

The Effect of Red Fragon Fruit toward Blood Glucose Levels Decreased

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Abstract: Diabetes mellitus prevalence continues to increase every year, World Health Organization data says about 346 million people suffer from diabetes and Indonesia is ranked fourth in the number of people with diabetes in the world. Diets management of DM patients needs to be modified, especially fibre and antioxidants intake. Dragon fruit can control blood glucose levels so as to prevent complications. The numbers of respondents were 30 people, the sampling technique with purposive sampling. This research was quasi-experimental study with non equivalent control group design. From the study results, average blood glucose levels before treatment 349.73 mg / dl and after 323.27 mg / dl. There is decrease in glucose levels after consuming dragon fruit juice for 14 days because of its fibre and vitamin C content so that DM sufferers have decreased glucose levels up to 29 mg / dl.

1 INTRODUCTION

Diabetes mellitus (DM) is a disease whose prevalence is increasing rapidly every year throughout the world. DM sufferers in the world in 2000 totalled 171 million people, in 2011 totalled 346 million and it is expected to double in 2030 (Glauber, 2016; WHO, 2015). Indonesia is fourth ranked that has most DM sufferers in the world. Sedentary diet and lifestyle are risk factors that influence the increased prevalence of DM, the shift in eating patterns towards high-energy, fat and low-fibre diets trigger an imbalance in nutritional intake that leads to the development of degenerative diseases such as DM which is as serious health problem and difficult to overcome until now (Widya, et al, 2016). An increasing sufferer's number of non-communicable diseases occurs consistently, it shows that diabetes mellitus is health problem that needs special attention from various parties including the government. The health policies that have been made by Indonesia Government are listed in the Regulation of Health Minister of Indonesia Republic Number: 1144 / Menkes / per / VIII / 2010 concern the Organization and Administration of Health Ministry, the government has established Sub-Directorate for controlling diabetes mellitus and metabolic diseases.

In Indonesia, DM is the main cause of death which is 2.1% of all deaths (MOH, 2016). One feature of DM is blood glucose levels that rise above normal called hyperglycaemia. Uncontrolled glucose levels cause various complications, including cardiovascular disease such as coronary heart disease which is characterized by high levels of cholesterol and blood lipids (Shrivastava et al, 2016; Farnz et al, 2016; bernaurd, 2016).

Diabetes mellitus is a disease that is mostly suffered by most Indonesian people. However, people still perceive diabetes mellitus as elderly disease or disease that only arises because of heredity. In fact, anyone can have diabetes mellitus both young and old because the main factors causing diabetes mellitus are diet and sedentary lifestyle.

Diabetes mellitus is disorder that occurs due to the body's lack of the hormone insulin, as a result glucose continues to circulate in the bloodstream and it is difficult to penetrate the cell wall. The absence of glucose entering the cell causes the cell experience less energy for cellular metabolic processes.

The reported incidence of pre diabetes continues to increase. 4-9% of pre diabetes sufferers will become diabetic every year (PERKENI, 2011). Based on DM prevalence illustrates the importance of early prevention for the disease. DM management is very effective in the early stages before the

symptoms of pre diabetes (Sizer, 2008). In accordance with the criteria of American Diabetic Association (ADA), pre diabetes is characterized by fasting blood glucose (FBG) between 100-125 mg / dL (ADA, 2012). Various efforts to overcome this disease have been carried out, including by regulating diet, regular exercise (Malawiq 2012), oral anti diabetic drugs usage and insulin injections (Levich 2011). Intensive administration of insulin requires relatively expensive cost. The synthetic drugs usage such as sulfonyl and biguanide groups also cannot reduce glucose concentrations to normal and restore the normal pattern of glucose homeostasis permanently.

People/patinets with diabetes mellitus in the long term will experience complications that can cause organ damage such as decreased vision, weak heart, kidney failure, liver damage, and others. Treatment is usually done by people with diabetes mellitus is by injection or anti-diabetic chemical drugs, such as glibenclamide which is a derivative of sulfonylurea. Glibenclamide works by stimulating insulin secretion by pancreatic beta cells (Handoko and Suharto, 2005). However, these methods of treatment can cause side effects such as nausea, abdominal discomfort and anorexia (Puspanti et al., 2013) and maintenance of diabetes, taking up huge funds each year (Sovia et al., 2011).

In dietary settings, DM sufferers are advised to pay attention to carbohydrate and fibre intake because it is important in controlling blood glucose levels. In fact, DM sufferers who have already run diet program have not been able to control blood glucose properly so that their daily levels remain high. The reason is the lack of fruit and vegetable intake as source of fibre and antioxidants. The research result in United States showed that fibre intake of DM sufferers <15 g / day, it is lower than recommendation of 25 g / day. Based on the research result that conducted at General Hospital, Sanglah Denpasar reported their average fibre intake was only 8.9g / day and according to Malaysian Medical Faculty division said that dragon fruit administration as much as 200-300 g / day was able to reduce blood sugar levels and choleterol type 2 of DM patients (Wiardiani, 2013; Khalili, 2016).

Increased blood glucose levels can be controlled with chemical drugs besides food regulation which also provides an effective effect on reducing blood glucose levels that are relatively inexpensive. Red dragon fruit (*Hylocereus Polyrhizus*) is one of the best fruits in the functional food category (Norhayati, 2006), which contains water-soluble fibre (19 gr) and archaic acid (vitamin

c - 540.27 mg) which plays a role in the human body to neutralize free radicals. Vitamin C which acts as an antioxidant can reduce insulin resistance by increasing endothelial function and reducing oxidative stress. Based on study proving that supplementation of vitamin C 1000 mg / day significantly reduces fasting blood glucose levels (Afkhami, 2007).

To overcome the above problem, previous research has been done with the respondent method divided into two treatments with intervention for 21 days by giving 70 ml of juice, and also with three treatments for 10 days by giving 250 ml of juice and two treatments for 11 days by giving juice as much as 200 ml (Widyastuti, 2015; Wiardiani, 2013, Roiffatul, 2017). In this study, researchers collaborated with Karo District Health Office and researchers proposed management dragon fruit juice usage with the method of juice administering for 14 days at dose of 200 mg / 250 cc. Dragon fruit can be blood sugar levels balancer because this fruit contains variety of antioxidants namely flavonoids, vitamin E, vitamin C, and beta-carotene which have the ability to reduce oxidative stress and Reactive Oxygen Species so that they can cause protective effects on pancreatic β cells and increase sensitivity insulin (Lianiwati, 2011).

2 METHOD

This research conducted at Barusjahe Public Health Center, Barusjahe District, Karo District with sample of 30 people with fasting blood glucose level criteria ≥ 126 mg / dl, age > 30 years, did not use insulin injection and herbal supplements, with sampling technique used purposive sampling technique. The research type carried out quasi-experimental study by using non-equivalent control group design.

In the dependent variable, blood glucose levels measured by GCU Easy Touch tool. Diabetes Mellitus patients are given education about the benefits of dragon fruit firstly. After being given education, approval is sought for action to be taken. Before the patient is checked for blood glucose levels, the patient advised to fast for 10 hours. Patients advised to fast starting from 22:00 until 08:00. After fasting, blood glucose levels are checked firstly, after checking the initial blood glucose level within 15 minutes given 250 mL of dragon fruit juice. After giving the intervention, the blood glucose level is checked again 20 minutes later. After completing the intervention, the patient

is not recommended to eat or drink sweet or high fat foods because these foods and drinks can increase blood glucose levels even if it is given the intervention. So that patients can control their food patterns, each patient is given a food recall sheet whose purpose is to find out what foods and drinks are consumed by the patient during the intervention. The act of giving this intervention carried out for 14 days. During these 14 days blood glucose level is controlled before and after the administration of the intervention, it is expected that during the intervention the patient does not violate the food rules recommended by the researcher, if any patient eats sweet or fatty foods, then the expected results is not optimal because it cause an increase in blood glucose levels and the administration of the intervention considered a failure. After 14 days of the intervention is checked again and the results obtained from the first day until the fourteenth day seen in comparison that the administration of the dragon fruit has an effect on reducing blood glucose levels or not.

During the treatment, the portion of juice consumed was monitored and all complaints experienced by the sample were recorded. The data obtained was processed on a computer for univariate and bivariate analysis. This research used paired-T test.

Table 1: Concentration of blood sugar at time and fasting

Blood Glucose Level (mg/dL)	Blood	Not DM	Uncertain DM	DM
In the time that (mg/dL)	Plasma Vena	<110 mg/dL	110-199 mg/dl	>200 mg/Dl
Fasting (mg/dL)	Plasma Vena	<100 mg/dL	110-125 mg/dL	>126 mg/dL
	Darah Kapiler	<90 mg/dL	90-99 mg/dL	>110 mg/dL

The intervention was by administering 250 ml of dragon fruit juice derived from 200 grams of red dragon that was rendered without sugar with frequency of 1x / day for 14 days. Dragon fruit juice is administered directly by the researcher and each respondent must drink it in front of the researcher until it runs out. Blood glucose levels are measured with glucose meter. Before intervene the subject, it is recommended fasting for 10 hours and then measuring blood glucose levels and after 15 minutes checking, it is given dragon fruit juice, after 20 minutes of giving dragon fruit juice is done again

checking blood glucose levels and this intervention is carried out every day for 14 days.

After completing the intervention, it is recommended for the patient do not to eat or drink sweet or high fat foods because these foods and drinks can increase blood glucose levels even if it is given the intervention. So that patients can control their food patterns, each patient is given a food recall sheet whose purpose is to find out what foods and drinks are consumed by the patient during the intervention.



Figure 1: Research conceptual framework

3 RESULTS AND DISCUSSIONS

DM is a metabolic disorder characterized by blood glucose levels increased due to insulin insufficiency or resistance. Control of blood glucose levels is very important to prevent further complications. Giving therapy that contains fibre, antioxidants and has low

glycaemia value is one of the main pillars of DM control especially DM type 2. One of the fruits that can be utilized is red dragon fruit. Provision of red dragon fruit juice in the sample shows good acceptance. All samples finished the juice according to the portion which is given because basically they like the colour and taste of fresh juice of red dragon fruit.

The amount of 1 gram of dragon fruit contains 50 calories which is the same as one exchange unit on the exchange list. Dragon fruit consumption is recommended at least one exchange unit (100 gr) to two exchange units (200 gr) in one serving that can be consumed with the lunch menu or as a snack (Wiardiani, 2014). Juice therapy is given every day with dose of 250 ml of juice for 14 consecutive days.

The samples number used by researchers were 30 people and they were given the action of consuming 200 grams of red dragon fruit (250 ml) for 14 days and the process of consuming the dragon fruit was carried out for 20 minutes after breakfast and dinner. Presentation of data includes a description of the respondent's characteristics, blood glucose levels before consuming red dragon fruit (pre-test) and after consuming red dragon fruit (post-test).

Based on study results, it is noted that the sample of DM sufferer diagnosed between 4 months to 2 years. The average age of the sample are 63 years, the majority are male, with an average educational background of completing elementary school, with agricultural work.

The analysis results of the average level from blood glucose levels before consuming red dragon fruit was 349.73, the median was 359.00 with a standard deviation of 51.579 and standard error of 9.417, minimum value of 219 and maximum of 420 and the results of an average analysis of blood glucose levels after consuming the red dragon fruit was 323.27, the median was 339.00 with standard deviation of 61.476 and standard error of 11.224, minimum value of 170 and maximum value of 410. It can be seen in Table 2 below.

There was a difference between all respondents after being given red dragon fruit juice therapy, the highest difference was 49 mg / dl and the lowest difference was 10 mg / dl.

The most difference is 20 mg / dl that is equal to 20 mg / dl; this is because each respondent has different value of glucose levels and activity, some of the respondents who do regular exercise so that it looks very significant glucose levels decrease. In addition, it also because the average respondents were elderly and local village health center is very

encouraging for elderly gymnastics, thus making the activities of the elderly with DM more directed and controlled.

Table 2. Frequency of blood glucose level in diabetes mellitus patients before and after consuming red dragon fruit (n = 30).

No	Before Emergency Nursing	After Emergency Nursing	Difference
1	219	170	49
2	225	189	36
3	229	190	39
4	310	269	41
5	315	275	40
6	317	276	41
7	319	276	43
8	328	284	44
9	332	289	43
10	336	290	46
11	342	320	22
12	347	325	22
13	350	330	20
14	354	335	19
15	358	338	20
16	360	340	20
17	369	348	21
18	375	354	21
19	379	355	24
20	385	360	25
21	385	364	21
22	387	367	20
23	388	369	19
24	390	370	20
25	390	375	15
26	391	378	21
27	396	379	17
28	398	385	13
29	398	388	10
30	420	410	10

The average analysis results of blood glucose levels in diabetes mellitus patients before consuming red dragon fruit is mean value of 349.73 with standard deviation of 51.579. The blood glucose levels of diabetes mellitus patients after consuming red dragon fruit is mean value of 323.27 with standard deviation of 61.476.

The value of difference between blood glucose levels before and after consuming red dragon fruit is 26.467 with standard deviation of 12.019. From the statistical tests results, the p value = 0,000 was obtained. Based on the provisions of hypothesis test that if $p(0,000) < \alpha(0.05)$ then the decision H_0 is

rejected and H_a is accepted, then it is concluded that there is significant influence between glucose levels of diabetes mellitus patients before and after consuming red dragon fruit.

The results showed that most respondents did not follow dietary rules because they were not accustomed to and were not ready to go on a diet in accordance with the guidelines that had been prepared previously. Apart from dietary factors, the average respondent also only did light activities even though the average job was farming. Approximately 43% of respondents never did physical training due to busy work, most also have obesity status where the condition has an impact on inhibiting the work of insulin so that it can cause many complications. Giving red dragon fruit juice aims to reduce blood glucose levels in DM sufferers.

An increase of emergency nursing in patient can be caused due to mental factors, eating foods that contain fat, drinks that contain excessive alcohol and soda, and the age factor that is no longer productive, including the elderly. DM disease will not only attack the elderly, in adulthood can also occur in DM disease, especially patients who are obese and lack of activities such as sports (Perkeni, 2011).

The results showed that blood glucose level of the sample was relatively high with an average of 349.73 mg / dl and thereafter 323.27 mg / dl. High blood glucose indicates a disturbance in carbohydrate metabolism, where insulin is no longer able to transport blood glucose to cells due to interference with the sensitivity of cells to insulin (Nelms, 2011).

Dragon fruit, especially red dragon fruit, contains fibre and antioxidants that are beneficial for diabetics and cardiovascular patients. The content of dragon fruit fibre especially in the form of pectin has the ability to slow the absorption of glucose by increasing the thickness of the intestinal volume which has the potential to reduce the speed of diffusion so that glucose levels decrease. Dragon fruit also contains phytochemicals that function as antioxidants that can maintain the elasticity of blood vessels and cell permeability which will increase insulin sensitivity so that more blood glucose is carried by insulin into cells to be metabolized. It has an impact on reducing blood glucose levels (Nelms, 2011).

The content of vitamin C can also affect blood sugar levels. Red dragon fruit contains 540.27 mg / 100 g of vitamin C or reaches 6 times from the requirement. Vitamin C which is very rich in red dragon fruit functions as an antioxidant can reduce

insulin resistance by increasing endothelial function and reducing oxidative stress (Chen. Et al, 2016). Antioxidants are useful in maintaining the elasticity and permeability of blood vessels. To increase fibre intake and antioxidants of DM sufferers, dietary improvement is needed by adding a formula in the form of juice therapy whose source of fruits as a source of fibre-rich foods, especially soluble fibre can improve blood glucose control (Raihana, 2016).

In addition to vitamin C, dragon fruit also contains flavonoids which also function to reduce blood glucose levels. Flavonoid compounds such as isoflavones can prevent the efficacy of prostate cancer; reduce the risk of heart disease, diabetes, kidney and osteoporosis. Decreased blood sugar levels occur because flavonoids which are antioxidants can reduce the tension of the mind which can have an impact on the inhibition of pancreatic beta cells to increase insulin sensitivity (Asih, 2012).

The type of antioxidant that plays the most roles in reducing blood glucose levels namely flavonoids. The flavonoids content of red dragon fruit meat is 7.21 ± 0.02 mg CE / 100 gram. The ability of flavonoids, especially quercetin, is to inhibit Glucose Transporters 2 (GLUT 2) intestinal mucosa so that it can reduce glucose absorption. It causes decrease in absorption of glucose and fructose from the intestine so that blood glucose levels fall. Glucose Transporters 2 (GLUT 2) is thought to be a major glucose transporter in the intestine under normal conditions (Song 2014 in Roiffatul, 2017).

The fibre found in red dragon fruit is water soluble fibre that can be used as hypoglycaemic therapy. The role of water soluble fibre as hypoglycaemic therapy is to improve insulin sensitivity and reduce insulin requirements. Consumption of fibre in sufficient quantities can provide metabolic benefits in blood glucose control. Water-soluble fibre increases food transit time in the intestine, delays gastric emptying and slows glucose absorption. If glucose absorption is slow, insulin secretion will not be excessive so that it will reduce insulin requirements and insulin sensitivity increases. Fibre also has the ability to slow the absorption of glucose and fat by increasing the viscosity of stool which indirectly decreases the speed of diffusion so that blood glucose levels, lipid profiles and cholesterol decrease (Sulstyani, 2012).

The study results are in line with Hadi, et al research (2016) who examined the effect of consumption of red dragon fruit on glucose levels in type 2 DM, showing a decrease in all groups and an

amount of 600 g most effective in reducing blood glucose levels with decrease up to 34, 7% (Hadi. Et al, 2016).

The same thing was stated by Raihana (2017) that of dragon fruit pollen administration > 100 g for 1 month did not cause a negative impact on the liver and kidneys as indicated by normal liver and kidney function values (Raihana, 2016).

According to Englyst and Englyst (2016), one determinant of carbohydrates absorption rate is the degree of polymerization, where only monosaccharides are absorbed by the small intestine and circulated through the blood. Therefore, fruit sugar in the form of glucose and fructose determines the glycemic response. Raihana et al (2015) and Khalili (2014) research stated red dragon fruit contains fibre and antioxidants that are beneficial for diabetics and cardiovascular patients. Dragon fruit also contains phytochemicals that function as antioxidants. Antioxidants can maintain blood vessel elasticity and cell permeability. Giving red dragon fruit therapy for 14 days with maximum amount of 200gr can be said to be relatively safe for consumption. It is evident that during the administration monitoring every day there were no complaints, both physical and clinical. The same thing was stated by Hadi et al (2016) that the red dragon fruit pollen administration > 100gr for 1 month did not cause a negative impact on the liver and kidneys.

Giving red dragon fruit juice therapy for 14 days with an amount of 250 ml can be said to be relatively safe to consume, it can be proven that during the administration or treatment there were no physical and clinical complaints found.

The same was stated by Raihana (2016) that the dragon fruit pollen administration > 100g for 1 month did not cause negative effects on the liver and kidneys as indicated by the value of liver and kidney function is still normal.

It shows that diet plays an important role in maintaining glucose control. Diets should be varied and integrated with other pillars of DM management such as regular exercise, health education and drug administration.

The study results are also in line with Wiardani's research, 2014 which examined Red Dragon Fruit Juice Reduce Blood Glucose Levels in DM Patients who showed that administration of dragon fruit juice with 200gr of dragon fruit was more effective in reducing compared with 100 gr therapies.

4 CONCLUSION

Dragon fruit juice therapy can significantly reduce blood glucose and cholesterol levels. Decreased blood glucose levels ranged from 9.1% - 29.1%. There is a significant difference in the effectiveness of dragon fruit juice therapy in reducing blood glucose levels. Dragon fruit juice therapy with 200 g of dragon fruit is more effective in reducing blood glucose levels with the highest reduction of 29.1%. There needs to be consistency in carrying out a modified diet in DM patients so that blood glucose levels are controlled.

It needs to be consistency in carrying out a modified diet in DM patients so that blood glucose levels are well controlled and there is further research on red dragon fruit juice administration that can be modified with fruits or vegetables that are high in fibre and antioxidants so that respondents are not saturated in running therapy.

5 SUGGESTIONS

- a. For people/patients with diabetes mellitus, the results of this study are expected to be a media of information to increase their knowledge and motivate them to be positive in choosing foods that are in accordance with the recommended diabetes mellitus diet and can use red dragon fruit as one of the accompanying fruits of the diabetes mellitus diet and the fruit can help to reduce blood glucose levels.
- b. For the community, the results of this study are expected to make people more able to utilize red dragon fruit as a natural alternative in reducing blood glucose levels
- c. For further researchers, the results of this study are expected to be used as a reference for further research, and it can be used to develop research related to this research by controlling for factors that might influence blood glucose levels such as physical activity, stress, diet, and consumption of anti-hyperglycemia drugs.

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