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Anti-diabetic activity of *Abelmoschus esculentus* Linn. on alloxan–induced diabetic rats

S.Ramachandran*, V.Sai Sandeep, N.Kalyan Srinivas, M.D.Dhanaraju

Department of Pharmacology, GIET School of Pharmacy, Rajahmundry, Andhra Pradesh - 533 294, (INDIA)

E-mail- ramsnetin@yahoo.com

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ABSTRACT

The objective of this investigation was to evaluate the therapeutic efficacy of *Abelmoschus Esculentus* fruits in animal models of diabetic rats. Animals were made diabetic by using alloxan and were treated with *Abelmoschus Esculentus* fruit extract of 400mg/kg & 100 mg/kg body weight for a period of 15 days. Blood glucose levels were estimated in all groups on 1st, 7th, and 15th day of the treatment with the extract and were compared with diabetic control and standard groups. The blood glucose levels were elevated in the diabetic group, but were brought to standard group level in the diabetic group treated with 400mg/kg body weight of *Abelmoschus Esculentus* fruit extract. The results justify the traditional use of fruit in the treatment of diabetes.

KEYWORDS

Alloxan monohydrate;
Anti-diabetic activity;
Abelmoschus esculentus Linn;
Tinder's test.

INTRODUCTION

Diabetes mellitus is a group of syndromes characterized by hyperglycemia, altered metabolism of lipids, carbohydrates and proteins, and an increased risk of complications from vascular disease[1]. Diabetes mellitus remains a global major health problem in the World over with the tropics inclusive. In the past decade, the United States has recorded a 33% rise in the cases of diabetes[2].

The chronic hyperglycemia[3] of diabetes is associated with damage, dysfunction, and failure of various organs over the long term[4]. In diabetic rats, the impaired utilization of carbohydrate leads to accelerated lipolysis, resulting in hyperlipidemia[5,6].

Despite the availability of many antidiabetic drugs in the market, diabetes and related complications continued to be major medical problems. Plant derivatives with purported hypoglycemic properties are used in folk medicine and traditional healing systems around the world. The antihyperglycemic effects of these plants are attributed to their ability to increase insulin output from the pancreas, or inhibit intestinal absorption of glucose, or some other processes[7].

Many pharmaceuticals used in modern medicine are also of natural, plant origin. There is little information available regarding the efficacy and safety of the herbs used in diabetes[8,9]. More than 400 species of plants have been reported to display hypoglycemic effects, but only few have been investigated[10].

Abelmoschus Esculentus L. (family- malvaceae) is a shrub or small tree, growing to 2m tall. The fruit is a capsule up to 18 cm long, containing numerous seeds, The seed pods rapidly become fibrous and woody and

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must be harvested within a week of the fruit being pollinated to be edible[11]. It's a traditional food plant. Unspecified parts of the plant reportedly possess diuretic properties[12,13]. Okra oil is seed oil, extracted from seeds of *Abelmoschus Esculentus*[14], and is high in unsaturated fats such as oleic acid and linoleic acid, also it is useful in treating leucorrhoea, spermatorrhoea, thinness of semen, premature ejaculation, catarrhal jaundice[15].

MATERIALS AND METHODS

Plant materials

The fruits of *Abelmoschus Esculentus* were identified by the taxonomist of Regional Forest Research Center (RFRC), Rajahmundry, East Godavari District, Andhra Pradesh. Subsequently, it was sliced and used for obtaining the extract.

Preparation of extract

The sliced fresh fruits were subjected to extraction daily using water as a solvent (aqueous extract) by simple maceration at room temperature for 24h, after 24h of maceration gummy liquid was obtained 150mg/ml. This gummy extract was used for the antidiabetic activity on alloxan induced rats.

Experimental animals

Wistar rats of either sex weighing between 150-200g were used for antidiabetic activity and were housed in standard environmental conditions (22±1°C, humidity 60±5%, light 12h dark 12 h light cycle) with free access to a standard commercial diet and water. Experiment was performed according to the guidelines and the study was approved by the Institutional Animal Ethics Committee (IAEC).

Induction of experimental diabetes

Rats weighing 150-200g, fasted overnight were used for induction of diabetes by injecting alloxan monohydrate solution 10mg/ml was prepared in ice-cold citrate buffer 0.1M pH 4.5 kept in ice and was administrated to the rats within 5 min at a dose of 60mg/kg[17] body weight intraperitoneally. The unique capacity of alloxan to selectively destroy the pancreatic beta cells was first described by Dunn et al.[16]. The site at which alloxan interacts with the cell membrane is uncertain[18].

After 48hr of alloxan monohydrate administration, rats showing blood glucose levels of 250-350 mg/dl were considered as diabetic and were employed in the study.

TABLE 1 : Glucose levels of rats of different groups at different week intervals

Group	0 week	1st week	2nd week
Group I	92±1.2	95±0.8	96±1.0
Group II	263±2.2	293±2.2	324±7.5
Group III	265±3.1	113±2.0**	107±2.0**
Group IV	267±2.7	146±5.3**	135±2.6**
Group V	264±2.7	138±4.0**	115±2.6**

The values are mean ± SEM; n= 6 rats in each group. Df = 4, 25 p<0.001 as compared to diabetic control**

Design of work

The rats were housed in polyethylene cages and divided into five groups of six animals each.

- Group I : Served as solvent control (distilled water)
- Group II : Served as diabetic control (alloxan-induced)
- Group III : Received insulin 0.6 U/kg, SC[19]
- Group IV: Received extraction of *Abelmoschus Esculentus* (100mg/kg, orally)
- Group V : Received extraction of *Abelmoschus Esculentus* (400mg/kg, orally)

Determination of serum glucose

On the 0, 1 and 2 weeks, the animals were fasted for 8h and the blood samples were drawn by orbital sinus puncture under mild ether anesthesia. The blood samples were collected in Eppendroff's tubes that contained 50 µl of anticoagulant (EDTA). Plasma was separated by centrifugation at 5000 rpm for 10 min and glucose levels were estimated by using Tinder's method[20] using a GOD/POD kit.

Statistical analysis

The results were recorded as mean ± standard error of the mean (SEM). Statistical difference between the means was determined by ANOVA followed by Dunnett's test. A value of $p < 0.001$ was considered significant.

RESULTS AND DISCUSSION

The extract of *Abelmoschus Esculentus* produced significant changes in alloxan-induced diabetic rats. The extract of *Abelmoschus Esculentus* reduced the glu-

cose levels considerably. The prolonged treatment of *Abelmoschus Esculentus* extract on alloxan-induced diabetes rats produced consistent reduction in the blood glucose level.

The blood glucose data obtained clearly indicate that the *Abelmoschus Esculentus* produces significant and consistent anti-hyperglycemic effect in alloxan induced diabetic rats. The continues treatment with *Abelmoschus Esculentus* for a period of 21 days produced a significant decreases in the blood glucose levels of diabetic rats (TABLE 1), but not in the glucose levels of the diabetic rats, but not in the normal rats. It is possible that the drug may be acting by potentiating the pancreatic secretion or increasing the glucose uptake.

It can be concluded that *Abelmoschus Esculentus* fruit showed significant anti-diabetic effect in diabetic rats after oral administration. Thus, the claim made by the folklore medicine regarding the use of fruit of this plant in the treatment of diabetes is validated.

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