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The Difference in Effect of Arabica Coffee Gayo Beans and Leaf (*Coffea Arabica Gayo*) Extract on Decreasing Blood Sugar Levels in Healthy Mice

Sake Juli Martina[1, 2*], Pradeepa A. P. Govindan[1], Arlinda Sari Wahyuni[3]

[1]*Department of Pharmacology and Therapeutics Faculty of Medicine, Jl. Dr Mansur No.5 Kampus USU, Medan, Indonesia;* [2]*University Sumatera Utara Hospital, Jalan dr. T. Mansur No.66 Kampus USU, Medan, Indonesia;* [3]*Department of Public Health, Faculty of Medicine, Universitas Sumatera Utara, Jl. Dr Mansur No.5 Kampus USU Medan, Indonesia*

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Abstract

BACKGROUND: High incidence rate of diabetes mellitus (DM) and increased incidence of complications from DM as well as the use of less effective antidiabetic drugs and high financing to treat demands alternative therapy.

AIM: This study was conducted to determine the difference in the effect of Arabica coffee gayo bean and leaf extract on blood sugar levels in healthy mice before and after the intervention of extract and fasting and postprandial blood glucose level after consumption of glucose.

METHODS: This research is an experimental research study. The study used experimental animals which were divided into 8 groups which are the control group (Aquadest), group given Acarbose, the group given the Arabica coffee gayo bean extract with dosage of 50 mg, 100 mg and 200 mg in healthy mice, the group given the Arabica coffee gayo leaf extract with dosage of 30 mg, 60 mg and 120 mg in healthy mice.

RESULTS: The results of the study obtained are before and after the intervention of extract showed the difference of p= 0.523 and after consumption of glucose the fasting and postprandial result showed the difference of p = 0.005.

CONCLUSION: The use of Arabica coffee gayo bean and leaf extract showed a high decrease in blood glucose levels (BGL) compared to the control group.

Introduction

Diabetes mellitus (DM) is a clinical symptom that arises due to an increase in chronic blood glucose levels due to lack of insulin, both relative and absolute [1]. DM is also a chronic disease that requires long-term management [2].

Type 1 diabetes patients and type 2 diabetes who prescribe flexible insulin therapy programs, education on how to use carbohydrate calculations and in some cases estimation of grams and protein grams to determine the time-consuming insulin dose is recommended to increase glycemic control [3].

Studies that examined the ideal number of carbohydrate intake for people with diabetes were inconclusive, despite monitoring carbohydrate intake and considering blood glucose responses to carbohydrate diets to improve postprandial glucose control. The literature on the glycemic index and the glycemic load in individuals with diabetes is complex often producing mixed results, although in some studies reducing the glycemic load of carbohydrates consumed has been shown to decrease A1C-0.2% to -0.5%. Study reports of more than 12 weeks have no significant effect on glycemic index or independent glycemic load weight loss on A1C; however, mixed results have been reported for fasting glucose levels and endogenous insulin levels [3].

Globally, an estimated 422 million adults lived with diabetes in 2014, compared with 108 million in 1980. The global prevalence (standard age) of diabetes has nearly doubled since 1980, increasing from 4.7% to 8.5% in the adult population. This shows an increase in related risk factors such as being overweight or obese. Over the past decade, the prevalence of diabetes has increased more rapidly in low- and middle-income countries than in high-income countries. Diabetes caused 1.5 million deaths in 2012. Higher than optimal blood sugar caused an additional 2.2 million deaths, increasing the risk of cardiovascular disease and others. Forty-three percent of the 3.7 million deaths occur before the age of 70 years. The percentage of deaths caused by high blood glucose or diabetes that occur before age 70 is higher in low and middle-income countries than in high-income countries [4].

A decrease in blood sugar levels can be reduced by taking acarbose treatment which is a treatment of artificial oligosaccharides which is competitive inhibitors and can inhibit the action of the α-glucosidase enzyme, which can slow digestion in carbohydrates [5].

Also, a decrease in blood sugar levels can be reduced by using Arabica coffee gayo bean extract as an alternative treatment. Consuming coffee can help reduce the risk of type 2 diabetes, while caffeine promotes lipolysis in adipocytes. Chlorogenic acid, another major constituent of coffee beans, has recently been reported to selectively inhibit hepatic glucose-6-phosphatase which is a limitation of the rate of enzymes involved in gluconeogenesis. However, roasting coffee beans has been shown to reduce the chlorogenic acid content in coffee. Arabica coffee gayo beans are rich in chlorogenic acid and their related compounds have a hypotensive effect [6].

Therefore, this study was conducted to determine the effect of Arabica coffee gayo bean extract on blood sugar levels in healthy mice after loading glucose.

Material and Methods

This research is an experimental study. The study used 25 animals as mice which were divided into 5 groups, namely the control group (-) (Aquadest), control group (+) (Acarbose) with a dose of 6.5 mg/KgBB, groups of Arabica coffee gayo beans with dosage of 50 mg, 100 mg and 200 mg and Arabica coffee gayo leaf with dosage of 30 mg, 60 mg and 120 mg. This research was conducted at the Pharmacology Laboratory at the University of North Sumatra (USU). In this study male mice (Mus musculus) will be used, Double Distsch Webster strain (DDW) age: 2-3 months (adults), weight 20-30 grams,

healthy, never used in other studies. Mice were obtained from the FMIPA Biology USU Medan Laboratory. Arabica coffee gayo bean and leaf extract will be provided in the pharmacy faculty. The raw material for Arabica coffee gayo beans and leaves is obtained from a doctor.

The selection of samples and groupings was carried out using simple random sampling, in which every 40 samples that met the predetermined inclusion criteria will be numbered, then divided into 8 groups.

Arabica coffee gayo bean and leaf extract are done by drying. After that, the coffee beans and leaves are stretched to become smooth, and ethanol is 96% and mixed with Aquadest so it becomes 50% ethanol and left for 5 days for masturbation. Arabica coffee gayo bean and leaf extract are stirred every day. After 5 days, coffee bean and leaf extract are evaporated and left for 3 days to become thick, after 3 days coffee bean and leaf extract can be used for experimental research. Experimental research was carried out by administering aqua destilata, acarbose, Arabica coffee gayo bean extract with a dose of 50 mg, 100 mg, and 200 mg and Arabica coffee gayo leaf extract with dosage of 30 mg, 60 mg and 120 mg given to mice. Treatment and extract interventions were given for 3 days. On the third day, the blood glucose level (BGL) of mice were examined after the intervention and were fasted so that day 4. On day 4, BGL was examined for mice fasting, then given starch at a dose of 5 g/Kg to increase the BGL of mice and examined BGL postprandial mice. This research was conducted for 4 days. BGL mice are measured by the EasyTouch brand glucometer in mmol/L units and mice are given food every day while conducting research in the form of corn pellets, as much as 5 grams/day and also given as much as 30 ml water drinks. The thing that needs to be considered in this study is if the group of Arabica coffee gayo beans and leaves are effective to reduce BGL mice.

Results

The results of the study obtained are as followed below:

Table 1: Results Comparison of BGL of mice before and after the intervention of the green coffee bean group with the green coffee leaf group

Group	Comparison Group	N	Average	Standard Deviation	P
Arabica Coffee Gayo Bean	Arabica Coffee Gayo Leaf	14	-1.20	6.83	0.523

Description: Paired T-test = significance; p < 0.05.

Based on the results of Table 1, Paired T-test results of comparison of green coffee bean groups

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with a dose of 50 mg, 100 mg and 200 mg with a group of green coffee leaves with a dose of 30 mg, 60 mg and 120 mg showed a p-value = 0.523 was not significant because the p-value < 0.05.

Table 2: Results Comparison of BGL fasting mice and Post Prandial groups of green coffee beans with groups of green coffee leaves

Group	Comparison Group	N	Average	Standard Deviation	P
Arabica Coffee Gayo Bean	Arabica Coffee Gayo Leaf	14	0.84	0.93	0.005

Description: Paired T-test = significance; p < 0.05.

Based on the results of Table 2, Paired T-test results of comparison of green coffee bean groups with a dose of 50 mg, 100 mg and 20 0mg with a group of green coffee leaves with a dose of 30 mg, 60 mg and 120 mg showed a p-value = 0.005 was significant due to a p-value < 0.05.

Discussion

This study showed that from 38 mice grouped into 8 groups with 5 mice per group, two mice were excluded due to the exclusion criteria of the study. In clinical trials, the results showed before and after the intervention of extract showed the difference of p = 0.523 and after consumption of glucose, the fasting and postprandial result showed the difference of p = 0.005.

The above results can occur because Arabica coffee gayo beans have chlorogenic acid compounds, consumption of chlorogenic acid in coffee can reduce the risk of type 2 diabetes mellitus. These compounds can stimulate glucose uptake in skeletal muscles through activation of adenosine monophosphate-activated protein kinase (AMPK). AMPK can show a positive impact that can direct the results of metabolites of useful substances such as decreased glucose production in the liver and fat synthesis [7].

There are epidemiological evidence and other significant evidence that coffee consumption reduces the risk of type 2 diabetes. One large study indicated a 50% risk reduction for people who drank seven cups of coffee a day compared to those who only drank two cups a day. Evidence shows chlorogenic acid as the active ingredient in coffee that prevents diabetes and improves glucose control in normal, prediabetic and diabetic patients [8].

Besides that, the Arabica coffee gayo leaves have mangiferin compounds which are useful for reducing the risk of heart disease and diabetes mellitus. Besides, coffee leaves also contain high amounts of antioxidants compared to green tea and

black tea. The findings indicate that it promises that coffee leaves can be beneficial to be processed as a standardized herbal product that can be consumed daily and has efficacy as an anti-diabetes mellitus [9].

From the results of this study, it can be concluded as follows the use of Arabica coffee gayo bean and leaf extract showed before and after the intervention of extract showed the difference of p = 0.523 and after consumption of glucose the fasting and postprandial result showed the difference of p = 0.005

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