

Short Communication

Antidiabetic activity of water extract of *Solanum trilobatum* (Linn.) in alloxan-induced diabetes in rats

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The antidiabetic potential of the water extract of *Solanum trilobatum* L. (Solanaceae), a medicinal plant widely used in the traditional Ayurveda and Siddha systems of medicine for the treatment of diabetes mellitus was evaluated in the alloxan monohydrate induced diabetic model. Graded doses of the water extract were administered to normal and experimental diabetic rats for 10 days. Significant ($p < 0.05$) reduction in fasting blood glucose levels were observed in the normal as well as in the treated diabetic animals. Serum insulin levels were not stimulated in the animals treated with the extract. In addition, changes in body weight, serum lipid profiles and liver glycogen levels assessed in the extract treated diabetic rats were compared with diabetic control and normal animals. Significant results were observed in the estimated parameters, thereby justifying the use of the plant in the indigenous system of medicine.

Key words: Antidiabetic activity, alloxan monohydrate, Gliben clamide, rats, *Solanum trilobatum*.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder affecting carbohydrate, fat and protein metabolism. Panoply of defenses against oxidative stress has evolved and operates at distinct levels. There are reduced generation of reactive oxygen in species, enhancement of antioxidant enzymes like superoxide dismutase (SOD), catalase, glutathione peroxidase (GPX) and Glutathione reductase (GSH) and repair systems at the level of DNA (Sagara et al., 1996). Though the role of oxidative stress in the development of Diabetes Mellitus and its vascular complications are extensively studied there are very few therapeutic agents which are targeted to this (Shankar et al., 2005). Recently several thiazolidenediones such as troglitazone and pioglitazone have been developed as antidiabetic drugs. Of interest among these is triglitazone, which possess structural similarity to alpha tocopherol, an established antioxidant (Yoshioka et al., 1959).

The worldwide survey reported that the DM is affecting nearly 10% of the population. The oral antihyperglycemic agents currently used in clinical practice have characteristic profiles of serious side effects (Pickup and Williams, 1991). This leads to increasing demand for herbal products with anti-diabetic activity and less side effects (Vetrichelvan et al., 2002). *Solanum trilobatum* extract decreased the phagocyte activities of macrophages in alloxan-induced diabetes which indicate that it was effective reducing lipid peroxidation in experimental diabetes. Therefore the present study was carried out to evaluate the antidiabetic activity of *S. trilobatum* in alloxan-induced diabetes and to probe into the mechanism of its antidiabetic property.

MATERIAL AND METHODS

Plant material and decoction preparation

The leaves of *S. trilobatum* were collected from Coimbatore district, Tamilnadu, India and authenticated by Dr. Gopalan, Scientist, Botanical garden Survey of India, Southern circle, Tamilnadu, India. A voucher specimen is being maintained in the Rathinavel Subra-

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Table 1. Glucose and cholesterol content of serum of control and experimental rat groups.

Parameter	Control (Group I)	Diabetic control (Group II)	Diabetic + Glibenclamide (1 ml) (Group III)	Diabetic + <i>S. trilobatum</i> extract treated (1 ml) (Group IV)	<i>S. trilobatum</i> extract-treated (1 ml) (Group V)
Glucose (mg/dl)	117.5±0.5	249.5±1.5 ^{a***}	145±0.3 ^{b***}	151±1.9 ^{c***}	158.5±0.5 ^{d***}
Cholesterol (mg/dl)	121±2.01	240±1.81 ^{a***}	115±3.40 ^{b***}	113±2.82 ^{c***}	119±2.00 ^{dNS}

Values are taken as a mean of five individuals experiments, and expressed as mean ± S.D.

***p< 0.001, **p< 0.01 and *p< 0.05. NS = Not Significant.

Table 2. The Concentrations of urea, total protein, SGOT and SGPT in serum of control and experimental groups.

Parameter	Control (Group I)	Diabetic control (Group II)	Diabetic + Glibenclamide (1 ml) (Group III)	Diabetic + <i>S. trilobatum</i> extract treated (1 ml) (Group IV)	<i>S. trilobatum</i> extract-treated (1 ml) (Group V)
Urea (mg/dl)	45±0.1	61.5±2.5 ^{a***}	56.5±1.5 ^{b***}	91±1.9 ^{c***}	49±2.0 ^{d**}
SGOT (U/L)	22.6±2.5	23.0±2.4 ^{a***}	29.9±6.3 ^{b***}	30.7±5.5 ^{c***}	40.9±1.4 ^{d***}
SGPT (U/L)	25.0±3.0	27.7±4.5 ^{a***}	32.1±3.2 ^{b***}	35.1±2.3 ^{c***}	43.1±1.5 ^{d***}
Total protein (g/dl)	7.1±0.15	4.5±0.29 ^{a***}	2.2±0.21 ^{b***}	7.4±0.31 ^{c***}	7.9±0.8 ^{d*}

Values are taken as a mean of five individuals experiments, and expressed as mean ± S.D.

***p< 0.001, **p< 0.01 and *p< 0.05. NS = Not Significant.

maniam College of Arts and Science Medical and Ayurvedic foundation, Coimbatore. The leaves were dried in shade.

The *S. trilobatum* L leaves were collected in December (the beginning of winter) and 150 g of dried powdered leaves was boiled 1 liter of water for 5 min, allowing the decoction to stand for 30 min and filtering through Whatman no.1 filter paper. Such procedure resulted in a decoction with a 15% higher concentration than that produced by the method described by Teixeira et al. (1990).

Test animals

The test animals used in the study were procured from Karpagam Medical And Research Foundation. Albino rats of wistar strain of either six weighing 150 - 200 g bred in Animal Tissue Culture Lab, Karpagam Arts and Science College. They were individually housed in polypropylene cages in well-ventilated rooms, under hygienic conditions. Animals were given water *ad libitum* and fed with rat pellet feed.

Induction of experimental diabetes and treatment

Alloxan monohydrate solution of 10 mg/ml was prepared in ice-cold citrate buffer 0.1 M pH 4.5 kept in ice and was administered to the rats within 5 min at a dose of 50 mg/kg body weight intraperitoneally. After 48 h of alloxan monohydrate administration, rats with moderate diabetes having glycosuria and hyperglycemia were taken for the experiment.

Rats weighing, 150 – 160 g, fasted over night were used for induction of diabetes. Rats were divided into two sets; diabetic and non-diabetic. Group I received normal diet and served as normal control. Group II consists of alloxan-induced rats receiving normal diet and serving as diabetic control. Group III consists of alloxan-induced rats receiving Glibenclamide (synthetic antidiabetic drug) at 0.5 mg/kg body weight once a day orally for 10 days. Group IV consists of alloxan-induced rats receiving *S. trilobatum* (1 ml) once a day orally for 10 days. Group V consists of normal rats receiving

S. trilobatum (1 ml) once a day orally for 10 days.

Blood samples were collected through the tail vein just prior to and on days 10 after drug administration. The blood glucose, urea, cholesterol, serum glutamate oxygenate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) were determined for all the samples.

Statistics

The data were analyzed using one-way ANOVA followed by Dunnett's test. The level of significance was set at 0.05.

RESULTS AND DISCUSSION

The extracts of *S. trilobatum* produced significant changes in the alloxan-induced diabetic rats (Table 1). The aqueous extracts of *S. trilobatum* reduced the glucose levels considerably. Treatment of the diabetic rats with Glibenclamide (10 mg/kg) also reduced blood glucose level. The prolonged treatment of *S. trilobatum* extracts on alloxan-induced diabetes rats produced consistent reduction in the blood glucose levels. The aqueous extract also reduced urea protein and cholesterol during the 10 days treatment period (Tables 1 and 2).

The blood glucose data obtained clearly indicate that the *S. trilobatum* produced significant and consistent anti-hyperglycemic effect in alloxan-induced diabetic rats. The continuous treatment with *S. trilobatum* for a period of 10 days produced a significant decrease in the blood glucose levels of the diabetic rats, but not in the normal rats. It is possible that the drug may be acting by potentiating the pancreatic secretion or increasing the glucose

uptake. Hypercholesterolemia, hypertriglyceridemia and hyperurea have been reported to occur in alloxan diabetic rats (Resmi et al., 2001; Joy and Kuttan, 1999). Increase in glycogen in liver can be brought about by an increase in glycogenesis and/or decrease a glycogenolysis. Therefore, the *S. trilobatum* extract could have stimulated glycogenesis and/or inhibited glycogenolysis in diabetic rat liver. The plant extract alone treated animals showed non-toxicity of the extract. It thus indicates that unlike insulin and other common hypoglycemic agents, overdose of the drug may not result in hypoglycemia. The increase in total protein (Table 2) may be due to changes in circulating amino acids levels, hepatic amino acids uptake, and muscle output of amino acid concentrations (Felig et al., 1977). The non-protein nitrogen compound urea is found to be increased when compared to plant extract treated rats. The level of SGPT and SGOT increased remarkably in the *S. trilobatum* extract-treated rats (Nagappa et al., 2003). Our results support that of Ghosh et al. (2004) who reported that transaminase activity is increased in serum of diabetics. The increased levels of transaminases, which are active in absence of insulin, because of the availability of amino acids in the blood of diabetes, are responsible for the increased gluconeogenesis and ketogenesis observed in diabetics. In diabetic animals, the changes in level of serum enzymes are directly related to changes in the metabolism in which these enzymes are involved (Felig et al., 1977).

In conclusion *S. trilobatum* leaf extract showed significant anti-diabetic effect in diabetic rats after oral administration. Thus, the claim made by the Indian systems of medicine regarding the use of leaf extract of this plant in the treatment of diabetes is validated. Present efforts are directed to isolate the active constituents from the water extract of *S. trilobatum* leaf and elucidation of mechanism of action.

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