



ORAL GLUCOSE TOLERANCE TEST (OGTT) WITH METHANOL EXTRACT OF *SENNA OBTUSIFOLIA* WHOLE PLANT

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Article Received on
28 Oct. 2017,

Revised on 19 Nov. 2017,
Accepted on 10 Dec. 2017,

DOI: 10.20959/wjpps20181-10727

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ABSTRACT

Background. *Senna obtusifolia* is used in some traditional medicines as a blood glucose lowering agent in diabetic patients. The objective of the present study was to determine the antihyperglycemic effects of methanol extract of *Senna obtusifolia* whole plants in glucose-challenged mice. **Methods.** Antihyperglycemic activity was determined through oral glucose tolerance test (OGTT) in mice. **Results.** Administration of methanol extract of *Senna obtusifolia* whole plants (MESO) at doses of 50, 100, 200, and 400 mg per kg body weight each to glucose-loaded mice dose-dependently reduced blood glucose levels by 11.7, 20.1, 28.3, and 37.1%, 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 36.7%. **Conclusion.** Methanolic extract of whole plants of *Senna obtusifolia* can effectively lower elevated blood glucose levels, which at the highest dose tested was as effective as glibenclamide.

KEYWORDS: Antihyperglycemic, *Senna obtusifolia*, glibenclamide, OGTT.

BACKGROUND

Senna obtusifolia (L.) H.S. Irwin & Barneby is a leguminous plant known in English as Java bean or Sicklepod and in Bengali as Achkigard. The plant is invasive and considered a weed in Bangladesh. Most often, the plant is found on fallow lands or by the roadsides. Despite its

classification as an invasive weed, the plant is considered medicinally important in many countries. The Hausa people in Kano Metropolis, Northern Nigeria, use the leaves, bark and root of the plant to treat diabetes.^[1] Crude methanol extract of seeds of the plant reportedly demonstrated alpha-amylase inhibitory activity.^[2]

Diabetes is a fast spreading disorder throughout the world including Bangladesh. Despite being known for at least 3500 years in Egyptian manuscripts (described as too great emptying of urine) or in Ayurveda (described as madhumeha),^[3] the disorder has proved resistant to cure even with modern medicine (modern medicine can only reduce elevated blood glucose levels but cannot cure diabetes). Moreover, the prevalence of this disorder, characterized by glucose intolerance (elevated blood glucose levels) is increasing at a fast rate possibly due to changes in lifestyle and food habits. Rural people in Bangladesh and other parts of the world either lack access to proper blood glucose lowering medications and cannot afford or are hesitant to use glucometers or take insulin injections or even blood glucose lowering drugs.

Elevated blood glucose level (or glucose intolerance leading to disturbances in glucose homeostasis) is a hallmark for diabetes and pre-diabetes. Long-term elevations of blood glucose levels can lead to complications like blindness, renal failure, cardiovascular disorders, and foot ulcers. Readily available, affordable and acceptable medications are necessary for people with glucose intolerance or elevated blood glucose levels. Plants being a good source of medications from traditional to modern times, we had been screening local plants for their blood glucose lowering ability for a number of years.^[4-31] *Senna obtusifolia* is a commonly available plant in Bangladesh. It was the objective of the present study to determine the antihyperglycemic effect of methanolic extract of *Senna obtusifolia* whole plant (MESO). Antihyperglycemic ability was measured through oral glucose tolerance test (OGTT), which is a reliable test for impaired glucose tolerance as happens during pre-diabetic and diabetic conditions.^[32]

METHODS

Plant material collection and extraction

Whole plants of *Senna obtusifolia* were collected from Rema Kalenga Wildlife Sanctuary in Habiganj district, Sylhet Division during December 2016. Plant specimen was taxonomically identified by a trained botanist at the University of Development Alternative. The sliced air-dried whole plants were grounded into a fine powder and 68g of the powder was extracted

with methanol (1:5, w/v) for 48 hours. The extract (MESO) was evaporated to dryness at 40°C and stored at -20°C till use. The final weight of MESO was 4.55g.

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. During this period, they were kept in a temperature controlled room (25°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)^[33] 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 MESO 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 = $(1 - W_e/W_c) \times 100$, 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.

Statistical analysis: Experimental values are expressed as mean \pm 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.^[25]

RESULTS

Oral glucose tolerance test (OGTT) results

Administration of methanol extract of MESO at doses of 50, 100, 200 and 400 mg per kg body weight each to glucose-loaded mice reduced blood glucose levels dose-dependently by 11.7, 20.1, 28.3, and 37.1%, 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 36.7%. Thus at the highest dose tested, MESO demonstrated comparable ability to glibenclamide in its antihyperglycemic activity.

Table 1: Effect of MESO 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	5.66 ± 0.12	-
Glibenclamide	10 mg	3.58 ± 0.09	36.7*
(MESO)	50 mg	5.00 ± 0.08	11.7*
(MESO)	100 mg	4.52 ± 0.07	20.1*
(MESO)	200 mg	4.06 ± 0.13	28.3*
(MESO)	400 mg	3.56 ± 0.17	37.1*

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

DISCUSSION

Senna obtusifolia is considered a weed by the farmers and as a result is available at very low or no costs. The plant can therefore be of use in discovery of low-cost antihyperglycemic medication. It would also be of interest to investigate whether the plant can retain its antihyperglycemic properties following cooking, and whether the cooked plant is edible. If both premises hold true then all that a diabetic person needs to do is to collect the plant from waysides and fallow lands, cook, and consume enough amounts of the plant as required to keep blood glucose under control.

Different groups of phytochemicals like anthraquinones, phytosterols, triterpenoids and flavonoids have been reported from the plant.^[34, 35] These phytochemicals may be responsible for the observed antihyperglycemic effects,^[36-38] although further studies are necessary to confirm the identity of the active bioconstituent(s).

CONCLUSION

The results suggest that methanolic extract of whole plants of *Senna obtusifolia* (MESO) possess antihyperglycemic effects as demonstrated through OGTT.

CONFLICTS OF INTEREST

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

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