Effectiveness of the Extract of Celery (Apium Graveolens L) Against Calculations Glucose In Vivo as Antidiabetic Alternatives

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Abstract. Diabetes Mellitus is a group of disorders characterized by increased blood glucose levels (hyperglycemia) and there may be a decrease in the ability to respond to insulin as well as a decrease in insulin formation by the pancreas. Celery plant is an herbal medicine with antidiabetic activity which is widely used because of its nature which is more suitable for the human body. The content found in celery leaves is flavonoids, terpenoids, alkaloids, and steroids. This study aims to determine whether celery leaf extract (Apium Graveolens L) can reduce blood glucose levels in male mice (Mus Musculus L) to determine the concentration of blood sugar levels which can reduce blood glucose levels in male mice (Mus Musculus L) and to analyzed the effect of celery leaf extract (Apium Graveolens L) on blood glucose levels in male mice (Mus Musculus L). The research method used was true experiment with pre test approach and post test only control group design. The results of the research on celery leaf extract (Apium Graveolens L) were proven to be able to reduce blood glucose levels in male mice (Mus Musculus L), which was the most effective in the P3 group with a dose of 177 mg/kgBW.

Keywords: Celery Leaves (Apium Graveolens L) · Glucose · In vivo · Antidiabetic

1 Introduction

Diabetes Mellitus is a group of disorders characterized by increased blood glucose levels (hyperglycemia) and there may be a decrease in the ability to respond to insulin as well as a decrease in insulin formation by the pancreas. Diabetes is a disease that is a major health problem in the world. The International Diabetes Federation (IDF) states that in 2017 there were around 425 million adults aged 20–79 years living with diabetes worldwide and Indonesia is one of the top 10 countries with the highest diabetes rates in the world. According to the IDF, Indonesia is ranked 7th, with 10.3 million people with diabetes in 2017. The IDF also stated that, if this trend continues, the number is expected to increase to 16.7 million by 2045. This increase in number is due to population growth,

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an increase in the average age of the population, and an increase in the prevalence of diabetes at all ages [1].

Pharmacological diabetes therapy can be done using synthetic drugs, such as insulin and oral anti-diabetes. These medications act to control blood glucose levels. However, it can cause serious side effects such as severe hypoglycemia, lactic acid poisoning with gastrointestinal disorders. Due to the serious side effects that can be caused, alternative treatments that have minimal side effects are needed, such as herbal medicines [2]. Herbal medicines with antidiabetic activity are widely used because they are more suited to the human body, are more readily available and have fewer side effects when compared to synthetic drugs. Celery plant is one of the herbs known to be rich in antioxidants, the main compounds such as apigenin, luteolin, saponins, camphorol, and vitamins A and C. The chemical compounds contained in celery, namely flavonoids, terpenoids, alkaloids, and steroids, are the reasons why celery is widely used in traditional medicine. Traditionally, celery was used as a diuretic, laxative, and sedative. Celery (Apium graveolens L.) has properties as a medicine for hypertension, asthma, rheumatism, inflammation, aciduric, and cholesterol-lowering [3].

With the aim of the research to find out whether the administration of celery leaf extract (Apium Graveolens L) can reduce blood glucose levels in male mice (Mus Musculus L). The formulation of the problem in this study is whether celery leaf extract (Apium graveolens) can reduce blood glucose levels in male mice (Mus musculus L)? The therapeutic activity of celery (Apium graveolens L.) has been reported in scientific studies, including having anticancer, anti-inflammatory, antifungal, antibacterial, and antihypertensive activity [4]. Based on the results of previous studies it has been reported that methanol extracts of celery seeds and broccoli flowers 400 and 300 mg/kg BW induced by Sprague Dawely mice can significantly reduce blood glucose levels and increase serum insulin concentrations in test rats [5].

2 Research Methods

2.1 Research Design

2.1.1 Place and Time of Research

This research was a true experiment with pre-test and post-test only control group design approaches, on 25 mice.

This research was conducted at the Laboratory of Chemistry and Biology, Polytechnic Medica Farma Husada Mataram. The antidiabetic activity test was carried out at the Biology Laboratory of the Medica Farma Husada Mataram Polytechnic in July 2020.

2.2 Operational Variables and Definitions

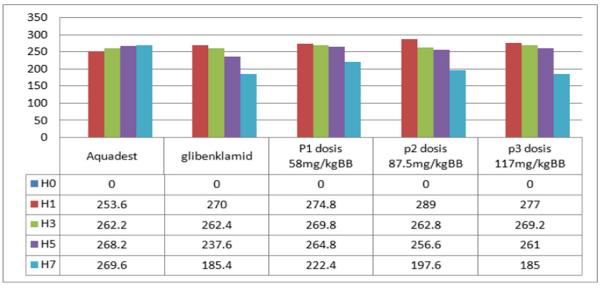
The variables in this study included the independent variables of this study were celery leaf extract (Apium graveolens L) obtained by maceration method using 96% methanol as solvent. The dependent variable in this study was the antidiabetic activity by measuring blood sugar levels in mice from celery leaf extract (Apium graveolens L). The operational definition in this study is the ethanol extract of celery leaves (Apium graveolens L), blood sugar levels, male mice (Mus Musculus L).

2.3 Data Collection Technique

The data collection technique in this research was done by checking the blood sugar levels of Pre-DM and DM in mice (Mus musculus L).

3 Results and Discussion

3.1 Results in Average Blood Glucose Levels



	Aquadest	glibenklamid	P1 dosis 58mg/kgBB	p2 dosis 87.5mg/kgBB	p3 dosis 117mg/kgBB
H0	0	0	0	0	0
H1	253.6	270	274.8	289	277
H3	262.2	262.4	269.8	262.8	269.2
H5	268.2	237.6	264.8	256.6	261
H7	269.6	185.4	222.4	197.6	185

Fig. 1. Average Blood Glucose Levels of Mice per Day.

Information:
H1: Day 1 P1: Treatment of 1 celery extract at a dose of 58 mg/kg BW
H3: Day 3 P2: Treatment of 2 celery extracts at a dose of 87.5 mg/kg BW
H5: Day 5 P3: Treatment 3 celedridosis extracts 117 mg/kg BW
H7: Day 7

The graph in Fig. 1 shows that the blood glucose levels in the Aquadest group from H1 increased until day 7 with an average blood glucose level of 253.6 mg/dl to 269.6 mg/dl because there was no treatment in the Aquadest group. In the treatment group Glibenclamide from H1 decreased with blood glucose levels of 270 mg/dl decreasing on day 7 with blood glucose levels of 185.4 mg/dl. In the P1 treatment group with a dose of 58 mg/kg body weight also decreased from day 1 with a blood glucose level of 274.8 mg/dl experiencing a decrease to 224.4 mg/dl. In P2 group with a dose of 87.5 mg/kg body weight decreased from H1 with blood glucose levels of 289 mg/dl decreased in H7 with blood glucose levels of 197.6 mg/dl. And in the P3 treatment group with a dose of 117 mg/kgBW experienced a decrease from H1 with a blood glucose level of 277 mg/dl and the most effective was a decrease in H7 with a blood glucose level of 185 mg/dl.

3.2 ANOVA Test Results

Table 1 shows the results of the analysis (ANOVA) showing the p value (sig.) of 0.743 in H1 treatment there is no difference because the P value > 0.005. In the H3 treatment, the Psebesar value was $0.837 > 0.005$, which means there was no difference because the sig value was >0.005. And H7 treatment shows a sig value of $029 < 0.005$, which

Table 1. Comparative Test Results of Blood Glucose Levels

		Sum of Squares	Df	Mean Square	F	Sig.
H1	Between Groups	4481.440	4	1120.360	.490	.743
	Within Groups	45740.000	20	2287.000		
	Total	50221.440	24			
H3	Between Groups	3425.600	4	856.400	.356	.837
	Within Groups	48154.400	20	2407.720		
	Total	51580.000	24			
H7	Between Groups	25431.440	4	6357.860	3.375	.029
	Within Groups	37680.400	20	1884.020		
	Total	63111.840	24			

means there is a difference because the p value < 0.05. So the comparison of H1, H3 and H7 in all treatment groups K−, K+, P1, P2, P3 is more effective. On H7 with the highest dose in the P3 group 117 mg/kgBW. So that the decision taken is to reject Ho or accept H1 which means in other words celery leaf extract can reduce blood glucose levels.

3.3 Discussion

One of the extract quality parameters is the yield of the extract produced. Yield is the ratio of the amount (quantity) of extract produced from plant extracts, the extract yield is calculated based on the ratio of the final weight (weight of the extract produced) to the initial weight and multiplied by 100% [6]. The yield value produced by celery leaf extract was 3.65%.

The results of this study indicate that the blood glucose levels in the Aquadest group from H1 increased up to day 7 with an average blood glucose level of 253.6 mg/dl to 269.6 mg/dl. In the treatment group Glibenclamide from H1 decreased with blood glucose levels of 270 mg/dl decreasing on day 7 with blood glucose levels of 185.4 mg/dl. In the P1 treatment group with a dose of 58 mg/kg body weight also decreased from day 1 with blood glucose levels of 274.8 m g/dl experiencing a decrease to 224.4 mg/dl. In the P2 group with a dose of 87.5 mg/kg BW experienced a decrease from H9 with a blood glucose level of 289 mg/dl decreased in H7 with a blood glucose level of 197.6 mg/dl. And in the P3 treatment group with a dose of 117 mg/kg BW also decreased from H1 with a blood glucose level of 277 mg/dl to H7 with a blood glucose level of 185 mg/dl.

Furthermore, the results of the test analysis (ANOVA) showed a p value (sig.) Of 0.743 in H1 treatment there was no difference because p value > 0.005. In the H3 treatment, the p value is $0.837 > 0.005$, which means there is no difference because the sig value > 0.005. In the H7 treatment, the sig value is $029 < 0.005$, which means that there is a difference because the p value is < 0.05. So the comparison of H1, H3, and H7 in all treatment groups K−, K+, P1, P2, P3, which was more effective, experienced

a decrease in H7 with the highest dose, namely in the P3 group of 117mg/kg BW. So that the decision taken is to reject Ho or accept H1, which means in other words celery leaf extract can reduce blood glucose levels.

The decrease in blood glucose levels in mice in various treatment groups was caused by the presence of flavonoids, saponins and tannins in celery, which act as antioxidants. Flavonoids are known to be able to capture free radicals via electron transfer and inhibit peroxidation reactions. Flavonoids can act directly on pancreatic beta cells, by triggering the activation of a signal cascade to amplify glucose-sensitized insulin secretion. Saponins are also responsible for maintaining intracellular Ca2+ concentration and homoestasis. Saponins can stimulate insulin secretion in pancreatic beta cells [7].

According to Rohilla and Ali [8] explained that the destruction of the β cells of the pancreas which can produce insulin is caused by alloxan which is a pyrimidine oxygen derivate. Alloxan is able to induce a multiphase blood glucose response when injected into experimental animals which is accompanied by changes in plasma insulin concentrations followed by sequential changes in β-cell ultrastructures that ultimately lead to necrotic cell death.

Previous research by Suarsana [9] reported that one of the factors was the very large variation in the blood glucose profile of alloxan-induced mice because the resistance of different mice to alloxan caused the initial conditions of diabetes to be not uniform. The results of the initial experiment, namely on the 0th to 7th day after alloxan injection showed that there were differences in blood glucose levels of mice.

Before the hyperglycemia was made, all the mice in the treatment group had their blood drawn. The process of taking blood was carried out on the tail of each mouse to check blood glucose levels. After that, mice with blood glucose levels above 200 mg/dl were used in this study because mice were considered to have hyperglycemia [10].

Hyperglycemic mice have polyuria. This can be seen in damp cage conditions. These mice were then given treatment according to the test group orally for 7 days. Glibenclamide positive control was used as a comparison to see the effect of oral antidiabetic which has proven its efficacy to reduce blood glucose levels. The dose of glibenclamide used was 0.65 mg/kg BW, this dose was used based on the effective oral dose in humans, namely 5 mg/day which was then converted to the dose of mice [11].

The dose of glibenclamide of 0.65 mg/kgBW which was given refers to previous research [12] which can effectively reduce blood glucose levels in mice tested animals by a percentage of 185.4% on Day 15. Determination of the dose of celery leaf extract (Apium Graveolens L.) which can provide a decrease in blood glucose is done by using the Anova test, the value is 0.029 at a dose of 117mg/kgBB on the 15th day.

This proves that the administration of celery leaf extract (Apium Graveolens L) at a dose of 117 mg/kg BW is equivalent to a positive control glibenclamide dose of 0.65 mg/kg BW in mice is even more effective, but the group dose of P157 mg/kg BW, and the group dose is P2 87, 5 mg/kg BW tends to be lower. This is due to the saturation point of the treatment so that the decrease will look stable or constant.

Thus, the influence of the flavonoid, saponin, and tannin groups as electro-giving compounds can inhibit the oxidation process due to damage such as genetic mutations. So that the damage to panceratic beta cells, DNA in normal cells due to free radicals and carcinogenic compounds can be controlled because of the antioxidant properties

found in plants which contain flavonoid, saponin and tannin compound groups. This is in accordance with the statement [4] which says that celery leaves are proven to have antioxidant activity.

4 Conclusions and Suggestions

4.1 Conclusions

In the aquadest control group there was no decrease due to the absence of treatment, whereas in the glibenclamide group and the other celery extract treatment groups P1 58 mg/kgBB, P2 87.5 mg/kgBB, and P3 117 mg/kgBB, there was a decrease in H1 to 7. However decreased in P3 treatment at a dose of 177 mg/kgBW on day 7. The results of the SPSS test, which was more effective, decreased in H7 with the highest dose, namely in the P3 treatment group 117 mg/kgBW because the sig value < 0.005.

4.2 Suggestions

Further research needs to be done using celery leaf extract (Apium Graveolens L) with a higher dose level.

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