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Effectiveness of Pumpkin Pudding and Pineapple Pudding on Blood Glucose Levels in Diabetic Patients

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ABSTRACT

Hyperglycemia, often known as high blood sugar, is a disease that causes diabetes. Free radicals are produced as a result of hyperglycemia. Due to elevated blood sugar levels, the antioxidant content in pumpkin and pineapple can prevent the formation of free radicals. Reducing blood glucose levels as a result. The purpose of the study is to determine whether giving diabetics pumpkin and pineapple pudding lowers their random blood glucose levels.

This type of research is a quasi-experimental design with a pretest and posttest with control group. The sampling technique used was purposive sampling with a sample of 30 diabetic patients, consisting of 2 groups (which were given pumpkin and pineapple pudding): each consisted of 15 patients. Provision for 7 days in a row as much as 250 gr. Random blood glucose levels were measured one day before and after the intervention using the Blood Glucose test. Data analysis using Wilcoxon and Mann Whitney test.

The results of this study showed a significant difference in decreasing random blood glucose levels in patients who were given pumpkin pudding (P1) and patients who were given pineapple pudding (P2) between initial and final random blood glucose levels. This research also shows the effectiveness of pumpkin and pineapple pudding in lowering random blood glucose levels.

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Introduction

Diabetics is a chronic metabolic disorder characterized by increased blood glucose levels (hyperglycemia). Hyperglycemia is caused by a shortage of insulin synthesis or faulty insulin receptors. Insulin is a hormone generated by the pancreas gland that transports glucose from the bloodstream to the cells of the body, where it is turned into energy. Long-term hyperglycemia can lead to issues in different organs of the body, including cataracts, retinopathy, neuropathy, nephropathy, and cardiovascular disorders (Saeedi et al., 2019).

Diabetes is seen as a widespread, rising, significant, costly, and potentially preventable public health issue. Diabetes prevalence is anticipated to rise from 117 million in 2000 to 366 million by 2030. Diabetes' prevalence will continue to place a financial and health burden on individuals, families, and governments (Jin et al., 2013).

Hyperglycemia can cause the body to produce more free radicals. When the body's defense system is impaired, it cannot counteract the production of Reactive Oxygen Species (ROS), resulting in an imbalance between ROS and cellular protective systems, leading to oxidative stress. Any imbalance between ROS and antioxidants can be hazardous to one's health (Chandra et al., 2019).

Pumpkin (Cucurbita moschata) is reported to have antioxidants that can lower blood glucose levels and oxidative stress in diabetics. This fruit includes a variety of beneficial chemicals, including beta-carotene, flavonoids, vitamins C and E. These compounds are antioxidants, which can decrease free radical activity in the presence of oxidative stress. Flavonoids can reduce insulin resistance, improve insulin sensitivity, and lower blood sugar levels. Pumpkin's antioxidant content is important in managing blood glucose levels. Furthermore, its antioxidant concentration assists in the management of MDA accumulation. Pumpkin flavanol components are known to limit glucose absorption in the intestine and protect the pancreas from damage (Ayda et al., 2022).

Besides pumpkin, pineapple (Ananas comosus) is high in minerals such as calcium, potassium, and vitamins C and A. Pineapple contains bromelain, which has anti-inflammatory properties. Eight phenolic compounds found in pineapple fruit have antioxidant and anti-inflammatory properties and the ability to inhibit hydrolytic and oxidative enzymes in human cells. This antioxidant and anti-

inflammatory component has the potential to lower blood glucose levels (El-Shazly et al., 2018).
According to the research of Rahmi Fathonah et al (2014), they supplied 56 mg/200 g weight/day of pumpkin water extract to diabetic rats. This treatment's dose proved effective in lowering fasting blood glucose levels in diabetic rat models (Fathonah et al., 2014).
Giving up to 200 g of pineapple is based on research by Ayu Rohmawati et al. (2018), who gave alloxan-induced rats pineapple extract at a dose of 45 mg/200 g weight/day. This treatment's dose proved effective in lowering blood glucose levels in diabetic male Wistar rats (Rochmawati & Ardiansyah, 2018).
In various clinical studies, antioxidant feeding has been demonstrated to reduce endogenous antioxidant depletion and thereby associated oxidative damage. Current recommendations are based on a balanced diet (high in fruits, vegetables, and whole grains, and low in red meat and alcohol) and a healthy lifestyle, both of which have been demonstrated to lower the risk of degenerative diseases (Liu et al., 2018).
Based on the explanation above, the purpose of this study is to investigate the effectiveness of Pumpkin Pudding and Pineapple Pudding in lowering blood glucose levels in diabetic patients. Giving pumpkin and pineapple in the form of pudding, in addition to being simple to implement, can improve the fiber content of the snack.

Method

This study was a quasi-experimental study with a pretest-posttest with a control group design, namely by comparing blood glucose levels between the treatment group given pumpkin pudding and the treatment group given pineapple pudding. Data collection was carried out for 7 days. The population in this study were all diabetic patients who had been diagnosed by a doctor.
Based on the calculation, it was found that the sample size was 14 respondents. To anticipate that there would be a sample that dropped out, a 10% correction was made from the total sample, namely 1 respondent. Based on the calculation above, it was obtained that the sample size was 15 people, with the ratio of the sample that was used as the treatment group that was given pumpkin pudding and the treatment group that was given pineapple pudding was 1:1, so one treatment group consisted of 15 people each. Samples were taken using the purposive sampling method, namely sampling based on certain considerations made by researchers with inclusion and exclusion criteria. The inclusion criteria in this study were people with diabetes based on a doctor's diagnosis, using the same anti-hyperglycemia drugs, being able to communicate well, being willing to be research samples, liking pumpkin, pineapple, and milk. Exclusion criteria in this study were moving domicile, other diabetic, not eating pumpkin and pineapple for 1 day or more, there are complications with other diseases (e.g. ulcers, gastrointestinal disorders, diabetic nephropathy, diabetic neuropathy, etc.)
Making pumpkin pudding by preparing 200 g of pumpkin, 3 g of agar powder, and 50 ml of low-calorie liquid milk. peel the pumpkin, clean, and wash. Weigh the pumpkin. Then steam for 15 minutes until soft. Put the pumpkin that has been mashed into the pan. Put the dissolved agar into the pan. Then cook until it boils and add liquid milk. Wait until it boils again, then remove it and put it in the cup. The composition and preparation of pineapple pudding is the same as pumpkin pudding.

Results

Table 1. Characteristics of diabetic patients

General description		*Group* Pumpkin Pudding		pineapple Pudding		Total	
		n	%	n	%	n	%
Gender	Female	14	93.3	14	93.3	28	93.3
	Male	1	6.7	1	6.7	2	6.7
Age	30-49	1	6.7	4	26.7	5	16.7
	50-64	7	46.7	9	60	16	53.3
	65-80	7	46,7	2	13.3	9	30
BMI	Normal	11	73.3	8	53.3	19	63.3
	Over weight	2	13.3	4	26.7	6	20
	Moderate Obase	2	13.3	3	20	5	16.7
Total		**15**	**100**	**15**	**100**	**30**	**100**

Based on Table 1 above, it can be seen that almost all of the patients in this study were female, namely 28 patients (93.3%). More than half of the respondents were aged 50-64 years, namely 16 patients (53.3%). The nutritional status of the patients was determined using the BMI (Body Mass Index) which was obtained from the results of measuring the height and weight of the patients. More than half of the patients had normal BMI, namely 19 people (63.3%). The treatment group could finish the given pudding (100%).

Table 2. Analysis of Differences in Initial and Final Blood Glucose Levels of Patient Given Pumpkin Pudding and Pineapple Pudding

Group	n	Mean ±SD (mg/dL)	ΔBGL (mg/dL)	Sig.
P1a	15	284,5±61,1	76,8	0,01
P1b	15	207,7±59,1		
P2a	15	253,3±36,7	53,3	0,01
P2b	15	200,1±26,8		

Description: P1a = initial random blood sugar levels in the group given the pumpkin
P1b = final random blood sugar levels in the group given the pumpkin
P2a = Initial random blood sugar levels in the group given pineapple
P2b = final random blood sugar levels in the group given pineapple

The results showed that the average blood glucose level when the patients were given pumpkin pudding was 284.5 mg/dl and decreased to 207.7 mg/dl after being given pumpkin pudding with an average decrease of 76.8 mg/dl. All group patients who were

given pumpkin pudding were able to finish it. The average blood glucose level when the patients were given pineapple pudding was 253.3 mg/dl and decreased to 200.1 mg/dl after being given pumpkin pudding with an average decrease of 53.3 mg/dl.
Based on Table 2, it can be seen that there was a significant difference (p<0.05) between the initial and final blood glucose levels of the patients who were given pumpkin pudding, namely p value (0.01) and there was also a significant difference (p<0, 05) between initial and final blood glucose levels of the patients who were given pineapple pudding, namely p value (0.01).

Table 3. Results of Analysis of Changes in Average Initial and Final Blood Glucose Levels of Patients Given Pumpkin Pudding and Pineapple Pudding

∆BGL	n	Mean	SD	P
P1	15	76,8	29	0,026
P2	15	53,3	38	

Statistical analysis obtained P value = 0.026, which means there is a significant difference between the average decrease in blood glucose levels when patients were given pumpkin pudding and patients who were given pineapple pudding.

Discussion

High blood glucose levels that are uncontrolled can lead to an increase in the production of ROS free radicals. Excessive ROS production can result in oxidative stress. In diabetes mellitus, oxidative stress can damage pancreatic cells, causing high blood glucose levels to get out of control (Decroli, 2019). Antioxidants are believed to reduce oxidative stress. If oxidative stress is reduced, further damage to pancreatic cells can be avoided, allowing blood glucose levels to rise more slowly. As a result, antioxidants can help to regulate excessive blood glucose levels (Ayda et al., 2022).
There is no research related to giving pumpkin pudding and pineapple pudding to reducing blood glucose levels when people with diabetes do not yet exist, so the literature supporting giving pumpkin pudding and pineapple pudding to reduce blood glucose levels is very limited to be used as a comparison, but there are several studies related to the effect of pumpkin and the effect of pineapple on blood glucose levels, as well as literature on the content of nutrients and antioxidants in pumpkin and pineapple.
The decrease in blood glucose levels in the group given pumpkin pudding was in line with research conducted by Rahmi Fathonah, who obtained the result that giving pumpkin water extract at a dose of 56 mg/200gweight/day was able to reduce fasting blood glucose levels in diabetic rats, decreasing blood glucose levels, namely 107.57 mg/dl with a significant value of 0.006.(Fathonah et al., 2014) Another study said that giving pumpkin enteral formula as much as 20 g/kg weight for 9 days affected the average blood glucose level of diabetic rats (Hawa & Murbawani, 2015).
Meanwhile, the reduction in blood glucose levels in the pineapple pudding group was consistent with the findings of Rochmawati and Ardiansyah (2018), who discovered that pineapple hump extract (Ananas comusus L) doses of 25%, 50%, 75%, and 100% could lower rat blood glucose levels. Diabetes in a male wistar (Rattus norvegicus L). The 100% concentration is the most effective for decreasing glucose levels (Rochmawati & Ardiansyah, 2018).
Based on this test, it is known that there is an effect of giving pumpkin pudding and pineapple pudding on decreasing blood glucose levels, but if seen from the average decrease in blood glucose levels among respondents, giving pumpkin pudding as an alternative snack is more effective for reducing blood glucose levels during compared to pineapple pudding.
This is because pumpkin pudding includes more active components than pineapple pudding, such as beta carotene, zinc, flavonoids, and fiber. Pineapple pudding contains large concentrations of active compounds, such as vitamin C and bromelain enzymes (Ayda et al., 2022; El-Shazly et al., 2018). The content of beta carotene in 100 g of pumpkin is 1569 mcg while in pineapple it is only 17 mcg (Kementrian Kesehatan RI, 2017). The ability of beta-carotene as an antioxidant is hypothesized to protect the functions of the pancreas by protecting pancreatic cells from free radicals and to improve the ability of cells to make and produce insulin, allowing blood glucose levels to fall. Insulin lowers blood glucose levels by increasing glucose transfer into adipose tissue and muscle by recruiting glucose transport. Insulin binding and its receptors require GLUT4 to enter muscle cells and adipose tissue and efficiently uptake glucose (Soviana et al., 2014).
Besides from beta-carotene and flavonoids, zinc is another active element that can lower blood glucose levels. The zinc level of 100 g of pumpkin (1.5 mg) is higher than that of 100 g of pineapple (0.1 mg) (Kementrian Kesehatan RI, 2017). Zinc is a mineral that plays a key role in insulin synthesis, storage, secretion, and action. One of the zinc levels in the body is concentrated in the pancreatic Langerhans cells. Zinc forms a combination with insulin to create the insulin-zinc-hexamer in beta cells. This structure stabilizes the insulin structure and allows insulin to be stored in pancreatic beta-cell granules. This zinc can then act paracrinely to regulate glucagon output in pancreatic alpha cells. Zinc, as a signaling molecule, aids in the transport of glucose into cells. Zinc can activate cAMP phosphodiesterase and mobilize the glucose transporter to the cell plasma membrane in mice adipocytes (Ridwan et al., 2023). Zinc can also inhibit protein tyrosine phosphatase 1B (PTP1B). PTP1B acts as a negative regulator of the insulin and leptin signaling pathways. If zinc inhibits PTP1B, insulin stimulation of the signal transduction pathway may last longer. Zinc can also influence glycogen production, and lipogenesis, and inhibit gluconeogenesis and lipolysis. As a result, supplementing with zinc can prolong insulin action. Epidemiological research indicates a link between low zinc levels and hyperglycemia (Ridwan et al., 2023).

Besides beta carotene, flavonoids, and zinc, other active substances that are antioxidants that can lower blood glucose levels are vitamin C. The content of vitamin C in 100 g of pineapple (11 g) is higher than 100 g of pumpkin (2 g) (Kementrian Kesehatan RI, 2017). Vitamin C, also known as ascorbic acid, is an effective air-soluble antioxidant that has a scavenging impact on excess free radicals in diabetic patients' bodies as well as an effect on tissue damage induced by oxidative stress. Several studies have found that the administration of vitamin C can improve islet cell function in diabetes patients, which can be used for early diabetes prevention and subsequent treatment complications (Shi et al., 2020). Diabetic patients experience a deficiency of vitamin C, resulting in an increased need for vitamin C. Vitamin C is beneficial in managing glycemic control and preventing further complications (Ridwan et al., 2023).

Based on the description above, pumpkin pudding is more effective as an alternative snack for diabetic patients because pumpkin pudding contains more active ingredients compared to pineapple pudding. Therefore, diversification of food ingredients is very good so that the active substances in food can be more. In this case, combining pumpkin and pineapple components to make pudding will yield better results than either pumpkin or pineapple pudding independently.

Conclusion

There were differences in blood glucose levels at the beginning and end of the group given pumpkin pudding. There were differences in the initial and final blood glucose levels of the group given pineapple pudding. There is an effectiveness of giving pumpkin pudding and pineapple pudding as an alternative snack to changes in blood glucose levels when diabetic with a tendency for the average change in blood glucose levels when the group given pumpkin pudding is higher than pineapple pudding.

Suggesting further research to analyze the specific effects, nutritional content, portion sizes, and duration of changes in blood glucose levels due to pumpkin and pineapple pudding. Additionally, assess the long-term sustainability and impacts on individuals with diabetes for comprehensive insights into using these desserts as alternative snacks.

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Author Contribution and Competing Interest

scriptwriter by YIP. The research concept was created by HZY and Has.

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