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ANTI-DIABETIC ACTIVITY OF *ADENTHERA PAVONINA* L. (MIMOSOIDEAE) LEAVES

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Plant-based medicinal products (active natural principles and crude extracts) have been used to control diabetes in the traditional medicinal systems of many cultures worldwide, including those of the Asian Indians, Chinese and South Americans.An attempt was made to evaluate *Adenthera pavonina* L.(Mimosoideae) for the antidiabetic activity against Streptozotocin induced diabetes in female rat for the first time.in this study the significant result was found .The experiment was showing the reduction in blood plasma glucose level at 4hr of administration of drug.

Keywords: *Adenthera pavonina;* Antidiabetic activity; Blood plasma glucose; Streptozotocin-induced diabetes.

Introduction

Diabetes mellitus is one of the world's major diseases, which is caused due to endocrine disorder. It currently affects an estimated 143 million people worldwide and the number is growing rapidly[1]. In the USA alone, about 20.8 million or 7% of the population suffer from diabetes or related complications. The estimated direct and indirect costs of diabetes exceed US$ 132 billion annually[2]. Plant-based medicinal products have been known since ancient times (active natural principles and crude extracts) that have been used to control diabetes in the traditional medicinal systems of many cultures worldwide, including those of the Asian Indians, Chinese and South Americans. A limited number of these plant species have been studied and validated for their hypoglycemic properties using diabetic animal models and in clinical studies using human subjects. Several oral hypoglycemic agents are the primary forms of treatment for diabetes. However, prominent side-effects of such drugs are the main reason for an increasing number of people seeking alternative therapies that may have less severe or no side-effects. Thus plant-based herbal drugs are emerging as the primary components of holistic approaches to diabetes management. Ayurveda and other Indian literature mention the use of plants in treatment of various human ailments. India has about 45000 plant species and among them, several thousands have been claimed to possess medicinal properties. Research conducted in last few decades on plants mentioned in ancient literature or used traditionally for diabetes has shown anti-diabetic property.

In the present study *Adenthera pavonina* L. was selected for anti diabetic screening. This plant belongs to family leguminoseae (sub family-mimosoideae).It's common name is Raktakanchan, Ranjan (Beng.); Coral or red wood tree (Eng.).and it's edible Parts are young leaves, flower, seed, wood.: This perennial plant is found in the wild in India. It is also introduced in many countries of America; Brazil, specially in Caatinga vegetation; Costa Rica, Honduras, Cuba, Jamaica, Puerto Rico, Trinidad, Tobago, Venezuela, and the United States, specially in southern Florida. . *A. pavonina* is often cultivated as forage, a medicinal plant, and an ornamental plant. This tree is common within the tropics of the old world, particularly in the Maldives, principally upon the shores. The beauty of the seeds, their use as beads for necklace, and their nourishing qualities, has combined to scatter the plant: A red powder made from the wood of *A. pavonin*a is also used as an antiseptic paste. In Ancient Indian medicine, the ground seeds are used to treat boils and inflammations. A decoction of the leaves is used to treat gout and rheumatism. The bark was used to wash hair. Many scientists[3,4], have worked on medicinal plants for anti diabetic screening. Mimosoideae plants sps have also been evaluated for the anti diabetic activity[5] . In the recent years, anti diabetic activity of medicinally important plant has been patented[6].

Material and Methods

The leaves of *Adenthera pavonina* L. tree were collected from the Haffkine Institute,parel Mumbai in the month of December. The leaves were dried at the temperature of

40°C and powdered. The leaves powder was given for the evaluation of antidiabetic activity against Streptozotocin induced diabetes in female rats. The animals were divided in to three groups.

GR I	STZ Conrol	Received DW
GR II	STZ+Geebenclamide	Received 400µG/Kg STZ
GR III	STZ+Plant Powder	Received 250MG/KG A

Diabetes Model for Efficacy Study: Diabetic model can be generated using known diabetic inducers such as Streptozotocin. The mechanism of their action in B cells of the pancreas has been intensively and quite well understood. The cytotoxic action of both those diabetogenic agents is mediated by reactive oxygen species; however the source of their generation is different in the case of Streptozotocin.

Streptozotocin: Streptozotocin enters the β cell *via* a glucose transporter (GLUT2) and causes alkylation of DNA. DNA damage induces activation of poly ADP-ribosylation, a process that is more important for the diabetogenicity of streptozotocin than DNA damage itself. Poly ADP-ribosylation leads to depletion of cellular NAD^+ and ATP. Enhanced ATP dephosphorylation after Streptozotocin treatment supplies a substrate for xanthine oxidase resulting in the formation of superoxide radicals. Consequently, hydrogen peroxide and hydroxyl radicals are also generated. Furthermore streptozotocin liberates toxic amounts of nitric oxide that inhibits aconitase activity and participates in DNA damage. As a result of the streptozotocin action, β cells undergo destruction by necrosis [7].

Modern Drug Used for Efficacy Study-Glibenclamide (Daonil 5 mg manufactured by Aventis Pharma Ltd.) a well known antidiabetic sulphonylurea was used in the present research work as the known hypoglycemic agent for efficacy study. This was purchased from the market.

Dosage for Streptozotocin model - Streptozotocin (STZ) is customarily administration as a single bolus to produce diabetes within 72 hours. Diabetes was induced by an intraperitoneal injection of streptozotocin dissolved in çitrate buffer at a dose of 50 mg/kg of bodyweight for Groups. The animals(female rats) were carefully monitored every day and weighed. No significant changes were noticed in the behavior and general health of the animal after administration of streptozotocin. After three days, rats with marked hyperglycemia (blood glucose>200mg %) were selected and used for the study. 2ml of distilled water was administered to group 1. Glibenclamide (500µg /Kg) was administered to group II. Aqueous slurry of *A. Pavonina* leaves powder was given to group III and blood samples were collected in clean and pre-heparinised vials after dosing at 0, 1, 2, 3, 4, 5, 6 and 24 hr. Each vial was labeled properly with the identification number corresponding to the animal and the plasma samples were processed for estimation of plasma glucose.

The wistar female rats weighing 200-250 g were obtained from Bharat Serum pvt. Ltd. All the animals were kept in an environmentally controlled room with 12hrs light/12 hrs dark cycle.. The animals were fasted overnight and diabetes was induced by a single intraperitoneal injection of freshly prepared solution of Streptozotocin (50 mg/kg body weight) dissolved in 0.2 ml of 0.1M cold citrate buffer pH 4.5. The animals were allowed to drink 5% glucose solution overnight to overcome drug induced hypoglycemia. STZ Injected animals' exhibited massive glycosuria and hyperglycemia [8]. After three days animals with marked hyperglycemia (blood glucose level above 200mg %) were selected and used for the efficacy evaluation hypoglycemia. Food but not water is withheld for 2 hrs. Prior to oral administration of drug and 6 hrs. post dose till the last sampling point. Food is withdrawn till the end of the sampling points during study. Water is supplied ad labium. Parameters for evaluation of Plasma glucose was done by GOD-POD method. Blood was collected in a test tube containing anticoagulant. Experiments were conducted according to the ethical norms approved by the Institutional Animal Ethics Committee. Blood was collected by orbitosinus method[9] in a test tube containing anticoagulant. The blood was centrifuged at 2500 rpm for 15 min and the plasma was separated. Glucose concentration in the plasma was estimated using GOD/POD kit and measured. For the administration of the sample, a suspension was prepared by mixing 300 mg of *A. pavonina* leaves powder in 5 ml water blade. Blood was collected in a test tube containing anticoagulant. The blood was centrifuged at 2500 rpm for 15 min. and the plasma was separated. Glucose concentration in the plasma was estimated using GOD/POD kit and measured at 500 nm using Supertonic UVD spectrophotometer.

Results and Discussion

It was believed, through pharmacological studies, that medicinal herbs were meticulously organized in the antidiabetic drug formulas such that polysaccharide containing herbs restore the functions of pancreatic tissues and cause an increase in insulin output by the functional beta cells, while other ingredients enhance the microcirculation, increase the availability of insulin and facilitate the metabolism in insulin dependent processes. Pharmacological and clinical evaluations indicated that these drugs had a mild, but significant, blood glucose

Table 1. Plasma glucose levels (mg/dl) for STZ control group.

Gr I	Ani. no.	0 hr	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	24 hr
STZ	1	302.76	253.68	268.94	261.25	258.74	245.65	243.44	282.82
control	2	310.28	289.64	292.57	278.54	279.63	274.84	295.36	306.98
	3	305.30	296.36	287.53	263.35	255.43	268.79	284.75	299.84
	4	298.58	284.56	276.32	269.54	253.21	267.36	298.54	306.32
	5	314.04	302.59	298.41	287.54	282.56	276.58	287.56	300.40
	6	312.67	286.15	272.10	266.12	271.53	268.69	290.32	314.08
	Mean	307.27	285.50	282.12	271.24	266.73	267.00	283.33	301.74
	sd	8.70	7.52	10.21	9.54	13.56	4.11	5.63	5.80

Table 2. Plasma glucose levels (mg/dl) for STZ + Glebenclamide group.

Gr I	Ani. no.	0 hr	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	24 hr
STZ	1	448.75	425.13	382.56	302.58	216.48	268.56	344.23	418.56
control	2	456.31	417.34	354.23	287.45	236.64	278.59	366.58	415.48
	3	420.78	413.70	374.70	299.96	229.36	255.36	341.25	405.10
	4	446.32	410.00	341.78	284.31	213.94	266.39	352.26	412.21
	5	427.34	381.24	350.43	287.34	206.38	272.43	354.23	395.56
	6	461.23	430.52	376.98	294.31	213.34	264.12	347.58	425.81
	Mean	443.46	412.99	363.40	292.66	219.36	267.58	346.02	412.12
	sd	16.07	17.27	16.77	7.48	11.32	7.85	6.69	10.62

Table 3. Plasma glucose levels (mg/dl) for STZ + *Adenthera* leaves.

Gr I	Ani. no.	0 hr	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	24 hr
STZ	1	460.76	317.16	247.17	245.92	185.58	214.36	248.35	362.36
control	2	475.32	336.54	274.98	238.45	201.23	231.23	252.09	350.85
	3	457.32	342.74	264.34	226.56	192.34	247.73	275.45	338.09
	4	434.54	367.54	282.33	250.75	205.64	239.09	287.54	347.75
	5	424.65	351.62	269.08	217.65	180.45	220.86	263.47	328.09
	6	448.09	331.26	239.79	209.75	191.34	226.87	269.85	364.87
	Mean	450.11	341.14	262.94	231.15	192.76	230.02	265.96	348.67
	sd	18.42	17.34	16.41	16.22	9.41	12.14	14.40	14.08

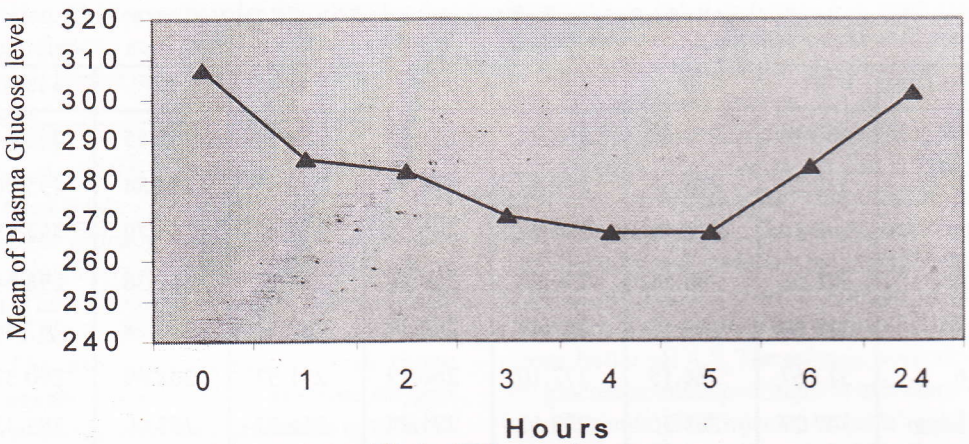

Fig.1. Plasma glucose levels (mg/dl) for STZ control group.

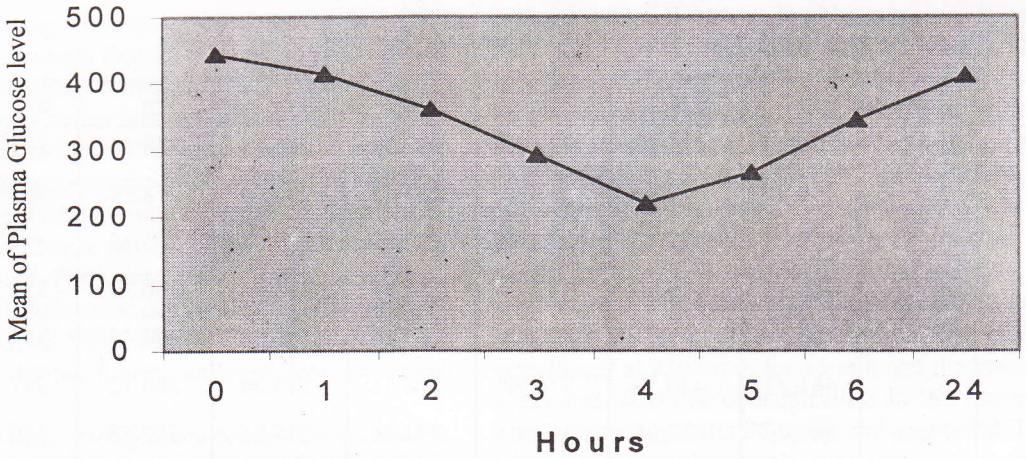

Fig.2. Plasma glucose levels (mg/dl) for STZ+Glebenclamide Group.

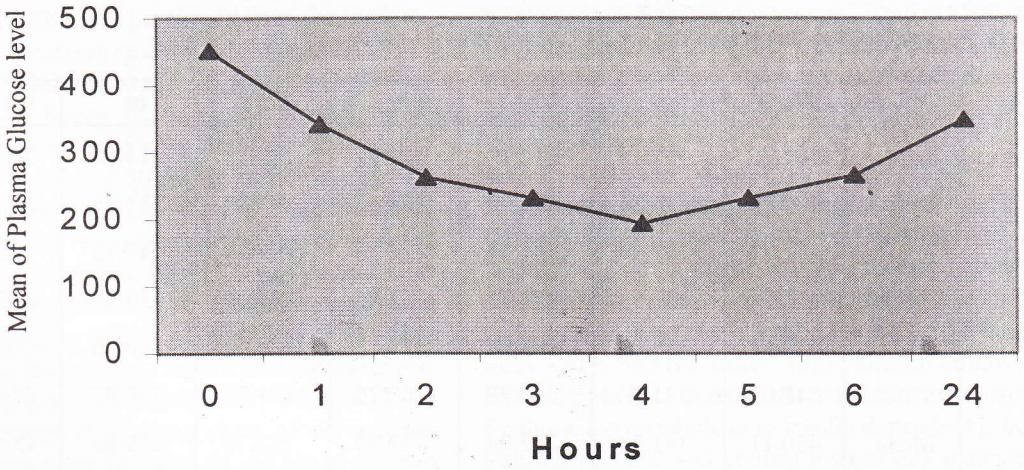

Fig.3. Plasma glucose levels (mg/dl) for STZ+*Adenthera* leaves powder.

lowering effect and that the long-term use of these agents may be advantageous over chemical drugs in alleviating some of the chronic diseases and complications caused by diabetes. It was generally believed by a number of investigators that the polysaccharides in the herbal drugs, may protect pancreatic islets and beta cells, help the regeneration of beta cells, and therefore, increase the insulin secretion from pancreas[10-12].

In the present study, *Adenthera pavonina* L. leaves were evaluated for anti diabetic activity in female rat for the first time. The results show the significant anti diabetic activity in STZ induced diabetes female rat (Table 1-3). The mean maximum activity was seen after 4hr of administration of Glebenclamide (plasma glucose level 219.36mg/dl Table 2) which was lower than activity of *A. pavonina* (plasma glucose level 192.76mg/dl Table 3).In both the cases the mean plasma glucose level was linearly decreased up to 4hr of oral administration after that an enhancement was seen (Fig. 2,3).The statistical analysis was found as significant(p value>0.05). This suggests that the long term use of this herbal drug may be advantageous over chemical drugs in alleviating some chronic diseases and complications caused by diabetes, while adverse effects of these herbal extracts are minimal.

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