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Review Article

Jamun- ‘’A Traditional Remedy with Modern Antidiabetic Application

Lahane Nikita*, Gaikwad Tejaswini, Akanksha Pawar

Institute of Pharmacy Loni KD.

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ABSTRACT

Jamun (Syzygium cumini) or Indian blackberry has been used in old days for healing, especially in the fight against diabetes. It is full of good stuff like anthocyanins, ellagic acid and flavonoids. The fruit, seeds and bark of Jamun can do many good things, like fight against free radicals, stop swelling and help cure diabetes. Old time medicine used Jamun in ways that are still in use today. Old medicine people used it in systems of medicine called Ayurvedic and Unani to keep blood sugar levels in check and boost the health of the body’s systems. Scientists have now looked into Jamun and found that the plant can now do many of the things that a person with diabetes needs. Tests have proved that many different extracts of Jamun can work like insulin, change the way sugar is used in the body and cut back on the way the body fights against insulin. One thing that is very good about Jamun is a thing called jamboline. It keeps away two enzymes called alpha-amylase and alpha-glucosidase. Both of these enzymes help to slow down the rush of sugar into the blood after eating. Jamun’s rich polyphenol content helps to fight against the effects of free radicals in the body. This can keep the body’s very small, but very important, insulin producing factory (pancreas) from harm. It can help the body to use the insulin that it makes and can help the body make more insulin. This short paper looks at how Jamun has gone from an old cure to a new cure for diabetes. By mixing old cures with new facts, Jamun may be a good choice for natural cures for Type 2 diabetes. Besides, if we look closely at what Jamun is made of, we might be able to create good foods and herbs for people who have diabetes.

INTRODUCTION

Jamun (Syzygium cumini), called the Indian blackberry by some, is a fruit that grows in the warm lands of the Indian subcontinent. It has a long history of use in ancient forms of medicine such as Ayurvedic and Unani. For many years, Jamun has been known for its health value, especially for its ability to help control blood sugar. It is said to be a strong natural cure for those who have diabetes, a condition that is spreading at a fast pace in today’s world. The fruit itself, and

***Corresponding Author:** Lahane Nikita
Address: *Institute of Pharmacy Loni KD.*
Email ✉: lahanenikita8822@gmail.com

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the seeds and bark of Jamun, have all been used in traditional forms of healing to treat many different diseases. But its use for controlling blood glucose levels is the one that is most well-known. The action of Jamun for helping with diabetes can be linked to the many bioactive compounds it contains. These compounds include anthocyanins, flavonoids, alkaloids, and tannins. These compounds have been shown to have effects as antioxidants, anti-inflammatories, and as anti-diabetes agents. In traditional forms of medicine, the powdered form of the seeds, extracts of the fruit, and even the bark have been used in formulas that help with the symptoms of diabetes. These formulas often boost the insulin sensitivity and lower hyperglycemia. As the world sees an increase in the number of cases of Type 2 diabetes mellitus (T2DM), which is a long-term disease of the body's metabolism, scientists are now looking more at Jamun for its possible role as an approach to treat modern disease. There have been some studies that have supported its traditional use by showing that it can help with how the body uses glucose, boost how it makes insulin, and lessen the damage caused by free radicals, all of which are key factors in the treatment of diabetes. Considering its nutritional and functional qualities, the seed has been applied in different food formulations, such as cookies, biscuits, chips, and wine. Researchers have also explored the antioxidant potential of the seed and established its application in extending the oxidative stability of various food matrices. The nutritional and phytochemical profiles of jamun seeds revealed that they could be a novel source for pharmaceutical and food industries. This review gives insight into the nutritional aspects of jamun seeds along with their applications as an ingredient in the formulation of functional food. It also highlights the safety aspects involved in the consumption of JS, thus paving the way for further research to develop a variety of functional foods using jamun seeds or their extracts within safe acceptable limits.

Objective:

1. Looking into old ways Jamun was used to treat Diabetes:

- Find out how Jamun (Syzygium cumini) was used in old times as a way to fix blood sugar levels.
- See how old ways from all over the world (mainly in India) used parts of Jamun plant to fix Diabetes and its signs.

2. What's in Jamun (Phytochemical Composition of Jamun):

- Find out what is in Jamun (like anthocyanins, flavonoids, alkaloids, and tannins) that could make it good against Diabetes.
- See how those things work with ways that cells use sugar, change how the body reacts to insulin, and fix damage from free radicals.

3. How science today has shown Jamun's use in fighting against Diabetes:

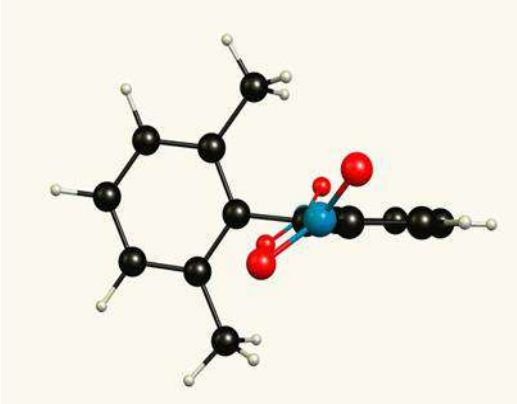
- Look at new studies, tests, and tests that have checked whether Jamun and its parts can fight against Diabetes.

Phytochemical Analysis:

Numerous phytochemicals are produced by leaves, roots, stems, fruits, and seeds of Jamun. Jamun leaves extracted in ethanol, water, chloroform, hexane, ethyl acetate, petroleum ether, and methanol showed the presence of alkaloids, anthraquinones, cardiac glycosides, glycosides, flavonoids, phenols, phytosterols, saponins, steroids, tannins, proteins, triterpenoids,

mucilage, carbohydrates, amino acids, fats, fixed oils, volatile oil, and terpenoids. The micronutrients including copper, calcium, iron, manganese, magnesium, nitrogen, potassium, sulfur phosphorus, and zinc were reported from Jamun leaves. Analysis of the ethanol leaf extract of Jamun indicated the presence of flavonoids, tannins, terpenoids, and carbohydrates, whereas the chloroform, ethyl acetate, and methanol Jamun leaf extracts contained carbohydrates only. The glycosides, resins, phenols, saponins, and proteins were detected in the Jamun leaf acetone extract whereas acetone stem bark extract showed alkaloids and flavonoids. The analysis of acetone Jamun root extract showed the presence of alkaloids, flavonoids, glycosides, phenols, resins, saponins, and proteins. The stem bark extracted in ethanol of Jamun showed alkaloids, anthraquinone, catechins, glycosides, phenols, phytosterols, quinones, saponins, steroids, tannins, terpenoids, amino acids, whereas methanol stem bark extract contained flavonoids additionally. The aqueous Jamun stem bark extract showed flavonoids, catechins, phenols, and quinones.

Chemical Properties and Interactions: Jambolin



Solubility: Jamboline, being a glycoside, is usually soluble in water, which means it can be taken up in the gut after taken by mouth.

Stability: The hydroxyl groups and the glycosidic bond make jamboline fairly stable under normal conditions but able to be broken down by enzymes in the gut, which can free the active flavonoid.

Morphological characteristics:

1.Morphological Characteristics of Jamun

Jamun is a tree that grows in warm places. It is part of the Myrtaceae family. Both the tree and its fruit are easy to tell apart because they look very different from each other:

Tree (Syzygium cumini)

• **Height:** The tree grows very tall, about 30-40 meters.

• **Bark:** The bark is gray-brown and has a smooth look to it.

• **Leaves:** The leaves are long and thin, with a shiny green surface. The leaves grow directly across from each other and have no ridges or bump on their sides.

• **Flowers:** The tiny, white or pinkish flowers grow on small bunches. There are many stamens in each flower. They also make the tree look pretty.

• **Fruit:** The fruit is a berry and is deep purple to black when ready. It is square or round, and it is full of juice and has a sweet and tart taste with a strange smell. The fruit is around 2–3 cm long and has 1–2 seeds in the center of it.

Fruit Characteristics

• Color: dark purple to black when ripe.

• Size: around 1–3 cm long.

• Taste: sweet and a bit bitter when fully ripe.

• Texture: The skin is thin and smooth, with a juicy, somewhat fleshy interior.

• Seed: Hard, usually around 1–2 seeds in each fruits.

2. Jamun's Uses in Old Days

Jamun has been used in old time medicine, mainly in Ayurveda, to cure many ills:

• Gut Problems: Jamun helps food to go smoothly and fixes diarrhea and dysentery.

• Astringent: The fruit has astringent qualities, which tighten the stomach and stop bleeding.

• Antioxidant Powers: Full of anthocyanins and polyphenols, Jamun is a strong antioxidant.

• Control of Blood Sugar: The seeds of Jamun are used to cure high blood sugar and are thought to have big blood sugar lowering effects.

3. New Use of Jamun in Medicine

Findings on the use of Jamun in the treatment of diabetes show good results due to its active bio-compounds:

• Active Ingredients: Jamun has jamboline and jambosine. They are alkaloids in the seeds. They work by stopping the enzyme alpha-amylase. This enzyme turns carbs into sugar.

• How it works:

o Lower sugar: Jamun seeds help you not to get high sugar after a meal, by slowing down the carbs turning into sugar.

o More insulin: Jamun helps the cells in the pancreas that make insulin to work better. This helps your body use sugar better.

o Protection from stress: The anti-oxidant features of Jamun help your body not to deal with stress, which is a big part of having diabetes.

• Jamun Leaf Extract: The leaves of the Jamun tree also have healing powers, mainly in the form of effects that lower sugar. The leaf extract has been shown to help the body use insulin better and lower sugar levels.

• Other Good Things:

o Keeping weight: The anti-inflammatory and fat lowering powers of Jamun may help in lowering body fat and helping insulin work better.

o Heart health: Jamun can also help the heart by making sugar levels better and lowering what stress does to the body.

4. Scientific Research on Jamun for Diabetes

• Clinical Trials: Many studies and tests have proved Jamun's use for diabetes. One such test found that Jamun seed powder, taken by diabetic rats, had a big effect on blood sugar and cholesterol.

• Phytochemical Studies: Phytochemical tests found many things in Jamun, such as flavonoids, tannins, terpenoids, and alkaloids, all of which add to Jamun's health roles, especially its power to fight inflammation and lower blood sugar.

5. Formulations

Since Jamun has such good power to fight diabetes, you can find it now in many ways:

• Powder (from seeds and leaves).

• Jamun extracts in pills or tinctures.

• Jamun juice.

• Jamun syrups.

People often use these forms as food supplements or with other herbs to treat type 2 diabetes.

2 Health benefits of jamun seeds

- Jamun fruit seeds have been shown to help diabetic patients with a variety of issues, including lowering blood glucose levels and delaying the development of complications like neuropathy and cataracts. Jamun fruit also lowers blood sugar levels, which makes it a key component in the management of diabetes.
- Jamun seeds have a number of bioactive substances that help to control the blood lipid profile the methanolic extract of jamun seeds demonstrated cytotoxic action against the colon cancer cell line .
- The jamun seed extract demonstrated antibacterial potential against human bacterial infections that were multidrug resistant.

Mechanism of action:

1.Inhibition of carbohydrate-digesting enzymes

Seed-made phenolic items do act as strong α-glucosidase inhibitors, cut down on the breakdown of complex sugars into glucose and slow post-meal glucose absorption.

2. Anti-glycation and antioxidant effects

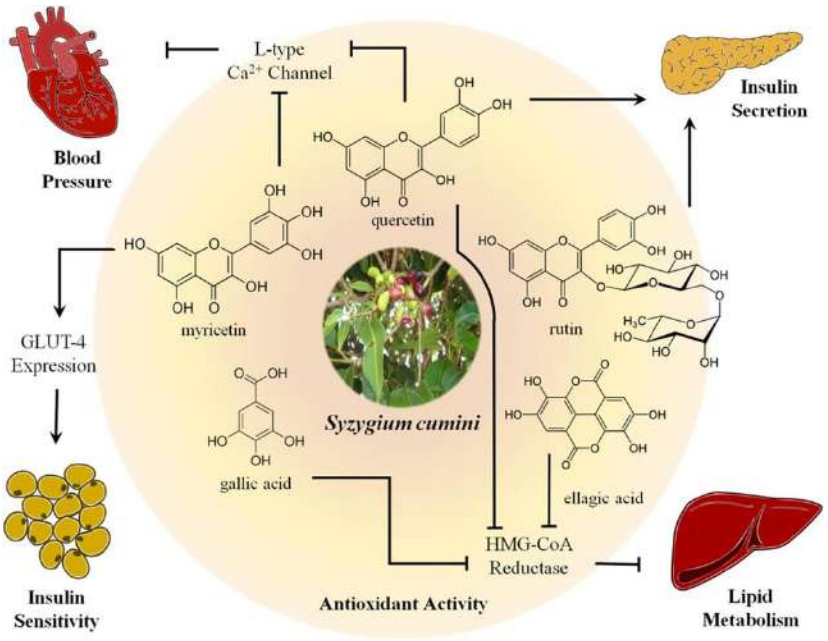
- Phenolic extracts from seeds strongly cut back advanced glycation endproduct (AGE) formation, as good as or better than synthetic agents like aminoguanidine
- Jamun seeds and extracts also catch reactive oxygen species (ROS), boost actions of antioxidants like SOD, catalase, glutathione peroxidase, and bring back less glutathione levels in tissues.
- All this helps to keep ß-cells safe from the harm of oxidative stress-caused damage, in turn slowing down diabetic problems.

3. Enhancement of insulin secretion and preservation of ß-cells

- Preclinical studies in diabetic rodents show big jumps in plasma insulin, and better glucose tolerance and glycogen storage after jamun

seed extract treatment, showing boost of insulin release from remaining ß-cells.

- Jamun extract also seems to cut down insulin breakdown, keep higher levels of insulin in blood.
- Some triterpenoid-rich fruit extracts keep the pancreatic islet cells, help ß-cell survival, and better ß-cell/iThe Akt cell signal in liver, cutting down on gluconeogenesis in streptozotocin-diabetic mice



Future prospect:

1. Nutraceutical & Pharmacological Development

• Jamun seeds have a lot of good stuff in them, like gallic acid, corilagin, ellagic acid, flavonoids, and jamboline. They have shown to fight sugar disease, fight off harmful stuff in the body, fight cancer, fight swelling, kill bad bugs, help the heart, help the liver, and help the brain in many test labs and in real best ways Reddit+9ScienceDirect+9PMC+9.

• People who study them say that we should turn seed extracts into good food and medicines, especially for fighting sugar disease and body problems—a problem for health around the world ScienceDirectMDPI.

• We still do not have enough tests and studies on the seed extracts; more work is recommended to find the exact safe stuff, prove how it works, and see if it is safe for people SCIRPScienceDirect.

2. Genomics, Agronomy & Breed Improvement

• The genome of S. cumini was recently decod-ed by people at IISER Bhopal as part of the G-India Project. It found some genes for stress tolerance (drought, salinity, heat), disease resistance and resilience. These are key traits to breed climate-ready types ThePrint.

• Better types like Goma Priyanka and CISHJ 37, made by ICAR, now give high yield, high pulp content, small size, and work well for high count planting in many Indian states. These types are already raising farm pay in semi dry parts Indian

Council of Agricultural Research+1ACS Publisher+1.

• Recent genotype surveys (for example, 2022–23 work at Rahuri, Maharashtra) show big fruit-quality difference between local Jamun types. This shows room to improve taste, sugar/acid balance, and health value Biochemistry Journal.

3. Digital Tools: AI & Disease Management

• Though not yet used on Jamun, machine learning and computer vision have been used to find leaf disease in related species. There are many reviews that say to try these tools (e.g. CNNs, Vision Transformers like GreenViT, Tiny LeViT) to Jamun to help make it easier to do diseases' diagnosis and better orchard management arxiv.org.

4. Economic & Market Outlook

• More and more people are aware of Jamun's good points—plus, there are new value added products being made—so there is great potential for local and global markets Wikifarmeragriculture.institute.

• With the GI status (given in March 2024 to Badlapur Jamun and Bahadoli Jamun in Maharashtra), there is more interest in giving local varieties a brand to increase the local economy, and tourism markets..

CONCLUSION:

Jamun has interesting forms and is hot on the inside, with many uses to lower sugar in the blood. The fruit and what is in the seeds are good parts of the jamun to help in lowering sugar in the blood.

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