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Comparative evaluation of the hypoglycaemic activity of various parts of *Capparis decidua*

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Abstract. Alcoholic extracts (50%) of fruits, flowers and bark of *Capparis decidua* Linn. (Capparidaceae) were tested for hypoglycaemic activities. Glimepride 0.1mg kg^{-1} was used as the reference drug. Results indicated that the alcoholic extracts of every tested part, manifests significant hypoglycaemic activity. The alcoholic extract of fruit displayed the best hypoglycaemic activity, followed by that of bark and flower. This study gives an indication to traditional healers to use from different parts of this plant the active part that has the ability to manage the complications of diabetes.

Key words: Hypoglycaemic, *Capparis decidua,* Alcoholic extract

Introduction

The use of medicinal plants in the management of various illnesses is due to their phytochemical constituents and dates back to antiquity (Yakuba et al. 2007). During the last decade, an increase in the use of medicinal plants have been observed in metropolitan areas of developed countries (Hamack et al. 2001). Diabetes mellitus, considered for a long time a disease of minor significance to world health, is now taking its place as one of the main threats to human health in the twenty-first century (Miller & Silverstein 2006). Changes in human behaviour and lifestyle over the last century have resulted in a dramatic increase in the incidence of diabetes worldwide (Grover et al. 2005). At least 177 million people suffer from diabetes and this number is likely to be more than double by 2030 (Wild et al. 2004).

The plant used for present study *Capparis deciduas*, known as Kair, Karil or delha, belong to family Capparidaceae and it is widely distributed in dry regions from India and Pakistan. The plant has a bad smell and taste. The Photograph 1 shows the ripened fruits of *Capparis deciduas*, that has sharp hot taste; astringent to the bowels, destroys foul breath, biliousness and urinary purulent discharges; it is helpful in cardiac troubles (Ayurveda). This plant is being utilized as a carminative, tonic, emmenagogue, aphrodisiac and alexipharmic. It improves appetite and is good for rheumatism, lumbago, hiccough, cough and asthma (Yunani).

The bark, under phytochemical investigations revealed the presence of n-pentacosane, n-tricontanol and β-sitaosterol besides a water-soluble alkaloid, 1-stachydrine (Yadav et al. 1997). Besides these, six new phytoconstituents have been isolated and characterized from the root bark, which are capparisterol, Capparideciduasterol, Capparisditerpenol, in aliphatic hydroxyketone and capparisditerpenyl ester (Gupta & Ali 1998).

Material & Methods

Plant material

The fruit, flower and bark of *C. decidua* were collected from Jodhpur (Rajasthan, India) in March, 2004 and authenticated by experts of Department of Botany, JNV University, Jodhpur.

Extraction

The collected plant parts were dried and powdered. The powdered material (500g) was extracted with hydro alcohol (50:50) for 72 h in soxhlet apparatus. The extract was then evaporated under reduced pressure to obtain solid mass. Extract was stored in sterile glass containers at - 4°C.

Experimental Animals

With the approval of the Institutional Animal Ethical Committee, albino rats, *Rattus norvegicus* of Sprague Dawley strain, weighing about 150 to 200 gm were selected from our inbred colony and were used for the experiment. They were housed in polypropylene cages measuring 12"x10"x8" under

controlled temperature conditions (25 ± 2°C) with 12:12 hrs light and dark cycle. Animals were fed on balanced diet of soaked maize, wheat and chicken beans supplemented with multivitamins and water *ad libitum*.

Animals were regularly checked throughout the investigation for any infection and if found infected, the animals were isolated and treated. A total check of cleanliness of the cages and general environment of animal house was kept. Animals were treated intermittently with antibiotic and antihelminthic suspensions as a prophylactic measure.

Induction of Type 1 Diabetes

Diabetes was induced in rats that had been fasted for 24 hours, by intraperitoneal injection of streptozotocin (Sigma chemicals Co., St. Louis, MO, U.S.A.) freshly dissolved in citrate buffer (pH 4.5) immediately before use. Streptozotocin was given at a dose of 65 mg / Kg body weight (Theodorou et al. 1980). The streptozotocin treated animals were given 5% glucose solution for 24 hours following streptozotocin injection to prevent initial drug induced hypoglycaemic mortality (Andallu & Varadacharyulu 2002).

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. Milipitas, 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 with polydipsia, polyuria and polyphagia were selected for the experiment.

Experimental design

The effect of *Capparis decidua*'s bark, flower and fruit extract was tested in type 1 diabetic model rats. The experimental models were administered with various plant extracts for a period of 30 days. Each treatment was divided into five groups. The control and experimental groups consisted of 8-10 animals each. The study consisted of following groups:

Group 1: Control or Intact: The group was made 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 1 diabetic rats. They received drug vehicle only for 30 days without any plant extract administration.

Group 3: Diabetic and *Capparis decidua* bark extract treatment: The group consisted of streptozotocin induced type 1 diabetic rats which were given *Capparis deciduas* bark extract treatment for 30 days.

Group 4: Diabetic coupled with *Capparis decidua* flower extract treatment: The group was composed of streptozotocin induced type 1 diabetic rats which were given *Capparis decidua* flower extract treatment for 30 days.

Group 5: Diabetic plus *Capparis decidua* fruit extract treatment: The group consisted of streptozotocin induced type 1 diabetic rats which were given fruit extract treatment for a time period of 30 days.

Group 6: Diabetic plus Glimepride treatment : The group comprised type 1 diabetic rats which received 0.1 mg kg^{-1} of Glimepride as - hypoglycaemic reference drug.

Acute toxicity studies

The acute toxicity test (LD_{50}) of the extract was determined according to the OCED test guidelines No.420 (Organization for Economic Co-operation and development).

Drug Administration

The various extracts of *Capparis decidua* were prepared for oral administration by dissolving in normal saline.The animals were fed with extracts at an effective dose of 500 mg / kg body weight. Various groups received the appropriate treatment daily in the morning and the blood samples were collected from the tail vein at 0 hrs in the (1st day), and at 3hrs after the administration of morning dose in the 5th day, 7th day, 15th day and 30th day (according to the different treatments) in order to determine the blood glucose levels. Changes in the body weight of animals were monitored daily.

Statistical Calculations

All values were expressed in terms of mean value ± standard error. The different groups were compared among each other using student "t" test (Ipstein and Poly 1970). The results were analyzed for statistical significance using one way ANOVA test.

Results

The acute toxicity studies of 50% alcoholic extracts were performed using OCED test guideline no.420. At a starting dose of 5000mg/kg, no mortality was observed for any extracts. So, 1/10 of this dose was selected for all in vivo studies as a maximal dose and the activity was studied using dose level of 500mg/kg body weight.

The 50% alcoholic extracts of *C. decidua* were subjected to hypoglycaemic studies and the results are given in Table 1. The extracts of all parts expressed hypoglycaemic activity at the 7th, 15th and 30th day as shown in Figure 1. Comparatively, the best hypoglycaemic activity was exhibited by the extract of fruits followed by the extract of bark. The flower extract displayed less activity compared to the other two parts.

Discussion

This study was performed to identify the effect of *Capparis decidua*'s extracts on the blood glucose level of type 1 diabetic rats.The plant has been used in various traditional medical practices. Diabetes is a major health

Photograph 1.
The ripened fruits of *Capparis deciduas*

Table 1. Table showing changes in serum glucose level (Group 2, 3, 4, 5 and 6 were compared with Group 1; Group 3, 4, 5 and 6 were compared with Group 2; P ≤ 0.05=a, P ≤ 0.01=b, P ≤ 0.001=c, P ≤ 0.05=e, P ≤ 0.01=f, P ≤ 0.001=g, Non-significant= d and h)

Treatment groups	Initial 0 day	7th Day	% Deviation	15th Day	% Deviation	30th Day	% Deviation
Intact Control (Group 1)	90.43 ±4.36	86.19 ±7.73	4.47	89.76 ±5.01	0.52	91.06 ±13.51	0.91
Diabetic Control (Group 2)	457.41^{c} ±23.32	362.26^{c} ±25.62	20.8	425.54^{c} ±22.66	6.96	399.1^{c} ±30.48	12.7
Diabetic plus *C. decidua* bark extract treatment (Group 3)	426.25^{c,h} ±41.36	135^{d,g} ±12.32	68.32	129.5^{d,g} ±11.83	69.62	114.50^{d,g} ±9.76	73.14
Diabetic plus *C. decidua* flower extract treatment (Group 4)	206.5^{a,g} ±14.67	183.5^{a,g} ±13.32	11.1	173.5^{b,g} ±15.36	15.98	147^{a,g} ±10.36	28.81
Diabetic plus *C. decidua* fruit extract treatment (Group 5)	316.50^{c,f} ±17.32	86.50^{d,g} ±5.36	72.6	82^{d,g} ±7.01	74.09	71^{d,g} ±5.98	77.57
Diabetic plus Glimepride treatment (Group 6)	350.6^{c,f} ±12.45	70.56^{d,g} ±3.86	79.87	68.74^{d,g} ± 5.89	80.39	60.26^{a,g} ±6.92	82.81

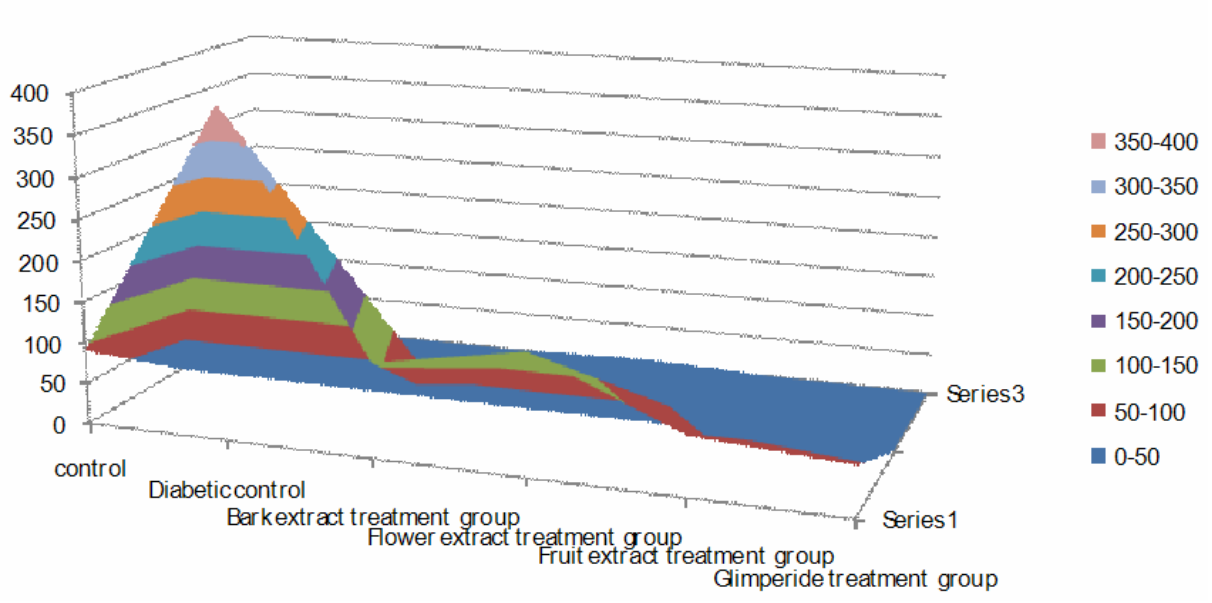

Figure 1. Changes in blood glucose level of type1 diabetic models over a 30 days period

problem affecting a significant part of the populations worldwide. Effective blood glucose control is the key for preventing or reversing diabetic complications and improving the quality of life in patients with diabetes. Plants represent an important potential source of drugs concerning hyperglycaemia (Malalavidhane et al. 2003, Aybar et al. 2001). The compounds or drugs developed from different plants may ameliorate the chronic complications of diabetes which predominantly affect the vascular system thus placing diabetes as one of the commonest causes for loss of vision, kidney failure and accelerated atherosclerosis (Shanmugasundaram et al. 1983, Jouad et al. 2001, Eddouks et al. 2003).

A significant increase in the levels of serum glucose was observed in diabetic control group. This is in concordance with the findings of Kamtchouing et al. 1998, where a 208% increase in serum glucose level was observed in streptozotocin induced diabetic control rats. Administration of streptozotocin or alloxan results in the destruction of β cells, the insulin producing machinery, and thereby causing high glucose levels of blood. The results revealed that alcoholic extract of *Capparis decidua*'s bark, flower and fruit suppresses the glucose level in diabetic rats compared with placebo treated animals. The effect of glimepride, the standard drug used in this study, on glucose tolerance has been attributed to enhanced activity of the beta cells of pancreas resulting in secretion of larger amounts of insulin.

Also, the results showed that water soluble ethanolic extract might increase the hypoglycaemic effect of insulin. The decrease in the blood glucose concentration after the administration of *Capparis decidua*'s extract might be due to increased peripheral glucose utilization, decreased synthesis or release of glucose by the liver. It might be suggested that the hypoglycaemic action of the extract appeared as a result of direct metabolic effect on tissue and/ or increase in insulin secretion (Shanmugasundaram et al. 1990, Farva et al. 1986).

From the foregoing account it is evident that *Capparis decidua* is highly potent in reducing the elevated serum glucose levels in type1 diabetes. The results indicate that the plant possess pronounced antidiabetic efficacy and it can be very useful in the management of the diabetes epidemic. It can serve as a potential source of discovery of new orally active agents for future therapy.

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