

SHORT COMMUNICATION

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Hypoglycemic effect of leaf extract of *Fimbristylis miliacea* in mice model

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Abstract

Hypoglycemic effect of methanol extract of leaf of *Fimbristylis miliacea* was examined in mice model. Standard drug glibenclamide reduced fasting blood glucose concentration by 46.69% after 3 h while extract at 400 mg/kg showed 36.92% reduction after same time span. Therefore, it can be concluded that the plant extract is expected to contain phytoconstituent(s) with potential hypoglycemic effect in dextrose-induced hyperglycemic mouse model.

Introduction

Fimbristylis miliacea (L.) Vahl (Cyperaceae) is a widely distributed rice-field weed and found in Bangladesh, India, Pakistan, Cambodia, Laos, Myanmar, Indonesia, Malaysia, central America, west Africa, north Australia, etc. [1, 2]. Several species of *Fimbristylis* genus are used as herbal medicine such as *F. miliacea* to treat fever, *F. squarrosa* for sore throat, *F. falcata* in dysentery, *F. ovata* in rheumatism, *F. umbellaris* in splenomegaly, *F. pauciflora* to induce labour, etc. [3].

Diabetes mellitus is a chronic metabolic disease characterized by abnormalities in carbohydrate metabolism. Insufficient production of insulin and/or increased resistance to insulin causes diabetes. The primary manifestation of the disease is hyperglycemia and it beckons other complications such as hyperlipidemia, hypertension, atherosclerosis, etc. [4]. Oral synthetic hypoglycemic drugs are found therapeutically effective against insulin resistant type 2 diabetes but these drugs also show adverse effects and become ineffective in long-time treatment. Treatment of hyperglycemia with herbal medicines can be considered a pragmatic approach due to availability of plants, low risk of side effects and most importantly low cost of the treatment. Numerous reports have been published reporting potential hypoglycemic effect of plant extracts [5–8]. Therefore, our present study aims to examine hypoglycemic effect of methanol extract of leaf of *Fimbristylis miliacea*.

Material and methods

Preparation of plant extract

Whole plant of *Fimbristylis miliacea* was collected from Manikgonj, Bangladesh and verified by Bangladesh National Herbarium (Identification No.: DACB-46517). The leaves were then separated and properly cleaned followed by drying at room temperature and finally pulverized. 500 g of leaves powder was taken in a clean, flat bottomed glass container and soaked in 1500 mL of 80% methanol at room temperature for three weeks. The solution was then filtered using filter cloth and Whatman filter paper No. 1 and finally concentrated with rotary evaporator. A brownish black gummy concentrate was obtained and percentage yield of this gummy methanol extract was 1.3% (w/w).

Chemicals and drugs

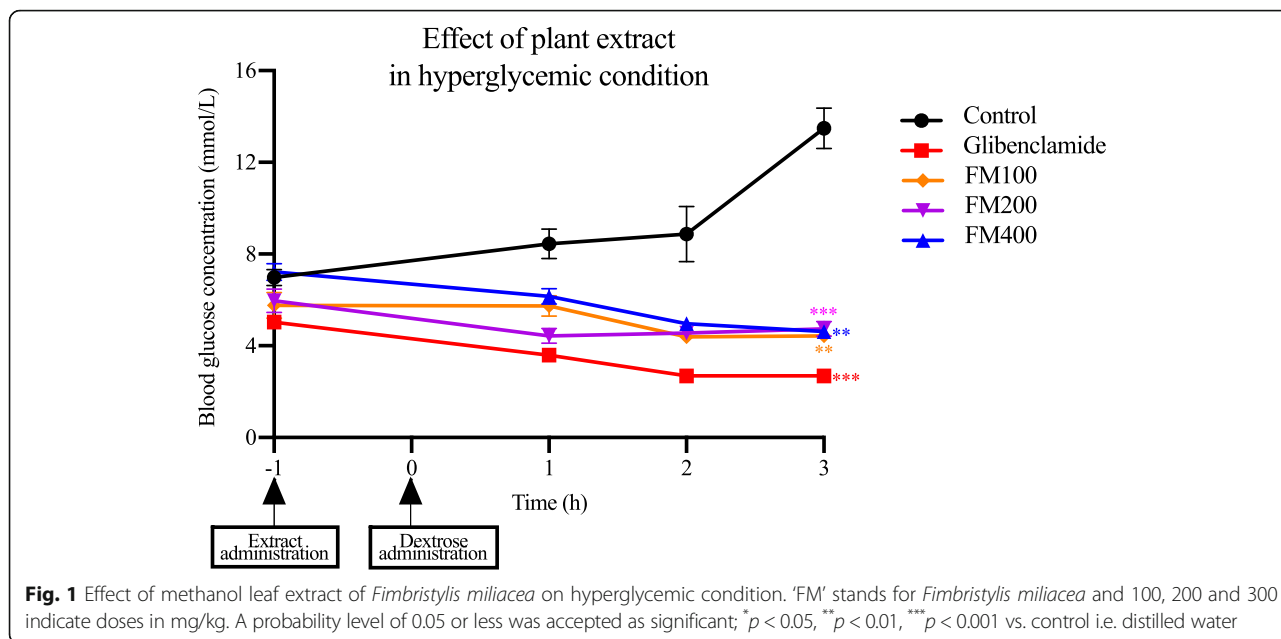
Glibenclamide (Square Pharmaceuticals Limited, Bangladesh) was used as standard. Dextrose (Glaxo SmithKline Bangladesh) was used to produce hyperglycemia. Methanol was purchased from local vendor of Merck, Germany.

Animals

Swiss albino mice (20–25 g) of both sexes were collected from International Centre for Diarrhoeal Disease Research, Bangladesh. Animals were housed in groups of six in each cage (40 cm × 30 cm × 17 cm) made up of polypropylene base with stainless-steel net. A standard 12 h light: 12 h dark cycle was maintained in the animal room having a temperature of 23–25 °C and relative humidity of 50–55%. Food and water were allowed ad libitum during entire study period.

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Experimental procedures

Hypoglycemic effect of leaf extract in mice model was performed according the method described by Joy and Kuttan (1999) [9]. A group of six mice was used for each test sample. For Group I (control), mice were given only distilled water (10 mL/kg of mouse body weight) while Group II was used as standard group and treated with glibenclamide (10 mg/kg). Group III, IV and V were treated with leaf extract at doses of 100 mg/kg, 200 mg/kg and 400 mg/kg of mouse body weight respectively. All animals were fasted overnight before the experiment. The experiment was started by measuring blood glucose concentration (fasting glucose concentration) followed by immediate administration (p.o.) of test sample to respective group and then rested for next 1 h. After this period, dextrose (2 g/kg) solution was administered to all groups. Blood was collected from mouse tail vein after 1 h, 2 h and 3 h of glucose administration. Glucose concentration was measured by Accu-Check electronic glucometer (Roche, Germany).

Statistical analysis

Data were calculated as mean ± SEM values. One-way ANOVA with Dunnett’s test was done using GraphPad

Prism (version 8.0). A probability level of 0.05 or less was accepted as significant; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ vs. control. Percentage reduction in glucose concentration was calculated as (fasting glucose concentration – glucose concentration at specific time point) × 100/fasting glucose concentration.

Results and discussion

Effect of methanol leaf extract on hyperglycemia is shown in Fig. 1 and Table 1. Leaf extract at all doses showed significant reduction ($p < 0.01$ for 100 mg/kg, $p < 0.001$ for 200 mg/kg and $p < 0.01$ for 400 mg/kg) in blood glucose concentration. Extract at 400 mg/kg produced time-dependent effect that gradually increased as time elapsed; similar phenomenon was observed for 100 mg/kg dose. Extract at doses of 200 mg/kg showed prompt effect at 1 h but effect was slightly reduced over time. Maximum hypoglycemic effect (36.92%) was observed at 400 mg/kg extract after 3 h while glibenclamide produced 46.69% reduction.

Different plant extracts of diverse genera and families have been reported to show hypoglycemic effect due to the presence of various classes of phytoconstituents such

Table 1 Percentage reduction of blood glucose concentration by methanolic extract of leaf of *Fimbristylis miliacea*

	Reduction of blood glucose concentration (from fasting glucose concentration)		
	After 1 h	After 2 h	After 3 h
Glibenclamide	28.47%	46.69%	46.69%
FM100	0.59%	23.70%	24.87%
FM200	25.70%	23.74%	20.68%
FM400	14.78%	31.18%	36.92%

'FM' stands for *Fimbristylis miliacea* and 100, 200 and 400 indicate doses in mg/kg

as terpenoids [10], alkaloids [11], flavonoids [12], glycosides [13], etc. Hypoglycemic effect of plant extracts may be due to stimulation of insulin release by β -cells or inhibition of glucose absorption from intestine. Leaf extract of *Fimbristylis miliacea* is expected to contain important phytoconstituents that offer potent hypoglycemic effect. Further phytochemical and biological investigations are required to isolate one or more phytoconstituent responsible for hypoglycemic effect with mechanism of action.

Abbreviations

g: Gram; h: Hour; mg: Milligram; SEM: Standard error mean

Acknowledgments

Not applicable.

Authors' contributions

SM and RR equally participated in the conduction of the experiments. RR, AA and MAB did the initial literature search and assisted animal handling. SM, RR, AA and MAB participated in preparing the manuscript and MA Basher designed the concept, analyzed the data and revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The animal experiment performed in this study was approved by the Departmental Ethics Committee.

Consent for publication

Not applicable.

Competing interests

All authors declared that they have no competing interests.

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