



Phytochemical and Pharmacognostic Revelations of *Syzygium cumini* (L.)

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Introduction

Various medicinal plants are present in a collection of herbal preparations of the Indian traditional health care system (Ayurveda) named “Rasayana”. From the ancient time, plants have been playing a key role for the betterment of mankind presenting as an extraordinary source of natural medicine (Anjali *et al.*, 2017). The complexity in formulating chemical-based drugs as well as their health related side effects and uprising cost has led worldwide researchers to focus on medicinal plant research. Bangladesh has a vast repository of diverse plant species where about five thousand plants species have been claimed as having significant medicinal values. The researched papers on medicinal plants publishing from last few decades mention the activities of different plant bioactive compounds that are used widely in the treatment of various human ailments. *Syzygium cumini* Linn. (syn. *Eugenia jambolana*) Plant is commonly known as the Jamun plant in Hindi and Jambhul in Marathi, which is distributed along tropical and sub-tropical regions of world. In India the Jamun plant is distributed in all over the country, it is cultivated and

sometime occurs wild. The plant has many medicinal properties, which is used in folk medicine from the ancient periods. This plant belongs to the Myrtaceae family. Although it is a tropical tree but it grows easily in subtropical climates also. *S. cumini* is a fast-growing plant; it can grow up to a height of 30 m and can live for approximately 100 years. Its dense foliage provides shade and is grown just for their fruits and ornamental values (Murti *et al.* 2012). Vitamin C, alkaloids, saponin, gallic acid, tannins, anthocyanins, glucoside, phenolic compound, and other substances have all been shown to be present in jamun plants (Suradkar *et al.*, 2015). The plant is well known for its therapeutic and restorative properties and is used to treat a variety of illnesses. Characteristics such as antioxidant, hepatoprotective, antidiuretic, antibacterial, antifungal, and many more. The fruit's stunning purple to black hue results from the presence of anthocyanin, which also gives it strong antioxidant qualities. A variant of the tree produces green coloured young fruit and after ripen the fruit converted as purple to black coloured. The fruit has a combination of fragrant sweet, astringent flavour and

mildly sour tends to colour the tongue purple. The leaves, stem-bark, fruit and seeds are used in many disease treatments. Leaves, bark and fruits are used for the treatment of diabetes, sore throat,

astringent and diarrhoea. The plant powder used for headache, stomach-ache, roughness loss of skin coloration. Seed are used for diabetes, the mature fruit used for indigestion (More *et al.*, 2023).

Taxonomical Classification:

Kingdom : Plantae

Unranked : Angiosperms

Order : Myrtales

Family : Myrtaceae

Genus : *Syzygium*

Species : *Cumini*

Bionomial name : *Syzygium cumini*

Phytochemical Constituents:

The Greek term for plant is "phyto." The human body benefits from phytochemicals in a number of ways, and they belong to numerous families. Phytochemicals may shield people from a variety of illnesses. Non-nutritive plant compounds with protective and disease-prevention qualities are known as phytochemicals. The primary acid found in *Syzygium cumini* fruit is malic acid, which makes up 0.59 of the fruit's weight. A trace amount of oxalic acid is also claimed to be present. The fruit's astringency is caused by tannins and gallic acid. The presence of cyaniding diglycosides gives *Syzygium cumini* fruit its purple hue.

Jamun is rich in compounds containing anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol and myrecetin. The seeds are claimed to contain alkaloid, jambosine, and glycoside jambolin or antimellin, which halts the diastatic conversion of starch into sugar and seed extract has lowered blood pressure by 34.6% and this action is attributed to the ellagic acid content. The seeds have been reported to be rich in flavonoids, a well-known antioxidant, which accounts for the scavenging of free radicals and protective effect on antioxidant enzymes and also found to have high total phenolics with significant antioxidant activity and are fairly rich in protein and calcium. Java plums are rich in

sugar, mineral salts, vitamins C, PP which fortifies the beneficial effects of vitamin C, anthocyanins and flavonoids (Bajpai *et al.*, 2005).



Leaves: The leaves are rich in acylated flavonol glycosides, quercetin, myricetin, myricitin, myricetin 3-O-4-acetyl-L-rhamnopyranoside, triterpenoids, esterase, galloyl carboxylase, and tannin.

Stem bark: The stem bark is abundant in quercetin, kaempferol, myricetin, gallic and ellagic acid, bergenins, flavonoids, tannins, betulinic acid, friedelin, epi-friedelanol, β -sitosterol, eugenin, and fatty acid ester of epi-friedelanol. The astringent quality of stem bark may be caused by the presence of gallo- and ellagi-tannins.

Flowers: The flowers are rich in kaempferol, quercetin, myricetin,

isoquercetin (quercetin-3-glucoside), myricetin-3-L-arabinoside, quercetin-3-D-galactoside, dihydromyricetin, oleanolic acid, acetyl oleanolic acid, eugenol-triterpenoid-A and eugenol triterpenoid-B.

Fruits: The fruits are rich in raffinose, glucose, fructose, citric acid, mallic acid, gallic acid, anthocyanins; delphinidin-3-gentiobioside, malvidin-3-laminaribioside, petunidin-3-gentiobioside, cyanidin diglycoside, petunidin and malvidin. The sourness of fruits may be due to presence of gallic acid. The color of the fruits might be due to the presence of anthocyanins. The fruit contains 83.70-85.80 g moisture, 0.70-0.13 g protein, 0.15-0.30 g fat, 0.30-0.90 g crude fiber, 14.00 g carbohydrate, 0.32-0.40 g ash, 8.30-15.00 mg calcium, 35.00 mg magnesium, 15.00-16.20 mg phosphorus, 1.20-1.62 mg iron, 26.20 mg sodium, 55.00 mg potassium, 0.23 mg copper, 13.00 mg sulfur, 8.00 mg chlorine, 80 I.U. vitamin A, 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, 7.00 mg choline and 3.00 mcg folic acid per 100 g of edible portion (Noomrio and Dahot, 1996).

Table 1: Medicinal Importance of Chemicals Present in Leaves

Chemical present in leaves	Medical importance
Quercetin	Decreases DMBA-induced DNA damage
β - sitosterol	Topical application of β -sitosterol inhibited the TPA-induced inflammation.
Myricetin	Inhibits polycyclic aromatic hydrocarbon-DNA adduct formation in epidermis and lungs of SENCAR mice.
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.
Oleanolic acid	Inhibits tumor promotion ion in mouse skin.

Pharmacological Properties:

A range of pharmacological properties is possessed by various extracts of jamun which include antidiabetic, antihyperlipidemic, antihypercholesterolemic, anticancer, cardioprotective, hepatoprotective, neuroprotective, anti-inflammatory, antioxidant, and antimicrobial activities, as established by different scientific studies.

Antidiabetic Activity: The antidiabetic effect of many natural products is based on the inhibition of α -amylase and α -glucosidase activities, which slow down starch digestion contributing to the reduction in blood glucose level. Shinde *et al.* (2008) evaluated inhibitory activity of jamun seed extracts against microbial (*Saccharomyces cerevisiae* and *Bacillus stearothermophilus*, in vitro), and mammalian (*in vivo* on Goto-Kakizaki rat intestine, administration of 250 mg/kg body weight) α -glucosidase. Both acetone and 70% ethanol extracts exhibited inhibitory activity against enzyme of all three sources. Several in vivo studies

showed the antidiabetic activity of jamun seeds, their extracts and phytochemicals. Study revealed that jamun seed extract preferably improves various biochemical actions, such as glucose tolerance and glucose uptake, maintains glucose homeostasis in diabetic animals, and exhibits benefits in restoring β -cells.



Antihyperlipidemic and antihypercholesterolemic activity: The presence of several bioactive compounds in jamun seeds helps to regulate the blood lipid profile. Oral infusion of an alcoholic jamun seed extract (100 mg/kg body weight) in diabetic rats

resulted in a significant reduction in serum lipids. In both streptozotocin-induced diabetic rats and alloxan-induced diabetic rabbits, the jamun seed extract also reduced the 3-hydroxy-3-methyl-glutaryl-coenzyme A (HMG-CoA) reductase activity, serum low-density lipoprotein (LDL) cholesterol level, and total serum cholesterol to high-density lipoprotein (HDL) cholesterol ratio (Sharma *et al.*, 2003). In Sharma *et al.* (2017) trials, diabetic rats were given 200 and 400 mg/kg×day) of a water extract from jamun seeds. In comparison to the diabetic control group, the authors found lower serum levels of LDL cholesterol (by 28.3 and 32.9%, respectively), triglycerides (by 43.1 and 46.7%, respectively), and total cholesterol (by 39.9 and 44.2%, respectively). When extracts were added to the rat diet, the HDL-cholesterol concentration rose by 14.6% and 20.2%, respectively.

Hepatoprotective activity: The ability of jamun peel extract to protect rat hepatocytes from oxidative damage caused by carbon tetrachloride (CCl₄). Das and Sarma's (2009) *in vivo* research on rats' toxicity from paracetamol has further substantiated the hepatoprotective effect. They showed a decrease in the rise of serum enzymes, total protein, and albumin levels due to hepatoprotection, based on the oral administration of an ethanolic pulp extract in a dose-dependent manner. Additionally, the investigation confirmed that the liver's histological structure was intact and that there was no acute oral damage.

Immunomodulatory activity: 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. 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 (Barh and Vishwanathan, 2008).

Antibacterial activity: A recent study conducted by Patel and Rao (2010) found that jamun pulp has antimicrobial properties. The study used extracts from several fruit pulp maturity indices (young, premature, mature, preripened, and ripened) and solvent systems (ethyl acetate, acetone, methanol, aqueous, and diethyl ether). Gram positive bacteria were said to be more susceptible to the extracts' effects than Gram negative ones. The most promising antibacterial agent among the various maturity stages and solvents was the diethyl ether extract from preripened pulp.

Cardioprotective activity: A study found that the methanolic extract of jamun seeds helped protect albino rats' hearts from

myocardial infarction caused by isoproterenol. The effect was probably related to strengthening of the myocardial membrane, induced by the phytochemicals like alkaloids, amino acids, flavonoids, glycosides, phytosterols, saponins, steroids, tannins and triterpenoids in the extract.

Conclusion:

Jamun (*Syzygium cumini*), sometimes referred to as Java Plum, Blackberry, or Black Plum, is a huge, glabrous, evergreen tree that grows all throughout India. The trees bear rectangular or ellipsoid berries every year. When fully ripe, they turn purple black, yet when raw, they are green. The ripe fruits have a little tangy and sweet flavor. According to studies, the berries include minerals, carbohydrates, and pharmacologically active phytochemicals such as anthocyanins, terpenes, and flavonoids. Phenolic and other non-phenolic bioactives are abundant in the entire jamun, which includes the peel, pulp, and seed. The most extensively researched of them is the ameliorating activity against Type 1 and Type 2 diabetes. Pharmacological studies link the phytochemicals to a variety of therapeutic actions, including antioxidative, anti-cancer, antidiabetic, antibacterial, and radioprotective activities.

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