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Antidiabetic properties of Jamun (syzygium cumini)

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ABSTRACT

Syzygium cumin (Family-Myrtaceae) is a medicinal plant commonly recommended as adjuvant therapy for type 2 diabetes. This plant has been thoroughly researched over the last 125 years. This plant has traditionally been used for its rich nutrition and medicinal value. The current review focuses on a recent research study that included Jamun's unique pharmacy studies. Jamun plant is reported to be rich in phytoconstituents such as ellagic acid, glucoside, anthocyanins, kaempferol, isoquercetin, myrecetin and so on. The seeds most commonly used for their medicinal value are said to contain alkaloid-jambosine and glycoside-jambolin or antimellin to prevent the conversion of starch into sugar. Different plant parts are said to contain different nutrients Jamun has long been used to treat diabetes.
Apart from this it has also shown its beneficial properties as anti-allergic, antibacterial, anti-cancer,anti-diarrheal, anti-fertility, anti-fungal, anti-hyperlipidemic, anti-hypertensive, anti inflammatory, antilieshmanial, antinociceptive, antioxidant, antiviral, ascaricidal, cardioprotective, chemoprotective, diuretic, gastroprotective, hepatoprotective, hypothermic, neuropsycho pharmacological and radioprotective agent. Jamun may activate PPARγ and PPARα genes that suppress NF κB, COX, NOS, TNF - α and other inflammatory cytokines are followed by Nrf2 regulation.

Keywords: S.cumini, Myrtaceae, Phytochemistry, Antidiabetic, Pharmacological activity, Anti-diabetic

INTRODUCTION

The WHO predicts that diabetes will be the 7th leading cause of death in 20301 India leads the world in the number of diabetics who experience the dubious diversity of so-called "diabetic world capital". is increasing worldwide, the prevalence of type 2 diabetes is rising dramatically, perhaps due to obesity, declining employment rates as countries develop economically and as a result of aging. Over time, diabetes can increase the risk of developing health problems, including blindness, kidney damage, nerve damage, amputation, and cardio vascular disease. Although diabetes cannot be cured, the disease can be controlled by non-pharmacological and pharmacological strategies, where the development of glycemic control factors is important factors in delaying the onset and progression of diabetes-related

complications. A great way to manage diabetes can be achieved through diet, exercise and / or treatment instead of insulin.[1]

In the modern medical system, managing diabetes without side effects remains a challenge. In India's traditional medicine program, more than 100 diabetic herbs are mentioned where more than one herb combined is used to treat health problems and this herbal extract extracted in the form of a tonic or blend shows better results. [2]

Diabetes is a metabolic disorder characterized by hyperglycemia and glucose intolerance. Pancreas dysfunction is a major cause of these metabolic disorders. This may be due to a lack of insulin production, insulin dysfunction or both. Diabetes is of four types depending on the etiology and presentation of the clinic. Insulin-dependent diabetes mellitus (IDDM, Type I) and insulin-dependent diabetes mellitus (NIDDM, Type II). Other types of diabetes include gestational diabetes, and certain types. Diabetes I (IDDM) is an autoimmune disease caused by ly-cell destruction of the Langerhans islands by T lymphocytes leading to local intrusion and suppression of insulin production and this requires treatment instead of insulin. It is characterized by increased peripheral insulin resistance and impaired production of insulin by pancreas. It is more common than type I. People with type II diabetes suffer from intermediate stages of glucose fasting disorders and improper glucose tolerance and hence it is also known as prediabetes. Obesity is one of the leading causes of type II diabetes and 90% of patients with diabetes fall under this category.[2]

A large number of herbal medicines are listed with hypoglycemic properties worldwide. Jamun is one of the ancient fruits commonly used by a physician in the treatment of diabetes. In India, Syzygium cumini (S. cumini) of the Myrtaceae family has been widely used to treat diabetes by traditional healers for centuries. S.cumini is commonly called jamun, black plum or indian black berry. but also by improving lipid metabolism and antioxidant status etc. Therefore research from plants known traditionally may be clinically useful or may have new effects, such as promoting ukw cell proliferation. It is therefore possible to discover new drugs with new mechanisms. This study performed the effect of jamun seed powder on glycemic control, dyslipidemia in type 2 diabetes studies and the control group.[3]

Characteristics Of Jamun

Scientific Names

Eugenia jambolana Lam., Myrtus cumini Linn., Syzygium jambolana DC., Syzygium jambolanum (Lam.) DC., Eugenia djouant Perr., Calyptranthes jambolana Willd., Eugenia cumini (Linn.) Druce., and Eugenia caryophyllifolia Lam

Popular Name

Jambolão, jamun, jamblon, jambolana, jamoon, black plum, blackberry, jamelão, jalão, azeitona-roxa, murta, jambuí, oliva, oliveira, java plum, portuguese plum, malabar plum, purple plum, damson plum, jaman, jambu, jambool, jambhool, jamelong, jamblang, jiwat, salam, jambeiro.

Table 1:Taxonomical Classification[4]

1	Domain	Eukaryota
2	Kingdom	Plantae
3	Phylum	Spermatophyta
4	Subphylum	Angiospermae
5	Class	Dicotyledonae
6	Order	Myrtales
7	Family	Myrtaceae
8	Genus	Syzygium
9	Species	Syzygium cumini

Morphological Characteristics Of Syzygium Cumini (Jamun)[5]

Jamun is a large evergreen and dense tree with dense gray bark, which produces wood scales. The wood is white, strong and durable; gets black dye and gum Kino type. The leaves are leathery, ovate-ovate to elliptic or obovate-elliptic with a length of 6 to 12 inches (extremely flexible, smooth and shiny with many nerve fibers within the border), the tip is broad and very thin. The panicles are mainly taken from the lower branches of the leaves, which are usually axillary or terminal and are 4 to 6 inches long. The flowers are fragrant, greenish-white, with only a few clusters of 10 to 40 and are round or oblong and are found in dichotomous paniculate cymes. The calyx is shaped, about four inches [4 mm] long, and has teeth. The leaves are joined together and fall together like a small disk. The stamens are as large and long as the calyx. Several varieties have been developed, varying in color and size of the fruit, including improved varieties that produce blue or white flesh and fruitless seeds. The fruits are berry and are usually oblong, 1.5 to 3.5 cm long, dark-purple or almost dark, shiny, fleshy and edible; contains one large seed.The plant produces small purple plums, with a very sweet flavor, which turns slightly to the edges of the pulp as the fruit grows. The ripe fruits of dark violet give the appearance of an olive tree both in weight and shape and have an astringent taste.

a.Plants, **b. Fruits**

c.Dried seed, **d. Dried powder**

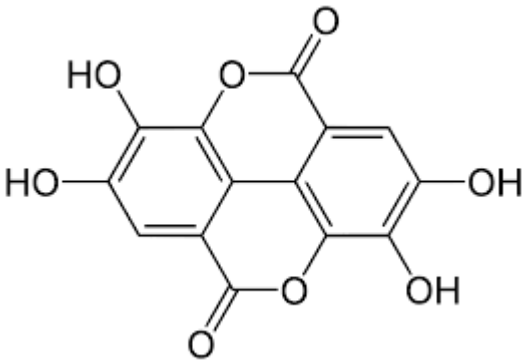
Fig 1: Syzygium cumini

Table 2: Phytochemical Constituent[6,3]

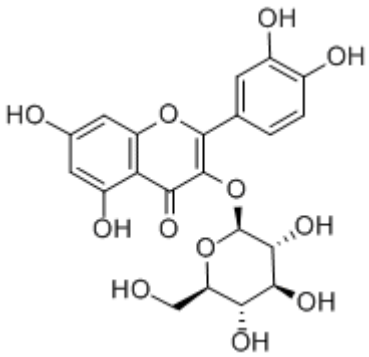
S.No	Plant Part	Phytochemical
1	Fruit Pulp	Anthocyanins, diglucosides of delphinidin, petunidin, malvidin, peonidin, and cyanidin.Volatile oils (α-pinene, ß-pinene, ß-myrcene, cis-ocimene, trans-ocimene, terpinolene, linalool, 4 terpineol, α-terpineol, cis-dihydrocarvone, caryophyllene, α-humelene, cis-ß-farnesene, cis- α-farnesene, trans- α-farnesene, cis-nerolidol, geranyl butyrate, globulol, widdrol, torreyol, neocedranol, ß-bisabolol)
2	Seed	Ellagitannins, Jambosine, gallic acid, ellagic acid, corilagin, 3, 6-hexahydroxy diphenoylglucose, 1-galloylglucose, 3 galloylglucose, quercetin, β-sitoterol, and 4,6 hexahydroxy diphenoyl glucose
3	Stem Bark	barkFriedelin, friedelan-3-α-ol, betulinic acid, β-sitosterol, kaempferol, β-sitosterol-D-glucoside, gallic acid, ellagic acid, gallotannin, ellagitannin, and myricetine.
4	Leaves	β-sitosterol, betulinic acid, mycaminose, crategolic (maslinic) acid, n-hepatcosane, n-nonacosane, n-hentriacontane, noctacosanol, n-triacontanol, n-dotricontanol, quercetin, myricetin, myricitrin and the flavonol glycosides myricetin3-O-(4"-acetyl)- α-Lrhamnopyranosides. Essential oils (α-terpeneol, myrtenol, eucarvone, muurolol, α-myrtenal, 1, 8-cineole, geranyl acetone, α-cadinol, pinocarvone)
5	Flowers	Flowers Oleanolic acid, ellagic acids, isoquercetin, quercetin, kampferol, and myricetin.
6	Roots	Isohamnetin-3-O-rutinside and flavonoid glycosides

Composition Of Jamun[7]

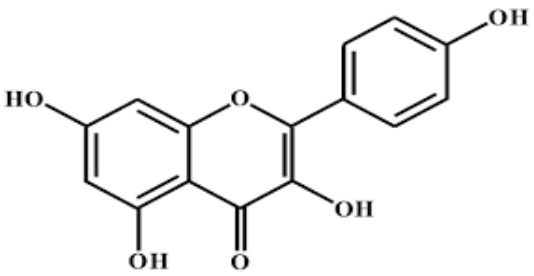
Jamun fruit is generally accepted as a high quality for its medicinal properties especially diabetic due to its effect on the pancreas. Jamun seeds also contain albumen, oils, glycosides, alkaloids; jambosine, resin, ellagic acid, quercetin, gallic acid and elements zinc, vanadium, chromium, sodium and potassium. Sitoterol is present in the undisputed seed oil. Jamun pulp also contains 82.19 ± 2.46% humidity, 2.15 ± protein ± 0.06%, 0.83 amafutha 0.02% crude oil, 1.76 ± fiber ± 0.05%, 2.04 ash 0 0.06% and nitrogen-free components (3 However, Jamun seeds were moist (16.34 ± 0.49%), crude protein (1.97 ± 0.59%), crude oil (0.65 ± 0.01%), green, fiber (4.19 ± 0.12%), ash (2.18 ± 0.06%) and NFE (74.67 ± 2.24%) 1 (Ahmad et al., 2015). This plant is rich in compounds containing anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol and The seeds are said to contain the alkaloid, jambosine, and glycoside jambolin or antimellin, which stop the diastatic conversion of starch into sugar.



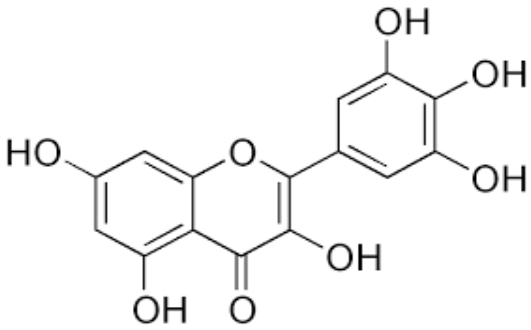
Ellagic acid



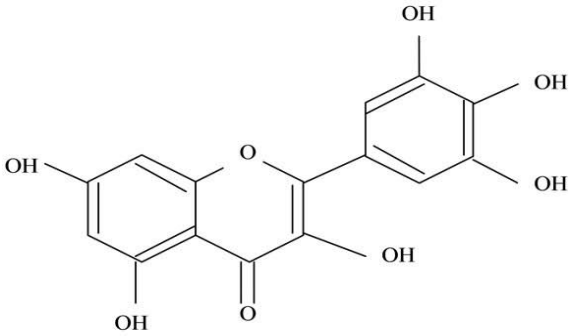
Isoquericetin



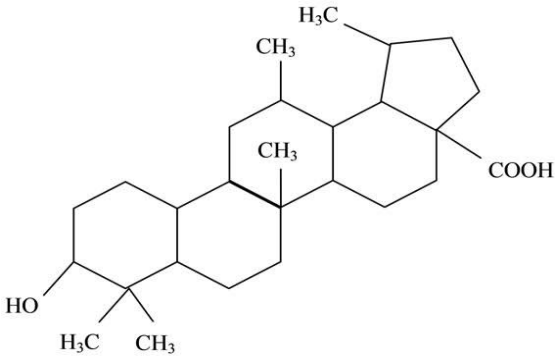
Kaemferol.



Myrecetin



Jambosine



Jambolin

Fig 2: Pharmacological Action of Jamun[8]

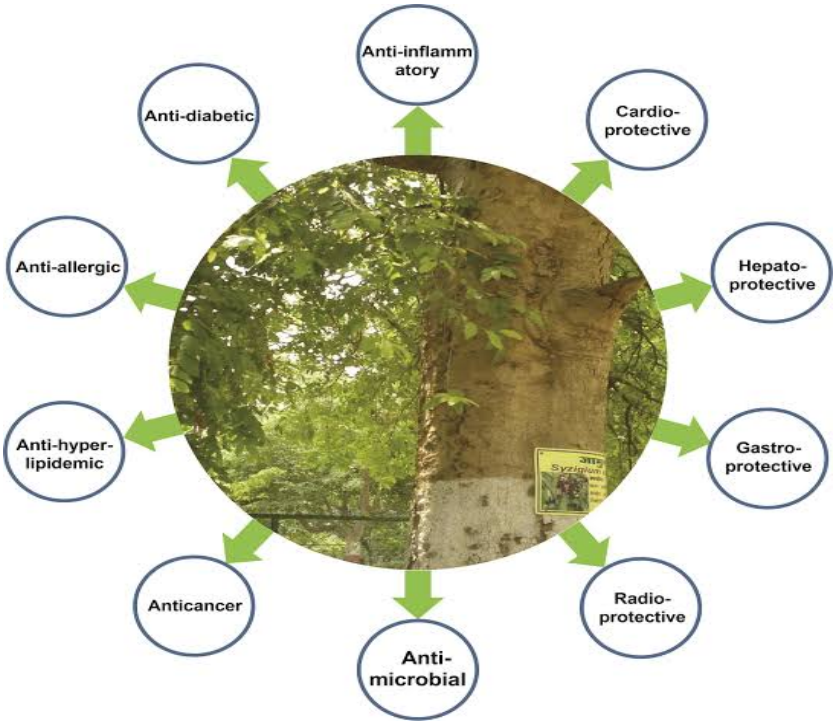


Fig 3: Pharmacological Action of jamun

Antidiabetic Property

The Antidiabetic effect of Jamun has been demonstrated in Ayurvedic pharmacopoeia, claiming that Jamun seed powder is effective in controlling high blood sugar levels. Jamun has been used to control blood sugar levels for more than 130 years in the West however, clinical studies are mixed results. Some of the patients showed control of blood sugar levels after being administered on Jamun treatment indicating a positive response to treatment, while others did not show improvement after treatment. The hypoglycemic effect of various components of Jamun on diabetes control pre-clinical models investigated by several researchers showed that Jamun lowers blood sugar levels. These pre-clinical studies have mixed results as few studies have been negative where no hypoglycemic effect of jamun has been detected in alloxan-induced diabetes mice. However, most pre-clinical reports have shown that different components of Jamun lower blood sugar levels in rat models. Diabetes and clinical status.[9]

Some Experiment and Outcomes

- Extracted seed powder has been shown to lower blood sugar levels in diabetic rabbits. Administration of aqueous Jamun seeds extracted at a dose of 1 g / kg b. wt. in diabetic rats it has been reported to produce a hypoglycemic effect on the blood.
- The lyophilized powder of aqueous seed extract has been reported to lower blood sugar levels in diabetic rats and mice. Similarly, the aqueous seed extract of Jamun comprising gummy fibers has been very effective in controlling diabetes in alloxan diabetes mice. However, in contrast, aqueous extracts without gummy fiber did not affect blood ion levels. Alloxan diabetic rats and rabbits given ethanol extracted from Jamun seeds showed a rapid decrease in blood glucose levels in a previous study.[10]
- Similarly, ethanol-derived Jamun kernel seeds lowered blood sugar levels in diabetic rats produced by streptozotocin and also restored the functions of catalase, glutathione peroxidase and superoxide dismutase enzymes associated with the concentration of glindathione gluten and glutathione they have diabetes. various doses of Jamun seed powder into diabetic streptozotocin-induced mice showed a decrease in fasting glucose levels. Similarly, the treatment of mice with streptozotocin-induced diabetes by 100mg / kg b. wt. seed kernel ethanol extract lowered blood sugar, urea and cholesterol and led to increased glucose tolerance and reduced activity of glutamate oxaloacetate transaminase and glutamate pyruvate transaminase.[11]
- Decreased blood sugar levels in diabetic mice induced by streptozotocin have been reported after treatment with mycaminose isolated from Jamun and ethyl acetate and methanol extracts from Jamun seeds in a previous study. Treatment of alloxan-induced diabetes mice with rats with Jamun seed methanol extract has been reported to lower serum glucose levels early.
- Management of Jamun seed extract of ethanol reduced blood serum glucose levels in diabetic rats produced by streptozotocin in some studies. The sepadex gel separated from the active ingredient in the ethanol component extracted from Jamun has been reported to reduce the glucose level in serum to the mild and heavy alloxan-indated sugar in mice.
- Administration of streptozotocin-induced type -II diabetic mice containing 400 mg / kg of extracts of Jun extract has been found to lower glucose levels to normal levels and increase the production of PPARγ and PPARα proteins in rat liver. Aqueous Jamun seed extract has been reported to reduce serum glucose levels in alloxan-induced diabetes mice.[12]
- Adding Jamun seed powder to a person's diabetic head for 30 days reduces fasting rate and post prandial blood glucose. Liquid and methanol extracts of the roots, stem, leaf and seeds extracted from Jamun have been reported to lower glucose levels in serum in alloxan-induced diabetes in Sprague Dawley mice.
- Recently, the administration of ethanol extracted from Jamun seeds and fruits for 60 days lowered serum sugar levels in hyperglycaemic / diabetes mice and for the first time was more effective than later. Powder for various forms for 60 days showed a significant decrease in serum glucose levels and relief from symptoms including fatigue, polyurea and fatigue. diabetes. Reduce fasting blood sugar levels by 9%, 18%, and 30% and post prandial glucose by 8%, 15%, and 22% after 30, 60, and 90 days, respectively.
- Numerous studies on fruit pulp have been found to be effective in treating diabetes with a mouse

model of diabetes mellitus. Treatment of diabetic rats treated with streptozotocin with Jamun fruit lyophilized pulp extract did not eliminate high blood sugar levels in a Brazilian study, while both liquid and ethanol extracts of Jamun fruit pulp lowered blood sugar in alloxan mice. and the aqueous extract was higher than the extracted ethanol. The aqueous Jamun fruit pulp extract was reported to reduce serum glucose levels in Wistar female rats produced by streptozotocin, however, the compound Jamun fruit extract and stem bark extract of Cinnamon zeylanicum were more effective than the treatment alone. Methanol extracted from Jamun fruit (pulp, seeds, seed coat and kernel has been found to produce a high antidiabetic effect recently.[13]

- In addition to seeds and fruit, Jamun stem bark was also found to be effective in lowering blood sugar levels in diabetic rats. The release of ethanol of Jamun bark has also been found to reduce blood glucose levels in mice.46 The aqueous leaf extract of Jamun reduced adenosine deaminase activity and glucose levels in the serum of diabetic patients.
- Recent research on oral administration of ethanol leaf 100mg / kg b. wt. of Jamun has been found to reduce insulin resistance and lower blood sugar levels in the sugar caused by dexamethasone in mice.

Recent Advanced Study

Various preclinical and clinical studies have been performed to evaluate the anti-diabetic potential of S.cumini.

1. Evaluating the strength of both jamun seeds (Syzygium cumini) and fruit ingredients against hyperglycemia.
   Methods - Sprague Dawley male rats are used to test the hypoglycemic power of jamun extracts. Aimed at, jamun fruit and seeds of ethanolic extracts based diet were given to a normal and high sucrose diet caused by rats hyperglycemic / diabetes for 60 days. Serum glucose levels and insulin levels are monitored at intervals of each month to assess the hypoglycemic effect of jamun extracts.
   Results - Results of a quick study showed that both seeds and extracts lowered blood sugar levels significantly and regulated insulin levels in hyperglycemic mice. It was noted that jamun fruit extract attenuated serum glucose levels to 5.35% and 12.29% in normal and hyperglycemic mice, respectively; while insulin levels improved by 2.82% and 6.19%, respectively. Although, the extraction of jamun seeds reduced glucose to 7.04% & 14.36% and showed insulin levels of 3.56% and 7.24% higher in normal and hyperglycemic mice, respectively. [14]
2. Method: -The extract of SC containing water and alcohol was tested for its ability to fight diabetes in rabbits with alloxan diabetes.
   Result: -It has been found that aqueous extract is very effective in improving blood glucose in glucose tolerance tests and in reducing glucose fasting.
3. Method: -Getting the effect of Syzygium cumini (jamun) powder on glycemic control 99 patients with type 2 diabetes patients with poor glycemic control of which 50 patients received 10 gm of jamun seed powder supplementation in double dose daily. before meals and oral hypoglycemic agents continued as before and 49 patients received placebo with oral hypoglycemic agents continuing as before. All patients were monitored for a total of 90 days,
   Result: No significant weight change, B.M.I., Waist circumference, hip rotation, neck rotation and frozen hip measurement. The results of the present study have largely demonstrated the effect of jamun seed powder supplementation in improving glycemic control and dyslipidemia.[1]
4. Numerous studies have been conducted to demonstrate the beneficial effects of SC released on normalizing lipid profiles in diabetic rats, elevating serum insulin and increasing SOD and GPx activity. SC seeds have a protective effect on diabetes-related complications such as neuropathy, gastropathy, nephropathy, diabetic cataract and peptic ulcer reduction.[15]
5. SC has the ability to inhibit carbohydrate hydrolyzing A polyherbal formulation (ADJ6) enzymes containing SC and other antidiabetic drugs that have shown significant inhibitory action against α-glucosidase and α-amylase. SC seeds have shown the ability to regenerate pancreatic islet cells in streptozotocin mice and alloxan diabetes mice. Various clinical studies have been conducted to confirm the use of SC in sugar. In a newly opened randomized controlled trial, people with type II diabetes were given a standard SC seed powder that showed a decrease in blood sugar,

insulin resistance and high HDL cholesterol at the end of month.[15]

Mechanism Of Action Of S.Cumini[16,3]

Many scientists have studied the possible mechanism of action of S.cumini. According to Achrekar et al., Extracts of the juice of fruit pulp of E.jambolana have shown hypoglycemic activity by stimulating insulin production. Bansal et al. reported an increase in plasmainsulin induced by S seeds. cumini could be called toproinsulin insulin modification possible by pancreatic cathepsin Band or its production. S. cumin has a dual effect i.e. a combination of the mechanism of sulfonylurea and biguanids.B. Sharmaet al. showed that the anti-hyperglycemic effect of the flavonoid-rich ex-tract of S seeds. cumini due to its direct insulinotropic action. In vivo research using mice Goto-kakizaki (GK), Shinde et al. examined, the release of ac-etone was a potent inhibitor of alpha glucosidase hydrolysis of maltose compared with untreated control animals. This effect therefore points to the inhibition of alpha glucosidase as a possibility. Kumar et al., A mycaminose isolated from S.cumini seed methanol with antidiabetic activity. The potential mechanism of action may be due to the potential for plasma insulin effect by increasing the insulin production of the pancreas in ß-cells of isletsof Lagerhans or its release in bound form. A mycaminose-like form of glibenclamide.

PPAR-y - Peroxisome Proliferator Activated receptor gamma, *NF-kB- Nuclear factor Kappa -light Chain enhancer

Fig 4: Mechanism Of Action Of S.Cumini

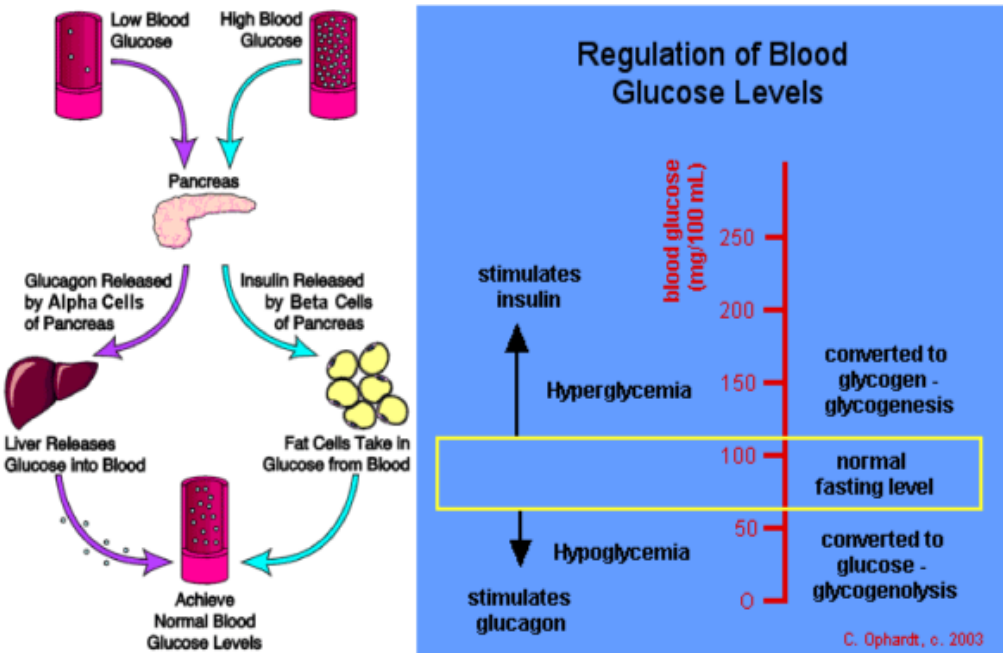


Fig 5: Regulation of blood glucose lavel. [3]

Major Pharmacological Action Of S.Cumini (Jamun) [2]

Jamun has following major Pharmacological property including inhibition of cycloygenase, PPAR-y receptors which play a significant role in diabetes.

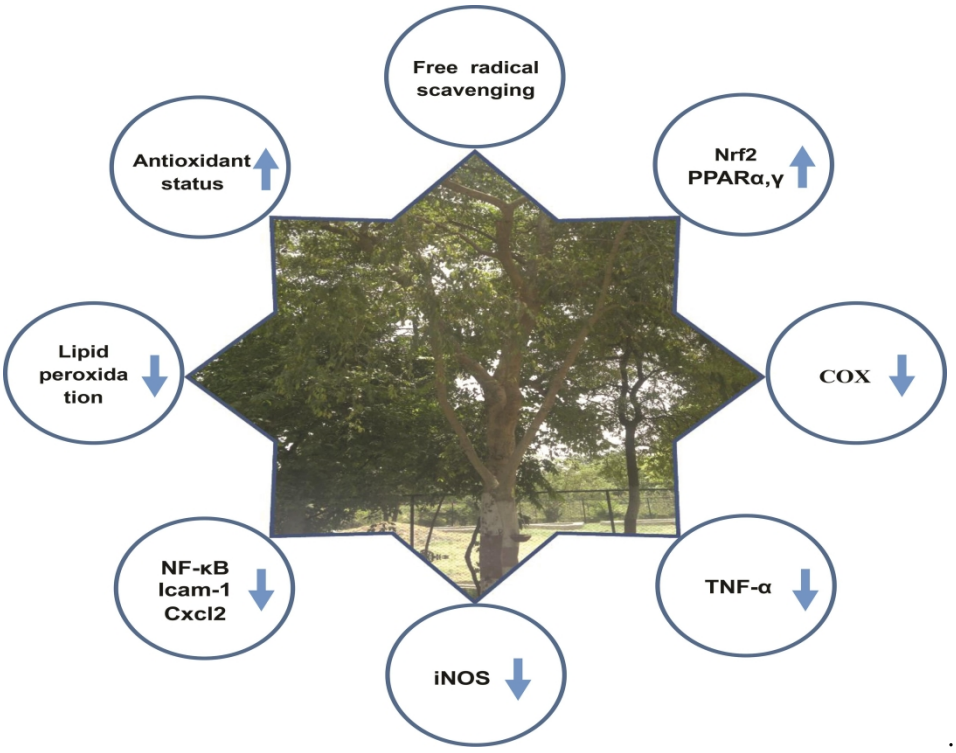


Fig 6: Major Pharmacological Action of S.cumini

Insulin Mimetic And Insulinotropic Effect[17]

The pancreatic β-cell acts as a neurotransmitter in the sense of sugar to regulate glucose homeostasis. Any degeneration of these cells is a major factor in the development and progression of diabetes due to the combined effects of genes and genes. Patients with type 2 diabetes have reduced the number of islet and / or reduced the number of beta cells in the pancreas due to increased beta cell death. Therefore, effective and targeted strategies for the prevention and treatment of non-insulin-dependent diabetes should be focused. Seed of S. cumin is very rich in phenolics and flavonoids with antioxidant activity. Quercetin, a flavonoid that helps to stimulate pancreatic β cells and stimulates the release of insulin in diabetic rats produced by streptozotocin. The intraperitoneal injection of quercetin significantly reduced glucose levels in plasma, GTT, plasma cholesterol and triglycerides in diabetic rats, and hepatic glucokinase activity was found to be significantly higher.[18]

Activation Of The Nuclear Receptor Ppar-Γ

PPARs are a group of nuclear receptor proteins, which regulate carbohydrate and lipid metabolism by treating energy homeostasis as components of the compound. This large nuclear receptor family is of three types: PPARα, PPARβ / δ and PPARγ. Among them PPARγ is present mainly in adipose tissue and regulates insulin resistance, lipid retention and adipocyte secretion. Insulin production from pancreatic islands has been found to increase in diabetic rats induced by streptozotocin after oral administration of a rich flavonoid of S seeds. cumini. This rich flavonoid release significantly established dual-regulation function in both PPARα and PPARγ in a dose-dependent manner and was found to increase up to 3-4 fold over control and assist in the separation of adipocytes into preadipocytes.[17]This observation clearly elevates the regulation of PPARα and PPARγ and its beneficial effects as hypoglycemic. Higher control of the expression of PPARγ and PPARα proteins in the hepatic tissue was also noted for the fluid secretion of S. cumin in streptozotocin produced by diabetic mouse at a dose of 400mg / kg. PPARγ agonists activate PPARγ and increase Glut-4 secretion and glucose uptake. Methanolic extracts of A. marmelosand S. cumini increases glucose uptake by increasing PPARγ Glut-4, and PI3 kinase by activating the sugar transport system.[18]

Prevent Glucose Absorption

Absorption of glucose monomers after the breakdown of complex carbohydrates in simple sugars with alpha-glucosidase and alpha-amylase in the intestines causes postprandial hyperglycemia. The risk of becoming a chronic complication of secondary complications increases in postprandial hyperglycemia due to non-enzymatic glycosylation of the protein and is difficult to manage in the first stage. Inhibition of intestinal α-glucosidase in the small intestine during carbohydrate metabolism and its absorption helps to control postprandial hyperglycemia.[19] Inhibition of α-amylase and α-glucosidase, which are carbohydrate-hydrolyzing enzymes that reduce digestion and absorption in the digestive tract, would be an effective treatment for postprandial hyperglycemia in diabetes. Hypoglycemic effect of various S quotes. cumini seed kernel was tested against various alpha-glucosidase, such as B. stearothermophilus (bacterium), S. cerevisiae (yeast), and mammalian (mouse intestines) for their function of inhibiting α-glucosidase in Goto-Kakizaki (GK) mice. Among them alpha-glucosidase from the intestines of mice was found to be more effective in preventing maltase, compared to acarbose, from good control. Thus many alpha-glucosidase and α-amylase inhibitors have been identified from different S-releases. cumin, α-glucosidase and pancreatic α-amylase inhibitors can be used to monitor the onset and progression of type II diabetes and will be of great benefit. strategy for managing the disease.[20]

CONCLUSION

Jamun, Syzygium cumin has been used in traditional medicine to treat diabetes. The hypoglycemic and hypolipidemic activities of Jamun may be triggered by free radicals as diabetes is caused by excessive oxidative stress, high activity of catalase glutathione peroxidase, glutathione-s-transferase and increased glutathione concentration are associated with and decreased lipid peroxidation. Jamun may have activated PPARγ and PPARα genes that suppress the uptake of NF-κB, COX, NOS, TNF- α and other inflammatory cytokines following Nrf2 regulation. Syzygium cumin has been widely used by traditional healers for diabetes and its related problems for centuries. Numerous clinical and experimental studies have confirmed that S. cumin and its distinctive component, especially seeds are very effective in

controlling diabetes. The various active ingredients present in the seeds regulate glucose homeostasis by attacking the hyperglycemic pathways through a variety of mechanisms. Seed of S. cumin is widely used as an antidiabetic drug to treat type 2 diabetes mellitus II and the hypoglycemic behavior of this genus is due to its Insulin mimetic and insulinotropic effect. It acts as an antidiabetesic drug or by promoting the release of insulin into beta cells or by reducing intestinal glucose absorption, production of glucose in the liver and improving insulin sensitivity by improving the absorption and utilization of peripheral glucose, activating nuclear receptor PPAR - γ. Overall, there is compelling evidence that parts of S. cumin has antihy-perglycemic properties that have been confirmed mainly by a large number of animal studies.

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