

## Jamun (*Syzygium cumini*) Skeels: A Traditional Therapeutic Tree and its Processed Food Products

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### ABSTRACT

*Jamun (Syzygium cumini) is traditionally used for various treatments in Ayurveda. Worldwide evidences have been observed for its therapeutic action by many scientists. The whole plant (Leaves, Seeds, Flowers, Fruits and Bark) is being used for its therapeutic action. The present review focuses on traditional uses of Jamun along with advanced therapeutic actions. In Ayurveda the Jamun is used as Grahi, Vatakara, Shramahara, Pittahara, Dahahara Kantartihara and to control Shosha, Krimi, Atisara, Kasa, Vishtambhini, etc. As per many scientists Jamun contains various phytochemicals present in seeds, leaves, fruits and other parts which possess many therapeutic actions viz. Antidiabetic, Antimicrobial, Antidiarrhoea, Antidysentery and Anti-allergic. Various value added food products can be prepared from jamun fruits such as Juice, RTS, Squash, Wine, Jam, Jelly, Cheese, Toffee, etc. The pulp or seeds powder can be fortified with some Indian traditional food products to increase its functional characteristics.*

**Key words:** Jamun, Ayurveda, Phytochemical, Therapeutic, Processing

### INTRODUCTION

*Syzygium cumini* Skeels (Syn. *Eugenia jambolana* Lam.) ‘Brahapati’ in Sanskrit, popularly known as Java plum, Portuguese plum, Malabar plum, Black plum, Indian blackberry, Jamun, Jambu, Jambul, Jambool and Naval belongs to the family Myrtaceae. *S. cumini* is a large evergreen tree native to India. However, it is found in Eastern Africa, South America, Madagascar and warmer regions of the United States of America<sup>23</sup>. Its synonyms such as *Syzygium cumini* (L.) Druce, *Eugenia*

*jambolana* Lam., *Syzygium jambolanum* DC. belonging to the family *Myrtaceae*, is a large evergreen tree up to 30 m height and a girth of 3.6 m with a bole upto 15 m found through India upto an altitude of 1,800 m. Most of the plant parts of *E. jambolana* are used in traditional system of medicine in India. Different parts of the tree including leaf, bark, seed, and pulp, are used in the treatment of diabetes, allergies, viral infection, inflammation, and gastric ulcer.

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Meanwhile all the parts of Jamun tree have medicinal value. Jamun seed powder is produced commercially by herbal manufacturers in India and is very useful for patients suffering from diabetes. Jamun seeds are used in Ayurveda to treat digestive ailments. Jamun fruit juice is prepared in homes and it is also available commercially<sup>21</sup>. The tree fruits once in a year and the berries are sweetish sour to taste. The ripe fruits are used for health drinks, making preserves, squashes, jellies and wine<sup>33</sup>. The present review emphasizes on Ayurvedic importance of Jamun with Advanced nutraceutical values.

### Scientific Classification

**Kingdom** : Plantae  
**Order** : Myrtales  
**Family** : Myrtaceae  
**Genus** : Syzygium  
**Species** : Cumini  
**Binomial name** : *Syzygium cumini* (L.) Skeels.

### Jamun in Ayurveda

**Sanskrit synonyms:** Mahaphala, Kokileshta, Pikabhaksha, Phalendra, Surabhipatra, Jambava, Mahaskandha.

### Medicinal qualities of Jamun in Ayurveda

**Rasa** (Taste) – Kashaya (astringent), Madhura (sweet), Amla (sour)

**Guna** (qualities) – Laghu (light to digest), Rooksha (dry)

**Vipaka** (taste conversion after digestion) – Katu (pungent)

**Veerya** (potency) – Sheeta (cold)

**Effect on Tridosha** – It increases Vata but balances Kapha and Pitta.

### Jamun uses in Ayurveda

**Grahi** – Absorbent, useful in malabsorption syndrome and diarrhea

**Vatakara** – Increases Vata

**Shramahara** – Relieves tiredness

**Pittahara, Dahahara** – Balances Pitta and its symptoms like burning sensation.

**Kantarti hara** – Relieves throat pain

**Shosha** – Emaciation

**Krimi** – Worm infestation, infection

**Shwasa** – Asthma, COPD (chronic obstructive pulmonary disease), wheezing, breathing difficulty

**Atisara** – Diarrhoea, dysentery

**Kasa** – Cough, cold

**Vishtambhini** – Causes constipation, useful in diarrhea and dysentery

**Rochana** – Improves taste, useful in anorexia

**Pachani** – Improves digestion<sup>3</sup>.

According to Ayurveda, its bark is acrid, sweet, digestive, astringent to the bowels, anthelmintic and in good for sore throat, bronchitis, asthma, thirst, biliousness, dysentery, blood impurities and to cure ulcers. Syrup or vinegar prepared from the ripe fruit is useful in spleen enlargement and efficient astringent in chronic diarrhea. Hot water extract of dried fruits is used for stomach ulcers, reduce acidity and for diabetes. The ethanolic extract of *Syzygium cumini* seeds decreased blood sugar level in alloxan induced diabetic rats also having antibacterial activity<sup>9,13</sup>.

### Composition of Jamun

Jamun fruit is generally acknowledged to be very high quality for its curative function chiefly against diabetes because of its effect on pancreas. Jamun seeds also contains albumen, fat, glycosides, an alkaloid; jambosine, resin, ellagic acid, quercetin, gallic acid as well as elements of zinc, vanadium, chromium, sodium and potassium. Sitosterol is present in unsaponifiable material of seed fat. Also Jamun pulp contains moisture content of 82.19±2.46%, crude protein 2.15±0.06%, crude fat 0.83±0.02%, crude fiber 1.76±0.05%, ash 2.04±0.06% and nitrogen free extracts (NFE) 11.03±0.33%. Whereas, Jamun seed consisted of moisture (16.34±0.49%), crude protein (1.97±0.59%), crude fat (0.65±0.01%), crude fiber (4.19±0.12%), ash (2.18±0.06%) and NFE (74.67±2.24%)<sup>1</sup> (Ahmad *et al.*, 2015). The plant 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<sup>19</sup>.

Table 1: Composition of Jamun Fruit Pulp and Seeds<sup>15</sup>

Component (Dry Basis)	Pulp	Seeds
Moisture (%)	75.93	11.04
Protein (%)	3.88	10.64
Fat (%)	0.17	0.88
Ash (%)	2.67	2.76
Fibre (%)	1.82	3.39
Carbohydrates (%)	15.53	71.29
Ascorbic acid (mg)	204.00	35.75
Carotenoids (mg)	2.02	7.42
TSS <sup>0</sup> Brix	24	3.7

## Phytochemical Constituents of various parts of Jamun

### Fruit

Fruit of Jamun contains Malic acid is the major acid (0.59 of the wt of fruit), a small quantity of oxalic acid is also reported to be present. Gallic acid and tannins account for astringency of the fruit. The purple colour of the fruit is due to presence of cyanidin diglycosides. Fruit contain sugar (8.09%), non-reducing sugar (9.26%) and sulfuric acid (1.21%)<sup>2,10</sup>. It also contains glucose, fructose, mannose, and galactose as the principal sugar moieties. The mineral constituents are also reported to present which includes Ca, Mg, Na, K, Cu and vitamins such as thiamine, riboflavin, nicotinic acid etc<sup>31,32</sup>. Studies have shown that the pulp of Jamun contains anthocyanins, delphinidin, petunidin, malvidin-diglucosides, and are responsible for the bright purple color<sup>23</sup>.

Fruit pulp contains Anthocyanins, diglucosides of delphinidin, petunidin, malvidin, peonidin, and cyanidin. Volatile oils such as  $\alpha$ -pinene,  $\beta$ -pinene,  $\beta$ -myrcene, cis-ocimene, trans-ocimene, terpinolene, linalool, 4-terpineol,  $\alpha$ -terpineol, cis-dihydrocarvone, caryophyllene,  $\alpha$ -humelene, cis- $\beta$ -farnesene, cis- $\alpha$ -farnesene, trans- $\alpha$ -farnesene, cis-nerolidol, geranyl butyrate, globulol, widdrol, torreyol, neocedranol,  $\beta$ -bisabolol<sup>6</sup>.

### Seeds

Seed contains a glucoside jamboline, a new phenolic substance, a trace of pale yellow essential oil, chlorophyll, fat, resin, albumen, tannins (19%), Phenolic such as ellagic acid, gallic acid (1-2%), caffeic and ferulic acids and derivatives, guaicol, resorcinol dimethyl

ether and corilagin<sup>9</sup>. Farrukh *et al*<sup>6</sup>, investigated that Jamun seeds contains Ellagitannins, Jambosine, gallic acid, ellagic acid, corilagin, 3, 6-hexahydroxy diphenylglucose, 1-galloylglucose, 3-galloylglucose, quercetin,  $\beta$ -sitosterol, and 4,6-hexahydroxydiphenylglucose. Brij and Subramanian<sup>4</sup>, reported that seeds of jamun to contains antimellin, alkaloid, glycoside jambolin and jambosine, which halts the diastatic conversion of starch into sugar.

### Flower

Ramya *et al*<sup>23</sup>, investigated that the flowers of *S. cumini* contains erategolic acid (maslinic acid), flavonoids - isoquercitrin, quercetin, kaempferol, myricetin-3-L-arabinoside, quercetin-3-D-galactoside, dihydromyricetin, oleanolic acid, acetyl oleanolic acid, eugenol-triterpenoid A and eugenoltriterpenoid B.

### Stem bark

The stem bark of *S. cumini* has been testified to possess friedelin, friedelan- 3-a-ol, betulinic acid,  $\beta$ -sitosterol, kaempferol,  $\beta$ -sitosterol-D-glucoside, gallic acid, ellagic acid, gallotannin, ellagitannin and myricetin, betulinic acid, eugenin and fatty acid ester of epi-friedelanol, quercetin, bergenins, flavonoids and tannins, lignan derivatives cuminiresinol, syzygiresinol A, syzygiresinol B, di-demethyl-5-hydroxypinoresinol, dimethylpinoresinol, didemethoxy- pinoresinol, pinoresinol and 4'-methyl- 5'-hydroxypinoresinol<sup>17,25,27</sup>.

### Leaves

The leaves are used as food for livestock. The leaves and bark are used for controlling blood pressure. Vinegar and wine are also made from the fruit. The *S. cumini* leaves reported to contain  $\beta$ -sitosterol, betulinic acid,

mycaminose, crategolic acid, n-hepatcosane, n-nonacosane, n-hentriacontane, noctacosanol, n-triacontanol, n-dotriconanol, quercetin, myricetin, myricitrin and flavonol glycosides, myricetin 3-O-(4"-acetyl)-a-Lrhamnopyranosides, acylated flavonol glycosides, triterpenoids and tannin, eicosane, octacosane, octadecane. Essential oils from leaves are rich in pinocarveol, a-terpeneol, myrtenol, eucarvone, muurolol, a- myrtenal, cineole, geranyl acetone, a-cadinol and pinocarpone<sup>17,25,27</sup>.

### Therapeutic Properties of various parts of Jamun

The phytochemicals like oxalic acid, gallic acid, malic acid, tannins, oleanolic acid, cyanidin, flavonoids, betunilic acid, essential oils have been reported for significant antinaemic, gingivitis, antipyretic, antidiarrheal, anti-bacterial, anti-inflammatory, hypoglycemic, gastro protective and hypolipidemic properties. The phytochemicals like alkaloids, tannins, saponins, terpenoids and quinines are confirmed by qualitative analysis. The bioactive compounds from different solvent extracts suspected of anti-diabetic properties. The leaves of *Syzygium cumini* is considered as an antibacterial and also used to strengthen the teeth and gums in folklore medicine<sup>4</sup>.

### Anti- Diarrhoea and Dysentery

The whole plant of Jamun (*Syzygium cumini*) such as seeds, fruit, leaves, flower, bark used in traditional medicine. *Charaka* used seeds and leaves decoctions for diarrhoea and the bark as an astringent. *Sushruta* prescribed the fruit internally in obesity, in vaginal discharges and menstrual disorders, cold infusion in intrinsic haemorrhage. The bark is astringent; its juice is given (56-112 ml) doses in chronic diarrhoea, dysentery, and menorrhagia. Decoction of the bark is an efficacious mouth-wash and gargle for treating spongy gums, stomatitis, relaxed throat and other diseases of mouth. Bark also used for inflammation of skin<sup>12,20</sup>.

### Antimicrobial Effect

Gangadhar *et al*<sup>7</sup>, studied the antibacterial activity against *E. coli*, *B. subtilis*, *P.*

*aeruginosa* and *S. aureus* and inhibitory effect on glucoamylase of ethanolic extracts isolated at different temperatures from seeds of *Syzygium cumini* was investigated in vitro. The ethanolic extracts of leaves and aqueous extracts of seeds were found to have very high anti-microbial property for wide range of gram positive and gram negative bacterial strains<sup>29</sup>.

### Antidiabetic

*Syzygium cumini* (Myrtaceae) is widely used traditional system of medicine to treat diabetes in India. Kumar *et al*<sup>14</sup>, isolated a compound mycaminose from SC seed extract. The isolated compound mycaminose (50 mg/kg) and ethyl acetate [EA] and methanol [ME] extracted compounds of *S. cumini* seed (200 and 400 mg/kg) was undertaken to evaluate the anti-diabetic activity against streptozotocin (STZ) - induced diabetic rats. The compound 'Mycaminose' and ethyl acetate and methanol extracted produced significant ( $p < 0.05$ ) reduction in blood glucose level. According to Khan *et al*<sup>11</sup>, decoction of aerial parts, taken orally by adults at a dose (500mg/ person) was active as an anti-hyperglycemic agent. Ratsimamanga *et al*<sup>24</sup>, reported that the ethanolic extract of bark of jamun decrease blood sugar level by 21% after one hour in hyperglycaemic rabbits in a dose corresponding to 10 gm/kg.

Ravi *et al*<sup>26</sup>, evaluated hypoglycaemic activity of different parts of *E. jambolana* seeds such as whole seed, kernel and seed coat on streptozotocin induced diabetic rats. Administration of ethanolic extract of kernel at a concentration 100mg/kg of body weight significantly decreased the levels of blood glucose, blood urea and cholesterol, increased glucose tolerance and levels of total proteins and liver glycogen and decreased the activities of glutamate oxaloacetate transaminase and glutamate pyruvate transaminase in experimental diabetes rats.

A glycoside in the seed, jamboline, is considered to have antidiabetic properties. Older French research shows that the seeds have a significant hypoglycemic effect in diabetic rabbits. Jamun fruit seeds and pulp have been reported to serve various purposes

in diabetic patients, such as lowering blood glucose levels and delaying diabetic complications including neuropathy and cataracts. Jamun is most often recognized as an adjuvant therapy in type-2 diabetes. This has been traced not only to its anthocyanin-rich, dark-purple fleshy pulp, but also to its seeds, which have been most studied for their antidiabetic principles<sup>8,22,28</sup>.

#### **Anti-allergic**

Allergy is an abnormal reaction of the body to the allergen introduced by ingestion, injection, inhalation or skin contact. A novel, safe and effective remedy is required for this ailment. In an investigation, the aqueous extract of SC leaves (25-100mg/kg, p.o.) inhibited the rat paw edema induced by 48/80 (allergenic compound), histamine and 5-HT. However, the extract could not produce any beneficial effects against the platelet aggregating factor-induced paw edema<sup>5</sup>.

#### **Processed Food Products**

The various processed food products can be prepared from Jamun fruits viz. fermented and non-fermented beverages. Besides that, jam, jelly, cheese, toffee, etc. can be prepared. Also, fortified products can be prepared from jamun pulp or its other parts. Procedures of preparation of different product are given below.

#### **Jamun Juice**

Take the *Jamun* fruit and wash it to clean. Grate the fruits to separate pulp. After heating the pulp at 60°C extract the juice through basket press. Strain it to remove unwanted particles from juice. Pasteurization the juice at 85°C and add the Sodium benzoate as preservative. Then, Bottled the juice in clean and sterile glass bottles and store at ambient temperature.

#### **Jamun Ready to Serve drink (RTS)**

Take the *Jamun* fruit pulp and mix with strained syrup solution (as per requirement). Then, homogenize the mixture. Fill the RTS in glass bottles, cork it tightly. Pasteurize at 85°C for 20 min and cool to room temperature. Store at ambient temperature.

#### **Jamun Squash**

Take the *Jamun* fruit wash it to clean. Cutting and removal of seed. Extract the juice through basket press. Straining is done to remove unwanted particles from juice. Measure the juice to prepare sugar syrup. Prepare the sugar syrup by mixing 1.8 kg sugar, 1 L water and 15 g citric acid. Straining the syrup to remove foreign particles and scum. Mix the syrup with juice homogeneously. Addition of sodium benzoate (3.0 g/L squash) as preservative. Bottled the juice in clean and sterile glass bottles. Store at ambient temperature.

#### **Jamun Wine**

Take the *Jamun* fruit and wash by using clean tap water then dip in 5% NaCl salt solution for 72 hour. Separate the seed from the fruit and crush the fruit pulp with water (1:1 ratio) in a Mixture cum grinder. Press the pulp extract the juice and add sodium metabisulphite (100 µg ml<sup>-1</sup>). Adjust the TSS to 17 °Brix with cane sugar. Acidify the must to pH 4.5 using 1N acetic acid. Inoculate the must with wine yeast starter culture (use 28-48 hour old starter culture at 2% v/v) and keep it for Fermentation (at 32 ± 2°C for 6 days). Racking and decantation (First racking when Brix reaches 2-3°. Two to three more racking at 15 days intervals if sedimentation persists). Clarify the wine by chemical method (add 0.04% Bentonite). Carry out final racking to clear the wine. Fill the wine in Bottles and cork it (Add 100 µg ml<sup>-1</sup> sodium metabisulphite). Then seal the bottle with bees wax. Store the wine at ambient temperature.

#### **Jamun Jam**

Take a known quantity of jamun fruit pulp and sugar in a stainless steel kettle and heated to about 110°C under constant stirring and turned low. Add Pectin at 2 g/kg or 0.2%, with some sugar, then add into the fruit pulp and stirred constantly to prevent the pectin from clotting. When the pectin dissolved, add remaining sugar and dissolve completely in the mixture. Heat the jam mixture and stirred constantly till it started boiling vigorously. Stir the product occasionally. Near the finishing point (approximately 221°C or at 68-70% TSS), add acidifier (citric acid) at 4g kg<sup>-1</sup> emulsion to get

the expected acidity. Also add sodium benzoate as preservative at 1 g kg<sup>-1</sup> by weight. Fill the jam in jars at 190°C. Cool the jars in running cold water until they reached a temperature slightly above room temperature, then dry and labeled it<sup>18</sup>.

### **Jamun Jelly**

Take the *Jamun* fruit wash it with clean water. Stored under -18°C to avoid spoilage on longer storage. Remove the fruits from store whenever required and thaw it. Separate the seed from the fruits. Crushed and homogenize the fruit pulp with water (7:3 ratio) in a Mixture cum Grinder. Adjust pH 3.4 (by using citric acid) Add and mix sugar with pulp (4:6 ratio); add 1 % pectin. Cook the mixture up to 67° brix. Fill hot in sterilized bottle. Wax the product to prevent moisture loss and microbial contamination. Cap the jar and store at ambient temperature.

### **Jamun Cheese**

Wash the ripe jamun fruits with water. Extract the pulp manually from the seeds. Mix one kg extracted pulp with 100 ml water and heat up to 70°C and passed through fruit Pulper to get the homogeneous pulp. Add 2 % pectin to pulp for firm setting of cheese. Add the sugar, citric acid and butter to the pulp. Cook the mixture to obtain a desired consistency. Finally add salt as per recipe and benzoic acid @ 500 ppm into the cooked mass. Spread the prepared product on butter smeared trays (0.60 cm thick) and left for cooling and setting for 5-6 hours. Cut suitable size pieces of cheese and wrap in butter paper and packed in polyethylene bags<sup>16</sup>.

### **Jamun Toffee**

Wash the ripe jamun with water and the pulp was extracted manually from seeds. Extract the pulp manually from the seeds. Mix one kg extracted pulp with 100 ml water and heat up to 70°C and passed through fruit Pulper to get the homogeneous pulp. Cook the pulp till its contents became one third of its original volume. At this stage, add requisite amount of sugar, commercial glucose and butter to the pulp and cook it again till the mass became sufficiently solid and started leaving sides of the pan. Add the skim milk powder in a little

lukewarm water and mix with the cooked mass and it again cook for 2 to 3 minutes. Add Benzoic acid @ 500 ppm into the cooked mass. Finally rolled the mass into sheets (0.50 to 0.75 cm thick) on a smeared tray and left for cooling and setting for 5 to 6 hours. Cut the toffee as per need and wrap in butter paper and packed in polythene bags<sup>16</sup>.

### **Fortified Food Products**

#### **Unleavened flat bread or Chapatti**

Swati *et al*<sup>30</sup>, prepared Chapatti by fortification of *Jamun* pulp. They took pulp and blended with the whole wheat flour (50g) at different levels and mixed with desired quantity of water. Knead it for 2.5 minutes for dough development and rest for 30 min at 30°C and 85 % RH (relative humidity). Divided dough into four equal parts and round manually followed by sheeting/rolling on smooth surface to obtain circular *chapattis* of 15 cm in diameter. Immediately place the raw *chapatti* on an open hot girdle and baked on one side and then invert and bake on the other side followed by final baking on the first side. Optimize final product on the basis of puffiness, stickiness and sensory evaluation of chapatti.

### **CONCLUSION**

The traditional uses of Jamun are noted in Ayurveda and it has tremendous health benefits over a various diseases. *Suzigium Cumini* has many phytochemicals in its seeds like Jambolin and some organic acids. The leaves and bark are also full of phytochemicals. The phytochemicals are useful in treatment of various health problems as discussed above. Various value added products can be prepared from fruits as discussed above. Ultimately, we could say that *Suzigium Cumini* is a real therapeutic tree and its fruits can be commercialized for production of various processed food products.

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