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Review Article

A Review on The Role of Jamun, *Syzygium Cumini* Skeels In Treatment of Diabetes

Shubhangi Jadhav*, Tejaswini Bhadake, Dr. Gajanan Sanap

Late Bhagirathi Yashwantrao Pathrikar Collage of Pharmacy Pathri Phulmbri Chh Sambhajinagar 431111

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ABSTRACT

JAMUN (*Syzygium cumini*), sometimes called Java Plum, Black Plum, Jambul, or Black Berries, is a huge, glabrous, evergreen tree that grows in Australia, Malaya, Sri Lanka, and India. The trees yield berries that are ellipsoid or oblong every year. When fully ripe, they are purple black, and when they are still green. The ripe fruits taste slightly tart and sweet. Studies have showed that the berries include carbohydrates, minerals and the pharmacologically active phytochemicals such flavonoids, terpenes, and anthocyanins. The characteristics of black plums prevent diabetes. The fruit regulates blood sugar levels and aids in the conversion of starch into energy. Due to its low glycemic index, Black Plum should be a frequent summertime food for sugar patients. It lessens diabetic symptoms like frequent urination. and pushing. For the treatment of diabetes, bark, seed, and leaf extracts are all too helpful. In addition, jamun has been utilized since ancient times to treat a variety of illnesses. The primary focus of this review is the medicinal value of jamun plants and how they can be used to treat a variety of illnesses.

INTRODUCTION

Plants are extremely important and have been used as medicine to treat a wide range of illnesses for thousands of years. Man has always looked for that natural gift that calms the mind and cures the body. In India, jamun is regarded as a native and significant minor crop. It native to Bangladesh, India, Nepal, Pakistan, Sri Lanka, and other tropical countries, is an evergreen tree Indonesia

and the Philippines. It's a resilient fruit crop. It has a very tall, evergreen tree. Partially deciduous when there is a drought. India is where jamun originated.¹ It's located expanding untamed across the nation. Large evergreen tree Jamun grows to a height of It is planted on the roadside avenues of the bunds for its tasty fruits, windbreak, and shade. A crop that is cross-pollinated is jamun. This tree can produce fruit for up to 60–70 years. Typically,

***Corresponding Author:** Shubhangi Jadhav

Address: Late Bhagirathi Yashwantrao Pathrikar Collage of Pharmacy Pathri Phulmbri Chh Sambhajinagar 431111.

Email ✉: jadhavshubhangi058@gmail.com

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the berries, foliage, seeds, and bark application in traditional Indian medicine. Its bark has compounds such as sugars and tannins. Micronutrients that are beneficial in the fight against a variety of illnesses. The plant's bark is digestive, anthelmintic, carminative, pleasant, refrigerant, diuretic, and febrifuge stomachic, antimicrobial, and constipating. Diabetes is treated with the help of the fruits and seeds.² urethrorrhea, spleenopathy, ringworm infection, and pharyngitis. The foliage has been often used to prevent blood discharges from the faces and to treat leucorrhoea, diabetes, and constipation.³

Syzygium cumini, sometimes referred to as *Syzygium jamun*, is a member of the Myrtaceae family. Native to the Indian subcontinent, evergreen tropical and subtropical plants. It is also referred to as Jamblang, Jamun, Indian Blackberry, Black Plum, Java Plum, Jambul, etc the tree bears fruit only once a year, and the early purple berries eventually turn black and have a harsh flavour lovely.⁴ Despite being a tropical and subtropical plant, it thrives in cooler temperatures as well. Himalayan regions reaching a height of 1,300 meters above mean sea level. Seasonally, you can get it from the Indian months of May through July. This plant's various sections, including the leaves, bark and seeds have been linked to health benefits. It works incredibly well for treating of nitric oxide scavenging, diabetic mellitus, ulcer, antioxidant, antibacterial, and antifungal antibacterial, anti-HIV, radical scavenging, and radioprotective methods. Ayurveda was developed in ancient times and employed seeds, barks, flowers, and leaves. Namasivayam et al. (2008) state that the plant's bark, which mostly consists of tannins and carbohydrates, has been used as a dysentery remedy. The seeds of jamun have been shown to possess antioxidant qualities in diabetes and inflammatory consequences in rats. In addition to this, Jamun has been utilized to treat a variety of

illnesses since ancient times. This review focuses primarily on the therapeutic value of jamun plants and how they are used to treat.⁵

1.1 Morphological Classification of Java plum

1. Kingdom: Plantae
2. Division: Magnoliophyta
3. Class: Magnoliopsida
4. Order: Myrtales
5. Family: Myrtaceae
6. Genus: *Syzygium*
7. Species: *S. Cumini*⁶



Fig 1. Java plum

Morphology Features of *Syzygium cumini*'s (jamun):

Jamun is a sizable tree that is always green and has a dense covering of leaves, along with thick bark that is greyish-brown. Scrubbing with a rough texture made of wood-like scales. The wood is pale in color, has a dense texture, and is long-lasting; produces brown colour dyes and a type of resin known as Kino. The leaves are tough and have a shape ranging from oblong-ovate to elliptic or obovate oval with lengths ranging from 6 to 12 centimeters (varying greatly in shape, glossy and smooth with multiple nerves converge towards the edge, with a broad and less pointed tip. Original text was not provided. Panicles typically grow from the branchlets located beneath the leaves, frequently appearing in the axils terminal and measure between 4 and 6 centimeters in length. Flowers grow in clusters and have a greenish-white color and a pleasant scent. Only a small amount ranging from 10 to 40, either round or oblong in form, can be located in dichotomous

paniculate clusters of flower buds. The calyx is roughly 4 millimeters in length, toothed, and shaped like a funnel. The petals stick together descend simultaneously in unison as a compact disc. There are many stamens that are approximately the same length as the calyx. Various kinds, distinguished by the variations in the colour and size of their fruits, such as certain upgraded varieties. New varieties of fruits, which have purple to violet or white flesh and are seed less, have been created. Fruits are berries that are typically elongated, measuring between 1.5 and 3.5 centimeters in length, and are usually dark-purple. Almost black, juicy, succulent, and edible; it has one big seed inside.^{6,7} The plant produces tiny purple plums that are sweet tasting, with a slightly astringent flavor later on the pulp's edges ripen as the fruit matures. The fully matured fruits with a deep violet hue provide a rich colour. The olive fruit is recognizable by its weight and shape, and is known for its astringent taste.⁷



Fig 2. Health Benefits Of Jamun

Medicinal uses of *Syzygium cumini*'s (jamun): Leaf

Sagaravat et al. (2006) suggested that the leaves of *S. cumini* contain various compounds with medicinal value.⁷ These substances are β -sitosterol, betulinic acid, mycaminose, kratgolic acid (meslic), n-hepatcosane, n-nonacosane, n-hentriacontan, noctacosanol, ntriacontanol, n-dotricontanol, quercetinside, myrinitric 3-O-(4"-Acetyl)-a Lrhamnopyranosides. These substances

have been widely used in the pharmaceutical industry to treat various diseases. According to studies by Eshwarappa et al. (2014) pickled leaf extract contains phytochemicals that have antioxidant properties that are used for the treatment of various metabolic diseases such as diabetes, arthritis, cancer, liver diseases, and others were found to be methanolic and aqueous extracts of *S. Cumin* leaves contain various substances such as phenolics and tannins, flavonoids, phytosterols and triterpenoids, alkaloids and saponins.⁸ According to their findings the extracts obtained using a high polarity solvent (methanol) are very effective radical scavengers. Kumar et al (2014) studied the antimicrobial activity of *S. cumini* leaves from different regions of North India. They found that the ethyl acetate extract of *S. cumini* leaves showed the highest antimicrobial activity at a concentration of 200 mg/ml. GC et al. (2008) showed that the dichloromethane extract of jamun leaves showed radioprotective effects when administered intravenously. Jamon leaf extract at different concentrations (0.0, 1.56, 3.125, 6.25, 12.5, 25, 50 and 100 μ g/ml) reduced DNA damage in human peripheral blood cultured in lymphocytes.⁹

Seeds and fruits

Reza et al. (2017) showed that blood sugar levels in rat scan be reduced by using Jamun fruit and seed extract. Their study found that seed extract and jamun fruit extract reduced blood sugar levels and normalized insulin levels in hyperglycemic rats. Jamun fruit extract was found to reduce blood glucose level by 5.35% and 12.29% in healthy and hyperglycemic rats, respectively. While insulin levels improved by 2.82% and 6.19%. Although jamun seed extract reduced glucose by 7.04% and 14.36% and showed 3.56% and 7.24% higher insulin in healthy and hyperglycemic rats, respectively. Their research concluded that seeds and fruits are effective in preventing high blood

sugar. Dry jamun powder is a medicinal product and very effective in controlling diabetes mellitus.¹⁰ Ambika Chauhan (2015) reported the biochemical estimation of jamun fruit and found 70.5 grams of moisture, 16.2 grams of moisture fiber and 12.8 mg of iron and 8.2 g of total protein.¹¹ Klinger et al (2015) reported that Jamun essential oil and its major component α -pinene were evaluated for their anti-asthmatic activity against *Leishmania amazonensis*. α -pinene showed its efficacy with an IC₅₀ of 19.7 mg/ml.¹⁰ The presence of anthocyanins, diglucosides of delphinidin, petunidin, malvidin, peonidin and cyanidin was reported by Farooq et al. (2014).¹² I have 100% pinene and 100% linalool, 4-terpineol, α -terpineol, cis-dihydrocarone, caryophyllene, α -hops, cis- β -farnesene, cis- α -farnesene, trans- α -farnesene, cisnerolidol, geranyl butyrate, globolol, witherol, thoriol, neosedranol, beta-bisabolol and I roto and I penupenu Jamon. I tell you a few things about the seeds of jamunellagitannin, jambusin, aidad gallic, aidad ellagic, corylagin, 3,6-hexahydroxydiphenylglucose, 1-galloylglucose, 3-galloylglucose, quercetin, hexagluhydroxy. β -sitorol, contains 4,6-tangohanga methanol from the berries of which the fungus is pathogenic According to a study by Pant et al. (2014).¹³ SC seed extract (200 mg/kg) was evaluated by Jonnalagadda et al. (2013) for its anti-cancer activity. First, diabetes was induced using low-dose streptozotocin (35 mg/kg) and a high-fat diet. Later, ulcers were induced in the ethanol and indomethacin models of diabetic rats.¹⁴ It was found that significant reduction in gastric ulcer score was observed after administration of SC extract alone and in combination with acarbose (5mg/kg). Das et al (2009) concluded that the alcoholic extract of SC pulp (100 and 200 mg / kg / day) has a significant hepatoprotective effect compared to paracetamol (PCM) in albino mice. Increased serum levels of ALT, AST, AP decreased and histopathological studies showed

reduced fibrosis and necrosis.¹⁵ Kasyapan et al (2005) reported that the ethanol extract of *S. Cumini* kernel (100 mg/kg) has a hypolipidemic effect on the levels of triglycerides, cholesterol, phospholipids, free fatty acids in plasma, kidney tissue. and liver of STZ (55 mg/kg) diabetic rats. The results showed that extraction was able to restore all parameters to their normal range.¹⁶ Ravi et al (2004) suggested that the ethanolic extract of cumin seeds reduces the increase in oxidative stress in the pathogenesis and progression of diabetic tissue damage. This activity was observed when the increase in the level of plasma glucose, vitamin E, ceruloplasmin, lipid peroxides and the decrease in the level of vitamin C and glutathione were observed in the diabetic mice. Levels after treatment with *S. cumini* seed extract histopathological studies also show its protective effect on pancreatic β -cells.¹⁷ Sharma et al (2003) reported that the alcoholic extract from the seeds reduced serum and tissue fat in alloxan-diabetic rats. The hypolipidemic effect of the ethanolic extract was also observed from the reduction of total cholesterol/HDL cholesterol ratio, serum LDL cholesterol level and reduction of HMG Co-A reductase activity. In addition, histopathological studies of the liver, pancreas and aorta in diabetic groups treated with rabbit alcohol extract showed a normal pattern.^{18,19}

Bark

Using different concentrations of n-hexane, alcohol and water extracts of different parts of jamun plant (stem and root bark, fruits and leaves) to investigate the disease severity fungicidal against *Ascochyta rabiei* - agent of *Cicer arietinum* blight by J.K. and colleagues (2010).²⁰ All aqueous extracts, n- hexane stem, bark extract and alcoholic extract of both bark showed significant antifungal activity. AR Ivan (2006) reported the presence of betulinic acid pentacyclitriterpenoid in the skin of the Jamon



plant.²¹ Yogeswari et al (2005) demonstrated the role of betulinic acid in selective cytotoxicity against specific tumor types. It is estimated that the presence of β -sitosterol in the skin of the plant, which has the same chemical structure as cholesterol, is very effective in lowering blood cholesterol and has an anti-inflammatory effect.²² Pandey et al (2002) reported that the ethanol extract of *Syzgium cumin* has anti-inflammatory activity against histamine, serotonin and prostaglandin. For this study, inflammation was induced by individual autacoids, histamine (1 mg/ml), serotonin (5HT, 1 mg/ml), bradykinin (0.02 mg/ml) and prostaglandin (PGE2, 0.001 mg/ml) used as an anti-inflammatory. When injected into the rat paw, the ethanol extract showed anti-inflammatory effects against histamine, PGE2 and 5-HT-induced paw edema. Although there was no significant inhibition of edema size in rat paw edema.²³

Flowers

Ramya et al (2012), investigated that the flowers of *S. cumin* contain ertaglic acid (maselic acid), galactoside, dihydromyristin, oleanolic acid, flavonoids

-isoquercitrin, quercetin, kaempferol, myristicin-3-L-arabinoside, quercetin, 3-D-acetyloleanolic acid, eugenolterpenoid A and eugenolterpenoid B.²³ Sagaravat et al., (2006) reported that Jamun flower contains oleanolic acid, ellagic acid, isoquercetin, quercetin, kaempferol and myristin.²⁴

Therapeutic use of jamun:

Entire plant of jamun (seeds, fruit pulp, leaves, flower and bark) is renowned for its medicinal value.²⁵ Jamun encompasses its use in various traditional medicinal systems like Ayurveda, Unani, Siddha and Homeopathic. History of medicinal usage of jamun is marked by its prescribed use by Charkha and Sushruta for curing many diseases like diarrhoea, obesity, vaginal discharge, menstrual disorders,

haemorrhage, etc.²⁶ Recent studies have demonstrated its several pharmacological effects like antibacterial,^{27,28} antifungal,²⁹ antiviral,³⁰ antioxidant potential,^{31,32} anti-inflammatory,³³ hepatoprotective,³³⁻³⁵ antidiabetic,^{36,37} hypolipidemic,³⁸ cardioprotective, anti-diarrhoeal, anti-allergic,³⁹ antipyretic, anti-neoplastic, chemopreventive.⁴⁰ Among all these therapeutic properties, antidiabetic effect is most vividly studied. Antimicrobial- Effectiveness of jamun seed extract as antibacterial agent against *Bacillus cereus*, *B. subtilis*, *B. megaterium*, *Staphylococcus aureus*, *Shigella dysenteriae*, *Sh. Higa*, *Sh. Boydi*, *Sh. flexneriae*, *Sh. sonnei*, *Escherichia coli*, *Salmonella typhi* B, *Sal. Typhi* B-56 and *Klebsiella* species.⁴¹ Antioxidant- Antioxidants control free radicals that lead to many diseases and accelerate aging. Many laboratory studies have shown the effectiveness of using alcoholic extracts of the seed. Extracts can work in different ways by scavenging free radicals such as superoxide, hydroxyl, lipid peroxide and 2,2-diphenyl-1-picrylhydrazyl (DPPH) and nitric oxide and intermediate metal catalysts such as iron ions. Antidiabetic- Jamun seeds are prescribed widely in many medicine systems for controlling diabetes. Anti-diabetic effect of jamun seed has also been substantiated by many pharmacological studies.⁴² The studies carried out by Helmstadter and Kumar et al revealed considerable reduction in blood glucose level of induced diabetic animals when treated with jamun seed.^{12,43} Effectiveness of the extracts using different solvents has been explored by different scientists on different animal models. Hepatoprotective- Effectuality of jamun peel extract as hepatoprotective agent against carbon tetrachloride (CCl₄) induced oxidative damage on rat hepatocytes. In vivo studies by Das and Sarma on paracetamol induced toxicity in rats has also supported the hepato-protective effect.⁴⁴



Based on oral administration of ethanolic extract of pulp in dose dependent manner, they reported decrement in rise of serum enzymes, level of total protein and albumin owing towards hepatoprotection. The study also asserted no acute oral toxicity and intact histological structure of liver. Immunomodulatory- The term immunomodulatory means regulation of the immune system by suppression and stimulation of cells and organs of the immune system. It is now being recognized that immunomodulatory therapy could be practiced as an alternative to conventional chemotherapy towards variety of diseased conditions. the methanolic extract of jamun seeds possesses promising immunomodulatory activity.[45] While working on humoral and cellular immunity in mice by injecting carbon ink suspension and hemagglutination reaction and delayed type hypersensitivity response in rats induced by Sheep Red Blood Cell, they reported a significant increase in total white blood cell, neutrophils and lymphocytes count in dose-dependent manner.⁴⁵ Hypolipidemic- Alteration in lipid profile is one of the most common complications in diabetic mellitus and in that context hypolipidemic effect of jamun seed has been thoroughly studied on both alloxan and streptozotocin induced diabetic rats.^{46,47} Ethanolic extract of seeds is able to reduce the level of total serum cholesterol/high density lipoprotein cholesterol ratio, low density lipoproteins (LDL) and triglycerides.^{45,48} Elevated levels of cholesterol, phospholipids, triglycerides and free fatty acids in the plasma, liver and kidney tissues of streptozotocin induced diabetic rats were reverted back to normalcy on oral administration of ethanolic extract of jamun kerne.⁷ According to them, the lowering effect was comparable to that of the treatment with standard drug (glibenclamide). Anticancerous effect of jamun pulp has been successfully studied on human

cervical carcinoma cell lines i.e. HeLa and SiHa using crude methanolic extract⁴⁵ and breast cancer cells using hexane: acetone: methanolic extract.⁴⁹ The study revealed that the extracts induced apoptosis in tumorous cells and the antiproliferative effect was proportional to dose and exposure time. the extract exerted no apoptotic effect on non-tumorous breast cells.⁵⁰ These in vitro oncological studies profess the potentiality of jamun pulp extracts towards inhibition and death of cancerous cells. Chemopreventive- study have reported that hydro-alcoholic extract of jamun seed possesses chemopreventive properties in the DMBA-induced and croton oil promoted skin carcinogenesis in Swiss albino mice.⁵¹ According to them, feeding of 125 mg extract/kg body weight/day during phases of, either pre-initiation (i. e 7 days before and 7 days after application of DMBA) or post initiation (i.e. from the day of start of croton oil treatment and continued till the day of experiment), reduced the cumulative numbers of papillomas, the tumour incidence and increased the average latency period when compared with the control group (carcinogen alone). In continuation to this study concluded that jamun seed has the potential to modulate biochemical and histopathological status during skin carcinogenesis.⁵² Researchers have identified antioxidant capacity of jamun seed as the probable mechanism of chemopreventive effect.^{53,54} In addition and also have observed that administration of the aqueous extract of jamun seed (25 mg/kg body weight/day) was effective in preventing benzo-a-pyrene (BaP)-induced for stomach carcinogenesis in Swiss albino mice, when applied as pre-, post- and pre-post treatment; it reduced the tumour incidence, tumour burden and cumulative number of gastric carcinomas.^{17,55}

CONCLUSION:

The whole jamon including the skin, pulp and seeds is a rich source of phytochemicals, including phenolic and non-phenolic bioactives. Medical



studies have linked phytochemicals to provide various therapeutic properties such as antioxidants, anticancer, antidiabetic, antimicrobial, radioprotective, etc. Further research is needed to identify the main functional area responsible for such activities. Jamun, with a beautiful colour, airy aroma and a lot of minerals and vitamins, is a fruit of the season, perishable and not used. Jamun is widely used by traditional medicine to treat various diseases, especially diabetes and related diseases. Most of the medicinal work for diabetes has been done with the seeds, but the medicinal potential of other parts of the plant needs to be further investigated. Also, not much has been done about the medicinal benefits of jamun phytochemical compounds. Based on this information, the authors hope that this review will show the role of jamun in various treatments and recommend more phytochemical and clinical research on this traditional medicinal plant to discover the safer medicine. Jamun has great potential to be used as a raw material for post-harvest processing and the development of functional capacity to prevent foodborne diseases in addition to its primary function of providing nutrients. This review contains a lot of information about the nutritional, medicinal and processing aspects of Jamon.

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