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DRAGON FRUIT JUICE REDUCES BLOOD SUGAR LEVELS IN DIABETES MELLITUS CLIENTS

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Abstract

Diabetes Mellitus (DM) is a health problem that threatens people's lives around the world, characterized by increasing morbidity and mortality rates due to DM which is related to unhealthy lifestyles. The impact of DM that occurs is various kinds of disease complications, disability and death. One non-pharmacological intervention that can control blood sugar levels is giving dragon fruit juice as a complementary therapy. This research aims to analyse the effect of dragon fruit juice on blood sugar levels in DM clients. The research design uses Almost Experiment with a pre and post-test approach with the control group. The total sample was 19 respondents for each intervention and control group. This research was conducted in June-July 2024 in the working area of the Ngemplak Community Health Center, Kudus Regency. Dragon fruit juice was given 2 times/day for 7 days. Instrument The research used observation sheets and a glucometer with the Easy Touch brand Type ET-301. Data analysis used the Wilcoxon and Mann-Whitney tests. There is an effect of giving dragon fruit juice on blood sugar levels in DM clients with a value of p = 0.000 (p<0.05). Giving dragon fruit juice can lower blood sugar levels. Therefore, DM clients are expected to consume dragon fruit juice as an independent intervention in lowering blood sugar levels. This form of intervention can be integrated into public health efforts in the work area of the Public health centre through the prolanis or posbindu program for non-communicable diseases.

I. INTRODUCTION

Diabetes mellitus (DM) is a very important public health problem and is one of four non-communicable diseases that are a priority in the world (Fottrell et al., 2019). DM poses a risk to all levels of society regardless of socio-economic status and age group. DM is a burden for clients, families, communities, and even the country. Clients must undergo medication every day which may cause decreased productivity and quality of life. The family must provide care for the client while undergoing treatment. The community participates in efforts to prevent and treat DM. The country currently has to allocate quite high treatment costs for clients with non-communicable diseases which are mostly caused by unhealthy lifestyles.

Diabetes Mellitus occurs due to blood glucose levels being too high, caused by a lack of insulin or damage to insulin production (Apriyani, 2020). Based on 2019 International Diabetes Federation data, Indonesia has diabetes alert status because it ranks 7th out of 10 countries in the world with the highest number of diabetes patients after China, India, the United States, Brazil, Russia, and Mexico. Forty-three per cent of these 3.7 million deaths occurred before the age of 70. The percentage of deaths caused by diabetes that occur before age 70 is higher in low- and middle-income countries than in

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high-income countries. The number of diabetes is estimated to increase by 45% or the equivalent of 629 million patients per year. This is based on data from the *International Diabetes Federation* In 2019, the number of type 2 diabetes clients continues to increase in various countries in the world, including Indonesia.

Every year, the number of people with diabetes mellitus rises over the world, including in Indonesia. According to Rosyid et al. (2020), this disease is one of the leading causes of death and disability in a number of nations. Based on the findings of the 2018 National Basic Health Research, approximately 26.3% of Indonesians have diabetes mellitus with impaired glucose tolerance (IGT) and 30.8% have it with impaired fasting blood glucose (GDPT). Compared to rural areas, the prevalence of diabetes mellitus in urban settings is 1.9% greater. Province of Central Java is ranked eleventh (Kem RI, 2018).

Data from the Central Java Health Service for 2022 (Central Java Health Office, 2023) is 6,136,532 cases. The proportion of new PTM cases in 2022 is as follows. Hypertension still occupies the largest proportion of all reported NCDs, namely 76.5%, while the second highest is Diabetes Mellitus at 10%. In Central Java, preventing these two illnesses is the top priority when it comes to NCD control. If diabetes mellitus and hypertension are not adequately controlled, they will lead to further NCDs like renal failure, heart disease, and stroke.

It is possible to control NCDs by implementing the right therapies for each unique target or demographic group, hence halting the rise in newly diagnosed cases. There are 23,495 diabetes mellitus clients in Kudus City and occupy the 7th position as the most clients. The Ngemplak Community Health Center itself occupies the 9th position as the most clients with 692 diabetes mellitus clients (Holy Health Office. 2023). Based on preliminary data on Diabetes Mellitus (DM) patients from 10 respondents in the Nemplak Health Centre working area who had blood sugar levels above 200 mg/dL, of which 4 people had blood sugar levels ≥ 210 mg/dL, and 6 more people had blood sugar level ≥ 240 mg/dL.

Diabetes that is not under control is characterized by blood glucose levels that are higher than normal and have both short-term (dehydration, weight loss, impaired vision, hunger) and long-term (micro and macrovascular damage) effects. According to PERKENI (2018), a number of variables, such as age and a history of being born underweight (~2.5 kg), affect the incidence of Type-II Diabetes Mellitus. Excess body weight, stress, poor diet, dyslipidemia, hypertension, lack of physical activity, and lifestyle choices all raise the chance of developing diabetes mellitus.

The impact of Diabetes Mellitus if not treated quickly can affect kidney function, causing kidney failure, causing heart problems and vision problems, and if not treated immediately it will have social impacts, DM clients will withdraw from society because of the disease and the client will also become embarrassed and their socialization will be hampered because of their illness (Utomo et al., 2020).

DM clients over a long period can cause serious complications, one of which is stroke, wounds that are difficult to heal which can progress to gangrene, kidney failure or cardiovascular disease. This condition has an impact on the quality of life of DM patients. The illnesses and treatments suffered by DM clients can affect the functional, psychological and social health and well-being of DM patients (Anggraini et al, 2020). Based on the results of interviews with the person in charge of the non-communicable disease program at the Ngemplak Community Health Center, it was found that so far the Community Health Center has made several efforts such as routine monthly screening for diabetes clients and diabetes exercise once a week. However, the enthusiasm of the community or diabetes mellitus clients was lacking so only a few diabetes mellitus or community members participated

DM clients must be able to control blood sugar levels because with good blood sugar

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control complications due to diabetes can be prevented. Various methods of controlling blood glucose levels, such as the frequently used pharmacological therapy, namely Oral Hypoglycemic Drugs (OHO), are the main line of treatment for type II diabetes. Apart from pharmacological therapy, there is nutritional therapy that can be carried out by DM clients in the form of dietary adjustments.

In recent years, natural drinks and foods have received further attention as part of a holistic approach to diabetes control. One fruit that attracts attention is dragon fruit, especially the red dragon variety. Dragon fruit is known for its fibre content, antioxidants, and potential to help control blood sugar levels. Various preliminary studies suggest that red dragon fruit juice may have a beneficial effect on reducing blood sugar levels in type-II diabetes patients.

Quercetin, kaempferol, isorhamnetin, and other flavonoids are among the many minerals and bioactive substances found in red dragon fruit, along with vitamin C and beta-carotene. These substances are thought to have the ability to support the maintenance of stable blood glucose levels due to their antioxidant qualities. Red dragon fruit's antioxidant content can aid in shielding cells from oxidative damage linked to diabetes and hyperglycemia.

Based on research by Hadi et al. (2018), there were changes in blood glucose levels after being given red dragon fruit. The average decrease in blood glucose levels was 51.8 mg/dl. The highest decrease in blood glucose levels was 181 mg/dl and the highest increase in glucose was 25 mg/dl. The decrease in blood glucose levels is thought to be because red dragon fruit has active flavonoid components which can act as antioxidants which can reduce oxidative stress, reduce Reactive Oxygen Species (ROS), and are a strong inhibitor of GLUT 2 glucose transport in the intestinal mucosa. Blood glucose levels drop as a result of this decreased intestinal absorption of glucose and fructose.

The fibre content in dragon fruit is 0.5g per 100g, this is a fairly high source of fibre. Red dragon fruit has water-soluble fiber that can be utilized as treatment for those with blood sugar issues. By lengthening the time that food takes to pass through the intestines, soluble fiber serves as a blood sugar treatment that both increases insulin sensitivity and lowers insulin needs. Researchers assume that after being given the non-pharmacological intervention, dragon fruit juice reduced the respondents' blood sugar because dragon fruit contains antioxidants and vitamins C, B1, B2, B3 and flavonoids which can reduce insulin resistance and provide a protective effect and then result in insulin sensitivity so that it can reduce blood sugar. (Priyanti, Latifah, & Manto, 2023).

This research chose a different population and research location from previous research. Based on research (Astuti, 2019) entitled Giving Dragon Fruit Juice to blood sugar levels in Type 2 DM clients in Tambak Deres Rw 01, Kenjeran Subdistrict, Surabaya, namely 11 people, while my research population was all clients in the working area of the Ngemplak and Puskesmas. The location of this research was carried out in the working area of the Ngemplak Community Health Center, Kudus Regency.

The results of this research are the basis for determining appropriate independent nursing interventions to treat diabetes mellitus clients' blood sugar levels and appropriately prove the professionalism of nurses as a profession parallel to health professions such as public health experts. Nurses in this case become *educator*s and nurse *caregiver*s namely providing direct nursing care in lowering blood sugar levels through herbal therapy, one of which is using dragon fruit juice for diabetes mellitus clients in various age groups which are currently a health threat from non-communicable diseases in Indonesia and for *researcher* is to examine the effect of giving dragon fruit juice on blood sugar levels in clients with diabetes mellitus. This research aims To analyze the effect of dragon fruit juice on blood sugar levels in diabetes mellitus (DM) clients.

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II. RESEARCH METHODS

A quasi-experimental pre- and post-test was employed in the research design, with the control group. The independent variable is nutritional management and the dependent variable is blood sugar levels. This research was conducted in the working area of the Ngemplak Community Health Center, Kudus Regency in June 2024. The research sample was 19 clients for each intervention group and control group. Purposive sampling was employed as the sample technique, and the inclusion criteria were clients with diabetes mellitus who were consuming herbal remedies or pharmaceuticals (metformin, sulfonylurea, meglitinide, etc.) and had blood sugar levels ≥150 mg/dL in the working area of the Ngemplak Community Health Center, Kudus Regency. Exclusion criteria are clients who have disease complications or do not participate in the research until the final stage.

The research instrument used a New glucometer with Easy Touch Type ET-30 brand with specifications to check the level of sugar, cholesterol and uric acid in the blood etc, uses AAA batteries and in a box contains a Glucometer, 25 sugar strips, 25 uric acid strips and 10 cholesterol strips, a lancing device and lancet, and a blood sugar level observation sheet. Researchers used new tools so they did not calibrate the tools. Researchers provided intervention in the form of giving 400 ml of dragon fruit juice with the composition of 400g of dragon fruit and 250 ml of water. Dragon fruit juice is divided into 2 parts, each consumed 2 times for 7 days in the morning 08.00 – 11.00 and 15.00-17.00 in the afternoon. Dragon fruit juice is given a delay of ± 1 hour before consuming the medicine.

Blood sugar was tested both before and after the dragon fruit juice was administered. Before the research, researchers provide information about procedures, objectives, benefits, rights and obligations during the research process then respondents fill out informed consent. Data analysis used the Wilcoxon test to analyze differences in blood sugar levels before and after intervention in each intervention and control group. The Mann-Whitney test measures the effect of giving dragon fruit juice on blood sugar levels. This research has been declared to have passed ethical review from the Health Research Ethics Committee (KEPK) Universitas Muhammadiyah Kudus with Number: 33/Z-7/KEPK/UMKU/VI/2024 on June 24 2024.

III. RESULTS AND DISCUSSION

A. DM Client Characteristics

Table 1. Characteristics of DM Clients (n=38)

Characteristics	Intervention		Control		Intervention		Control	
	f	%	f	%	Mean	SD	Mean	SD
Age					58.21	9.059	54.63	6.914
Gender								
Man	2	10.5	3	15.8	-	-	-	-
Woman	17	89.5	16	84.2	-	-	-	-
Education								
No school	13	15.8	4	21.1	-	-	-	-
Elementary school	10	52.6	2	10.5	-	-	-	-
Junior High School	4	21.1	4	21.1	-	-	-	-
Senior High School	1	5.3	6	31.6	-	-	-	-
College	1	5.3	3	15.8	-	-	-	-
Work								
Housewife	16	84.2	12	63.2	-	-	-	-
Farmer	2	10.5	2	10.5	-	-	-	-
Self-employed	1	5.3	4	21.1	-	-	-	-
Government employees	0	0	1	5.3	-	-	-	-
Income								

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Characteristics	Intervention		Control		Intervention		Control	
	f	%	f	%	Mean	SD	Mean	SD
Have no income	16	84.2	12	63.2	-	-	-	-
≥ IDR 2,516,888*	1	5.3	5	26.3	-	-	-	-
< IDR 2,516,888*	2	10.5	2	10.5	-	-	-	-
Total	19	100	19	100	-	-	-	-

*) Kudus Regency Regional Minimum Wage in 2024

Table 1 shows that respondents in the intervention group were, on average, 58.84 years old with a standard deviation of 9.059, while respondents in the control group were, on average, 51.30 years old with a standard deviation of 6.914. With a total of 17 respondents (89.5%) in the intervention group, women made up the majority of respondents; in the control group, there were 16 respondents (84.2%) who were female. In contrast, the majority of respondents (52.6%) in the intervention group had completed elementary school, whereas just 6 respondents (31.6%) in the control group's education part had completed high school. Meanwhile, in terms of employment in the intervention group and the control group, almost all of them were housewives, with 16 respondents (84.2%) in the intervention group and 12 respondents (63.2%). Meanwhile, income in the intervention group and control group was almost entirely the same and there was no income, namely 16 respondents (84.2%) in the intervention group and 12 respondents (63.2%) in the control group.

Table 2. Blood Sugar Levels During Diabetes Mellitus Clients in the Intervention and Control Groups Before and After Intervention (n = 38)

Blood sugar levels	Intervention				Control			
	Before		After		Before		After	
	f	%	f	%	f	%	f	%
Light	16	84.2	18	94.7	10	52.6	16	84.2
Moderate	3	15.8	1	5.3	9	47.4	3	15.8
Total	19	100	19	100	19	100	19	100

Based on table 2, shows that the instantaneous blood sugar levels of DM clients in the intervention group before being given dragon fruit juice mostly had mild blood sugar levels as many as 16 respondents (84.2%) and after being given treatment some had temporary blood sugar levels (GDS).) while there were 18 respondents (94.7%). Temporary blood sugar levels in DM clients in the control group before being given treatment. Most had mild blood sugar levels, namely 10 respondents (52.6%) and after being given treatment, some had mild temporary blood sugar levels (GDS), 16 respondents (84). .2%).

Table 3. Differences in Blood Sugar Levels Before and After Intervention in the Intervention Group and Control Group

Group	The p-value
Intervention	0,000
Control	0,000

Table 4. Effect of Giving Dragon Fruit Juice on Blood Sugar Levels

Group	The p-value
Intervention	0,000
Control	

Table 3 shows that there is a statistically significant difference in blood sugar levels before and after the intervention in both the intervention and control groups with each value of p=0.000 (p<0.05). Table 4 explains that there is a significant influence on statistics giving dragon fruit juice reduced blood sugar levels in DM clients with a value of p=0.000 (p<0.05).

The average age of diabetes mellitus clients in the intervention group and control group shows that the majority of diabetes mellitus clients are pre-elderly (45-59 years) to late elderly (60-80 years) according to (the Indonesian Ministry of Health, 2016). This can be seen from WHO stating that after a person reaches the age of 45 years and over,

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blood glucose levels increase by 1-2 mg% per year when fasting and increase by around 5.6-13 mg% 2 hours after eating. The older the age, the higher the prevalence of Diabetes Mellitus is significantly (Melani & Handayani, 2021). Likewise, research (Galaresa, 2023) shows that there is a relationship between age and the incidence of DM. The age group < 45 years is the age group that is less at risk of suffering from DM. The risk in the age group < 45 years is 72% lower than in the age group ≥ 45 years.

Increasing age causes physical changes and a decrease in body function which affects the intake and absorption of nutrients so it can trigger obesity which is closely related to degenerative diseases, especially diabetes mellitus. This is supported by research conducted (Galaresa, 2023) that increasing a person's age causes glucose intolerance, increasing.

Glucose intolerance in the elderly is often associated with obesity, lack of physical activity, reduced pasta muscles, the presence of comorbidities, and medication use. Besides that, in elderly people, there has been a decrease in insulin secretion and insulin retention levels. The risk of developing blood sugar levels increases with ageing, and experts agree from the age of 45 years and above.

The gender distribution of clients with diabetes mellitus reveals that nearly all respondents in both the intervention and control groups were female. The findings of a study by Rebekah (2022) at the Teling Atas Community Health Center, Manado, which revealed that 62.8% of respondents were female, provide support for this study. Women are more likely than men to develop Diabetes Mellitus due to a higher risk of body mass index increase associated with monthly cycle syndrome, also known as premenstrual syndrome (Wahyuni, 2024) in women. Because of this hormonal process, women who have gone through the menopause are more likely to collect body fat, which increases their chance of developing diabetes mellitus. Similarly, studies by Komariah & Rahayu (2020) indicate that a higher proportion of women than men suffer from diabetes. Women are more likely than males to become overweight, which increases the risk of obesity and diabetes. Women also have a larger body fat composition.

Regarding educational characteristics, most of the intervention group had completed elementary school. Meanwhile, in the control group, it was almost half. Likewise, research conducted by Riamah (2022) explained that 36.0% had an educational background equivalent to elementary school. This suggests that the incidence of diabetes mellitus is influenced by education level. High educated individuals are typically well-versed in health issues. People will be conscious of the need to preserve their health after learning this information.

Previous studies have demonstrated a correlation between education level and the incidence of diabetes mellitus, finding that those with less education have a 4.895-fold increased risk of developing the disease compared to those with greater education (Pahlawati & Nugroho, 2019). This is supported by literature, which claims that one reason for the large number of sickness cases is low levels of education and awareness. Knowledge can be obtained through health promotion, one of which is health education (Susilawati et al., 2022). Likewise, the results of research by (Widyawati, 2020), state that clients who have a low level of education will find it difficult to receive and understand the health messages conveyed by health workers, which will affect the client's ability to respond to the problems they face.

Housewives made up the majority of the jobs held by respondents in both the intervention and control groups. According to research (Ribka Camelia, 2022), the majority of respondents—58.3%—are housewives. This indicates that people with higher education levels typically engage in more office work that involves some physical exertion. Conversely, those with less education are more likely to become housewives or farmers who engage in regular or intense physical activity.

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The results of this research according to (AM Fajriati, 2021) show that housewives are caused by the fact that apart from eating daily food, housewives also eat other foods such as consuming leftover food from their children. This can cause an increase in the amount of fat deposits in the body. Apart from that, housewives also have lighter physical activity so they have a higher risk factor for developing diabetes mellitus and there may be other risk factors such as stress which can trigger an increase in sympathetic nerve activity so that blood pressure becomes persistently higher than usual (Pramestutie et al ., 2021).

The average income in Most of the intervention group and control group almost all respondents had no income. This is equivalent to research conducted by (Priyanti, 2023) explaining that 75.0% of clients on average have no income. This is based on research by Mainous et al. (2020) in research on diabetes prevention and management explains that socioeconomic factors, especially income, have a very important influence on diabetes prevention management. The ability to conduct examinations, offer food and therapy, and so on is correlated with income. According to research conducted by Saidah et al. (2020), those with poor incomes in developed nations have twice the risk of dying than they have of contracting diseases, particularly diabetes mellitus.

According to (Yulianti, 2020), the higher the income, the greater the respondent's awareness of seeking treatment so that chronic complications of DM can be prevented. Income is also related to one's ability to carry out examinations and provide food according to the diabetes diet and treatment. Based on the research results, shows that there were blood sugar levels before the intervention in the intervention group and control group, namely that almost all of them experienced low blood sugar levels. This is in line with research (Nurhidayati, 2021) showing that 44.83% of clients on average have light blood sugar levels. This research is also supported by (Astuti, 2020), which shows that 61% of clients have blood sugar levels in the mild category on average.

Blood sugar is the main nutritional ingredient used for cell metabolism and providing energy in the body, as well as regulating and maintaining glucose within normal limits. When carbohydrates enter the digestive system, they will increase after consuming food and will decrease in the morning before consuming food (Rohmawati et al., 2021).

The energy source in the body used by cells and tissues comes from glucose. Energy is formed from improper fatty acid metabolism. The combustion process will produce dangerous acid metabolites which, if left to continue, will accumulate. Blood sugar levels are influenced by homeostatic mechanisms so that in a healthy state you can maintain fasting glucose levels of 70 - 110 mg/dl (Priyanto & Suprayetno, 2022). When a person has finished consuming food, blood sugar levels will increase, which is still within the normal limit of 170 mg/dl. In maintaining normal glucose levels and responding to anxiety, this cannot be separated from the help of hormones. Glucose levels that are too high or too low can cause homeostatic disorders so it is necessary to monitor glucose levels to resolve these disorders (Tasya & Amiruddin, 2022).

Hyperglycemia occurs due to insufficient or sufficient but ineffective amounts of the insulin hormone (insulin resistance). High blood sugar levels cannot be absorbed and cannot be used as a source of energy in body cells, especially muscle cells. This condition causes a person to lack energy so they get tired easily, eat a lot but lose weight, urinate a lot and drink a lot. Meanwhile, hypoglycemia occurs when you are hungry or have physiological disorders. The causes of hypoglycemia in clients are hypoglycemia medication, eating less, losing weight, exercising, after giving birth, and inappropriate insulin administration (Qowi, Harmiardillah, & L, 2022).

According to Munjiati (2021), Consensus on Diabetes Management and Prevention

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Mellitus in Indonesia (2021), fasting blood sugar levels (mg/dl) are grouped into 4 categories, namely: Normal 100-149 mg/dl, Mild GDS 150-200 mg/dl, Moderate GDS 201-400 mg/dl, and Severe GDS > 400 mg/dl. These measurements are carried out to monitor the success of regulatory mechanisms. Excessive deviations from normal, either too high or too low, indicate a disorder of homeostasis and should encourage health workers to carry out examinations and look for the aetiology. Based on this, DM clients, whether included in the intervention group or control group, must be able to control their blood sugar levels to normal limits.

Based on the study findings, it can be shown that both the intervention group and the control group had blood sugar levels following the dragon fruit juice intervention, with nearly all of them having moderate blood sugar. This is consistent with study (Nisa et al., 2021) that demonstrates that, on average, 60% of clients had modest blood sugar levels following therapy. In addition, the study is corroborated by Astuti (2020), who reported that following treatment for diabetes mellitus, 50% of patients had normal blood sugar levels. The study's findings support the theory (Laxmi et al., 2017) that dragon fruit, which is high in antioxidants and contains a variety of nutrients like calcium, beta-carotene, vitamin B1, vitamin B2, vitamin C, phosphorus, and flavonoids, caused a drop in blood sugar levels in the intervention group following treatment. in order to use it as a treatment to lower blood sugar levels by stopping oxidative reactions-induced apoptosis.

Even though there was a decrease, the blood sugar levels of DM clients in both the intervention and control groups, if seen from what is required by (Munjiati, 2021), were still in the high category, namely instant blood sugar levels (GDS) of more than 150 mg/dl. The still high blood sugar levels may be related to many factors that have not been studied, for example, anxiety and exercise.

Lack of exercise, eating more food, stress and other emotional factors, anxiety, knowledge of the diabetes mellitus diet, aging and weight gain, and the effects of drug treatment, such as steroids, are all factors that can affect blood sugar in people with diabetes mellitus (Fox & Kilvert, 2020). It is important to keep in mind that a variety of things can affect blood sugar levels. Despite the tiny amount of dragon fruit juice that has been shown to assist lower blood sugar levels in this study, people with diabetes mellitus can continue to consume it without risk.

According to the study's findings, the intervention group's blood sugar levels before and after the intervention differed significantly from each other. The findings of this study are consistent with those of Priyanti's (2023) research, which demonstrated a substantial difference between the pretest and posttest of feeding dragon fruit juice. According to this study, administering dragon fruit juice to older patients with diabetes mellitus can lower their blood sugar levels. Clients with diabetes experience a drop in blood sugar when administered dragon fruit juice. Give blood glucose levels 200 cc of juice twice a day for seven days. This is due to the high concentrations of bioactive substances found in red dragon fruit, such as anthocyanins, flavonoids, and folic acid. Because 1195.181 ppm of red dragon fruit powder is required to capture 50% of free radicals, the antioxidant activity of red dragon fruit powder in vitro is lower than that of normal vitamin C, BHT, and quercetin.

This is because, in contrast to the extracted red dragon fruit powder, which contains 30% maltodextrin fillers and other components, standard vitamin C, BHT, and quercetin are components of a single bioactive compound. macronutrients, micronutrients, and bioactive others (Maigoda, et al, 2017). Based on the fact that red dragon fruit has a high water content and a vitamin C concentration of around 9.4 mg, red dragon fruit juice has been shown to have a reducing effect on blood glucose. Chemicals called flavonoids, phenolic acids, and polyphenols are found in dragon fruit. Antioxidants and vitamins C, B1, B2, and B3 found in red dragon fruit have the ability to

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bind free radicals, reducing insulin resistance and offering a protective impact that leads to insulin sensitivity, which in turn lowers blood sugar.

The reduction in blood glucose levels shown in this research sample is consistent with Wahyuni, D. et al.'s (2020) research, which found that feeding Type 2 DM clients 100 grams of red dragon fruit juice in 250 ml of juice for ten days can lower blood glucose levels. The administration of red dragon fruit juice has been shown to lower blood glucose levels in patients with type 2 diabetes mellitus by 2.82 mg/dl. Comparable to the research done (Ribka, 2022), the study's findings showed that blood sugar levels varied before and after treatment. The P value = 0.000 with a significance level of <0.05 indicated that the blood sugar levels of clients with type 2 diabetes at the Telling Atas Community Health Center in Manado City were influenced.

The results of the study showed that blood sugar levels in diabetes mellitus clients in the control group showed that there was a significant difference in the control group before and after being given treatment. This research is supported by research by Riamah (2022) that there are differences in blood sugar levels with *p-value* = 0.000. This also shows that diabetes patients' increasing understanding and knowledge about their disease can help these clients control their blood glucose levels. This research is also supported by Massiani, Lestari, & Prasida, 2023) stating that there are differences in blood sugar levels p *value* = 0.000. This also shows that diabetes mellitus clients are becoming more aware and knowledgeable about their disease, and can help these clients control blood sugar levels through diet compliance.

Clients with diabetes mellitus (DM) need to be able to control their blood sugar levels because, among other things, effective blood sugar management can prevent complications related to diabetes. Therapy, not pharmacology, involves modifying your diet to include more fruits and vegetables, whole grains, low-fat and low-calorie foods, and other low-fat and low-calorie items. One of the fruits that can be made as therapy is red dragon fruit (Hylocereus) which has the advantage of being rich in fibre and calcium magnesium, potassium and sodium. Anti-hyperglycemic drugs It is possible to administer oral therapy alone or in combination. Referrals to secondary or tertiary health care must be made right away in cases of severe metabolic decompensation, such as ketoacidosis, stress, fast weight loss, or the presence of ketone uria (Perkeni, 2021). Referring to this, it is necessary to realize that the reduction in blood sugar levels is not completely influenced by giving dragon fruit juice, but is influenced by various factors. Administration of anti-drugs hyperglycemic oral medications such as glibenclamide, and metformin, must still be taken according to doctor's recommendations. Apart from this, DM clients must also exercise regularly, because sports can reduce insulin resistance and increase insulin sensitivity.

The effect of feeding dragon fruit juice on lowering blood sugar levels in diabetic patients was tested statistically, and the results showed that the p-value was 0.000 because the p-value was less than 0.05. The research conducted at the Ngemplak Community Health Center Working Area, Kudus Regency, has demonstrated an impact on the blood sugar levels of clients with diabetes mellitus both before and after the intervention of supplying dragon fruit juice. Yasmina (2021) found that buying dragon fruit juice significantly lowered blood sugar levels in patients with diabetes mellitus. The study examined blood sugar levels before and after administering the juice. A week or seven days were dedicated to doing this study.

This research is in line with a study conducted by Hadi (2018), by giving 250 grams (200 ml) of red dragon fruit juice for 10 consecutive days with an average decrease in blood sugar levels of 51.8 mg/dl. Juice or fruit juice can be defined as a liquid that is taken or squeezed from the part of the fruit that can be eaten in edible portions by pressing or other mechanical means. Turbid fruit juice contains cell components in colloidal suspension with some tissue debris.

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Fruit juice or juice (comes from the English word juice, but more precisely fruit juice) is a liquid that is found naturally in fruit. Fruit juice is popularly consumed by humans as a drink. It is usually made by blending fruit A little water and appropriate sugar measurements (Khalisa, Lubis, & Agustina, 2021).

Dragon fruit or in England called Pitaya is a fruit that originates from European countries, namely Mexico, Central America and South America. This fruit is a type of cactus plant from the Hylocereus and Selenicereus genera. This fruit is currently cultivated in many countries in Asia such as Taiwan, Vietnam, the Philippines, Malaysia and Indonesia (Chen, Sabir, & Qin, 2023). Based on this definition, dragon fruit juice can be interpreted as a liquid naturally found in dragon fruit which is taken or squeezed from parts of the fruit for human consumption as a drink by pressing or other mechanical methods.

Giving dragon fruit juice had a substantial impact on the blood sugar levels of both the intervention and control groups; the study's p value of 0.000 was less than 0.05. The results of this study support previous research which stated that after being given non-pharmacological intervention, namely dragon fruit juice, the respondents' blood glucose levels would decrease because dragon fruit contains antioxidants and vitamin C, vitamin B1, vitamin B2, and vitamin B3 which can bind free radicals. free so that it can reduce insulin resistance and provide a protective effect then results in sensitivity insulin so that it can reduce blood glucose levels (Rohmawati et al., 2020).

The high amount of fibre in dragon fruit juice can help inhibit blood sugar spikes that occur after eating foods with a high glycemic index. By making feces more viscous, fiber can indirectly slow down the rate of diffusion, lowering blood glucose levels and lipid and cholesterol profiles while also slowing the absorption of fat and glucose (Hariyanti, Kurnia, & Fauziah, 2023). Considering that dragon fruit contains a lot of fibre, DM patients can consume dragon fruit juice regularly to inhibit glucose absorption so that blood sugar levels can decrease.

Because red dragon fruit is high in fiber and vitamin C, its ability to reduce blood sugar levels is well established. By delaying intestinal transit time and reducing stomach emptying, a high fiber content can reduce the absorption of glucose. Because fiber causes the stomach to produce gel, which causes chime to begin in the stomach and move more slowly to the intestines, the gastric emptying period is prolonged. As a result, food stays in your stomach longer, making you feel satisfied for longer.

Red dragon fruit juice contains water-soluble fiber that can be utilized as a hypoglycemic agent. Soluble fiber can lower insulin needs and increase insulin sensitivity in hypoglycemic therapy. This fiber that dissolves in water makes the stomach more viscous, which slows down the pace at which glucose is absorbed. Getting enough fiber in your diet can help with blood glucose regulation and metabolism. Soluble fiber inhibits the absorption of glucose, prolongs the time that food takes to pass through the colon, and delays the emptying of the stomach. Insulin secretion won't be excessive if glucose absorption is sluggish, which will lower the need for insulin and raise insulin sensitivity.

Red dragon fruit juice's fiber may absorb a lot of water and gel, which makes it easier for glucose to bind to the small intestine's wall and reach the bloodstream. Blood glucose levels fall as the pancreas produces less insulin in response to less glucose entering the blood. The RDA indicates 38 g of fiber per day as the recommended consumption. This red dragon fruit can provide ± 52% of the daily required amount of fiber. The amount of vitamin C can also impact GDS levels. Six times the recommended amount of vitamin C, or 540.27 mg/100 g, is found in red dragon fruit. Red dragon fruit's extremely high vitamin C content lowers insulin resistance by enhancing endothelial function and lowering oxidative stress. It also serves as an antioxidant. Furthermore, vitamin C contributes to the inhibition of the aldose

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reductase enzyme, which lowers the reducing equivalent of oxidized glutathione (GSSG) to reduced glutathione (GSH). Mulyasari (2021).

The weakness of this research is that the researcher did not control variable confounders that can influence the reduction in blood sugar levels due to paying attention to research ethics. Researchers validated the consumption of dragon fruit juice indirectly only through videos or photos sent by respondents while monitoring blood sugar levels.

IV. CONCLUSION

Giving dragon fruit juice affects blood sugar levels in diabetes mellitus clients. The results of the research can be a reference for education regarding giving dragon fruit juice to blood sugar levels in diabetes mellitus clients. The research results become the basis for nurses to carry out nursing actions based on scientific evidence. DM clients can integrate this intervention into daily life as an effort to control blood sugar levels. The results of this research can also be integrated by community health centres in posyandu activities for non-communicable diseases and the elderly. Future research can identify other non-pharmacological therapies that can reduce blood sugar levels in DM clients or examine other variables that can be controlled through giving dragon fruit juice, for example, cholesterol levels, uric acid, blood pressure, etc.

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