

HYPOGLYCAEMIC ACTIVITY OF SCOPARIA DULCIS L. IN DIFFERENT SOLVENT SYSTEMS

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ABSTRACT

Objective: The highest hypoglycaemic activity of *Scoparia dulcis* L. in different solvent systems viz. Petroleum ether, Methanol, Ethanol and Acetone was investigated.

Materials and Methods: The effects of different extracts of *Scoparia dulcis* L. was studied to determine the level of efficacy of each extract. The in vivo antidiabetic efficiency was studied by estimating blood glucose level of mice on administration of various extracts were characterized in Swiss male albino mice (20-25gm) which were made diabetic by administering Streptozotocin (STZ) in the dose of 150mg/kg body wt. (dissolved in water for injection) at an hourly basis of 6h, 24h and 48h duration.

Results: The acetone extract of *Scoparia dulcis* L. exhibited more and significant hypoglycaemic activity than the other extracts.

Conclusion: Treatment of diabetic mice with this plant extract restored the elevated biochemical parameter and the activity was found time dependant as the glucose level reduced gradually after 6h, 24h and 48 h.

Keywords: *Scoparia dulcis*, Hypoglycaemia, Acetone, Experimental animal (Swiss albino mice).

INTRODUCTION

Diabetes mellitus is a non communicable disease considered as one of the leading causes of death worldwide. [1] It is generally divided into two different types- Insulin dependent diabetes mellitus (IDDM) and non-insulin diabetes mellitus (NIDDM).[2] It is a metabolic disorder characterized by hyperglycemia, glucosurea and negative nitrogen balance and is mainly due to lack of insulin secretion in the beta cells of pancreas and desensitization of insulin receptors for insulin. It is the most prevalent disease in the world affecting 25% of population. [3]

Many synthetic drugs are available in the market for the treatment of diabetes and many more potential drugs currently in investigation by the pharmaceutical companies. But plant based products have been popular all over the world for centuries. In diabetics, some herbal alternatives are proven to provide symptomatic relief and assist in prevention of secondary complications of the disease. A majority of plants has been found to contain substances like alkaloids, flavonoids, terpenoids, steroids and glycosides etc. that have antidiabetic implications. As natural products or formulations are free from side effects so their demand in the pharmaceutical industry is gaining grounds. [4, 5, 6,7]

Scoparia dulcis L. (Family- Scrophulariaceae) also known as Sweetbroom weed/ Vassourinha or licorice weed, an erect annual herb in the foxglove family grows upto 1/2m in height. It produces serrated leaves and many small white flowers. It is widely distributed in many parts of the world. It has been shown to possess a wide range of biological activities such as antihyperglycemic, antitumor, antimicrobial, analgesic, cardiogenic, CNS depressant, hypotensive, antioxidant, hepatogenic, contraceptive, cough suppressant, wound healing etc.[8] Three antidiabetic compounds have been isolated from *Scoparia dulcis*- amellin, scoparic acid D and diasulin. Amellin, an antidiabetic compound is a glycoside which has been reported in the leaf and stem of fresh green plants. An infusion of the leaf is used in fever, cough and bronchitis and as gargle for toothache. A hot infusion is a diuretic. An infusion of roots leaves and tops are useful in diarrhea and dysentery. All parts of the plant are useful as emetic. An infusion of seeds obtained by soaking them in water overnight is a cooling drink. *Scoparia dulcis* L. is medicinally used in Paraguay as crude drug namely "Typycha Kuratu" to improve digestion and protect the stomach. In Taiwan, the same plant is used as cure for hypertension and in India for toothache,

blenorhagia and stomach troubles.[9,10,11,12,13] An anti-diabetic compound, Scoparic acid D (SAD) , a diterpenoid isolated from the ethanolic extract.[14] Diasulin is made from 10 medicinal plants among which *Scoparia* is one. The whole plant is used in concentration 40mg/l. A total of 62 compounds have been isolated of which 24 are terpenoids, 20 are flavonoids, 4 steroids and 14 miscellaneous.

Pharmacologic studies reveal the fact that diabetes is revealed in animal models either by alloxan or Streptozotocin and herbal extracts are thereby tested to study their efficacy to lower the blood glucose level. The present study has been designed to study the efficacy of various extracts of *Scoparia dulcis* L. in different solvent systems.

One of the study suggested that ethanolic extract of leaf of *Phragmites vallisneria* showed a promising role in therapy to STZ induced diabetic rats. Further studies are in progress to isolate the active principle(s) of the extract as well as to elucidate their exact mechanism(s) of action.[15]

Antidiabetic activity of *Momordica charantia* fruit extracts established the scientific basis for the utility of this plant in the treatment of diabetes. The aqueous extract have shown significant reduction in blood glucose levels in both glucose loaded, normal and alloxan induced diabetic rats. Long term administration of 500mg/kg of aqueous extract of *Momordica charantia* showed significant anti-diabetic effects, decreased postprandial glycaemia but not fasting blood glucose. Thus the claim made by the traditional Indian systems of medicines regarding the use of fruit juice of this plant in the treatment of diabetes stands confirms. [16]

MATERIALS AND METHODS

Chemicals and reagents

All chemicals were procured from Qualigens Chemicals which were of analytical grade. The kits were purchased from Agappe (glucose kits)

Plant material

The plants have been collected through extensive field work in various areas in and around the neighbouring areas of Assam University. The plant has been authenticated and identified by Assam University herbarium authority.

The plants were then air dried in shade for a period of 15-20 days and then milled to fine particles. The milled material was dipped in different solvent systems - Petroleum ether, ethanol, methanol and acetone to yield the crude extract. The crude extract was made solvent free using a rotary evaporator. The extract was then stored for further analysis.

Animals and animal treatment

Swiss albino mice weighing 20-25g were used for the experiment. They were housed in spacious cages, fed with standard pellet diet and were provided a light and dark cycle of 12hr, till the end of experimentation. All experiments were conducted according to the guidelines of experimental animal care set up by the ethical committee.

The antidiabetic activity was carried out in Streptozotocin (STZ) induced diabetic mice. STZ dissolved in water for injection in the dose of 150mg/kg body wt intraperitoneally. After 7days the blood glucose level was checked. The animals were then divided into 5 groups of 12 animals in each group. Again, in each group 6

animals were administered dose orally and 6 intraperitoneally. [17, 18]

Group I, II, III and IV were made diabetic by single intraperitoneal injection of Streptozotocin (STZ). Mice having glucose level more than 200-300 mg % of blood glucose were selected for the study. The samples were then administered orally and intraperitoneally in 8 groups of mice in the dose of 100mg/kg body wt. The blood glucose level for each animal of each group (6mice) was estimated after 6h, 24h and 48h of administration. Water for injection was used as control (2 groups of mice were used more)

Blood glucose analysis

Blood was collected intraperitoneally from the thigh muscle. It was collected in fresh centrifuge tubes and plasma was separated in an electric centrifuge at 2000rpm for 15 mins. Plasma samples were analysed for glucose content by using commercial diagnostic kits in an Automated Chemical analyzer which were further randomly checked by orthotoluidine method. The method used has been approved by the Ethical Committee of Assam University.

Statistical analysis

Table 1: Blood glucose level of *Scoparia dulcis* whole plant extracts (acetone, methanol, petroleum ether and ethanol) on oral administration in diabetic mice.

Extracts	Initial	0 hr	6 hr	24 hr	48 hr
Diabetic control	97.67±1.02	249.67±12.28	249.66±13.28	248.67±13.29	248.0±13.43
Acetone	66.5±1.61	213.83±1.70	205.33±2.08**	175.0±1.57***	74.67±1.61***
Methanol	89.17±2.01	239.83±5.54	234.67±5.10	223.5±5.06	120.0±5.76***
Pet ether	93.33±1.43	237.00±1.88	231.83±1.85	223.5±2.35	121.33±5.54***
Ethanol	89.17±2.68	241.00±5.38	237.33±5.48	231.83±6.11	130.17±4.50***

***P<0.001, **<P<0.01, *P<0.05, when drug treated group compared with diabetic control group.

Table 2: Blood glucose level of *Scoparia dulcis* whole plant extracts (acetone, methanol, petroleum ether and ethanol) on intraperitoneal administration in diabetic mice.

Extracts	Initial	0 hr	6 hr	24 hr	48 hr
Diabetic control	97.5±0.72	238.33±0.95	239.17±0.83	238.83±0.98	237.83±0.60
Acetone	77.33±1.86	248.00±2.15	214.5±1.91***	176.83±1.72***	77.33±2.45***
Methanol	89.67±2.88	290.67±3.36	274.83±3.16	229.0±4.87	127.83±4.71***
Pet ether	89.17±2.20	231.5±1.93	225.17±2.33*	197.0±1/67***	112.0±2.05***
Ethanol	58.16±1.91	260.83±0.83	249.0±0.93	222.5±3.31**	127.83±8.59***

***P<0.001, **<P<0.01, *P<0.05, when drug treated group compared with diabetic control group.

RESULTS

The analysis showed that acetone extract of *Scoparia dulcis* L. showed highest and significant hypoglycaemic activity followed by methanol, petroleum ether and ethanol. Treatment of diabetic mice with this plant extract restored the elevated biochemical parameter and the activity was found time dependent as the glucose level reduced after 6h, 24h and 48h gradually. Table - 1 and 2 are depicted, which describe the activity of extracts administered orally and intraperitoneally respectively.

DISCUSSION

The present study supports the traditional claim that the acetone extract of this plant could be added in the traditional preparations for the ailment of various diabetes associated complications. Although the plant has been in trial for antidiabetic activity. The acetone extract of this plant has never been explained before. Acetone extract at a dose of 150mg/kg body wt for 7 days showed the highest activity in reducing the blood sugar level. Again, with time, the reduction in the blood sugar level showed considerable changes. The hypoglycaemic activity of ethanolic extract was also reported earlier as at a dose of 100 and 200mg/kg body weight of Albino mice showed considerable fall in elevated blood glucose level i.e. of 31.87% and 46.97% respectively in allowance induced diabetic mice while 50.74% was found for metformin.[19] Due to this fact only, 10% concentrated ethanolic extract of *Scoparia*

dulcis ointment showed significant responses in all types of wound.[20] Hypoglycaemic activity recorded for methanolic and petroleum ether were also supportive to some extent by a published report. The extract of mixture solvent system i.e. of petroleum ether, diethyl ether and methanol (PDM- 1:1:1) at a dose of 800mg/kg p.o. significantly prevented CCl₄ induced changes in the serum and liver biochemistry and in liver histopathology. It has potential hepatoprotective activity and is due to terpenoid constituents. [21]

Further, the hypoglycaemic activity of *Scoparia dulcis* in other polar solvent was also significant as oral administration of 0.15, 0.30 and 0.45g/kg body weight of aqueous extract of *Scoparia dulcis* leaves for 45 days resulted in a significant reduction in blood glucose, glycosylated haemoglobin and an increase in total haemoglobin and in 0.45g/kg body weight the effect was highly significant.[22] In addition, interestingly treatment with *Scoparia dulcis* plant extract (250mg/kg and 125 mg/kg) significantly increased the glycogen and brought them near to normal level.[23]

Significant differences in hypoglycaemic activity between oral and intraperitoneal administration of extracts were not observed. However, acetone extract showed better activity on oral administration. In fine, *Scoparia dulcis* is a promising antidiabetic plant and acetone extract of it was found to be most active one.

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