ORAL GLUCOSE TOLERANCE AND ANALGESIC ACTIVITY TESTS
WITH AERIAL PARTS OF CORCHORUS AESTUANS L.

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ABSTRACT

Background. Corchorus aestuans is grown in Bangladesh for its fiber, which is used in making bags, carpets, and rugs. It was of interest to determine the antihyperglycemic and analgesic properties of aerial parts of the plant. Methods. Antihyperglycemic activity was determined through oral glucose tolerance tests (OGTT). Analgesic activity was determined by observed decreases in abdominal constrictions (writhings) in intraperitoneally administered acetic acid-induced pain model in mice. Results. Administration of methanol extract of aerial parts led to dose-dependent reductions in blood glucose levels in glucose-loaded mice. At doses of 50, 100, 200 and 400 mg per kg body weight, the extract, significantly and dose-dependently, reduced blood glucose levels by 15.8, 29.0, 41.1, and 49.2%, respectively compared to control animals. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight, reduced blood glucose level by 49.2%. In analgesic activity tests, the extract at doses of 50, 100, 200 and 400 mg per kg body weight significantly and dose-dependently reduced the number of abdominal constrictions (writhings) by 31.0, 37.9, 55.2, and 62.1%, respectively. A standard pain relieving (analgesic) drug, aspirin, reduced the number of writhings by 34.5 and 55.2%, respectively, when administered at doses of 200 and 400 mg per kg body weight. Conclusion. The aerial parts of the plant can be beneficial in lowering blood glucose and for alleviating pain.

KEY WORDS: Antihyperglycemic, Corchorus aestuans, analgesic, Tiliaceae.
BACKGROUND

Corchorus aestuans L. (Tiliaceae) is a variety of jute grown in Bangladesh primarily for its fiber, which is used in making bags, carpets and rugs. Aerial parts of the plant are also cooked and consumed as vegetable mainly by the less affluent sections of the population. In Bengali, the plant is known as tita pat shak. It has been reported that the plant is also consumed in Senegal as a leafy vegetable.[1]

Since diabetes (characterized by high blood glucose levels) and pain are common afflictions throughout the world including Bangladesh and affect millions of people, we had been experimenting with various medicinal plants of Bangladesh towards providing relief from diabetes and pain in the form of using the plants themselves or their crude extracts.[2-23] We had previously reported antihyperglycemic and analgesic potential of aerial parts of Corchorus olitorius.[24] The objective of the present study was to evaluate the antihyperglycemic potential of methanol extract of Corchorus aestuans aerial parts (MECA) in glucose-loaded mice through oral glucose tolerance tests (OGTT), and analgesic potential of MECA in intraperitoneally acetic acid injected pain-induced mice.

METHODS

Plant material collection

Aerial parts were collected during September from Dhaka district, Bangladesh. The aerial parts were taxonomically identified at the Bangladesh National Herbarium (Accession Number 39,537).

Preparation of methanolic extract of aerial parts

The aerial parts (stems and leaves) were washed thoroughly, cut down into small pieces, and next thoroughly dried in the shade and 100g of dried and powdered aerial parts were extracted with methanol (w:v ratio of 1:5, final weight of the extract 4g). The extract was stored at -20°C till use.

Chemicals and Drugs

Glibenclamide, aspirin, and glucose were obtained from Square Pharmaceuticals Ltd., Bangladesh. All other chemicals were of analytical grade.

Animals: Swiss albino mice, which weighed between 15-19g 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 antihyperglycemic activity**

Oral glucose tolerance tests were carried out as per the procedure previously described by Joy and Kuttan (1999) \[25\] 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 (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 3-6 received methanolic extract of aerial parts (MECA) 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.\[26\] The percent lowering of blood glucose levels were calculated according to the formula described below.

\[
\text{Percent lowering of blood glucose level} = (1 – \frac{W_e}{W_c}) \times 100, \quad \text{where } W_e \text{ and } W_c \text{ represents the blood glucose concentration in glibenclamide or MECA administered mice (Groups 2-6), and control mice (Group 1), respectively.}
\]

**Analgesic activity evaluation through abdominal writhing test**

Analgesic activity of MECA was examined as previously described.\[27\] Mice were divided into seven groups of five mice each. Group 1 served as control and was administered vehicle only. Groups 2 and 3 were orally administered the standard analgesic drug aspirin at doses of 200 and 400 mg per kg body weight, respectively. Groups 4-7 were administered MECA at doses of 50, 100, 200 and 400 mg per kg body weight, respectively. Following a period of 60 minutes after oral administration of standard drug or MECA, all mice were intraperitoneally injected with 1% acetic acid at a dose of 10 ml per kg body weight. A period of 5 minutes was given to each animal to ensure bioavailability and onset of chemically induced irritation of acetic acid \[28\], following which period, the number of abdominal constrictions (writhings) was counted for 10 min. The percent inhibitions of abdominal constrictions were calculated according to the formula given below.

\[
\text{Percent inhibition} = (1 – \frac{W_e}{W_c}) \times 100
\]
where \( W_e \) and \( W_c \) represents the number of writhings in aspirin or MECA administered mice (Groups 2-7), 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.[12]

**RESULTS**

Table 1: Effect of crude methanol extract of aerial parts (MECA) on blood glucose level in hyperglycemic mice following 120 minutes of glucose loading.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose (mg/kg body weight)</th>
<th>Blood glucose level (mmol/l)</th>
<th>% lowering of blood glucose level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10 ml</td>
<td>5.94 ± 0.33</td>
<td>-</td>
</tr>
<tr>
<td>Glibenclamide</td>
<td>10 mg</td>
<td>3.02 ± 0.16</td>
<td>49.2*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>50 mg</td>
<td>5.00 ± 0.23</td>
<td>15.8*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>100 mg</td>
<td>4.22 ± 0.18</td>
<td>29.0*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>200 mg</td>
<td>3.50 ± 0.14</td>
<td>41.1*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>400 mg</td>
<td>3.02 ± 0.22</td>
<td>49.2*</td>
</tr>
</tbody>
</table>

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

Table 2: Analgesic effect of crude methanol extract of aerial parts (MECA) in acetic acid-induced pain model mice.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose (mg/kg body weight)</th>
<th>Mean number of abdominal constrictions</th>
<th>% inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10 ml</td>
<td>5.8 ± 0.37</td>
<td>-</td>
</tr>
<tr>
<td>Aspirin</td>
<td>200 mg</td>
<td>3.8 ± 0.73</td>
<td>34.5*</td>
</tr>
<tr>
<td>Aspirin</td>
<td>400 mg</td>
<td>2.6 ± 0.68</td>
<td>55.2*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>50 mg</td>
<td>4.0 ± 0.55</td>
<td>31.0*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>100 mg</td>
<td>3.6 ± 0.24</td>
<td>37.9*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>200 mg</td>
<td>2.6 ± 0.40</td>
<td>55.2*</td>
</tr>
<tr>
<td>(MECA)</td>
<td>400 mg</td>
<td>2.2 ± 0.58</td>
<td>62.1*</td>
</tr>
</tbody>
</table>

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

**Antihyperglycemic activity evaluation results**

Administration of methanol extract of aerial parts led to dose-dependent reductions in blood glucose levels in glucose-loaded mice. At doses of 50, 100, 200 and 400 mg per kg body
weight, the extract, significantly and dose-dependently, reduced blood glucose levels by 15.8, 29.0, 41.1, and 49.2%, respectively compared to control animals. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight, reduced blood glucose level by 49.2%. The results are shown in Table 1 and suggest that MECA possess comparable antihyperglycemic properties to that of glibenclamide.

**Analgesic activity evaluation results**

In analgesic activity tests, the extract at doses of 50, 100, 200 and 400 mg per kg body weight significantly and dose-dependently reduced the number of abdominal constrictions by 31.0, 37.9, 55.2, and 62.1%, respectively. A standard pain relieving (analgesic) drug, aspirin, reduced the number of writhings by 34.5 and 55.2%, respectively, when administered at doses of 200 and 400 mg per kg body weight. The results are shown in Table 2 and demonstrate that MECA had better pain alleviating effect than that of aspirin.

**DISCUSSION**

The fruits of *Corchorus aestuans* have previously been reported to contain a cardiac glycoside with cardiotonic activity.\textsuperscript{[29]} To the best of our knowledge, this is the first reported antihyperglycemic and analgesic activity of aerial parts of the plant. The plant is grown and so widely available in the rural areas of Bangladesh. As such, the aerial parts may prove to be useful towards discovery of new and effective drugs, which can reduce high blood glucose levels in diabetic patients and alleviate pain in people suffering from painful diseases.

**CONCLUSION**

The results suggest that methanolic extract of aerial parts of *Corchorus aestuans* can be used for lowering blood glucose and for alleviating pain.

**CONFLICTS OF INTEREST**

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

**REFERENCES**


