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ORAL GLUCOSE TOLERANCE TEST (OGTT) WITH WHOLE PLANTS OF *ALOCASIA FORNICATA* ROXB. (ARACEAE)

S. M. Shatil Shahriar, Jannatul Ferdoes Shoma and Mohammed Rahmatullah*

Department of Pharmacy, University of Development Alternative, Lalmatia, Dhaka-1207, Bangladesh.

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***Corresponding Author**
Prof. Dr. Mohammed Rahmatullah
Department of Pharmacy, University of Development Alternative, Lalmatia, Dhaka-1207, Bangladesh.

ABSTRACT

Background: *Alocasia fornicata* is an Araceae family plant of which not much is known about its pharmacological properties. As such, the objective of this study was to evaluate the antihyperglycemic potential of methanolic extract of whole plant of *Alocasia fornicata*. **Methods:** Oral glucose tolerance test (OGTT) was done to evaluate antihyperglycemic potential. **Results:** In oral glucose tolerance tests, methanol extract of whole plants of *Alocasia fornicata* (MEAF) significantly and dose-dependently reduced blood glucose levels in glucose-loaded mice by 13.0, 22.1, 31.2, and 37.2%, respectively, at doses of 50, 100, 200 and 400 mg per kg body weight in mice. By comparison, a standard antihyperglycemic drug, glibenclamide, reduced blood glucose levels by 37.9% at a dose of 10 mg per kg. **Conclusion:** *Alocasia fornicata* can potentially be an excellent source for blood glucose lowering lead compounds or drugs.

KEYWORDS: Antihyperglycemic, *Alocasia fornicata*, OGTT, Araceae.

BACKGROUND

Alocasia fornicata Roxb. is an Araceae family plant found in the wild in Sylhet region in the northeast part of Bangladesh. The plant is native to Indian subcontinent and Indochina. The plant is rhizomatous and the spadix of the plant is cooked and consumed in northeast India. Various parts of the plant have been shown to demonstrate antibacterial and cytotoxic activities.[1]

Diabetes is a disorder, which is growing rapidly throughout the world. According to the World Health Organization (WHO), an estimated 422 million adults were living in the world in 2014 with diabetes.[2] The disease is characterized by elevated blood glucose levels. Although glucose-lowering drugs are available, they cannot cure diabetes. Moreover, such drugs can be costly, have adverse effects, and may be not readily available to the rural population or people living in remote areas. As such, newer medications are necessary.

Alocasia genus plants have been reported for their antihyperglycemic effects. Rhizome extract of *Alocasia macrorrhizos* has been shown to have an antidiabetic effect in alloxan-induced hyperglycemic mice.[3] Antidiabetic activity of leaf and stem extract of *Alocasia indica* has been shown in streptozotocin diabetic rats.[4] To alleviate elevated blood glucose levels during impaired glucose metabolism with easily affordable and available drugs, we had been experimenting with various local plants and formulations for their blood glucose lowering effects.[5-17] As such, it was of interest to determine the antihyperglycemic activity of whole plant extract of *Alocasia fornicata*.

METHODS

Plant material collection: Whole plants of *Alocasia fornicata* were collected during November 2016 from Rema Kalenga Wildlife Sanctuary in Sylhet Division, Bangladesh and identified at the Bangladesh National Herbarium (Accession Number 43727).

Preparation of methanolic extract of Alocasia fornicata whole plants: For preparation of methanol extract of whole plants of *Alocasia fornicata* (MEAF), whole plants were thoroughly dried and pulverized into a fine powder. 75g of the powder was extracted with 375 ml methanol over 48 hours. Methanol was evaporated at 50^{o}C and the extract was dissolved in Tween 20 prior to administration to mice by gavaging. The final weight of the extract was 1.774g.

Chemicals and Drugs: Glibenclamide and glucose were obtained from Square Pharmaceuticals Ltd., Bangladesh. All other chemicals were of analytical grade.

Animals

Swiss albino mice, which weighed between 12-15g were used in the present study. The animals were obtained from International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The animals were acclimatized for three days prior to actual

experiments. The study was conducted following approval by the Institutional Animal Ethical Committee of University of Development Alternative, Dhaka, Bangladesh.

Oral glucose tolerance tests for evaluation of antihyperglycemic activity

Oral glucose tolerance tests (OGTT) were carried out as per the procedure previously described by Joy and Kuttan[18] with minor modifications. Briefly, fasted mice were grouped into six groups of five mice each. The various groups received different treatments like Group 1 received vehicle (1% Tween 20 in water, 10 ml/kg body weight) and served as control, Group 2 received standard drug (glibenclamide, 10 mg/kg body weight). Groups 3-6 received MEAF dissolved in Tween 20 at doses of 50, 100, 200 and 400 mg per kg body weight. All substances were orally administered by gavaging. The amount of Tween 20 administered was same in both control and experimental mice. Following a period of one hour as described earlier[8,14], all mice were orally administered 2g glucose/kg of body weight. Blood samples were collected 120 minutes after the glucose administration through puncturing heart following previously published procedures.[8,14] Blood glucose levels were measured with a glucometer. The percent lowering of blood glucose levels were calculated according to the formula described below.

Percent lowering of blood glucose level = $(1 - W_e/W_c) \times 100$, where W_e and W_c represents the blood glucose concentration in glibenclamide or MEAF administered mice (Groups 2-6), and control mice (Group 1), respectively. Experiments were conducted following approval by the Institutional Animal Ethical Committee of University of Development Alternative, Dhaka, Bangladesh.

Statistical analysis: Experimental values are expressed as mean ± SEM. Independent Sample t-test was carried out for statistical comparison. Statistical significance was considered to be indicated by a p value < 0.05 in all cases.[14]

RESULTS

MEAF, when administered at doses of 50, 100, 200 and 400 mg per kg body weight, dose-dependently and significantly reduced blood glucose levels, respectively, by 13.0, 22.1, 31.2, and 37.2%. Comparatively, a standard antihyperglycemic drug, glibenclamide, when administered to mice at a dose of 10 mg per kg body weight, reduced blood glucose levels by 37.9%. The results show that at the highest dose, MEAF was nearly equivalent to glibenclamide and thus can possibly be used as an effective substitute for the drug.

Table. 1: Effect of MEFA on blood glucose level in hyperglycemic mice following 120 minutes of glucose loading.

Treatment	Dose (mg/kg body weight)	Blood glucose level (mmol/l)	% lowering of blood glucose level
Control	10 ml	5.70 ± 0.14	-
Glibenclamide	10 mg	3.54 ± 0.05	37.9*
(MEFA)	50 mg	4.96 ± 0.18	13.0*
(MEFA)	100 mg	4.44 ± 0.11	22.1*
(MEFA)	200 mg	3.92 ± 0.15	31.2*
(MEFA)	400 mg	3.58 ± 0.12	37.2*

All administrations were made orally. Values represented as mean ± SEM, (n=5); $^{*}P < 0.05$; significant compared to hyperglycemic control animals.

DISCUSSION

Despite ongoing attempts, no satisfactory solutions have been found so far for cure of diabetes. Medications are available for lowering elevated blood glucose, like glibenclamide or insulin injections. The latter is disliked by a number of people because of the necessity for daily injections; the former along with other glucose lowering drugs can have adverse effects.[19] Moreover, in developing countries like Bangladesh, rural people suffer from both lack of income and availability of modern clinics and medicines. From that view point, plants like *Alocasia fornicata* can be effective substitutes for allopathic blood glucose lowering drugs, more so, if the plants can easily be cultivated and consumed as regular vegetables.

CONCLUSION

The results suggest that methanolic extract of *Alocasia fornicata* can be used for lowering of blood glucose.

CONFLICTS OF INTEREST

The author(s) declare that they have no competing interests.

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AUTHOR'S CONTRIBUTIONS

SMSS and JFS collected the plant material, did the extraction, and performed the experiments under the supervision of MR. MR wrote the manuscript draft, which was read and edited by all authors. All authors read and approved the final version of the manuscript.

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