Antihyperglycemic Activity of *Trianthema Portulacastrum* Plant in Streptozotocin Induced Diabetic Rats

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Summary

The objective of the present study was to evaluate the antihyperglycemic activity of methanolic extract of *Trianthema portulacastrum* whole plant in streptozotocin-induced diabetic rats. The STZ induced diabetic rats are divided into four groups of six animals each. Group I served as diabetic control, Group II diabetic rats were treated with a standard oral hypoglycaemic agent, glibenclamide (1mg/kg) while Group III and IV diabetic rats received 100 mg/kg and 200 mg/kg suspension of methanolic extract of *Trianthema portulacastrum*. The methanolic extract (METP) produced a significant antihyperglycemic effect ($p<0.05$) after 1 hr following administration and this antihyperglycemic effect was more pronounced after 4 hrs of treatment in streptozotocin-induced diabetic rats. The findings of the present study suggest that the methanolic extract of *Trianthema portulacastrum* produced significant antihyperglycemic activity in STZ induced diabetic rat which is comparable to Glibenclamide (a standard oral hypoglycaemic agent).

Keywords: *Trianthema portulacastrum,* streptozotocin-induced diabetes, oral hypoglycaemic agent, antihyperglycemic effect.

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Introduction

Diabetes is a chronic metabolic disorder characterised by hyperglycaemia. It is a complex and multifarious group of disorders leading to micro & macro vascular complications. It generally involves absolute lack of insulin secretion or insulin resistance or both. Diabetes has reached epidemic proportions in the present century [1]. Even though many classes of drugs like Biguanides, Sulphonylureas and glitazones are in the market, the concern for safety profile of the drug is seeking more research into this area [2-3]. The goal of a successful anti-diabetic drug is to keep the blood glucose level under control without prolonging the complications over time. Management of diabetes without any side-effects is still a challenge for medical community. So, there is continuous search for alternative classes of drugs having no side-effects, thus it is prudent to look into the herbal medicines for diabetes as well. WHO (1980) has also recommended the evaluation of the effective of plants in conditions where there are no safe modern drugs [4]. In the indigenous Indian system of medicine good numbers of plants were mentioned for the cure of diabetes and some of them have been experimentally evaluated and active principle were isolated [5]. Recently the medicinal values of various plants extracts have been studied by many scientists in the field of diabetic research [6]. Considerably large number of hypoglycaemic/antidiabetic plants and herbs are known through folklore but their introduction into modern therapy waits pharmacological testing by modern methods. The Study of such medicines might offer a natural key to unlock a diabetologist's pharmacy for the future.

Trianthema portulacastrum Linn is plant of the family Aizoaceae, found almost throughout India as a weed in cultivated and wastelands. The plant is bitter and used as analgesic, stomachic, laxative, and serves as alterative cure for bronchitis, heart disease, anaemia and inflammation [7]. The plant has a remarkable protection against the chemical induced and hepatocarcinogenesis [8]. Previously, it was reported the hepatoprotective activity [9] of *Trianthema portulacastrum* (TP) against paracetamol thioacetamide intoxication in albino rats and antifungal activity of *T. portulacastrum*. The objective of the present study was to evaluate the antihyperglycemic activity of methanolic extract of *Trianthema portulacastrum* whole plant in streptozotocin-induced diabetic rats.

Materials and Methods

Extraction of plant material

The plant *Trianthema portulacastrum*, was collected in the month of October, 2007 and the plant was taxonomically identified and authenticated as *Trianthema Portulacastrum Linn*. by Prof. Chelladurai, Research Botanist, Palayamkottai, Tamil Nadu, India. The whole plant was dried under shade and ground to a fine powder in a mechanical blender. The powder of the plant was initially extracted in a *Soxhlet apparatus* with petroleum benzene (60^{o}-80^{o}C) to remove the chlorophyll followed by methanol by the method of continuous hot extraction to get the methanol extract of *Trianthema portulacastrum* (METP). The suspension of methanolic extract was prepared using gum acacia and was used for subsequent experiments.

Phytochemical screening

The methanolic extract was screened for the presence of various phyto-constituents like steroids, alkaloids, terpenoids, glycosides, flavonoids, phenolic compounds and carbohydrates [10-11].

Animals

Wister albino adult male rats of either sex, weighing 200-220g were selected and housed in polypropylene cages in a room where the congenial temperature was 27°C ±1°C and 12 hrs light and dark cycles were maintained. The animals were allowed to acclimatize to the environment for 7 days and supplied with a standard pellet diet (Hindustan Lever Ltd., Bangalore) and water *ad libitum*.

Activity in STZ induced hyperglycaemic (diabetic) animals

After fasting, diabetes mellitus was induced by intraperitoneal injection of Streptozotocin (Sigma, USA) dissolved in 0.1 M cold sodium citrate buffer (pH 4.4) at a dose of 30 mg/kg body wt. STZ-treated animals were considered as diabetic when the fasting plasma levels were observed above 250 mg/dl with glucosuria [12]. After 5 days, blood samples were collected by retro-orbital puncture under mild anaesthesia and serum glucose levels were monitored. Rats showing serum glucose level above 200 mg/dl were used for the antihyperglycemic evaluations and randomly divided into groups four groups of 6 animals each. Group I served as diabetic control by receiving gum acacia, group 2 diabetic rats treated with a standard oral hypoglycaemic agent, glibenclamide (1mg/kg) while group 3 and 4 diabetic rats received 100 mg/kg and 200 mg/kg of methanolic extract of TP. Blood samples were collected at 0 hr, 1hr, 2 hr, 4 hr and 8hr from the start of treatment for the estimation of plasma glucose levels in all overnight fasted rats.

Collection of blood samples and estimation of glucose

The blood was collected from orbital plexus in heparinized tubes and serum was separated by immediate centrifugation of blood samples using semi ultra cooling centrifuge at 3000 rpm for 5 minutes at room temperature and was directly used for estimating serum glucose levels using Span diagnostic kits.

Statistical Analysis

The results were expressed as mean ± SD. Statistical analysis were carried out using paired t-test and one-way ANOVA followed by Bonferroni's test. Differences below $P<0.05$ implied statistically significance.

Results and Discussion

Diabetes mellitus is a major endocrine disorder in which the homeostasis of carbohydrates, protein and lipid metabolism is improperly regulated by the insulin, resulting in elevation of fasting and post prandial blood glucose levels [13].

Preliminary phytochemical screening of the methanolic extract of *T. portulacastrum* reveals the presence of alkaloids, flavonoids, saponins, phenolic compounds and terpenoids. Different doses of methanolic extract were screened for their oral toxicity. No mortality was recorded till 3000 mg/kg with methanolic extract, hence the extracts were found to be safe up to the dose levels of 3000 mg/kg.

In Streptozotocin-induced diabetic rats, the methanolic extract (METP) and glibenclamide produced significant antihyperglycemic effect ($p<0.05$) after 1 hr of their administration and this antihyperglycemic effect was more pronounced after 4 hrs of treatment (table 1). The present study results suggest that the methanolic extract of TP whole plant exhibited significant antihyperglycemic activities in streptozotocin-induced diabetic rats. Fasting blood glucose level in diabetic rats is an important basal parameter for monitoring diabetes [14] and it has shown that the METP causes the antihyperglycemic effect by reducing the fasting blood glucose level (table1). The significant decrease in the levels of fasting blood glucose in diabetic rats treated with the METP may be due to the increased secretion of insulin from b-cells of pancreas or stimulation of the residual pancreatic mechanism, probably by increasing peripheral utilization of glucose.

In conclusion, the methanolic extract of *T. portulacastrum* produced significant antihyperglycemic activity against STZ induced diabetic rats. Further studies are needed to identify the chemical constituents of the methanolic extract of *T. portulacastrum* that may be responsible for the antihyperglycemic activity.

Table 1: Effect of METP on plasma glucose levels of hyperglycaemic rats (mean ± SD)

Treatment	Dose	0 hr	1 hr	2 hr	4 hr	8 hr
Diabetic Control	-	286.3 ± 3.2	285.9 ±2.2	285.1±2.9	283.2 ± 3.2	281.2± 3.2
Diabetic+ Glibenclamide	1mg/kg	287.9 ± 5.7	260.8 ±3.9[b] (9.41%)	225.4 ±5.2[b] (21.7%)	180.2 ±4.2[b] (37.4%)	200.2 ±4.2[b] (30.4 %)
Diabetic+ METP	100mg/kg	289.2 ±4.8	263.6 ±4.1[a] (8.85%)	252.5 ±2.1 (12.69%)	220.3±2.9 (23.82%)	234.7 ±3.4 (18.84%)
Diabetic+ METP	200 mg/kg	288.1 ± 3.9	255.9± 3.3[b] (11.17%)	239.3± 4.1[b] (16.94%)	201.9±3.8 (29.92%)	219.6± 3.7[b] (23.77%)

Values are in mean ± SD; n =6; a= $p < 0.005$, b=$p<0.0001$ Vs Control

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