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Hypoglycemic effect of *Gymnema sylvestre* (retz.,) R.Br leaf in normal and alloxan induced diabetic rats

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Abstract

The water extract of *Gymnema sylvestre* R.Br leaf was tested for hypoglycemic activity in normal and alloxan induced diabetic rats. Grated amount (2ml/kg) of the water extract of *Gymnema sylvestre* leaf was given to both normal and alloxan induced diabetic rats. A significant reduction of glucose concentration was noticed in normal rats, blood glucose level was significantly reduced in diabetic rats. Protein level is also decreased in diabetic rats. Urea, uric acid and creatinine levels were increased in diabetic condition. After the herbal treatment the levels were altered near to normal level.

Key words: *Gymnema sylvestre*; hypoglycemic activity; Alloxan induced diabetic rats; Blood glucose, Protein levels, Biochemical parameters.

Introduction

Diabetes mellitus is a metabolic disorder affecting carbohydrate, fat and protein metabolism and represents a heterogeneous group of disorders characterized by hyperglycemia, which may be due to impaired carbohydrate utilization resulting from a defective or deficient insulin secretion response[1].

Diabetes mellitus is marked by sustained hyperglycemia and has deleterious effect on kidney. The characteristic symptoms of diabetes are polyuria, polydypsia, polyphagia and unexpected weight loss[2].

The medicinal plants, the backbone of traditional medicine are the potential sources of new compounds of therapeutic values and of lead compounds in drug development[3]. In this study, we have evaluated the hypoglycemic effect of water extract of *Gymnema sylvestre* for evidence to support of the folklore calim.

Materials and methods

Plant material

The fresh, young, disease free herbal plant *Gymnema sylvestre* (Retz) R.Br. was procured from Forest College and research Center, Mettupalayam, Coimbatore, Tamilnadu in July 2005. Identification and authentication were done by a Taxonomist, in the Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India.

Preparation of plant extract

The plant was air dried in shade at room temperature. The dried plants were powered mechanically and sieved using a muslin cloth. The extract was prepared by taking 1g of the powder and adding 16ml of water, boiled and reduced to 4ml.

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Filtered after cooling and stored in a refrigerator it is used for the treatment of diabetic rats.

Experimental animals

Male Wister albino rats weighing about 130-150g were obtained from the Veterinary College, Thrissur, Kerala, were used for the studies. The animals were housed in large spacious cages and were fed with standard pellet diet and water *ad libitum*. The animals were maintained in their respective controlled temperature conditions for 30 days before experiment.

Experimental design

Animals were divided in to four groups of six animals each. Group I served as control rats and Group II as alloxan induced rats. Group III alloxan induced animals received the aqueous plant extract at a doses of 1ml/kg body weight orally administrated twice a day. Group IV normal rats administered with herbal extract for 30 days.

Experimental induction of diabetes mellitus

Diabetes was induced by intraperitonial administration of alloxan monohydrate, at a dose of 120mg/kg-body weight in ice-cold saline, before the 48hrs beginning of the experimental procedure [4].

Collection of blood, liver and kidney determination of blood glucose

After the treatment, the rats were fasted overnight and sacrificed by cervical decapitation. Blood was collected and centrifuged for 10min. Serum was separated and 1:10 dilution was made. Blood glucose levels were determined by glucose oxidase method by Barham and Trinder (1972) [5]. Protein levels in serum, liver and kidney were estimated by Folin ciocalteau method by Lowery (1951) [6].The levels of urea, uric acid and creatinine were estimated by standard methods by (Varley et al., 1980) [7.]

Statistical Analysis

The data as represented as mean SD and Statistical significance between treated and control group was analyzed by means of ANOVA $P<0.05$ implies significance.

Results

Table 1 shows that there is significant ($p<0.05$) increase of blood glucose in alloxan induced rats as compared to the control group. Similar results have been reported by (Babu et al., 2002) [8.] This increase in blood glucose level might be due to defective glucose utilization by the target tissues. After the treatment with *Gymnema sylvestre* there was a significant ($p<0.05$) decrease in blood glucose as compared to alloxan induced rats.

Effect of *gymnema sylvestre* on the liver glycogen is depicted in the table I. Glycogen in the toxic group was reduced significantly ($p<0.05$) when compared to control group. While in treated rats, there is a significant ($p<0.05$) increase in the levels of glycogen as compared to toxic rats (Babu et al., 2002) [8.]

Table 2 shows that there is significant ($p<0.05$) decreases in the levels of proteins were observed in serum and tissues of alloxan induced rats (Group II) as compared to the control (Group I). Similar results have been reported by (Babu et al., 2002) [8.] However herbal extract treatment in group III reversed these conditions back to near normal levels.

Protein synthesis has been found to be decreased in the cells of diabetic rat liver, an effect mediated by keto acids, derived as a consequence of increase protein catabolism and gluconeogenesis. Transport mechanisms are inhibited in toxic cells. Uptake of the precursor is through to be at least partially involved in the reduction of protein biosynthesis.

Table 3 shows that there is significant ($p<0.05$) increased in the levels of urea,

uric acid and creatinine in serum of alloxan induced rats (Group II) as compared to the control (Group I). Similar results have been reported by (Babu et al., 2002) [8.] However herbal extract treatment in group III reversed these conditions back to near normal levels.

Discussion

Diabetes is a chronic disease caused by inherited or acquired deficiency leading to the lower production of insulin by pancreas or by the ineffectiveness of the insulin produced. This results in increased level of glucose in the blood, damage of many organs of the body systems, blood vessels, nerves, kidney and eyes.

Thus our studies provide experimental evidence for the herbal plant *Gymnema sylvestre* in the prevention and curing of alloxan induced diabetic rats without any side effects.

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Parameters	Glucose	Glycogen
Group I	112.0±3.79	9.19±0.53
Group II	282.7±12.2a*	5.21±0.37a*
Group III	169.7±8.72b*	7.83±0.26b*
Group IV	110.2±2.98cns	9.44±0.49cns

Table1. Levels of blood glucose and liver glycogen in control and experimental rats.

Values are expressed as mean ± SD for 6 animals**.**

The symbols represent statistical significance *p<0.05.ns: non-significant

Units:

Glucose-mg/100ml.

Glycogen-mg/g wet tissue.

Comparison between groups:

a. Group I and II

b. Group II and III

c. Group I and IV

Table 2. Level of protein in serum and tissue of control and experimental rats

Parameters	Serum protein	Liver protein	Kidney protein
Group I	7.48±0.35	1.30±0.09	1.36±0.12
Group II	4.43±0.19a*	1.00±0.05a*	1.15±0.05a*
Group III	6.98±0.48b*	1.15±0.04b*	1.30±0.04b*
Group IV	7.65±0.27cns	1.31±0.08cns	1.37±0.12cns

Values are expressed as mean ± SD for 6 animals.

The symbols represent statistical significance *p<0.05.ns: non-significant

Units:

Glucose-mg/100ml

Glycogen-mg/g wet tissue

Table 3. Level of serum constituents-urea, uric acid, and creatinine in control and experimental rats.

Parameters	Urea	Uric acid	Creatinine
Group I	11.58±1.17	0.92±0.12	0.43±0.08
Group II	14.32±1.59a*	2.00±0.18a*	1.38±0.13a*
Group III	11.96±0.03b*	1.22±0.25b*	1.72±0.16b*
Group IV	11.07±1.00cns	0.89±0.09cns	0.36±0.16cns

Values are expressed as mean ± SD for 6 animals.

The symbols represent statistical significance *p<0.05.ns: non-significant.

Units:

Urea, uric acid and creatinine – mg/dl.

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