Correlation Between Body Mass Index (BMI), Blood Pressure, Glucose Levels And Ages

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Abstract *- Obesity is a growing global public health problem. Patients with obesity are at high risk for a variety of comorbid conditions, including cardiovascular disease, gastrointestinal disorders, type 2 diabetes, joint and muscle disorders, respiratory problems, and psychological problems, which can significantly impact life and increase the risk of death. Even modest weight loss can enable patients to reduce their risk of cardiovascular disease, diabetes, obstructive sleep apnea and hypertension among many other comorbidities. Purposive sampling is used in this study's descriptive correlational approach.*
This study aimed to determine the correlation between Body Mass Index (BMI), Blood Pressure, Blood Glucose s and ages in Wiyono Village Lampung, were chosen as the research sites for this study. In all, 40 adult residents participated in this study. Both one- and two-variable analyses were carried out. Measurements of BMI, blood pressure and blood samples to determine blood glucose levels were part of the data gathering process. Following the results, health professionals provided counselling on a healthy lifestyle to each responder based on the findings of their assessment. The data show that there is a significant correlation between age and blood pressure, with a significant value of 0.001 < 0.05 and a moderate positive correlation (r = -0.513), which means that as age increases, blood pressure tends to increase. Techniques for implementing healthy lifestyle education, sustainable weight management, and routine weight maintenance are essential to prevent the impact of diseases caused by obesity, increased blood pressure and blood sugar levels.

Keywords*: Age, Blood Pressure, Blood Glucose, BMI*

I. INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health [5]. Body mass index (BMI) is calculated using the formula of a person's body weight (in kilograms) divided by the square of his height (in meters) [6]. BMI is categorized as underweight (BMI <18.5 kg/m2), normal (BMI 18.5 to 22.9 kg/m2), overweight (BMI 23 to 24.9 kg/m2), and obese (BMI ≥25 kg/m2). Obesity has now reached epidemic proportions, with more than 4 billion people worldwide expected to be overweight or obese by 2035. This represents an increase from 38% of the world's population in 2020 to more than 50% by 2035. The prevalence of obesity alone is expected to increase from 14% to 24% of the population over the same period, affecting nearly 2 billion adults, children and adolescents by 2035. Obesity is a growing health problem in Indonesia, with prevalence continuing to increase n recent years. Data from the Ministry of Health shows that the

prevalence of obesity in adults in Indonesia reached 21.8% in 2018 and increased to 28.7% in 2023. Individuals with abdominal (visceral) obesity are at a greater risk of acquiring multiple pathological conditions and have a higher morbidity and mortality rate.[3] Studies involving participants aged 18–85 years in both Japan and the United States have consistently shown that those with a BMI indicating overweight and obesity, exhibited a higher risk of hypertension, diabetes mellitus, and dyslipidemia, compared to that of individuals with a normal BMI. 15

Obesity has a major role causing various diseases like cardiovascular and type-2 diabetes mellitus. This condition showed in excessive weight and body fat due to some variety factors, such as dietary habits with high carbohydrates, physical inactivity, and some psychological factors. Imbalance of the excess energy stored and utilized by the body is one of the main causes of obesity (Chandrasekaran & Weiskirchen, 2024). Recent studies have shown the positive correlation between the BMI and blood glucose level (Ge et al., 2022; Patel et al., 2023; Radhina et al., 2023). Although there was correlation, some studies have shown no significant correlation in statistical assay between random blood glucose level and BMI (Thummakomma & Rajeswari, 2020; Yuliati et al., 2022). Mean ages of the subjects was different of these studies that shown correlation but not statistically significant.

Overweight and obesity increase the risk of developing hypertension through multiple pathophysiologic mechanisms [5–7] and the prevalence of hypertension increases at higher levels of BMI [8,9]. The risk factors of the increasing prevalence of hypertension are age, food consumption, inactive physical activity, and obesity4 . Obesity one of the main predictors of noncommunicable diseases including hypertension. BMI has been widely associated with blood pressure and hypertension. BMI was correlated with blood pressure ($p<0.001$) even after correction of age factor. The greater BMI the risk of increasing blood pressure also increase8 It is generally understood that an increased BMI places an individual at significant risk of developing hypertension, hyperlipidemia, and diabetes, all risk factors for coronary heart disease.[12] A growing body of evidence supports the notion that obesity is a causative factor in the development of hypertension At the cellular level, an increase in BMI will likely increase stored energy and adipocytes. With 10 kilograms of excess weight, there is a 10 to 30% increase in beta cell mass, leading to an increase in insulin secretion.[10] An increase in insulin secretion leads to a down-regulation of insulin receptors, ultimately causing insulin resistance and, eventually, diabetes. Obese individuals typically have increased adipose tissue hypertrophy, leading to endocrine dysregulation and insulin resistance. Insulin resistance increases triglycerides, serum glucose, and blood pressure, increasing the risk of cardiovascular disease and type 2 diabetes mellitus. Excess adipose tissue leads to insulin resistance by releasing excess free fatty acids.[14]. This study aims to explore the relationship between BMI, uric acid and ages.

II. LITERATURE REVIEW

Obesity, hypertension, and hyperglycemia are widely recognized as key risk factors for non-communicable diseases (NCDs), particularly cardiovascular and metabolic disorders. Body Mass Index (BMI) has long been used as an accessible indicator of nutritional status and potential health risks. Previous studies have shown a strong association between increased BMI and elevated blood pressure as well as impaired glucose metabolism (Kumar et al., 2021; Thomas, 2022). These conditions tend to worsen with age due to physiological changes and cumulative lifestyle-related exposures (Alqahtani & Kavakli-Thorne, 2023).

A study by Nguyen et al. (2021) emphasized the progressive nature of hypertension and diabetes in populations with high BMI, highlighting that as individuals age, their vascular elasticity decreases, insulin resistance increases, and the likelihood of metabolic syndrome becomes greater. These findings are supported by Bryman (2021), who discussed how aging contributes to diminished physical activity and poor dietary choices, which exacerbate the risk factors of obesity and related diseases.

The correlation between BMI and blood pressure has also been explored extensively. Research has found that adiposity contributes to vascular resistance and sodium retention, which elevate systolic and diastolic pressure (Goodfellow et al., 2020). Furthermore, studies have identified that high BMI increases insulin secretion demands, and when the pancreas fails to meet this demand, blood glucose levels rise—eventually leading to hyperglycemia (Ahmed & Rahman, 2020).

Despite these well-documented associations, gaps remain in the literature, particularly concerning the synergistic impact of these variables in rural and semi-urban Indonesian populations. While national surveys provide broad epidemiological data, localized studies are necessary to capture region-specific patterns that inform targeted health interventions. This study addresses that gap by examining the relationship between BMI, blood pressure, blood glucose, and age among adults in Wiyono Village, Lampung.

In contrast to urban-centered research, this study adds valuable insight into how demographic and lifestyle factors in rural settings may influence these interrelated health indicators. In doing so, it aims to enhance the evidence base for community-specific public health policies and early preventive measures. Additionally, it contributes to the methodological advancement by employing a descriptive correlational design, which allows for the simultaneous evaluation of multiple variables and their relationships in a real-world context.

III. MATERIALS AND METHODS

Purposive sampling is used in this study's descriptive correlational approach. The research area for this study was chosen to be Wiyono Village District.The ethical clearance number for this research is 451/KEPK-FIK.UNAI/EC/III/25. A total of 40 adult residents

participated in this investigation. Both univariate and bivariate analyses were performed. The data collection technique included BMI, blood pressure and blood sample analysis to assess blood glucose levels. Following the results, health professionals provided each responder with counselling on leading a healthy lifestyle based on the findings of their assessment.

IV. RESULTS AND DISCUSSION

Table 1. Distribution of Characteristic (=40)

Variabel	Category	Frequency	Percentage
Gender	Man	16	40
	Women	24	60
Age	Adult	12	30
	Middle Age	16	40
	Early	12	30
BMI	Underweight	1	2.5
	Normal weight	20	50
	Overweight	14	35
	Obesity class I	5	12.5
Blood Pressure	Normal	11	27.5
	Elevated	5	12.5
	Hypertension Stage I	4	10
	Hypertension Stage 2	14	35
	Hypertension Crisis	6	15
Blood Glucose	Normal	28	70
	Pre diabetes	8	20
	Diabetic	4	10

Based on the results of the study, 60% of respondents were female and most were middle age (40%). The results showed that BMI levels were in the overweight group (35%) Meanwhile,

blood pressure was in the hypertension stage 2 group (35%) and blood glucose was Diabetic (10%).

Table 2 Gender and Blood Pressure

Variable Category		Blood Pressure				
		Normal	Elevated	Hypertension Stage I	Hypertension Stage 2	Hypertension Crisis
Gender	Man	7	1	2	2	4
	Women	9	3	4	6	2
Total		16	4	6	8	6

Based on the results of the study, in women who experienced stage 2 hypertension as many as 6, hypertensive crisis as many as 4 men and more women who had normal blood pressure as many as 9 people.

Table 3. Correlation Between BMI, Age, Blood Pressure and Blood Glucose

		Age	BMI	Blood Pressure	Blood Glucose
Usia	Correlation Coefficient	1	-.117	.100	-.052
	Sig. (2-tailed)		.473	.540	.753
	N	40	40	40	40
BMI	Correlation Coefficient	-.117	1	.165	-.057
	Sig. (2-tailed)	.473		.308	.729
	N	40	40	40	40
Blood Pressure	Correlation Coefficient	.513	.139	1	.158
	Sig. (2-tailed)	.001	.392		.338
	N	40	40	40	40
Blood	Correlation Coefficient	-.052	-.057	.158	1

Glucose	Sig. (2-tailed)	.753	.729	.338	
	N	40	40	40	40

Table 3 Based on of the result of the study shows that there is a significant correlation between age and blood pressure, with a significant value of 0.001 < 0.05 and a moderate positive correlation (r = -0.513), which means that as age increases, blood pressure tends to increase.

Based on of the result of the study shows that there is a significant correlation between age and blood pressure, with a significant value of 0.001 < 0.05 and a moderate positive correlation (r = -0.513), which means that as age increases, blood pressure tends to increase. The deleterious consequences of obesity include an increased risk of death from cardiovascular disease (CVD) (20), type 2 diabetes mellitus (T2DM) (21), cancer (22), and chronic kidney disease (23). In the Framingham Offspring Study, 78% of new cases of essential hypertension in men and 65% in women were attributable to excess body fat (28). A 5% increase in body weight was associated with a 20–30% increase in the incidence of hypertension (29). BMI is the strongest risk factor for developing hypertension, with obese women having nearly five times the incidence of hypertension compared with those with a BMI <23.0 kg/m2 (30). Modest weight loss can lower BP in hypertensive patients. For example, in the TOHP II (Trial of Hypertension Prevention, phase II) study, in which overweight and obese adults were randomized to a weight loss intervention group versus usual care, participants who maintained a 4.5 kg weight loss over 30 months reduced their risk of developing hypertension by 65% (31). The primary goal of treatment for obesityrelated hypertension is weight loss, as this reverses the pathophysiological mechanisms that maintain hypertension. The BP-lowering effect of weight loss appears to be linear, with BP reductions of approximately 1 mmHg reported per kg of weight loss (73), although this effect may be attenuated in the long term, with reductions of approximately 6 mmHg observed per 10 kg of weight loss (74). Weight loss is initially attempted through nonpharmacological approaches such as lifestyle changes.

The relationship between obesity and hypertension is well described in children and adults and across both sexes (5,27). The majority of women develop hypertension at an older age than men, and a sharper increase in blood pressure begins in the third decade and continues throughout women's lives (Ghazi & Bello, 2022; Ji et al., 2020). In addition to SBP, both Pulse Pressure (PP) and Mean Arterial Pressure (MAP) experience a steady increase before menopause, followed by a marked acceleration in the years after menopause (Samargandy et al., 2022). By age 50, Diastolic Blood pressure generally increases due to increased arteriolar resistance (Singh et al., 2023). Along with time, increases in blood pressure may occur due to changes in the arteries. The lumen of arterial blood vessels in old age tends to experience narrowing and hardening of the blood vessel walls through the process of forming atherosclerosis (Singh et al., 2023)

The BMI elevated thenit followed by increases blood glucoselevel, or they have linear relations(Adnan et al., 2013; Chandrasekaran & Weiskirchen, 2024; Huang et al., 2023).Another variable that can be considered for accurate results of the research is metabolic

syndrome such as hypertension and high triglyceride level which can bring on insulin resistance. The development of insulin resistance was related to decline metabolic clearance rate of insulin (MCRI). These responses impaired to individual with type two diabetes mellitus (Gastaldelli et al., 2021). The type two diabetes mellitus is a complex disease and caused by many factors. Analysis for the correlation between this disease with obesity needs comprehensive examination of other variables like genetics condition, adipose tissue, adiponectin, fat mass and fat distribution, free fatty acids, and microbiome on digestive system (Chandrasekaran & Weiskirchen, 2024; Klimontov & Semenova, 2022; Wang et al., 2022)The study that included 63,180 Chinese and American participants indicated that a significant association between obesity and diabetes mellitus was observed in those aged ≥75 years as well. 18 The present study in Japanese participants showed no such association in women aged ≥75 years; hence, these results are inconsistent. However, stratified analysis by region revealed that individuals with obesity aged ≥75 years had a high risk of diabetes mellitus in the US but not in China. 18 Therefore, the inconsistency could be mainly due to ethnicity. 19 , 20 Originally, Japanese people have a lower insulin secretion than Caucasians. 19 On the other hand, the prevalence of obesity is less common in Asia, including Japan. 20. Individuals with obesity, based on BMI and WC, consistently had high risk of hypertension, diabetes mellitus, and dyslipidemia among those aged 18–74 years, regardless of gender. Among those aged ≥75 years, obesity based on BMI and WC was associated with high risk of metabolic disease in men, but only with hypertension and dyslipidemia in women.

V. CONCLUSION

Lifestyle and dietary changes, managing obesity, can have positive implications for overall physical health. Management of obesity is an important part of the clinical health care setting. consider weight-management strategies that may help patients achieve and maintain weight loss.

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