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Effectiveness of Homemade Herbal Powder in Reducing Blood Glucose Levels in Diabetes Mellitus Mice

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ABSTRACT

Diabetes Mellitus is a disease characterized by the inability of the pancreas gland to produce insulin, which can cause an increase in glucose levels in the blood. Treatment for this disease can be said to be quite expensive and requires long treatment. Noni, red ginger, black cumin, Chinese petai seeds and cardamom contain antioxidant compounds that can reduce blood glucose levels. These natural ingredients can be made into a drink in the form of homemade herbal powder can reduce glucose levels in the blood. This study aims to determine the effectiveness of homemade herbal powder on blood glucose levels. The method used in this research is an experimental method with a pre-post design. This study was divided into 5 treatment groups, namely negative control group, positive control, treatment group 1 with a dose of 400 mg/kg BB, treatment group 2 with a dose of 600 mg/kg BB and treatment group 3 with a dose of 800 mg/kg BB. The sample size was determined using the Federer formula, amounting to 5 individuals in each treatment. The results of analysis using Paired sample T-test showed a p-value of 0.000 or sig value <0.05 , which means that homemade herbal powder at doses of 400, 600 and 800 mg/kg BW can reduce blood glucose levels. The compounds contained in herbal plants that function as antioxidants can help absorb glucose and help pancreatic beta cells produce insulin. Homemade herbal powder can reduce blood glucose levels and the highest average reduction was found at a dose of 800 mg/kg BB.

Keywords: Diabetes mellitus; Blood Glucose; Herbal Powder

INTRODUCTION

High blood glucose levels are usually synonymous with the condition of Diabetes Mellitus (DM). Diabetes is one of the many diseases that are a health problem in Indonesia and the world that are often found in the 21st century (Subeki et al, 2015). Based on data from the International Diabetes Observatory (IDF), the prevalence of DM in the world is 1.9% and causes the seventh order of death in the world. About 1.3 million patients suffer from DM disease and 4% of patients die. The number of DM cases in Indonesia is 11.3% of the total population, which makes Indonesia ranked 3rd out of ten countries in the world where there is an incidence of DM (Dewi et al, 2022). Based on data from the Jember Regency Office (DinKes, 2020), the number of DM sufferers in Jember is 35,951 people out of a total population of 2,459,980.

Diabetes Mellitus is a disease characterized by the pancreatic gland being unable to produce insulin optimally. Factors that can cause the emergence of this disease



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include environmental factors that increase so that unbalanced dietary changes occur. In addition to diet, diabetes is also caused by genetic factors or hereditary factors (Pangestika, 2022). In general, DM disease is divided into two types, namely type 1 DM and type 2 DM. Type 1 DM is caused by damage to pancreatic beta cells that results in pancreatic cells being unable to produce insulin, while type 2 DM occurs because the hormone insulin is unable to respond properly (Prawitasari, 2019). This disease is usually called the great imitator, which is a disease that can attack all parts of the body so that it makes complaints, one of which is a heart attack, stroke, and can also cause death (Subeki et al, 2015). Treatment for DM patients can be said to be quite expensive and also requires a longer treatment than other diseases. One alternative treatment for DM is to use medicines or herbal plants (Ariska, 2019).

Herbal medicine or commonly called herbal medicine is a raw material or preparation made from plants that has therapeutic effects or other effects that are beneficial for the health of the human body. Herbal medicines consist of raw materials or ingredients that have gone through advanced processes derived from one or more (Yunitasari, 2018). Herbal plants that are used as a diabetes medicine began to develop from various types of plants, including a mixture of the five ingredients, namely noni, Chinese petai, black cumin, cardamom seeds and red ginger which are processed into drink powder.

Noni (*Morinda citrifolia* L.) or commonly called pace is one of the many herbal plants that can be used as traditional medicines. Noni fruit contains proxeronine and proxenoninase through the formation of xeronine which is useful for regenerating damaged pancreatic beta cells so that pancreatic beta cells can function again and produce enough insulin to control blood sugar (Wijayanti, 2022). In addition to noni fruit, Chinese petai or lantoro can also be used as an alternative medicine to lower blood sugar levels. Generally, the part of the plant used is the leaves, other parts of the plant that can lower blood sugar levels are Chinese petai seeds or lantoro seeds (Akuba, 2022). The content of chemical compounds that have the potential to be antidiabetic is phenolic compounds and flavonoids. This compound is found in other herbal plants, namely cardamom seeds which have the potential to be antidiabetic. Another plant that has the potential to be antidiabetic is black cumin. Black cumin has also been known as a medicinal plant since ancient times. Black cumin has many benefits such as anti-inflammatory, anti-hypertensive, anti-parasitic, anti-microbial, antioxidant and also as an anticancer. The plant also contains the compound Thymoquinone which can lower blood sugar levels (Murfat, 2022). Another plant that is also often used as an alternative medicine is red ginger. Red ginger is generally used as a kitchen spice or a drink that warms the body but can also be used as an antidiabetic drug. The phenol content possessed by red ginger makes this plant able to lower blood sugar levels (Wicaksono, 2015).

These five ingredients are useful for lowering sugar levels in the blood, because diabetes is a metabolic disorder characterized by elevated blood sugar levels due to insulin secretion that occurs in pancreatic beta cells (Fatimah, 2015).

METHODS

Research Ethics



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The ethics of this research are carried out through the ethics committee at the University of dr. Soebandi Jember. Based on the ethics letter that has been issued with No.253/KEPK/UDS/III/2024, this research was declared to have passed the ethics test.

Test Animals

The test animals used in this study were male mice aged 2-3 months with a body weight of 20-30gr. Before the research was carried out, the test animals first went through an adaptation process for 7 days. The test animals were fed standard mice in the form of pellets.

Treatment

This study uses experimental research with a pre-post design research. The test animals were divided into 5 treatment groups with the number of mice as many as 24 mice determined by Federer's formula and the formula of the proportion of sample loss so that the total number of mice was 30. The negative treatment group was only given CMC Na 0.5% while the positive control group was given aloxan treatment with a dose of 120 mg/kg BB mice. Treatment groups 1, 2 and 3 were given homemade herbal powder with doses of 400; 600; 800 mg/kg BB.

The ingredients used for the treatment of test animals are homemade herbal powders made from a mixture of noni, red ginger, black cumin, Chinese petai seeds and cardamom. The treatment was carried out by giving it orally to mice using a sonde. The volume of administration was adjusted to the weight of the mice.

Data Capture

The data collected in this study were in the form of blood glucose levels of mice after being induced with aloxan before being given herbal powder and blood glucose levels of mice after being given herbal powder.

Data Analysis

The data analysis test in this study used the Shapiro-wilk normality test and the Levene-test homogeneity test with a significance result of >0.05 . The test is also carried out with a paired T-test if the data obtained is distributed normally and homogeneously. The test was carried out with a confidence degree of 95% and a p-value of 0.05. The independent variable in this study was homemade herbal powder and the bound variable was blood glucose level.

RESULT AND DISCUSSION

Consumption of large amounts of glucose over a long period of time can cause hyperglycemic conditions. Untreated hyperglycemic conditions can cause pancreatic beta cells to not be optimal in producing insulin, increasing the risk of DM disease (Wijayanti, 2022).

Glucose levels above normal can be declared as a hyperglycemic condition with the induction of a dose of 120 mg/Kg BB in mice. Induction of aloxan will cause an increase in blood glucose levels because aloxan has the effect of damaging pancreatic beta cells so that it can cause DM conditions characterized by hyperglycemic (Zega, 2016). Research conducted by Riyanti, et al. shows that aloxan with a dose of 120 mg/kg BB can increase glucose levels in the blood (Riyanti, 2014). Hyperglycemia can be prevented by consuming medicines and medicines made from natural ingredients, for example a mixture of red ginger, black cumin, Chinese petai, cardamom and noni which are used as herbal powder drinks. The herbal powder used is dissolved with



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CMC Na 0.5% solvent. CMC Na is used for thickeners because it is quite stable in use and storage. CMC Na is also excellent for stabilizing a liquid preparation to keep it in a homogeneous state (Rashati, 2022). Blood glucose test results after being given herbal powders made from the five ingredients showed different results with negative controls. This shows that herbal powders made from a mixture of these five ingredients have the ability to prevent hyperglycemic.

The first stage is an adaptation process for 7 days which aims to familiarize the test animals to their new environment. Feeding is carried out 2 times a day and the drinking water is checked periodically.

The condition of hyperglycemia in mice is obtained from the induction of aloxan with a dose of 120mg/kg BB of mice until it reaches glucose levels of >200 mg/dl. Glucose measurements were taken on the 7th day after the administration of herbal powder therapy. The negative control group was the group that was given only CMC Na 0.5%, the positive control group was the group that was allaxan-induced and given the drug Glimepirid 1 mg. Treatment group I (P1) is the group that was given herbal powder with a dose of 400 mg/kg BB in mice. Treatment group II (P2) is the group that was given herbal powder with a dose of 600 mg/kg of mouse BB. Treatment group III (P3) was the group that was given herbal powder with a dose of 800 mg/kg of mouse BB.

Based on the decrease in blood glucose, it can be stated that there is a difference between the positive group, treatment group 1, treatment group 2, and also treatment group 3. The smallest decrease in glucose occurred in treatment group 1 with a dose of 400 mg/kg BB with an average value of 38.6. The treatment group with 2 doses of 600 mg/kg BB experienced an average decrease of 52 and the results of the calculation of the highest average reduction in glucose levels were at a dose of 800 mg/kg BB with an average reduction of 52.4%. The negative treatment group did not show a high decrease because the negative treatment group was not given treatment.

Normality testing using the Shapiro-wilk test and homogeneity testing using the Levene-test. This test was carried out to determine the normality and homogeneity of the data. The test was carried out using a 95% confidence degree or significance value of 0.05. The results of the normality test showed that the significance value was >0.05 which means that the data is normally distributed while the results of the homogeneity test obtained a significance value of >0.05 which means that the data is homogeneous. From the results of the test, it can be continued with the Paired T-test because the data in this study is distributed normally and homogeneously.

Paired testing of T-test samples is used to see the effectiveness of homemade herbal powder in lowering blood glucose levels. This test was conducted using a 95% confidence degree. The test results showed that the $p=0,000$ value or significance value <0.05 or H_0 was rejected which means that homemade herbal powder is effective in lowering glucose levels in the blood.

The content of secondary metabolites includes flavonoids, alkaloids and tannins contained in Chinese petai seeds, cardamom seeds and noni which has activity as an antihyperglycemic. The phenol content contained in red ginger can also be antihyperglycemic and also thymoquinone contained in black cumin can function as an anti-diabetic which is also an antioxidant. The antioxidants contained in these herbal plants can inhibit free radicals and also as a defense against free radicals that will

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prevent the appearance of oxidative stress in diabetes. It can increase glucose absorption activity to the maximum and help pancreatic beta cells produce insulin (Prawitasari, 2019). The phenolic compounds contained in herbal plants have antidiabetic activity, mechanism of inhibition of the pathway a glucosidase or a amylase, glucose absorption and also increase insulin sensitivity (Deka, 2022).

This study is in line with the research of Zega, et al. (2016) which showed that noni fruit extract can reduce blood glucose levels in aloxan-induced wistar rats (Zega, 2016). This research is also in line with research conducted by Nuvita, et al. (2018) which showed that Chinese petai plants have antidiabetic activity by showing the activity of the enzyme a-glucosidase (Rachmatiah, 2018) and also research conducted by Dewi and Frioza (2022) which showed that red ginger boiled water can reduce blood glucose levels in patients suffering from Diabetes Mellitus in Mekarjaya (Dewi, 2022).

CONCLUSION

Based on the results obtained from this study, it can be concluded that homemade herbal powder with a dose of 400 mg/kg BB, 600 mg/kg BB and 800 mg/kg BB can reduce blood glucose levels. The highest average decrease was in homemade herbal powders with a dose of 800 mg/kg BB. The author's suggestion for the perfection of the research can then be tested for other levels related to Diabetes Mellitus so that it can improve the benefits of homemade herbal powder in more detail.

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TABLE AND FIGURE

Table 1. Blood Glucose Measurement Results

Glucose Testing	Control Negative (mg/dL)	Positive Control (mg/dL)	P1 (mg/dL)	P2 (mg/dL)	P3 (mg/dL)
Pre	99	212	200	210	209
	121	217	207	221	216
	109	211	211	217	203
	117	220	215	204	219
	128	201	202	212	208
Post	93	170	175	167	153
	112	171	166	160	156
	96	177	180	168	149
	102	179	165	160	174
	125	166	156	149	161

Table 2. Average Glucose Drop

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Treatment Groups	Average Decline $\pm$ STD
Control Negative	9,2 $\pm$ 4,91
Positive Control	39,6 $\pm$ 6,42
Treatment 1 (P1)	38,6 $\pm$ 10,4
Treatment 2 (P2)	52 $\pm$ 9,43
Treatment 3 (P3)	52,4 $\pm$ 6,26

Table 3. Normality Test

Antidiabetes Testing Group	Asym. Sig.
Pre	
Control Negative	0,943
Positive Control	0,666
Groups 1 (400mg/kg BB)	0,789
Groups 2 (600mg/kg BB)	0,971
Groups 3 (800mg/kg BB)	0,745
Post	
Control Negative	0,577
Positive Control	0,685
Groups 1 (400mg/kg BB)	0,848
Groups 2 (600mg/kg BB)	0,348
Groups 3 (800mg/kg BB)	0,541

Table 4. Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Pre-test Testing	.217	4	20	.532
Post-test testing	2.658	4	20	.376

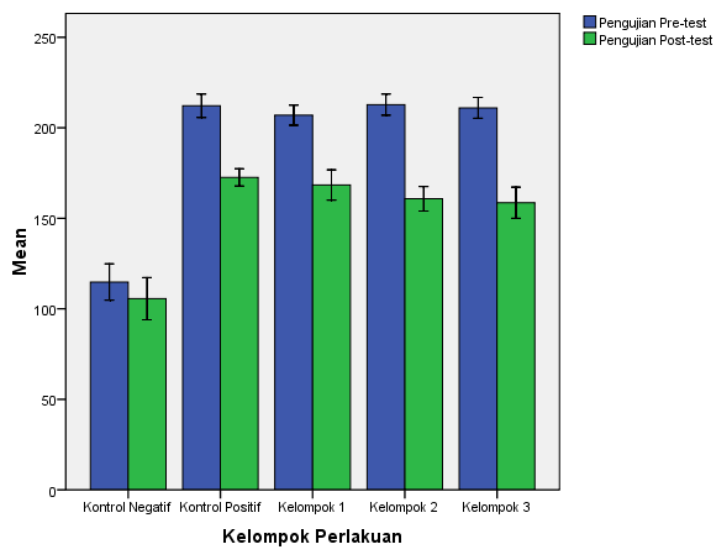
Table 5. Paired Test Sample T-Test

		Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2- tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre-test testing - Post-test testing	38.360	17.464	3.493	31.151	45.569	10.983	24	.000



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Error Bars: ± 2 SE

Figure 1. Glucose Drop Graph