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Evaluation of antidiabetic activity of methanolic extract of *Pennisetum americanum* in alloxan and dexamethasone induced diabetic rats

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ABSTRACT

Diabetes mellitus is a major health threat today. There are over 150 million diabetics worldwide currently and the figure is likely to be 300 million by 2025. In the present study, the formulation was evaluated for its protective effect of methanolic extract of *Pennisetum Americanum* whole plant against alloxan & dexamethasone induced insulin dependent diabetes mellitus in male Wistar rats of weight range 167 ± 15 g. the animals were treated with dose range of 100, 200 mg/kg body weight with plant extract.

Keywords: Anti diabetic activity, methanolic extracts of *Pennisetum Americanum*, alloxan and dexamethasone induced diabetic models in rats.

INTRODUCTION

Diabetes is the world's largest endocrine disease involving metabolic disorder of carbohydrate, fat and protein [1]. According to W.H.O projections, there are over 150 million diabetics worldwide currently and this number is likely to increase to 300 million by 2025.

Statistical projection about India suggests that the number of diabetics will rise from 15 million in 1995 to 57 million in the year 2025 making it the country with the maximum number of diabetics in the world [2].

The methods available to treat diabetes in modern medicine are effective enough but like all other methods of therapy they too have side effects like insulin resistance after chronic insulin treatment. The thrust these days therefore is to look for alternative methods with minimal side effects to manage the disease [3-5].

In recent years there has been a renewed interest in plant medicines¹ for treatment against different diseases. An attempt on these lines has therefore been made through this study to evaluate the usefulness of the plant extract of "*Pennisetum americanum*" in diabetic condition in rats.

MATERIALS AND METHODS

Collection and preparation of extract

The plant materials used in this study were "*pennisetum americanum*" plant collected from the Sri Venkateswara university, tirupati and identified and authenticated taxonomically by Dr.K.Madhavachetty. The plant (3kg) was chopped into small pieces and dried in tray drier under controlled conditions. Air dried *pennisetum americanum*

whole plant was powdered and extracted by maceration for 18 hours with 1 lit volume of methanolic extract and mixture was boiled for 3 hours and filtered to get extract. Again the marc was extracted with 1 lit volumes of Methanolic solvent by boiling for 3 hours and filtered. Both the filtrates were combined and concentrated in Rotavapour (Buchi, USA) and then dried in lyophilizer (Labconco, USA) under reduced pressure to obtain 50 g of solid residue (yield 5.0% w/w).

Animals:

Adult male Wistar rats 167 ± 15 g were maintained under standard environmental conditions with free access to feed and water during the experimental period. The animals were fasted for 16 hours before the experiment but allowed free access to water. All experiments were performed in the morning according to current guidelines for the care of laboratory animals and the ethical guidelines for investigation of experimental pain in conscious animals.

ANTI DIABETIC STUDIES

Experimental design

Group I: normal control

Group II: disease control

Group III: standard glibenclamide (500 mg/kg p.o) in diabetes rats

Group IV: methanolic plant extract of *Pennisetum Americanum* (100 mg/kg) in rats.

Group V: methanolic plant extract of *Pennisetum Americanum* (150 mg/kg) in rats.

Methanolic plant extract of *Pennisetum Americanum* was administered orally once daily for 14 days, after inducing the diabetes in the rats, normal control group animals were received distilled water (10 ml/kg).

Alloxan induced diabetes:

Diabetes was induced in 16 hrs fasted male Wistar rats 167 ± 15 g by intraperitoneal injection of 150 mg/kg body weight of alloxan. After 72 hours, animals with levels of blood glucose higher than 245 mg/dl were selected and used. They were divided into five groups of six rats each. Blood was collected from the animals for blood glucose estimation before starting the treatment on the first day. Blood samples were collected from the animals from the animals after 14th day.

Dexamethasone induced diabetes:

Animals were divided into 5 groups, each consisting of six rats. Rats in the first group received distilled water only and served as control group 1, while the second group of rats received dexamethasone (10 mg/kg s.c.) and served as disease control group 2. Rats in experimental groups 4 and 5 were treated with plant extract (100 & 150 mg/kg) plus dexamethasone, whereas rats in the 3rd group were treated with standard drug (500 µg/mg). All the animals received their respective assigned treatment daily for a period of 12 days. Rats of group 2-5 were daily fasted overnight before dexamethasone treatment. On day 4th, 8th blood was collected from tail and measure the blood sugar level and on 12th day the animals were anesthetized with ether and blood was collected from retro-orbital plexus. Serum was then separated for the estimation of glucose by using respective kits.

RESULTS

Alloxan induced diabetes:

Table 1: Effect of Administration of plant extract (100 mg/kg), and higher dose of (150 mg/kg) glibenclamide (500 mcg/kg, p.o) for 14 days on serum glucose levels in diabetic rats

Group	Treatment	Serum Glucose levels (mg/dl)		
		Initial	Final	% Change
Group1	Normal Control	87.33 $\pm$ 1.30	91.28 $\pm$ 0.87	4.04
Group2	Disease Control	303.4 $\pm$ 4.30	329.3 $\pm$ 8.03	8.53
Group3	Glibenclamide (500 mcg/kg, p.o)	311.16 $\pm$ 7.76	119.91 $\pm$ 4.24	38.58
Group4	Plant extract (100 mg/kg)	303.7 $\pm$ 1.81	179.44 $\pm$ 2.9**	59.08
Group5	Plant extract (150 mg/kg)	307.5 $\pm$ 5.8	153 $\pm$ 3.29**	49.75

Values are expressed in mean $\pm$ SEM, n = 6. *P < 0.001, **P < 0.01, P < 0.05. @ Experimental groups statistically compared with control (Gr1) *P < 0.001.

Table 2: Effect of Administration of plant extract(100mg/kg), and higher dose of (150mg/kg) glibenclamide (500mcg/kg , p.o) for 14 days on serum cholesterol, serum triglycerides, serum HDL, serum LDL, serum VLDL levels in diabetic rats

Group	Treatment	Serum Cholesterol (mg/dl)	Serum Triglycerides (mg/dl)	Serum HDL (mg/dl)	Serum LDL (mg/dl)	Serum VLDL (mg/dl)
Group - 1	Normal Control	81.23±0.38	63.88±0.29	43.22±0.22	58.83±0.41	17.66±0.15
Group - 2	Disease Control	140.96±2.17	135.1±0.57	23.48±0.32	177.88±0.31	38.98±0.34
Group - 3	Glibenclamide (500 mcg/kg , p.o)	83.46±0.34	88.96±0.70	39.38±0.17	56.32±0.58	16.6±0.15
Group - 4	Plant extract(100mg/kg)	121.3±0.36	76.16±0.49***	30.71±0.53***	75.63±0.47***	26.16±0.16***
Group - 5	Plant Extract(150mg/kg)	99.18±2.21	69.75±0.38**	38.38±0.38**	44.1±0.16**	20.06±0.18**

Values are expressed in mean ± SEM, n = 6. *P < 0.001, **P < 0.01, P < 0.05. @ Experimental groups statistically compared with control (Gr1) *P < 0.001

Dexamethasone induced diabetes:

Table 7: Effect of Administration of plant extract(100mg/kg), and higher dose of (150mg/kg) along with dexamethasone, glibenclamide (500mcg/kg , p.o) for 14 days on serum glucose levels in diabetic rats

Group	Treatment	Serum Glucose Level (mg/dl)		
		4 th day	8 th day	12 th day
Group1	Normal control	74.66±0.88	76.53±0.28	74.9±0.41
Group2	Disease control	154.66±1.08	163.38±0.74	170.48±0.73
Group3	Glibenclamide (500mcg/kg , p.o)	92.53±0.85	88.78±0.41	84.31±0.10
Group4	Gebinclamide +Plant extract(100mg/kg)	110.53±0.58***	107.78±0.69***	101.76±0.42***
Group5	Gebinclamide +Plant extract(150mg/kg)	104.46±0.24**	99.15±0.16**	93.4±0.34**

Values are expressed in mean ± SEM, n = 6. *P < 0.001, **P < 0.01, ***P < 0.05. @ Experimental groups statistically compared with control (Gr1) *P < 0.001

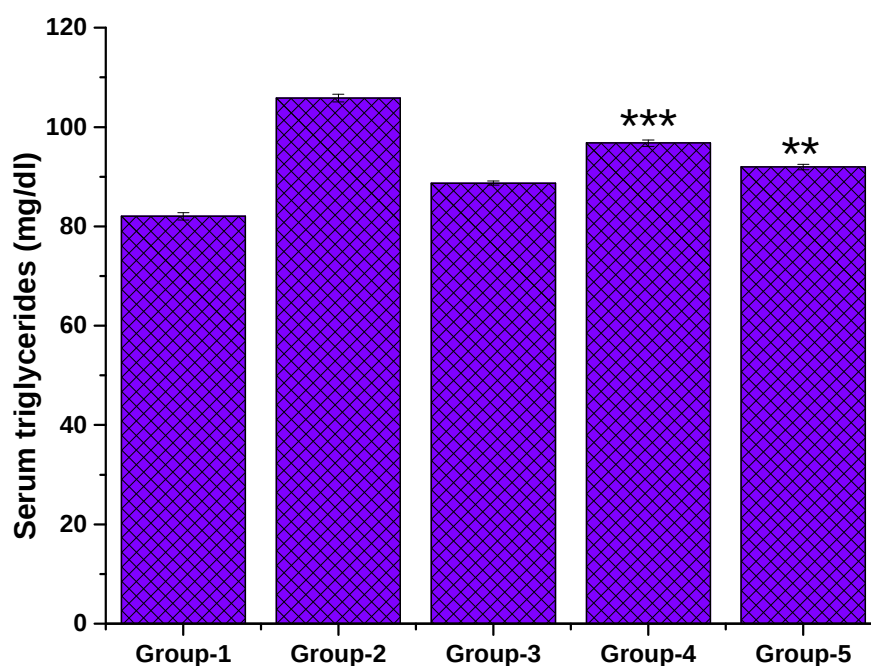


Fig 1: Effect of plant extract on serum triglycerides in dexamethasone induced diabetic rats

Values are expressed in mean ± SEM, n = 6. *P < 0.001, **P < 0.01, ***P < 0.05. Experimental groups statistically compared with control (Gr1) *P < 0.001. (Group-1 = Normal control; Group-2 = Disease control; Group-3 = Glibenclamide(500mcg/kg ,p.o); Group-4 = Dexamethasone +Plant extract(100mg/kg); Group-5 = Dexamethasone +Plant extract(150mg/kg))

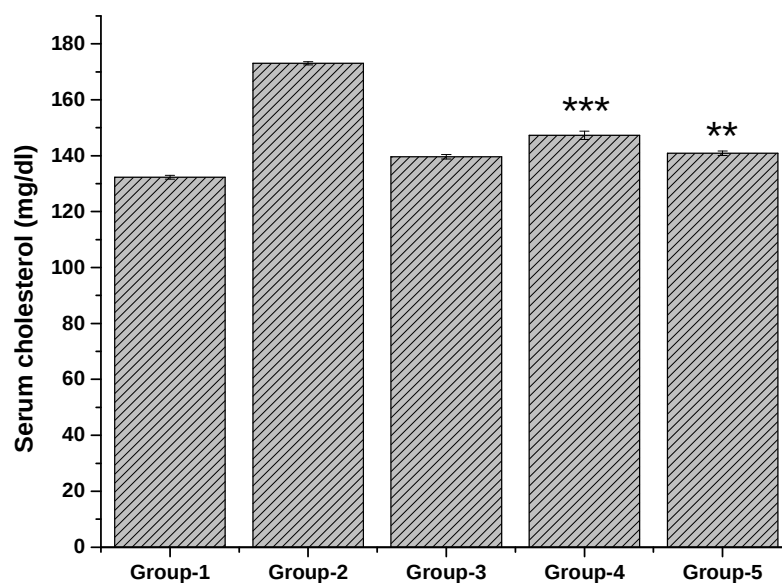


Fig 2:Effect of plant extract on serum cholesterol in dexamethasone induced diabetic rats

Values are expressed in mean $\pm$ SEM, n = 6. * $P < 0.001$, ** $P < 0.01$, *** $P < 0.05$. Experimental groups statistically compared with control (Gr1) * $P < 0.001$. (Group-1 = Normal control; Group-2 = Disease control; Group-3 = Glibenclamide(500mcg/kg ,p.o); Group-4 = Dexomethasone + Plant extract(100mg/kg); Group-5 = Dexomethasone + Plant extract(150mg/kg))

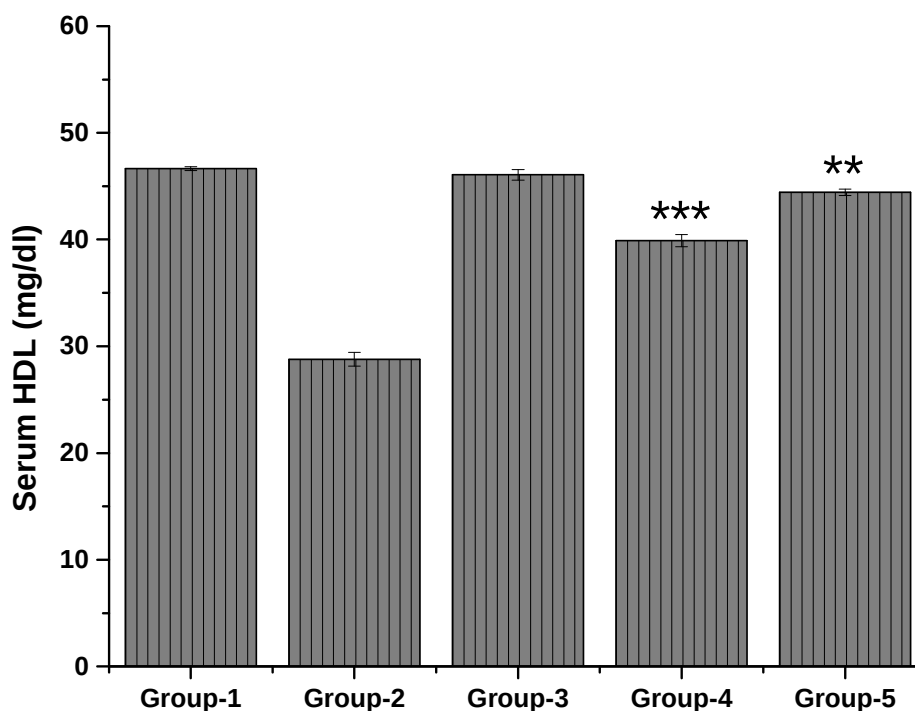


Fig 3. Effect of plant extract on serum HDL levels in dexamethasone induced diabetic rats

Values are expressed in mean $\pm$ SEM, n = 6. * $P < 0.001$, ** $P < 0.01$, *** $P < 0.05$. Experimental groups statistically compared with control (Gr1) * $P < 0.001$. (Group-1 = Normal control; Group-2 = Disease control; Group-3 = Glibenclamide (500 mcg/kg ,p.o); Group-4 = Dexomethasone + Plant extract(100mg/kg); Group-5 = Dexomethasone + Plant extract(150 mg/kg))

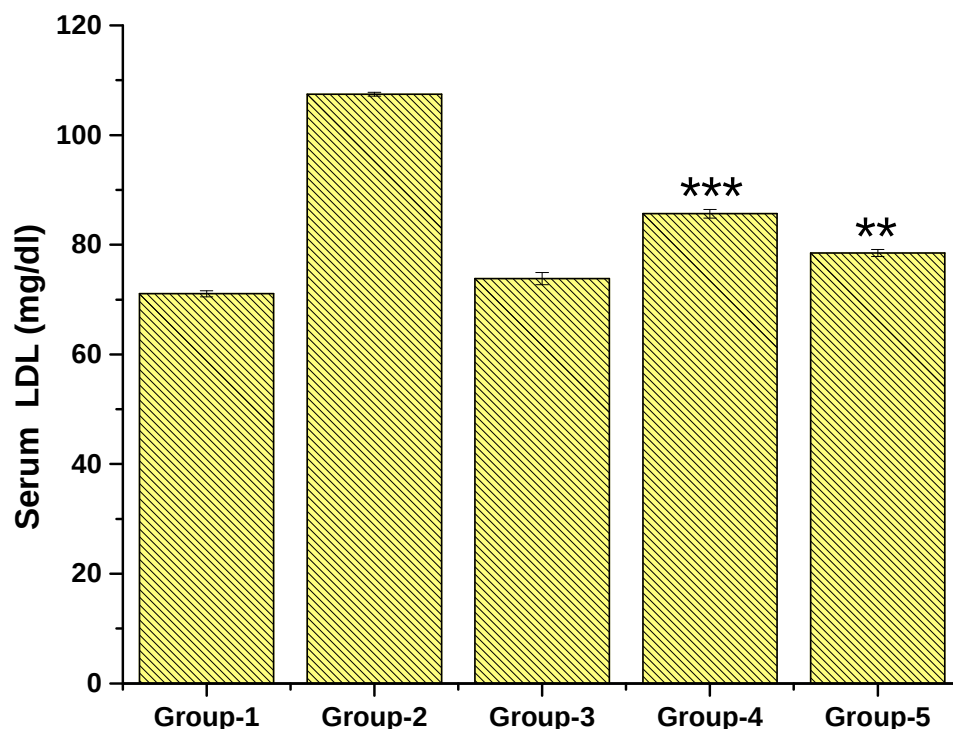


Fig 4:- Effect of plant extract on serum LDL level in dexamethasone induced diabetic rats

Values are expressed in mean $\pm$ SEM, n = 6. *P < 0.001, ** P < 0.01, ***P < 0.05. Experimental groups statistically compared with control (Gr1) *P < 0.001. (Group-1 = Normal control; Group-2 = Disease control; Group-3 = Glibenclamide(500 mcg/kg, p.o); Group-4 = Dexomethasone + Plant extract(100mg/kg); Group-5 = Dexomethasone + Plant extract(150mg/kg))

CONCLUSION

Pennisetum Americanum plant extract exhibited antihyperglycemic activity in alloxan and dexamethasone induced diabetic rats. *Pennisetum Americanum* plant extract also significantly reduced the hyperglycemia in glucose fed normal rats.

Pennisetum Americanum whole plant extract, a crude drug obtained from the srivenkateswarauniversity was found to have anti diabetic activity as noticed from animal experiments. *Pennisetum Americanum* plant extract could also be of benefit in overcoming accompanying secondary complications of diabetes mellitus like antihyperlipidemic activity.

Further studies will be necessary to establish the probable mechanisms of action of *Pennisetum Americanum* plant extract. These could include measurement of serum insulin levels and liver enzyme levels involved in glucose metabolism.

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