Antidiabetic activity of fruits of *Luffa acutangula* var. *amara* in streptozotocine induced diabetic rats

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**Abstract**
Cucurbits are well documented for their food value and medicinal potential. Many cucurbits have been scanned on this basis by researchers throughout the world. *Luffa acutangula* var. *amara* is a member of cucurbitaceae growing in wild habitats along the coastline of Maharashtra. It is exhaustibly utilized for treating the diseases such as inflammation of joints, catharact, liver complaints etc. in folklore. In present piece of work anti diabetic activity of fruits of *L. acutangula* var. *amara* is evaluated in streptozotocine induced (60 mg/kg body wt.) diabetic rat models. Fruit powder of the plant was extracted successively with methyl alcohol and water; LD50 studies for both the extracts were conducted up to the dose level of 1.5 g/kg by following “Up and Down method of OECD Guidelines No. 425, 1/10th dose is selected for the present study. Activity is tested against Glibenclamide as standard and dist. water as control. Both methanolic and aqueous extracts of fruit show significant anti-diabetic activity and reduce blood glucose level up to 75%. It suggests that the plant may have therapeutic value in diabetes and related complications.

**Citation:**

**1. Introduction**
Diabetes is a syndrome characterized by deranged carbohydrate metabolism resulting in abnormally high blood sugar level (hyperglycemia). It is caused by hereditary, increasing age, poor diet, imperfect digestion, obesity, sedentary lifestyle, stress, drug-induced, infection in pancreas, hypertension, high serum lipid and lipoproteins, less glucose utilization and other factors. Almost 1.3% of the population suffers from this disease throughout the world and number of diabetics is increasing by 6% per year. (Ghosh et al., 2004) Approximately 300,000 deaths each year are attributed to diabetes. (Resmi, 2001) The number of people suffering from diabetes has soared to 246 million. Type 1 diabetes is caused by deficiency of insulin secretion from β-pancreatic cells. On the other hand, type 2 diabetes is closely associated with obesity and characterized by initial phases of progressive insulin resistance. (Sriparna et al., 2011) The drugs which are available for therapy of diabetes are tolbutamide, chlorpropamide, glipizide, repaglinide, metformin, phenformin, pioglitazone, rosiglitazone etc. But the traditional medicinal plants are used throughout the World for treatment of diabetes mellitus, because the plants drugs are considered to be less toxic and free from side effects than synthetic ones (Panda et al., 2012).

The family Cucurbitaceae comprises members that are cultivated throughout the world as source of food, fiber and indigenous medicines (Nayar and More, 1998) *Luffa acutangula* var. *amara* belonging to family cucurbitaceae is an annual herb found in all parts of India, especially along the costal lines (Chakravarty, 1982). The plant is used as a laxative,
carminative. It is used to cure Vata, Kapha, liver complaints, leucoderma, piles etc. (Chopra et al., 1986). It is used as a bitter tonic (Biswas and Ghosh, 1973). Many other plants belonging to Cucurbitaceae family have been successfully screened for antidiabetic study. Cucurbitacin is an important class of compound responsible for the antidiabetic activity of these plants. Available literature revealed that members of cucurbitaceae can proved potent for antidiabetic activity. The aim of present study is to evaluate antidiabetic activity of fruits of Luffa acutangula var.amara

2. Review of literature

Ayurveda and other traditional medicinal system for the treatment of diabetes describe a number of plants used as herbal drugs. Hence, they play an important role as alternative medicine due to less side effects and low cost. The active principles present in medicinal plants have been reported to possess pancreatic beta cells regenerating, insulin releasing and fighting the problem of insulin resistance. Aloe vera juice stimulates the release of insulin from the beta-cells in human, Acacia catechu wood extract enhances the regeneration of pancreatic beta cells in rabbits, Momordica charantia fruit extract enhances insulin secretion by the islets of Langerhans. A significant proportion of these plants have been observed to possess potent antioxidant activity, which may contribute to anti-diabetic property in streptozotocin/ alloxan, induced animal model. Not only in Ayurveda, but also in several other traditional systems of medicine, it is described that plants useful in diabetes also possess strong antioxidant/ free-radical scavenging properties. Different cucurbits have been scanned for the same purpose, some of them are listed as ‘Evaluation of hypoglycemic and antihyperglycemic effects of Luffa cylindrica fruit extract in rats’ (Sriparna et. al, 2011.); a comprehensive study of Luffa acutangula: a overview (Sarode et. al. 2010). Antidiabetic activity of Luffa aegyptica (Mill) in alloxan induced diabetic rats (Chaurasia et.al, 2011), Antihyperglycemic activity of Momordica dioica fruits (Reddy et al., 2006) etc. Luffa acutangula var. amara has been scanned for phytochemical and pharmacological evaluation of fruit extracts, hypolipidemic activity, hepatoprotective activity of Plant material etc. the evaluation of antidiabetic activity of fruits is initiated by present paper which focuses effect of fruit extracts on blood sugar levels in rats.

3. Materials and methods

3.1 Plant material

Mature fresh fruits of Luffa acutangula var. amara were collected from village, Aachara in the Sindhudurga district of Maharashtra, India. The plant was authenticated at Department of Botany, Shivaji University, Kolhapur, India. The fruits were washed thoroughly to remove adhered dust and other particles. Fruits are shade dried. They were mechanically powdered and sieved. The methanolic and aqueous extracts were made by following standard method.

3.2 Animals

Wistar albino rats of either sex weighing 150 – 250 g were used for antidiabetic study. They were housed in standard environment condition and fed with standard pellets and water ad libitum. The study was carried out in the Bharati Vidyapeeth’s college of Pharmacy, Kolhapur, Maharashtra, India. Ethical clearance for the animal study was obtained from Institutional Animal Ethical committee.

3.3 Induction of experimental diabetes

After one week of acclimatization, the rats were subjected for 16 hrs fast. Diabetes was induced with a single i.p. injection of Streptozotocin (STZ) at a dose of 55 mg/kg body weight. The STZ was freshly dissolved in citrate buffer (0.01 M, pH 4.5) (Bolkent et al., 2000). Hyperglycemia was confirmed by the elevated glucose levels determined by measuring fasting blood glucose (FBG) after 72 hrs of injection and the diabetic rats exhibiting blood glucose levels in the range of 275 to 300 mg/dl were selected for the study.

3.4 Determination of acute toxicity (LD50)

The oral acute toxicity of alcoholic and aqueous extracts was determined in albino Wistar albino rats (150-250 g), maintained under standard husbandry conditions. The animals were fasted 3 hrs prior to the experiment and “Up and Down” procedure of OECD Guidelines No. 425 method of CPCSEA was adapted for toxicity studies. Animals were administered with single doses of alcoholic and aqueous extracts in different groups and observed for the mortality during 48 hrs study period (short term) toxicity. Based on the short term profile the doses for the next group of animals were determined as per OECD Guidelines No. 425. All the animals were observed for long term toxicity (14 days) and from the observed LD50 doses of, alcoholic and aqueous extracts 1/10th doses were selected for the present study.
3.5 Experimental design
A total of 30 rats (6 normal + 24 diabetic) were used. The animals were divided into five groups each containing six. Group A was normal untreated rats and received distilled water whereas; group B represented STZ-induced diabetic rats which were untreated i.e. Diabetic control. Group C contained diabetic rats treated with Glibenclamide orally (5 mg/kg). Group D diabetic rats treated with oral dose of 50 mg/kg methanolic extract of fruits of \textit{Luffa acutangula} var. amara. Group E diabetic rats, which were treated with oral dose of 100 mg/kg of fruits of \textit{Luffa acutangula} var. amara aqueous extract.

3.6. Estimation of Fasting blood glucose levels
The blood glucose levels were estimated on 0, 3rd, 7th and 15th day after induction of streptozotocine. The blood was collected from the tip of tail and blood glucose was estimated by using glucometer (One touch Ultra). The data was analyzed statistically and values of blood glucose level were recorded. All the values of body weight, fasting blood sugars were expressed as mean ± standard deviation of mean. After 15 days, body weights were determined and the animals were sacrificed under the influence of anesthetic ether to study histology of pancreases and kidney.

4. Results
In the study of antidiabetic activity, the effects of \textit{Luffa acutangula} var. amara fruit extracts on body weight is measured on 1st , 7th and 15th day of post induction and were compared with control groups . The values are shown in Table -1. STZ induced diabetic rats showed a significant decrease in body weight. Oral administration of methanolic and aqueous extracts at the dose of 50 mg/kg body weight showed a significant decrease in blood glucose level in 7th and 15th days’ treatment. The fasting blood glucose after doses of methanolic extract on 7th day of post induction was 191.16 ±1.47 mg/dl compared to fasting blood glucose of standard drug Glibenclamides (5 mg/kg) treated rats 235.16 ± 1.60 mg/dl and aqueous extract on 7th day of post induction was 184.66 ± 1.50 mg/dl compared to standard drug treated rats.

Table-1: Effect of \textit{Luffa acutangula} var. amara fruit extracts on body weight in STZ induced diabetic rats.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Day 1</th>
<th>Day 7</th>
<th>Day 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>240 ±20.49</td>
<td>240 ±22.80</td>
<td>240 ±25.88</td>
</tr>
<tr>
<td>Diabetic control</td>
<td>200 ±10.95</td>
<td>190 ±13.41</td>
<td>180 ±10.95</td>
</tr>
<tr>
<td>Diabetic rats + Glibenclamide (5 mg/kg bw)</td>
<td>200 ±13.41</td>
<td>220 ±13.50</td>
<td>220 ±11.40</td>
</tr>
<tr>
<td>Diabetic rats +MeOH extract (50 mg/kg)</td>
<td>120 ±34.35</td>
<td>140 ±35.98</td>
<td>160 ±34.20</td>
</tr>
<tr>
<td>Diabetic rats +Aq. extract (150 mg/kg)</td>
<td>220 ±12.94</td>
<td>230 ±10.83</td>
<td>240 ±12.44</td>
</tr>
</tbody>
</table>

[Values are expressed as Mean ± SD, n = 6, Body weight in gram (Mean ± SD)]
Table 2: Effect of *Luffa acutangula* var. *amara* fruit extracts on blood sugar level in STZ induced diabetic rats.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Day 0</th>
<th>Day 3</th>
<th>Day 7</th>
<th>Day 11</th>
<th>Day 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>89.5 ± 1.51</td>
<td>89.5 ± 2.42</td>
<td>89.66 ± 2.42</td>
<td>90.5 ± 1.04</td>
<td>90.33 ± 2.16</td>
</tr>
<tr>
<td>Diabetic control</td>
<td>469.33 ± 4.13</td>
<td>450.5 ± 2.88</td>
<td>430.83 ± 2.04</td>
<td>349.66 ± 2.25</td>
<td>343.16 ± 1.16</td>
</tr>
<tr>
<td>Diabetic rats + Glibenclamide (5 mg/kg bw)</td>
<td>464.83 ± 2.71</td>
<td>260.5 ± 1.87</td>
<td>235.16 ± 1.60</td>
<td>205.83 ± 2.13</td>
<td>150.5 ± 2.94</td>
</tr>
<tr>
<td>Diabetic rats + MeOH extract (50 mg/kg)</td>
<td>461.83 ± 4.99</td>
<td>427.5 ± 2.25</td>
<td>191.16 ± 1.47</td>
<td>126 ± 2.60</td>
<td>103.33 ± 2.06</td>
</tr>
<tr>
<td>Diabetic rats + Aq. extract (150 mg/kg)</td>
<td>461.66 ± 5.04</td>
<td>383.83 ± 2.04</td>
<td>184.66 ± 1.50</td>
<td>166.66 ± 2.06</td>
<td>105.83 ± 1.16</td>
</tr>
</tbody>
</table>

Values are expressed as Mean ± SD, n = 6 Blood Glucose level in mg/dl (Mean ± SD)

Fig 1: Graph showing effect of fruit extracts of *Luffa amara* on Blood glucose level

Series 1 - changes in MDA level, Gr.i vs Gr.ii, Gr.iii & Gr.iv = *** p <0.0001,
Series 2 - changes in Testosterone level, Gr.i vs Gr.ii, Gr. iii & Gr.iv = ***p <0.0001

the study, it is suggested that the possible mechanism by which the plant extracts decrease the blood glucose level may be by potentiation of insulin effect either by increase in pancreatic secretion of insulin from beta cells of islets of langerhans. Histopathological studies of pancreas and kidney are under study. The bioactive principle will be identified and characterization will be done based on their chemical nature.

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