

The Effect of Yacon Leaf Powder (Smallanthus Sonchifolius) on White Rats (*Rattus norvegicus*) Blood Glucose Levels with High Sugar Diet

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The Effect of Yacon Leaf Powder (*Smallanthus Sonchifolius*) on White Rats (*Rattus norvegicus*) Blood Glucose Levels with High Sugar Diet

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Abstract

Maintaining a lifestyle can reduce the incidence of DM (diabetes mellitus). DM occurs due to insulin disorders so that blood glucose levels increase, which can lead to various complications. The management of blood glucose levels by activating the insulin function can be done by using natural ingredients such as the Yacon (*Smallanthus sonchifolius*) plant. Yacon leaves contain phenol which can reduce blood glucose. The design of this study was experimental with a pre-posttest approach with control-group design, using male and healthy white rats (*Rattus norvegicus*). Rats were divided into 3 groups, treatment dose 1, treatment dose 2 and control. The rats were given a high carbohydrate diet during 9 weeks to make the rats hyperglycemic. In the treatment group, dose 1 was 150 mg/kg BW, dose 2 was 300 mg/kg BW, and was given for 3 days. The results showed that the rats in the treatment group dose 1 had decreased in the average blood sugar level of 114.10 mg / dl (p 0.002) and dose 2 was 105.27 mg / dl (p 0.005). This showed that there was an effect of treatments on blood sugar levels. The comparison results showed that there was a significant difference between the dose 1, the dose 2 group and the control (Sig. (2-tailed) = 0.001 (α) = 0.05). There was no significant difference in the treatment between dose 1 and treatment dose 2 (Sig. (2-tailed) = 0.693, (α) = 0.05). Yacon leaves can be used alternative to lower to control blood glucose levels in rats receiving a high-carbohydrate diet

INTRODUCTION

Lifestyle is closely related to a person's health status. Maintaining a healthy lifestyle can reduce the incidence of various diseases such as Diabetes mellitus (DM). DM is a metabolic disease due to insulin disorders. DM is characterized by an increase ⁶ blood glucose levels (Yahya, 2018). Uncontrolled blood glucose levels in the long term can trigger various complications such as damage to the heart, blood vessels, eyes, kidney ¹⁴ and nerves (Oetari, 2019).

According to the International Federation, approximately 415 million people were suffering diabetes, and this number is expected to exceed 640 million by the year 2040 (IDF, 2015). ²⁴

DM conditions can be recognized by the appearance of symptoms such as hunger (polyphagia), thirst (polydipsia), frequent urination (polyuria), drastic weight loss and weakness. In general, DM category is grouped into 2 types, type 1 DM due to genetic factors and type 2 DM caused by an unhealthy lifestyle (WHO, 2016).

Giving insulin therapy is able to control blood glucose levels, but insulin therapy by injection causes side effects on the body and requires a fairly high cost. Non-pharmacological alternatives have begun to be developed to provide solutions to these problems, natural ingredients or plants become healthy lifestyle choices (Hamzah, 2019).

Herbal medicines from several plants as an alternative treatment for diabetes mellitus include Yacon (*Smallanthus sonchifolius*), Gembili (*Dioscorea esculenta* L), and Yam (*Pachyrhizus erosus*) tubers (Sabda, 2018). Yacon plant (*Smallanthus sochifolius*) contains protein, lipid, fiber and saccharide, catechone, terpenes, and flavonoids. Compared to other plants, the Yacon plant has the advantage of not providing a hypoglycemic effect (Oetari, et al 2016). Yacon (*Smallanthus sonchifolius*) leaves contain 35% free fructose and 25% bound fructose. This study aimed to determine the powder of Yacon Leaf (*Smallanthus Sonchifolius*) on White Rats (*Rattus norvegicus*) Blood Glucose Levels with High Sugar Diet

METHOD

The material used was the leaves ²⁰ of the Yacon (*Smallanthus sonchifolius*) plant, 3 pieces were selected from the shoots. The animal was male *Rattus norvegicus* white rats aged 2-3 months. High sugar diet (511 pellets, wheat flour, and glucose), husk powder, aquadest. Tools used: Easy Touch blood glucose or glucometer, mouse cage, blender, sonde, digital scale, oven.

The Yacon leaves powder ²² collected from the top 3 leaves as much as 200 grams, then washed and drained. The drying process used an oven with a temperature of 100-150° C for 30 minutes and the last step was making the powder by means of a blender. ²³

Experimental animals after 2 weeks of acclimatization were divided into 3 groups of 6 each. The high-carbohydrate diet (511 pellets, wheat flour, and glucose) given during for 9 weeks to get a hyperglycemic condition. Glucose level assessment instrument blood using a blood glucose check tool (Gluko Dr) by taking blood from the tip of the rat's tail. The 1st dose of Yacon leaf powder was 150 mg/kgBW, the 2nd dose was 300 mg/kgBW/day. The treatment was 1 time every day for 3 consecutive days using a probe. Measurement of blood glucose levels was carried out after 24 hours of treatment through the tip of the rat's tail. Blood glucose levels are expressed in mg/dL. Data analysis used One Way Anova to determine the difference between dose 1 treatment, dose 2 treatment and control.

RESULT

¹ The average measurement of blood glucose levels of white rats (*Rattus norvegicus*) on a high-carbohydrate diet before and after administration of Yacon (*Smallanthus sonchifolius*) leaf powder.

Table 1. Average pre and post blood glucose levels of white rats (*Rattus norvegicus*) after a high-carb diet (mg/dL)

Variable	Pre	Post	Difference chage
control	201,33	201,16	0,17
Dose 1	233,33	100,50	122,83
Dose 2	260,00	93,17	166,83

Souce: Primary Data

Table 1. Shows the difference in the decrease in blood glucose level that occurred in the treatment group at dose 1 and dose 2. Based on the Paired Sample Test, it showed that the treatment group at dose 1 and dose 2 showed that there was an effect of giving Yakon (*Smallanthus soncifolius*) leaf powder.

Table2. Differences in blood glucose levels of white rats (*Rattus norvegicus*) with a high-carbohydrate diet between the control group, treatment dose 1, and dose 2

Variabel	N	Mean	Std. Deviation	Max	Min	95 % Confindence Interval Mean		
						Lower	Upper	
Control	6	201,17	30,492	230	156	169,17	233,17	
Dose 1	6	100,50	12,958	120	83	86,90	114,10	
Dose 2	6	93,17	11,531	106	80	81,07	105,27	
Control - dose 1	p = 0,001							
Control - dose 2	p = 0,000							
Dose 1 - dose 2	p = 0,693							

Statistical test to determine the difference between the control group, treatment group dose 1 and dose 2. Based on the table above, it can be seen that there is no difference in blood glucose levels of white rats after administration of Yakon leaf powder at treatment dose 1 with dose 2 with p value = 0.693 which means there is no significant difference between dose 1 and dose 2.

DISCUSSION

A significant decrease in blood glucose levels after treatment the powder Yakon leaves. The Yakon leaf contains more components that lower blood glucose levels including phenolic, chlorogenic, and ferullic which have the ability to repair damaged pancreatic cells (Herman, 2008). Lachman (2007), shows that Yakon leaf (mg/100gr) contains 83.2% water, 2.87% protein, 1.24% lipid, 1.68% fiber, 1.44% saccharides and several minerals. Yakon leaf shoots contain fructose glucose which cannot be digested by digestive enzymes but can be fermented by the large intestine (Widowati, 2010).

The powder of Yakon leaves were made by dried using an oven. Gumilang (2016) who said that the extract by drying using the oven had the highest inhibitory activity against the α -glucosidase enzyme. Glucosidase is an enzyme that plays a role in carbohydrate metabolism in the small intestine. The powder form can be completely dissolved in water so as to maximize the absorption process (Setiana, 2018). It is suspected that the decrease in blood glucose levels of rats at treatment dose 1 was due to the technical selection of the treatment.

In the 2nd dose treatment group, 300 mg/kgBW of Yakon leaf powder was shown to have an effect on the blood glucose levels of rats. The results of this study are in line with research by Baroni et al. (2008) on the use of leaf extract of *Smallanthus sonchifolius* at a dose of 400 mg/kgBW for 14 days which was proven to reduce 59% blood glucose levels in diabetic rats close to normal glucose levels. The observations in this study showed that the rats in the dose 2 group experienced a decrease in their consumption of food and drink after receiving treatment for 3 days. Widowati (2010) said, the leaves of the yakon plant contain phenol components that have an insulin-like effect, namely to reduce glucose production in hepatocytes by inhibiting the α -glucosidase enzyme in the small intestine wall. The glucosidase enzymes such as maltase, isomaltase, glucoamylase and sucrase are associated with the function of hydrolyzing oligosaccharides and disaccharides. The activation of these enzymes reduce the digestion of complex carbohydrates and their absorption. Inhibition of the α -glucosidase enzyme help reduce blood glucose levels for patients with type 2 diabetes mellitus (Subramanian et al., 2008). The condition of the decrease in blood glucose levels forced the rats to experience changes in their diet. This is in line with the results of Jafar's research (2014) which shows that there is a relationship between diet and a decrease in blood glucose levels.

there were differences in blood glucose levels of white rats (*Rattus norvegicus*) between the control group and the treatment group. However, in the treatment group at dose 1 and dose 2, there was no significant difference in the blood glucose levels of white rats after being given Yakon (*Smallanthus sonchifolius*) leaf powder. The content of flavonoids in insulin plants is able to reduce blood glucose levels because the breakdown of carbohydrates into monosaccharides does not occur so that the intestine does not absorb glucose, so there is a decrease in blood glucose levels (Baroni et al., 2008). Yakon (*smallanthus sonchifolius*) leaves contain active ingredients such as proteins, lipids, fiber and saccharides, catechone, terpenes, and flavonoids and do not cause hypoglycemic effects (Oktar et al 2016). So giving Yakon (*Smallanthus sonchifolius*) plant powder can still be an alternative as a control for the blood glucose levels of white rats (*Rattus norvegicus*) with a high-carbohydrate diet.

2 CONCLUSION

Based on the results of the research that has been done, it can be concluded that:

There is an effect of treatment dose 1 (150 mg/Kg BW) on blood glucose levels of white rats before and after treatment compared to control. There is an effect of treatment dose 2 (300 mg/kg BW) on blood glucose levels of white rats before and after treatment. There is no difference between treatment dose 1 and dose 2 on the blood levels of white rats

SUGGESTION

It is necessary to add time for observing the blood glucose levels of white rats after receiving treatment with Yakon leaf powder (*Smallanthus sonchifolius*).

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