EFFECT OF *CAPPARIS DECIDUA* EXTRACTS ON THE SERUM GLUCOSE LEVELS OF STREPTOZOTOCIN INDUCED TYPE 2 DIABETIC RATS

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Abstract: *Capparis decidua* is xerophytic shrub, commonly known as Kair. The ethanolic extracts (50%) of different parts of *Capparis decidua* i.e. bark, fruit and flower (500 mg/kg b. wt.) were used to evaluate their glucose lowering potential. Diabetes (type 2) was induced in rats of either sex, aged 48 ± 2 hrs, were injected with Streptozotocin in citrate buffer (pH 4.5) at a dose of 90mg / kg body weight intraperitoneal route. After 12-14 weeks, animals weighing above 150 gm were selected for screening in NIDDM model, by OGTT (Oral glucose tolerance test). For this purpose, blood was taken at 0 hrs from the tail vein from overnight (12 hrs) fasted rats and they were fed glucose at a dose of 2.5 gm /kg body weight. Then blood was taken at 30, 60 and 120 minutes intervals. The rats having blood glucose level 7-12 mmol/l at 0 hours and showing highest rise at 60 minutes with the blood sugar level 234 to 360 mg/dl, which returned to their 0 hrs value at 120 minutes, were included in the study. A significant increase in the levels of serum glucose was evident in diabetic control group. The serum glucose levels reduced by 81.4%, 60.48% and 55.43% in fruit, flower and bark extract treatments respectively. These results indicate that *Capparis decidua* bark and fruit possess antihyperglycaemic properties.

Key words: *Capparis decidua*, Antihyperglycaemic, Serum glucose

INTRODUCTION

Changes in human behavior and lifestyle over the last century have resulted in a dramatic increase in the incidence of diabetes world wide [1]. The number of people with diabetes is increasing due to population growth, ageing, urbanization, increasing prevalence of obesity and physical inactivity [2,3]. The fact that type 1 diabetes is due to the failure of one of the cell types of a single organ with a relatively simple function (i.e. the failure of the islets of langerhans) has led to the study of several possible schemes to cure diabetes [4]. In contrast, type 2 diabetes is more complex with fewer prospects of a curative measure, but further understanding of the underlying mechanism of insulin resistance may make a cure possible. Correcting insulin resistance may provide a cure for type 2 diabetes [5]. Type 2 diabetes can be prevented in part by maintaining a stable body weight through diet and exercise.

In view of increasing incidence of diabetes mellitus throughout the world, inability of current therapies to control all metabolic defects of disease and their pathological consequences, the great expenses of modern therapy, the emotional and social impact of diabetes i.e. significant psychological dysfunction in patients and their families due to the demands of therapy, there is a clear need for the development of alternative strategies, for diabetic therapy.

There is a huge literature on herbal medicines deriving from a variety of cultures worldwide and dealing in part with treatment of diabetes [6]. However, before the compounds (or mixtures of compounds) responsible for such medical effects can be used as
a pharmaceuticals, there is a long and expensive research path involving testing of plant extracts in cell free systems, cell cultures, and in animal models, isolation and structural characterization of the active components, determination of molecular sites of action, efficacy, safety and contraindication studies and finally clinical trials. Use of herbal medicines has problems relating to efficacy, safety, quality control and compatibility with concurrent mainstream medical treatment [6,7].

A number of plants have been reported to possess antidiabetic potential as evident from the ancient ayurvedic and modern literature [8]. The aqueous or organic solvent extracts are mainly obtained from different parts of the plants such as aerial, leaf, bark, wood, seed, rhizome, bulb or tuber. Most of the plants have been chosen for study because of an ethanobotanical tradition, typically from Europe, The Middle East, India, South East Asia, China and Japan.

MATERIALS AND METHODS

*Capparis decidua* belongs to family Capparidaceae, commonly known as Kair, Karil or delha. It is commonly found in the dry regions in India and Pakistan. The plant is distributed in Sind, Baluchistan, Western Rajasthan, Punjab, Central India, Gujarat, Deccan, Socotra, Egypt and Tropical Africa. It’s a struggling, glabrous shrub. Its branches are smooth and green. Leaves are present on young shoots only (older branches leafless). Leaves are small, less than 12 mm, long, linear-oblong, acute, spinous-pointed with short petioles. It has stipular thorns long, sharp, straight and orange-yellow. Flowers in many flowered corymbs, from the old branches or from short lateral shoots. Pedicels are slender, about 12 mm long. Fruit is globular, size of a small cherry, glabrous beaked 9.

**Collection and identification of plant material:**
The chosen plant, *Capparis decidua* was identified and selected by the experts of Botany Department, J.N.V. University, Jodhpur. For the present study various parts of plants i.e., fruits, flowers and bark were collected in and around university campus.

**Preparation of plant extract:** The collected plant material was shade dried and subjected to Soxhlet extraction with 50% ethyl alcohol. Ethanol was separated under reduced pressure to obtain a brownish crude extract. Extract was stored in sterile glass containers at 4°C.

**Induction of Type 2 diabetes:** The model was developed according to the description of Bonner-Weir et al. [10]. Rats of either sex, aged 48 ± 2 h, were injected with streptozotocin in citrate buffer (pH 4.5) at a dose of 90 mg/kg body weight by intraperitoneal route. After 12-14 weeks, animals weighing above 150 gm were selected for screening in NIDDM model, by OGTT (Oral-glucose tolerance test). For this purpose, blood was taken at 0 hrs from the tail vein from overnight (12 hrs) fasted rats and they were fed glucose at a dose of 2.5 gm/kg body weight. Then blood was taken at 30, 60 and 120 minutes after feed. The rats having blood glucose level 7-12 mmol/l at 0 hours and showing highest rise at 60 minutes with the blood sugar level 234 to 360 mg/dl, which returned to their 0 hrs value at 120 minutes, were included in the study.

**Determination of Serum Glucose:** The diabetic state of animals was assessed by measuring blood glucose concentrations 72 hrs after streptozotocin treatment. Glucose determinations were made with the One Touch Profile (Lifescan Inc. Milpitas, California, U.S.A). The results were validated by O-Toluidine method (Glucose Kit, Siddham Diagnostic, India). The rats with a blood sugar level above 300 mg/dl as well as polydipsia, polyuria and polyphagia were selected for the experiment.

**Experimental design:** The study consisted of treatment of type 2 diabetes with various extracts of *Capparis decidua*. *Capparis decidua* bark, flower and fruit extract were tested in type 2 diabetic model rats. The experimental models were administered various plant extracts for a period of 30 days. Each of the treatment was divided into five groups. The control and experimental groups consisted of 8-10 animals each. The study consisted of following groups for type 2 diabetes: Group 1: Control or Intact: The group consisted of non-diabetic rats without any streptozotocin induction. They received drug vehicle only i.e. normal saline water (2 ml / kg body weight/ day) for 30 days orally. Group 2: Diabetic control: The group contained streptozotocin induced type 2 diabetic rats. They received drug only for 30 days without any plant extract administration. Group 3: Diabetic + *Capparis decidua* bark extract treatment: The group consisted of streptozotocin induced type2 diabetic rats which were given *Capparis decidua* bark extract treatment for 30 days. Group 4: Diabetic + *Capparis decidua* flower extract treatment: The group consisted of streptozotocin induced type2 diabetic rats which were given *Capparis decidua* bark extract treatment for 30 days.
flower extract treatment for 30 days. Group 5: Diabetic + *Capparis decidua* fruit extract treatment: The group consisted of Streptozotocin induced type2 diabetic rats which were given fruit extract treatment for a time period of 30 days.

**Drug administration:** The various extracts of *Capparis decidua* were prepared for oral administration by dissolving it in normal saline. The extract was fed at an effective dose of 500 mg/kg body weight. Various groups were administered appropriate treatment daily in the morning and the blood samples were collected from the tail vein at 0 hrs (1st day), 5th day, 7th day, 15th day and 30th day and the blood glucose levels were determined. Blood samples were collected 3 h after the administration of morning dose. Changes in the body weight of animals were monitored daily.

**Statistical Calculations:** All the values of body/organ weights, haematological parameters and biochemical estimations were expressed in terms of mean value ± standard error. The different groups were compared with each other using student “t” test [11]. The probability “p” for obtaining “t” value for a given degree of freedom (df) was determined by comparing Fischer’s tables [12].

**RESULT AND DISCUSSION**

Animal model for NIDDM (or type 2 diabetes) were prepared by injecting 90mg/kg body weight of streptozotocin to two days old neonatal rats. This resulted in a highly significant (Pd"0.001) increase in serum glucose levels in diabetic control group (Group 2) in comparison to intact control group (Group 1). This is in accordance with the findings of Kamtchouing et al. [13], where a 208 % increase in serum glucose level was observed in streptozotocin induced diabetic control rats.

After 7 days of treatment of *Capparis decidua* bark extract (Group 3), a non-significant decrease in the serum glucose level was observed in comparison with diabetic control group (Group 2). However, a highly significant (Pd"0.001) reduction of serum glucose was seen in the Diabetic + *Capparis decidua* flower extract treatment (Group 4) and Diabetic + *Capparis decidua* fruit extract treatment (Group 5), when compared with Diabetic control group (Group 2). After 15 days of *Capparis decidua* flower extract administration (Group 4), a significant (Pd"0.01) reduction was observed in comparison with respective control group. In Group 3 and Group 5, an insignificant reduction was observed, when compared with intact control group (Group 1) i.e., the values were restored to the normal range.

A significant (Pd"0.001) reduction was observed in the treatment groups as compared to diabetic control group after 30 days of application of various extracts of *Capparis decidua*. Maximum reduction of serum glucose level was observed after 30 days of fruit extract treatment. A percentage deviation of 81.4%, 60.48% and 55.43% was evident in fruit, flower and bark extract treatments respectively. A significant (Pd"0.01) decrease in Group 3 and highly significant decrease (Pd"0.001) in Group 4 and Group 5 was evident in comparison to the Intact control group (Group 6) [Table-1].

From overall data it is evident that alcoholic extract of *Capparis decidua* bark, flower and fruit extract suppresses the glucose level in diabetic rats when compared with placebo treated animals. Also, the results show that water soluble ethanolic extract may potentiate the hypoglycemic effect of insulin.

<p>| Table 1: Change in serum glucose levels of 30 days treatments of various extracts of <em>Capparis decidua</em> in albino rats (type 2 diabetes). Group 2, 3, 4 and 5 were compared with group1. Group 3, 4 and 5 were compared with group 2. P d” 0.05 = a, P d” 0.01 = b, P d” 0.001 = c, Non-significant = d P d” 0.05 = e, P d” 0.01 = f, P d” 0.001 = g, Non-significant = h |</p>
<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>Initial 0 day</th>
<th>7th Day</th>
<th>% Deviation</th>
<th>15th Day</th>
<th>% Deviation</th>
<th>30th Day</th>
<th>% Deviation</th>
</tr>
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<tbody>
<tr>
<td>Intact Control (Group 1)</td>
<td>97.67 (ISE: 2.67)</td>
<td>92.36 (ISE: 4.62)</td>
<td>5.74</td>
<td>90.01 (ISE: 3.67)</td>
<td>7.84</td>
<td>98.01 (ISE: 4.02)</td>
<td>0.34</td>
</tr>
<tr>
<td>Diabetic Control (Group 2)</td>
<td>187.62 a (ISE: 10.67)</td>
<td>180.32 b (ISE: 12.36)</td>
<td>3.89</td>
<td>175.25 c (ISE: 10.36)</td>
<td>6.59</td>
<td>170.25 d (ISE: 9.46)</td>
<td>9.25</td>
</tr>
<tr>
<td>Diabetic + <em>C. decidua</em> bark extract treatment (Group 3)</td>
<td>167.75 e (ISE: 7.02)</td>
<td>155.75 f (ISE: 6.67)</td>
<td>7.15</td>
<td>81.5 g f (ISE: 2.66)</td>
<td>51.41</td>
<td>74.75 h (ISE: 3.23)</td>
<td>55.43</td>
</tr>
<tr>
<td>Diabetic + <em>C. decidua</em> flower extract treatment (Group 4)</td>
<td>164.5 a (ISE: 10.02)</td>
<td>56.0 b (ISE: 1.02)</td>
<td>65.95</td>
<td>67.5 c (ISE: 2.08)</td>
<td>58.96</td>
<td>65.01 d (ISE: 2.26)</td>
<td>60.48</td>
</tr>
<tr>
<td>Diabetic + <em>C. decidua</em> fruit extract treatment (Group 5)</td>
<td>337 e (ISE: 12.36)</td>
<td>108.66 f (ISE: 3.73)</td>
<td>67.75</td>
<td>88.33 g (ISE: 3.69)</td>
<td>73.78</td>
<td>62.66 h (ISE: 3.01)</td>
<td>81.4</td>
</tr>
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Decrease in the blood glucose concentration after *Capparis decidua* extract administration may be due to increased peripheral glucose utilization, decreased synthesis or release of glucose by the liver. It may be suggested that the hypoglycemic action of *Capparis decidua* extract may be due to direct metabolic effect on tissue and/or increase in insulin secretion. The results are in agreement with the study of Shanmugasundaram et al. [14], where the herbal therapy brought about glucose homeostasis through increased serum insulin levels provided by repair or regeneration of the endocrine pancreas. These findings are also in complete agreement with the findings of Farva et al. [15], where administration of garlic helped in raising the insulin level in blood, which resulted in lowering of blood sugar level by affecting carbohydrate metabolism. In conclusion it is suggested that the fruit extract is the best to control sugar in Type2 diabetic rats.

**REFERENCES**