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Assessment of Antidiabetic Potential of Cressa Cretica Linn in Streptozotocin-Induced Diabetic Rats

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Abstract

The present study was undertaken to investigate the antidiabetic potential of methanolic extract of Cressa cretica against streptozotocin induced diabetic rats. The halophytic plant Cressa cretica is widely used as a traditional treatment for diabetes mellitus. The methanolic extract of Cressa cretica administered orally at a dose of 100 mg/kg, for 15 days to streptozotocin induced diabetic rats. Fasting blood glucose level and change in body weight assessed in methanolic extract treated diabetic rats, were compaired with normal animal, diabetic control and standard drug treated rats. The yield of methanolic extract in Cressa cretica was found to be 16.18 %. Methanolic extract of Cressa cretica produced a significant reduction in fasting blood glucose level in streptozotocin induced diabetic rats. Significant differences were also observed in body weight by methnolic extract treated diabetic rats, when compared with diabetic control, normal control and standard drug treated rats. Methnolic extract of Cressa cretica exhibit significant anti-hyperglycemic activity in streptozotocin-induced rats. Preliminary phytochemical investigation revealed the presence of phenolic compounds and flavonoids which may be responcible for antidiabetic activity.

1. Introduction

In the last few decades there has been an exponential growth in the field of herbal medicine and the populariety of herbal drugs in the developed countries due to its natural origin with lesser side effects.1 Majority of the traditional medicines used in healthcare are obtained from plants.[2] Cressa cretica L. belonging to family Convolvulaceae is one of the important halophytic plant from traditional system of medicine distributed throughout India, along sandy shores.[3] Cressa cretica is commonly known as Rudravanti.[4] It is mysterious and sought after herbs in India mythology.[5] Diabetes mellitus is a metabolic disorder due to the disturbances in carbohydrate, protein and lipid metabolism causing hyperglycemia with complication such as neuropathy, retinopathy, nephropathy and atherosclero vascular disease.[6] The treatment of diabetes mellitus is based on oral antihyperglycemic agents and insulin. The oral antihyperglycemic agents currently used in clinical practice. [7] Currently there are 190 million people with diabetes in the world and their number may double in next three decades.8 About 90% diabetics suffer from diabetes mellitus, which is recognized as vascular disease.[9] This leads to increasing demand for herbal products because of their effectiveness, minimal side effects in clinical experience and low cost.[10]

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2. Materials and Methods

2.1. Animals

Adult albino wistar rats (200 to 250 gm) were used for the study. They were housed in polypropylene cages and fed with a standard diet and water ad libitum. The animals were exposed to an

alternating 12 h light and dark cycle. All the experimental procedures and protocols involving animals were reviewed by the Institutional Animal Ethics Committee in accordance with the guidelines of CPCSEA.

2.2. Collection and authentication of plant material

Fresh plant of Cressa cretica was collected in the month of May, 2012 from Venkateswara University, Tirupati, and Andhra Pradesh, India. The plant was identified and authenticated by Dr. K. Madhava Chetty, Asst. Professor, Department of Botany, Sri Venkateswara University, Tirupati, and Andhra Pradesh, India. A voucher specimen has been deposited at the College of Pharmacy, TMU Moradabad (TMU/Consult/2011-12/204) for future reference.

2.3. Drugs and chemicals

Streptozotocin (CAS no. 18883-66-4) was purchased from Sisco Research Laboratories Pvt. Ltd. Mumbai, India. Oral antidiabetic drug Daonil (batch no. F25898 glibenclamide) was obtained from Aventis Pharma Limited, Goa. Analytical grade chemicals including various organic solvents (Petroleum ether, Methanol) from Rankem, Pvt. Ltd., New Delhi were used for the successive extraction.

2.4. Preparation of the Extract

The powdered Cressa cretica material (120 g) was extracted using petroleum ether and methanol by hot extraction using Sohlxet apparatus at a temperature of 60˚C.The extracts were concentrated under reduced pressure using a rotary vaccume evaporator to constant weight and preserved in desiccator for further studies. [11]

2.5. Preliminary phytochemical screening

Preliminary phytochemical screenings were done to find the presence of the active chemical constituents in methanolic extract such as alkaloids, glycosides & flavonoids. [12]

2.6. Acute toxicity study

Acute toxicity study for the extract was carried out according to the method described in the literature. The methanolic extract of Cressa cretica suspended in 5% gum acacia solution in doses of 50, 100, 200, 300, 400 and 500 mg/kg were administered orally to animals. The animals were observed continuously for any change in autonomic or behavioral responses for first few hours and at 24 hour interval for a period of 72 hours. At the end of this period the mortality if any in each group was noted. [13]

2.7. Induction of diabetes

Diabetes mellitus was induced by single intraperitonieal injection of streptozotocin (55 mg/kg in 0.1 M citrate buffer pH 4.5). The normal control group received equivalent amount of citrate buffer only (0.4 ml). The rats were fasted overnight for 16 h with free access to water throughout the duration of the experiment. Diabetes was confirmed by the determination of fasting glucose levels on the third day post administration of streptozotocin. [14]

2.8. Treatment protocol

The animals were divided into four groups of six rats (n = 6) each.

Group I - Normal control rats, received only distilled water daily.

Group II- Diabetic control rats, received Streptozotocin (55 mg/kg) only

Group III - Diabetic rats received methanolic extract of Cressa cretica (100 mg/kg, p.o.) for 15 days.

Group IV - Diabetic rats received standard antidiabetic drug glibenclamide (10 mg/kg, p.o.). After 15 days of treatment, experiments were terminated and observations were made. Blood glucose level was estimated on 1, 4, 7 , 10 and 15 day of experiment with the help of glucometer using strip method after taking the blood from tip of the tail.

2.9. Statistical analysis

The results are expressed as mean ± S.E.M. Statistical difference was tested by using one-way analysis of variance (ANOVA) followed by post hoc Dunnett's multiple comparison test. A difference in the mean P value <0.01 was considered as significant.

3. Results

3.1 Yield of plant extract

The 120 gm powder of Cressa cretica was taken for extraction by Soxhlet apparatus. Total 18.75 gm methanolic extract was obtained. The yield of methanolic extract was found to be 16.18 % w/w.

3.2 Acute toxicity

No toxic effects were observed at a higher dose of 500 mg/kg body weight. Hence, there were no lethal effects in any of the groups. In the study, methanolic extract of Cressa cretica was administered 100 mg/kg dosage, which was determined as the most effective dosage.

3.3 Changes in body weight

At the end of 15 days treatment the body weight of diabetic control group decreased whereas treatment with methanolic extract of Cressa creticas (100 mg/kg, p.o.) and GLB (10 mg/kg, p.o.) significantly recovered the body weight towards normal level (Table 1).

3.4 Blood glucose level

The effect of methanolic extract on fasting blood glucose in the diabetic rats is shown in Table 2. The results from the study clearly indicated that the methanolic extract exhibited significant hypoglycemic activity in STZ-diabetic rats. The standard drug glibenclamide also indicated a significant decrease of blood glucose levels.

4. Discussion

The fundamental mechanism underlying hyperglycemia involves over-production (excessive hepatic glycogenolysis and gluconeogenesis) and decreased utilization of glucose by the tissues.15 Persistent hyperglycemia, the common characteristic of diabetes can cause most diabetic complications. Treatment should aim to lower blood glucose to near-normal levels. In our investigation, the normoglycaemic studies revealed that the methanolic extract of Cressa cretica has the capacity to lower blood glucose levels. The diabetic syndrome in rats administered STZ is characterized by stable moderate hyperglycemia, glucose intolerance and altered but significant glucose stimulated insulin secretion.16 In normoglycaemic study, the data indicates that the Cressa cretica treatment significantly reduced the blood glucose levels in the diabetic rats towards the normal level in the 15 days of study period. The characteristic loss of body weight associated with STZ induced diabetes is due to increased muscle wasting in diabetes.17 The Cressa cretica treated animals recovered the body weight significantly towards normal level. This may be directly due to the lipid lowering activity of the extract or indirectly to the influence on various lipid regulation systems. Methanol extract showed the presence of alkaloids, glycosides, flavonoids and polyphenolic compound. The anti-diabetic activity of Cressa cretica may be due to the presence of flavanoid. It is reported that flavanoid constitute the active biological principle of most medicinal plants with hypoglycemic and anti-diabetic properties.18 However the extract should further be subjected to bioactivity guided drug discovery to isolate the lead compound responsible for anti-diabetic and possible mechanism(s) of action.

Table: 1. Effect of methnolic extract of Cressa cretica on body weight in STZ-induced diabetic rats

Groups	Body weight (g)		Change in body weight (%)
	Day 1	Day 15	
Normal Control	214.83±1.6	219.5±2.2	-
Diabetic Control	214.5±1.4	196.83±1.4[c]	-
Methanolic extract (100mg/kg)	213.83±1.4	217.66±1.4[a]	1.79
Standard drug (10mg/kg)	211.83±0.9	215.83±0.9[b]	1.88

Values are expressed as mean ± S.E.M. (n=6)

[a]$P<0.01$ as compared to control

[b]$P<0.01$ as compared to control

[c]$P<0.001$ as compared to control

Table: 2. Effect of methnolic extract of Cressa cretica on fasting blood glucose level in diabetic rats

Group	Blood glucose level (mg/dl)					Reduction in blood glucose level (%)
	Day 1	Day 4	Day 7	Day 10	Day 15	
Normal	86.33±1.2	85.5±1.4	85.83±1.0	87.16±1.1	87.83±0.8	-
Diabetic control	300.83±1.2[c]	372.83±1.4[c]	399.33±1.0[c]	393.83±0.9[c]	387.83±0.9[c]	-
Methanol extract (100mg/kg)	282.33±0.7[c]	204.5±0.9[c]	171±0.9[c]	140±0.5[c]	128.83±0.8[c]	54.36
Standard drug (10mg/kg)	287.33±1.4[c]	198.83±1.2[c]	168.5±1.0[c]	130.33±1.2[c]	125±1.5[c]	56.49

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