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ARTIKEL PENELITIAN

Effect of Suweg Flour *(Amorphophallus Campanulatus)* on Reducing Blood Glucose Levels in Diabetic Rats

Ika Setyawati[1], Farindira Vesti Rahmasari[2]

[1]Department of Biochemistry, Faculty of Medicine, Faculty of Medicine and Health Sciences, Muhammadiyah University of Yogyakarta, Yogyakarta, Indonesia
[2]Department of Parasitology, Faculty of Medicine, Faculty of Medicine and Health Sciences, Yogyakarta Muhammadiyah University, Yogyakarta, Indonesia

Email:ikasetyawati.dr@umy.ac.id

Abstract: Suweg *(Amorphophallus campanulatus)* is a food ingredient with a low glycemic index that contains phenolic and flavonoid antioxidants, as well as glucomannan. Food intake is a key factor in managing Diabetes Mellitus (DM). Diabetes mellitus (DM) is a chronic non-communicable disease that can cause various complications.This study aims to determine the hypoglycemic effect of suweg *(Amorphophallus campanulatus)* flour. This experimental research used 25 male Wistar white rats divided into five groups. The group is normal (N), positive control (K), standard (S), treatment group with suweg flour 1.25 gr/day(P1), and the treatment group with suweg flour 2.50 gr/day(P2). Data was obtained by measuring glucose levels before and after giving suweg flour. Data were analyzed using paired difference tests (paired sample t-test). This research showsThere was a significant difference in blood glucose levels between the group given suweg flour and the positive control ($p<0.001$). Significant correlation in treatment groups (P1 and P2).It can be concluded that administration of suweg flour *(Amorphophallus campanulatus)* has hypoglycemic activity ($p<0.05$).
Keywords: diabetes mellitus, hypoglycemic, suweg *(Amorphallus campanulus)*

INTRODUCTION

The prevalence of diabetes mellitus sufferers will continue to increase every year. The number of diabetes mellitus sufferers in the world in 2015 was 422 million people.[1]In 2040, the number of diabetes mellitus sufferers will increase to 642 million people.[2] Non-communicable diseases such as Diabetes Mellitus in Indonesia are a healthproblem with an increasing incidence rate.[3] Indonesia is ranked 7th in the world with the most diabetes mellitus sufferers.[4]

Diabetes mellitus is a chronic disease characterized by blood sugar

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levels that are higher than normal due to insulin not working effectively in the body. Polyuria, polydipsia and polyphagia are the three main symptoms of someone experiencing diabetes mellitus.

The types of food recommended for diabetes mellitus sufferers are brown rice, wheat flour, vegetables, fruit, and others. Consuming white rice needs to be avoided because it has a high sugar content.[5]

Suweg flour (Amorphophallus campanulatus) is an ingredient that contains crude fiber and carbohydrates with low sugar content so it can be used as a substitute for other food ingredients, for example white rice.[6,7]

This research differs from previous research in terms of the form of natural ingredients used for experimental animal interventions. This research uses natural ingredients in the form of flour with the aim of facilitating its application in society to be processed into various kinds of food preparations.

It is hoped that this research can help in the management of Diabetes Mellitus because of the innovation in using natural ingredients, namely suweg in the form of flour, so that it can contribute to therapeutic options, increasing utilization and developing food biodiversity

METHOD

Tools and materials used

The non-chemical research material used was old suweg. The chemicals used are filter paper,glibenclamide, streptozotocin, nicotinamide, 75% alcohol, hypnorm, EDTA anticoagulant.

The tools used are drop pipettes, 1000 mL beakers, test tubes, stirrers, digital scales, cuvettes, UV-Vis spectrophotometers, micro pipettes, rat cages, gloves, scales, micro tubes, test tube racks, micro hematocrit pipettes, timers, spectrophotometer label,Anddisk mill machinewith 80 mesh screened.

Experimental design

This research uses a pre-test and post-test with control group design. The 25 mice were divided into 5 groups (n=5) consisting of: group 1:N= normal control, group 2: K = positive control, group 3: S = standard(diabetic rats + glibenclamide 0.09 mg/200 grBW/day), group 4: P1

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= (diabetic rats + suweg flour 1.25 g/day), group 5: P2 (diabetic rats + suweg flour 2.50 g/ day). Single dose suweg flour intervention using the sonde method.

Animal

This study used 25 white male rats (Rattus novergicus) aged between 2 – 3 months with a body weight of ± 150-200 g and healthy physical condition were used as samples. The exclusion criteria were mice that showed a decline in physical condition during the adaptation phase. Mice were adapted for 7 days in the Inter-University Central Laboratory Building (PAU), Center for Food and Nutrition Studies, Gajah Mada University, Yogyakarta, Indonesia by providing sufficient food with standard mouse pellet food, drinking and lighting at room temperature.

Sample

The sample for this study is serum which will be used to measure blood glucose levels using the Dyasis Kit reagent with the GOD-PAP (Glucose Oxidase-Peroxidase Aminoantypyrine) method.

*Induction of Streptozotocin (STZ) and Nicotinamic Acid (NA.*Streptozotocinand NA induction was carried out by injecting STZ 45 mg/kgBW intraperitoneally and NA 110 mg/kgBW for 7 days after the adaptation phase to induce damage to pancreatic β-cells in male rats (Rattus novergicus). The main characteristic of diabetic mice is hyperglycemia with blood glucose levels >160 mg/dL.Mice were tested for hyperglycemia by measuring their blood glucose concentrations at 3 and 7 days after injection of STZ and NA.

Suweg Flour

Making suweg flour begins with harvesting suweg. Suweg can be harvested at the beginning of the dry season. Suweg is peeled, washed and then coarsely grated. Once grated, put it in a spinner to reduce the water content and relieve itching. Then dry it in the sun to dry for 2 days with a drying time of 6-7 hours per day. After drying, the suweg is put into a disk mill machine and ground at a speed of 1500 rpm and an 80mesh sieve. 1 kg of suweg produces 300-350 grams of wheat flour.[8]

Statistic analysis

Data were analyzed using SPSS 15 for Windows. Then first determine

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the distribution of the data using the Shapiro-Wilk test. Differences in blood glucose levels were analyzed using the Paired Sample T-test. All values from each sample are expressed as the average with± standard deviation (SD). The One Way ANOVA test was used to determine whether there were significant differences in blood sugar levels between groups. Results are statistically significant at $p < 0.05$.

RESULTS

This research shows that there are differences in pre-test and post-test blood glucose levels in diabetes model mice treated with suweg flour ($p<0.001$) in groups S, P1 and P2 (Table 1).Table 2 reports that there are significant differences in blood glucose levels in each standard group and the group treated with suweg flour($p<0.05$).

Table 1. Average Pre-test and Post-test Blood Glucose Levels After STZ + NA Induction

Group	Mean Blood Glucose Levels (mg/dL) ± SD		p value*
	Pre-test	Post test	
N (normal control)	63.89 ± 0.96	65.27 ± 1.06	0.002
K (positive control)	265.03 ± 2.31	267.70 ± 1.73	0.020
S (standard)	261.61±3.13	100.25 ± 2.63	<0.001
P1 (suweg flour 1.25 gr/day)	260.00 ± 5.10	140.08 ± 2.92	<0.001
P2 (suweg flour 2.50 gr/day)	258.59 ± 3.99	108.78 ± 4.23	<0.001

*Mean differences are significant $p<0.05$. Confidence Interval is 95%.

Table 2. Comparison Test Results Between Groups

Group	Between groups	p value
S	P1	<0.001
	P2	0.004
P1	S	<0.001
	P2	<0.001
P2	S	0.004
	P1	<0.001

**Post Hoc Test*with $p<0.05$ significantly different. Confidence Interval is 95%.

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DISCUSSION

Food intake is a key factor that can be modified in the management of diabetes mellitus. Consuming foods with a low glycemic index has a more beneficial effect in controlling blood glucose levels than consuming foods with a high glycemic index and has relevance to the prevention and management of diabetes mellitus.[9,10]

The glycemic index (GI) is a score that shows the ability to increase blood glucose levels of a food containing carbohydrates.[11]Foods with a high GI can increase blood glucose levels quickly, while foods with a low GI increase blood sugar levels slowly. The glycemic index value consists of three levels, namely, high glycemic index (>70), medium glycemic index (55-70), low glycemic index (<55).[12]

Suweg is a food with a low glycemic index, with a glycemic index value of 40.[8] The low value of the Glycemic Index (GI) in suweg flour is used to indicate the speed of absorption of food by the body into blood sugar. So, the higher the GI value, the faster blood sugar levels will increase. This value is obtained from measuring blood sugar levels in the first 2 hours after eating which is measured every 30 minutes. Based on previous research, the GI number obtained for suweg flour is 42 (GI<55). This shows that suweg flour can also be used to help lower blood sugar levels.[7]

Suweg can help lower blood glucose levels with bioactive compounds in the form of Water Soluble Polysaccharides (PLA) and dietary fiber.[13] Suweg tuber flour fermented by lactic acid bacteria (LAB) has a low glycemic index value, this is caused by the effect of reducing carbohydrate levels. Increased levels of fat and protein in fermented BAL of suweg tuber flour can slow down the gastric emptying process and slow down carbohydrate digestion.[14]

Suweg fluor contains antioxidants. In vitro studies show that suweg fluorine has high levels of antioxidants and has radical scavenging activity associated with high levels of phenolic and flavonoid antioxidants.[15] Antioxidants can protect biomolecules from the effects of ROS thereby reducing oxidative

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stress conditions in cells.[16]Apart from containing antioxidants, suweg also contains water-soluble polysaccharides, namely glucomannan, which affects carbohydrate and lipid metabolism.[17,18]

Based on research, these two bioactive substances (phenolics and flavonoids) have antidiabetic properties.[19] Phenolics control diabetes by inhibiting the enzymes-amylase andα-glucosidase enzyme involved in hyperglycemia[20]. Inhibition of this enzyme results in a decrease in blood glucose levels so that ROS production decreases and triglyceride lipolysis in tissues also decreases. Flavonoids can regenerate pancreatic β cells and stimulate insulin secretion[21]. Regenerating pancreatic β cells cause increased insulin secretion thereby reducing triglyceride lipolysis.

CONCLUSION

Suweg flour has the effect of lowering blood glucose levels in a diabetic rat model.

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