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IMPROVED ORAL GLUCOSE TOLERANCE WITH METHANOL EXTRACT OF *MUSA TEXTILIS* NEE AND SYNERGISTIC ACTION WITH GLIBENCLAMIDE

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ABSTRACT

Background: In previous studies we have observed that methanol extracts of fruit skins of various types of cultivated banana species (*Musa sapientum* and *Musa seminifera*) can improve glucose tolerance in glucose-loaded mice. The objective of this study was to evaluate the glucose tolerance ability of methanol extract of fruit skins of a wild banana species, *Musa textilis* Nee. **Methods:** Oral glucose tolerance test (OGTT) was done to evaluate glucose tolerance. **Results:** In oral glucose tolerance tests, methanol extract of fruit skins of *Musa textilis* (MEMT) significantly and dose-dependently reduced blood glucose levels in glucose-loaded mice by 21.4, 29.0, and 36.2%, respectively, at doses of 100, 200 and 400 mg each per kg body weight in mice. By comparison, a standard antihyperglycemic drug, glibenclamide, reduced blood glucose levels by 39.3% at a dose of 10 mg per kg. MEMT, when administered at doses of 200 and 400 mg per kg with 10 mg glibenclamide per kg demonstrated synergistic glucose lowering effect by reducing blood glucose by 41.7 and 44.5%, respectively. **Conclusion:** MEMT can be used as a blood glucose lowering agent in diabetic patients.

KEYWORDS: Antihyperglycemic, *Musa textilis*, OGTT, diabetes.

BACKGROUND

Diabetes is a serious disorder where the pancreas does not produce enough insulin, thus leading to elevated blood glucose levels. Left untreated, the disease quickly leads to other complicated disorders including cardiovascular disorder, diabetic retinopathy, diabetic

neuropathy and diabetic nephropathy. The disease has no total cure, except for blood glucose lowering drugs, which may act in various ways like stimulating insulin production or increasing glucose utilization. On the other hand, in a country like Bangladesh, where 10% of the population is possibly suffering from diabetes[1], allopathic blood glucose lowering drugs are not readily available or affordable in rural areas because of lack of doctors and medicine dispensing stores.

The prevailing situation calls for alternate medications, of which plants can form an excellent source.[2,17] The *Musa* genera (banana) have long been regarded by traditional medicinal practitioners to be able to control blood glucose. We have previously observed effective improvement of glucose tolerance with methanol extracts of fruit peels of *Musa seminifera* and *Musa sapientum.*[18,19] The objective of the present study was to evaluate the oral glucose tolerance efficacy of methanol extract of fruit skins of wild banana (MEMT), *Musa textilis* Nee (Musaceae family), known in Bengali as Pahari kola or Jongli kola, that is banana that grows in hilly regions or wild banana.

Methods

Plant material collection

Ripe banana fruits of *Musa textilis* were collected from Bandarban district in the Chittagong Hill Tracts region. The fruits were brought to Dhaka and identified at the University of Development Alternative.

Preparation of methanolic extract of Musa textilis fruit skins (MEMT)

For preparation of methanol extract of fruit skins of *Musa textilis* (MEMT), skins were taken off ripe fruits, thoroughly sliced, dried in the shade, and pulverized into a fine powder. 50g of the powder was extracted with 250 ml methanol over 48 hours. Methanol was evaporated at 40^{o}C and the extract was dissolved in Tween 20 prior to administration to mice by gavaging. The final weight of the extract was 6.5g.

Chemicals and Drugs

Glibenclamide and glucose were obtained from Square Pharmaceuticals Ltd., Bangladesh. All other chemicals were of analytical grade. Glucometer and strips were purchased from Lazz Pharma, Bangladesh.

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 time, the animals were fed with mice chow (supplied by ICDDR,B) 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 for evaluation of antihyperglycemic activity

Oral glucose tolerance tests (OGTT) were carried out as per the procedure previously described by Joy and Kuttan[20] with minor modifications. Briefly, fasted mice were grouped into seven 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). Groups 3-5 received, respectively, MEMT at doses of 100, 200 and 400 mg per kg body weight. Groups 6 and 7 received, respectively, 200 and 400 mg MEMT along with 10 mg glibenclamide per kg body weight. 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[6,12], all mice were orally administered 2g glucose per kg of body weight. Blood samples were collected 120 minutes after the glucose administration through puncturing heart following previously published procedures.[6,12] 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 MEMT or (MEMT + glibenclamide) administered mice (Groups 2-7), and control mice (Group 1), respectively. Gavaging was done carefully such that injuries do not happen, and no mice fatalities occurred during gavaging. Mice were handled carefully throughout the experiment so that they did not get subjected to any unnecessary pain.

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.[10]

RESULTS

In oral glucose tolerance tests, methanol extract of fruit skins of *Musa textilis* (MEMT) significantly and dose-dependently reduced blood glucose levels in glucose-loaded mice by 21.4, 29.0, and 36.2%, respectively, at doses of 100, 200 and 400 mg each per kg body weight in mice. By comparison, a standard antihyperglycemic drug, glibenclamide, reduced blood glucose levels by 39.3% at a dose of 10 mg per kg. Thus the highest dose of MEMT (400 mg per kg) did not vary much from glibenclamide in its ability to reduce blood glucose 36.2 versus 39.3%). MEMT, when administered at doses of 200 and 400 mg per kg with 10 mg glibenclamide per kg demonstrated synergistic glucose lowering effect by reducing blood glucose by 41.7 and 44.5%, respectively.

Table 1: Synergistic lowering action of MEMT and glibenclamide 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	5.80 ± 0.14	-
Glibenclamide	10 mg	3.52 ± 0.09	39.3*
(MEMT)	100 mg	4.56 ± 0.06	21.4*
(MEMT)	200 mg	4.12 ± 0.09	29.0*
(MEMT)	400 mg	3.70 ± 0.07	36.2*
(MEMT + glibenclamide)	(200 + 10) mg	3.38 ± 0.08	41.7*
(MEMT + glibenclamide)	(400 + 10) mg	3.22 ± 0.06	44.5*

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

DISCUSSION

It appears that methanol extract of fruit skins of various types of banana have the ability to lower blood glucose in glucose-challenged mice. Bangladesh has nearly two dozen banana cultivars. It would be beneficial if the cultivars are evaluated for efficacy of their fruit skin methanolic extract in lowering blood glucose. This can not only open a path for possible discovery of new glucose lowering drugs but also enable rural and remote area patients to get access to easily affordable and available means to control elevated diabetic blood glucose.

CONCLUSION

The results suggest that methanolic extract of fruit skins of *Musa textilis* can be used for lowering of blood glucose.

Conflicts of interest

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

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