EFFECT OF RAPHANUS SATIVUS ROOT EXTRACT ON GLUCOSE TOLERANCE IN GLUCOSE-LOADED HYPERGLYCEMIC MICE

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ABSTRACT

In oral glucose tolerance test (OGTT), methanol extract of Raphanus sativus roots, when administered orally to glucose-loaded Swiss albino mice at doses of 50, 100, 200 and 400 mg/kg body weight led to dose-dependent reductions in blood glucose levels. At these doses, the percent reductions in blood glucose levels were, respectively, 21.9, 34.0, 39.7, and 53.9% compared to control animals. A standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg/kg body weight reduced blood glucose levels by 49.2%. Preliminary phytochemical screening showed presence of alkaloids, flavonoids, and saponins in the extract, which components can be responsible for the observed blood glucose lowering effect.

KEYWORDS: Raphanus sativus, OGTT, antihyperglycemic, glibenclamide, alkaloid, flavonoid.

INTRODUCTION

Raphanus sativus L. (Cruciferae) is commonly cultivated in the world for its edible roots. In English it is known as ‘radish’, while its local name in Bangladesh is ‘lalmula’ or ‘red radish’. The reddish color of the root is due to the presence of cyanidin 3-sphorioside-5-glucoside and pelargonidin 3-sphorioside-5-glucoside, both di-glycosylated. Oral administration of root juice has been reported to lower blood glucose levels in streptozotocin-diabetic rats. [1]
Diabetes is a disease characterized by high blood sugar levels, and it has been estimated that in 2009, 3.4 million people died in the world from having high fasting blood sugar levels. [2] The disease has no total cure in allopathic medicine. Moreover, the rural people of Bangladesh lack access to or cannot afford anti-diabetic medicines. On the other hand, R. sativus is commonly cultivated throughout the country. It was therefore of interest to evaluate the antihyperglycemic potential of methanolic extract of R. sativus roots through oral glucose tolerance tests (OGTT) to determine whether consumption of the extract (as crude drug) can lead to alleviation of high blood glucose levels.

**METHODS**

**Plant material collection**

Roots of R. sativus were collected during November 2013 from a local market in Dhaka city, Bangladesh, and taxonomically identified at the Bangladesh National Herbarium (Accession Number 38,620).

**Preparation of methanolic extract of roots**

Roots were cut into small pieces, air-dried in the shade, and 150g of dried and powdered roots were extracted with methanol (w:v ratio of 1:5, final weight of the extract 24.3g).

**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 15-20g 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) [3] 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 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
methanolic root extract (MERS) 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 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. 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 MERS administered mice (Groups 2-6), and control mice (Group 1), respectively.

Preliminary phytochemical screening
Preliminary phytochemical analysis of MERS for presence of saponins, tannins, alkaloids, and flavonoids were conducted as described before.

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
Administration of MERS to glucose-loaded mice at doses of 50, 100, 200 and 400 mg/kg body weight led to dose-dependent reductions in blood glucose levels compared to control mice. At these doses, the percent reductions in blood glucose were, respectively, 21.9, 34.0, 39.7, and 53.9. A standard antihyperglycemic drug, glibenclamide, when administered at a dose of 10 mg/kg body weight reduced blood glucose levels by 49.2%. Thus the highest dose of the extract demonstrated more potency in reducing blood glucose than glibenclamide. The results are shown in Table 1.

Table 1: Effect of crude methanol extract of R. sativus roots (MERS) 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>(MERS)</td>
<td>50 mg</td>
<td>4.64 ± 0.23</td>
<td>21.9*</td>
</tr>
<tr>
<td>(MERS)</td>
<td>100 mg</td>
<td>3.92 ± 0.41</td>
<td>34.0*</td>
</tr>
<tr>
<td>(MERS)</td>
<td>200 mg</td>
<td>3.58 ± 0.12</td>
<td>39.7*</td>
</tr>
<tr>
<td>(MERS)</td>
<td>400 mg</td>
<td>2.74 ± 0.37</td>
<td>53.9*</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.
Preliminary phytochemical screening of MERS indicated the presence of alkaloids, flavonoids, and saponins. These groups of compounds, either individually or collectively, can act as antihyperglycemic agents. Antidiabetic effect of ethanolic extract of whole plant of *Tridax procumbens* has been reported in streptozotocin-diabetic rats. The extract was found to contain a mixture of alkaloids, flavonoids, and saponins. Stem bark extract of *Tamarindus indica* also demonstrated hypoglycemic action in alloxan diabetic rats; the extract contained alkaloids, flavonoids, and saponins. Additionally, roots of *R. sativus* reportedly contain ferulic acid. Ferulic acid reportedly showed hypoglycemic action in streptozotocin diabetic and KK-Ay (a model of non-insulin dependent diabetes mellitus) mice. Thus ferulic acid can be a component present in the extract (MERS) responsible for the observed antihyperglycemic effect. Diabetes is a debilitating disease, which can lead to increased risks of cardiovascular disorders, and which can also lead to other complications like diabetic neuropathy, nephropathy, and retinopathy. As such, since the plant *R. sativus* is widely available, decrease of high blood sugar through consumption of the roots or consumption of the methanolic extract of the roots (as a crude drug) can be beneficial to diabetic patients, and who can further benefit from the easy availability and affordability of the plant.

REFERENCES


