Characteristics of Prediabetes in Maros District, South Sulawesi, Indonesia

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Abstract.

Background: Prediabetes is a condition of increasing blood glucose levels but cannot yet be referred to as the criteria for Diabetes Mellitus. International Diabetes Federation (IDF) 2017 the prevalence of prediabetes 7.3% is estimated by 2045 to increase by 8.3% of the population. The purpose of this study was to determine the characteristics of prediabetes sufferers in Maros Regency, South Sulawesi, Indonesia.

Methods: Analytical descriptive design, by screening fasting blood glucose, samples obtained were 110 people from 1200 subjects according to inclusion and exclusion criteria.

Results: The highest proportion of prediabetes to age was 40-50 years (60.8%), female sex (76.4%), general high school education (63.3%), family history of diabetes (82.7%), over weight 83.6%, 1st degree hypertension was 34.5%.

1. Introduction

Prediabetes is a term used in which a person's blood glucose level increases but cannot be classified as a category of type 2 diabetes mellitus. Prediabetes screening is very important and useful in assessing individuals who have a high risk of type 2 diabetes mellitus and is a very effective intervention in preventing the progression of prediabetes to diabetes mellitus. Diabetes mellitus is one of the leading causes of death worldwide with an estimated prevalence of 6.4% and is generally undetectable(McCulloch & Hayward, 2019).Prediabetes screening is very important to do early to detect prediabets who are at risk of diabetes mellitus so that prevention can be done as early as possible. Prediabetes is a widespread health problem and has a serious impact (emerging epidemic) if it is not managed properly, the prevalence of prediabetes is always increasing every year worldwide, it is estimated that in 2030 an estimated 470 million prediabetes (Tabak, et al., 2012).

A 2016 publication in California, United States shows the prevalence of prediabetes and diabetes in the young adult age group of 55% of the total adult population (Babey, et al., 2016). According to IDF 2017, the prevalence of prediabetes is estimated at 7.3% of the adult population in 2017 and it is estimated that in 2045 it will increase to 8.3% (IDF, 2017). Studies on adult groups in Tehran, Iran, show the incidence of prediabetes and / or diabetes mellitus by one percent each year (Mirbolouk, et al., 2016). Research in the Iranian city of Birjand on primary school children shows 5% of children have prediabetes and diabetes (Chahkandi, et al., 2012). Various scientific publications show that both prediabetes and diabetes have almost the same risk factors, the risk factors for prediabetes / diabetes are multifactorial but can be grouped into three groups, namely sociodemographic factors, behavioral / lifestyle factors, and a person's clinical and mental condition factors. The prevalence of prediabetes in Indonesia in 2009 reached 10.2% and in 2013 it reached 36.6% (Miharja, 2014). According to IDF (2017) Indonesia is the 3rd highest country with the number of prediabetes at the age of 20-79 years. Singh et al in their study reported that prediabetes within 3-5 years, about 25% developed diabetes mellitus type 2, about 50% remained prediabetes, and 25% returned to normal blood glucose conditions. (Singh et al, 2015)

The condition of prediabetes in Indonesia in 2018 amounted to 50-60 million people identified from Interrupted Fasting Blood Glucose (GDPT) and / or Impaired Glucose Tolerance (TGT), the progression of prediabetes to diabetes reaching 5% to 10% each year (Djap et al. 2018; ADA, 2015; Soewondo&Pramono, 2011). Even in a cohort study in the City and Regency of Bogor, it was found that the figure was higher, with 13.4% of prediabetes experiencing a change to diabetes within 1 year (Sulistiowati&Sihombing, 2018).Prediabetes is the gold period (golden period) to prevent diabetes, because this condition is still reversible so that it can still be managed with the aim of preventing the rapid development of type 2 diabetes mellitus. Physiologically, blood glucose will be stored in muscle cells, liver cells, or fat cells as a source of energy but in conditions of insulin resistance, glucose cannot be used properly but has not caused clinical symptoms of diabetes, this condition if it continues will cause a condition of pancreatic function. decreased so that they are unable to secrete insulin as needed. Diabetes mellitus is one of the leading causes of death worldwide. The population of the United States has diabetes mellitus as much as 8% and 25-40% are not diagnosed. The prevalence of diabetes mellitus in the world in 2019 is 6.4% and generally, people with diabetes mellitus who are not detected are quite high, namely as much as 50%(McCulloch & Hayward, 2019). Uncontrolled diabetes mellitus will cause complications quickly because there is no prior prevention, complications can occur both microvascular and macrovascular including coronary heart disease, stroke, peripheral vascular disease, diabetic retinopathy, nephropathy, and diabetic foot ulcers. Based on Riskesdas 2018 data, the prevalence rate of diabetes in Indonesia in 2013 was 6.9% and in 2018 it became 8.5% (Riskesdas, 2018). DM is the third largest cause of death after stroke and hypertension (Ministry of Health, 2014; Ministry of Health, 2013; Soewondo et al., 2013). The purpose of this study was to determine the prevalence and characteristics of prediabetes in Maros district, South Sulawesi, Indonesia.

2. Research methods

Analytical descriptive research design. The research subjects were members of the Marusu, Mandai, Turikale and Marosbaru sub-districts, Maros regency, South Sulawesi, Indonesia. This research was conducted in June 2020 - December 2020, with 1200 subjects obtained as many as 110 samples according to the inclusion and exclusion criteria. Fasting blood glucose pre-diabetes was screened, before the examination was carried out fasting for 10-12 hours using an easy touch device, while the inclusion criteria were: men and women aged between 20-60 years, willing to sign informed consent, blood glucose levels fasting 100-125mg / dl. Exclusion: Sick during examination, illness during research, being pregnant, resigned during the study, data were collected and processed by computer using the SPSS 22 program, presented in narrative and table form. The data analysis used was univariate analysis to test data normality, distribution and frequency

3. Results and Discussion

Table 1. Characteristics of Research Respondents

Characteristics of Respondents		Frequency	Percentage (%)
Age			
≤28 years		1	0.9
29 - 39 years		9	8.4
40 - 50 years		67	60.8
≥51 years		33	29.9
Sex			
Man		26	23.6
Women		84	76.4
Work			
Yes		50	45.5
No		60	54.5

Education		
Bachelor	20	18.2
Senior high school	70	63.6
Junior high school	15	13.6
Primary school	3	2.7
No school	2	1.8
Family history of diabetes		
Yes	91	82,7
No	19	17,7
Total Respondents	**110**	**100,0**

Based on the table above, the highest age for prediabetes is between 40-50 years old as many as 67 people (60.8%). the lowest is the age <28 years, as many as 1 person (0.9%). The highest gender was in women, namely 84 people (76.4%), 60 people (54.5%) did not work formally, the highest level of prediabetes education was 70 people (63.3%), a family history of DM 91 people (82.7%). Prediabetes is a condition where blood sugar levels increase above normal but cannot be called Diabetes Mellitus, in the table above (table1). Prediabetes increases in older adults, namely 40-50 years old, the high prevalence of prediabetes was suspected In this age, humans are generally well-established, both economically and socially, so that there are no obstacles to eating whatever they want, besides that related to physical activity, generally decreases. In old adult, the aging process causes the production of enzymes that bind insulin to begin to disrupt and changes in cell permeability and the response of the cell nucleus to the insulin hormone, which allows for an increase in glucose levels in the blood (Robles et al 2018), Prediabetes increases in women compared to men, this is because women generally have less muscle mass so it is easy to experience insulin resistance in both moderate to severe muscle degrees. Prediabetes increases in patients who have jobs, it is suspected that they do not do enough physical activity, this behavior increases the risk of prediabetes. The background of most prediabetes education is in Senior High School education, this is possible because in Indonesia the largest graduates are Senior High Schools so that respondents much on that education. A history of DM in parents has a risk for prediabetes in their children, this is in accordance with the table above, namely the history of DM in the family to suffer from prediabetes with a frequency of 91 people (82.7%), this is in accordance with the multicentre study by Wagner in Germany which shows that family history of DM was significantly associated with the risk of prediabetes (OR = 1.4 with 95% CI = 1.27: 1.54, p <0.001). This family history of DM has an increased risk of suffering from prediabetes by about 40%(Wagner, R et al, 2013)

Table2. Body Mass Index Data		
Mass Index Data	f	%
Normal	16	14.5
Overweight	92	83.6
Obesitas	2	1.8
Total	110	100.0

Table3. Systole-Diastolic Blood Pressure Data		
	f	%
Normal	41	37.3
Pra hipertensi	31	28.2
Hipertensiderajat 1	38	34.5
Total	110	100.0

Table 2. The frequency of overweight was the highest in prediabetes by 92 people (83.6%) compared to those with normal weight. Body mass index that exceeds the normal limit will cause various kinds of complications including the risk of prediabetes, diabetes, hypertension etc. The body mass index mechanism causes insulin resistance, some literature states that a body mass index above normal causes peripheral resistance to glucose uptake and decreases the sensitivity of pancreatic beta cells. (Vittal, 1010) . According to Amir's research, 80% of overweight conditions experience hyperglycemia (Amir, 2015), while Salam Jasim Muhammed's research in Iraq shows that the BMI <25 kg / m2 group has a 2.7 times risk of hyperglycemia (Kim, 2018). The basis for prediabetes is insulin resistance which can occur in muscle, liver, and fat tissue. In prediabetes the increase in body mass index is the proportion of obesity and overweight compared to normal body weight. This can be caused by overweight there is an accumulation of excess visceral fat which results in insulin resistance in the liver and muscles so that glucose uptake decreases causing hyperglycemia. In normal circumstances insulin levels are sufficient and sensitive, insulin will work on insulin receptors on the surface of cells, then open the door to the cell, so that glucose enters the cells which are used as energy or as an energy reserve, so that blood glucose levels become normal. This is different in obese conditions, in obesity there is an increase in mRNA Lipopolysaccharides (LPS) inducing TNF-α factor and protein levels, which can cause an inflammatory process in obese patients, this condition results in insulin resistance, TNF-α is a strong trigger of proinflammatoryadipocytokinins such as IL- 6, MCP-1, leptin and PAI-1. This plays a big role in the inflammatory process in obese patients. The increase in TNF-α in the fat tissue of obese patients shows a direct relationship to the development of insulin resistance.

The dominant overweight condition that causes insulin resistance is related to a decrease in the number of receptors and post-receptor failure to activate tyrosine kinase, which is the 2nd subunit on the insulin receptor. Activation of this complex will activate autophosphorylase and insulin-mediated action to control blood sugar levels. Hyperinsulinemia occurs due to failure to deliver signals to regulate blood sugar levels. Risk factors for prediabetes include hereditary factors, physical activity, dietary intake, metabolism and hormones. Fat metabolism depends on energy requirements and is regulated by diet and nerve and hormonal signals. Increased glucose and fat will result in the transport of fatty acids into adipose and increased lipogenesis. This increase is under the influence of insulin. The parial oxidation of fatty acids produces ketones which are an alternative fuel source for the brain and various organs. Currently, fat tissue is known not only as a storage area for energy reserves but as a dynamic network with various functions. Excess fatty tissue, this condition commonly found in modern society, is also associated with insulin resistance (Ganong, 2008) .

In table 3. Hypertension grade 1 was found to be the highest, namely 38 people (35.5%). Hypertension is closely related to systolic and diastolic pressures or both continuously. Systolic pressure is related to the high pressure on the arteries when the heart contracts, while diastolic blood pressure is related to the arterial pressure when the heart relaxes between two heartbeats. From the measurement results, the systolic pressure has a value greater than the diastolic pressure. Prediabetes (hyperglycemia) when the condition continues, glucose will stick to the walls of blood vessels and an oxidation process will occur where glucose reacts with proteins from the walls of blood vessels causing advanced glycation end products (AGEs). These AGEs damage the inner walls of blood vessels and attract saturated fat or cholesterol to stick to the walls of blood vessels, causing an inflammatory reaction, this will invite white blood cells (leukocytes) and blood clotting cells (thrombocytes) which merge into one plaque clot. so that the blood vessels become hard, stiff and eventually blockage of the blood vessels and cause hypertension (Tandra, 2009).

4. Conclusion
In this study, the highest prediabetes was aged 40-50 years as many as 67 people (60.8%), 60 people (54.4%) were found in people who did not work formally, the highest prediabetes education background was public high school as many as 70 people (63.6%), prediabetes family history of diabetes as many as

91 people (82.7%), overweight as many as 92 people (83.7%) and grade 1 hypertension as many as 38 people (34.5%).

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