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Glucose Lowering Effect of Basil Leaves in Diabetic Rats

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Abstract

BACKGROUND: The incidence of diabetes and its complications has risen since the last decades, and it has been predicted that the prevalence of diabetes will be double in the coming year. Chronic hyperglycemia marked as elevated advanced glycation end products plays an important role in complications of diabetes. Basil leaves (Ocimum basilicum) originating from India and commonly found in Southeast Asia, is widely used empirically to decrease the blood sugar in diabetic patients.

AIM: The purpose of the study was to investigate the effect of extract ethanol of Basil leaves in diabetic rats.

METHODS: This is an experimental study; Streptozotocin was used to induce type 2 diabetic rats. Thirty Wistar male rats were divided into six groups (normal group, group treated with metformin 45 mg/kg body weight, group treated with Basil leaves 100 mg/kg body weight, 200 mg/kg body weight, 400 mg/kg body weight, control diabetic group). The blood glucose level was measured before induction and after treatment at week 1 and 4. Advanced glycation end products were measured in all groups at week 4.

RESULTS: Extract ethanol of basil leaves 100, 200, 400 mg/body weight all showed significant lowering blood glucose level ($p < 0.001$) compared to diabetic group without treatment, but did not show superior to metformin group ($p = 0.17$), advanced glycation end products did not show statistical significance between group with normal rats and group of diabetic rats treated with basil leaves 100 mg/kg, 200 mg/kg, 400 mg/kg ($p = 0.12$, $p = 0.33$, $p = 0.26$).

CONCLUSION: Extract ethanol of basil leaves showed good results in lowering blood glucose and advanced glycation end products in diabetic rats.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease manifested with hyperglycemia caused by insulin deficiency or resistance. Prolonged elevation of the blood glucose level will cause macro and microvascular complications that resulted in damage of various organs of the body. More than eighty per cent of these conditions were found in low- or middle-income countries [1]. It is estimated that in 2030, in every ten adults one person will get diabetes mellitus (DM) [2]. Chronic hyperglycemia may induce glycation of various plasma proteins, and collagen [3] thus advanced glycation end-products (AGEs) are largely produced and accumulated in various tissues and blood circulation [4]. This result of protein formation through non-enzymatic processes caused by high blood sugar levels are thought to alter the hemostatic system, activated coagulation system and generation of oxygen free radicals. Advanced glycation is one of the major causes of diabetic complications [5], [6]. Control diets, exercise and medicine, have been the mainstay treatments of diabetes [7], [8], [9]. Most of the people in Indonesia still used traditional medicine empirically to treat diabetes, like Poguntano leaves [10] as Indonesia is a country of plenty of medicinal plants. Basil leaves (Ocimum basilicum) from family Lamiaceae (mints) known as the king of herbs or "royal herb" originating from India and commonly found in Southeast Asia, is widely used as a culinary ingredient [11], [12].

Empirically, it was used widely to decrease

blood sugar in diabetic patients. Basil leaves were reported to have antihyperglycemic and liver protective effects as it stimulates the release of insulin from the pancreas, inhibit the glucose production in the liver and increased glycogen synthesis [13], [14].

This study aimed to study the effect of basil leaves on blood glucose level and AGE in diabetic rats.

Methods

This is an experimental study using Streptozotocin (STZ) in a dose of 40 mg/body weight injected intraperitoneal to induce type 2 diabetic rats. Thirty Wistar male rats weighed 150-200 grams were divided into six groups (normal group, group treated with metformin in a dose of 45 mg/kg body weight, group treated with basil leaves 100 mg/kg body weight, 200 mg/kg body weight, 400 mg/kg body weight, control diabetic group) for four weeks. Blood glucose levels were measured before starting the experiment; after the induction, blood glucose levels were measured in all groups at week 1, 4 and AGE level were measured in all groups at week 4.

This study will be analysed using SPSS V20 with One Way ANOVA.

Preparation of basil extract

Extraction was carried out by maceration using 96% ethanol as solvent standardisation of extracts including the determination of water content, levels of water-soluble and ethanol extracts, total ash content, insoluble acid and chromatogram profiles [15].

Laboratory Assay

Blood Glucose was measured using spectrophotometry, and AGE using sandwich Elisa with a double antibody.

Results

One way ANOVA was used to analyse the blood glucose levels at week 4 within groups, and it showed statistically significant (p = 0.0). Post hoc was used to analysed further and found out that the blood glucose level was statistically significant differences within the diabetic and treatment groups (p = 0.00) but did not show the statistical difference (p = 1) within treatment groups (metformin and basil groups).

Table 1: Blood Glucose level before induction of Streptozocin in all groups

	Group A	Group B	Group C	Group D	Group E	Group F
Blood Glucose level (mg/dl)	78 ± 2	79.3 ± 1.5	78 ± 2	80 ± 2	79.3 ± 2	81. 3 ±1.5

Note: Group A: normal control, Group B: Diabetic Control, Group C: a group treated with metformin, Group D: group treated with basil 100 mg, Group E: a group treated with basil 200 mg, Group F: a group treated with basil 400 mg.

Advanced glycation end products showed statistical significant within diabetic control group and group treated either with metformin or basil leaves (p = 0.01), but did not showed statistical significance between group with normal rats and group of diabetic rats treated with basil leaves extracts 100mg/kg, 200 mg/kg, 400 mg/kg (p = 0.12, p = 0.33, p = 0.26).

Table 2: Data of blood glucose level and AGE of experimental rats

	Group A	Group B	Group C	Group D	Group E	Group F
T1 (mg/dl)	80 ± 1	501 ± 6.1	553 ± 5	473 ± 2.5	531 ± 4.1	525 ± 7.8
T4 (mg/dl)	80 ± 1.5	495 ± 4.6	92 ± 4	131 ± 6.4	123 ± 3	107 ± 3
AGE (ng/ml)	8.5 ± 1.3	5.6 ± 1.4	17 ± 1.0	4.6 ± 1.8	5.5 ± 1.8	5.2 ± 1.3

Notes: T1: blood glucose level after 1 week STZ injection; T4: blood glucose level week 4.

Discussion

Basil leaves extract showed statistical significant lowering blood glucose between the diabetic control group and the group treated with metformin or basil leaves either in 100, 200, 400 mg/kg body weights (p = 0.0), but did not show a statistical difference within the treatment group (p = 1). This means that either metformin or basil leaves can be used for lowering blood glucose, and one is not inferior to the other; this has been reported by Eddouks M and Kumar S that basil leaves have the ability as anti-diabetic agents and improve the insulin sensitivity [16], [17].

Advanced glycation end products showed a significant difference between the diabetic control group and group treated either with metformin or basil leaves; these results showed that the Basil leaves could also be used to treat the chronic hyperglycemic effect of diabetes, one of the most important issues in diabetes.

In the basil treatment group, we do not find any inferior effect in lowering blood glucose level in the three groups (100 mg, 200 mg, 400 mg/kg body weights).

In conclusion, extract ethanol of basil leaves showed good results in lowering blood glucose and advanced glycation end products in diabetic rats.

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