

Full Length Research Paper

Cholesterol-Lowering Activity of *Capparis decidua* in Experimental Models

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The effect of various extracts (50% ethanolic) of *Capparis decidua* on lipid profile of streptozotocin diabetic rats was studied. The extract was administered to the diabetic models for 30 days. The extract produced a significant ($p < 0.05$) dose-dependent decrease in the levels of total cholesterol (TC), Triacylglycerol (TG), low-density lipoprotein-cholesterol (LDL cholesterol), with a significant increase in the level High-density lipoprotein-cholesterol (HDL-C). The extracts of *C. decidua* prove to have a hypolipidemic potential.

Key words: *Capparis decidua*, diabetes, hypolipidemic.

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). However, during the last decade, an increase in the use of medicinal plants has been observed in metropolitan areas of developed countries (Hamack et al., 2001).

Heart diseases have been implicated as leading causes of death in all racial and ethnic groups. The elevation of serum total cholesterol and low density lipoprotein (LDL) cholesterol has been implicated as a primary risk factor for cardiovascular disease (Edijala et al., 2005). A number of plants have been used traditionally in the treatment of various cardiovascular diseases.

Capparis decidua belongs to family Capparidaceae. It is commonly found in the dry regions in India, Pakistan, Egypt and Tropical Africa. It's a struggling, glabrous shrub. The fruit is blanched and used as a vegetable and as pickles (Agarwal and Chauhan, 1988). The bark has an acrid, sharp, hot taste; analgesic, diaphoretic, alexeteric, laxative, anthelmintic; good in cough and asthma, ulcers and boils, vomiting, piles and all inflammations (Ayurveda).

Sitosterol was isolated from the roots by extracting with ethanol and chromatographing the alcoholic extract on neutral alumina with the eluents benzene, ether, chloroform and methanol successively (Ahmad et al., 1987).

Colourless, crystalline and hygroscopic alkaloids Capparine, Capparine and Capparine were isolated from roots of *C. decidua* by extracting roots with ethanol and chromatographed on neutral alumina column with chloroform-methanol (90:10, 80:20, 50:50, 20:80) respectively (Satyanaryana et al., 2008). Five glycosides were isolated from the flowers. Flowers contain the hydrocarbons Nonacosane and Triacontane. Six oxygenated heterocyclic constituents capparisesterpenolide (3-carboxy-6,17-dihydroxy-7,11,15,19-tetramethyleicos-13-ene-d-lactone) and deciduaterpenolides (d-lactone derivatives of 1,3,3-trimethyl-1,4-cyclohexadien-6-one) A,B,C,D and E from alcoholic extract of root bark (Gupta and Ali, 1998).

The various parts of *C. decidua* are used in food preparations like pickles due to the belief that it has hypolipidaemic action and the study was performed to investigate the same.

Phytoconstituents reported

The plant is found to reveal the presence of a number of alkaloids, terpenoids, glycosides and some fatty acids.

MATERIALS AND METHODS

The chosen plant, *C. decidua* was identified and selected by the experts of Botany Department, J.N.V. University, Jodhpur. The plant was collected by Neelkamal Chahlia, Research fellow. For the pre-

sent study various parts of the *C. decidua* (that is fruits, flowers and barks) were collected in and around Jodhpur (India). A reference sample has been kept in the herbarium of the department.

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 .

After getting approval from 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 $12'' \times 10'' \times 8''$ under controlled temperature conditions ($25 \pm 2^{\circ}\text{C}$) with 12:12 h 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. Animals were treated intermittently with antibiotic and anti-helminthic suspensions as a prophylactic measure. Indicate the strain of rats used.

Diabetes was induced in rats that had been fasted for 24 h 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 h following streptozotocin injection to prevent initial drug induced hypoglycaemic mortality (Andallu and Varadacharyulu, 2002).

The experimental models were administered various plant extracts for a period of 30 days. The extract was fed at an effective dose of 500 mg/Kg body weight. The control and experimental groups consisted of 8-10 animals each. The study consisted of following groups:

Group 1: Control or Intact: They received drug vehicle only that is normal saline water (2 ml / kg body weight/day).

Group 2: Diabetic control

Group 3: Diabetic + *C. decidua* bark extract treatment

Group 4: Diabetic + *C. decidua* flower extract treatment

Group 5: Diabetic + *C. decidua* fruit extract treatment

The acute toxicity test (LD50) of the extract was determined according to the OCED test guidelines No.420 (Organization for Economic Co-operation and development).

The various extracts of *C. 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.

Twenty four hours after the last administration, the animals were anaesthetized with chloroform vapor and dissected. Whole blood was obtained by cardiac puncture from each rats and collected into sample bottles. The serum and tissue samples (liver, heart and adrenal gland) were kept at -20°C until assayed for Biochemical parameters.

Serum total cholesterol, triglyceride and High density Lipo-protein (HDL) were measured by enzymatic colorimetric method using Randox kits. The concentration of low density lipoprotein (LDL) cholesterol was calculated by the formula of Friedwald et al. (1972). Frozen tissues were analyzed for quantitative estimation. Cholesterol was estimated in liver, heart muscle and adrenal gland by method of Zaltkis et al., 1953.

All the values were expressed in terms of mean value $\pm$ 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 ANOVA test.

RESULTS

There was a significant decrease in HDL-cholesterol and a significant increase in the levels of LDL, VLDL, total Cholesterol and triglycerides in diabetic rats when compared to normal rats (Table 1). Administration of the ethanolic extracts restored the elevated levels of serum lipids to normal.

The ethanolic extracts of *C. decidua* produced a significant ($p < 0.05$) decrease in the levels of total cholesterol, triglyceride, LDL-cholesterol and VLDL-cholesterol of the extract treated group compared to diabetic control. The reduction was more pronounced in bark and fruit extract. There was a significant ($p < 0.05$) increase in the levels of HDL-cholesterol as compared to diabetic control.

DISCUSSION

The aim of the present study was to test the effect of the *C. decidua* extracts on serum and tissue cholesterol and triglyceride concentrations. It has been previously reported that *C. decidua* exhibited a hypoglycaemic and antioxidant activity in STZ rats (Gaiind et al., 1969). Administration of *C. decidua* extract to diabetic animals normalizes blood glucose concentration and reduces triglyceride levels. The results demonstrated that the ethanolic extracts of *C. decidua* induced a significant decrease of plasma cholesterol levels in STZ-diabetic rats. Some studies have reported a similar lipidemic-lowering activity of some medicinal plants (Ram et al., 1997 and Sharma et al., 1997).

Induction of diabetes in normal rats resulted in an increase in cholesterol content of liver, heart and adrenal (Table 2). As reported earlier by Mutalik et al. (2005) the elevated levels of cholesterol in the diabetic control group were significantly lowered in 30 days treatment group of *C. decidua* extracts. Similar results were obtained by Ananthan et al., 2003. Lower levels of serum triglycerides observed after *C. decidua* administration may be because of its hemicellulose content as Usha et al. (1984) observed a negative correlation between hemicellulose content of the diet and serum triglyceride levels (Agarwal and Chauhan, 1988).

Hyperlipidemia has been implicated in the development of atherosclerosis (Kaplan, 1989). The underlying mechanism of the lipidaemic-lowering activity of *C. decidua* could be the inhibition of lipid absorption due to the presence of saponins and tanins in the ethanolic extract (Goyal and Grewal, 2003); hence used as hypocholesterolemic. It may operate through increased fecal excretion of cholesterol as well as bile acids (Agarwal and Chavan, 1988).

Oral administration of saponins from some medicinal plants, significantly reduce triglycerides and cholesterol

Table 1. showing the Effect of the different crude extracts of *Capparis decidua* on serum cholesterol and triglyceride levels in fasting normoglycaemic and STZ induced hyperglycaemic rats ((MEAN OF 5 VALUES $\pm$ SEM)

Treatment groups	Cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)
Intact Control (Group1)	89.36 $\pm$ 0.432	66.68 $\pm$ 0.912	59.6 $\pm$ 0.45	78.2 $\pm$ 0.19	21.8 $\pm$ 0.36
Diabetic Control (Group 2)	201.50 ^c $\pm$ 0.58	149.20 ^c $\pm$ 0.56	14.9 ^c $\pm$ 0.29	144 ^c $\pm$ 0.67	47.8 ^c $\pm$ 0.30
Diabetic + <i>C. decidua</i> bark extract treatment (Group 3)	96.10 ^{a,f} $\pm$ 0.89	76.70 ^{a,f} $\pm$ 0.35	56.46 ^{a,g} $\pm$ 0.22	85.84 ^{a,f} $\pm$ 0.22	22.1 ^{d,f} $\pm$ 0.32
Diabetic + <i>C. decidua</i> flower extract treatment (Group 4)	125.4 ^{b,e} $\pm$ 0.67	80.63 ^{a,f} $\pm$ 0.42	46.02 ^{b,g} $\pm$ 0.30	126.42 ^{b,e} $\pm$ 0.72	34.26 ^{a,f} $\pm$ 0.39
Diabetic + <i>C. decidua</i> fruit extract treatment (Group 5)	98.00 ^{a,f} $\pm$ 0.34	76.20 ^{a,f} $\pm$ 0.72	44.2 ^{b,g} $\pm$ 0.19	92.6 ^{a,f} $\pm$ 1.28	22.9 ^{d,f} $\pm$ 0.33

Group 2, 3, 4 and 5 were compared with Group1

P $\leq$ 0.05

P $\leq$ 0.01

P $\leq$ 0.001

Non-significant

= a

= b

= c

= d

Group 3, 4 and 5 were compared with Group2

P $\leq$ 0.05

P $\leq$ 0.01

P $\leq$ 0.001

Non-significant

= e

= f

= g

= h

Table 2. Tissue biochemistry Of 30 days treatment of various extracts of *Capparis decidua* In albino rats (Type 1 diabetes)

Treatment groups	Cholesterol (mg/gm)		
	Liver	Heart	Adrenal
Intact Control (Group1)	13.82 $\pm$ 0.37	6.49 $\pm$ 0.16	24.06 $\pm$ 0.66
Diabetic Control (Group 2)	27.46 ^c $\pm$ 0.41	8.6 ^c $\pm$ 0.28	31.24 ^c $\pm$ 0.76
Diabetic + <i>C. decidua</i> bark extract treatment (Group 3)	14.36 ^{d,g} $\pm$ 0.22	8.09 ^{b,h} $\pm$ 0.46	24.02 ^{d,g} $\pm$ 0.39
Diabetic + <i>C. decidua</i> flower extract treatment (Group 4)	13.93 ^{d,g} $\pm$ 0.09	7.15 ^{d,f} $\pm$ 0.18	23.01 ^{d,g} $\pm$ 0.29
Diabetic + <i>C. decidua</i> fruit extract treatment (Group 5)	13.81 ^{d,g} $\pm$ 0.17	7.09 ^{d,f} $\pm$ 0.37	24.25 ^{d,g} $\pm$ 0.76

extract treatment (Group 5)

(Mean of 5 values $\pm$ Sem)

Group 2, 3, 4 and 5 were compared with Group 1

P $\leq$ 0.05

P $\leq$ 0.01

P $\leq$ 0.001

Non-significant

= a

= b

= c

= d

Group 3, 4 and 5 were compared with Group 2

P $\leq$ 0.05

P $\leq$ 0.01

P $\leq$ 0.001

Non-significant = h

= e

= f

= g

= h

levels in rat. The usage of diet with high saponins contents is also suggested to reduce heart diseases (Oakenfull, 1981).HDL functions in the transport of cholesterol away from the peripheral tissues to the liver, thus preventing the ge-nesis of atherosclerosis. The observed significant incre-ase in the level of HDL further points to the cardiac pro-ective activity of the extracts.

In the present study, there was a significant reduction in the levels of total cholesterol, triglycerides, LDL and VLDL cholesterol. Further investigations are warranted to

identify the hypolipidemic active principles and elucidate their mechanism of action.

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