**Original Article**

*Mucuna pruriens*: An evaluation of antihyperglycemic potential of seeds

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**ABSTRACT**

*Mucuna pruriens* is an annual, climbing shrub with long vines that can reach over 15 m in length. Seeds of the plant have uses in folk medicines of Bangladesh as an antidiabetic agent and for treatment of infertile males. Towards validating the use of seeds as an antidiabetic agent, oral glucose tolerance tests were conducted in Swiss albino mice with methanolic extract of seeds of the plant. The extract when administered at doses of 50, 100, 200 and 400 mg per kg body weight to glucose-loaded mice significantly and dose-dependently inhibited the rise in blood sugar concentrations by 48.3, 50.5, 52.9 and 54.1%, respectively. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight inhibited the increase in blood sugar concentration in glucose-loaded mice by 56.8%. Thus at the highest dose of the extract, the blood glucose lowering activity was comparable to that of glibenclamide. Taken together, the results not only validate the folk medicinal use of seeds as an antidiabetic agent but also suggest that further scientific studies should be carried out to identify the responsible phytochemical constituent(s) responsible for the observed blood sugar lowering effect.

**Key words:** *Mucuna pruriens*, antihyperglycemic, Swiss albino mice, Fabaceae

**Introduction**

*Mucuna pruriens* (L.) DC. is an annual, climbing shrub with long vines that can reach over 15 m in length. The plant is a Fabaceae family plant and is known in English as velvet bean and in Bengali as alkushie. The plant can be found in the wild in Bangladesh. In the folk medicinal system of Bangladesh, the folk medicinal practitioners use the seeds of this plant for lowering high blood sugar levels in diabetic patients and to treat male infertility. Previous studies by our research group have centered on ethnomedicinal surveys (Rahmatullah et al., 2009a-c; Rahmatullah et al., 2010a-g; Rahmatullah et al., 2011a,b; Rahmatullah et al., 2012a-d) followed by screening of the plants obtained for antihyperglycemic, antinociceptive and cytotoxic activities (Anwat et al., 2010; Jahan et al., 2010; Khan et al., 2010; Mannan et al., 2010; Rahman et al., 2010; Rahmatullah et al., 2010h; Shoha et al., 2010; Ali et al., 2011; Barman et al., 2011; Hossan et al., 2011; Jahan et al., 2011; Rahman et al., 2011; Sutradhar et al., 2011; Ahmed et al., 2012; Arefin et al., 2012; Haque et al., 2012; Sathi et al., 2012), because diabetes and various forms of cancer are fast increasing in Bangladesh. Pain is also a problem that is widely experienced by the population, and against which the majority of the rural population relies on medicinal plants for its alleviation. Towards a continuation of the above studies, the objective of the present study was to scientifically evaluate the antihyperglycemic potential of seeds of the plant in oral glucose tolerance tests conducted with Swiss albino mice.

**Materials and Methods**

Seeds of *Mucuna pruriens* were collected from Barisal district, Bangladesh during December, 2010. The plant was taxonomically identified at the Bangladesh National Herbarium at Dhaka (Accession Number 35,411). The dried seeds of *Mucuna pruriens* were grounded into a fine powder and 100g of the powder was extracted.
with methanol (1:5, w/v) for 48 hours. The extract was evaporated to dryness. The final weight of the extract was 3.56g.

**Chemicals:**

Glacial acetic acid was obtained from Sigma Chemicals, USA; glibenclamide and glucose were obtained from Square Pharmaceuticals Ltd., Bangladesh.

**Animals:**

In the present study, Swiss albino mice (male), which weighed between 20-23g 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.

**Antihyperglycemic activity:**

Glucose tolerance property of methanol extract of *Mucuna pruriens* seeds 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 *Mucuna pruriens* seeds 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. Blood 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**

In antihyperglycemic activity experiments done through oral glucose tolerance tests in glucose-loaded Swiss albino mice, the methanolic extract of *Mucuna pruriens* seeds exhibited dose-dependent and significant blood glucose lowering activity when administered at experimental doses of 50, 100, 200 and 400 mg per kg body weight in mice. At the afore-mentioned four doses, the extract inhibited the rise in blood sugar concentrations by 48.3, 50.5, 52.9 and 54.1%, respectively. By comparison, a standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg per kg body weight inhibited the increase in blood sugar concentration in glucose-loaded mice by 56.8%. Thus at the highest dose of the extract, the blood glucose lowering activity was comparable to that of glibenclamide. The results are shown in Table 1.

**Table 1:** Effect of methanol extract of *Mucuna pruriens* seeds 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 (Group 1)</td>
<td>10 ml</td>
<td>7.48 ± 0.69</td>
<td></td>
</tr>
<tr>
<td>Glibenclamide (Group 2)</td>
<td>10 mg</td>
<td>3.23 ± 0.41</td>
<td>56.8*</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em> (Group 3)</td>
<td>50 mg</td>
<td>3.87 ± 0.29</td>
<td>48.3*</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em> (Group 4)</td>
<td>100 mg</td>
<td>3.70 ± 0.12</td>
<td>50.5*</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em> (Group 5)</td>
<td>200 mg</td>
<td>3.52 ± 0.18</td>
<td>52.9*</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em> (Group 6)</td>
<td>400 mg</td>
<td>3.43 ± 0.44</td>
<td>54.1*</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.

Administration of crude ethanolic extract of seeds has been shown previously to diminish plasma glucose levels in alloxan-induced diabetic rats (Majekodunmi et al., 2011). Furthermore, oral administration of the seed extract also reportedly significantly reduced the weight loss associated with diabetes in diabetic rats. Ethanolic leaf extract of *Mucuna pruriens* also reportedly led to lowering of fasting blood sugar levels in alloxan-induced
diabetic Wistar rats (Eze et al., 2012). Additionally, administration of extract to diabetic rats was reported to result in restoration of degeneration of pancreatic islet cells. The previous studies, although done with ethanolic extract of leaves or seeds, are in agreement with the present study conducted with methanolic extract of seeds, and confirm the presence of active constituent(s) in the plant and which can exert antihyperglycemic effects.

The exact phytochemical constituent(s) present in the seeds and which may be responsible for the observed antihyperglycemic activity has not been ascertained in the present study. However, oligocyclitols (d-chiro-inositol and its two galacto-derivatives) with anti-diabetic properties has been reported from the seeds (Donati et al., 2005). It is quite possible that the observed antihyperglycemic activity as shown in oral glucose tolerance tests could be due to these phytochemicals. Taken together, the results strongly validate the use of Mucuna pruriens seeds in folk medicines of Bangladesh for lowering of high blood sugar levels in diabetic patients. Diabetes has no known cure in allopathic medicine. Moreover, diabetic patients with continuous high blood sugar levels have to rely on insulin injections, which are not only costly but also cumbersome to administer and moreover cannot be afforded by the rural poor segments of the Bangladesh population. As such, the seeds of Mucuna pruriens can offer a cheap and available alternative for alleviation of high blood sugar levels in diabetic patients of the poorer segments of the population in various countries of the world. This preliminary investigation also paves the way for further scientific studies leading to possible discovery of new drugs.

References


