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THE RELATIONSHIP BETWEEN BODY MASS INDEX AND WAIST CIRCUMFERENCE WITH FASTING BLOOD GLUCOSE IN REPRODUCTIVE-AGE WOMEN IN IDAMGAMLAMO VILLAGE

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Abstract

Central obesity and a high body mass index (BMI) are associated with an increased risk of metabolic disorders, such as elevated fasting blood glucose related to insulin resistance. The aim was to analyze the relationship between BMI and waist circumference with fasting blood glucose levels in productive-age women in Idamgamlamo Village. The research design method used a quantitative cross-sectional approach with 112 female respondents aged 18–59 years who were taken through the total sampling method. Data were obtained from measuring BMI, waist circumference, and fasting blood glucose, then analyzed using the Pearson statistical test for normally distributed data. The results showed that the majority of respondents had central obesity and BMI in the overweight or obese category. The Pearson test showed a significant relationship between BMI and fasting blood glucose levels (r = 0.293; p = 0.02) and between waist circumference and fasting blood glucose levels (r = 0.334; p = 0.01), although the strength of the relationship was weak. In conclusion, BMI and waist circumference were positively correlated with fasting blood glucose levels.

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INTRODUCTION

The global increase in obesity prevalence has become a major health concern, particularly due to its association with a higher risk of metabolic diseases such as type 2 diabetes mellitus. According to the word Obesity Federation, 2024, the number of adults with obesity has risen significantly 50% in recent years, with a projected surge in cases in developing countries [1]. In Indonesia, the prevalence of overweight individuals increased from 13.6% (2018) to 14.4% (2023), while obesity rates rose from 21.8% to 23.4%. Central obesity also showed a significant rise from 31% to 36.8% [2,3]. North Maluku Province, data from the 2023 Indonesian Health Survey (*Survei Kesehatan Indonesia*, SKI) indicated that 30.8% of women were classified as obese, 15.5% as overweight, 47.3% had a normal BMI, and only 6.3% were underweight. Additionally, the prevalence of central obesity among women in North Maluku reached 54.8% [3]. Obesity raises the risk of type 2 diabetes mellitus and other metabolic diseases, such as high fasting blood glucose levels [4,5]

Obesity can be measured using various parameters, including Body Mass Index (BMI) and waist circumference. Previous studies have demonstrated a relationship between obesity and elevated fasting blood glucose levels, particularly in connection with insulin resistance. A study by Rahmadinia et al. found that an increase in waist circumference is strongly associated with higher fasting blood glucose levels, while other research has shown that a higher BMI also increases the risk of diabetes mellitus [5 , 6]. However, discrepancies remain among different studies, particularly regarding the strength of the association betweencentral obesity

and fasting blood glucose levels, highlighting the need for further research to clarify this relationship. And also related to the impact when the BMI increase and glucose level in reproductive age women

This study aims to analyze the relationship between Body Mass Index (BMI) and waist circumference with fasting blood glucose levels in reproductive-age women in Idamgamlamo Village. The focus on reproductive-age women was chosen because this group has a higher risk of obesity and metabolic complications due to hormonal factors, dietary patterns, and physical activity levels [7,8]

METHOD

This study employed a cross-sectional design with a quantitative approach to analyze the relationship between Body Mass Index (BMI) and waist circumference with fasting blood glucose levels in productive-age women in Idamgamlamo Village, West Halmahera Regency. 112 respondents made up the sample, which was chosen using total sampling based on the participation requirements of women between the ages of 18-59. Data collection was completed through direct measurements of body weight, height, waist circumference, and fasting blood glucose levels using a digital scale, height measuring device, waist ruler, and a calibrated glucometer. Data analysis was performed using the Pearson correlation test. Respondents provided informed consent to ensure the protection of their rights, while personal information was kept confidential and used solely for research purposes.

RESULTS AND DISCUSSION

Table 1. Respondent Characteristics

Karakteristik	n	%
Age		
18-40	58	51,7
41-59	54	48,2
Occupation		
Housewife	88	78,6
Civil Servant (PNS)	13	11,6
Entrepreuner Contract	4	3.6
Worker Lecture	3	2,7
Retired	1	0,9
Pastor	1	0,9
Education	2	1,8
Junior High School		
Senior High School	2	1,8
Bachelor	84	75,0
BMI Kemenkes (2019)	26	23,2
Underweight (<17,0-18,4	4	3,6
Normal (18,5-25,0)	38	33,9
Overweight (25,1-27,0)	26	23,2
Obesity (>27,0)	44	39,3
Waist Circumference		
Kemenkes (2019)		
Not centrally obese (< 80 cm)	19	13,4
Centrally obese (>80 cm) **Fasting**		
Blood Glucose PERKENI (2021),	97	86,6
Normal (70-99 mg/dl)		
Pre-Diabetes (100-125 mg/dl)		
Diabetes (≥ 126 mg/dl)	71	63,4
	40	35,7
	1	0,9

Source: Primary Data, 2024

Table 1 shows that the majority of respondents in this study were aged between 18 and 40 years, with most working as housewives and having a high school education. Based on the measurements, most respondents had a BMI above the normal range, categorized as overweight or obese. This finding aligns with the fact that the majority of respondents were also classified as centrally obese based on their waist circumference. However, fasting blood glucose test results indicated that most respondents were still within the normal category, although some had already fallen into the pre-diabetes category.

Table 2. Normality Test of Variable Data

Variable	Kolmogorov-Smirnov		
	Statistic	df	Sig.
BMI	0,078	112	0,090
Waist Circumference	0,050	112	0,200*
Fasting blood glucose	0,074	112	0,168

Source: Primary Data, 2024

Table 2 presents the normality test of variable data using the Kolmogorov-Smirnov normality test. The criterion is that if the significance value is above 0.05, the data is normally distributed; otherwise, the data is not normally distributed. Since the significance values for all three

variables are higher than 0.05, the data is said to have a normal distribution.

Therefore, the bivariate analysis is continued using Pearson's correlation test.

Table 3. Pearson Correlation Test of the Relationship Between Body Mass Index and Fasting Blood Glucose in Reproductive-Age Women in Idamgamlamo Village

Independent Variable	Dependent Variable	(r)	*p-value*
Body Mass Index (BMI)	Fasting Blood Glucose	0,280	0,03
Waist Circumference	Fasting Blood Glucose	0,334	0,01

Source: Primary Data, 2024

Table 3 shows a positive relationship between BMI and waist circumference with fasting blood glucose. The results of the Pearson correlation test for fasting blood glucose and BMI showed a weak link, with a correlation coefficient (r) of 0.293 and a significance value of 0.02 ($p<0.05$). Meanwhile, the Pearson correlation test for waist circumference and fasting blood glucose showed a correlation coefficient (r) of 0.334 with a significance value of 0.01 ($p<0.05$), also indicating a weak correlation. These findings imply that an increase in fasting blood glucose levels typically follows an increase in BMI or waist circumference.

The Relationship Between Body Mass Index and Waist Circumference with Fasting Blood Glucose in Reproductive-Age Women in Idamgamlamo Village

Waist circumference and body mass index (BMI) are crucial markers for determining nutritional status and the likelihood of metabolic disorders like diabetes mellitus. BMI is used to classify an individual's nutritional status[11], while waist circumference reflects body fat distribution, particularly visceral fat, which contributes to insulin resistance and metabolic disorders due to its accumulation around vital organs such as the kidneys, intestines, and liver [12].

In this study, it was found that the majority of women in Idamgamlamo Village had a BMI classified as overweight or obese, particularly in the 41–59 age group. As age increases, the body's metabolism tends to slow down,

physical activity decreases, and hormonal changes such as menopause affect fat distribution, especially in the abdominal area[13, 14]. This finding aligns with the fact that most respondents in this study also experienced central obesity, characterized by an above- normal waist circumference. As visceral fat contributes to the development of insulin resistance and chronic inflammation, it is more dangerous than subcutaneous fat. An increase in waist circumference is a sign of this accumulation [15].

The bulk of study participants were housewives who did not routinely exercise but participated in moderate physical activities like babysitting and cooking. This result is consistent with research before which found that women working as housewives tend to have low physical activity levels, increasing the risk of central obesity [16]. Additionally, the stress of managing a household can influence eating patterns and metabolism, further raising the risk of obesity and blood glucose disorders [17]

The high prevalence of overweight and obesity among women of reproductive age is a multifactorial phenomenon that reflects the interaction of biological, behavioral, reproductive, and socio-structural factors. Biologically, women in this life stage experience hormonal and metabolic changes that predispose them to weight gain, including pregnancy-related fat deposition and the influence of reproductive hormones such as estrogen and progesterone on fat storage and energy regulation [18]. Polycystic ovary syndrome (PCOS) and other endocrine disorders are also more prevalent in reproductive-age women, further increasing susceptibility to obesity through insulin resistance and metabolic imbalance [19].

Reproductive events, particularly pregnancy and parity, contribute substantially to long-term weight gain. Pregnancy-related weight retention often persists postpartum and accumulates across successive pregnancies, increasing the likelihood of obesity later in reproductive life. Studies in Indonesia and other Southeast Asian countries have shown similar patterns, where multiparity is significantly associated with higher body mass index (BMI) among reproductive-age women [20]. Socio-behavioral and environmental determinants further exacerbate the

problem. Dietary transitions toward high-calorie, processed foods, combined with reduced physical activity due to urbanization and sedentary lifestyles, contribute to positive energy balance [21]. Urbanization, increased income, and changes in food availability have led to a "nutrition transition," particularly evident in low- and middle-income countries (LMICs), including Indonesia [15]. In contrast, in high-income countries, obesity is more prevalent among lower socioeconomic groups, reflecting differences in access to healthy food and opportunities for physical activity [8]. The low education level of most respondents also impacts their knowledge of healthy eating patterns and an active lifestyle, contributing to uncontrolled increases in BMI and waist circumference.

According to this study, the majority of participants with central obesity and BMIs of overweight and obese had fasting blood glucose levels that were within the normal range. A person's body composition, physical activity, and hormones can all have an impact on this. For instance, higher muscle mass can enhance glucose utilization in the blood, allowing individuals with a high BMI to maintain normal blood glucose levels. Previous research has revealed that fasting blood glucose levels can be affected by sex hormones, visceral fat, and muscle mass, all of which play a role in glucose metabolism regulation [22]. Other research indicates that because visceral fat has a bigger effect on glucose metabolism than total body mass index, central obesity is more strongly linked to an increased risk of insulin resistance [23].

The results of this investigation are consistent with those of a study before, which found a strong correlation between fasting blood glucose, waist circumference, and BMI in women who were overweight or obese. However, a other study which found that among women who were overweight or obese, there was a significant correlation between BMI, waist circumference, and fasting blood glucose [24, 25]. Nonetheless, a study by Bohari (2021) and Noer & Dieny (2023) found a strong correlation between central obesity and elevated fasting blood glucose, indicating that visceral fat accumulation influences insulin resistance more than total body weight [16, 26].

Dietary habits and local culture can impact the body's energy balance, influencing the risk of obesity and blood glucose problems in addition to BMI and waist size. Consuming large amounts of food without adequate physical activity can lead to excess calorie intake, which may increase the risk of insulin resistance and glucose metabolism disorders, contributing to the development of obesity and diabetes. Therefore, maintaining a balanced diet and leading an active lifestyle are essential for supporting metabolic health. Other factors, such as family history, high-carbohydrate diets, and lack of physical activity, can also elevate blood glucose levels and increase the risk of diabetes [27,28].

The prevention and management of diabetes risk among women in Idamgamlamo Village can be achieved through health education, community exercise promotion, and regular health check-ups. A study before found that a seven-day healthy lifestyle education program including restrictions on unhealthy food consumption, increased physical activity, and stress management was effective in reducing body weight and waist circumference. Therefore, intervention efforts involving nutritional counseling, exercise promotion, and counseling services for women with obesity are essential to maintaining a balanced BMI, waist circumference, and fasting blood glucose levels, ultimately preventing the risk of diabetes and other metabolic diseases [29)

CONCLUSION

There is a significant relationship between Body Mass Index (BMI) and waist circumference with fasting blood glucose levels in reproductive-age women, where an increase in BMI and waist circumference tends to be accompanied by higher blood glucose levels. Although theobserved correlation is weak, these findings still indicate a higher metabolic risk for women with central obesity. Health education, regular medical check-ups, and nutritional interventions by dietitians are necessary for the early detection of metabolic disorders and the efficient control of waist circumference and body weight. To obtain a more thorough knowledge of the relationship between

obesity and fasting blood glucose levels, future studies should take into account additional factors such food patterns, physical activity, and genetic influences.

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