

Original Article

ANTIDIABETIC ACTIVITY ON METHANOLIC EXTRACTS OF *SCHREBERA SWIETENOIDES* ROXB. ROOTS IN STREPTOZOTOCIN INDUCED DIABETIC RATS

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ABSTRACT

Objective: The aim of study was to evaluate acute toxicity and antidiabetic activity of methanolic extract of *Schrebera swietenoides* roots in streptozotocin induced diabetic rats.

Methods: Acute toxicity of the methanolic extracts of *Schrebera swietenoides* roots was studied in Wistar albino rats at a dose level upto 2 g/kg b.w. The animals were also closely examined for signs of intoxication, lethargy, behavioral modification and morbidity. The plant was evaluated for antidiabetic activity against Streptozotocin induced diabetic model in different concentrations of 100,200 and 400 mg/kg body weight. The mean and percent blood glucose reduction levels were calculated and comparable with the standard drug, glibenclamide (0.45 mg/kg b. w).

Results: The extracts did not produce any toxic signs during the observation period for 24 h. The oral administration of 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots showed significant ($P < 0.05$) decrease in blood glucose levels up to 18th h, more significant ($P < 0.01$) decrease in blood glucose levels at 4th and 12th h and highly significant ($P < 0.001$) decrease in blood glucose levels at 8th h respectively.

Conclusions: From the studies it is concluded that, the methanolic extract of *Schrebera swietenoides* roots is suitable to prepare ayurvedic formulations for the treatment of diabetes.

Keywords: *Schrebera swietenoides*, Glibenclamide, Streptozotocin, Antidiabetic activity.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder occurs with the impairment in carbohydrate metabolism due to release and absolute depletion of insulin. It is characterized by the appearance of higher concentration of glucose in blood commonly known as hyperglycemia, owing to reduced secretion of insulin from the pancreas and also tissue insensitivity to insulin. There is an increasing demand in use of natural products for treating antidiabetic activity due to the side effects associated with the use of synthetic drugs [1-3].

Schrebera swietenoides Roxb. (Oleaceae) is an important medicinal plant used in the treatment of leprosy, diabetes and hepatic disorders by ethnic people. Traditionally, the root paste has been applied on the throat and chest to relieve nasal obstruction of respiratory tract [4, 5]. The plant has been reported to possess *in vitro* inhibitory activity of intestinal alpha glucosidase enzyme maltase and also antioxidant activity [6, 7]. The aim of the study was to conduct acute toxicity studies and also antidiabetic activity of this plant as it is used in diabetic conditions by rural people and antidiabetic activity of this plant has not yet scientifically proven.

MATERIALS AND METHODS

Collection of plant material

The plant, *Schrebera swietenoides*, was collected from Tirupati in the month of September and was authenticated by Prof. M. Venkaiah, Department of Botany, Andhra University. The specimen was deposited in the herbarium with Voucher specimen number (AU/SS/01/11786).

Preparation of plant extracts

Shade dried roots of the plant were made into powder in a Wiley mill and extracted in a Soxhlet apparatus with methanol (Merck, India) for 6 h and concentrated to dryness in a rotary evaporator which resulted methanolic extract (34.28 g). The resultant methanolic extract was suspended in 1% Sodium CMC and administered at a different dose levels of 100, 200 and 400 mg/kg.

Animals

For this study Wistar albino rats of either sex (150-200 g) were maintained under controlled conditions. The rats were allowed to take standard laboratory feed and water ad libitum. The experimental protocol was approved by the institutional animal ethics committee of Andhra University, Vishakhapatnam, which was registered with the Committee for the purpose of control and supervision of experiments on animal (CPCSEA), Govt. Of india (registration no.516/01/A/CPCSEA).

Acute toxicity studies

Toxicity studies were conducted as per internationally accepted protocol drawn under OECD guidelines in Wistar albino rats at a dose level of extracts up to 2 g/kg b.w. The toxic effect of the methanolic extracts of *Schrebera swietenoides* roots were studied at a dose level upto 2 g/kg b.w. The animals were also closely examined for signs of intoxication, lethargy, behavioral modification and morbidity [8, 9].

Design of experiment

In this experiment, 30 rats were used which were randomly divided into 5 groups of 6 animals each. The different doses of extracts were administered orally to the STZ induced diabetic rats. All the extracts were suspended in 1% sodium CMC suspension. In these 5 groups, group 1 served control as they received orally 1% Sodium CMC suspension only. Group 2 was administered with a standard drug Glibenclamide, (0.45 mg/kg b. w). Group 3, 4 and 5 were treated with methanolic extracts of *Schrebera swietenoides* roots at doses of 100, 200 and 400 mg/kg b.w. The drug treatment was given to the animals and was fasted for 12 h before estimating the blood glucose level.

Induction of diabetes

Diabetes was induced by a single intraperitoneal dose of 60 mg/kg of b. w of streptozotocin (STZ) dissolved in 0.1M fresh cold citrate buffer (pH 4.5) into 12 h fasted rats. On third day of the STZ injection of the rats, the blood samples were taken from the retro orbital plexus of the rats for the estimation of blood glucose levels by using the auto

analyzer. Rats with diabetes having hyperglycemia (i.e. with blood glucose to 185 to 460 mg/dl) were taken for the experiment [10-12].

Collection of blood samples and serum glucose estimation

The blood samples (0.5 ml) were collected for every time intervals of 0, 2, 4, 8, 12, 18, and 24th h in 1 ml Eppendorf's tubes. Serum was separated by centrifuging at 3000 rpm for 10 min. 30 µl of serum sample and 3 ml of working glucose reagent were taken in to a dry and clean test tube and incubated for 10 min at 37°C. The pink color developed was measured by using an auto analyzer [13-15].

Statistical analysis

The values were expressed as mean±SEM. The data were subjected to the analysis of variance (one way ANOVA) to determine the significance of changes followed by students "t"-test [16-18]. The

statistical significance of difference between two independent groups was calculated for the determination of blood glucose levels.

RESULTS

The extracts did not produce any toxic signs during the observation period for 24 h in any of the rats they were tested. Hence it was concluded that extracts are safe upto 2000 mg/kg and beneficial for assessment of antidiabetic activity.

The mean blood glucose levels of control and drug treated animals after oral administration of different doses (100, 200 and 400 mg/kg b. w) of methanolic extract of *Schrebera swietenoides* roots at various time intervals (0, 2, 4, 8, 12, 18 and 24 h) were shown in table 1. The statistical significance of a decrease in blood glucose levels was calculated with respect to initial blood glucose levels.

Table 1: Effect of Methanol extract of *Schrebera swietenoides* roots on blood glucose levels in STZ induced diabetic rats

Group (n=6)	Treatment mg/kg b.w.	Time in h						
		0	2	4	8	12	18	24
1	Control	352.26±14.	343.53±12.	343.00±14.6	341.09±12.0	335.06±11.	341.05±11.9	339.63±10.
		13	32	8	3	37	5	76
2	Glibenclamide (0.45 mg/kg b.w.)	353.29±12.	261.20±8.5	201.93±5.24	274.68±15.4	302.52±	323.76±5.00	333.85±7.0
		13	2**	***	1*	3.47*		9
3	SS 100	342.89±7.4	327.53±5.5	320.84±5.28	318.99±7.90	320.70±6.8	318.82±6.4	318.42±8.1
		5	9			9		8
4	SS 200	357.34±15.	344.34±13.	317.91±7.58	289.13±7.62	281.68±9.3	292.41±5.94	318.75±3.8
		22	50	*		4**	*	9
5	SS 400	348.14±6.1	322.34±10.	290.61±9.80	220.56±9.61	283.43±9.1	297.52±11.6	312.96±14.
		1	59	**	**	1**	5*	23

Each value is expressed as mean±S. E. M.(n = 6). *P<0.05 significant decrease as compared to Zero h of standard drug glibenclamide. **P<0.01 More significant decrease as compared to zero h. ***P<0.001 Highly significant decrease as compared to zero h.

The blood glucose levels of diabetic rats treated with Glibenclamide (0.45 mg/kg b. w) showed significant (P<0.05) decrease in blood glucose levels at 8 & 12th h, more significant (P<0.01) decrease in blood glucose levels at 2nd hr and highly significant (P<0.001) decrease in blood glucose levels at 4th h.

Administration of 100 mg/kg b. w of plant crude drug produced no significant (P>0.05) decrease in blood glucose levels at all the time intervals. However, administration of 200 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots produced no significant (P>0.05) decrease in blood glucose levels up to 4th after oral administration. However, it showed significant (P<0.05) decrease in blood glucose levels at 8th and 18th h respectively after the oral administration of the extract. It also showed more significant (P<0.01) decrease in blood glucose levels at 12th h after the administration of the extract.

The oral administration of 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots showed significant (P<0.05) decrease

in blood glucose levels up to 18th h, more significant (P<0.01) decrease in blood glucose levels at 4th and 12th h and highly significant (P<0.001) decrease in blood glucose levels at 8th h respectively. The mean blood glucose levels were 348.14±6.11, 290.61±9.80, 220.56±9.61, 283.43±9.11 and 297.52±11.65 mg/dl at 0, 4, 8, 12 and 18th h respectively after the administration of 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots.

The percent decrease in blood glucose levels after the oral administration of different doses (100, 200 and 400 mg/kg b. w) of methanolic extract of *Schrebera swietenoides* roots was shown in table 2. The administration of standard drug Glibenclamide showed 25.47±4.23 %, 42.41±2.94 %, 21.65±5.62 % and 13.81±3.41 % reduction in blood glucose levels at 2, 4, 8 and 12 h respectively. The percent decrease in blood glucose level at 24th h after the administration of Glibenclamide was not significant (P>0.05).

Table 2: Effect of methanol extract of *Schrebera swietenoides* roots on percent decrease blood glucose levels in STZ induced diabetic rats

Group (n=6)	Treatment mg/kg b.w.	Time in hours					
		2	4	8	12	18	24
1	Control	2.30±2.02	2.48±2.83	2.90±2.61	4.54±2.92	2.91±2.55	3.29±2.34
2	Glibenclamide (0.45 mg/kg b. w)	25.47±4.23**	42.41±2.94***	21.65±5.62**	13.81±3.41**	7.59±4.60	4.87±4.18
3	SS 100	4.37±1.60*	6.34±1.21**	6.8±2.8	6.15±3.34	6.69±3.34	6.93±3.04
4	SS 200	3.52±1.19*	10.62±2.16**	18.45±3.73**	20.5±4.18**	17.28±4.57**	9.74±5.05
5	SS 400	7.32±3.24	16.39±3.28**	36.46±3.35***	18.46±2.95**	14.37±3.82*	10.13±3.68*

Each value is expressed as mean±S. E. M.(n = 6).*P<0.05 significant decrease as compared to Zero h of standard drug glibenclamide. **P<0.01 More significant decrease as compared to zero h. ***P<0.001 Highly significant decrease as compared to zero h.

Administration of 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots produced significant (P<0.05) decrease in blood glucose level at 18 and 24th h, more significant (P<0.01) decrease in blood glucose levels at 4 and 12th h and highly significant (P<0.001) decrease in blood glucose levels at 8th h. Administration of 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* roots showed 16.39±3.28%, 36.46±3.35%, 18.46±2.95%, 14.37±3.82%

and 10.13±3.68% reduction in blood glucose levels at 4, 8, 12, 18 and 24 h respectively.

DISCUSSION

Streptozotocin is one of the most toxic chemical selectively destroy the pancreatic insulin secreting β cells by causing diabetes in rats[19]. The present study was designed for antidiabetic activity of

root extract of *Schrebera swietenoides* in Streptozotocin induced diabetic rats. In this study, damage of pancreas in streptozotocin treated diabetic control mice and regeneration of islets of Langerhans by glibenclamide was observed. The activity of plant extract on the activity of pancreatic beta cells might be attributed to the increase in the inhibitory effect against insulinase enzyme, increase of the insulin sensitivity. The hypoglycemic effect by methanolic extracts of *Schrebera swietenoides* may be assigned due to the regeneration of islet of Langerhans which may confirm the efficiency of the given extract in the management of diabetes [20].

The lowest blood glucose levels were observed at 12th and 8th h after oral administration of 200 and 400 mg/kg b. w of methanolic extract of *Schrebera swietenoides* respectively. It also showed antidiabetic activity in a dose dependent manner in STZ induced diabetic rats and proceeded with the duration of treatment. Methanol extract showed the presence of flavanoids, saponins, phenolic compounds and tannins. It is reported that flavanoid constitute the biological active principle of most medicinal plants with hypoglycemic and anti-diabetic properties. Our study presents significant antidiabetic activity of the methanolic leaf extract of *Schrebera swietenoides* for its principle constituent flavanoids.

CONCLUSION

Methanolic extract of roots the of *Schrebera swietenoides* exhibited prominent antidiabetic activity at different doses which reveals that the plant in extract form is used as one of the ingredient to design the ayurvedic formulation for the treatment of diabetes.

CONFLICT OF INTERESTS

Declared None

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