



HYPOGLYCEMIC EFFECT OF *SYZYGIUM CUMINI* SEED EXTRACT IN ALLOXAN INDUCED ALBINO RATS

Biological Science

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ABSTRACT

Diabetes mellitus can be defined as a group of syndromes characterized by hyperglycemia, altered metabolism of lipids, carbohydrates and proteins along with an increased risk of complications from vascular disease. The primary objective of the study was to examine the anti-diabetic potential of sub-chronic oral administration of *Syzygium cumini* seed powder in rats with alloxan- induced diabetes. Hypoglycemic study was conducted to test the efficacy of the seed extract. Treatment with extract in suspension form started. Blood glucose level was investigated by 1, 3 and 4 hours of intervals by one touch strip method.

KEYWORDS

Albino rats, Diabetes, Alloxan, Herbal extract, *Syzygium cumini*.

INTRODUCTION

The term diabetes can be defined as to "pass through". The word diabetes has been derived from Greek word ('dia' means through; 'betes' means pass). More approximately it has been defined as the secretion of an inordinate quantity of sweet tasting, urine with a peculiar smell, accompanied with great thirst, dryness of skin, extreme debility, and general emaciation. In diabetes, the deficiency of insulin leads into a complex series of reactions which are clinically manifested as hyperglycemia. It is well known that glucose is an important source of energy for the cerebral tissue, and if it is lost owing to diabetes, the function of tissue is affected.

Diabetes is a chronic health condition where the body is unable to produce insulin and breakdown sugar (glucose) in the blood. Prevalence of diabetes in adults worldwide was estimated to be about 4 percent in 1995 and will rise to 5.4 percent by the year 2025. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. Nature has provided us a rich storehouse of herbal remedies to cure all ailments of mankind. India has vast and inexhaustible resources of drugs of plant origin. There has been resurgence in the consumption and demand for medicinal plants (Chandrasekhar *et al.* 2002). These plants are finding use as pharmaceuticals, nutraceuticals, cosmetics, and food supplements. Even as traditional source of medicines they continue to play a pivotal role. Plants have been source of medicine from ancient times.

In India, *Syzygium cumini* has been used as treatment for diabetes mellitus since ancient times but the mechanism was not known. In the last two decades it was shown that the administration of *Syzygium cumini* to diabetic animals not only resulted in glucose improvement, but was accompanied by a regeneration of beta cells in the pancreas.

In Type 2 diabetic mellitus *Syzygium cumini* study all participants were taking oral anti- diabetic medication, and treatment with the herb resulted not only in a lowering of oral medication necessity, but almost 25 % of the participants were able to discontinue conventional oral medication and maintain blood glucose control with *Syzygium cumini* alone. The fact that *Syzygium cumini* extract lowered conventional medication requirements, increased serum insulin levels and required months to obtain optimal effects, led the authors to speculate that. "These data suggest that the beta cells may be regenerated/ repaired in Type 2 diabetic patients on *Syzygium cumini* extract supplementation.

Syzygium cumini may also improve the insulin receptors; so that the body's natural insulin will work better. The third way the herb works is by thwarting the desire for sweets.

The Indian subcontinent has given to the medicinal world, natural remedies such as Ayurveda, Yunani and Siddha. Based on such

systems, we can find not only new remedies; but also new lead molecules may be obtained. Though data from clinical trials are required. Most of the drugs from plant sources are secondary metabolites, which have no role in plant metabolism, but are postulated to play a significant role in the plant defense mechanism. However, not much difference is seen in the basic metabolic processes in plants as well as animals.

In the present study, an attempt has been made to find out the effect of jamun seed extract on beta cells of the Islets of Langerhans and probable mode of hypoglycemic action of alcoholic extract of *Syzygium cumini* seeds.

Description Of The Plant

Medicinal Plant : *Syzygium Cumini*

Classification

Kingdom	: Plantae
Order	: Myrtales
Family	: Myrtaceae
Genus	: <i>Syzygium</i>
Species	: <i>Cumini</i>

Syzygium cumini (Jamun) is native to Bangladesh , India, Nepal, Pakistan , Sri lanka, Philippines and Indonesia. The name of the fruit is sometimes mistranslated as blackberry which is different fruit in a related family.



Syzygium cumini (Jamun Tree)



Syzygium cumini (Jamun Fruit)



Syzygium cumini (Jamun Seed Powder)

The *Syzygium cumini* tree belongs to the Myrtaceae family. This is also called as Jamun, Jambul and Jambol in India and Malaya. The barks, leaves and seeds extracts of *Syzygium cumini* have been reported to possess anti-inflammatory antibacterial (Bhuiyan *et al.*, 1996) and anti-diarrhoeal effects. The present study was designed to evaluate the anti-diabetic activity of isolated compound mycaminose, and Methanol extracts of the *Syzygium cumini* extracts was compared to glibenclamide, which is often used as a standard drug.

The primary objective of the study was to examine the anti diabetic potential of sub-chronic oral administration of *Syzygium cumini* seed powder in rats with alloxan- induced diabetes.

MATERIALS AND METHODS

Plant Materials :

The fully mature *Syzygium cumini* seeds were collected in June- July 2021 from a single tree.

Preparation Of Plant Extract :

The *Syzygium cumini* fruits were first washed well and pulp was removed from the seeds. Seeds were washed several times with distilled water to remove the traces of pulp from the seeds. The seeds were dried at room temperature and coarsely powdered. The powder was extracted with hexane to remove lipids. It was then filtered and the filtrate was discarded. The residue was successively extracted with ethyl acetate and methanol using cold percolation method. The percentage yields were 1.81 % in ethyl acetate and 10.36% in methanol.

Albino Rats



Intraperitoneal Injection Of Alloxan



Collections Of Blood Samples:

Blood Samples were collected from the rats by tail vein puncture. In the un-anesthetized animals, lateral or dorsal veins are dilated by rubbing with xylol and then cleaning the part with spirit. The tail was grasped between the thumb and index finger and a needle (25 to 27 gauge and 0.5-1 inch long) is introduced near the distal portion of tail with level up. The drop of blood accumulated at the tip of tail after puncture was collected at the tip of Glucometer strip and reading was noted down. The procedure was carried out for the estimation of Blood glucose level before injection of alloxan.

Experimental Induction Of Diabetes:

Diabetes was induced in the rats by single intra peritoneal injection of alloxan (45 mg/kg). Alloxan was first weighed individually for each animal, according to its weight, and solubilized with 0.2 mL saline (154mM NaCl) just prior to injection. All the animals (albino wistar rats) used in this study developed Diabetes mellitus after alloxan injection. Treatment with extract in suspension form started. Blood glucose level was investigated by 1, 3 and 4 hours of intervals by one touch strip method.

Hypoglycemic Activity:

Hypoglycemic study was conducted to test the efficacy of the seed extract, as per the method described earlier (Nityanand 1984; Mukherjee 1987) in four different experimental models and the blood sugar lowering efficacy of the seed extract was studied as follows.

Fasted Model:

Rats were fasted overnight by withdrawing pellets from the cage. After collection of the blood sample from the region, the next morning at 10

am the rats were fed with plant extract (250 mg/kg body weight). Blood was collected after 1,2,3 and 4 hours for glucose estimation after the oral administration of the plant extract.

Fed Model:

Rats were not fasted; pellets in excess amount were put in the cage on the previous evening. Pellets were left over in the next morning. The blood sample from the tail region, the next morning at 10 am the rats were fed with plant extract (250 mg/kg body weight). The experiment was performed the same way as above and blood glucose level was estimated at 1,3 and 4 hours of intervals.

Glucose Loaded Model:

Blood Sample was collected from the overnight fasted rats (0-hrs) and the extract was fed in the same way as (250 mg /kg body weight). After half an hour of interval, 10 % glucose solution (1.5g /kg body weight) was fed by oral intubation and blood sample was collected for glucose estimation at 1, 3 and 4 hours of intervals.

Diabetic Model:

Diabetes was induced by intraperitoneal injection of alloxan (40mg/kg body wt) in citrate phosphate buffer at pH 4.5 as described earlier (Theodorocet al 1980). Four separate sets of control groups were maintained simultaneously using identical protocols except that only vehicle i.e. 2 % gum acacia suspension was fed to the rats.

Estimation Of Blood Glucose:

In each case 200 µl of blood sample was collected from the tail vein and estimated for glucose by glucometer.

RESULTS AND DISCUSSION

The results of the hypoglycemic study conducted were recorded (Tables 1-4)

Fasted Model:

In the fasted model the blood glucose level was estimated in the plant extract fed animal (Ef) and compared with that of the control ©. The blood glucose decreased (80.1) in Ef group when compared to that of the control (C) .

Fed Model:

The Blood glucose levels were estimated in extract fed (Ef) group at 1,3 and 4 hours intervals. (After feeding the extract) and compared with that of the control (C) group. The blood glucose level was higher (9.8%) in control (C) group when compared to that of normal rats. In extract fed (Ef) group blood glucose level was decreased consistently at 1 hour (153) , 3 hour (115) and 4 hour (108) respectively.

Glucose Loaded Model:

The blood glucose levels were reduced in the extract fed (Ef) group consistently at 1 hour (133), 3 hour (119) and 4 hour (106) of intervals when compared to that of the control group (159) maintained.

Diabetic Model:

Diabetes was induced by intraperitoneal injection of alloxan (65mg/kg body weight) in citrate phosphate buffer at Ph 4.5 as described earlier (Theodorocet al 1980). Four separate sets of control groups were maintained simultaneously using identical protocols except that only vehicle i.e. 2 % gum acacia suspension was fed to the rats. The blood glucose levels were reduced in the extract fed (Ef) group consistently at 1 hour (362), 3 hour (208) and 4 hour (109) of intervals when compared to that of the control group (422) maintained.

Estimation Of Blood Glucose:

In each case 200 µl of blood sample was collected from the tail vein and estimated for glucose by glucometer.

Effect Of Extract Fed In Different Models (table 1-4)

Table 1. Fasted Model

Normal Rats	Control	Extract Fed (AFTER 3 HRS)
100.1	90.2	80.1

Table 2. Fed Model

Normal Rats	Control Rats	Extract fed 1st hour	Extract fed 3rd hour	Extract fed 4th hour
100.1	170	153	115	108

Table 3. Glucose Loaded Model

Normal Rats	Control Rats	Extract fed 1 st hour	Extract fed 3 rd hour	Extract fed 4 th hour
100.1	159	133	119	106

Table 4. Diabetic Model

Control C	Experimental EC	EF 1 st hour	EF 3 rd hour	EF 4 th hour
Normal Rats	Control Rats	Extract Fed	Extract Fed	Extract Fed
100.1	422	362	208	109

Units : Glucose- mg/100ml

In recent years, many studies have been undertaken with traditional medicines in an attempt to develop new drugs for diabetes. In the present study *Syzygium cumini* leaves were found to be efficient in anti-diabetic effect. The result obtained from the above experimental models clearly shows that the leaf extract of the plant *Syzygium cumini* has enough potency to produce the blood glucose level in rats. The results demonstrate that the extracts of *Syzygium cumini* leaves showed anti hyperglycemic effect in diabetic model rats when the extracts were fed simultaneously with glucose. In the glucose loaded animal model, the blood glucose level was steadily increased in the control group (C) at 1, 3 and 4 hours of intervals. Hypoglycemic activity that is found when given with a simultaneous glucose load in diabetic rats indicates that the extracts may interfere with the intestinal glucose absorption in the gut by various mechanisms (Nehar *et al* 2000, Vinik & Wing 1990).

In (Ef) group the blood glucose level reduced consistently at 1, 3 and 4 hours of intervals when compared to the control group. At the 4th hour the blood glucose level of Ef rat was recorded almost equal to the normal value. In diabetic rat a drastic increase in the blood glucose level was recorded 331.1 % when compared to that of normal rats. (Subramonium *et al* 1996, Nelsom 1994). In the Ef rats the blood glucose level was reduced consistently at 1, 3 and 4 hour intervals when compared that of control rats. Similar reduction in the serum glucose level was obtained in the albino rats fed with leaves of *Syzygium cumini* (Sabu and Subburaju 2002, Jafri *et al* 2000, Sendhilvadivu.M.2010).

Although hypoglycemic property of *Syzygium cumini* seeds, both on normal and alloxan diabetic animals has been reported, most of these studies were conducted only on hourly basis. Sepha and Bose treated diabetic patients with *Syzygium* seed powder, Brahmchari and Augusti concluded that seeds of *Syzygium cumini* contained some alcohol soluble orally effective hypoglycemic principle. Shrotri *et al*. tested the pulp of *Syzygium cumini* fruit and its seed powder on normal rat, alloxan diabetic albino rats. Kedar and Chakrabarti tested *Syzygium cumini* seed powder on alloxan diabetic albino rat and reported that the blood sugar level and glucose tolerance test became normal within few days. Sharma *et al* used ethanolic extract of *Syzygium cumini* seed powder on alloxan diabetic rat and reported increase in body weight, reduced fasting blood glucose and improved lipid profile.

The results of diabetic control group of the present study that alloxan produces permanent hyperglycemia by selective destruction of the beta cells of the islets of langerhans of pancreas are in agreement with those of, (Bhaveja *et al*)

After inducing alloxan all the beta cells, which were partially damaged by alloxan injection showed recovery and blood sugar became normal in almost all the animals treated with 50 mg or 75 mg doses. Sharma *et al* have also reported improvement in islet picture after giving oral feeding of *Syzygium cumini* seed powder extract. Regeneration of islet cells by dietary components and stimulation of insulin secretion by different plant extracts have been reported. Most probably some alkaloid in the alcoholic extracts of *Syzygium cumini* acts in the same manner and causes improvement in beta cells.

One important finding of the present study is that the blood sugar level which once dropped to normal level after extract feeding did not increase again after discontinuation of extract feeding. The finding is in accordance with the observation of Sepha and Bose on diabetic patients.

It can be concluded that the effect of antidiabetic extract of *Syzygium cumini* appears to be curative rather than palliative.

The possible mechanism by which seed brings about a decrease in

blood sugar level may be by potentiation of the insulin effect of plasma by increasing either the pancreatic secretion of insulin effect of plasma by increasing either the pancreatic secretion of insulin from beta cells of the islets of langerhans or its release from the bound form.

The above results threw a light for further research studies in finding an efficient anti hyperglycemic drug from the leaves of *Syzygium cumini*.

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