Risk Factors of Type 2 Diabetes Mellitus in Hospital of Bengkulu City, Indonesia: Case Control Study

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Abstract

Background: The prevalence of diabetes mellitus is currently increasing and is an important cause of premature death and disability. Insulin resistance in people with type 2 diabetes mellitus is caused by multiple factors such as non-modifiable factors and modifiable factors. **Objectives:** assess the relationship of factors can not be modified and factors can be modified with the incidence of type 2 diabetes mellitus. **Methods:** This is a case control study. Samples taken based on several criteria, namely: 1) patients aged ≥ 18 years, 2) patients can communicate smoothly. Risk factors were analyzed using the chi-square test, knowing the magnitude of the risk using the Odds ratio (OR). **Results:** variables related to type 2 diabetes mellitus were age (p = 0.019), OR = 2.5 (1.2-5.2), family history of diabetes (p = 0.007), OR = 2.9 (1, 3-6.1), body mass index (BMI) (p = 0.001), OR = 3.2 (1.6-6.5), high sugar diet (p = 0,000), OR = 4.2 (2.0 -8.6), low fiber diet (p = 0.018), OR = 2.5 (1.2-5.4), and physical activity (p = 0.000), OR = 7.1 (3.0- 16.6). **Conclusion:** Risk factors proven to be related to type 2 diabetes mellitus are age, family history of diabetes, BMI, high sugar diet, low fiber diet, and physical activity. While gender, central obesity and smoking cannot be proven to be risk factors for type 2 diabetes mellitus. Physical activity is a major risk factor for type 2 diabetes mellitus, with a 4 times greater risk for those who lack physical activity

Keywords: *Diabetes mellitus, risk factors, physical activity, body mass index, diet*

Introduction

Non-Communicable Diseases (NCD) is one of the leading causes of death in the world. [1] One of the NCDs that causes premature death and disability is diabetes. [2] The global prevalence of diabetes has increased almost doubled since 1980, increasing from 4.7% to 8.5% in adult populations. This reflects the associated risk factors such as obesity and overweight. Elevated blood sugar levels, passing through optimum levels, have led to an additional 2.2 million deaths, thereby increasing the risk of cardiovascular disease and neoplasia. 43% of the 3.7 million deaths occurred in patients under the age of 70 years. [3] Indonesia is the seventh-largest country in the world after China, India, the USA, Brazil, Russia, and Mexiko. [4] The prevalence of diabetes in Indonesia increases from year to year. In 1983, the prevalence of diabetes in Indonesia was 1.63%, increasing 5.7% in 2007 and estimated at 6.0% in 2030. The survey in Indonesia reported the high number of undiagnosed diabetes in Indonesia was 4.3%. Therefore, the prevalence of diabetes in Indonesia is potentially higher than the data available. [5]

Diabetes mellitus type 2 is the result of the ineffective use of insulin by the body. Risk factors for diabetes are categorized as excess weight or metabolic or physiological risk factors and hyperlipidemia (high-fat levels in the blood). Also, the factors can be modified such as an unhealthy diet, less physical activity, and smoking and alcohol. [6] With the increasing burden of diabetes, hypertension, and other risk factors, this tends to pose a major threat to the health system. [7]

Bengkulu Province, the number of new cases of diabetes diagnosed with 4,184 and 84 diabetics who passed away. The city of Bengkulu is the most contributor

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to the death of 32 deaths. Based on the recapitulation of disease data in the hospital of Bengkulu, diabetes is one of the highest contributors to the disease in the disease polyclinic during the last 3 years. Increased cases of diabetes in the disease polyclinics in the city Hospital of Bengkulu, so we want to know the risk factors of the incidence of type 2 diabetes.

Material and Methods

The design used in this study is quantitative case-control. A large sample is calculated by using a hypothetical test formula of two proportions, resulting in a sample of 70 respondents in the case. The control takes a comparison of one to one, so the number of control samples is 70 respondents. Samples taken based on several criteria are 1) patients aged ≥ 18 years, 2) patients can communicate fluently.

Data is collected in two ways, first: blood sugar, weight, height, and abdominal circumference are taken based on the record of the patient's medical records. Second: Age, gender, family history of diabetes, physical activity, high sugar diet, low fiber diet, and smoking are gathered from the results of the filling of shared questionnaires. Risk factors are analyzed using the chi-square test, to determine the risk magnitude using the Odds ratio (OR). After that, multivariate analysis is performed using multiple logistic regression.

Findings

Table.1 Risk Factors Based On Factors That Cannot Be Modified And Can Be Modified

Risk Factors	No.140	%
Age	94	67,1
≥ 40 years	46	32,9
< 40 years		
Gender		
Women	92	65,7
Men	48	34,3
Family history of Diabetes		
Yes	46	32,9
Not	94	67,1
Body Mass Index		
≥ 25	66	47,1
< 25	74	52,9
Central obesity		
Yes	58	41,4
Not	82	58,6
High sugar Diet		
Yes	76	54,3
Not	64	45,7
Low Fibre diet		
Yes	96	68,6
Not	44	31,4
Smoking		
Yes	78	55,7
Not	62	44,3
Physical Activity		
Inadequate	95	67,9
Adequate	45	32,1

The results of the study showed most patients aged ≥ 40 years (67.1%) and women (65.7%). Almost half the BMI of patients ≥ 25 (47.1%), more than one-third of patients experienced central obesity (41.4%), about 2/3 patients had less physical activity, more than half of patients consumed foods high in sugar, and about 68% of low-fiber food patterns.

Table.2 Chi-Square Test On Risk Factors Of Diabetes Mellitus Type-2

Risk Factors	Type 2 Diabetes Mellitus				P-value	OR (95% CI) Lower - Upper
	Diabetes		No Diabetes			
	No.70	%	No.70	%		
Age						
≥ 40 years	54	77,1	40	57,1	0,019	2,531 1,218 - 5,261
< 40 years	16	22,9	30	42,9		
Gender						
Women	44	62,9	48	68,6	0,593	0,776 0,385 - 1,562
Men	26	37,1	22	31,4		
Family history of Diabetes						
Yes	31	44,3	15	21,4	0,007	2,915 1,390 - 6,112
Not	39	55,7	55	78,6		
Body Mass Index						
≥ 25	42	60,0	22	31,4	0,001	3,273 1,633 - 6,559
< 25	28	40,0	48	68,6		
Central obesity						
Yes	27	38,6	31	44,3	0,607	0,790 0,403 - 1,550
Not	43	61,4	39	55,7		
High sugar Diet						
Yes	50	71,4	26	37,1	0,000	4,231 2,080 - 8,604
Not	20	62,9	44	62,9		
Low Fibre diet						
Yes	55	78,6	41	58,6	0,018	2,593 1,234 - 5,452
Not	15	21,4	29	41,4		
Smoking						
Yes	29	41,4	25	35,7	0,602	1,273 0,644 - 2,518
Not	41	58,6	45	64,3		
Physical Activity						
Inadequate	61	87,1	34	48,6	0,000	7,176 3,091 - 16,662
Adequate	9	12,9	36	51,4		

The study showed that variables that were significantly related to the incidence of diabetes mellitus type-2 were age (P = 0,019), OR = 2.5 (1, 2-5.2), Family diabetes History (P = 0,007), OR = 2.9 (1, 3-6.1), IMT (p = 0.001), OR = 3.2 (1.6-6.5), high-sugar diet (p = 0,000), OR = 4.2 (2.0-8.6), low-fibre diet (P = 0,018), OR = 2.5 (1, 2-5.4), and physical activity (P = 0,000), OR = 7.1 (3.0-16.6). .

Table.3 Multiple Logistic Regression Test Results For The Final Risk Factor Related Of Diabetes Mellitus Type-2

Risk Factors	P-Value	OR	95% THERE	
			Lower	Upper
Age	0,029	2,677	1,105	6,483
Body Mass Index	0,011	2,870	1,268	6,497
Physical Activity	0,002	4,486	1,776	11,336
High sugar Diet	0,032	2,444	1,080	5,532
Family History of Diabetes	0,106	2,024	0,860	4,765

A multivariate analysis was conducted to see the dominant variable being the risk factor of type 2 diabetes mellitus. Table 3 shows that physical activity is the dominant factor in type 2 diabetes mellitus.

Discussion

Risk Factors Cannot Be Modified

The study reported that age proved to be a risk factor of type 2 diabetes mellitus. A person who is over 40 years of age is at risk twice as much as diabetes mellitus type 2 compared to people who are easier (less than 40 years). Study in India proves the age above 45 years is the risk factor of diabetes mellitus. (6) Other studies indicate a higher prevalence occurs at the age of over 25 years, and a decrease in the prevalence of diabetes after 65 years may be due to death at an early age due to complications of diabetes. [8] The study in Malaysia proved that patients higher than 60 years significantly suffer from diabetes mellitus complications. Age ≥ 60 years is an independent risk factor for diabetic-related complications. [9] In this study, it is not proven that women are more at risk of suffering from type 2 diabetes. Studies in the Iranian state that women should be more serious about monitoring blood glucose independently and women are one of the risk factors in glycemic control and diabetic complications. [10]

The results of our study proved that the family history of diabetes is a risk factor for diabetes mellitus. People who have a history of diabetes are riskier than those who do not have a history of diabetes. Study in India proves the family history of diabetes is as a risk factor that is significantly related to diabetes mellitus. [7] The family history of diabetes with the incidence of diabetes is not directly linked to the size of the femoral adipocytes, accumulated visceral fat, or the concentration of triglycerides in the fasting plasma. However, the family history of diabetes is an independent predictor of the size of abdominal adipocytes in women. The limited peripheral adipose storage capacity is important in the pathogenesis of insulin resistance and the increased risk of diabetes mellitus in those with a family history of diabetes. [11]

Risk Factors Can Be Modified

In population studies, it proved that BMI is a risk

factor of type 2 diabetes mellitus. Their risk of having type 2 diabetes mellitus should have a BMI ≥ 25 is tripled. A study in Japan mentions most Japanese people with type 2 diabetes mellitus resistant to insulin and has a BMI > 25 is a risk factor for severe insulin resistance. [12] A recent cohort study proved a linear relationship between the initial IMT and the risk of diabetes. The risk of incidence of diabetes increased by 35% for each BMI increase of kg/m2 in the 20-30-year group and 31% in the 30-40-year-old group. [13] Obesity is a major risk factor for the development of diabetes. A meta-analysis study that detects a dose-response relationship between BMI and type 2 diabetes mellitus. This shows that per kg/m2 increase in BMI, the risk of diabetes increased by 18%. [14]

This study showed that the diet of high sugar is the risk factor of type 2 diabetes mellitus. The meta-analysis study expressed the frequent consumption of sweetened beverages associated with the incidence of type 2 diabetes mellitus. Although beverages and fruit juices that are diet supplementary sugar also show positive relationships with the incidence of type 2 diabetes. The common people who consume sweet drinks over the years may be related to the increasing number of new cases of type 2 diabetes mellitus. [15] In our study also proved that a low-fiber diet is a risk factor of type 2 diabetes mellitus. Previous meta-analysis studies reported causal relationships between fruit and vegetable consumption and the incidence of type 2 diabetes mellitus. Potential mechanistic evidence is mainly evident in fiber content, which has been shown to increase insulin sensitivity and insulin secretion to overcome insulin resistance. [16] In our study central obesity and smoking did not prove to be a risk factor for type 2 diatebes mellitus.

Our study reports that physical activity is a risk factor in type 2 diabetes mellitus. Analysis of multiple logistic regression proves that physical activity is the most dominant factor related to type 2 diabetes mellitus. Study in India proves the factors related to type 2 diabetes mellitus after adjusting for scaffolding are physical activity, intake of excessive unsaturated fats, IMT, waist-to-hip ratio, and tobacco consumption. [17] The most physical activity done by the group that suffers from type 2 diabetes mellitus is doing the homework. There are only a few respondents who do physical activities such as jogging and cycling. Meta-analysis studies show an inverse relationship between physical activity and the incidence of type 2 diabetes mellitus. The accumulated volume of physical activity that commensurates with public health recommendations currently 150 minutes per week performs moderate to strong physical activity or 75 minutes of strong physical activity per week to maintain general health. [18] But we could not prove it, we recommend a healthy lifestyle to those especially women to do Yoga gymnastics. Previous meta-analysis studies proved that yoga can relate to lipid profiles, blood pressure, BMI, waist/hip ratio, and cholesterol levels. Yoga can improve glycemic results and other risk factors to reduce the complications of type 2 diabetes mellitus in adults. [19]

Conclusion

A proven risk factor with type 2 diabetes mellitus is the age, family diabetes history, BMI, high sugar diet, low fiber diet, and physical activity. While sex, central obesity, and smoking can not be proved to be a risk factor of type 2 diabetes mellitus. This study proves that physical activity is the main risk factor of type 2 diabetes mellitus, with a 4 times greater risk magnitude in those with less physical activity.

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