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Research Article

Antidiabetic Activity of First Grade Orthodox Black Tea in Alloxan Induced Male Albino Mice

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ABSTRACT

The present study was carried out to evaluate antiabetic activity of first grade orthodox black tea in alloxan induced white male mice. Generally, administered of first grade orthodox black tea infusion expected of PF, showed a better reduction toward blood glucose level as compared with normal control, distilled water. On treatment with infusion of first grade orthodox black tea, the fasting mean blood glucose level on day 1 (after being diabetic) i.e. 92.00 ± 5.79 mg/dl reduce to 67.40 ± 17.11 mg/dl, 81.20 ± 20.77 mg/dl to 68.00 ± 18.40 mg/dl, 110.00 ± 8.34 mg/dl to 63.00 ± 15.66 mg/dl, 92.40 ± 5.50 mg/dl to 83.60 ± 3.65 mg/dl for BOP, BOPF, Dust and BP respectively. The reduction account for 26.74%, 16.26%, 42.73% and 9.62% respectively.

Keywords: Antidiabetic, orthodox black tea, alloxan, mice, phytochemical

INTRODUCTION

Diabetes mellitus is a metabolic disorder initially characterized by a loss of glucose homeostasis with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both[1]. Deficiency of insulin will affect the cells absorbinginsufficient glucose from the blood; hence blood glucose levels increase, which is termed as hyperglycemia. If the glucose level in the blood remains high over a long period of time, this can result in long-term damage to organs, such as the kidneys, liver, eyes, nerves, heart and blood vessels. Complications in some of these organs can lead to death[2]. In modern medicine, there were no satisfactory and effective therapy available to cure diabetes mellitus[3]. There is increasing demand by patients to use natural products with antidiabetic activity due to side effects associated with the use of insulin and oral hypoglycemic agents[4–6]. Plants and many plant derived preparations have long been used as traditional remedies for the treatment of diabetes in many parts of the world. Recently, tea (*Camellia sinensis*) have been widely studied to assess their beneficial effects in treatment and prevention of diabetes mellitus. In vitro and in vivo studies evidenced the potential of tea to normalize blood glucose level in diabetes mellitus[7]. Three main types of tea can be produced based on how the leaves of *Camellia sinensis* are processed: green tea (non-fermented), oolong tea (partly fermented), and black tea (fermented). More than 70% of tea produced in Indonesia is black tea and mostly exported in the form of first grade orthodox such as Broken Orange Pekoe (BOP), Broken Orange Pekoe Fanning (BOPF), Pekoe Fanning (PF), Dust, and Broken Pekoe (BP). This study aims to evaluate of antiabetic activity of first grade orthodox black tea in alloxan-induced male albino mice

MATERIALS AND METHODS

Plant Material

First grade orthodox black teas (BOP, BOPF, PF, Dust, and BP) were produced by Laboratory of Post Harvest Technology and Engineering, Research Institute for Tea and Cinchona, Indonesia.

Black Tea Infusion Preparation

Infusion of first grade orthodox black teas was prepared by Rohdiana et al., (2012)[8].

Pharmaceutical Study

Animals

Male albino mice (20-30g) were obtained from the School of Biological Science and Technology, Bandung Institute of Technology, Indonesia. The animals were kept under standard environmental conditions of temperature, relative humidity, dark/light cycle, and fed with standardized pellets and water ad libitum during the period in aluminum cages. The mice were fasted for 12hrs before experimentation but were allowed free access to water.

Animal Test Preparation

Alloxan monohydrate doses of 70 mg / kg b.w. administered intravenously through the mice. The mice were then grouped into 7 groups of five mice each as follows:

Group 1: Positive Control: glibenclamide (0.91 mg/kg b.w.)
Group 2: Normal control: distilled water (1 mL/20 g b.w)
Group 3: 1 mL/20 g b.w. BOP infusion 2% w/v
Group 4: 1 mL/20 g b.w. BOPF infusion 2% w/v

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Table 1: Effects of the first grade orthodox black tea infusion on blood glucose levels in alloxan induced diabetic mice (mg/dl).

Test material	Blood glucose level (mg/dL)			
	Sampling time (day)			
	0	1	7	14
Glibenclamide	92.80 ± 6.64	142.00 ± 6.91*	176.40 ± 12.79	114.00 ± 2.30
Distilled water	136.40 ± 7.57	107.80 ± 9.33	103.20 ± 2.54	106.80 ± 5.65*
BOP Infusion	121.20 ± 6.98	92.00 ± 5.79*	92.80 ± 4.14	67.40 ± 17.11
BOPF Infusion	110.00 ± 20.78	81.20 ± 20.77*	80.20 ± 21.87	68.00 ± 18.40
PF Infusion	99.80 ± 18.19	58.40 ± 16.10*	70.80 ± 20.01	66.20 ± 17.20
Dust Infusion	121. 00 ± 10.07	110.00 ± 8.34*	73.60 ± 18.50	63.00 ± 15.66
BP Infusion	96.60 ± 9.52	92.40 ± 5.50*	78.60 ± 7.21	83.60 ± 3.65*

P<0.05 with respect to both Glibenclamide and Physiological saline; The data was analyzed using Student's t-test. All the results were expressed as mean ± SEM.

Table 2: Phytochemicals screening of the first grade orthodox black tea infusion

Phytochemistry	First Grade Orthodox Black Tea Infusion				
	BOP	BOPF	PF	Dust	BP
Alkaloids	+	+	+	+	+
Flavonoids	+	+	+	+	+
Saponins	+	+	+	+	+
Tannins	+	+	+	+	+
Quinones	+	+	+	+	+
Steroids/triterpenoids	+	+	+	+	+

Key: +: present, -: absent

Group 5: 1 mL/20 g b.w. PF infusion 2% w/v
Group 6: 1 mL/20 g b.w. Dust infusion 2% w/v
Group 7: 1 mL/20 g b.w. BP infusion 2% w/v
The animals were treated orally once with each dose and fasting blood glucose concentrations were measured at 0, 1, 7, and 14 days[9]. Blood samples were taken by a snip-cut at the tip of the tail and blood sugar level was measured by using the Glucometer (OneTouch Ultra easy blood glucose monitoring system, LifeScan Europe Division of Cilag GmbH international 6300 Zug Switzerland).

Statistical Analysis

All the values of fasting blood glucose were expressed as mean ± SEM (n=5) and statistical significances between the treated and control groups (glibenclamide and distilled water) were analyzed by means of Student's t-test; *P* values <0.05 were considered significant.

Phytochemical Screening

Phytochemical screening was carried out on the dry tea and its infusion to determine the presence of alkaloids, tannins, terpenoids, flavonoids, and saponins[10].

RESULTS AND DISCUSSION

Pharmacological study

The effects of the first grade orthodox black tea infusion on fasting blood glucose levels in alloxan-induced male albino mice have been given in Table 1.

Phytochemical Screening

Phytochemical screening was done using color forming and precipitation of chemical reagent on tea infusion. The result obtained from the test were summarized in Table 2.

Generally, administered of first grade black tea infusion expected of PF, showed a better reduction toward blood glucose level as compared with normal control, distilled water. On treatment with infusion of first grade orthodox black tea, the fasting mean blood glucose level on day 1 (after being diabetic) i.e. 92.00 ± 5.79 mg/dl reduce to 67.40 ± 17.11 mg/dl, 81.20 ± 20.77 mg/dl to 68.00 ± 18.40 mg/dl, 110.00 ± 8.34 mg/dl to 63.00 ± 15.66 mg/dl, 92.40 ± 5.50 mg/dl to 83.60 ± 3.65 mg/dl for BOP, BOPF, Dust and BP respectively. The reduction account for 26.74%, 16.26%, 42.73% and 9.62% respectively.

The chemical test revealed the presence or absence of major secondary metabolites such as alkaloid, flavonoids, saponins, tannins, quinones, and steroids/triterpenoids in the black tea infusion. The presence of alkaloid, flavonoids, saponins, tannins, quinones, and steroids/triterpenoids on tea also was reported in the previous Study[11,12].

Several authors have reported that alkaloids, flavonoids, saponins, tannins, steroids/triterpenoids as bioactive antidiabetic principles[13]. Alkaloids have been severally reported to have antidiabetic activity. For example, Alkaloids isolated from *Catharanthus roseus* leaves have shown antidiabetic and antioxidant properties in mouse β-TC6 pancreatic cell line[14]. Generally, alkaloids have been said to inhibit α-glucosidase and decrease glucose transport through the intestinal epithelium[15,16].

Flavonoids have also been reported to suppress glucose level significantly and the typical flavonoid as luteolin, has been found to be a strong inhibitor of α-glucosidase[17].

Saponin an abundant secondary metabolite in the seed of *Entada phaseoloides*was reported[18]to have been able to reduced fasted blood glucose and serum insulin levels and then alleviates hyperglycemia associated oxidative stress in type 2 diabetic. In another study[19]reported that saponin extract from the root of *Garcinia kola* (bitter cola)

demonstrated remarkable antidiabetic activity more than metformin in alloxan-induced diabetic rats.The antidiabetic effects (α-amylase and α-glucosidase inhibition activities) of tannins extracted from some cereals, legumes, oil seeds, and vegetables have been studied[20] and the results have shown positive effects.

CONCLUSION

First grade orthodox black tea have antidiabetic activity measured by Glucometer. On day 14, first grade orthodox black tea more better than glibenclamide to reduce the blood glucose level

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