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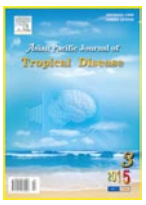

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Hypoglycemic activity of methanolic leaf extract of *Blumea lacera* in Swiss-albino mice

Md. Nazmul Hasan[1,2], Mohammad Habibur Rahman[2], Renkai Guo[1], Akinori Hirashima[1*]

[1]*Laboratory of Pesticide Chemistry, Division of Molecular Biosciences, Department of Bioscience and Biotechnology, Faculty of Agriculture, Kyushu University, Fukuoka 812-8581, Japan*

[2]*Department of Genetic Engineering and Biotechnology, Faculty of Biological Science and Technology, Jessore University of Science and Technology, Jessore 7408, Bangladesh*

PEER REVIEW

Peer reviewer

SM Abdul Awal, Assistant Professor, Biotechnology and Genetic Engineering Discipline, Life Sciences School, Khulna University, Khulna-9208, Bangladesh.
E-mail: sohagbge@yahoo.com

Comments

This is an appreciated research work in which authors have demonstrated the hypoglycemic activity of *B. lacera* leaf extract using a very simple method termed oral glucose tolerance test. The activity was measured by studying the effect of the plant extract on glucose absorption in the blood cell of Swiss albino mice. It showed that the leaf extract exerted hypoglycemic effect dose dependently.
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ABSTRACT

Objective: To estimate the hypoglycemic activity of *Blumea lacera* (*B. lacera*) leaf methanol extract.
Methods: A study was undertaken for preliminary exploration of hypoglycemic activity via oral glucose tolerance test. *B. lacera* leaves were dried under shaded sunlight, milled and then macerated in methanol. Glibenclamide was used as reference drug, and 50-400 mg/kg leaf extract was administered orally to four test groups.
Results: Treatment of leaf extract on glucose loaded hypoglycemic mice lead to significant (P<0.000 1) reduction of the blood glucose levels in a dose dependent manner.
Conclusions: The result suggests that methanolic leaf extract of *B. lacera* possesses anti-diabetic properties, and its use as ethnomedicine for treatment of diabetes.

KEYWORDS

Blumea lacera, Methanol extract, Hypoglycemic activity, Glibenclamide, Oral glucose tolerance test

1. Introduction

Diabetes mellitus is a heterogeneous group of disorders, and is a chronic disease caused by genetic or environmental or a combination of genetic and environmental risk factors, disturbing in the metabolism of carbohydrates, fat and protein. It results from defects in β-cells of pancreas, lack of insulin secretion or sensitivity of the tissue to insulin[1]. Insulin mainly controls the glycolytic pathway by regulating the glucose entry into cell and its phosphorylation for further metabolism[2]. More than 347 million people worldwide have diabetes[3]. More than 80% of diabetes deaths occur in middle and low-income countries[4].

A lot of plants have been used traditionally to produce a countless herbal drug to cure diabetes, a few of which

*Corresponding author: Dr. Akinori Hirashima, Laboratory of Pesticide Chemistry, Division of Molecular Biosciences, Department of Bioscience and Biotechnology, Faculty of Agriculture, Kyushu University, Fukuoka 812-8581, Japan.
Tel/Fax: +81-92-642-2856.
E-mail: ahirasim@agr.kyushu-u.ac.jp
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have been established scientifically[5]. Over 1 200 plants are used experimentally or ethnopharmacologically to treat diabetes[6]. Several therapeutic phytoconstituents of medicinal plants act against a range of target multifarious disorders like diabetes by different modes and mechanisms[7].

Blumea lacera (*B. lacera*) is a species of Asteraceae family, locally known as Bonomula or Shealmoti. *B. lacera* is an annual herb and found in the tropical and sub-tropical zones of Asia, especially in the Southeast Asia. Leaves are simple and covered with hair. Mature leaves are 18 to 24 cm long and 10 to 14 cm wide. Stem erect, simple or branched, grown up to 50-90 cm is densely covered with short woolly velvety hairs. There are many flower heads in single plant, arranged in axillary cymes or terminal panicle. Flowers are bright yellow. Fruits are an achene, oblong and not ribbed. Flowering time is January to April[8]. *B. lacera* grows as a weed in fallow lands all over Bangladesh. Methanol extract of *B. lacera* contains carbohydrate, reducing sugar, phytosterols, cumarine, tannins and phenolic compound, saponins, amino acid, steroid and flavonoids[9]. The reported constituents include β-caryophyllene, thymol hydroquinone, dimethylether, caryophyllene oxide, α-humulene, E-β-farnesene, 19-α-hydroxy-12-ene-24, 28-dioate-3-O-β-D-xylopyrinoside, 2-isoprenyl-5-isopropylphenol-4-O-β-D-xylopyrinoside, 5-hydroxyl-3,6,7,3′,4′-pentamethoxy flavone, 5,3′,4′-trihydroxy-3,6,7-trimethoxy flavone, campesterol and a coniferyl alcohol derivative[10].

Methanolic leaf extract of *B. lacera* showed anti-bacterial activity, anti-fungal activity, antipyretic activity and cytotoxicity[9,11-14]. *B. lacera* has anti-leukemic, anti-viral activity and antidiarrheal activity[13,15]. The phytoconstituents flavonoids and tannins in the *B. lacera* leaf methanol extract are responsible for the free radical scavenging effects[9,16]. The goal of current work is to find out the effect of *B. lacera* leaf extract on blood glucose level in Swiss-albino mice.

2. Materials and methods

2.1. Plant material

Mature and healthy leaves of *B. lacera* were collected from Jessore University of Science and Technology campus, Jessore, Bangladesh. The plant identified by Bangladesh National Herbarium as a reference specimen (No. DACB38376) was deposited in the herbarium for future reference. The leaves were washed with fresh water, and dried under shade of sunlight for 5 d.

2.2. Preparation of leaf extract

Dried leaves were milled into powder with suitable grinder (1 200 g). The leaf powder (75 g) was macerated in 350 mL methanol and agitated (120 g) for 2 h in a flask at 30 °C. The mixture was allowed to suspend for 48 h at 30 °C. Then supernatant was filtrated and liquid filtrate was concentrated and evaporated to remove methanol by hot water bath for 72 h at 38 °C. After 72 h a sticky oily precipitate (extract) was found and kept in a vial. Extract was preserved in a refrigerator at 4 °C. The methanol (Merck KGaA, Germany) and other chemicals used in this experiment were of analytical grade.

2.3. Experimental animal

Young Swiss-albino male and female mice were collected from Animal Resource Branch, ICDDR′B, Mohakhali, Dhaka, Bangladesh. They were 5-6 weeks old, weighing 20-25 g on average. Standard laboratory feed and fresh water were supplied and the mice were acclimatized for 7 d at the animal house, Department of Genetic Engineering and Biotechnology, where experiments were carried out. The mice were housed in standard sized metallic cages in properly ventilated room, temperature of (25±2) °C was maintained at natural day-night cycles in an isolated and noiseless place. The experimental procedures were approved by the Animal Ethics Committee, Jessore University of Science and Technology, Bangladesh, and also followed the current instructions for the care of laboratory animals.

2.4. Experimental design

Oral glucose tolerence test was performed following the procedure described by Joy and Kuttan with slight modification[17]. Hypoglycemic activity of *B. lacera* leaf methanol extract was evaluated in normal and glucose loaded hyperglycemic mice. Fourty eight mice were used in this experiment and divided into six groups: Group-I (control), Group-II (standard), and remaining four groups were treated with four different doses of *B. lacera* leaf methanol extract at 50, 100, 200 and 400 mg/kg respectly. Experimental mice were consent to fasted overnight. During the experiment, distilled water was administered orally to Group-I, glibenclamide (10 mg/kg) to Group-II, and leaf extract to Group-III, IV, V and VI; and then mice were allowed to rest for 1 h. Glucose (2 g/kg) solution was administered to mice by gavaging. After 2 h of glucose gavaging, blood was collected and glucose levels were evaluated by one touch electronic gluco-meter.

2.5. Statistical analysis

The experimented data were expressed as mean±SEM and were evaluated by Student′s *t*-test using Past software to determine the significant difference at $P<0.000\,1$.

3. Results

The results obtained from this study indicate that the methanol leaf extract of *B. lacera* has glucose lowering capacity at all doses examined in a dose-dependent manner ($P<0.000\,1$). Maximum hypoglycemic activity (46.85%) of methanol extract of *B. lacera* leaves in glucose-

induced hyperglycemic mice was observed at 400 mg/kg, while the standard drug, glibenclamide produced 47.53% at dose of 10 mg/kg (Table 1).

Table 1
Effect of methanolic extract of *B. lacera* leaf on serum glucose level in hyperglycemic mice.

Group (n=8)	Treatment	Serum glucose level (mmol/L)	% Inhibition
I	Control	5.575±0.096[a]	–
II	Standard	2.925±0.072[e]	47.53
III	Extract (50 mg/kg)	5.063±0.103[b]	9.18
IV	Extract (100 mg/kg)	4.588±0.103[c]	17.71
V	Extract (200 mg/kg)	3.525±0.055[d]	37.77
VI	Extract (400 mg/kg)	2.963±0.069[e]	46.85

[a-e]: The same letter is not significantly different at P<0.0001.

4. Discussion

This oral glucose tolerance test was carried out to evaluate the hypoglycemic activity of *B. lacera* in glucose loaded hyperglycemic mice. Flavonoids and phenolic compounds are the most widely distributed phytoconstituents that account for majority of the experimental pharmacological actions, primarily via their renowned antioxidant activities[18]. The significant antidiabetic effect of *B. lacera* could be due to the presence of various phytoconstituents tannins and flavonoids. Some alkaloids, flavonoids, tannins, and cardiac glycosides are of hypoglycemic activities[19-21]. The mono, di and tri terpenoids have also shown hypoglycemic activity in animal model[22].

Some plant extracts showed hypoglycemic activity through potentiating effect of insulin, either via increasing the secretion of insulin from β-cells of islets of langerhans or its discharge from bound insulin[23]. The existence of some minerals in the plant extract are good micronutrient complements because they will help in modulating the immune system and pancreatic insulin secretion and action[24].

B. lacera exerted its anti-diabetic effect probably via enhancing pancreatic insulin secretion. In this oral glucose tolerance test the hypoglycemic effect of *B. lacera* was compared with glibenclamide, a standard anti-diabetic drug and it credibly proposed that *B. lacera* may have similar activity to that of glibenclamide.

B. lacera leaf extract may have acted through one or more of the above mechanisms, resulting in a better antidiabetic activity than the glibenclamide. From this experiment we can conclude that methanolic leaf extract of *B. lacera* has advantageous effects on blood glucose level. Advanced study on this species is necessary to confirm the exact phytoconstituents that are responsible for anti-diabetic activity and to elucidate the detail mechanism of activity at the cellular and molecular levels of *B. lacera*. So, this study provides some scientific bases for the use of this plant as anti-diabetic agent.

Conflict of interest statement

We declare that we have no conflict of interest.

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Comments

Background

Diabetes has become a major health problem worldwide. Owing to the side effects and occasional lessening in response after continued use, there is no ideal anti-diabetic therapy in the world at present. Thus, there is a serious need of new natural compounds with anti-diabetic properties to overcome any resistance developed by patients to the currently used drugs. So, Nowadays researchers are trying to find a lead compound from natural sources to overcome side effects of anti-diabetic drug.

Research frontiers

The present research work shows the hypoglycemic effects of methanol extract of leaf of *B. lacera* using a very simple method termed oral glucose tolerance test to measure the blood glucose level in mice model.

Related reports

Anti-bacterial activity, anti-fungal activity, antipyretic activity and cytotoxicity activity of the extract of *B. lacera* has been reported by different researchers from many countries.

Innovations & breakthroughs

The proper scientific and medical evaluation of majority of traditional anti-diabetic plants are expected for the

plant ability to improve blood glucose control. In this context, the present investigation is an attempt to explore the possible mechanism of action of *B. lacera* which was traditionally unknown for its ant-diabetic potential.

Applications

Diabetes mellitus is a common and very prevalent disease which affects both the citizen of developed and developing countries. The present exploration verified the anti-diabetic properties of *B. lacera* as implied by oral glucose tolerance test. These effects need to be confirmed by employing different *in vivo* models and clinical trials for their effective utilization as therapeutic agents.

Peer review

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