PRELIMINARY STUDIES ON THE HYPOGLYCAEMIC EFFECT OF *ABROMA AUGUSTA* IN ALLOXAN DIABETIC RATS

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ABSTRACT

The hypoglycemic effect of the aqueous extract of *Abroma augusta* (Family : *Steculiceae*) was studied in normal as well as alloxan diabetic rats. Treatment of diabetic rats with 4 ml (4gm dry weight) of aqueous extract of *A. augusta* for 16 weeks resulted in gradual but significant fall in fasting blood glucose and improvement in glucose tolerance. Serum total and LDL cholesterol and triacylglycerol which increased in diabetic rats showed improvement. These results show that the water extract of *A. augusta* has both hypoglycemic and hypocholesterolemic effects.

KEY WORDS : *Abroma augusta*, diabetes mellitus, hypoglycemic effect, hypolipidemic effect .

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia resulting from defects either in insulin secretion or insulin action or both (1). Due to deficient action of insulin on the target tissues and the consequent alterations in the metabolism of carbohydrates, fats and proteins in uncontrolled diabetes, damage of tissues, dysfunction and ultimate functional failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels might occur (2). The poorly controlled diabetes aggravates the risk of diabetic complications, particularly cardiovascular diseases (3), neuropathy (4). However, the disadvantages of the drugs available at present are that they have to be given throughout the life of a diabetic person and produce side effects. A variety of plant preparations have been mentioned in Ayurveda and other indigenous systems of medicine, which are claimed to be useful for the treatment of diabetes mellitus and their complications. Even WHO suggested the evaluation of the potential of plants as effective therapeutic agents, especially in areas where we lack safe modern drugs (10). Some of the plants known to be useful in diabetes have been recently reviewed by Shukala et. al. (6). *Abroma augusta* is

reported to be effective in the treatment of diabetes and amenorrheas (7). There are many studies which show that the root bark of *A. augusta* contains one alkaloid abromine (8) and the leaves contain some sterols (9). Petroleum ether extract was found to contain antifertility agents (10). In spite of the mention of its beneficial effect in diabetes mellitus, there are no detailed studies on its use in diabetes. We have therefore undertaken studies on the hypoglycemic activity of *A. augusta*.

MATERIALS AND METHODS

Plant material : *Abroma augusta*

A. augusta collected from Assam and Khasia mountains was purchased and its identity was confirmed by Botanical Research Institute, Lucknow.

Preparation of the aqueous extract

The dried whole root was ground by an electrical mill. 100 gm of dried whole root bark powder was extracted by soaking in 200 ml of distilled water at room temperature for two days with frequent stirring. Then it was filtered. The residue was extracted three more times in a similar way. The extract was concentrated by lyophilization and stored in air tight containers in a deep freeze. At the time of use, it was

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dissolved in water (1gm dry residue in 1ml water).

Induction of diabetes in rats

Healthy male albino Wistar rats (150-200gm) procured from Centre for Cellular and Molecular Biology (CCMB), Hyderabad were used in this study. The animals were fed on a pellet diet (Hindustan Lever, India) and water ad libitum.

Rats were starved over night and each rat received a single subcutaneous injection of alloxan monohydrate in freshly prepared sodium-acetate buffer (0.15 M, pH 4.5). The dose of alloxan was 20 mg/100g body weight in a volume of 0.10 to 0.15 ml. The same volume of acetate buffer was given to each control rats. From next day, a single injection of 2 units of protamine-Zn insulin prepared in normal saline was given to each alloxan treated rat, for 6 days. This decreased the mortality of the animals. Controls were given the same volume of normal saline instead of insulin.

Experimental design

Animals were divided into 3 groups of 5 animals each. Group 1 served as healthy controls and Group 2 were untreated diabetic rats. Animals of both the groups were given water for 16 weeks. Group 3 were diabetic rats given 4 ml (4gm dry wt.) of aqueous extract of *A. augusta* daily once using an intragastric tube for 16 weeks.

Plasma glucose levels, fasting as well as in oral glucose tolerance test and serum lipid profile were determined at 0, 4, 8 and 16 weeks. The blood was collected retro-orbitally from the inner canthus of the eye using Micro Hematocrit Capillaries, Mucaps. The blood was collected in sodium fluoride and plasma was separated for plasma glucose determination. Serum was used for estimating lipids.

Parameters studied

Plasma glucose: It was estimated by glucose oxidase-peroxidase method using kit from Ranbasay Labs, Delhi.

Glucose tolerance test:

The standard oral glucose tolerance test was performed in all rats at 0, 4, 8, 12 and 16 weeks from overnight fasted rats, fasting blood was collected. Then glucose (2g/kg) dissolved in water was given orally to the rats. The blood was collected at 0, 0.5, 1, 1.5 and 2 hrs. Plasma glucose was estimated in all the samples.

Serum lipids:

Total cholesterol, LDL-and HDL- cholesterol and triacylglycerol were estimated using kits from Dr. Reddy's Pathology Labs Hyderabad following manufacturer's instructions.

Statistical analysis:

All the data were statistically evaluated and the significance was calculated using student's-test. All the results were expressed as mean $\pm$ S.D.

RESULTS AND DISCUSSION

This study reports not only the anti-hyperglycaemic effect but also for the first time the hypolipidemic effect of *A. augusta*. Results in table 1 show the effect of water extract of *A. augusta* on the fasting plasma glucose (FPG) of normal and untreated diabetic rats. It can be seen that treatment rats with 4 ml of water extract of *A. augusta* brought down the FPG level to normal value. Lower dose (2 ml) showed partial improvement (results not shown). Treatment of diabetic rats with 4 ml of extract showed considerable improvement in glucose tolerance also (Table 2). These results point out that the diabetic rats showed abnormal glucose pattern. After treatment for 16 weeks with *A. augusta* the glucose tolerance pattern was normal.

Table 1. Effect of water extract of *A. augusta* on the fasting plasma glucose level in rats

Group	Plasma glucose mg/dl, mean $\pm$ SD	
	0 weeks	16 weeks
Normal	95.5 $\pm$ 26.6	84.0 $\pm$ 29.3
Diabetic untreated	166.7 $\pm$ 50.4	300.7 $\pm$ 50.9
Diabetic + <i>Abroma</i> (4 ml) treated	164.6 $\pm$ 26.9	107.5 $\pm$ 28.6

Table 2. Effect of 4 ml of *A. augusta* extract on glucose tolerance in diabetic rats after 16 weeks treatment.

Group	plasma glucose mg/dl, mean $\pm$ S.D				
	0 hr.	0.5 hr.	1 hr.	1.5 hr.	2 hr.
Normal	96.5 $\pm$ 26.9	142.6 $\pm$ 14.8	135.2 $\pm$ 30.2	118.5 $\pm$ 11.4	106.0 $\pm$ 14.0
Diabetic	155.7 $\pm$ 42.0	240.6 $\pm$ 78.1	271.0 $\pm$ 91.1	284.7 $\pm$ 81.8	275.0 $\pm$ 85.2
Diabetic treated	89.8 $\pm$ 25.2	115.0 $\pm$ 21.1	116.4 $\pm$ 16.0	104.0 $\pm$ 11.4	99.8 $\pm$ 25.0

Table 3. Effect of treatment with water extract of *A. augusta* on the serum lipid profile in diabetic rats.

Group	Serum lipids				
	TC (mg/dl)	LDLC (mg/dl)	HDLc (mg/dl)	LDLC/HDLc	TAG (mg/dl)
1. Normal	168.6 $\pm$ 16.9	78.0 $\pm$ 12.2	44.9 $\pm$ 13.3	1.7 $\pm$ 0.3	115.6 $\pm$ 42.6
2. Diabetic untreated	246.0 $\pm$ 14.4	152.2 $\pm$ 12.6	45.0 $\pm$ 12.0	3.3 $\pm$ 0.4	181.8 $\pm$ 18.8
3. Diabetic treated	186.0 $\pm$ 14.8	99.7 $\pm$ 16.8	51.3 $\pm$ 8.4	1.9 $\pm$ 0.4	175.0 $\pm$ 15.8

TC, LDLc, HDLc= total, low density and high density lipoprotein cholesterol respectively.

TAG= triacylglycerol.

Since the untreated diabetic rats had a very high FPG 300.7 $\pm$ 50.9 mg/dl (Table 1), it is quite possible that their pancreas is considerably damaged. Since treatment of the diabetic rats with *A. augusta* extract brought down the FPG to normal value, one can expect that *A. augusta* extract can either repair the damaged pancreas or the extract stimulated directly the utilization of glucose by various tissues.

In view of the observations of Pugazhenthay et al (11) that extracts of some medicinal plants contain not only hypoglycemic but also hyperglycemic compounds, it is quite possible that *A. augusta* extract also contains both hypoglycemic and hyperglycemic compounds. In such a case, the activity observed with *A. augusta* extract in the present study would be the net effect of the activities of the two compounds with opposite effects. If so purification of the active hypoglycemic compound(s) would show hypoglycemic activity at a much lower dose. Considering this possibility, we are trying to purify the hypoglycemic constituent of *A. augusta*.

In the diabetic rats there was increase in total- and LDL- cholesterol, LDL/HDL ratio and triacylglycerols (Table 3). After treatment with 4ml. of *A. augusta* extract, there was significant lowering of the serum lipids. There was slight increase in HDL- cholesterol. This indicates that the water extract of *A. augusta* has effect on the lipid metabolism of diabetic rats also. There are reports that some plants with hypoglycemic constituents have hypolipidemic effect also (12, 13).

It is anticipated that isolation of the active hypoglycemic compound(s) and detailed work on its effect on carbohydrate and lipid metabolism and blood insulin levels would throw light on mechanism of hypoglycemic action of *A. augusta*.

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