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A REVIEW ON MORPHOLOGY: THE ROLE OF JAMUN, SYZYGIUM CUMINI IN THE TREATMENT OF DIABETES & PHYTOCHEMICAL STUDY

Shantanu Chothe*1, Krushna Dhole*2, Mohan Phad*3, Tabassum Attar*4, Dr. Sunil Kolhe*5

*1,2,3Student, Department Of Quality Assurance, College Of Pharmaceutical Science & Research, Ashti, Maharashtra, India.

*4Assistant Professor, Department Of Quality Assurance, College Of Pharmaceutical Science & Research, Ashti, Maharashtra, India.

*5Principal, Department Of Pharmaceutical Chemistry, College Of Pharmaceutical Science & Research, Ashti, Maharashtra, India.

ABSTRACT

A significant tropical tree species that is native to South Asia is Syzygium cumini, also known as Jamun. In this in-depth assessment, we carefully examine the morphological characteristics, phytochemical components, and their significant therapeutic importance in the management of diabetes. S. cumin is distinguished morphologically by its medium height, elliptical and glossy leaves, and the production of tiny, elliptical, purple-black berries with a peculiar sweet-tart taste profile. Jamun's bark, leaves, and fruits have been used therapeutically for thousands of years by traditional medical systems, which attribute antidiabetic characteristics to them. The empirical data supporting jamun's function in the treatment of diabetes are rigorously examined in this study. Scientific studies have shown the hypoglycemic effects of jamun, mostly because of its complex composition ellagic acid, anthocyanins, and tannins are only a few of the bioactive substances in the spectrum. Together, these synergistic phytochemical components promote increased insulin sensitivity, reduce glucose absorption, and alleviate oxidative stress, which results in notably improved glycemic control. In addition, a thorough phytochemical investigation performed here confirms the existence of these beneficial components, supporting the long-standing conventional medical wisdom that supports the use of jamun for the treatment of diabetes. These results highlight the significant potential of S. cumini as a complementary natural treatment for diabetes. They want more research to clarify the complexities of its molecular foundations and enhance its therapeutic uses. To properly utilize jamun's medicinal potential to fight the global diabetes pandemic, a thorough study of its morphological traits and bioactive components is necessary.

Keywords: Jamun, Antidiabetic, Ayurveda, Nutrients, Insulin, Nutraceutical Supplement.

I. INTRODUCTION

Common names for the Syzygium cumini (L.) plant include Jamun, Indian Blackberry, Black Plum, Jambul, Java Plum, and Jamblang; other names for the plant include Syzygium jambolanum and Eugenia cumini1. East African subcontinent, Madagascar area, South and Central America, and the United States.

All plant components, including the stem, bark, fruit, leaves, seeds, and roots, have been utilized ethnically to cure several ailments2. The plant is most well-known for its berries or fruits, which are used medicinally to cure conditions including cough, diabetes, inflammation, ringworms, chronic diarrhea, and dysentery3. Jamun is a fruit that is both edible and traditionally used as medicine. It is a fruit that is full of nutrients. The fleshy berries known as jamuns have an oval form and a single, dark brown seed in the center that is loaded with a variety of bioactive substances.

It was originally indigenous to India, Myanmar and Sri Lanka before being spread to Himalayan Asia, China, Eastern Australia, and the Southeast Asian islands.

In the Indian subcontinent, Syzygium cumini has significant cultural and historical value. It is frequently linked to many religious and traditional practices. In Hindu tradition, for example, the tree is associated with Lord Kubera, the deity of riches, and may be found in temple courtyards. The fruit's role in traditional Ayurvedic therapy and reference in ancient Sanskrit manuscripts underline its historical significance.

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Fig 1: Syzigium cumini

Aside from religious and therapeutic value, the fruit of the Java Plum tree is important in cultural festivities and festivals. It is a fertility symbol that is commonly utilized at weddings and other auspicious occasions4.

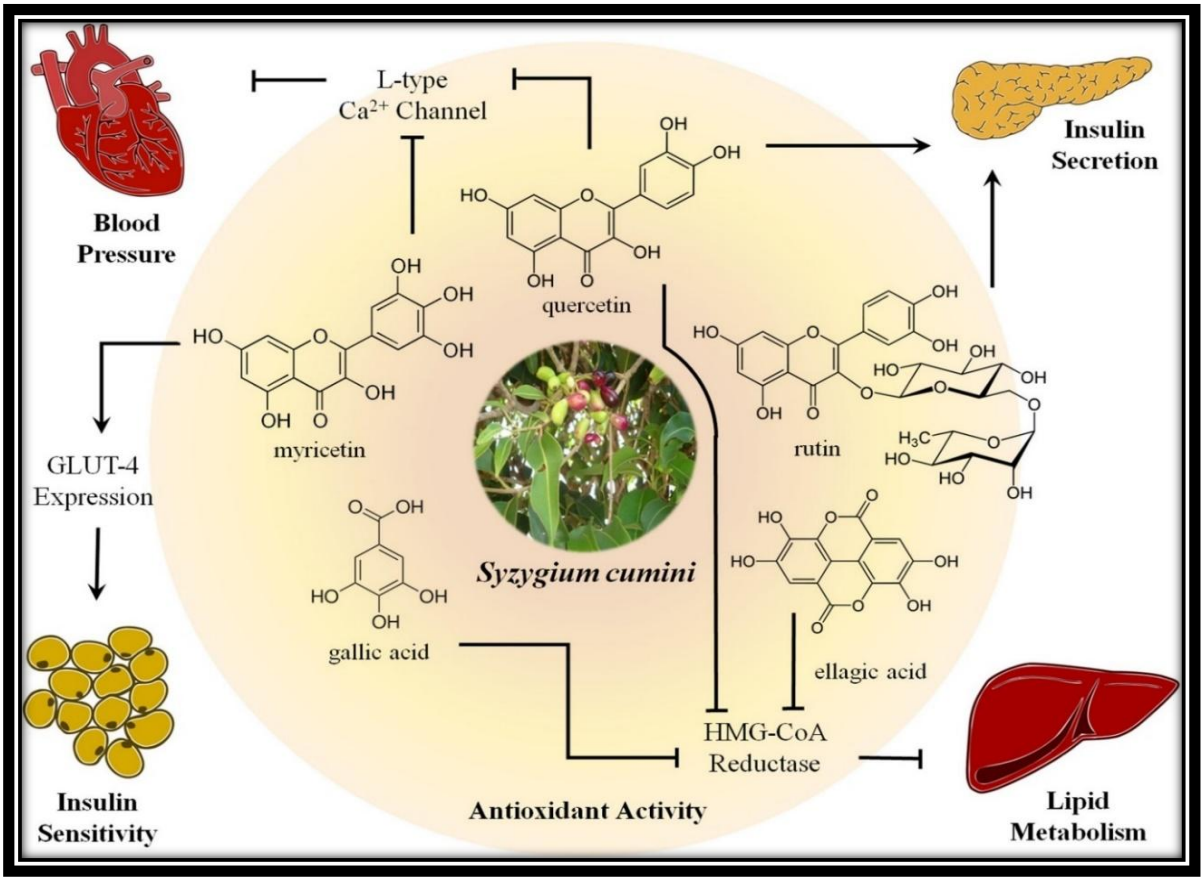

Fig 2: Physiochemical Constituents with chemical structure

One of the most prevalent medical issues in the globe is diabetes. In 2017, 425 million individuals worldwide were living with diabetes. There are 114.4 million diabetics in China, making them the nation with the greatest percentage of the condition. In 2015, India had 72.9 million diabetes patients, making it the country with the second-highest number. Between 2005 and 2015, the number of diabetes patients in India increased by over 50%. The USA, which has the third-largest number of diabetic patients (32.2 million), also has a serious diabetes problem5.

❖ **Morphological Characteristics:**

- **Botanical Description:**

a) Kingdom: Plantae
b) Subkingdom: Viridaeplantae
c) Infrakingdom: Streptophyta
d) Division: Tracheophyta
e) Subdivision: Spermatophytina
f) Infradivision: Angiospermae

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g) Class: Magnliopsida
h) Superorder: Rosanae
i) Order: Myrtales
j) Family: Myrtaceae
k) Genus: Syzygium
l) Species: Cumini
m) Scientific Name: Syzigium cumini.

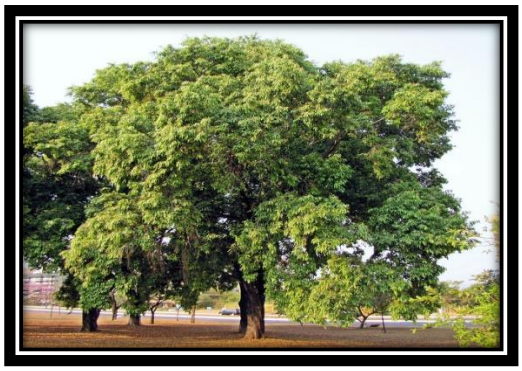

Fig 3: Image of Syzigium cumini Tree

Table 1: Phytochemical Constituents with Extract Data

SR. NO.	PHYTOCHEMICAL CONSTITUENTS	METHANOLIC EXTRACT OF S. CUMIN SEEDS
1	Alkaloids	Moderately present
2	Flavonoids	Appreciable amount
3	Glycosides	Moderately present
4	Steroids	Appreciable amount
5	Cardiac glycosides	Present
6	Saponins	Present
7	Resins	Present
8	Phenols	Moderately present
9	Tannins	Present
10	Terpenoids	Present

Antidiabetic Diagnosis:-

1. Phytochemical Composition: Jamun is rich in bioactive compounds, including alkaloids, flavonoids, polyphenols, and tannins. Among these, jamboline, a polyphenolic compound found in Jamun seeds, has garnered significant interest due to its potential to regulate carbohydrate metabolism and inhibit glucose absorption in the intestines6.

2. Mechanisms of Action: Research suggests that Jamun may act through multiple pathways. It appears to enhance insulin secretion from pancreatic beta cells and improve peripheral glucose uptake by tissues. Additionally, its antioxidant properties are believed to protect pancreatic cells from oxidative stress, preserving their function in insulin production7.

3. Incretin Modulation: Some studies propose that Jamun compounds may influence incretin hormones, such as GLP-1 (glucagon-like peptide-1), which are crucial in regulating insulin secretion and glucose homeostasis. Modulating incretin pathways could be a key aspect of Jamun's antidiabetic effects8.

4. Gut Microbiota Interaction: Emerging research indicates that certain phytochemicals interact with gut microbiota, influencing the composition of beneficial bacteria. This interaction might have implications for

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metabolic health, including glucose regulation. Exploring Jamun's impact on the gut microbiome could provide valuable insights into its antidiabetic mechanisms9.

5. Clinical Challenges: The variability in clinical responses to Jamun therapy highlights the complexity of diabetes as a multifactorial disease. Genetic predisposition, lifestyle factors, and the heterogeneity of diabetes subtypes all contribute to individual responses. Designing clinical trials that account for these factors is essential for accurately evaluating Jamun's efficacy10.

6. Dosage and Formulation: Determining the optimal dosage and formulation of Jamun extracts or compounds is crucial. Factors such as bioavailability, stability, and sustained release properties need to be considered to ensure consistent and effective delivery of active components to the target tissues11.

7. Long-Term Effects: Understanding the long-term effects of Jamun supplementation is paramount. Monitoring parameters beyond glycemic control, such as lipid profiles, kidney function, and cardiovascular outcomes, is necessary to assess the overall impact and safety of Jamun as a prolonged antidiabetic therapy12.

Table 2: Antidiabetic Effect of Different Methods of Extracts

Sr.No.	Parts Used	Extract Type	Species
1)	Leaf	Aqueous	Humans Rat
2)	Seed	Aqueous Ethanol	Rabbit, Rat, Mice
3)	Fruit	Aqueous Ethanol	Rat, Rat, Mice

Fig 4: Syzigium cumini

Fig 5: Syzigium cumini Germination of New Fruit

The potential of black jamun seeds in diabetes management is an exciting area of research. These seeds have demonstrated the ability to slow down starch digestion, which is crucial in controlling blood glucose levels13. This is achieved by inhibiting two key enzymes involved in starch digestion: α-amylase and α-glucosidase. In addition to this, various extracts and compounds derived from black jamun seeds have shown promising results in laboratory and animal studies. They have been observed to improve glucose tolerance, which is a measure of how well the body can manage sugar, and glucose homeostasis, which refers to the maintenance of stable blood sugar levels14. However, it's important to note that while these findings are promising, more research is needed to fully understand the potential benefits and risks associated with the use of black jamun seeds for diabetes management. As with all potential treatments, rigorous scientific studies must be conducted to ensure safety and efficacy. In conclusion, black jamun seeds represent a promising natural approach to diabetes management. Their ability to slow starch digestion and improve glucose tolerance and homeostasis could make them a valuable tool in the fight against diabetes. However, further research is needed to fully explore their potential15.

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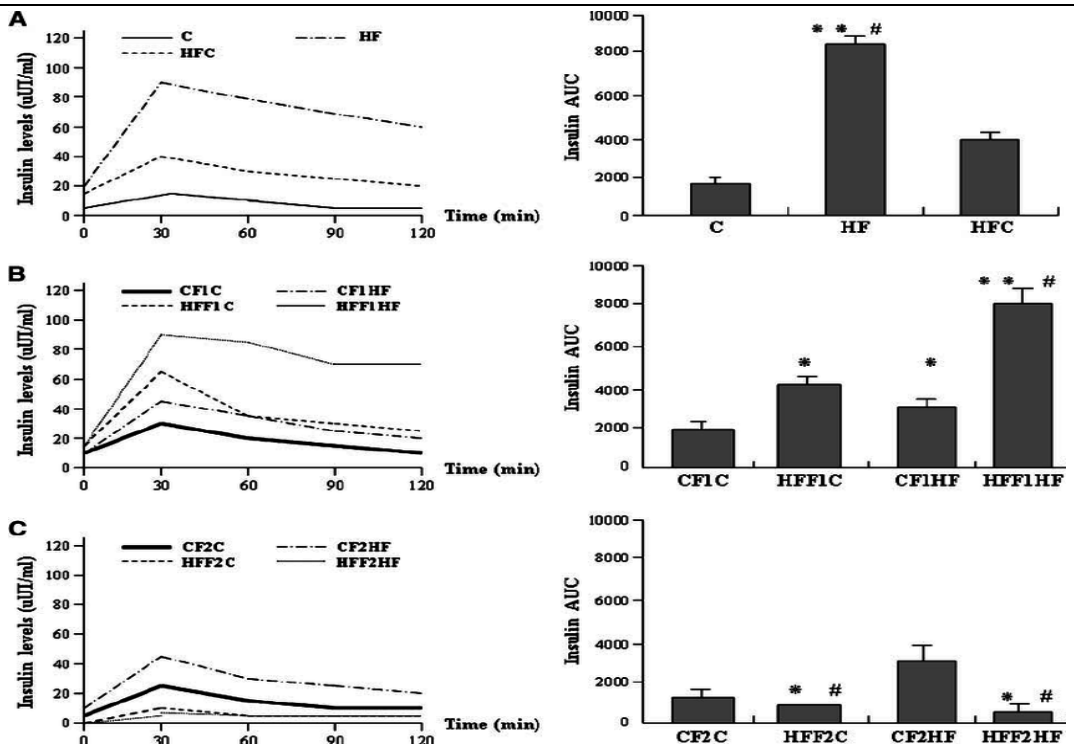

Fig 6: Glucose time course and area under the curve (AUC) after an intraperitoneal glucose tolerance test (IPGTT) (2 g glucose per kg of body weight). A: Young adult female mice. ** Glucose AUC: HF vs. C mice (P 5 0.0003); # HF vs. HFC (P 5 0.002). HFC, HF diet mice shifted to a C diet. B: F1. ** Glucose AUC: HFF1HF, CF1HF, and HFF1C vs. CF1C mice (P 5 0.009). C: F2. * Glucose AUC: CF2HF, HFF2HF, and HFF2C vs. CF2C mice (P 5 0.03). Error bars indicate 6 SD

Different parts of the Jamun were reported for its antidiabetic, antioxidant, hypolipidemic, neuropsycho-pharmacological, anti-ulcerogenic, free radical scavenging, nitric oxide scavenging, and radio-protective activities. Both in-vivo and in-vitro anti-diabetic activity are reported from the drug. The chemical constituents responsible for the inhibition of glucose are terpenoids, glycosides, saponins, flavonoids, phenols, etc. Jamun contains an important glycoside namely Jambolin which prevents the conversion of starch into sugar thereby helping in controlling the blood sugar16.

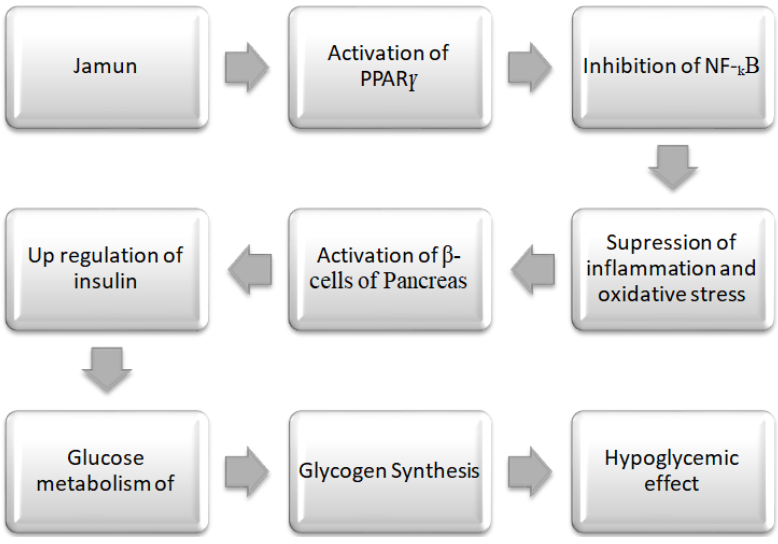

Chart 1: Anti-diabetic action of Syzygium cumini

Jamun fruit's anti-diabetic properties may be attributed to its potential to reduce free radicals, thereby improving the functioning of pancreatic β-cells and reducing blood sugar levels. It may also stimulate the

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activation of enzymes like catalase and glutathione peroxidase, and increase the synthesis of glutathione, reducing lipid peroxidation. Furthermore, Jamun may suppress the activation of transcription factors like NF-κB, iNOS, TNF-α, and cyclooxygenases, reducing inflammation and protecting against diabetes and hyperlipidemia. Lastly, it may upregulate the transcription of Nrf2, increasing antioxidants and promoting the proper functioning of pancreatic β-cells17.

II. APPLICATIONS

There are various health advantages of the entire jamun plant, including the leaves, bark, fruit pulp, and seeds. Numerous traditional medical systems, including Unani, Homeopathy, Siddha, and Ayurveda, employ jamun18.

The Jamun leaves are utilized to nourish the gums and teeth in addition to being recognized for their antibacterial properties. According to rumors, the leaf is used to make tea with antihyperglycemic properties.

The bark of the Jamun tree is used as a blood cleanser, to cure ulcers, diarrhea, asthma, bronchitis, and sore throats20.

Due to the presence of the glycoside Jamboline, seeds have anti-diabetic potential. The fruit is frequently used to cure diabetes, ringworm, inflammation, diarrhea, cough, and other conditions

III. CONCLUSION

In conclusion, the review has highlighted the significant role of Jamun (Syzygium cumini) in the treatment of diabetes. The unique morphology and rich phytochemical composition of Jamun contribute to its therapeutic potential. Various studies have underscored its ability to regulate blood sugar levels, primarily attributed to its antioxidant properties and the presence of bioactive compounds. However, further research is warranted to fully understand the mechanisms involved and to validate these findings in clinical settings. This could pave the way for the development of more effective, plant-based treatments for diabetes.

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