Antidiabetic activity on *Butea monosperma* (seeds) and *Ficus benghalensis* (aerial roots)

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Abstract

Antidiabetic activities of the extracts of *B. monosperma* (seeds) and *F. benghalensis* (aerial roots) were performed on alloxan induced diabetic rats and showed the antidiabetic activity. The administration of alloxan increased the various serum lipids. Treatment with the extracts of *F. benghalensis* decreased the lipid parameters significantly (*P*<0.01) while *B. monosperma* decreased the lipid parameters not significantly (*P*>0.05).

Keywords: Antidiabetic activity, *Butea monosperma*, *Ficus benghalensis*, lipid parameters

Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by a high blood glucose concentration-hyperglycaemia (fasting plasma glucose >7.0 mmol) or plasma glucose >11.1 mmol/12 hour after a meal), caused by insulin deficiency, often combined with insulin resistance. Hyperglycaemia occurs because of uncontrolled hepatic glucose output and reduced uptake of glucose by skeletal muscle with reduced glycogen synthesis. When the renal threshold for glucose reabsorption is exceeded, glucose spills over into the urine (glycosuria) and causes an osmotic diuresis (polyurea), which in turn, results in dehydration, thirst and increased drinking (polydipsia). Insulin deficiency causes wasting through increased breakdown and reduced synthesis of proteins. Diabetic ketoacidosis is an acute emergency. It develops in the absence of insulin because of accelerated fat breakdown to acetyl-CoA, which in the absence of aerobic carbohydrate metabolism, is converted to acetoacetate and β-hydroxybutyrate (which causes acidosis) and acetone (a ketone) (Rang *et al.*, 2003). There will be a 42% increase from 51 to 72 million in the developed countries and 170% increase from 84 to 228 million, in the developing countries. Thus, by the year 2025, over 75% of all people with diabetes will be in the developing countries, as compared to 62% in 1995. Madhumeha which has been correlated with diabetes mellitus has become a global problem in spite of advances in modern science. India has been projected by WHO as the country with the fastest growing population of diabetic patients. It is estimated that between 1995-2025 diabetic patients in India will increase by 95% (Mukherji *et al.*, 1999).

Antidiabetic Activity

Diabetes mellitus is a chronic metabolic disorder characterized by a high blood glucose concentration-hyperglycaemia (fasting plasma glucose >7.0 mmol) or plasma glucose >11.1 mmol/12 hour after a meal), caused by insulin deficiency, often combined with insulin resistance. Hyperglycaemia occurs because of uncontrolled hepatic glucose output and reduced uptake of glucose by skeletal muscle with reduced glycogen synthesis. When the renal threshold for glucose reabsorption is exceeded, glucose spills over into the urine (glycosuria) and causes an osmotic diuresis (polyurea), which in turn, results in dehydration, thirst and increased drinking (polydipsia). Insulin deficiency causes wasting through increased breakdown and reduced synthesis of proteins. Diabetic ketoacidosis is an acute emergency. It develops in the absence of insulin because of accelerated fat breakdown to acetyl-CoA, which in the absence of aerobic carbohydrate metabolism, is converted to acetoacetate and β-hydroxybutyrate (which causes acidosis) and acetone (a ketone) (Rang *et al.*, 2003).

Two major types of diabetes mellitus are:

Type I - Insulin dependent diabetes mellitus (IDDM)
Type II - Non insulin dependent diabetes mellitus (NIDDM)
Type 1- Insulin dependent diabetes mellitus, juvenile onset diabetes mellitus

There is β cell destruction in pancreatic islets; majority of cases are autoimmune (type 1A) antibodies that destroy β cells are detectable in blood, but some are idiopathic (type 1B)- no β cell antibody is found. In all type 1 cases circulating insulin levels are very low, and patients are more prone to ketosis. This type is less common and has low degree of genetic predisposition.

Type 11- Non insulin dependent diabetes mellitus, maturity onset diabetes mellitus

There is no loss or moderate reduction in β cell mass; insulin in circulation is low, normal or even high, no anti β-cell antibody is demonstrable; has a high degree of genetic predisposition; generally has a late onset (past middle age). Over 90% cases are type IDM. The causes may be:

Abnormality in glucose-receptor of β cells so that they respond at higher glucose concentration. Reduced sensitivity of peripheral tissues to insulin: reduction in number of insulin receptor, down regulation, of insulin receptors. Many hypertensives are hyperinsulimemic but normoglycaemic; exhibit insulin resistance. Hyperinsulinemia per se has been implicated in causing angiopathy. Excess of hyperglycemic hormones (glucagons etc.)/obesity: causes relative insulin deficiency- the β cells lag behind (Tripathy, 2003).

Materials and Methods Plants material

*Butea monosperma* seeds were procured from the Hansraj & Sons, Khari Baoli, and local market of Delhi. *F. bengalensis* aerial roots were collected from the campus of Jamia Hamdard Delhi.

Preparation of the extracts

Air-dried, powdered plant material was extracted exhaustively with methanol. The filtrate was dried in vacuum and stored in a refrigerator for further studies. The dried extracts were suspended in 1% Tween 80

Animals

Wistar albino rats (150-200 g) were obtained from Central Animal Facility, Jamia Hamdard University and maintained in 25 ± 1 °C, with 55 ± 5% humidity with 12 hr light/dark cycle and allowed food and water ad-libitum. Animals were acclimatized to the conditions before start of the experiments. The Institutional Animal Ethics Committee approved the experiments. All the extracts and the standard drugs were administered orally.

Procedure

Diabetes was induced in animals by single intraperitoneal injection of Alloxan (150 mg/kg) freshly prepared in normal saline. Control rats received only the normal saline. Diabetes was confirmed by checking the blood glucose levels after 7 days. Animals showing blood glucose level above 250 mg/dl were selected for the study. Diabetic animals were randomly assigned to groups. Group I contained normal animals and served as normal control. Group II served as diabetic control (toxic). Groups I and II received vehicle during the experiments, while the Group III received the reference standard drug glibenclamide (3 mg/kg) and groups from IV to V received the extracts of *F. bengalensis* and *B. monosperma* (250 mg/kg, and 250 mg/kg) respectively. Blood glucose level was measured at zero and two hr after drugs administration on 1st day and 8th day.

Estimation of blood glucose

The blood glucose level was estimated with glucose Test Kit. Enzymatic GOD-POD method. (Span diagnostics Ltd. Sachin).

Statistical analysis

Values are expressed as mean ± standard error of the mean. Statistical significance was calculated by using one way analysis of variance followed by Dunnetts’t test. The values were considered significantly different when the P- value was less than 0.05.

Table 1: Effect of different extracts of drugs on blood glucose of alloxan-induced diabetic rats

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Dose</th>
<th>Blood glucose level in mg/100 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 hr</td>
<td>2 hr</td>
</tr>
<tr>
<td>I</td>
<td>Control (Vehicle)</td>
<td>10 ml/kg</td>
<td>84.57± 4.96*</td>
</tr>
<tr>
<td>II</td>
<td>Control (Diabetic)</td>
<td>10 ml/kg</td>
<td>285.99±9.6</td>
</tr>
<tr>
<td>III</td>
<td>Standard (Glibenclamide)</td>
<td>3 mg/kg</td>
<td>270.42 ± 13.69*</td>
</tr>
<tr>
<td>IV</td>
<td>Extract of <em>F. bengalensis</em></td>
<td>250 mg/kg</td>
<td>253.86 ± 5.12*</td>
</tr>
<tr>
<td>V</td>
<td>Extract of <em>B. monosperma</em></td>
<td>250 mg/kg</td>
<td>250.40 ± 8.41*</td>
</tr>
</tbody>
</table>

All values are Mean ± SEM; n=6
* P<0.01 when compared with diabetic control (group II)

Effect of extracts on serum lipid profile of alloxan-induced diabetic rats

Diabetes was induced in animals by single intraperitoneal injection of alloxan (150 mg/kg) freshly prepared in normal saline. Control rats received only the normal saline. Diabetes was confirmed by checking the blood glucose levels after 7 days of alloxan injection. Animals showing blood glucose level above 250 mg/dl were selected for the study. Diabetic animals were randomly assigned to different groups. Group I contained normal animals and served as normal control. Group II received vehicle during the experiments, while the, groups III received the reference standard drug glibenclamide (3 mg/kg). Group IV and V received extracts of *F. bengalensis* and *B. monosperma* at a dose of 250 mg/kg, and 250 mg/kg respectively for 8 days.

Estimation of Lipid profile

The body weight of animals was monitored to adjust the dose. Animals were fasted overnight and the blood was collected from tail vein of each animal. Serum was separated from the blood by centrifugation at 3000 rpm for 20 min. The
estimation of triglycerides, total cholesterol, and VLDL were carried out using the commercially available kits. The serum total cholesterol (TC), triglycerides (TG) and VLDL were estimated using commercially available kits (Span Diagnostics, India). The method given by the manufacturer along with the kit was followed. The VLDL were calculated using the following formulae (Friedewald et al., 1972).

\[
\text{VLDL} = \frac{TG}{5}
\]
Result and Discussion

Effect of 8 days treatment of extracts on blood glucose of alloxan-induced diabetic rats

Extracts of *F. bengalensis* and *B. monosperma* decreases the blood glucose levels significantly (P<0.01) which is shown in Table 1.

Effect of 8 days treatment of extracts on serum lipid profile of alloxan-induced diabetic rats

The administration of alloxan increases the various serum lipids. Treatment with extracts of *F. bengalensis* decreases the lipid parameters significantly (P<0.01) while *B. monosperma* decreases the lipid parameters not significantly (P>0.05) which is shown in Table 2.

Antidiabetic activities of the extracts of *B. monosperma* (seeds) and *F. bengalensis* (aerial roots) were performed on alloxan induced diabetic rats and showed the antidiabetic activity. The administration of alloxan increased the various serum lipids. Treatment with the extracts of *F. bengalensis* decreased the lipid parameters significantly (P<0.01) while *B. monosperma* decreased the lipid parameters not significantly (P>0.05).

References