**Introduction**

Diabetic is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both [1]. Hyperglycemia is associated with disturbances in carbohydrate, fat and protein metabolism due to defects in insulin secretion and insulin action [2-3]. Insulin is the hormone that enables glucose uptake and utilization by the body cells for energy supply. In addition to hyperglycemia, it leads to many other complications such as hyperlipidemia, hypertension, atherosclerosis etc [4]. The world health organization (WHO) estimates that more than 180 million people worldwide have diabetes, an estimated 1.1 million people died of this disease condition in 2005 alone [5]. It is estimated that there are 171 million people in the world with diabetes in year 2000 and this is likely to increase up to 366 million by 2030 (6). The WHO expert committee recommended that the important to investigate the hypoglycemic agents from plant origins which were used in traditional medicine for the treatment of diabetes mellitus [7]. The antihyperglycemic agents have been focused on plants used in traditional medicine because that may be a better treatment than currently used synthetic drugs [8]. *Ipomoea pes-caprae*, also known as Beach Morning Glory or Goat's Foot, is a common pantropical creeping vine belonging to the family Convolvulaceae. It grows on the upper parts of beaches and endures salted air. This plant namely the subspecies *brasiliensis* is known as *salsa-da-praia* in Brazilian folk medicine and is used to treat inflammation and gastrointestinal disorders. *Ipomoea pes-caprae* is a traditional medicinal plant used in the treatment of headache and various types of inflammation including jellyfish sting dermatitis [9-10]. Since there is no any innovative work has been initiated against diabetic.

In view of above medicinal properties, the present study was designed to investigate the antidiabetic and antihyperlipidemic activity of ethanolic extract of in *Ipomoea pes-caprae* streptozotocin induced diabetic rats.

**Materials and Methods**

**Chemicals**

Streptozotocin (STZ) was purchased from Sigma-Chemical Co.Bangalore. All other chemicals and reagents used for this study were analytical grade.

**Plant material**

*Ipomoea pes-caprae* was collected from Parangipettai, Tamil Nadu. Identified by the Department of Botany, Annamalai University.

**Preparation of plant extract**

The *Ipomoea pes-caprae* leaves were dried at room temperature and then were powdered using dry grinder and passed through sieve. Hundred grams of *Ipomoea pes-caprae* were packed in a soxhlet apparatus and extracted with ethanol. The ethanol extracts were concentrated a rotary evaporator.

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**Antihyperglycemic and Antihyperlipidimic Effect of *Ipomoea pes-caprae* plant extract in diabetic rats**

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Experimental animal
Male Wistar albino rats (180-220 g) were procured from Rajah Muthiah Medical College and Hospital, Annamalai University, Chidambaram, Chennai, India and were housed in polycarbonate cages in an animal room with 12 hr day – night cycle. The animals were allowed free access to tap water and standard laboratory rat food. All the animal experimentation was approved by Institutional Animal Ethical Committee (IAEC-889/2013).

Induction of experimental diabetes
Diabetes was induced in rats by intraperitoneal (I.P.) injection of streptozotocin (STZ) at a dose of (55 mg/kg b.w) dissolved in 0.1 M cold citrate buffer (pH = 4.5) (11). The rats were allowed to drink 5% glucose solution overnight to overcome the drug-induced hypoglycemia. The blood glucose values above 250 mg/dl on the third day after streptozotocin injection were considered as diabetic rats. Then the treatment was started on the fifth day after streptozotocin injection and it was considered as first day of treatment.

Experimental design
All animals were randomly divided into four groups with six animals in each group
Group 1: Normal untreated rats
Group 2: Diabetic control rats
Group 3: Diabetic rats given ethanol extract of Ipomoea pes-caprae leaves (300 mg/kg of body weight)
Group 4: Diabetic rats given standard drug glibenclamide (600 µg/kg of body weight).

Biochemical analysis
The animals were sacrificed at the end of experimental period by decapitation. Blood was collected, serum separated by centrifugation at 3000 g for 10 minutes. Serum glucose was measured by the 0 toluidine method (11). Insulin level was assayed by Enzyme Linked Immunosorbant Assay (ELISA) kit (12). Glycosylated hemoglobin (HbA1c) estimation was carried out by colorimetric method of (13). Serum total cholesterol (TC) (14), total triglycerides (TG) (15), low density lipoprotein cholesterol (LDL-C) (16), very low density lipoprotein cholesterol (17) were analyzed.

Statistical analysis
All biochemical data are expressed as mean ± SEM. Statistical analysis was performed using one-way ANOVA followed by Tukey’s multiple tests using SPSS (version 18) of computer software. In all cases, a P-value of less than 0.05 was considered to be significant.

RESULTS
Ipomoea pes-caprae extract treated diabetic rats exerted the drastic changes in blood glucose, serum insulin and glycedated hemoglobin level. Serum blood glucose was tremendously reduced after Ipomoea pes-caprae treatment in diabetic rats and the insulin level vice versa in consecutive days of experiment period (Table 1). Administration of Ipomoea pes-caprae to diabetic rats, reversed plasma lipid profile near normal values. Ipomoea pes-caprae significantly improved the lipid profile in diabetic animals. The effect

<table>
<thead>
<tr>
<th>Groups</th>
<th>Blood glucose (mg/dL)</th>
<th>Insulin (µU/ml)</th>
<th>Glycosylated hemoglobin (HbA1C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>89.21±0.41</td>
<td>16.09±1.11</td>
<td>4.14±2.35</td>
</tr>
<tr>
<td>Diabetic</td>
<td>183.1±1.42</td>
<td>10.19±0.22</td>
<td>7.04±0.57</td>
</tr>
<tr>
<td>Ipomoea pes-caprae (300 mg/kg)</td>
<td>109.24±0.6</td>
<td>13.51±0.94</td>
<td>6.04±0.58</td>
</tr>
<tr>
<td>Glibenclamide (600µg/kg)</td>
<td>92.36±0.14</td>
<td>15.1±1.51</td>
<td>4.55±0.42</td>
</tr>
</tbody>
</table>

Ipomoea pes-caprae of (300 mg/kg; p.o.) was more significant comparable with that of glibenclamide (600µg/kg; p.o.) (Table 2).

Discussion
The streptozotocin induced diabetics causes the destruction of β-cells of the islets, which leads to a reduction in insulin release (18). An insufficient release of insulin, that leads high blood glucose namely hyperglycemia. The treatment of medicinal plant extract to the streptozotocin induced diabetic rats that activated the β-cells and granulation return to normal, like to be insulinogenic effect (19). The glibenclamide is a standard antidiabetic drug, used to compare the antihyperglycemic property in experimental rats. Glibenclamide have been involved in stimulating insulin secretion from pancreatic β-cells principally by inhibiting ATP sensitive KATP channels in the plasma membrane (20).

In the present study streptozotocin diabetic rats showed significant increase in blood glucose level. Chronic treatment with ethanol extract of Ipomoea pes-caprae reduced blood glucose level throughout the experimental period in duration dependent manner indicating its antihyperglycemic activity. The decrease level of blood glucose and increased level of plasma insulin were observed in our present study, which indicates that Ipomoea pes-caprae extract stimulates insulin secretion from the remnant β-cells or regenerated β-cells. The mechanism of the antidiabetic activity of Ipomoea pes-caprae extract may be involved by increasing either the pancreatic secretion of insulin from the remnant cells of the islets of langerhans. Some plants have antidiabetic activity through insulin releasing stimulatory effect (21).

The excess of glucose is present in the blood during diabetes, which react with hemoglobin and form glycosylated hemoglobin. In poorly controlled diabetes, there is upsurge in the glycosylation of some proteins including hemoglobin. Glycosylated hemoglobin develops...
reduced affinity for oxygen which contributes to long-term complications of diabetes [22]. Ipomoea pes-caprae extract treated group showed significant decrease in glycosylated hemoglobin indicated that the efficiency of Ipomoea pes-caprae in glyemic control.

Streptozotocin induced the elevation of triglycerides, total cholesterol, LDL-cholesterol and decrease HDL-cholesterol. Hypertri-glyceridaemia and hypercholesterolemia are major factors of diabetic state involved in the development of atherosclerosis and coronary heart disease which are the secondary complications of diabetes [23]. Dyslipidaemia is characterized by high plasma level of total cholesterol, LDL-cholesterol and triglycerides, with low plasma levels of HDL-cholesterol [24]. Present study indicate that, plant extract administered reduced total cholesterol, LDL-cholesterol, triglycerides and lowered serum levels of HDL-cholesterol. Thus Ipomoea pes-caprae ethanol extract could have a potential to reduce long-term cardiovascular complications in diabetic conditions.

Conclusion

The results of this study indicate that Ethanolic extract of the leaves of Ipomoea pes-caprae possesses antidiabetic properties. It can prevent the complications of diabetes that result from glycation of hemoglobin and antihyperlipidemic. Further studies should be carried out on this plant in order to understand its mechanism of action.

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References


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