Effects of Physical Activity, Obesity and Smoking Habits on the Risk of Type 2 Diabetes Mellitus

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Abstract: Diabetes mellitus (DM) characterized by the occurrence of hyperglycemia and metabolism disorders associated with deficiencies of insulin secretion. Based on Health Research (Riskesdas) 2013, the number of DM cases in Banjar District was the highest in South Kalimantan. This study aims to analyze the correlation of physical activity, obesity and smoking habits with type 2 DM incidence in the work area of Martapura Public Health Center. This research is a quantitative research using a case-control design. The population is people who are treated at Martapura Public Health Center from September until December 2017. The sample, as many as 150 samples with 75 types 2 DM cases and 75 control subjects were included in this research. The sample was taken by purposive sampling technique. Data were analyzed by univariate with frequency distribution table and bivariate analysis by *chi-square test*. Incidence of Type 2 DM occurs in less physical activity (64%), obesity (56%) and smoking habits (33,3%). Chi-Square test showed there was correlation between physical activity (p=0,009;OR=2,523) obesity (p=0,003; OR=2,877) and smoking status (p=0,039; OR=2,385) with type 2 DM incident. It is advisable to community and health workers from applying a healthy life behaviour to prevent the incidence of type 2 DM

1 INTRODUCTION

Diabetes mellitus (DM) is a disease characterized by the occurrence of hyperglycemia and metabolic disorders that are associated with a lack of insulin work and secretion [World Health Organization, 2015]. The global prevalence of DM in the community (aged 20-79 years) in 2014 as many as 387 million people (8.3%) with cases of type 2 DM were the most common cases (70%) [International Diabetes Foundation, 2015]. Based on IDF data in 2014, Indonesia ranked fifth of DM patients in the world, with an estimated 9 million people with a prevalence of 1.1%. According to the results of the Basic Health Research (Riskesdas) 2013, the prevalence of DM in Indonesia was 2.1%. This prevalence is higher than the prevalence in 2007, which was 1.1% [Ministry of Health of Republic, Indonesia, 2013].

Banjar District is one of the districts in South Kalimantan. Based on the data from Riskesdas (2013) the number of cases of DM in Banjar District was the highest in South Kalimantan (3.8%) and above the national prevalence (2.1%) [4]. Based on data from the Banjar District Health Office in 2016 the highest health centre with DM cases was Martapura health centre, which was 1114 cases with the highest cases in type 2 DM (566 cases). Monthly morbidity data at Martapura Public Health Center, Banjar Regency, showed that cases of type 2 DM still high in the last three months as many as 39 cases in October, 43 cases in November and 34 cases in December 2016.

Sukmaningsih WR (2016) study found OR=7.737 which means that someone who has low physical activity has a risk of 8 times more likely to experience the incidence of type 2 DM. In addition, there is a relationship between obesity and the incidence of type 2 diabetes mellitus (p = 0,000) then there is a significant relationship between obesity and the incidence of type 2 DM. Smoking habits can also trigger the occurrence of type 2 DM. Sukmaningsih WR (2016) states that someone who smokes has a risk

of 2,538 times more likely to experience the incidence of type 2 DM.

Based on the above problems, a study was conducted to explain the risk factors for the incidence of type 2 DM in the work area of Martapura Public Health Center, Banjar District

2 METHODS

This study used an observational analytic design with a case-control design that aimed to analyze the relationship between physical activity, obesity and smoking habits with the incidence of type 2 DM in the work area of Martapura Public Health Center. The study population was all resident who seeks treatment Martapura Public Health Centres many as 82,194 people in 2016. The number of samples was 150 with 75 cases samples (type 2 DM patients) and 75 control samples (not type 2 DM patients). Determination of samples using a purposive sampling technique. The instrument used in this study was a questionnaire. The independent variables in this study were physical activity, obesity, and smoking habits, while the dependent variable was the incidence of type 2 DM. Data were extracted from the questionnaire into Microsoft Excel and to SPSS 21.0 for analysis. Data were analyzed using univariate frequency distribution tables and bivariate analysis using the chi-square test.

3 RESULTS

3.1 Univariate Analysis

Based on the results of the study, the frequency distribution of the research variables can be seen in Table 1 below:

Table 1: Frequency Distribution of Research Variables.

Variable		Type 2 DM Incident			
		Case		Control	
		n	%	n	%
Physical Activity					
	Less	48	64,0	31	41,3
	Good	27	36,0	44	58,7
Obesity					
	Obesity	42	56,0	23	30,7
	Not Obesity	33	44,0	52	69,3
Smoking Habits					
	Smoker	25	33,3	13	17,3
	Non Smoker	50	66,7	62	82,7

Based on table 1, it is known that the majority of respondents have a less physical activity that is equal to 79 people (52.7%) compared to respondents with good physical activity, which is equal to 71 people (47.3%). Physical activity will cause metabolic changes that are also influenced by duration, the weight of exercise and fitness level. Proper physical activity can provide freshness of the body, more controlled blood glucose, reduce the need for drugs or insulin and can prevent type 2 DM [Sugiyanto Z, 2014].

Based on table 1, it is known that 65 respondents (43.3%) were obese, and 85 respondents (56.7%) were not obese. Obesity is a direct factor that can affect the incidence of type 2 diabetes, obese people have excessive fat distribution in the body, especially the abdomen is more likely to develop type 2 diabetes [Trisnawati et all, 2013].

Table 1 shows that 65 respondents (43.3%) were smokers and 85 respondents (56.7%) were non-smokers. The biological habit of smoking can increase free radicals in the body which causes damage to endothelial cell function and damage beta cells in the pancreas. It is known that the hormone insulin is produced by beta cells in the pancreas, if there is damage to the pancreas, it will affect the production of insulin which will inhibit the entry of glucose into the cell and eventually will increase glucose levels in the blood and cause the incidence of type 2 DM [Adiningsih et all, 2014].

3.2 Bivariate Analysis

Bivariate analysis was done to see the correlation of each independent variable with dependent. The results of the bivariate analysis can be seen in Table 2 below.

Table 2: Correlation between Independent Variables With The Incidence Of Type 2 DM.

Variable		Type 2 DM Incident				p-value	OR
		Case		Control			
		n	%	n	%		(95% Cl)
Physical Activity							
	Less	48	64,0	31	41,3	0,009	2,523
	Good	27	36,0	44	58,7		(1,306 – 4,874)
Obesity							

Varia ble		Type 2 DM Incident				p-val ue	OR
		Case		Control			
		n	%	n	%		(95% Cl)
	Obesit y	4 2	56, 0	2 3	30, 7	0,0 03	2
	Non Obesit yy	3 3	44, 0	3 5 2	69, 3		, 8 7 7
							(1,473 – 5,623)
Smoking Habits							
	Smok er	2 5	33, 3	1 3	17, 3	0,0 39	2,385
	Non Smok er	5 0	66, 7	6 2	82, 7		(1,108 – 5,134)

Based on table 2, it is known that there is a relationship between physical activity and the incidence of type 2 DM (p = 0.009; OR = 2.523). Respondents with less physical activity were 2.523 times more likely for developing type 2 diabetes compared to people with good physical activity. Obesity is also a risk factor for the incidence of type 2 diabetes mellitus. Based on table 2, it is known that there is a relationship between smoking status and the incidence of type 2 DM (p=0.039; OR=2.338). Respondents who were smokers were 2,385 times more likely to develop type 2 diabetes compared to non-smokers.

Another factor that has a relationship with the incidence of type 2 diabetes is the smoking status of the respondents. The results showed that there was a relationship between smoking status and the incidence of type 2 DM (p=0.039; OR=2.338). Respondents who were smokers were 2,385 times more likely to develop type 2 diabetes compared to non-smokers

4 DISCUSSION

Type 2 DM is a hyperglycemic disease due to cell insensitivity to insulin. Insulin levels may decrease slightly or be in the normal range. Insulin is still produced by pancreatic beta cells, then type 2 DM is considered as non-insulin DM. Based on table 2, it can be seen that there is a correlation between physical activity with the incidence of type 2 DM. Based on observations in the field, type 2 DM patients rarely carry out regular exercise activities for reasons of being lazy to exercise, and they feel tired quickly. This, of course, can lead to a lack of response to insulin (insulin resistance) so that glucose cannot enter the cell.

This study is in line with the research of Sukmaningsih WR (2016), which states that a person who has low physical activity is eight times more likely to experience type 2 DM [10].

Fikasari's (2012) study showed that there was a relationship between physical activity and the incidence of type 2 DM (p = 0.045 <0.05). Regular physical activity can reduce the risk factors for type 2 DM because physical activity can reduce weight and improve sensitivity to insulin, which can improve glucose control in the blood [Sukmaningsih, 2016].

The results showed that there was a correlation between obesity and the incidence of type 2 DM. Based on the results of the study, DM patient with obese stated that their weight was high because they did not maintain their diet and didn't do a regular exercise. This makes insulin unable to work optimally to help body cells absorb glucose because it is disturbed by complications of obesity, such as high blood fat levels (cholesterol).

The results of this study are in line with the research conducted by Jin Ook Chung, Dong Hyeok Cho, Dong Jin Chung, and Min Young Chung (2012) which states that there is a significant relationship between obesity and insulin resistance (p <0.05). Obesity condition causes excess fat deposits. Freeform fatty acids can circulate in blood vessels throughout the body and cause oxidative stress which we are familiar with lipotoxicity. Lipotoxicity will interfere with insulin receptor function [Jin OC et all, 2012].

The results of the statistics analysis showed that there was a correlation between smoking habits with the incidence of type 2 DM. Based on the facts in the field, they smoke to eliminate tension and stress because nicotine releases certain compounds to create a calm and relaxing effect. Besides that they smoke because they see the habits of their parents, who are also smokers. This situation certainly causes insulin resistance and causes blood sugar levels to increase, which causes type 2 DM disease.

The results of this study are in accordance with the research of Trisnawati et al. (2013) which states that there is an influence of smoking habits on the incidence of type 2 DM (p=0.002). Someone who smokes 2.4 times more likely to developing type 2 DM compared to non-smokers. According to previous research, smoking habits caused impaired glucose metabolism and increased insulin resistance which causes an increased risk of developing DM. This result is in accordance with the Coronary Artery Risk Development in Young Adults study data, which

found that active smoker was associated with the risk of glucose intolerance.

Based on the theory, cigarettes are the main product of tobacco-containing TAR, including the polycyclic aromatic hydrocarbon compound, containing nicotine CO, HCN, and benzopyrene. Nicotine can cause a reduction in sensitivity and increase the occurrence of insulin resistance. In addition, smoking can reduce HDL cholesterol in the bloodstream; smoking can also make blood quickly freeze, which increases the likelihood of arterial blockage. Nicotine can increase blood glucose levels which can cause insulin resistance. Nicotine significantly affects the stress hormone cortisol. This cortisol hormone causes the body to be resistant to insulin

5 CONCLUSION

There was a correlation between physical activity, obesity, and smoking habit with type 2 DM incident in the work area of Martapura Public Health Center. It is advisable to community and health workers from applying a healthy life behaviour to prevent the incidence of type 2 DM

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