PHYTOCHEMICAL SCREENING AND ANTIHYPERGLYCEMIC ACTIVITY OF ETHANOLIC EXTRACT OF *Coriandrum sativum* L. LEAF

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ABSTRACT

The synthetic drugs for DM treatment are available in the market, but they have side effects in long term treatment. This makes a research about effective natural resources to reduce diabetes intensity are rampant, one of them is Coriander leaf (*Coriandrum sativum* L). Ethanolic extract of coriander leaf (EELC) was tested for phytochemical screening and anti-diabetic activity, by glucose tolerance test in normal rats and alloxan-induced diabetic mice. The mice were divided into five groups of six animals each (diabetic control, standard drug-treated, and plant treated groups (100, 20 and 400 mg/kg bw)). On the 0th, 3th, 6th, 9th, 12th and 15th days, the blood samples were analyzed for blood glucose. The results of phytochemical screening showed that EELC has a lot of phytochemical compounds such as alkaloids, flavonoids, tannins, glycosides, saponins and steroids. Antihyperglycemic study showed that there were not have significant differences between EELC and metformin 65 mg/kg bw group. Based on the research investigation, it can be concluded that EELC has an antihyperglycemic effect.

Keywords: Coriander, Alloxan, Antihyperglycemic, Extract, Ethanolic

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INTRODUCTION

Hyperglycemia is a medical condition in the form of an increase in blood glucose levels exceeding the normal limit. Hyperglycemia is one of the typical signs of diabetes mellitus (DM), although it may also be found in several other conditions.¹ Treatment of DM disease by using two groups of drugs, namely insulin and oral drugs that have hypoglycemic effects such as glibenclamide, tolbutamide, and metformin. These synthetic drugs are available on the market, but in the long term will have side effects.² Side effects of these drugs could be included hypoglycemia and digestive disorders.³ This makes research on natural ingredients that are effective in reducing the intensity of diabetes is being carried out.⁴ One of these plants is Coriander (*Coriandrum sativum* L.), whose leaf parts have been used in many traditional medicine systems to treat some diseases. There are a large number of compounds isolated from Coriander, including flavonoids (quercetin), polyphenols, β -carotene, cineol, coumarin, and tannins. Traditionally, coriander is used for the treatment of antiseptic, gastrointestinal complications, and antidiabetes.⁵ The aim of this study is to investigate the phytochemical compounds in EELC and evaluate the antihyperglycemic activity on alloxan-induced diabetic mice.

EXPERIMENTAL

Sample Collection

Fresh leaf of Coriander (*Coriandrum sativum* L.), were collected from the local market of Medan (Indonesia). The plant specimen was identified and authenticated by the Herbarium Medanense (MEDA) Universitas Sumatera Utara (No: 3928/MEDA/2019). Fresh leaf of coriander was dried in open air without exposure to direct sunlight and then the dried sample was powdered by mechanical milled.

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Extract Preparation

Extract of coriander leaf was prepared by the ethanolic solvent by using maceration method for 5 days. About 300 g of the fine powder coriander leaf was extracted with 96% ethanol by using maceration for 5 days at room temperature. The ethanol extract of coriander leaf (EECL) solution part was evaporated by using rotary evaporator to get the crude extract.^{6,7}

Preliminary Phytochemical Screening

The crude extract of EECL was screening by using the standard protocol to know the presence of phytochemical compounds.⁸

Animals Preparation

Healthy adult male mice (± 20 g of body weight) were obtained from Animal House of Faculty of Pharmacy, Universitas Sumatera Utara. Mice were housed in polycarbonate cages at room temperature with 12 hrs day-night circle. The mice were fed on a standard animal pellet and water freely. This study was approved by AREC No: 00141/KEPH-FMIPA/2019) which the experiments were conducted according to the ethical norms by AREC.⁹ The animals were fasted for 12h before experimentation but allowed free access to water.

Oral Glucose Tolerance Test

This method was using fasted mice which are divided into 5 groups of six male mice each. Group I as the control group (Na CMC 0.5%), Group II-IV received EECL respectively at dose 100, 200 and 400 mg/kg bw. Group V received glibenclamide 0.65 mg/kg bw. All the mice from these 5 groups were given glucose (3g/kg bw) by p.o 30 mins after administration of the Na CMC, EECL and glibenclamide. Blood samples were collected at 30, 60, 90 and 120 min after the glucose loading and measured by glucometer.

Alloxan Induced Test

Male mice were induced diabetic (hyperglycemia) by a single i.p injection of alloxan (160 mg/kg bw) After 3 days, blood samples were collected to confirm the development of hyperglycemic activity. These diabetic mice then divided into 5 groups which are group I as control group (Na CMC 0.5%), Group II-IV received EECL respectively at dose 100, 200 and 400 mg/kg bw. Group V received metformin 0.65 mg/kg bw. Blood samples were collected and measured respectively at 0th, 3th, 6th, 9th, 12th and 15th days by using glucometer.

Statistic Analysis

All the data were expressed as mean $\pm$ SEM. The significant difference of data between different groups was compared by ANOVA followed by Post Hoc Tukey HSD test.

RESULTS AND DISCUSSION

Preliminary Phytochemical Screening

Preliminary phytochemical screening was tested by standard procedure on the EECL. Table-1 showed the result of phytochemical screening. Alkaloids, flavonoids, tannins, glycosides, saponins and steroids are present in EECL. All of these phytochemical compounds are predicted to have a beneficial pharmacological effect to us.⁹

Table-1: Preliminary Phytochemical Screening of EECL

Phytochemical Compounds	Test	Results
Alkaloids	Mayer Test	Positive
	Bouchardat Test	Positive
	Dragendorff Test	Positive
Flavonoids	Shinoda Test	Positive
Saponins	Froth Forming Test	Positive
Glycosides	Glycosides Test	Positive
Steroids	Liebermann-Burchard Test	Positive

Oral Glucose Tolerance Test

From the results of the Post Hoc Tukey HSD statistical analysis at 120 minutes (Table-2), it was found that the EECL group 100, 200, and 400 mg/kg bw did not have a significant difference with the glibenclamide group 0.65 mg/kg bw ($p > 0.05$). This shows that EECL 100, 200, and 400 mg/kg bw resembles the antihyperglycemic glibenclamide effect and can reduce the glucose level of mice.

Table-2: Oral Glucose Tolerance Test Result

Group	Average Blood Sugar Level (mg/dL)				
	Time (min)				
	0 (fasting)	30	60	90	120
Na-CMC 0.5%	84 ± 3.80	257.75 ± 10.64 ^{*b}	294.75 ± 24.67	251 ± 13.08 ^{*b}	238.75 ± 14.66 ^{*b}
EECL 100 mg/kg bw	88.75 ± 4.64	249.25 ± 42.63 ^{*b}	261 ± 95.48 ^{*b}	211 ± 72.73 ^{*b}	92.25 ± 16.96 ^{*b}
EECL 200 mg/kg bw	83.25 ± 5.36	222.25 ± 37.21 ^{*b}	222 ± 31.21 ^{*b}	122.5 ± 8.22	95.5 ± 5.95 ^{*a}
EECL 400 mg/kg bw	81.75 ± 5.39	289.25 ± 61.92 ^{*b}	199.75 ± 67.32 ^{*b}	116.5 ± 15.26	79.25 ± 7.97 ^{*a}
Glibenclamide 0.65 mg/kg bw	82.5 ± 3.77	128 ± 13.12	82.25 ± 6.83	74.5 ± 7.63 ^{*a}	63.5 ± 2.87 ^{*a}

Values are given as mean ± SEM for six mice in each group. ^{*a} $P < 0.05$ significant difference compared with Na-CMC 0.5%. ^{*b} $P < 0.05$ significant difference compared with glibenclamide.

Alloxan Induced Test

Based on the Fig.-1, it can be concluded that EECL groups were able to reduce the blood glucose of mice induced by alloxan. The decreased in blood glucose with EECL therapy can be caused by the presence of bioactive compounds contained in EECL which can prevent the oxidation of pancreatic beta cells due to the induction of alloxan so that damage can be minimized. Bioactive compounds contained in EECL included flavonoids, alkaloids, saponins, tannins, glycosides, and steroids.

Fig.-1: Blood Glucose Level

Flavonoids have hypoglycemic effects by several mechanisms, such as by stimulating insulin release or acting like insulin, inhibiting glucose absorption, increasing glucose tolerance, increasing glucose uptake by peripheral tissues and regulating enzymes that play a role in carbohydrate metabolism.¹⁰ Flavonoids are protective against beta-cell damage as an insulin producer and can increase insulin sensitivity.¹¹ Polyphenols, and flavonoids are known to play a role in antioxidants and have the potential to attract free radicals. Previous research shows that total antioxidant activity and phenolic content in coriander extract both leaves and stems can be utilized as a source of important natural antioxidants with potential health protection.¹²

Alkaloids work by stimulating the hypothalamus which will induce hypoglycemia and reduce gluconeogenesis so that blood glucose levels and insulin requirements decrease. Alkaloids are also shown to have the ability to regenerate damaged pancreatic β cells. Tanin has hypoglycemic activity by increasing glycogenesis, besides that, tannin also functions as chelating which shrinks the small intestinal epithelial membrane thereby reducing the absorption of food essence and as a result inhibits sugar intake and the rate of increase in blood sugar is not too high.¹³

Saponin can provide a hypoglycemic effect because it is able to regenerate the pancreas which causes an increase in the number of pancreatic and langerhans beta cells so that insulin secretion will increase. Increased insulin secretion will help reduce blood glucose levels.¹⁴ The ability of saponins to reduce blood glucose levels makes saponins a very good and efficient antioxidant in the remediation of diabetes mellitus.¹⁵

The pathological conditions of experimental animals do not fully describe real pathological conditions in humans. This is due to differences in physiological conditions, pathology of several models of diabetes mellitus, the variety of diabetes mellitus, and the existence of complications from the disease.¹⁶

CONCLUSION

Phytochemical screening of EECL showed the presence of many phytochemical compounds, such as alkaloids, flavonoids, tannins, glycosides, saponins and steroids. EECL also showed antihyperglycemic effect against alloxan induced in mice. It could be concluded that EECL has immense potential for developing a novel and safe treatment for diabetes.

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