction that will lead to insulin resistance[VI]. Insulin resistance, neurohormonal activity, and chronic inflammation have a role in initiating the progression of metabolic syndrome to cardiovascular disease and T2DM[VII].

The goal of this paper is to provide a background and perspective on the current understanding of the correlations between BMI and the occurance of metabolic syndrome.

II. METHODS

This study was an observational analytic study with a cross-sectional approach to analyze the relationship between BMI and the incidence of metabolic syndrome in the internal medicine clinic of Anutapura Hospital Palu. The research was conducted in July - August 2022. The sampling technique used purposive sampling with a total sample of 96 people who met the inclusion and exclusion criteria. The inclusion criteria of the study were patients aged 35-65 years and patients who first came for treatment at the internal medicine clinic of Anutapura Hospital, Palu. Exclusion criteria were incomplete medical record data and treatment that could cause bias in the study.

III. RESULT AND DISCUSSION

The number of samples who had normal BMI was 44 people (45.8%) and 52 people (54.2%) had BMI above normal. Most of the samples had metabolic syndrome, namely 79 people (82.3%) and only 17 people who did not meet the criteria for metabolic syndrome. A total of 82 people (85.4%) had central obesity, and 78 people (81.3%) had hypertension. 69 people had hyperglycemia, 63 people had hypertriglycerides and 22 people had HDL levels below normal.

Table 1. BMI Distribution and Components of Metabolic Syndrome

Variable		Frequency	%
BMI	Normal	44	45.8
	Excess	52	54.2
Metabolic Syndrome	Not	17	17.7
	Yes	79	82.3
Circumference Waist	Normal	14	14.6
	Central Autonomy	82	85.4
Blood Pressure	Normal	18	18.7
	Hypertension	78	81.3
GDP	Normal	27	28.1
	Hyperglycemia	69	71.9
Triglycerides	Normal	33	34.3
	Hypertriglycerides	63	65.6
HDL	Normal	72	77.1
	Not	22	22.9

Table 2. Crosstabulation of BMI with Metabolic Syndrome Components

Metabolic Syndrome					
BMI	**Not**		**Yes**		*p* Value
	Frequency	**%**	**Frequency**	**%**	
Normal	14	31.8	30	68.2	0.001
Excess	3	5.8	49	94.2	p < 0.05
Total	**17.7**	**17.7**	**79**	**82.3**	
Waist Circumference					
BMI	**Normal**		**Central Obesity**		***p* Value**
	Frequency	**%**	**Frequency**	**%**	
Normal	13	29.5	31	70.5	0.000
Excess	1	1.4	51	98.1	p < 0.05
Total	**14**	**14.6**	**82**	**85.4**	
Blood Pressure					
BMI	**Normal**		**Hypertension**		***p* Value**
	Frequency	**%**	**Frequency**	**%**	
Normal	14	31.8	30	68.2	0.003
Excess	4	7.7	48	48	*p* < 0.05
Total	**18**	**18.8**	**78**	**81.3**	
GDP					
BMI	**Normal**		**Hyperglycemia**		***p* Value**
	Frequency	**%**	**Frequency**	**%**	
Normal	11	25	33	75	0.531
Excess	16	30.8	36	69.2	*p* > 0.05
Total	**27**	**28.1**	**69**	**71.9**	

Triglycerides					
BMI	**Normal**		**Hypertriglyceridemia**		***p* Value**
	Frequency	**(%)**	**Frequency**	**(%)**	
Normal	30	68.2	14	31.8	0.000
Excess	3	5.8	49	49	$p < 0.00$
Total	**33**	**34.4**	**63**	**63**	
HDL					
BMI	**Normal**		**Not**		***p* Value**
	Frequency	**%**	**Frequency**	**%**	
Normal	25	56.8	19	43.2	0.000
Excess	49	94.2	3	5.8	$p < 0.05$
Total	**74**	**77.1**	**22**	**22.9**	

Table 2 shows the statistical analysis of BMI with metabolic syndrome components. It can be seen that the BMI variable with metabolic syndrome (*p*-value = 0.001) waist circumference (*p*-value = 0.000), blood pressure (*p*-value = 0.003), HDL (*p*-value = 0.000), and triglyceride levels (p-value = 0.000) have a *p*-value <0.05 which means there is a relationship between the two variables. Different results were obtained in the analysis of BMI with GDP levels (*p*-value = 0.531) this value > 0.05 so there is no relationship between BMI and GDP levels.

This research was conducted at the internal medicine clinic of Anutapura General Hospital in July-August 2022. The study sample amounted to 96 people. Statistical analysis between BMI and the incidence of metabolic syndrome obtained a *p*-value of 0.001 so it was concluded that there was a relationship between the two variables. A study involving 23.993 people stated that BMI < 25 kg/m^2 has a very high NPV to rule out metabolic syndrome. BMI > 25 kg/m^2 has a high specificity for metabolic syndrome. A BMI of 27 kg/m^2 is ideal for the identification of metabolic syndrome[III]. Lifestyle changes with high calorie and instant food consumption patterns coupled with low physical activity are associated with the risk of increased body mass and incidence of metabolic syndrome.

Statistical analysis between BMI and waist circumference showed a p value of 0.000 so it was concluded that there was a relationship between BMI and waist circumference. If BMI increases, other body proportions will also increase, in this case, visceral fat which will affect waist circumference[VIII].

In this study, it was concluded that there was a relationship between BMI and blood pressure (*p*-value = 0.003). The greater the body mass, the greater the volume of blood to deliver oxygen to the body tissues. This will cause an increase in cardiac output or cardiac output. Total peripheral resistance also has an important role in the occurrence of high blood pressure[IX]. In patients with metabolic syndrome, insulin resistance occurs. When insulin resistance occurs, there will be impaired nitrogen oxide stimulus. This results in vasoconstriction and increased sodium and water retention resulting in an increase in blood pressure[X]. The results have shown that no relationship between BMI and GDP levels (*p*-value = 0.531). There are several other factors that affect BMI status and GDP levels, including diet and fat consumption[XI]. In people with obesity and metabolic syndrome, there is an increase in free fatty acid levels, decreased adiponectin, and insulin sensitivity. free fatty acids, decreased adiponectin, and insulin sensitivity. This results in endothelial dysfunction impaired insulin signaling and ultimately insulin resistance. Chronically elevated free fatty acids will cause lipotoxicity. This will affect pancreatic β-cells[XII-XIII].

This study also revealed that there was a relationship between BMI and triglyceride levels (*p*-value = 0.000). Factors that can affect triglyceride levels include diet and increased fat intake which will affect the body's metabolism[XIV]. Increased triglyceride levels are also associated with insulin resistance. Insulin resistance will increase free fatty acids. The increase in free fatty acids to the liver will stimulate the formation and secretion of VLDL. The increase in VLDL will result in hypertriglycerides[XV]. In addition, there was a relationship between BMI and HDL levels (*p*-value = 0.000). About 60-70% of people with obesity have dyslipidemia. The greater the increase in BMI, the greater the abnormality in the lipid profile. Lipid profile abnormalities result from a combination of increased free fatty acids transferred to the liver due to increased total adipocytes and visceral fat, insulin resistance, and pro-inflammatory components induced by macrophages[XVI].

CONCLUSION

In the study obtained *p*-value = 0.001, the results showed that there was a relationship between BMI and the incidence of metabolic syndrome in the internal

medicine clinic of Anutapura Palu General Hospital. There is a relationship between BMI and waist circumference. (p = 0.000), blood pressure (p = 0.003), triglycerides (p = 0.000), and HDL (p = 0.000) in patients at the internal medicine clinic of Anutapura Hospital Palu. There was no relationship between BMI and GDP levels (p = 0.531) in patients at the internal medicine clinic of Anutapura Hospital, Palu.

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REFERENCES

I. Kemenkes. Epidemi Obesitas. Jurnal Kesehatan. 2018;1-8

II. Riskesdas Sulteng. Laporan Riskesda Provinsi Sulawesi Tegah. Palu: Kesehatan Sulawesi Tengah; 2018

III. Ofer,K., Ronit., Ophir, A., & Amir K. Normal Body Mass Index (BMI) Can Rule Out Metabolic Syndrome: An Israeli Cohort Study. Medicine. 2019; 98(9) p e14712.

IV. Christijani, R. Penentuan Diagnosis Sindrom Metabolik Berdasarkan Penilaian Skor Sindrom Metabolik dan NCEP ATP-III Pada Remaja (Penelitian di Beberapa SMA di Kota Bogor). The Journal of Nutrition and Food Research. 2019. 42(1), 21–28.

V. Swarup, S., Goyal, A., Grigorova, Y., & Zeltser R. Metabolic Syndrome. Treasure Island (FL): StatPearls Publishing. 2020.

VI. Oda, E. Historical Perspective of the Metabolic Syndrome. Clinics in Dermatology. 2018;36(1),3-8.

VII. Fahed, G., Aoun, L., Zerdan, M.B., allam, S., Zerdan, M.B., Bouferraa, Y., & Assi, H.I. Metabolic Syndrome: Updates on Pathophysiology and Management in 2021. International Journal of Molecular Sciences. 2022; 23(2) 786.

VIII. Susantini, P. Hubungan Indeks Masa Tubuh (IMT) dengan Persen Lemak Tubuh dan Lemak Visceral di Kota Semarang. Jurnal Gizi. 2021; 10(1) 51-59.

IX. Setiati, S., Alwi, I., Sudoyo, A. W., Setiyohadi, B., & Syam, A.F. Buku Ajar Ilmu Penyakit Dalam Jilid I Edisi IV. Jakarta: Interna Publishing; 2014

X. Zhou, M. S., Wang, A., & Yu, H. Link Between Insulin Resistance and Hypertension: What is the Evidence From Evolutionary Biology?. Diabetology and Metabolic Syndrome. 2014

XI. Suryanti, S.D., Raras, A.T., Dini, C.Y., Ciptaningsih, A.H. Hubungan Indeks Massa Tubuh dengan Kadar Gula Darah Puasa Pada Pasien Diabetes Melitus Tipe 2. Poltekkita: Jurnal Ilmu Kesehatan. 2019: 13(2): 86-90

XII. Setiawati, D., Nuhriawangsa, A., & Wasita, B. Visceral Fat Level Correlate with Increase of Fasting Blood Glucose in Overweight and Obese Adult. 2019.

XIII. Rochlani, Y., Pothineni, N.V., Kovelamudi, S., & Mehta, J.L. Metabolic syndrome: Pathophysiology, Management, and Modulation by Natural Compounds. Therapeutic Advances in Cardiovascular Disease. 2017.

XIV. Hartinim H., & Febiola, W. Hubungan Indeks Massa Tubuh (Imt) Terhadap Kadar Trigliserida Pada Wanita Usia 40-60 Tahun. Jurnal Sains Dan Teknologi Laboratorium Medik, 2018: 2(1), 2–7.

XV. Ormazabala, V., Nair, S., Elfeky, O., Aguayo, C., Salomon, C., & Zuñiga, F.

XVI. Association Between Insulin Resistance and The Development of Cardiovascular Disease. Cardiovascular Diabetology. 2018.

XVII. Feingold, Kenneth. Obesity and Dyslipidemia. SoutDartmouth: MDText.com. 2020.