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STUDY OF DIFFERENCES IN BLOOD SUGAR LEVELS OF DIABETES MELLITUS PATIENTS WHO CONSUME RICE COOKED WITH THE RICE COOKER METHOD AND THE STEAMING METHOD

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ABSTRACT
The 2023 Indonesian Health Survey Report issued by the Ministry of Health revealed that there was an increase in the prevalence of diabetes mellitus (DM) in the population aged over 15 years based on the results of blood sugar level measurements. In the 2018 Basic Health Research, it was recorded that the prevalence of diabetes in Indonesia reached 10.9%. Now, the prevalence has reached 11.7% in 2023. The Aceh Health Office recorded that sufferers of Diabetes Mellitus until early 2023 reached 154,889 cases. The purpose of this study is to find out the difference in blood sugar levels in people with diabetes mellitus who consume rice after cooking with the *rice cooker* method and with the steaming method. This quantitative analytical research uses a cross-sectional study design. The population of the study was all people with diabetes mellitus at the Calang Health Center, Aceh Jaya Regency, totaling 50 people. Data collection was carried out from January 15 to March 15, 2024 using nonprobability sampling techniques. This study also took direct data by looking at the sugar content of the respondents by eating rice cooked by the rice cooker method and 1 month later by measuring the sugar content of the respondents consuming rice by cooking the rice by steaming. Data were analyzed using univariate, bivariate and multivariate statistical tests. The results of the study showed that factors related to blood sugar levels in DM patients were gender, age, education, occupation, income, physical activity, nutritional status, smoking behavior, and family history of diabetes. The factors most related to increased blood sugar levels in diabetes mellitus patients were steaming with OR=7.47, use of a rice cooker of 11.2 and family history of diabetes mellitus of 7.50. It is expected that respondents will control their blood sugar levels, so that DM sufferers and their families will cook rice using the steaming method, and control other risk factors that can cause high blood sugar levels.

Keywords: blood sugar levels; diabetes mellitus; rice

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INTRODUCTION

According to data from WHO, 90% of people with DM are caused by a lifestyle in society that tends to be unhealthy, such as lack of exercise and an unhealthy diet with excessive consumption, fat, carbohydrates and others (Paulus, 2022). Rice is the most commonly consumed source of carbohydrates by the community (Budjianto, 2022). Rice comes from white rice. It is known that from 100 grams of rice there is a carbohydrate content of 40.6% which will be converted into glucose and will increase blood sugar in the body quickly. According to data circulating around the world, rice or rice has a diverse glycemic index, depending on the type and how it is processed. Different ways of cooking and processing food ingredients will cause different glucose responses. The cooking or heating process will cause the gelatinization process in the starch so that the starch will be easier to digest because digestive enzymes in the intestines get a wider place to work (Rimbawan et al., 2020).

The control of blood sugar levels in diabetic patients is highly dependent on the client's adherence to the DM dietary recommendations, including the exact type, amount, and timing. Foods that have a low glycemic index and high fiber content that are acceptable to people with DM need to be produced, because they have been proven to reduce blood glucose levels in people with DM. The glycemic index value of carbohydrate-rich foods can decrease if served cold. This happens because the starch that becomes a gel during cooking undergoes retrogradation during cold storage, making the starch structure difficult to digest. Proper processing is carried out to lower carbohydrate and glucose levels in white rice so that it is safer to consume (Juwita, 2020). Based on the description above, the author wants to conduct a study on the difference in blood sugar level values in people with Diabetes Mellitus who consume rice cooked with the *rice cooker* method and the steaming method. The special purpose of this study is to find out the relationship between gender, age, education, occupation, income, physical activity, nutritional status, smoking behavior, history of diabetes mellitus, use of rice cooker and steamer with blood sugar level in patients with diabetes mellitus.

METHOD

The research design used is quantitative and analytical with a cross sectional research design. The research population is the entire productive age community of people with diabetes mellitus recorded at the Calang Health Center, Aceh Jaya Regency as many as 76 people with a total of 50 research samples that meet the inclusion criteria. Data collection was carried out from January 15 to March 15, 2024 using nonprobability sampling techniques Data was analyzed using univariate, bivariate and multivariate statistical tests.

RESULTS

Based on Table 1, it can be seen from 50 respondents whose blood sugar levels were controlled by 18.00% compared to uncontrolled by 82%, the gender of respondents who were female was 58% compared to male respondents of 42%, respondents with productive age of 80% compared to respondents of unproductive age of 10%, respondents with high school education of 36% compared to respondents who did not go to school by 4%, respondents with working status of 84% compared to respondents who do not work by 16%, respondents with an UMR income of 46% compared to respondents with an income below UMR of 54%, respondents with inactive physical activity of 82% compared to respondents with slightly active physical activity as much as 18%, respondents with normal nutritional status of 48% compared to respondents with obese nutritional status of 18%, Respondents who cooked rice using a rice coocer with a normal blood sugar level check result of 8% compared to respondents who had an abnormal virgin sugar level of 92%, respondents who cooked rice by steaming with a normal blood sugar level check result of 28% compared to respondents with abnormal blood sugar levels of 72%, respondents who had smoking behavior of 70% compared to non-smoking respondents of 30% and respondents who had a history of DM of 68% compared to respondents who did not have a family history of DM by 32%.

Table 1
Distribution of Blood Sugar Level Frequency, Gender, Age, Education, Occupation, Income, Physical Activity, Nutritional Status, Rice Steamer, Rice Cooker, Smoking, History of Diabetes

No	Variabel	f	%
Blood Sugar Levels of DM Patients			
1	Controlled	9	18,00
2	Uncontrolled	41	82,00
Gender			
1	Woman	29	58,00
2	Man	21	42,00
Age			
1	Productive	40	80,00
2	Unproductive	10	20,00
Education			
1	Sarjana	15	30,00
2	SMA	18	36,00
3	SMP	7	14,00
4	SD	8	16,00
5	Tidak Sekolah	2	4,00
Income			
1	UMR	23	46,00
2	Tidak UMR	27	54,00
Physical Activity			
1	Inactive	41	82,00
2	Little Active	9	18,00
3	Quite Active	0	0
4	Highly Active	0	0
5	Extra active	0	0
Status Gizi			
1	Normal	24	48,00
2	Overweight	16	32,00
3	Underweight	1	2,00
4	Obesitas	9	18,00
Rice cooker			
1	Normal	4	8,00
2	Abnormal	46	92,00
Steaming			
1	Normal	14	28,00
2	Abnormal	36	72,00
Smoking Behavior			
1	No	35	70,00
2	Already	15	30,00
DM History			
1	None	16	32,00
2	Ada	34	68,00

Table 2
Relationship between gender, age, education, occupation, income, physical activity, nutritional status, rice steamer, rice cooker, smoking, history of diabetes with blood sugar levels in diabetic respondents in the Calang Health Center Working Area

Variabel Independen	Up to Gula Darah				OR	CI 95%	P-*Value*
	Controlled		Uncontrollable				
	n	%	n	%			
Gender							
Woman	6	20,69	23	79,31	1,56	0,242-7,134	0,563
Man	3	14,29	18	85,71			
Age							
Productive	8	20	32	80	2,24	0,247-20,43	0,471
Unproductive	1	10	9	90			
Education							
Sarjana	5	33,33	10	66,67	1,25	0,176-8,87	0,823
SMA	0	0	18	100			
SMP	2	28,57	5	71,43	1,5	0,218-10,30	0,680
SD	2	25	8	75			
Tidak sekolah	0	0	2	100			
Work							
Work	7	16,67	35	83,33	0,599	0,099-3,609	0,577
Not working	2	25	6	75			
Income							
UMR	4	17,39	19	82,61	0,926	0,217-3,953	0,918
Tidak UMR	5	18,52	22	81,48			
Physical Activity							
Little Active	2	22,22	7	77,78	1,387	0,236-8,143	0,717
Inactive	7	17,07	34	82,93			
Nutritional Status							
Normal	5	20,83	19	79,17	1,140	0,231-5,624	0.872
Overweight	3	18,75	13	81,25			
Underweight	0	0	1	100	2,105	0,210-21,00	0,526
Obesitas	1	11,11	8	88,89			
Rice cooker							
Normal	3	75	1	25	20	1,777-225,0	0,015
Abnormal	6	13,04	40	86,96			
Steaming							
Normal	6	42,86	8	57,14	8,25	1,688-40,318	0,009
Abnormal	3	8,33	33	91,67			
Smoke							
No	8	22,86	27	77,14	4,148	0,470-36,577	0,200
Yes	1	6,67	14	93,33			
Family History of Diabetes							
None	6	37,50	10	62,50	6,2	1,304-29,45	0,022
Ada	3	8,82	31	91,18			

Table 3
The most dominant factors on blood sugar levels in diabetic respondents

No	Up to Gula Darah	OR	P value
1	Rice cooker	11,27	0,067
2	Steaming	7,47	0,996
3	DM History	7,50	0,996

Table 3 shows the results of a multivariate analysis of 3 variables, namely rice cooker, steaming and history of diabetes mellitus, showing that the factors most related to the increase in blood sugar levels of people with diabetes mellitus are steaming with OR=7.47, use of rice cooker=11.27 and history of diabetes mellitus=7.50

DISCUSSION

Sex relationship with blood sugar levels

From the results of the study, it was known that female respondents with normal blood sugar levels of 20.69% compared to male respondents with normal blood sugar levels of 14.29% while respondents with abnormal blood sugar levels with female sex were 79.31% compared to male respondents of 85.71%. The results of the statistical analysis obtained a p-value of 0.563 which showed that there was no relationship between sex and blood sugar level levels in patients with diabetes mellitus. The results of the odd *ratio* calculation obtained a value = 1.56 which means that male respondents are at 1.56 times higher risk of increasing blood sugar levels compared to female respondents.

The results of this study are in accordance with the results of the research of Trisnawati, S.K. and Setyorogo (2013) which showed that there was no relationship between sex and blood sugar levels. The results of the study found that based on the analysis between sex and the incidence of type 2 diabetes mellitus, the prevalence of type 2 diabetes mellitus in women was 1,007 times higher than in men. Women are more at risk of developing diabetes because physically women have a greater chance of increasing their body mass index. This is not in accordance with the research conducted by Allorerung, D. L., Sekeon, S. A., & Joseph (2016) which shows that there is a relationship between sex and fasting blood sugar levels. The results of the study found that respondents with a female gender had a 2.777 times greater risk of developing type 2 diabetes mellitus compared to male respondents (Komariah & Rahayu, 2020). According to the researcher's assumption in this study, both male respondents had the opportunity to increase blood sugar levels. While the female sex is at a lower risk because women have hormones that can maintain balance and normalize blood sugar levels so as to prevent chronic complications in people with diabetes mellitus. While there are some differences in the factors that can affect blood sugar levels between men and women, gender itself is not the main factor that determines blood sugar levels.

Relationship between age and blood sugar levels

Based on the results of the study, it was known that the productive age with normal blood sugar levels of 20% compared to the respondents of productive age with abnormal blood sugar levels of 80% while the respondents with abnormal blood sugar levels with an unproductive age of 10% compared to the respondents with abnormal blood sugar levels of 90%. The results of the statistical analysis obtained a p-value of 0.471 which showed no relationship between age and blood sugar level levels in patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 2.24 which means that respondents with an unproductive age are at risk of increasing blood sugar levels 2.24 times compared to respondents of productive age.

The results of this study are in accordance with the results of the research (Trisnawati, S.K. and Setyorogo, 2013) which shows that there is no relationship between age and fasting blood sugar levels where the age of ≥45 years is the most at risk of increasing blood sugar levels. This study is not in line with Komariah (2020) research which shows that the elderly age category (46-65 years old) tends to have normal fasting blood sugar levels as many as 50 patients (46.2%). In this study, the results of the statistical test showed p-value=0.004, so it

can be concluded that there is a relationship between age and fasting blood sugar levels in type 2 diabetes mellitus patients in KPRJ (Komariah & Rahayu, 2020). The researcher's assumption is that although age can be a risk factor for increasing blood sugar levels in people with diabetes mellitus. The relationship between age and blood sugar levels can be influenced by a variety of factors, including lifestyle, genetics, and overall health such as decreased pancreatic function, insulin resistance, decreased physical activity, changes in body composition, other diseases and medications, diet and lifestyle.

Relationship between education and blood sugar levels

Based on the results of the study, it is known that respondents with junior high school education with normal blood sugar levels of 28.57% compared to respondents with junior high school education with abnormal blood sugar levels of 71.43% while respondents with elementary school education with normal blood sugar levels of 25% compared to respondents with elementary school education with abnormal blood sugar levels of 75%. The results of statistical analysis obtained a p-value of 0.823 for junior high school education and 0.680 for *elementary* school education which showed no relationship between education and blood sugar level levels in people with diabetes mellitus. The results of the *odd ratio* calculation obtained a value = 1.5 which means that respondents with elementary education are at risk of increasing blood sugar levels 1.5 times compared to respondents with a bachelor's education.

The results of this study showed that there were 45.2% of low-educated respondents who had poor blood sugar levels. This research is in accordance with previous research which states that the lower a person's education, the worse his blood sugar levels will (Rachmawati & Kusumaningrum, 2017). Education can affect a person's knowledge in controlling their blood sugar levels, the higher the level of education, the more knowledge there will be and if the lower the education, the less knowledge a person will have. A person with low education, the majority of them do not know how to control blood sugar levels so that severe complications do not occur, because of low education and they do not know much information or have never received counseling about blood sugar levels and about how to control blood sugar so that blood sugar levels become high/bad (Rachmawati & Kusumaningrum, 2015). Furthermore, research conducted by Lestari and Intan (2016) showed that most (62.5%) of respondents with low education had poor blood sugar levels. The level of education will increase awareness about healthy living and pay attention to lifestyle and diet. Meanwhile, individuals with low education are at risk of paying less attention to lifestyle and diet and what should be considered to prevent an increase in blood glucose levels (Pahlawati & Nugroho, 2019). According to the researchers' assumption, although education itself is not a biological factor that directly affects blood sugar levels, its impact on knowledge, behavior, and access to health resources can significantly affect the management and control of blood sugar levels

Occupational relationship with blood sugar levels

Based on the results of the study, respondents with working status with normal blood sugar levels of 16.67% compared to respondents with non-working status with abnormal blood sugar levels of 83.33% while respondents with non-working status with normal blood sugar levels of 25% compared to respondents with non-working status with abnormal blood sugar levels of 75%. The results of the statistical analysis obtained a p-value of 0.577 which showed no relationship between work and blood sugar level levels in patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 0.599 which means that respondents with non-working status are at risk of 0.599 times the risk of increasing blood sugar levels compared to respondents with working status.

This research is not in line with research conducted by (Sarihati, Pratiwi & Swastini, 2021) showing that most (65.8%) do not work and have poor blood sugar levels. The results of this study are in accordance with previous research from Ugahari, Mewo and Kaligis (2016), which stated that the majority of those who have poor blood sugar levels are housewives and retirees, because they are no longer working and have less physical activity, causing a lack of energy burning by the body. Excess energy in the body will be stored in the form of fat and cause the number of fat deposits in the body not to decrease and increase glucose levels in the blood (Sarihati, Pratiwi, & Swastini, 2021). According to the researchers' assumption that the work has nothing to do with the blood sugar levels of people with diabetes mellitus, there are only a few chances that the work can affect blood sugar levels, there are many other variables that can reduce or mask the impact on people with diabetes mellitus. Effective diabetes management, personal adaptation to stress, and a supportive work environment can contribute to the stability of blood sugar levels, so the effects of work may not always be obvious.

Relationship between production and blood sugar levels

Based on the results of the study, it is known that respondents with a UMR income of normal blood sugar level of 17.39% compared to respondents with a UMR income with an abnormal blood sugar level of 83.33% while respondents with an income below the UMR with a normal blood sugar level of 18.52% compared to respondents who have a non-UMR income with an abnormal blood sugar level of 81.48%. The results of the statistical analysis obtained a p-value of 0.918 which showed that there was no relationship between UMR income and blood sugar level levels in patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 0.92 which means that respondents with incomes below UMR are at risk of 0.92 times the risk of increasing blood sugar levels compared to respondents with UMR income.

Previous research has shown that individuals with lower incomes tend to have a higher risk of experiencing health problems associated with abnormal blood sugar levels, such as insulin resistance, prediabetes, and diabetes (Xu, Yang, Deng, Liu, Zhang, Long & Wu, 2023). According to Hill-Briggs, Adler, Berkowitz, Chin, Gary-Webb, Navas-Acien & HaireJoshu (2021) this can be caused by several factors, such as: 1) Limited access to healthy food. Low-income individuals may have limitations in purchasing healthy and nutritious foods, which can lead them to eat high-calorie, low-nutrient-dense foods that can lead to obesity and insulin resistance; 2) Chronic stress. Low-income individuals may experience higher stress due to economic and social factors, which can lead to increased levels of stress hormones such as cortisol and an increased risk of insulin resistance and diabetes; 3) Limited access to healthcare. According to the researchers' assumptions although there are individual variations and some exceptions, in general, socioeconomic status or income has little effect on blood sugar levels. Factors such as access to healthcare, diet, environment, stress, education, and health insurance all play a role in this relationship. Therefore, improving socioeconomic status and reducing inequality can contribute to improving overall public health, including the control of diabetes and blood sugar levels.

Relationship between physical activity and blood sugar levels

Based on the results of the study, it was known that respondents with little physical activity had normal blood sugar levels of 22% compared to respondents with little physical activity with abnormal blood sugar levels of 77.78% while respondents with normal blood sugar levels with inactive physical activity were 17.07% compared to respondents with abnormal blood sugar levels of 82.93%. The results of the statistical analysis obtained a p-value of 0.717 which showed no relationship between physical activity and blood sugar level levels in

patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 1.38 which means that respondents with inactive physical activity are at risk of 1.38 times the risk of increasing blood sugar levels compared to respondents who do little physical activity.

The approach used in this study is moderate, regular, and regular activities doing it at least 3 times a week for at least 30 minutes. Moderate intensity physical activity for 30 minutes a day and a healthy diet can drastically reduce the risk of developing type 2 diabetes (WHO, 2016). Physical activity is an important part of regulating blood glucose levels and keeping the body healthy. Being physically active has many health benefits, namely lowering blood glucose, lowering blood pressure, increasing blood flow, burning excess calories (maintaining weight) and improving mood (Norton, Ketchum, Narva, Star, & Rodgers, 2017).

According to the researchers' assumptions, physical activity has an important role in general health, and in people with diabetes mellitus (DM), physical activity can affect the risk of developing gangrene lesions. Physical activity in people with diabetes should be tailored to their health condition, and consultation with a healthcare professional before starting a new exercise program is highly recommended. Physical activity that is too intensive or not in accordance with the physical condition of diabetics can increase the risk of injury and complications. Physical activity will greatly affect blood sugar levels in people with DM, because when a person does physical activity there will be an increase in glucose consumption by active muscles so that it can directly cause a decrease in the amount of blood sugar levels in the body, the more routine a person does physical activity, the more controlled blood sugar levels in a person will be.

Although physical activity is generally associated with lowering or controlling blood sugar levels, in some situations physical activity may not always have a direct relationship with increased blood sugar levels. Physical activity has many benefits in managing blood sugar levels and overall health. However, the body's response to physical activity can vary depending on various factors such as the type of activity, intensity, duration, medical condition, and medication management. With proper monitoring and consultation with a healthcare professional, the benefits of physical activity can be maximized without causing unwanted increases in blood sugar levels.

Relationship between nutritional status and blood sugar levels

Based on the results of the study, it was known that respondents with *overweight* nutritional status had normal blood sugar levels of 18.75% compared to respondents whose blood sugar levels were abnormal at 81.25% while respondents with obese nutritional status with normal blood sugar levels of 11.11% compared to respondents with abnormal blood sugar levels of 88.89%. The results of the statistical analysis obtained a p-value of 0.526 which showed that there was no relationship between nutritional status and blood sugar level levels in patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 2.10 which means that respondents with obese nutritional status are at risk of 2.10 times the increase in blood sugar levels compared to respondents with normal nutritional status. The results of this study are in line with the results of research by Mia Audina, Tonny Cortis Maigoda (2018) which shows that there is no relationship between nutritional status and blood sugar levels. One of the efforts that can be made to lower blood sugar levels in people with diabetes mellitus is to achieve good nutritional status. Obesity is a predisposing factor for the onset of increased blood sugar levels, this is because the beta cells of Langerhans island become less sensitive to stimuli or due to increased sugar levels and obesity will also suppress the number of insulin receptors in cells throughout the body.

Masruroh E (2018) stated that there was a correlation between nutritional status and blood sugar levels in patients with type II Diabetes Mellitus at the Internal Medicine Poly of dr. Iskak Tulungagung Hospital with p value = 0.000. More nutritional status can result in insulin resistance. This causes blood sugar levels to increase and worsen tissue conditions and has an impact on complications including central obesity due to lipolysis to the effects of insulin. This finding is in accordance with Suryanti, et al. (2019) who said that there was no relationship between BMI and fasting blood sugar levels in type 2 diabetes mellitus patients. The data showed that the respondents with the most abnormal blood sugar levels were found in the nutritional status of type 1 obesity of 7 people and followed by overweight nutritional status and normal nutritional status with each respondent of 6 people. According to researchers, nutritional status is not the only factor that can increase blood sugar levels in people with diabetes mellitus. While there may be a view that nutritional status has no direct relationship with blood sugar levels, scientific evidence suggests that diet and nutritional status significantly affect blood sugar regulation. Adopting a balanced diet with proper nutrition is key in managing blood sugar levels and preventing related complications.

The relationship between blood sugar levels using a *rice cooker* and blood sugar levels

Based on the results of the study, it was known that respondents with the use of rice cookers with normal blood sugar levels of 75% compared to respondents who used rice *cookers* with abnormal blood sugar levels of 25% while respondents with abnormal blood sugar levels with the use of *rice cookers* were 13.04% compared to respondents who used *rice cookers* with an abnormal blood sugar level of 86.96%. The results of the statistical analysis obtained a p-value of 0.015 which showed that there was a relationship between the use of *rice cooker* and the level of blood sugar levels in patients with diabetes mellitus. The results of the odd *ratio* calculation obtained a value = 20 which means that respondents with *abnormal rice cooker* use are 20 times at risk of increasing blood sugar levels compared to respondents who use *normal* rice cooker.

Research by Widhyasari et al. (2017) which shows that the longer the heating process in the *rice cooker*, the lower the carbohydrate content in white rice, and the water content decreases so that the rice will become harder and drier. The glucose level of rice stored at room temperature also decreases during storage for up to 12 hours. Juwita's research (2020) also stated that rice cooked with *a Teflon rice cooker* experienced a decrease in glucose levels at storage temperatures of 70 ºC, 42 ºC, and 30 ºC (Juwita, 2020). There are several factors that affect the carbohydrate and glucose content of rice, namely the type of rice, the way it is processed, and how it is stored. The glucose content in white rice was 25.4%, while the reduced sugar content including glucose in rice before cooking was 95.48% and decreased to 31.76% after cooking. This is because in the cooking process there are some carbohydrates that are lost and the reducing sugar content is damaged. On the other hand, the analysis of some rice processing shows that the glucose content of ordinary rice that is baked and baked has a higher glucose level than ordinary rice. This is because grilled rice and grilled rice undergo a reheating process so that water evaporation occurs in the larger rice (Mukti, Rohmawati, & Sulistiyani, 2018).

The research of Novianti et al. (2017) on the analysis of glucose levels of white rice stored for some time stated that white rice stored for 12 hours experienced an increase in glucose levels, then the glucose levels decreased in the next storage period. This is because starch that reacts at high temperatures increases the reducing sugar content. The long warming treatment will cause the breakdown of starch into simple sugars, namely glucose, so that it can increase the reducing sugar content in rice (Juwita, 2020). According to the researcher's assumption, the

use of *a rice cooker* does not directly affect blood sugar levels. However, the way it is cooked and the type of rice cooked using a *rice cooker* can affect the glycemic index of rice, which in turn can affect blood sugar levels. The use of *the rice cooker* itself does not have a direct impact on blood sugar levels. However, the type of rice cooked, the cooking method, and the way the rice is served and consumed can affect the glycemic index of rice and blood sugar levels. Choosing a type of rice with a lower GI, practicing certain cooking methods such as cooling and reheating rice, and combining rice with other healthy foods can help manage blood sugar levels better.

The relationship between cooking rice by steaming and blood sugar levels

Based on the results of the study, it was known that respondents who cooked rice by steaming had a normal blood sugar level of 42.86% compared to respondents whose blood sugar levels were abnormal at 57.14% while respondents whose blood sugar levels were normal by steaming were 8.33% compared to respondents who steamed with an abnormal blood sugar level of 91.67%. The results of the statistical analysis obtained a p-value of 0.009 which showed that there was a relationship between cooking by steaming and blood sugar levels in people with diabetes mellitus. The results of the *odd ratio* calculation obtained a value = 8.25 which means that respondents who do not cook by steaming have an 8.25 times risk of increasing blood sugar levels compared to respondents who cook rice by steaming. Cooking rice by steaming can affect blood sugar levels, although the effect has more to do with the type of rice and the overall preparation method than the steaming process itself. Here are some ways how cooking rice by steaming can be related to blood sugar levels (Rahmi & Kusuma, 2020). According to the researcher's assumption, there is a relationship between steaming rice and increased blood sugar levels in people with diabetes mellitus. Steaming rice can help maintain the nutritional value and starch structure, potentially affecting the glycemic index of rice. However, the type of rice used and the overall consumption method have more influence on blood sugar levels. Choosing a type of rice with a lower GI, combining it with other healthy foods, and controlling portion sizes are more effective strategies for managing blood sugar levels.

The relationship between smoking and blood sugar levels

Based on the results of the study, it was known that respondents with non-smoking behavior with normal blood sugar levels of 22.86% compared to non-smoking respondents with abnormal blood sugar levels of 77.14% while respondents with abnormal blood sugar levels with smoking behavior of 6.67% compared to respondents with smoking behavior with abnormal blood sugar levels of 93.33%. The results of the statistical analysis obtained a p-value of 0.200 which showed that there was no relationship between the use of smoking behavior and the level of blood sugar levels in patients with diabetes mellitus. The results of the *odd ratio calculation* obtained a value = 4.148 which means that respondents with smoking behavior are at risk of 4.148 times the increase in blood sugar levels compared to non-smoking respondents.

This study is in line with previous research conducted by Tanharjo (2016) which stated that smoking is not a factor related to blood sugar levels because the results of the chi-square test analysis showed that p=0.73>0.05. This study is in line with Nababan (2018) which showed that there was no significant relationship between smoking status and blood sugar levels, with p-value=0.459 (p>0.05). The absence of this relationship can be attributed to the fact that in this study the respondents were quite good in terms of reducing cigarette consumption where the results were obtained that of the 17 respondents, who had smoked, there were (94.1%) respondents who had poor blood sugar levels, more than those with good blood sugar levels

(5.9%). Meanwhile, of the 83 respondents who were not smokers, there were (85.5%) whose blood sugar levels were poor, greater than those with good blood sugar levels (14.5%) (B. B. Nababan, Saraswati, & Muniroh, 2018).

This study is also in line with the research of Kusumawardani (2020), the variable of the number of cigarette sticks in this study obtained a p value of 0.369, showing a p-value of >0.05 which means that there is no relationship between the number of cigarette sticks and diabetes mellitus. The coefficient correlation value in the study has a value of R= -0.093 which means that it has a weak correlation and has a negative pattern, meaning that the large number of cigarettes smoked has no effect on the increase in blood sugar levels of DM patients. The results of the statistical test for the variable of smoking duration obtained a p-value of 0.367 showing a p value of > 0.05 which means that there is no association between smoking and diabetes mellitus. The value of the correlation coefficient for the variable of smoking duration was obtained as R= -0.093 had a weak correlation and a negative pattern, which means that smoking duration did not affect the blood sugar levels of people with diabetes mellitus (Kusumawardani, Rohmawati, & Sa'adah, 2020). According to the assumption that there is no relationship between smoking behavior and increased virgin sugar levels in people with diabetes mellitus because the respondents are not active smokers because the respondents are aware of the dangers of smoking, smoking has a significant negative impact on blood sugar levels and overall health in people with diabetes mellitus. Smoking increases insulin resistance, increases stress hormones, and worsens diabetes complications. Quitting smoking is one of the best steps people with diabetes can take to improve blood sugar control, reduce the risk of complications, and improve quality of life.

Relationship between family history of diabetes and blood sugar levels

Based on the results of the study, it was known that respondents who did not have a history of diabetes mellitus had a normal blood sugar level of 37.50% compared to respondents who did not have a history of diabetes mellitus with abnormal blood sugar levels of 62.50% while respondents who had a history of diabetes mellitus with normal blood sugar levels of 8.82% compared to respondents who had a history of diabetes mellitus with abnormal blood sugar levels by 91.18%. The results of the statistical analysis obtained a p-value of 0.022 which showed no relationship between the history of diabetes mellitus and the level of blood sugar levels in people with diabetes mellitus. The results of the *odd ratio* calculation obtained a value = 6.2 which means that respondents who have a history of diabetes mellitus have a risk of increasing blood sugar levels 6.2 times compared to respondents who do not have a history of diabetes mellitus.

In accordance with Isnaini's (2018) research that there is a relationship between family history and blood sugar levels of people with type 2 diabetes mellitus, where people who have a family history of diabetes mellitus are 10.938 times more likely to suffer from type two diabetes mellitus than people who do not have a history. The findings of Frankilawati (2013), that there is a relationship between family history and blood sugar levels of people with type 2 diabetes mellitus, where people who have a family history of suffering from Diabetes Mellitus are at greater risk than people who do not have a family history of suffering from Diabetes Mellitus (A. S. V. Nababan, Pinem, Mini, & Purba, 2020). According to researchers, the family history of diabetes has a significant influence on a person's blood sugar levels. Research shows that individuals with a family history of diabetes have higher blood sugar levels compared to those who do not have such a history. Overall, a history of diabetes mellitus, both in the individual and in the family, plays an important role in determining blood

sugar levels and the risk of developing type 2 diabetes. Proper handling and monitoring of blood sugar levels are essential to prevent further complications.

CONCLUSION

Based on the results of the study, conclusions can be drawn from 11 variables that will be analyzed multivariously using the Logistic Regression test. The criteria for variables that are worthy of inclusion are if the significant value *(*p-value) < 0.20. The results of the feasibility test, namely 3 variables, namely rice cooker, steaming and history of diabetes mellitus, showed that the most influential factors for increasing blood sugar levels of people with diabetes mellitus were steaming with OR = 7.47, use of rice cooker 11.2 and history of diabetes mellitus 7.50

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