Evaluation of Antidiabetic activity of *Costus igneus*(L) leaves on STZ induced diabetic rats

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ABSTRACT

The aim of this research was to investigate antidiabetic activity of *Costus igneus* (also known as insulin plant) leaves extracts in streptozotocin induced diabetic albino rats. A comparison was made between the action of *Costus igneus* extract and a known antidiabetic drug glibenclamide (5mg/kg body wt.). An oral glucose tolerance test (OGTT) was also performed in experimental diabetic rats. Ethanolic and aqueous extracts of *Costus igneus*(L) were obtained by simple maceration method & were subjected to standardization by phytochemical screening methods. Preliminary phytochemical investigations showed the presence of alkaloids, flavonoids, phenolic compounds and steroids in ethanolic extract. Dose selection was made on the basis of acute oral toxicity study (50mg to 2000 mg/kg body weight) as per OECD guidelines423. The ethanolic extract of *Costus igneus* showed significant (P<0.001) antidiabetic activity. This extracts also prevented body weight loss in diabetic rats.

Keywords: Streptozotocin, Antidiabetic activity, Ethanolic and Aqueous extracts, *Costus igneus*.

INTRODUCTION

Diabetes mellitus (DM) is an endocrinial disorder associated with depleted insulin secretions, damaged pancreatic β-cells with altered carbohydrate, lipid and protein metabolism and additionally increased risk of complications of various vascular diseases etc. It has been estimated that Indian people are more genetically susceptible to diabetes accounting about 30 to 33 million and would go up to 40 million by the end of 2010 which further will reach to maximum of 74 million by 2025 [1]. It has been suggested that diabetes is the third leading cause of death due to high incidence of morbidity and mortality after cancer and cardiovascular disorders. Complications such as renal failure, coronary artery disorder, cerebro-vascular disease, neurological complications, blindness, limb amputation, long term damage, dysfunctions and failure of various organs and eventually premature death are associated with chronic hyperglycemia [2]. Therapy for DM includes long term use of oral hypoglycemic agents or insulin therapy and lifestyle modifications, dietary control and regular physical exercises [3]. Recently, it has been reported that phytotherapy is considered to be less toxic and minimal or no side effects in comparison to modern allopathic medicines [4]. Report of ethnobotany suggested that about 800 medicinal plants possess antidiabetic potential [5] and the bioactive compounds such as glycosides, alkaloids, terpenoids, carotenoids and flavonoids are effective drugs both in preclinical and clinical studies [6,7]. About 80% of population belonging to developing countries using traditional medicines of plant origin and continue to be an important for their primary health care needs.
In the present study attempt has been made to evaluate various pharmacognostical, phytochemical and pharmacological parameters of the plant leaves known as *Costus igneus* (L.). The plant *Costus igneus* belongs to the family Costaceae, which is found in tropical Africa, Asia, Australia, and North, Central and South America. In India, it is cultivated in coastal area, Utrar Kannada district of Karnataka and Tamilnadu. In this areas, people take traditionally 2-3 leaves of this plant twice a day for the management of diabetes. It is a prostrate growing plant with spreading, rooting stems. Its leaves are slender and lance shaped with tooted, scalloped or lobed margins. They are grayish green stained with red purple above and darker purple beneath. The tiny white flowers grow intermittently throughout the year. This plant reaches a height of 6-inches and has an indefinite spread [8-12].

**MATERIALS AND METHODS**

**Animal**

Male albino-Wistar rats weighing 150-250g were used in the present study. All rats were kept at room temperature of 22-25°C in the animal house. All the animals were followed the internationally accepted ethical guidelines for the care of laboratory animals. Prior to the experiments, rats were fed with standard food for 1 week in order to adapt to the laboratory conditions. All animal procedures were performed after approval from the institutional ethics committee and in accordance with the recommendations for the proper care and use of laboratory animals.

**Chemicals**

Streptozotocin (LOBA Chemie, Mumbai, India) was purchased, preserved at 25°C and used for this study. Metformin is an oral antidiabetic preparation with an efficient hypoglycemic action. Daonil (Metformin) (S.K.Prasad et al., 2009) manufactured by Aventis Pharma Ltd. Goa, India, was collected from market and preserved at room temperature.

**Plant material and extraction**

The fresh leaves of plant *Costus igneus* (L.) was collected from ABS botanical garden, karripatti village, Salem, Tamilnadu, India. The leaves were identified and authenticated by the botanist Mr. A Balasubramanian (consultant central siddha research) Executive Director ABS botanical garden, Salem, Tamilnadu. Authenticated fresh leaves were dried under shade and used for the preparation of extract. These leaves was coarsely powdered with the help of mechanical grinder and passed through sieve no.40. The powder was stored in an airtight container for further use.

**Oral toxicity studies**

Organization for Economic Co-operation and Development (OECD) guidelines (Guidelines 423; Fixed Dose Procedure) was followed for acute oral toxicity test to plant extract. Before experimentation rats (n=3) were fasted overnight with water *ad libitum* and was oral administered with fixed extracts dose of 5, 50, 300 and 2000 mg/kg body weight respectively by gavage using intubation canula. Administered dose was found tolerable as no death was found. Therefore, two dose levels of 250 and 500mg/kg b.wt were selected for antidiabetic activity. Animals were observed individually after dosing for first 30 min periodically and daily thereafter, till 14 days for any toxicity sign of gross changes in skin and fur, eyes and mucous membranes, circulatory, respiratory, autonomic and central nervous systems, and behavior pattern if any.

**Induction of Experimental Diabetes**

Diabetes is to be induced in overnight fasted adult Wistar albino rats weighing 200-250 gm by single i.p. injection of 60 mg/kg streptozotocin (M.Amarnath satheesh et al, 2004). Streptozotocin was dissolved in cold citrate buffer (pH 4.5). Animals were fed with 5 % glucose solution in order to prevent hypoglycemic shock for 18 hrs (Prince PSM et.al, 1998). Hyperglycemia is to be confirmed by elevated blood glucose levels in plasma, determined at 72 hrs and then on day 0 after injection. The threshold value of fasting plasma glucose to diagnose diabetes was taken as >200mg/dL. Only rats found with permanent diabetes were used for the antidiabetic study.

**DISCUSSION**

The antidiabetic activity of ethanolic and aqueous extracts of *Costus igneus* was evaluated in Streptozotocin induced diabetic rats by administering orally for 15 days for streptozotocin. The potency and efficacy of the extract was evaluated by measuring blood glucose level, biochemical parameters and histopathology of pancreas tissue.
In Streptozotocin induced diabetes the ethanolic and aqueous extracts of Costus igneus at a dose of 500mg/kg showed significant reduction in increased blood glucose level, Cholesterol, Triglycerides, LDL and elevated the decreased HDL level as that of standard. The histopathological studies revealed the same. Although the ethanolic and aqueous extracts of Costus igneus at a dose of 250mg/kg showed the reduction in increased blood glucose level, Cholesterol, Triglycerides, LDL and elevated the decreased HDL level as that of standard but it was lesser than that of 500mg/kg [13,14].

However, when compared the antidiabetic activity of ethanolic and aqueous extracts the antidiabetic activity of ethanolic extract was more significant than the aqueous extracts extract. The antidiabetic activity of ethanolic extract at 500mg/kg was almost significant as that of standard.

Table no.1: Effect of Ethanolic and Aqueous extracts of leaves of C.igneus on OGGT in normal rats

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Blood glucose level(mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 min</td>
</tr>
<tr>
<td>Normal (control)</td>
<td>79.17±0.479</td>
</tr>
<tr>
<td>Glibenclamide (5mg/kg)</td>
<td>81±0.86</td>
</tr>
<tr>
<td>EECI 250mg/kg</td>
<td>79.5±0.524</td>
</tr>
<tr>
<td>EECI 500mg/kg</td>
<td>80.17±0.752</td>
</tr>
<tr>
<td>AECI 250mg/kg</td>
<td>79.5±0.621</td>
</tr>
<tr>
<td>AECI 500mg/kg</td>
<td>81.33±0.36</td>
</tr>
</tbody>
</table>

Values are given as mean ± S.E.M from n=6 each group.
*** Represents statistical significance Vs control (P <0.001)
** Represents statistical significance Vs control (P < 0.01)
* Represents statistical significance Vs control (P < 0.05)
ns Represents non significance

Table no.2: Effect of Ethanolic and Aqueous extracts of leaves of C.igneus on STZ induced diabetic rats

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Blood glucose level(mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 day</td>
</tr>
<tr>
<td>Normal control</td>
<td>81±0.36</td>
</tr>
<tr>
<td>Diabetic control</td>
<td>82.5±0.43</td>
</tr>
<tr>
<td>Glibenclamide (5mg/kg)</td>
<td>82.33±1.206***</td>
</tr>
<tr>
<td>EECI 250mg/kg</td>
<td>82.06±0.96</td>
</tr>
<tr>
<td>EECI 500mg/kg</td>
<td>81.33±0.49</td>
</tr>
<tr>
<td>AECI 250mg/kg</td>
<td>82.17±0.48</td>
</tr>
<tr>
<td>AECI 500mg/kg</td>
<td>80.33±0.8</td>
</tr>
</tbody>
</table>

Values are given as mean ± S.E.M, N=6, ***=(P <0.001), ** = P < 0.01), * = (P < 0.05) vs. control

Group II is compared with group I control (P <0.001)
Group III,IV,VI and VIII compared with group II control

REFERENCES