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Research Article

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Oral Glucose Tolerance Tests with Aerial Parts of *Abroma augusta* L. (Sterculiaceae)

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ABSTRACT

Oral glucose tolerance tests were carried out with methanolic extract of Abroma augusta aerial parts (leaves and stems) in glucose-loaded mice. The extract at doses of 50, 100, 200 and 400 mg per kg body weight dose-dependently and significantly reduced blood glucose levels in hyperglycemic mice by 40.2, 40.7, 41.9, and 45.4%, respectively. A standard antihyperglycemic drug, glibenclamide, when administered to hyperglycemic mice at a dose of 10 mg per kg reduced blood glucose level by 41.9%. Thus the studies reveal that the extract possess considerable antihyperglycemic activity and can possibly be used to lower high blood glucose levels present in disorders like diabetes.

Keywords: *Abroma augusta*; Sterculiaceae; Antihyperglycemic; OGTT

INTRODUCTION

Abroma augusta L. (Sterculiaceae) is a tree found in tropical regions of the world including Bangladesh. In English it is known as the Devil's Cotton tree and in Bengali known as Ulot kombol. The tree has multiple medicinal uses in the folk medicinal system of Bangladesh, one of the uses being to lower blood glucose levels in diabetic patients. Since diabetes is rapidly becoming almost endemic in Bangladesh, and since antidiabetic drugs are not so affordable and accessible to rural people of Bangladesh, we had been screening various medicinal plants of Bangladesh for their antidiabetic activity [1-15]. The objective of this study was to evaluate the folk medicinal claim of antidiabetic properties of aerial parts of this plant through oral glucose tolerance tests (OGTT) in glucose-loaded mice. We have previously conducted antihyperglycemic studies with methanolic extract of leaves only [16]; this study was conducted with methanolic extract of a combination of leaves and stems' which is the combination used by folk medicinal practitioners to treat diabetic patients.

EXPERIMENTAL SECTION

Plant material collection

Leaves and soft stems of *Abroma augusta* were collected during April 2015 from Dhaka district, Bangladesh, and taxonomically identified at the Bangladesh National Herbarium.

Preparation of methanolic extract of leaf and stem

Leaves and soft stems were cut into small pieces, air-dried in the shade, and 100g of dried and powdered leaves and stems were extracted with methanol (w:v ratio of 1:5, final weight of the extract 9.33g). Methanol was evaporated at 50^oC and the extract suspended in Tween 80 prior to administration in mice in oral glucose tolerance tests (OGTT). Any toxic effects in mice were not observed following administration of the extract.

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 14-18g 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 anti-hyperglycemic activity

Oral glucose tolerance tests were carried out as per the procedure previously described by Joy and Kuttan [17] with minor modifications. Briefly, fasted mice were grouped into six groups of six mice each. The various groups received different treatments like Group 1 received vehicle (1% Tween 80 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 methanolic leaf and stem extract of *Abroma augusta* (MEAA) at doses of 50, 100, 200 and 400 mg per kg body weight. All substances were orally administered. Following a period of one hour, all mice were orally administered 2g glucose/kg of body weight. Blood samples were collected 120 minutes after the glucose administration through puncturing heart. Blood glucose levels were measured by glucose oxidase method [18].

The percent lowering of blood glucose levels were calculated according to the formula described below. Percent lowering of blood glucose level = $(1 – W_e/W_c)$ X 100, where W_e and W_c represents the blood glucose concentration in glibenclamide or MEAA administered mice (Groups 2-6), and control mice (Group 1), respectively.

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 [19].

RESULTS AND DISCUSSION

The methanolic extract of leaves and soft stems of *Abroma augusta* (MEAA) was observed to cause dose-dependent and significant reductions in blood glucose levels in mice in oral glucose tolerance tests. The extract at doses of 50, 100, 200 and 400 mg per kg body weight dose-dependently and significantly reduced blood glucose levels in hyperglycemic mice by 40.2, 40.7, 41.9, and 45.4%, respectively. A standard antihyperglycemic drug, glibenclamide, when administered to hyperglycemic mice at a dose of 10 mg per kg reduced blood glucose level by 41.9%. The results are shown in Table 1. Thus the studies reveal that the extract possess considerable antihyperglycemic activity, which at the highest dose of 400 mg tested was better than glibenclamide in reducing blood glucose levels.

Compared to our earlier study [16], we find that methanolic extract of a combination of leaf and stem of the plant (as used in the present study) is better in reducing blood glucose level in oral glucose tolerance tests in mice than methanolic extract of leaf alone. In the earlier study, methanol extract of leaf reduced blood glucose levels in OGTT in mice at doses of 100, 250, and 500 mg per kg body weight by 8.7, 13.1, and 36.9%, respectively. The results were statistically significant only at the highest dose of 500 mg per kg. On the other hand, a combination of leaf and stem extract gave highly significant reductions in blood glucose even at 50 mg per kg.

All administrations were made orally. Values represented as mean ± SEM, (n=6); $^*P < 0.05$; significant compared to hyperglycemic control animals.

Abroma augusta is readily available in Bangladesh. Our preliminary results indicate that at the doses administered, the extract was not toxic to the experimental animals. Thus the plant can be a potential source for blood glucose lowering in diabetic patients. In this connection it is worth noting that leaf extract of the plant has been reported to attenuate diabetes induced nephropathy and cardiomyopathy via inhibition of oxidative stress and inflammatory response [20].

Table 1: Effect of crude methanol extract of *A. augusta* leaf and stem (MEAA) 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	5.82 ± 0.25	-
Glibenclamide	10 mg	3.38 ± 0.33	41.9*
(MEAA)	50 mg	3.48 ± 0.12	40.2*
(MEAA)	100 mg	3.45 ± 0.19	40.7*
(MEAA)	200 mg	3.38 ± 0.32	41.9*
(MEAA)	400 mg	3.18 ± 0.29	45.4*

CONCLUSION

The experimental results suggest that the methanolic extract of leaves and stems of *A. augusta* possess antihyperglycemic potential and may be used for lowering blood glucose.

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