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RESEARCH ARTICLE

Abdominal Circumference Associated With Prediabetes Incidence At POSBINDU PTM UPTD Sipea Pea Health Center

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Abstract : Health in this world is now affected by obesity. Excessive fat accumulation resulting from a long-term mismatch between calorie intake and energy expenditure is known as obesity. Obesity is considered to exist if the body mass index (BMI) is more than 30 kg/m2. Increased visceral fat is linked to metabolic disorders, which can worsen insulin sensitivity and glucose tolerance, thereby increasing blood sugar levels. Prediabetes, which will eventually lead to diabetes mellitus, is a risk factor for this disease. Impaired glucose tolerance or impaired fasting blood sugar levels are symptoms of prediabetes. This research aims to understand the relationship between abdominal circumference and the prevalence of prediabetes in the working area of the UPTD Sipea Puskesmas kacang. The research method used is analytical descriptive research, with a cross sectional study research design, where the researcher only studies the subject once at a certain time. This research was conducted at the PTM Posbindu UPTD Sipea Pea in West Sorkam District, Central Tapanuli Regency, North Sumatra. Based on the results of the Spearman test, 50 respondents met the prediabetes criteria, with 11 respondents having a percentage of 22% and 39 respondents having a percentage of 78%. The p-value = 0.041. There is a significant relationship between abdominal circumference and the incidence of prediabetes at UPTD Sipea Health Center

Keywords: Abdominal Circumference, Prediabetes, Sipea Pea Health Centre.

INTRODUCTION

Obesity has become a global health problem. Obesity is an increase in total body fat, which is when it is found >20% in men and >25% in women. Obesity according to the WHO definition is stated if the body mass index (BMI) is more than 30 kg/m2. The determination of the category of obesity in the Asia-Pacific adult population is BMI with a value of more than 25 kg/m2. There are various methods of anthropometric body measurement that can be used as obesity screening, including the measurement of body mass index (BMI), abdominal circumference, pelvic circumference, neck circumference, as well as the

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comparison of waist circumference and pelvic circumference.[1,2,3]

Obesity is caused by genetic and environmental factors. In addition, lifestyle changes, namely increased consumption of high-calorie and high-fat foods and decreased physical activity, also lead to obesity. Usually, this prediabetes condition can increase the risk of vascular endhothelial damage. So it will increase the risk of microvascular disorders such as cerebral blood vessel blockage (stroke), blood vessel blockage in the heart (Myocardial infarction) and chronic kidney failure (CKD). The risk factors for prediabetes are the same as the risk of diabetes mellitus, one of which is obesity.[4,5]

The prevalence of obesity has increased worldwide to double based on data from *the World Health Organization* (WHO) in 2016, more than 1.9 billion people over the age of 18 are overweight, of which 650 million are obese**.** In Indonesia**,** the results of the 2007-2018 Riskesdas show an increasing trend of 10.5% (2007), 14.8% (2013) and 21.8% (2018). In 2018, the prevalence of type 2 diabetes mellitus in North Sumatra was around 2% with 7826 diabetics in Medan City. This figure shows that the incidence of diabetes mellitus in Medan City is the case with the highest incidence rate in the North Sumatra region (Riskesdas, 2018).

In Central Tapanuli Regency, the prevalence of obesity in males is 14.37% and in females 27.40%. This figure shows that the incidence of obesity is still high in North Sumatra Province, especially Central Tapanuli Regency.[6]

Obesity can be detected from nutritional status, fat thickness under the skin, body mass index or BMI, and abdominal circumference measurement. One of them is abdominal circumference measurement, which is generally done to detect metabolic disorders or central obesity. Abdominal circumference describes the accumulation of fat in the abdominal cavity. It can also describe the presence of central obesity. Which is one of the risk factors for prediabetes.[7,8]

Before the occurrence of type 2 diabetes mellitus, it will be preceded by prediabetes.[9] Prediabetes describes people with *Impaired Fasting Glucose* (IFG) or *Impaired Glucose Tolerance* (IGT). This condition is at high risk of developing type 2 Diabetes Mellitus (DMT2) and diabetes-related complications.[10] In Switzerland there is a study that shows prediabetes in 30.9% of the population and 79.9% is identified based on HbA1C.[11,12]

In 2021, based on the age of 20-79 years, IDF estimates that 541 million adults (10.6%) will experience Impaired Glucose Tolerance (IGT) while 319 million adults (6.2%) will experience Impaired Fasting Blood Sugar (IFBS). Meanwhile, by 2045, it is expected to increase to 730.3 million people (11.4%) in the world experiencing IGT and 440.8 million people (6.9%) experiencing IFBS. The prevalence of IFBS (8.8%) in Southeast Asia is higher than that of IGT (5.4%).[10]

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Prediabetes has the same risk factors as DMT2. The results of Paramita *et al's study* stated that first-time offspring with a family history of DMT2 were six times greater at risk of suffering from DMT2. Additional risk factors associated with DMT2 in youth include a family history of diabetes, female gender, and low socioeconomic status. According to the IDF 2021, the prevalence of IGT is expected to increase with age (20-79 years). Meanwhile, IFBS is higher at the age of 60-64 years.[11,13]

The onset of the development of DM disease often does not cause complaints and is detected after the disease enters the chronic phase. However, it can be detected as early as possible by conducting regular health checks. Early detection could open the door to type 2 diabetes prevention interventions.[14] Therefore, the Ministry of Health issued Minister of Health Regulation No. 71 of 2015, one of which is the early detection program of NCD risk factors through Posbindu.[15]

The higher the incidence of diabetes mellitus, the higher the prediabetes condition. Therefore, prediabetes risk factor screening is needed to detect diabetes mellitus early so that proper management can be given and complications prevented.[1,14]

So the researcher was interested and felt the need to research the relationship between abdominal circumference and prediabetes in the activities of the PTM Posbindu UPTD Puskesmas of West Sorkam District, Central Tapanuli Regency.

METHOD

This study is an analytical descriptive research with a *cross* sectional research design. Sampling was done using *purposive sampling.* The place for this research is located in the Posbindu conducted by the Sipea Pea Health Center

The population of this study is all people who check themselves at the activities of the Posbindu PTM Puskesmas Sipea Pea. The sample of this study was all people who fell under the inclusion criteria. The inclusion criteria for this study were that all people who had a male abdominal circumference of >90 cm and women >80 cm, were willing to be the subject of the study, fasted for at least 8 hours before their blood was drawn, and KGDP showed prediabetes at the time of examination. As for the exclusion criteria, namely women who gave birth to a baby > 4 kg, pregnant women who were diagnosed with gestational diabetes mellitus, refused to be the subject of the study. The total sample in this study was 50 respondents. Field observation data collection method. The research analysis used univariate and bivariate analysis. In bivariate analysis, the *Spearman test* with a P value of <0.05 will be used.

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RESULT

The following are the results of the statistical test in this study, namely:

Table 1. Frequency Distribution of Respondent Characteristics

Characteristics of respondents		(n)	(%)
Gender	Man	14	28
	Woman	36	72
Total		50	100.0

Based on the table above, as many as 50 respondents in this study were male as many as 14 respondents (28%), while female respondents were 36 respondents (72%).

Table 2. Variable Frequency Distribution

Variable Table		(n)	(%)
Abdominal circumference	Ya	50	100
Prediabetes	Tidak	39	22
	Ya	11	78
Total		**50**	**100**

Based on the table above, it was obtained that the respondents of this study experienced prediabetes, namely 11 respondents with a percentage of 22%. Meanwhile, there were 39 respondents who were not prediabetic with a percentage of 78%.

Table 3. Sex Relationship with Prediabetes

Variabel	Fasting blood sugar levels Prediabetes n %	Normal n %	P value	r
Abdominal circumference	11 22	39 78	0.041	0.290

Based on the table above, it was obtained that the relationship between abdominal circumference and prediabetes was obtained with a value of 0.041<0.05. So, it was concluded that there is a significant relationship between abdominal circumference and prediabetes. The correlation coefficient of this study is 0.290, which means that the level of closeness or correlation between abdominal circumference and prediabetes is a low correlation.

DISCUSSION

Based on the results of the study which aimed to determine the relationship between abdominal circumference and the incidence of prediabetes at POSBINDU PTM UPTD Sipea pea, it was found that the level of abdominal circumference that was more than the normal limit affected or could be used as a reference as a diagnosis of prediabetes incidence. The results of this study are in line with the research of Adnyana *et al,* which showed the results that abdominal circumference affects the incidence of prediabetes.[16]

In obese individuals, it is known to have decreased β cell function in the pancreas. β cells have an important role in

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regulating insulin production. Decreased β cell function due to obesity can result in inflammation in the pancreas, where this inflammation causes the proliferation of macrophages in the pancreas. These macrophages will interact with β cells, which is known that direct contact between the macrophages and the β cells causes damage to β cells. The occurrence of damage to these β cells can result in abnormal fasting glucose tolerance.[16,5,17]

Increased abdominal circumference can have an impact on the increase in blood sugar because glucogenesis occurs which can inhibit the work of insulin. Fat in the abdomen has metabolic products in the form of fatty acids that are released into the hepatic portal vein. Free fatty acids that circulate excessively to the liver will cause oxidation and produce Acetyl CoA. This acetyl CoA will activate the enzyme pyruvate carboxylase in the liver, which converts pyruvic acid into glucose in the liver, this process is called gluconeogenesis. In addition, increased levels of free fatty acids circulating in the liver can lead to a decrease in the sensitivity of muscle cells to insulin, leading to insulin resistance. Therefore, muscle cells need more insulin for blood glucose uptake into the muscles. The sensitivity of insulin will be affected in obese individuals. In individuals who have obesity, there is an increase in the secretion of *Non-esterified Fatty Acid* (NEFA) substances which can cause insulin resistance.[16,5,18]

The incidence of prediabetes is not only influenced by a single factor of abdominal circumference. Age, smoking behavior, nutritional status and anxiety disorders affect the incidence of prediabetes. Anxiety disorders not only affect the incidence of prediabetes but also other chronic diseases. Biological changes in the form of *aging* usually occur in adulthood and the production of enzymes such as; protein kinases, glycogen kinases, glucokinases that can bind to insulin begin to be disrupted, as a result of which glucose in the liver and muscles circulate back into the blood.[5,11]

Changes in cell permeability and the response of the cell nucleus to the hormone insulin, which results in glucose not being able to enter the cell are one of the effects of the aging process. The increasing prevalence of undiagnosed diabetes mellitus and prediabetes in premenopausal women also signals a lack of screening and low awareness of the risk of diabetes mellitus. In addition, the increasing trend of prediabetes and diabetes mellitus in premenopausal women is in line with the increase in obesity in adults and middle-aged adults. Premenopausal women with prediabetes or diabetes mellitus face more cardiometabolic risk factors compared to normoglycemia. Notably, their risk profile is equal to or even worse than that of men of the same age and postmenopausal women. Obesity, hypertension and dyslipidemia are the risk factors that accompany diabetes mellitus and the aggregation of these risk factors

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synergistically increases the risk of CVD and CKD.[19,20]

Good nutritional status is also one of the factors that affect the incidence of prediabetes. Good nutritional status comes from good nutritional intake. Nutrient intake that needs attention from the composition of macronutrients is relatively high total fat intake, accompanied by high cholesterol intake, while unsaturated fats (PUFAs) are relatively low. This is due to the high consumption of cooking oil, animal fats and foods high in cholesterol. This can trigger insulin resistance. To inhibit the progression towards diabetes mellitus weight loss through a reduction in daily energy intake below 1500 kcal, a reduction in the intake of cholesterol (less than 200 g) and saturated fat (less than 50 g), as well as an increase in omega-3 PUFAs (1-3 g).[21]

Then, a good diet planning and management to prevent diabetes is to eat a balanced nutritional diet with an energy composition of 45-65% carbohydrates, 10-15% protein and 20-25% fat as well as with a regular schedule, the amount according to the body's needs and the type of food varied. Poor nutritional status triggers an abnormal BMI. Stating that BMI and prediabetes are significantly correlated without gender differences. A higher BMI has been reported as a strong risk factor for prediabetes. A higher percentage of body fat results in greater amounts of free fatty acids, glycero, and pro-inflammatory cytokines that participate in the development of insulin insensitivity.[22]

Furthermore, smoking is also suspected to be related to the incidence of prediabetes and diabetes mellitus patients. Smoking increases the risk of diabetes where diabetes is more common in smokers. Research shows that opium can temporarily increase blood glucose. Among people who had a history of opium use, the prevalence of prediabetes was slightly higher than among those who had never used. Therefore, the relationship between cigarette and opium use and diabetes needs to be further tested.[23]

CONCLUSION

Based on the results of research and analysis that has been carried out at POSBINDU PTM UPTD Sipea pea, The conclusion that can be drawn in this study is that there is a relationship between abdominal circumference and the incidence of prediabetes in patients who visit the POSBINDU PTM UPTD Sipea pea.

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