Original Article

Evaluation of antihyperglycemic activity of Smilax perfoliata Lour. (Smilacaceae) leaves in Swiss albino mice

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ABSTRACT

The Smilax genus consists of about 300-350 species and can be found in the temperate zones, tropics and sub-tropical regions of the world. By nature, they are climbing flowering plants. Smilax perfoliata is a woody climbing plant found in the forest regions of Bangladesh. Leaves of the plant are often used in the folk medicinal system of Bangladesh for treatment of frequent urination and diabetes. As part of our ongoing studies on antihyperglycemic activity evaluation in medicinal plants of Bangladesh, the objective of the present study was to determine whether leaves of the plant have antihyperglycemic activity, as determined through oral glucose tolerance tests in glucose-loaded mice. The methanol extract of leaves of Smilax perfoliata, when administered at doses of 50, 100, 200 and 400 mg per kg body weight to glucose-loaded mice demonstrated dose-dependent antihyperglycemic activity. The percent reductions in serum glucose concentrations at these doses were, respectively, 16.7, 17.2, 27.6 and 56.8%; the results were statistically significant at all doses tested. The reduction in serum glucose concentration by 56.8% at the highest dose tested of 400 mg per kg body weight compares favorably with that of a standard drug, glibenclamide, which when administered at a dose of 10 mg per kg body weight, led to serum glucose reduction by 58.3%. The results validate the traditional use of this plant in Bangladesh to lower blood sugar in diabetic patients and merit further studies of the phytochemical constituents of the plant for their individual antihyperglycemic potentials.

Key words: Smilax perfoliata, antihyperglycemic, Smilacaceae, mice

Introduction

The Smilax genus (Family: Smilacaceae), worldwide, is known to contain 300-350 species and can be found widely distributed in the temperate, tropical and sub-tropical zones. The plants belonging to this genus are flowering plants and most of them are woody climbers. Several species of this genus can be observed in the wilds and fallow lands of Bangladesh, including Smilax aspericaulis Wall., Smilax china L., Smilax ovalifolia Roxb., Smilax perfoliata Lour., and Smilax zeylanica L. The plants are used widely in the folk medicinal system of Bangladesh, where the folk medicinal practitioners, otherwise known as Kavirajes treat diverse ailments mainly with juice, decoction or paste of medicinal plants. Smilax perfoliata (Bengali: Kumari lota) is mainly used by the Kavirajes for treatment of frequent urination and diabetes, where leaf juice is orally administered to patients. The plant or plant parts has not been studied widely and only a few scientific reports exist. In India, the tribals of Mayurbhanj district of North Orissa reportedly use the roots of the plant for treatment of gastric problem like indigestion (Rout et al., 2009). A number of chemical components have been isolated from 95% ethanolic extract of the plant, including smilglaside F, 1,6-O-diferuloyl-(3-O-p-coumaroyl)-6-D-fructofuranosyl-(2→1)-2-O-acetyl-1-D-glucopyranoside, rutin, narcissin, cassiamin A, cassiamin B, and 1,2,3-trimethoxy-5-hydroxyphenol-1-O-6-D-glucopyranoside (Yu-Biao et al., 2004).

Our laboratory has been conducting screening of Bangladeshi medicinal plants for the last few years, primarily for their antihyperglycemic and antinociceptive potentials (Anwar et al., 2010; Jahan et al., 2010; Khan et al., 2010; Mannan et al., 2010; Rahman et al., 2010; Ali et al., 2011; Khan et al., 2011; Rahman et al., 2011a,b; Shoha et al., 2011; Sutradhar et al., 2011). Diabetes is reaching endemic proportions within the human
population all over the world, and which is considered to become more severe in the future. The causative factors could possibly be the change of lifestyle of human beings, moving towards a more sedentary lifestyle. This change has been accompanied with a change in the food habit, including a tendency to consume more sugar within various dietary items. Diabetes is a debilitating disease for which modern or allopathic medicine has no known cure. Moreover, diabetes is not only limited to increase in blood sugar levels and secretion of sugar in urine; the disease progressively leads to diabetic neuropathy, nephropathy and retinopathy along with posing serious threats of cardiovascular disorders. Pain in one form or other is also prevalent worldwide, every human being at some time or other suffering from this condition. The objective of the present study was to evaluate the methanol extract of *Smilax perfoliata* leaves for any antihyperglycemic activity, which has been conducted through oral glucose tolerance tests in glucose loaded mice. The leaf juice of this plant, as earlier mentioned, is used by folk medicinal practitioners of Bangladesh to reduce blood sugar.

**Materials and Methods**

**Plant material and extraction:**

The leaves of *Smilax perfoliata* were collected in November 2011. The plant was taxonomically identified by the Bangladesh National Herbarium at Dhaka (Accession Number: 35,306). The leaves were cut into small pieces and air-dried in the shade for 120 hours, grounded into a fine powder, and were extracted with methanol at a ratio of 1:5 (w/v). The initial weight of dried leaf powder used for extraction was 100g; the final weight of the extract was 6.06g.

**Chemicals and Drugs:**

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

**Animals:**

In the present study, Swiss albino mice (male), which weighed between 18-22 g were used. The animals were obtained from International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B). All animals were kept under ambient temperature with 12h light followed by a 12h dark cycle. 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.

**Anti-hyperglycemic activity:**

Glucose tolerance property of methanol extract of *Smilax perfoliata* leaves was determined as per the procedure previously described by Joy and Kuttan (1999) with minor modifications. In brief, fasted mice were grouped into six groups of six mice each. The various groups received different treatments like Group 1 received vehicle (1% Tween 80 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 methanol extract of *Smilax perfoliata* leaves at doses of 50, 100, 200 and 400 mg per kg body weight. Each mouse was weighed and doses adjusted accordingly prior to administration of vehicle, standard drug, and test samples. All substances were orally administered. Following a period of one hour, all mice were orally administered 2 g glucose/kg of body weight. Blood samples were collected 120 minutes after the glucose administration through puncturing heart. Serum glucose levels were measured by glucose oxidase method (Venkatesh *et al.*, 2004).

**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.

**Results and Discussion**

The crude methanol extract of *Smilax perfoliata* leaves showed dose-dependent reductions in serum glucose levels when administered to glucose-loaded mice at doses of 50, 100, 200 and 400 mg per kg body weight. At these doses, the extract caused 16.7, 17.2, 27.6 and 56.8% reductions in serum glucose levels. The reductions of serum glucose at all doses were statistically significant. However, up till a dose of 100 mg per kg body weight, the antihyperglycemic activity of the extract was not strong. At a dose of 400 mg extract per kg body weight, the
Percent lowering of serum glucose concentration was high and was comparable to that of the standard antihyperglycemic drug, glibenclamide at the dose administered. At a dose of 10 mg per kg body weight, glibenclamide lowered serum glucose level by 58.3%. The results are shown in Table 1.

Table 1: Effect of methanol extract of *Smilax perfoliata* leaves on serum 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>Serum glucose level (mg/dl)</th>
<th>% lowering of serum glucose level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Group 1)</td>
<td>10 ml</td>
<td>86.49 ± 5.96</td>
<td>-</td>
</tr>
<tr>
<td>Glibenclamide (Group 2)</td>
<td>10 mg</td>
<td>36.04 ± 4.28</td>
<td>58.3*</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> (Group 3)</td>
<td>50 mg</td>
<td>72.08 ± 5.06</td>
<td>16.7*</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> (Group 4)</td>
<td>100 mg</td>
<td>71.63 ± 7.17</td>
<td>17.2*</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> (Group 5)</td>
<td>200 mg</td>
<td>62.61 ± 5.42</td>
<td>27.6*</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> (Group 6)</td>
<td>400 mg</td>
<td>37.39 ± 2.91</td>
<td>56.8*</td>
</tr>
</tbody>
</table>

All administrations were made orally. Values represented as mean ± SEM, (n=6); *P* < 0.05; significant compared to hyperglycemic control animals.

The observed glucose lowering effect by the crude extract of leaves may occur through several possible mechanisms. The extracts may potentiate the pancreatic secretion of insulin or increase the glucose uptake (Farjou *et al.*, 1987; Nyunai *et al.*, 2009). Alternately, the extracts may inhibit glucose absorption in gut (Bhowmik *et al.*, 2009). Any of the above three mechanisms or a combination of mechanisms can contribute to the observed lowering of blood sugar. However, the exact mechanism of antihyperglycemic action remains to be elucidated and is currently under investigation in our laboratory. Nevertheless, any successful identification of a responsible phytochemical component(s) from the plant and discovery of its antihyperglycemic effects can lead to possibly new and more efficacious drugs for diabetes treatment. It is noteworthy in this respect that rutin, a phytochemical component isolated from this plant reportedly possess -glucosidase and hypoglycemic properties (Li *et al.*, 2009; Fernandes *et al.*, 2010; Abd El-Mawla *et al.*, 2011; Gandhi *et al.*, 2011), which can contribute to the antihyperglycemic effects observed with methanol extract of leaves of the plant.

References


