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Nutrition Intake as a Fasting Plasma Glucose Regulation Control in DMT2 Patients

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Abstract

The prevalence of type-2 diabetes mellitus (DMT2) tends to increase worldwide. The prediction numbers of diabetes mellitus (DM) patients in Indonesia will be increasing from 8.4 million people in the year of 2000 to around 21.3 million in the year of 2030. Diabetes mellitus is a syndrome with metabolism disordered of carbohydrates, fats and proteins caused by the reduced of insulin secretion or the decreased of tissue sensitivity to insulin, as the result, the blood glucose level is increased (hyperglycemia). The purpose of the study was to examine nutritional status (intake of KH, protein, fat and fiber) of type-2 DM patients. This type of research was quantitative research with cross sectional approach. The independent variable of this study is the intake of nutrients (carbohydrates, proteins, fats and fiber) to the level of fasting plasma glucose. The population of this study were 450 people of all Type 2 DM patients who were treated and controlled in Arifin Achmad Hospital, Riau Province, and the sample taken by accidental sampling as many as 37 respondents. The results of the study performed by Chi Square test showed that nutritional intake that affected fasting glucose significantly was carbohydrate (0.031), fat (0.002) and protein (0.002) while fiber did not show significant results (0.068). The results of this study will be used for further research, to create a program to overcome the increasing in fasting plasma glucose by managing the nutritional intake of Type 2 DM patients.

Keywords: carbohydrate, fat, protein, as well as glucose, diabetes

1. Introduction

The prevalence of type-2 diabetes mellitus (DMT2) tends to increase worldwide [1]. The prediction numbers of diabetes mellitus (DM) patients in Indonesia will be increasing from 8.4 million people in the year of 2000 to around 21.3 million in the year of 2030. The research was conducted in various regions in Indonesia in the 1980s showed the prevalence of type DM - 2 between 0.8% in Toraja land and 6.1% in Manado. The results of the study in the 2000s showed that the prevalence of DM patients was very sharp. DM prevalence in Jakarta in 1982 was 1.7%, increasing to 5.7% in 1993, and in 2001 to 12.8% [2]. Diabetes mellitus is a syndrome with metabolism disordered of carbohydrates, fats and

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proteins caused by the reduced of insulin secretion or the decreased of tissue sensitivity to insulin, as the result, the blood glucose level is increased (hyperglycemia) [3]. Hyperglycemia is an important factor in the pathogenesis of diabetic vascular complications [4]. The participation of patients and their families in managing DM with doctors, nurses and nutritionists is very important [3]. DM management to prevent further complications not only from drugs, but also requires diet and exercise management. DM sufferers are encouraged to diet with foods that have a low glycemic index (IG) as a source of carbohydrates. Low GI diets are an important factor in preventing metabolic risk [5]. Low GI diets provide several benefits, including losing weight fast, reducing fasting blood sugar and insulin levels, reducing circulating triglyceride levels and improving blood pressure, reducing inflammation and endothelial dysfunction, which will reduce cardiovascular risk factors.

2. Research Methodology and Instruments

2.1. Method

This study will obtain food intakedata by using NutriSurvey program analysis so that the intake percentage of carbohydrate, fat, protein and fiber will describe the nutritional status of the research sample. This research will be conducted at Arifin Achmad Hospital, Riau Province. The reason for choosing this location was because Arifin Achmad Hospital is the central Hospital in Pekanbaru and became one of the referral Hospital of Riau Province. The population of this study was 420 type 2 DM patients who routinely controlled toInternist Clinic in Arifin Achmad Hospital Riau Province. The research sample taken based on the minimum sample size according to [6]. The technique of determining the sample with Purposive Sampling where the sample is determined based on certain considerations, the sample in this study were 37 respondents.

2.2. Research instruments

In this study, the instrument used is a form of 24 hours Food Recall, the secondary data, NutriSurvey program. 24hours Food Recall (consumption survey) which is used to find out the amount and type of nutrients consumedwhich can identify excess and nutrient deficiency, data about nutrition intake. Through 24-hour recall food, respondents gave information, the intake of food consumed from morning, afternoon and evening.

3. Results

3.1. Univariate analysis

The results of the univariate analysis describe the independent and dependent variables. The dependent variable described below is fasting glucose levels. Meanwhile carbohydrate, fat, protein and fiber variables are independent variables.

TABLE 1: Distribution of Frequency of Respondents.

No	Variable	Frequency	Persentage (%)
	Dependent Variables		
1	Glucose Fasting Level		
	High	18	48.6
	Normal	19	51.4
	Amount	37	100
	Independent Variables		
1	Carbohydrate		
	Less than good	16	43.2
	Good	21	56.8
	Amount	37	100
2	Fat		
	Less than good	17	45.9
	Good	20	54.1
	Amount	37	100
3	Protein		
	Less than good	15	40.5
	Good	22	59.5
	Amount	37	100
4	Fiber		
	Less than good	15	40.5
	Good	22	59.5
	Amount	37	100

Based on table 1, the respondents with high fasting glucose levels were 18 (48.6%).

3.2. Bivariate analysis

Relationship of Nutrient Intake with Fasting Sugar Levels

Based on the results of the bivariate analysis in table 5.2 it can be concluded that:

TABLE 2: Bivariate Analysis of Nutrient Intake Relationships with Fasting Blood Glucose Levels.

Variable	Glucose Fasting Level					P Value	OR (95% CI)
	High		Normal		Total		
	N	%	N	%	n (%)		
Carbohydrate							
Less than good	11	68.8	5	31.2	16 (100)	0.031	4.400 (1.093-17.720)
Good	7	33.3	14	66.7	21 (100)		
Total	18	48.6	19	51.4	37 (100)		
Fat							
Less than good	13	76.5	4	23.4	17 (100)	0.002	9.750 (2.154-44.138)
Good	5	25	15	75	20(100)		
Total	18	48.6	19	51.4	37 (100)		
Protein							
Less than good	12	80	3	20	15 (100)	0.002	10.667 (2.208-51.533)
Good	6	27.3	16	72.7	22 (100)		
Total	18	48.6	19	51.4	37 (100)		
Fiber							
Less than good	10	66.7	5	33.3	15 (100)	0.068	3.500 (0.880-13.925)
Good	8	36.4	14	63.6	22 (100)		
Total	18	48.6	19	51.4	37 (100)		

1. Respondents with poor carbohydrate intake (less than 100% of total energy needs) have fasting glucose 4.4 times higher than respondents who have good carbohydrate intake (> 100% of total energy needs)

2. Respondents with poor fat intake (less than 100% of total energy needs) have fasting glucose 9.8 times higher than respondents who consumed good fat (> 100% of total energy needs)

3. Respondents with protein intake Poor (less than 100% of total energy needs) have fasting glucose 10.7 times higher than respondents who have good protein intake (> 100% of total energy needs)

4. There is no significant relationship between fiber intake and fasting blood glucose levels

4. Discussion

4.1. Univariate analysis

4.1.1. Fasting blood glucose levels

Based on the results of the study, there were 18 respondents (48.6%) with high fasting blood glucose levels. Blood glucose comes from food, gluconeogenesis and glycogenolysis. Carbohydrates in the digestible foods will produce glucose, galactose and fructose transported to the liver via the hepatic portal vein. Galactose and fructose are converted into glucose in the liver. In gluconeogenesis, glucose is formed from two groups of compounds, namely groups that are involved in net changes directly into glucose, glucogenic amino acids and propionate, and groups that are products of glucose metabolism in tissues. Lactate formed through glycolysis in skeletal muscle and erythrocytes is transported to the liver and the kidneys are converted back to glucose. Glucose is also formed from liver glycogen through glycogenolysis.

4.1.2. Nutrition intake

In medical nutrition therapy the principle of eating compositions in diabetics is almost the same as the food recommended for public, which is a balanced diet that matches the caloric and nutritional needs of each individual. In diabetics, it is necessary to emphasize the importance of regularity of schedule, type and amount of food consumed, so that calorie intake, carbohydrate, fat, protein and fiber according to the needs per day [2].

4.1.3. Carbohydrate intake

Based on the results of the study, there were still 16 respondents (43.2%) who have poor carbohydrate intake. Aside from being a source of energy, carbohydrates is also functioned as food reserves, sweeteners in food, help in fecal expenditure by regulating intestinal peristalsis, protein saver because if carbohydrate of the food is met, protein will mainly be used as a building agent. Carbohydrates also function as a regulator of fat metabolism because carbohydrates can prevent imperfect fat oxidation. Carbohydrate is one of the main sources of energy in the human body, from the three main sources of energy, carbohydrates, fats and proteins, carbohydrates are the cheapest source of energy. Of all the 70-80% energy needed by the body comes from carbohydrates. Carbohydrates that have entered the body will be converted into fat when the energy is sufficient, then carbohydrates that have become fat also experience metabolism into fat.

The frequency of eating and how much carbohydrate consumed by humans converted into fat is a determining factor for the onset of atherosclerosis.

4.1.4. Fat intake

Based on the results of the research, there were still 17 respondents (45.9%)who have poor fat intake. Fat tissue in the body is a savings or energy reserves. Fat in the human body produces twice as much compared to protein and carbohydrates, which is 9 kcal / g of fat consumed. Fats also function as insulation in maintaining body temperature balance and protecting body organs. Other functions are as solvents of vitamins A, D, E and K to be absorbed by the body (Krisnatuti; Yenrina, 1999). Fats are very dangerous because they can raise LDL and reduce HDL.

4.1.5. Protein intake

Based on the results of the research, there were 15 respondents (40.5%) who have poor protein intake. Protein is a macronutrient that the body needs in large quantities. Proteins consist of a number of amino acids needed for the body to function properly. Amino acids can be grouped into two main types, essential amino acids and nonessential amino acids. Daily protein requirements for each person depend on gender, age, weight, activity, and general health conditions. If human gets protein deficiency, the body will lose weight due to reduced muscle mass (muscle shrinks), often there will be infection due to weakened immune system, muscle fatigue, swelling in the body, interference the cell growth, hair loss, diarrhea, fatty liver, anemia, to experience conditions of protein energy malnutrition, such as kwashiorkor and marasmus.

4.1.6. Fiber intake

Based on the results of the research, there were still 15 respondents (40.5%) who have poor fiber intake. Fiber is a type of mineral that is not easily digested and absorbed by the body. Fiber is almost the same as carbohydrates that can provide energy to the body, but fiber is lower in calories. Although difficult to digest, increasing fiber consumption can reduce the risk of cardiovascular disease, diabetes, cancer and obesity. Fiber can reduce the absorption of sugar in the blood so that it balances sugar levels and prevents type 2 diabetes.

4.2. Bivariate analysis

4.2.1. Relationship of nutrient intake with fasting blood glucose levels

Based on the results of the study using the Chi Square Test in getting the intake of nutrients that affect fasting blood glucose levels significantly are carbohydrates with P value (0.031), fat P value (0.002), and protein P value (0.002). While the fiber variable does not have a significant relationship to fasting glucose levels P value (0.068). Energy consumption that exceeds the body's needs causes more glucose in the body [6]. Sugar is a food source and fuel for the body that comes from the process of digestion of food. In patients with type 2 diabetes, their body tissues are unable to store and use glucose, so that blood glucose levels will rise and will become toxic to the body. The high level of blood glucose is influenced by high energy intake from food [6]. Protein intake that does not meet the needs will affect blood sugar levels due to one of the functions of protein as a body's energy source, to become energy types of amino acids that enter the carbohydrate pathway through the process of gluconeogenesis. This can also occur if the body lacks food energy intake [6].

5. Conclusion

Based on the results of the study using the Chi Square Test in getting the intake of nutrients,compounds that affect fasting blood glucose levels significantly are carbohydrates with P value (0.031), fat P value (0.002), and protein P value (0.002).

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Statement

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Important Conflict

The Authors do not have Important Conflicts to declare.

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