

# Jamun (*Syzygium cumini*)-A Great Gift of Nature: A Review

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**Abstract**— *Syzygium cumini*, commonly known as Jamun or black plum, is a rich source of bioactive compounds, including polyphenols, antioxidants, flavonoids, iron, and vitamin A and C. This tropical evergreen tree belongs to the Myrtaceae family and has been a significant medicinal plant in Indian and other traditional medicines worldwide. Jamun is primarily cultivated in Asian countries such as India, Pakistan, Sri Lanka, Bangladesh, Nepal, the Philippines and Indonesia. Usually the fruits, leaves, seeds and bark are all used in ayurvedic medicine. It has been used to treat various diseases and physiological conditions like diabetes, hyperlipidemia, hypertension, and obesity, making it a promising remedy for managing metabolic syndrome (MS). Jamun provides a lot of benefits owing to its antioxidant, antidiabetic, anti-inflammatory, anticancer, and lipid-lowering properties. This review illustrates mainly chemical compositions and utility of Jamun.

**Indexed Terms-** Diabetes, Gastroprotective, Jamun (*Syzygium cumini*), Phytochemicals.

## I. INTRODUCTION

Ayurveda, the ancient Indian medical system, is rooted in traditional texts and emphasizes a natural and holistic approach to physical and mental well-being. It is one of the world's oldest medical practices and continues to be a cornerstone of India's traditional healthcare. Jamun (*Syzygium cumini*) is the one of the great gifts of nature. This is because of the fact that various parts of the jambolan plant have been reported to exhibit antioxidant, anti-inflammatory, neuropsychopharmacological, anti-microbial, antibacterial, anti-HIV, anti-leishmanial, anti-fungal, nitric oxide scavenging, free radical scavenging, antidiarrheal, antifertility, anorexigenic, gastroprotective, anti-ulcerogenic, and radioprotective activities [1-4]. The anti-diabetic effect of jamun seeds has been supported by numerous pharmacological studies. Research by Helmstadter and Kumar et al demonstrated a significant reduction in blood glucose levels in diabetic animals treated with jamun seeds [5-

6]. S. S. Patil et. al reported that Jamun (*Syzygium cumini*) fruit has been used to produce red wine, which offers numerous health benefits and serves as an effective medicinal agent [7]. 1–3 g of dried jamun seed powder is commonly administered orally to treat diabetic conditions in Ayurvedic medicine. Various parts of the jamun plant have been traditionally used to address blisters in the mouth, colic, digestive issues, diarrhea, dysentery, diabetes, pimples, piles, stomach aches, and even cancer [8-10]. Seed extract of Jamun also is applied on cotton fabric for its antibacterial activity [11]. Jamun fruit extracts regulates growth performance, hematological parameters, serum antioxidant levels, skin mucosal immune responses, immune gene expression, and disease resistance in cyprinus carpio [12]. Sharma et. al. explored the potential of jamun seed powder as an eco-friendly agent for developing friction ridges on porous and nonporous surfaces [13]. Mindawati, Erisa, et al. reported the anti-breast cancer activity of Jamun [14]. The present study aims to evaluate the chemical composition and various health benefits of Jamun.

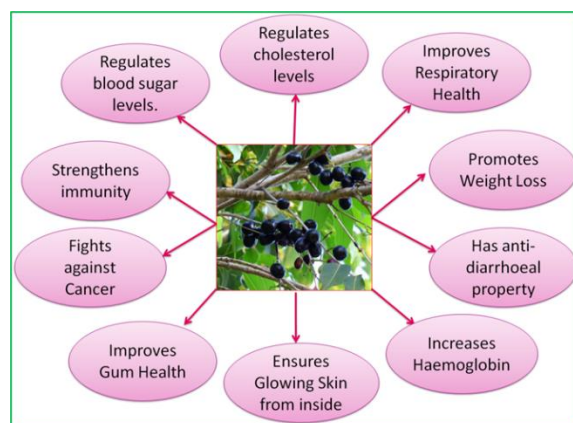


Fig. 1. Uses of Jamun.

## II. CHEMICAL COMPOSITION

Different parts of Jamun tree including the Leaves, stems, flowers, seeds, fruits and roots have been

extensively used in pharmaceutical industry owing to presence of valuable bioactive components.

#### 2.1 Leaves:

Jamun leaves are rich in various phytochemicals, including alkaloids, tannins, phenols, flavonoids, glycosides, steroids, saponins, cardiac glycosides, anthraquinones, catechins, and terpenoids. They also contain gallic acid, mallic acid, jambolin, ellagic acid, jambosine, antimellin, and betulinic acid [15-18].

#### 2.2 Stem bark:

Important phytochemicals present in the stem bark of Jamun tree are Friedelin, Epi-friedelanol,  $\beta$ -sitosterol, Eugenin, Fatty acid ester of epi-friedelanol, Betulinic acid, Gallic acid, Ellagic acid, Bergeniins, Flavonoids and Tannins [19].

#### 2.3 Flower:

The flowers contain a variety of bioactive compounds, including oleanolic acid, kaempferol, quercetin, myricetin, isoquercetin, myricetin-3-L-arabinoside, quercetin-3-D-galactoside, dihydromyricetin, acetyl oleanolic acid, eugenol-triterpenoid A and B [20].

#### 2.4 Fruits:

The fruits are rich in glucose, fructose, raffinose, mallic acid, gallic acid (considered responsible for the sourness of the fruit), citric acid, anthocyanins (may be effective for colour of the fruit), petunidin-3-gentiobioside delphinidin-3-gentiobioside, malvidin-3-lamaribioside, [14], diglycoside, cyaniding, malvidin and petunidin. The fruit restrain 83.70–85.80 g moisture, 14 g carbohydrate, 0.70–0.13 g protein, 0.15–0.30 g fat, 0.30–0.90 g crude fiber, 0.32–0.40 g ash, 26.20 mg Na, 55.00 mg K, 35.00 mg Mg, 8.30–15.00 mg Ca, 0.23 mg Cu, 1.20–1.62 mg Fe, 15.00–16.20 mg P, 13.00 mg S, 8.00 mg Chlorine, 80 I.U. vitamin A, 7.00 mg choline, 0.01–0.03 mg thiamine, 0.009–0.01 mg riboflavin, 0.20–0.29 mg niacin, 5.70–18.00 mg ascorbic acid, and 3.00 mcg folic acid per 100 g of edible part. The peel powder of jamun can also be used as a colorant in foods and pharmaceuticals. Additionally, anthocyanin pigments extracted from fruit peels have been studied for their antioxidant efficacy and stability, both as raw extracts and in various formulations [21-29].

#### 2.5 Seeds:

The seeds are a potential source of bioactive compounds, including hydrolyzable tannins, phenolic acids, flavonoids, other phenolics, terpenoids, phloroglucinol derivatives, and saponins [30].

#### 2.6 Roots:

Jamun roots are rich in various phytochemicals, including alkaloids, anthraquinones, catechins, cardiac glycosides, flavonoids, glycosides, isorhamnetin 3-O-rutinoside, steroids, phenols, tannins, and saponins [31-32].

### III. MEDICINAL ACTIVITIES

Jamun (*Syzygium cumini*) is known for its various pharmacological activities, owing to the presence of bioactive compounds in its fruits, seeds, and other parts. Some of the key pharmacological activities of jamun include:

#### 3.1 Antidiabetic Activity:

Jamun is widely recognized for its antidiabetic properties, making it a valuable natural remedy for managing diabetes. The key components of jamun, including its seeds, fruit, and other parts, contain bioactive compounds that help regulate blood sugar levels, improve insulin sensitivity and inhibiting the activity of enzymes that break down starch and reduce the rate of sugar absorption in the intestines, inhibit the activity of enzymes like alpha-amylase and alpha-glucosidase which are responsible for breaking down carbohydrates into glucose. This reduces the postprandial (after meal) rise in blood glucose levels. Some studies suggest that Jamun may help protect the insulin-producing beta cells in the pancreas from damage, which is crucial in preventing the onset of diabetes or managing it effectively. Jamun has been found to reduce HbA1c levels, improve lipid metabolism, reducing levels of total cholesterol, triglycerides, and LDL (bad cholesterol), while increasing HDL (good cholesterol), an important indicator of long-term blood sugar control, which is often elevated in individuals with diabetes [33-36].

#### 3.2 Antioxidant Activity:

Jamun contains anthocyanins, flavonoids, and phenolic compounds that exhibit strong antioxidant properties, helping to neutralize free radicals and protect the body from oxidative stress [37].

### 3.3 Antimicrobial Activity:

Jamun leaves exhibit significant antimicrobial activity against both gram-positive and gram-negative bacteria. This activity is attributed to the presence of various bioactive compounds, including alkaloids, flavonoids, tannins, and saponins, which possess antimicrobial properties. These compounds help in inhibiting the growth and spread of a wide range of bacterial pathogens, making jamun leaves a potential natural remedy for treating bacterial infections. The antimicrobial effects of jamun leaves make them a valuable resource in traditional medicine for combating infections caused by various bacterial strains [38].

### 3.4 Anti-inflammatory Activity:

Jamun has been recognized for its anti-inflammatory properties, which are primarily attributed to the presence of various bioactive compounds such as flavonoids, tannins, anthocyanins, and other phenolic compounds. These compounds help reduce inflammation in the body, making jamun a potential natural remedy for inflammatory conditions. The bioactive compounds in jamun help inhibit the production of pro-inflammatory cytokines and enzymes, such as TNF- $\alpha$  (tumor necrosis factor-alpha), IL-6 (interleukin-6), and COX-2 (cyclooxygenase-2), which play a key role in the inflammation process. Powerful antioxidants like anthocyanins and flavonoids, help to neutralize free radicals in the body. Oxidative stress is closely linked to inflammation, and by reducing free radicals, jamun helps mitigate inflammation-related damage. Jamun extract can help reduce swelling and edema, which are common signs of inflammation. Jamun is useful in managing inflammatory conditions such as arthritis and other inflammatory diseases. Analgesic (pain-relieving) properties of Jamun help in reducing the pain associated with inflammation. This is particularly beneficial in conditions like rheumatoid arthritis and other inflammatory disorders [39-41].

### 3.5 Cardio protective Effects:

The fruit and seeds of jamun have been found to have a positive impact on heart health by reducing cholesterol levels and promoting overall cardiovascular function. Its cardioprotective effects are attributed to the presence of bioactive compounds like anthocyanins, flavonoids, tannins, and other

antioxidants. The rich presence of antioxidants, including anthocyanins and flavonoids in jamun, helps neutralize free radicals and reduce oxidative stress. Oxidative stress is a major factor in the development of cardiovascular diseases (CVDs), and by combating free radicals, jamun helps protect the heart and blood vessels from damage. Jamun has been found to help regulate lipid metabolism, lowering total cholesterol and LDL (bad cholesterol) levels while increasing HDL (good cholesterol). This helps in reducing the risk of atherosclerosis (hardening and narrowing of the arteries) and other lipid-related cardiovascular issues help in controlling blood pressure by improving endothelial function and promoting vasodilation (widening of blood vessels). This leads to better blood flow and reduced strain on the heart, which is beneficial for individuals with hypertension [42-43].

### 3.6 Anti-cancer Activity:

Jamun is believed to have anti-cancer properties. Bioactive compounds present in Jamun may help to inhibit cancer cell growth and limit tumor spread. Anthocyanins exhibit anti-proliferative effects on cancer cells. Polyphenolic compounds have been shown to induce apoptosis (programmed cell death) in cancer cells and inhibit their proliferation. Flavonoids compounds possess anti-inflammatory and anti-cancer activities by modulating cell signaling pathways involved in cancer progression. Tannins can potentially prevent the initiation and growth of tumors. Gallic Acid exhibits cytotoxic effects on cancer cells and helps in inhibiting their spread. Betulinic Acid is a triterpenoid that has shown anti-tumor properties by inducing apoptosis in cancer cells [44-45].

### 3.7 Hepatoprotective Activity:

The bioactive compounds present in Jamun supports liver health by promoting detoxification and protecting liver cells from toxin-induced damage and oxidative stress. It also promote the regeneration of Liver Cells [46-47].

### 3.8 Anti-obesity Effects:

Jamun exhibits anti-obesity effects due to its unique nutritional and bioactive profile. Jamun is low in calories and has a low glycemic index, which helps prevents excessive fat storage. The fiber content in jamun promotes satiety, reduces hunger, and helps control calorie intake, supporting weight loss efforts.

Bioactive compounds like anthocyanins and flavonoids reduce inflammation, oxidative stress and may influence lipid metabolism by reducing the synthesis and accumulation of fat while promoting fat breakdown which are associated with obesity-related complications [48-49].

### 3.9 Injury Curing Effect:

Jamun's antimicrobial and anti-inflammatory properties also contribute to its effectiveness in promoting injury curing and prevent infections [50].

### 3.10 Antiulcer property:

Jamun has been found to possess anti-ulcer properties due to its rich composition of bioactive compounds help to reduce inflammation in the stomach lining, preventing the development of ulcers, support tissue regeneration and accelerate the healing process of existing ulcers and regulate gastric acid secretion, reducing excessive acid levels that contribute to ulcer development [51-52].

### 3.11 Anti-allergic effect:

Methanolic extracts of dried Jamun seeds had antiallergic property. Jamun's bioactive compounds, such as flavonoids and tannins, help reduce inflammation associated with allergic reactions, alleviating symptoms like swelling and redness. Certain compounds in jamun may help reduce the release of histamine, a key mediator in allergic reactions that causes itching, swelling, and irritation [53-54].

### 3.12 Radioprotective effect:

Jamun has been shown to possess radioprotective properties, which help protect the body from the harmful effects of radiation exposure. Jamun protects cellular DNA from radiation-induced damage by scavenging reactive oxygen species (ROS) and stabilizing cell membranes, reduce DNA fragmentation caused by radiation exposure, thereby protecting cells from mutation and cancerous transformation [55-57].

## CONCLUSION

Jamun (*Syzygium cumini*), a member of the Myrtaceae family, has long been used in traditional medicine to treat various health conditions, including

diabetes. Phytochemical analysis has identified a wide range of compounds in jamun, including alkaloids, anthraquinone glycosides, flavonoids, tannins, saponins, phenols, cardiac glycosides, terpenoids, phytosterols, steroids and amino acids, many of which have been isolated individually. Preclinical studies show that jamun possesses a variety of medicinal properties, such as antioxidant, antibacterial, antifungal, antiallergic, anti-inflammatory, antidiabetic, antihyperlipidemic, gastroprotective, cardioprotective, hepatoprotective, anticancer, and radioprotective effects.

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