

The Effects of Green Tea Infusion on Blood Sugar Levels of Employees with Hyperglycemia

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ABSTRACT:

Background: Blood sugar is one of the sources of energy in the body. Blood sugar levels are influenced by several factors such as age, gender, physical activity, stress, and diet. Increased blood sugar levels beyond normal limits are referred to as hyperglycemia. Hyperglycemia can cause symptoms such as frequent thirst, dizziness, blurry vision, and increased urination intensity. Green tea has an antihyperglycemic effect because it contains catechins, tannins, saponins, and alkaloids that can lower blood sugar levels.

Objective: This study aims to determine the effect of consumption of infusion green tea on the blood sugar levels of employees with hyperglycemia.

Method: The research design used a pseudo-experimental design with a type of non-randomized control group pretest posttest design. The sampling technique uses a purposive sampling nonprobability sampling method with a minimum sample of 18 respondents in each group. Data analysis using the Mann-Whitney analysis test and Wilcoxon Test.

Results: After being given green tea from a total of 18 respondents in the case group, 5 people experienced a decrease in blood sugar levels, 3 people experienced an increase, and 10 people experienced no change. The results of the analysis test showed no effect of infusion green tea on the blood sugar levels of employees with hyperglycemia with the results of the Mann-Whitney test value $p = 0.20$ and Wilcoxon test value $p = 0.53$.

Conclusions: There was no effect of infusion green tea on the blood sugar levels of employees with hyperglycemia

KEYWORDS: blood sugar, hyperglycemia, green tea

INTRODUCTION

Blood sugar is one source of energy for the body. Blood sugar is influenced by several factors, namely endogenous and exogenous factors. Endogenous factors are factors derived from the body such as the hormones insulin, glucagon, and cortisol which function to regulate blood sugar levels. Exogenous factors are external factors, such as stress levels, carbohydrate intake, dietary patterns, age, and physical activity ⁽¹⁾⁽²⁾.

An increase in excess blood sugar in the body is called hyperglycemia, while a decrease in blood sugar levels to below normal values is called hypoglycemia. Hyperglycemia is one of the characteristics of Diabetes Mellitus. Hyperglycemia in diabetic patients can cause dysfunction of organs such as eyes, kidneys, nerves, heart, and blood vessels. Symptoms of hyperglycemia can include frequent thirst, dizziness, blurry vision, and increased urination intensity⁽³⁾⁽⁴⁾.

Efforts to lower blood sugar levels can be done using 2 ways, namely pharmacologically and non-pharmacologically. Pharmacological treatment is using drugs that function to lower blood sugar levels while non-pharmacological treatment can be in the form of lifestyle changes. In addition, the use of natural ingredients such as tea leaves is also thought to be used to lower blood sugar.

Tea is one of the most consumed beverages in the world. In a study entitled the effect of consumption of infusion green tea (*Camellia sinensis*) on blood glucose and cholesterol levels of patients with diabetes mellitus shows that consumption of infusion

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green tea has an influence on reducing blood glucose and cholesterol levels because there are polyphenols that can affect metabolism and homeostasis blood sugar levels ⁽⁵⁾. This research is in line with research conducted on diabetic rats which shows that green tea can lower blood sugar because green tea contains flavonoids that can work like insulin. The insulin-like ability of flavonoids, especially Epigallocatechin Gallat (EGCG), is to increase the phosphorylation of insulin receptors and insulin-1 receptor substrates (IRS-1)⁽⁶⁾. In a study conducted on postmenopausal women also showed results that consumption of green tea rich in catechins for 4 weeks can reduce the concentration of postprandial plasma glucose ⁽⁷⁾ but there are also studies that show an increase in blood sugar after consuming green tea. Research conducted by Josik, et al (2010) showed the results that consumption of green tea does not reduce blood glucose levels. This can be due to differences in bioaccessibility as well as catechin metabolism in humans⁽⁸⁾. Based on this description, researchers are interested in conducting research to determine the effect of infusion green tea on blood sugar levels of employees with hyperglycemia.

METHOD

This study used quantitative research methods with *Quasy Experiment* research design / pseudoexperimental research design with a type of non-randomized control group pretest posttest design.

RESPONDENTS

The study was conducted at the East Nusa Tenggara Provincial Social Office with respondents used were employees of the NTT Provincial Social Office with fasting blood sugar levels of 100-125 mg / dl totaling 36 people divided into 18 case groups and 18 control groups. The inclusion criteria in this study were respondents with hyperglycemia blood sugar levels who were not taking drugs that affect blood sugar levels and aged 18-59 years. Respondents who were pregnant, had a history of stomach pain, had a history of anemia, and had the habit of consuming green tea were excluded in this study.

HOW TO BREW GREEN TEA

The green tea used is commercial green tea soaked in 200 ml water with a temperature of 70°C for 10 minutes. Infusion green tea is given 2 times a day for 7 consecutive days. The method of administration follows the procedures in the previous study, which is 2 times a day for 7 days ⁽⁵⁾ but changes in temperature and soaking duration due to temperatures of 70°C and the length of soaking tea for 10 minutes are considered to provide more optimal results ⁽⁹⁾.

BLOOD DRAW

The blood sugar assessed in this study was blood sugar after a 10-12 hour fast. Blood sugar examination using peripheral blood and checked using an *Autocheck tool*. Blood sugar measurements were taken before and after green tea. Blood sugar respondents in the second blood measurement fall into the category of decreasing if fasting blood sugar levels are in the range of 70-99 mg / dl, said to have no change if they remain in the range of 100-125 mg / dl, and increase if more than 125 mg / dl.

Data Analysis

Data analysis using Mann-Whitney analysis test and Wilcoxon Test on JASP application.

RESULT

Characteristics of Respondents Based on Age Range in Case Group and Control Group

Table 1. Case Group

Group	Age Range	n	Percentage(%)
Case	20-24	1	5,56 0,00
	25-29	0	11,11 0,00
	30-34	2	
	35-39	0	
	40-44	4	22,22

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45-49	4	22,22
50-54	3	16,67
55-59	4	22,22
Total 18		100,00

Table 2. Control Group

Group Age Range	n	Percentage(%)
20-24	1	5,56
		11,11
25-29	2	5,56
		16,67
30-34	1	
35-39	3	
Control		
40-44	4	22,22
45-49	0	0,00
50-54	2	11,11
		27,78
55-59	5	
Total	18	100,00

Characteristics of Respondents Based on Sex Range in Case Group and Control Group Table 3. Gender in Case Group and Control Group

Group Gender	n	Percentage(%)
L	8	44,44
Case		
P	10	55,56
L	10	55,56
Control		
P	8	44,44

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Description of Blood Sugar Levels of Respondents Before and After Intervention in Case Group and Control Group

The description of fasting blood sugar levels of respondents before the intervention was in the same category, namely hyperglycemia with a range of 100-125 mg / dl.

Table 4. Description of Blood Sugar Levels of Respondents After Intervention in Case Groups

Percentage Group	Hasil	n	(%)
Increase		3	16,67
Case	Decrease	5	27,78
Constant	10		55,56

Table 5. Description of Blood Sugar Levels of Respondents After Intervention in the Control Group

Group	Hasil	n	Percentage (%)
Increase	3		16,67
Control	Decrease	10	55,56
Constant	5		27,78

Analysis of Blood Sugar Levels of Respondents Before and After Intervention in Case Group and Control Group

Analysis of differences in respondents' blood sugar levels before and after the intervention was calculated using the Wilcoxon test. While the analysis of the difference in average blood sugar levels in the case group and the control group after the intervention was calculated using the Mann-Whitney test.

Table 6. Analysis of Blood Sugar Levels of Respondents Before and After Intervention in Case and Control Groups

Fasting Blood Sugar	Average		<i>p</i>	
	Case	Control	Case	Control
Before	104,898	110,11	0,53	0,20
After	106,94	103,56		

Table 7. Analysis of Differences in Average Blood Sugar Levels of Case Groups and Controls after Intervention Administration

Variable	Average		<i>p</i>
	Case	Control	
Fasting Blood Sugar Levels	106,94	103,56	0,20

DISCUSSION

In this study, an insignificant difference was obtained between the examination of blood sugar levels both in the case group and the control group when the Mann-Whitney test was carried out with a value of $p = 0.20$. In measurement I, the average blood sugar level in the case group was 104.89 while in the control group the average result of blood sugar measurement I was 110.11. In measurement II, the average blood sugar level in the case group was 106.94 while in the control group the average result of

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measuring blood sugar level II was 103.56. These results showed that there was an increase in average blood sugar levels in the group of cases after the intervention, but this increase was not significant with a value of $p = 0.53$. In the control group there was a decrease in the average results of blood sugar management, but this decrease was also not significant with a value of $p = 0.20$. This showed that there was no effect of infusion green tea on blood sugar levels in employees with hyperglycemia.

The decrease in fasting blood sugar levels in 5 respondents out of a total of 18 respondents in the case group was in line with research conducted on patients with Diabetes Mellitus and it was found that infusion green tea 2 times a day for 7 days can reduce blood glucose levels⁽⁵⁾. This decrease in blood glucose is caused by the content contained in green tea in the form of catechins, tannins, alkaloids, and saponins. Catechins act as antioxidants and act as antihyperglycemic, especially EGCG which has a way of working that is almost the same as insulin. Its role is to inhibit the production of liver glucose and control gluconeogenesis. Tannins can spur fat and glucose metabolism so as to prevent excess fat and glucose. Tannins can also increase glycogenesis and reduce the absorption of food juice, thereby inhibiting the rate of increase in blood sugar. Alkaloids work by stimulating the hypothalamus to increase secretion of Growth Hormone (GH). High GH levels will stimulate the liver to secrete Insulin-like Growth Factor-1 (IGF-1) so that it can induce hypoglycemia and reduce gluconeogenesis, besides that alkaloids have the ability to help regenerate damaged pancreatic β cells. Saponins work to prevent glucose absorption by preventing glucose transport to the intestinal brush border in the small intestine which is the site of glucose absorption.⁽¹⁰⁾

In this study there was an increase in blood sugar levels in 3 respondents in the case group, this is in line with research conducted on 15 healthy people to determine the effect of giving green tea on postprandial glucose and obtained results in the 120th minute group given green tea had higher blood sugar than the control group. Increased blood sugar levels after consuming infusion green tea can be caused by differences in the bioaccessibility and metabolism of catechins in humans⁽⁸⁾. This study is also in line with research conducted on 14 patients with type 2 diabetes and found no significant changes in fasting blood sugar after consuming green tea for 4 weeks. This can be caused by fasting done by respondents before checking blood sugar resulting in a long enough time span between the last green tea consumption and blood draw time which can cause a decrease in the amount of catechins in the body with a decrease time that corresponds to the metabolism of each respondent, so measuring the effect of green tea after 12 hours of fasting produces inconsistent results⁽¹¹⁾. Elevated blood sugar can also be caused by several other factors such as age, gender, diet, stress and physical activity. Increasing age can cause a decrease in physiological body functions. This can cause the activity of pancreatic beta cells to produce insulin to decrease and the sensitivity of cells to insulin also decreases which can cause an increase in blood sugar levels⁽¹²⁾. Gender is also one of the factors that can affect blood sugar. In a study conducted by Arania, et al (2021) stated that there is a relationship between sex, especially women, and the incidence of Diabetes Mellitus. This can be caused by a decrease in the hormones estrogen and progesterone at menopause causing a decrease in insulin response that can cause an increase in blood sugar levels⁽¹³⁾. Poor eating patterns such as consuming sweet foods and eating high carbohydrates regardless of frequency, type, and portion of meals can cause an increase in blood sugar levels⁽¹⁴⁾. Stress can also trigger hyperglycemia. Stress can increase the ACTH hormone which will activate the adrenal cortex to secrete glucocorticosteroid hormones that will increase gluconeogenesis so that blood sugar levels will increase⁽¹⁵⁾. Less physical activity can increase blood sugar levels. This is because when doing physical activity the muscles will actively move so that it can help insulin work in increasing blood sugar uptake to the muscles and causing a decrease in blood sugar levels⁽¹⁶⁾.

In the control group, out of a total of 18 respondents, there were 3 respondents who experienced an increase in blood sugar levels, 10 respondents experienced a decrease in blood sugar, and 5 respondents did not experience changes in blood sugar at the second examination. Increases or decreases in blood sugar levels in groups that are not given intervention can be caused by several factors such as age, sex, diet, stress and physical activity.

Suggestions for future researchers:

- Can control the diet and physical activity of respondents and record the daily physical activity of respondents.
- Can pay more attention to the age and gender of respondents, for example by only using respondents of 1 gender and the age gap is not too far.
- Can take blood measurements using venous blood.

CONCLUSION

There was no effect of Infusion green tea on employees with hyperglycemia

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