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ANTIHYPERGLYCEMIC EFFECT OF METHANOL EXTRACT OF *MUSA SAPIENTUM* FRUIT SKINS IN GLUCOSE-CHALLENGED MICE

Imam Hossain[1]*, Sharmin Akter[2]*, Jannatul Ferdoes Shoma[2], Md. Shahadat Hossan[3], Mohammed Rahmatullah*[2]

[1]Department of Biotechnology & Genetic Engineering, University of Development Alternative, Lalmatia, Dhaka-1207, Bangladesh.

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

[3]School of Pharmacy, University of Nottingham, UK.

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

ABSTRACT

Background. As part of our ongoing anti-diabetic project to identify local plant species and plant parts which can lower blood glucose levels, the objective of the present study was to determine the antihyperglycemic effects of methanol extract of *Musa sapientum* (banana) fruit skins in glucose-challenged mice. **Methods**. Antihyperglycemic activity was determined through oral glucose tolerance test (OGTT) in mice. **Results.** Administration of methanol extract of *Musa sapientum* fruit skins (MEMS) at doses of 50, 100, 200, and 400 mg per kg body weight each to glucose-loaded mice reduced blood glucose levels by 21.9, 29.3, 33.0 and 40.7%, 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 46.1%. **Conclusion**. Methanolic extract of fruit skins of *Musa sapientum* can effectively lower elevated blood glucose levels, which at the highest dose tested was nearly as effective as glibenclamide.

KEYWORDS: Antihyperglycemic, *Musa sapientum*, glibenclamide, OGTT.

BACKGROUND

Musa sapientum L. (Musaceae) is extensively grown in Bangladesh for its edible fruits, which are consumed in the ripe form. In English, the fruit is known as banana and in Bengali, the fruit is known as kola. Bananas are a popular fruit throughout the world because of their taste, nutritive and medicinal qualities. In Bangladesh, two types of bananas are cultivated mainly, namely *Musa sapientum* (banana) and *Musa paradisiaca* (plantain), the fruits of which are eaten in the unripe stage following cooking.

The hypoglycemic effect of ethanol extract of *Musa sapientum* flowers has been described in alloxan diabetic rats.[1] Methanolic extract of suckers of the plant has been shown to attenuate hyperglycemia in alloxan diabetic rats, when combined with exercise.[2] Diabetes mellitus is a debilitating disease characterized by hyperglycemia due to disturbances in the normal pattern of glucose homeostasis. The disorder can quickly lead to serious complications like cardiovascular disorders, diabetic retinopathy, diabetic neuropathy, and diabetic nephropathy. There are two major types of diabetes, namely insulin dependent diabetes mellitus (IDDM) and non-insulin dependent diabetes mellitus (NIDDM), the incidences of NIDDM being much higher than IDDM. Available allopathic drugs like sulphonyl ureas and biguanides can lower elevated blood glucose levels but have side effects and cannot cure the disease.[3,4]

Antidiabetic drugs are not always readily available and affordable to the particularly rural illiterate and poor population of Bangladesh, who may also lack access to modern clinics and doctors. Reduction of dependency on allopathic drugs is therefore a necessity in Bangladesh and local antidiabetic plants can fulfill this requirement. We had been screening local plants for their antidiabetic effects for a number of years.[5-32] The fruits of *Musa sapientum* are readily available and affordable in Bangladesh throughout the year. Various varieties are popular, the most popular variety being known as ‘sagor’ or ‘sagor kola’. Since the fruit skin is discarded after eating the fruit, such skins can be collected at very low cost. It was therefore the objective of the present study to determine the antihyperglycemic effect of methanolic extract of *Musa sapientum* fruit skins (MEMS). 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.[33]

Methods

Plant material collection and extraction

Fruit skins of the 'sagor' variety were collected from a vegetable market in Jatrabari, Dhaka city during October 2016. Plant specimen was taxonomically identified by a trained botanist at the University of Development Alternative. The sliced air-dried fruit skins were grounded into a fine powder and 95g of the powder was extracted with methanol (1:5, w/v) for 48 hours. The extract (MEMS) was evaporated to dryness at 40^{o}C and stored at -20^{o}C till use. The final weight of MEMS was 1.524g.

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)[34] 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 MEMS 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.

$$\text{Percent lowering of blood glucose level} = (1 - W_e/W_c) \text{ X } 100,$$

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.

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 *Musa sapientum* fruit skins (MEMS) at doses of 50, 100, 200 and 400 mg per kg body weight each to glucose-loaded mice reduced blood glucose levels by 21.9, 29.3, 33.0 and 40.7%, 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 46.1%. Thus at the highest dose tested, MEMS demonstrated nearly comparable ability to glibenclamide in its antihyperglycemic activity.

Table 1: Effect of MEMS 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	5.94 ± 0.16	-
Glibenclamide	10 mg	3.20 ± 0.14	46.1*
(MEMS)	50 mg	4.64 ± 0.29	21.9*
(MEMS)	100 mg	4.20 ± 0.22	29.3*
(MEMS)	200 mg	3.98 ± 0.24	33.0*
(MEMS)	400 mg	3.52 ± 0.04	40.7*

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

DISCUSSION

Different varieties of bananas (*Musa sapientum*) are grown extensively in Bangladesh and are readily available and affordable throughout the year. Fruit skins are discarded and so can be procured at almost no cost. From that view point, banana skins possess the potential for discovery of affordable yet novel antidiabetic drugs. It would be of interest not only to

identify the active component but also to evaluate various varieties of banana skins for their antihyperglycemic activities.

CONCLUSION

The results suggest that methanolic extract of 'sagor' variety of *Musa sapientum* fruit skins (MEMS) possess antihyperglycemic effects as demonstrated through OGTT.

Conflicts of interest

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

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