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## Therapeutic influence of Jamun (*Syzygium cumini*): A review

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### Abstract

Jamun or Black plum is an important summer fruit, associated with many health and medicinal benefits. The black plum is known to relieve stomach pain, carminative, anti-scorbutic and diuretic. Black Plum vinegar is good to reduce enlargement of spleen, diarrhoea, and those have urine retention problems. Jamun's polyphenolic compounds are effective against cancer, heart diseases, diabetes, asthma and arthritis. Black Plum fruit and its leaves are good for diabetic patients. The black plum has anti-diabetic features. The fruit helps to convert starch into energy and keep your blood sugar levels in check. In the summer season, the sugar patient should eat Black Plum regularly because of its low glycemic index. It reduces the symptoms of diabetes like frequent urination and thirsting. The extract of bark, seeds, and leaves are too beneficial in the treatment of diabetes. Besides from this jamun has been used to treat various diseases from ancient area till now. This review describes mainly on medicinal importance of jamun plants and their applications in the treatment of various diseases.

**Keywords:** Triclosan, TCS, determination, detection, sensor

### Introduction

*Syzygium cumini* belongs to family Myrtaceae and is also known as *Syzygium jabunum* is evergreen tropical and subtropical plant native to Indian subcontinent. It is commonly known as Jambul, Black Plum, Java Plum, Indian Blackberry, Jamblang, Jamun etc. The tree fruits once in a year and berries are purple during early stage, later they become black and taste bitter sweet. Being a tropical and subtropical plant but it also performs very well in lower ranges of Himalayas upto an altitude of 1300 meter from mean sea level. Seasonally, it is available from the month of May to July in Indian conditions. Various parts of this plant such as leaves, seeds, bark has been reported for its medicinal properties. It is very effective in the treatment of diabetes mellitus, ulcer, antioxidant, antibacterial, anti fungal, nitric oxide scavenging, free radical scavenging, antimicrobial, anti HIV and radioprotective measures. During an ancient era, the seeds, barks, flowers, leaves are all used in ayurveda. According to Namasivayam *et al.* (2008), the bark of the plant which mainly contains carbohydrates and tannins has been used to treat dysentery. Chaudhari *et al.* (1990) reported that the seeds jamun has anti-inflammatory effects in rat and antioxidant properties in diabetics. Besides from this jamun has been used to treat various diseases from ancient area till now. This review describes mainly on medicinal importance of jamun plants and their applications in the treatment of various diseases.

### Medicinal Value of Various Parts of Jamun Plant Leaves

Sagrawat *et al.* (2006) [4] suggested that the leaves of *S. cumini* contains various chemicals which have medicinal value. Those chemical includes  $\beta$ -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 myricetin 3-O-(4"-acetyl)- $\alpha$  Lrhamnopyranosides. These chemicals have been widely used in pharmacology industry for the treatment of various diseases.

According to research conducted by Eshwarappa *et al.* (2014) [2], leaf gall extract of jamun contains various phytochemicals which have antioxidant properties, which are used in the treatment of various metabolic diseases such as diabetes mellitus, arthritis, cancer, liver disorder etc. They found that methanolic and aqueous extract of *S. cumini* leaf contains phytochemicals like phenolics and tannin, flavonoids, phytosterols and triterpenoids, alkaloids and saponins. Their findings support the extracts obtained using a high polarity solvent (methanol) are considerably more effective radical scavenger.

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**Table 1:** Medicinal Importance of Chemicals Present in Leaves

Name of chemicals present on Jamun leaves	Medical importance	Reported by
Oleanolic acid	Inhibits tumor promotion ion in mouse skin	Sharma <i>et al.</i> (2010) [5]
Gallic acid	Inhibits the TPA-induced inductions of epidermal ornithine decarboxylase activity, hydroperoxide production and DNA synthesis, and also inhibit the promotion of skin papillomas and carcinomas in the two-step initiationpromotion protocol.	Del <i>et al.</i> (1983) [6]
Myricetin	Inhibits polycyclic aromatic hydrocarbon-DNA adduct formation in epidermis and lungs of SENCAR mice	Lee <i>et al.</i> (1997) [7]
$\beta$ - sitosterol	Topical application of $\beta$ -sitosterol inhibited the TPA-induced inflammation.	Kim <i>et al.</i> (2009) [8]
Quercetin	Decreases DMBA-induced DNA damage	De <i>et al.</i> (2010) [9]

Kumar *et al.* (2014) studied antimicrobial activity of leaves of *S. cumini* from various regions of North India. They found that ethyl acetate extract of *S. cumini* leaves showed maximum antimicrobial activity at a concentration of 200 mg per ml.

GC *et al.* (2008) [23] reported that Dichloromethane extract of jamun leaf extract when administered intraperitoneally exhibited radio protective effects. Jamun leaf extract in various concentrations (0.0, 1.56, 3.125, 6.25, 12.5, 25, 50 and 100  $\mu$ g/ml) was found to reduce the radiation induced DNA damage in the cultured human peripheral blood lymphocytes.

### Seeds and Fruit

Raza *et al.* (2017) [10] reported that blood glucose level in rat can be reduced by the application of fruits and seeds extract of Jamun. Their research depicted that both seed and fruit extract of Jamun reduce the blood glucose level and regulate insulin level in hyperglycemic rats. It was noted that jamun fruit extract attenuated serum glucose levels to 5.35% and 12.29% in normal and hyperglycemic rats, respectively; while insulin levels were improved by 2.82% and 6.19%, correspondingly. Whereas, jamun seed extract reduced glucose to 7.04% & 14.36% and showed 3.56% & 7.24% higher insulin levels in normal & hyperglycemic rats, respectively. Their research concluded that both the seed and fruit have potent prophylactic role against hyperglycemia.

Dried Jamun powder has a medicinal value and proved very effective in controlling diabetes mellitus. Ambika chauhan (2015) [14] reported the biochemical estimation of jamun fruits and investigated that it contains 70.5 gm of moisture, 16.2gms of crude fibre, and 12.8 mg of iron and 8.2 gm of total protein.

Klinger *et al.* (2015) [21] reported that the essential oil of Jamun and its main component  $\alpha$ -pinene was evaluated for its antileishmanial action against *Leishmania amazonensis*.  $\alpha$ -pinene showed its efficacy with IC<sub>50</sub> of 19.7 mg/ml.

The presence of Anthocyanins, diglucosides of delphinidin, petunidin, malvidin, peonidin, and cyaniding was reported by Farukh *et al.* (2014) [11]. Volatile oils such as  $\alpha$ -pinene,  $\beta$ -pinene,  $\beta$ -myrcene, cisocimene, trans-ocimene, terpinolene, linalool, 4-terpineol,  $\alpha$ -terpineol, cis-dihydrocarvone, caryophyllene,  $\alpha$ -humelene, cis- $\beta$ -farnesene, cis- $\alpha$ -farnesene, trans- $\alpha$ -farnesene, cisnerolidol, geranyl butyrate, globulol, widdrol, torreyol, neocedranol,  $\beta$ -bisabolol in fruit pulp of Jamun. He also reported that the seeds of Jamun contains Ellagitannins, Jambosine, gallic acid, ellagic acid, corilagin, 3,6-hexahydroxy diphenylglucose, 1-galloylglucose, 3-galloylglucose, quercetin,  $\beta$ -sitosterol, and 4,6-hexahydroxydiphenylglucose.

The methanolic fruit extract of Jamun has shown excellent antifungal action against the targeted pathogenic fungi -

*Fusarium oxysporium*, *Rhizoctonia solani* and *Sclerotium rolfsii* as per the study of Pant *et al.* (2014) [18].

The Seed kernel extract of SC (200 mg/kg) was evaluated by Jonnalagadda *et al.* (2013) for its antiulcer activity. First, the diabetes was induced using low dose streptozotocin (35mg/kg) in combination with high fat diet. Then, the gastric ulceration was produced in diabetic rat's ethanol and indomethacin models. It was observed that there was a significant decrease in the gastric ulcer index after the administration SC extract alone and as well as in combination with Acarbose (5mg/kg).

Das *et al.* (2009) [22] concluded that the alcoholic extract of the pulp of SC (100 and 200mg/kg/day) exhibited a significant hepatoprotective action on paracetamol (PCM)-induced hepatotoxicity in albino rats. The elevated serum levels of ALT, AST, AP were decreased and histopathological studies depicted a reduction in fibrosis and necrosis.

Kasiappan *et al.* (2005) [20] reported that the ethanolic extract of *S. cumini* kernels (100 mg/kg.) was evaluated for its hypolipidemic potential for the levels of triglycerides, cholesterol, phospholipids, free fatty acids in the plasma, kidney and liver tissues of STZ (55 mg/kg) induced diabetic rats. The results showed that the extract was able to restore all the parameters to their normal range.

Ravi *et al.* (2004) suggested that Ethanolic extract of *S. cumini* seed kernel lowering the increased oxidative stress involved in pathogenesis and progression of diabetic tissue damage. This activity was observed when an increase in levels of plasma glucose, vitamin-E, ceruloplasmin, lipid peroxides and a decrease in levels of vitamin-C and glutathione observed in diabetic rats, recover back to the normal levels after treatment with *S. cumini* seed kernel extract. Histopathological studies also promise its protective effect on pancreatic  $\beta$ -cells.

Sharma *et al.* (2003) [12] reported that alcoholic extract of seeds lowered lipid in serum and tissues in alloxan diabetic rats. Hypolipidaemic effect of ethanolic extract was also evident from fall in total serum cholesterol / HDL cholesterol ratio, serum LDL cholesterol level and lowering activity of HMGCo-A reductase. Also histopathological studies of liver, pancreas and aorta in alcoholic extract treated diabetic groups of rabbit revealed almost normal appearance.

Prince *et al.* (1998) [13] concluded that aqueous extract of seed is antianaemic nature and is responsible for increase in total haemoglobin, lowering body weight and lowering the formation of free radicle in tissues. They also reported that ethanolic extract of *Syzygium cumini* seed kernel also lowering the thiobarbituric acid reactive substance (TBARS) and increased in reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT).

**Table 2:** Medicinal Importance of Chemicals Present in Seeds and Fruits

Name of chemicals present on Jamun seeds and fruits.	Medical importance	Reported by
Alpha-Pinene	Gastroprotective and Antiulcerogenic effect induced by ethanol and indomethacin in mice.	<i>Pinheiro et al.</i> , (2015) [33]
Cynadin	Antitumorogenic	<i>Paluszczak et al.</i> (2014) [34]
Quercetin	Antioxidant and Antiviral application	<i>Maalik et al.</i> , (2014) [35]
Cisocimene	Antimutagenic	<i>Burt et al.</i> (2004) [36]
Beta- bisqbolal	Antiinflammatory, Anticancer, Antiviral	<i>Kamatou and Alvaro</i> (2010)

### Bark

The utilization of different concentrations of n-hexane, alcohol and aqueous extracts of different plant parts of jamun (barks of stem and roots, fruits and leaves) to study their antifungal potential against *Ascochyta rabiei*-the causative agent for blight disease of *Cicer arietinum* was reported by J.K. *et al.* (2010) [19]. All the aqueous extracts, n-hexane extract of stem-bark and alcoholic extracts of both the barks exhibited significant antifungal activity.

AR Ivan (2006) [15] reported that the presence of pentacyclic triterpenoid betulinic acid in the bark of jamun plant. Yogeswari *et al.* (2005) [16] demonstrated the role of betulinic acid in the selective cytotoxicity against a number of specific tumor. He also reported that presence of B-sitosterol in the bark of the plant which has a same chemical structure with cholesterol and is very much helpful in reducing blood cholesterol and have activity like anti-inflammatory.

Pandey *et al.* (2002) [17] reported that ethanolic extract of *Syzygium cumini* bark has been reported to possess antiinflammatory activity against histamine, serotonin and

prostaglandin. For this study inflammation was induced by individual autacoids insult, Histamine (1mg/ml), serotonin (5-HT, 1mg/ml), Bradykinin (0.02mg/ml) and prostaglandin (PGE2, 0.001mg/ml) was used as inflammogens. When injected in rat paw, ethanolic extract showed anti-inflammatory effects in histamine, PGE2 and 5-HT induced rat paw oedema. While there was no significant inhibition of oedema volume in bradykinin induced rat paw oedema at any dose level.

### Flower

Ramya *et al.* (2012) [24], investigated that the flowers of *S. cumini* contains erategolic acid (maslinic acid), galactoside, dihydromyricetin, oleanolic acid, flavonoids - isoquercitrin, quercetin, kaempferol, myricetin-3-L-arabinoside, quercetin-3-D- acetyl oleanolic acid, eugenoltriterpenoid A and eugenoltriterpenoid B.

Sagrawat *et al.*, (2006) [4] reported that the flower of jamun contain Oleanolic acid, ellagic acids, isoquercetin, quercetin, kampferol and myricetin.

**Table 3:** Therapeutic Role of Jamun in Medicine

Name of chemicals	Plant Part Used	Reported by
Antidiabetic	Extracts of Jamun seeds in various solvent.	Helmstadter <i>et al.</i> , and Kumar <i>et al.</i> , (2008) [27]
Hepatoprotective	a. Jamun peel extract against carbon tetra chloride (ccl4) induced oxidative damage on rat hepatocytes. b. Paracetamol induced toxicity in rats.	Das and Sarma (2009) [28]
Immunomodulatory	Methanolic extracts of Jamun seeds.	Barh and Vishwanathan (2009) [29]
Hypolipidemic	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.	P S <i>et al.</i> , (2003) [30] and Modi <i>et al.</i> , (2009) [31]
Anticancerous	Jamun pulp	Barh D and Vishanathan (2009) [29]
Antibacterial	Jamun pulp	Patel and Rao (2010) [32]
Cardioprotective	Methanolic extracts of Jamun seeds	Mastan <i>et al.</i> , (2009) [25]
Antioxidant	Leaf gall extract	Eshwarappa <i>et al.</i> (2014) [2]
Antifungal	Bark	J.K. <i>et al.</i> (2010) [19]
Antimicrobial	Ethyl acetate extract of leaf	Kumar <i>et al.</i> , (2014)

### Conclusion

Jamun is traditionally used for the treatment of various diseases especially diabetes and related complications. With the regard to the antineoplastic activities studies suggest that Jamun is selective in its action in breast cancer cells. The effect of Jamun and its phytochemicals should also be investigated for its chemopreventive effects in other models of carcinogens, that includes chemical, radiation and viral carcinogenesis models. Jamun raw and value added products should be advertised to urban population for its health benefits and especially for promotion of Jamun growers in tribal areas of India

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