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ORAL GLUCOSE TOLERANCE TESTS WITH METHANOLIC ROOT EXTRACTS OF *STEMONA TUBEROSA*

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ABSTRACT

The objective of the present study was to determine the antihyperglycemic effects of methanol extract of *Stemona tuberosa* roots in glucose-challenged mice. This is a part of our ongoing anti-diabetic project to identify antihyperglycemic local plant species. Antihyperglycemic activity was determined through oral glucose tolerance test (OGTT) in mice. Administration of methanol extract of *Stemona tuberosa* root (MEST) at doses of 50, 100, 200, and 400 mg per kg body weight each to glucose-loaded mice reduced blood glucose levels by 12.9, 30.7, 33.8, and 39.7%, respectively compared to control (untreated) mice. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight, reduced blood glucose level by 40.8%. **Conclusion**. Methanolic extract of roots of *Stemona tuberosa* can improve oral glucose tolerance and thus is effective in lowering elevated blood glucose levels, which at the highest dose tested was comparable to glibenclamide.

KEYWORDS: Antihyperglycemic, *Stemona tuberosa*, glibenclamide, OGTT.

INTRODUCTION

Stemona tuberosa Lour. is a vinous plant belonging to the Stemonaceae family. The plant is native to China and the Indian sub-continent. The plant has medicinal uses in various parts of the world. Some of the uses include use of roots for coughs and helminthiasis in Vietnam, use of roots for coughs and tuberculosis in Malaysia, for skin diseases in Myanmar, to treat scabies in Thailand, to treat tuberculosis and gynecological disorders in India, to treat respiratory disorders in China and Japan, and to treat mental disorder, helminthiasis, cough and jaundice in Bangladesh (reviewed in).[1]

Diabetes is a disorder increasing world-wide to almost epidemic proportions for factors not exactly identified thus far, but which may include changes in food and lifestyle. The disorder is characterized by elevated blood glucose levels, which also pass out with urine leading to a sweet taste and flavor of urine. Allopathic medicines can only result in reducing blood glucose levels but cannot cure the disorder. Diabetes can very quickly lead to major complications like cardiovascular disorders and damages to kidney and brain. Since diabetes is very much prevalent within Bangladesh, and glucose lowering drugs are not affordable or readily available to the rural people, we had been screening local plants and plant products for their glucose lowering efficacies[2-29] through oral glucose tolerance test (OGTT), a reliable test for impaired glucose tolerance (which occurs during diabetic and pre-diabetic conditions).[30] It was the objective of the present study to determine the antihyperglycemic effect of methanolic extract of *Stemona tuberosa* roots (MEST), since because of the plant's relative abundance, it can be a potential source of blood glucose lowering agent(s). Plants have always formed a reliable source for new drugs; more than 400 species of medicinal plants have been reported in the literature to be anti-diabetic and so can be useful sources of anti-diabetic drugs.[31]

MATERIALS AND METHODS

Plant material collection and extraction

Stemona tuberosa roots were collected from Rema-Kalenga Wildlife Sanctuary in Habiganj district, Sylhet Division in December 2016. Plant specimen was taxonomically identified by the Bangladesh National Herbarium, who provided an Accession Number of 43833. The air-dried roots were grounded into a fine powder and 86g of the powder was extracted with methanol (1:5, w/v) for 48 hours. The extract (MEST) was evaporated to dryness at 50^{o}C and stored at -20^{o}C till use. The final weight of MEST was 3.26g.

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. During this period, they were kept in a temperature controlled room (25^{o}C) and given standard mice chow and water *ad libitum*. The study was conducted following approval by the Institutional Animal Ethical Committee of University of Development Alternative, Dhaka, Bangladesh.

Oral glucose tolerance tests (OGTT) for evaluation of antihyperglycemic activity

Oral glucose tolerance tests were carried out as per the procedure previously described by Joy and Kuttan (1999) [32] 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 and served as control, Group 2 received standard drug (glibenclamide, 10 mg/kg body weight). Groups 3-6 received MEST at doses of 50, 100, 200, and 400 mg per kg body weight, respectively. 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 with a glucometer. The percent lowering of blood glucose levels were calculated according to the formula described below.

Percent lowering of blood glucose level = $(1 - W_e/W_c) X 100$, where W_e and W_c represents the blood glucose concentration in glibenclamide or various extracts administered mice (Groups 2-6), and control mice (Group 1), respectively.[26]

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.[28]

RESULTS

Oral glucose tolerance test (OGTT) results

Administration of methanol extract of *Stemona tuberosa* roots (MEST) at doses of 50, 100, 200, and 400 mg per kg body weight each to glucose-loaded mice reduced blood glucose levels by 12.9, 30.7, 33.8, and 39.7%, respectively, compared to control (untreated) mice. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight, reduced blood glucose level by 40.8%. Thus at the highest dose tested, MEST demonstrated comparable ability to glibenclamide in its antihyperglycemic activity or improved oral glucose tolerance ability. The results are shown in Table 1. As this plant is commonly available in Bangladesh in Sylhet Division (of which Rema-Kalenga Wildlife Sanctuary forms a part), it has the potential to be a replacement for costly anti-diabetic drugs.

Table 1: Effect of MEST 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	5.74 ± 0.07	-
Glibenclamide	10 mg	3.40 ± 0.07	40.8*
(MEST)	50 mg	5.00 ± 0.13	12.9*
(MEST)	100 mg	3.98 ± 0.19	30.7*
(MEST)	200 mg	3.80 ± 0.18	33.8*
(MEST)	400 mg	3.46 ± 0.19	39.7*

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

DISCUSSION

To our knowledge this is the first report on the blood glucose-lowering properties of *Stemona tuberosa* roots. The responsible bio-active component(s) for the observed effect is unknown and needs to be isolated and identified. However, various alkaloids have been isolated from roots of the plant,[33] and these alkaloids may be responsible for the glucose-lowering effects. However, this does not preclude other types of phytochemicals from being the responsible bio-active component(s). More studies need to be done in this regard in identifying the phytochemical constituents of this plant. At present, we are investigating aerial parts of the plant for their oral glucose tolerance effects.

CONCLUSION

The results suggest that methanolic extract of *Stemona tuberosa* roots (MEST) possess antihyperglycemic effects as demonstrated through OGTT.

CONFLICTS OF INTEREST

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

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