WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES
SJIF Impact Factor 6.647
Volume 6, Issue 11, 183-190 Research article ISSN 2278 – 4357

EVALUATION AS TO WHETHER *ALOCASIA FORNICATA* CAN AUGMENT BLOOD GLUCOSE LOWERING EFFECTS OF GLIBENCLAMIDE

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Article Received on
06 Sep. 2017,
Revised on 27 Sep. 2017,
Accepted on 17 October 2017
DOI: 10.20959/wjpps201711-10427

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ABSTRACT

Background: *Alocasia fornicata* whole plant methanolic extract has been reported previously to improve oral glucose tolerance that is lower blood glucose levels in glucose-challenged mice. As such, it was of interest to examine whether the methanolic extract of whole plant can further improve oral glucose tolerance when administered concomitantly with a standard antihyperglycemic drug, glibenclamide. **Methods:** Oral glucose tolerance was determined through oral glucose tolerance test (OGTT) in mice. **Results:** Administration of methanol extract of whole plant (MEAF) at a dose of 400 mg per kg body weight to glucose-loaded mice reduced blood glucose level by 22.7%. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight, reduced blood glucose level by 41.8%. MEAF, when administered at doses of 200 and 400 mg per kg along with glibenclamide at 10 mg per kg, respectively reduced blood glucose levels by 42.1 and 43.1%. **Conclusion:** MEAF can augment the effect of glibenclamide but at a low extent.

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

BACKGROUND

Alocasia fornicata Roxb. (Araceae) is a plant found in the northeast part of Bangladesh. The plant is yet to be studied in details regarding pharmacological activities and phytochemical constituents. The two reports thus far known about the plant mention the plant's antibacterial, cytotoxic, and antihyperglycemic potential.[1, 2]

Impaired glucose tolerance (indicated by high fasting blood glucose levels) can quickly lead to diabetes and cardiovascular disorders. In 2008, it has been estimated that around 9% of the total world population was suffering from diabetes. Needless to say, since diabetes has no total cure, and people have to rely life-long on blood glucose lowering medications, this puts serious financial stress on a family with even one diabetic patient. The costs for diabetes can be very high for diabetes can quickly lead to other life-threatening disorders. The situation can be complicated in a country like Bangladesh with a high percentage of people living under conditions of poverty.

On the other hand, Bangladesh is rich in flora. Antidiabetic research has centered on many floral species, which have been found to lower elevated blood glucose following oral administration of plant, plant part or plant extracts.[3, 4] It is easy for a rural glucose impaired or diabetic person to partake of an antidiabetic plant species (provided it is not toxic), which can be readily found within the vicinity of the diabetic person's residence. If more than one antidiabetic floral species is found, that is better, for all plant species may not be available throughout the year. As such, we had been screening medicinal plants of Bangladesh for their blood glucose lowering properties.[5-32] A secondary goal is to determine whether such blood glucose lowering plant extracts can augment or act synergistically with allopathic antidiabetic drugs. The objective of this study was to evaluate the combined blood glucose lowering potential of methanolic extract of *Alocasia fornicata* (which previously has been reported to have antihyperglycemic properties[2]) along with a standard antihyperglycemic drug, glibenclamide.

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).[2]

Preparation of methanolic extract of Alocasia fornicata whole plants

Methanolic extract of whole plant was done as described before. The final weight of the extract (MEAF) was 1.774g.[2] Extract was stored at -20^{o}C till use.

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 16-18g 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[33] with minor modifications. Briefly, fasted mice were grouped into five 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). Group 3 received MEAF dissolved in Tween 20 at a dose of 400 mg per kg body weight. Groups 4 and 5 were administered a combination of 10 mg glibenclamide per kg along with 200 and 400 mg MEAF per kg, respectively. 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 4g 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 2-5), 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.[18]

RESULTS

MEAF, when administered at a dose of 400 mg per kg body weight, significantly reduced blood glucose levels by 22.7%. This was lower than previously observed,[2] and could be due to aging of extract (this experiment was done four months later than the previous experiment[2]) or due to the higher amount of glucose used (4g in this experiment versus 2g in the previous one). 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 41.8%. MEAF, when administered at doses of 200 and 400 mg per kg along with glibenclamide (administered at a dose of 10 mg per kg), reduced blood glucose levels in glucose-challenged mice by 42.1 and 43.1%, respectively. The results suggest that MEAF, even at the highest dose tested, is slightly effective in augmenting the antihyperglycemic effects of glibenclamide.

Table 1: Effect of MEAF 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	5.98 ± 0.10	-
Glibenclamide	10 mg	3.48 ± 0.07	41.8*
(MEAF)	400 mg	4.62 ± 0.12	22.7*
(MEAF + glibenclamide)	(200 + 10) mg	3.46 ± 0.04	42.1*
(MEAF + glibenclamide)	(400 + 10) mg	3.40 ± 0.11	43.1*

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

DISCUSSION

Alocasia fornicata is consumed as a vegetable by the Mizo people in Mizoram India. Dried spadix of the plant is also available in India for cooking and consumption. What would be of interest is to determine whether the plant (fresh or dried) can following cooking and consumption improve glucose tolerance and as such reduce elevated blood glucose levels in persons with impaired glucose metabolism or diabetes.

CONCLUSION

The results suggest that methanolic extract of *Alocasia fornicata* can (at the doses tested) augment the antihyperglycemic effects of glibenclamide at a low extent.

CONFLICTS OF INTEREST

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

ACKNOWLEDGEMENTS

The authors thank Md. Najmul Hasan for his help in the experiments.

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