

Herbal medicine : *Syzygium cumini* : A Review

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ABSTRACT

Plants have provided mankind with herbal remedies for many diseases for many centuries and even to day. They continue to play a major role in primary healthcare as therapeutic remedies in developing countries. In India herbal medicines have been the bases of treatment and cure for various diseases in traditional methods practiced such as Ayurveda, Unani and Sidha . *Syzygium cumini* (syn.*Eugenia Jambolana*) commonly know as a “Jamun” having promising therapeutic value with its various phytoconstituents such as Tannins, Alkaloids, Steroids, Flavonoids, Terpenoids, Fatty acids, Phenols, Minerals, Carbohydrates and Vitamins. Its pharmacological actions like hypoglycaemic, diuretics, analgesic, anti-inflammatory, antiplaque, antimicrobial, antidiarrhoeal, antioxidant, gastro-protective and astringent to bowels proven on animal models. Most importantly the studies have shown that it protects against the radiation induced DNA damage and it has significantly decreases the fertilizing capacity of the male albino rats, some clinical trial reports are also available for its antidiabetic activity.

Keywords: *Syzygium cumini*, Myrtaceae, Phytochemistry, Antidiabetic.

INTRODUCTION

India is one of the nation blessed with a rich heritage of traditional medical systems and rich biodiversity to complement the herbal needs of the treatment administered by these traditional medical systems. The recognized Indian Systems of Medicine are Ayurveda, Siddha and Unani, which use herbs and minerals in the formulations. India, which has 15 agro-climatic zones, 47000 plant species of which 15000 are reported to have medicinal properties varying degrees. The World Health Organization(1980) has also recommended the evaluation of the effectiveness of plants in conditions where there is lack of safe synthetic drugs.¹

Syzygium cumini (L.) synonyms such as *Syzygium cumini* (L.) Druce, *Eugenia jambolana* Lam., *Syzygium jambolanum* DC.² 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.³ Most of the plant parts of *E. jambolana* are used in traditional system of medicine in India.

BOTANICAL DESCRIPTION :

A smooth tree of the Myrtaceae family , 4-15 meters in height. Leaves leathery oblong-ovate to elliptical or obovate and 6-12 cm long , the tip being broad and shortly pointed. The panicles are borne mostly from the branchlets below the leaves , often being axillary or terminal and 4-6 cm long. The flowers are numerous, scented, pink or nearly white, without stalks, and borne in crowded

fascicles on the ends of the branchlets. The calyx is funnel shaped, about 4 mm long, and 4 toothed. The petals cohere and fall together as a small disk . The stamens are very numerous and as long as the calyx. Fruit is oval to elliptic; 1.5-3.5 cm long, dark purple or nearly black, luscious, fleshy and edible; it contains single large seed.⁴

SCIENTIFIC CLASSIFICATION : ⁵

Kingdom : Plantae
Unranked : Angiosperms
Unranked : Eudicots

Unranked : Rosids
Order : Myrtales
Family : Myrtaceae
Genus : *Syzygium*
Species : *Cumini*

Binomial name : *Syzygium cumini* (L) Skeels.

PARTS USED : seeds, leaves , fruits , bark.⁶

AYURVEDIC PROPERTIES : ³⁻⁶

Rasa - Kasaya , Madhura , Amla.

Virya - Sita

Guna - Laghu, Ruksa.

Vipala - Madhura , Katu.

Karma – Vatala, Pittahara, Kaphahara, Vistambhi, Grahi.

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Photographs of *Syzygium cumini*

ORIGIN AND DISTRIBUTION :

The original home of *Syzygium cumini* is India or the East Indies. It is found in Thailand, Philippines, Madagascar and some other countries. The plant has been successfully introduced into many other tropical countries such as the West Indies, East and West Africa and some sub tropical regions including Florida, California, Algeria and Israel.⁴

SYNONYMS :³

Sansk. : Mahajambu, Ksudrajambu
Assam. : Jam
Beng. : Jaam , Kalajam
Eng. : Jambul tree
Guj : Gambu,Jamun
Hindi : Jamuna
Mar. : Jambul
Mal. : Njaval
Ori. : Jamu
Punj. : Jaamun
Tam. : Naval
Urdu. : Jamun

MICROSCOPY :³

Syzygium cumini seed :

Shows cotyledons consisting of single layered epidermis, mesophyll composed of isodiametric thin-walled, parenchymatous cells fully packed with simple starch grains,

oval ,rounded measuring 7-28 μ in diameter a few schizogenous cavities are also found.

Syzygium cumini seed powder :

Brown coloured; shows a few parenchymatous cells and numerous oval, rounded starch grains, measuring 7-28 μ in diameter.

Syzygium cumini stem bark :

Mature bark shows a wide zone cork differentiated into upper and lower cork zones, forming a rhytidoma; cork consisting of tangentially elongated rectangular cells, upper few layers thick, stratified and reddish brown, having groups of 2-4 stone cells and crushed elements of phloem; lower cork thin and colourless; cork cambium not distinct; secondary phloem composed of sieve elements, and phloem rays; phloem parenchyma thin walled and polyhedral in shape ; stone cells ,oval to angular, elongated fibres aseptate; both stone cells and fibres single or in groups present throughout this region; phloem rays 1-4 cells wide; reddish brown content ,rosette crystals of calcium oxalate and simple ,round to oval starch grains, measuring 5-11 μ in diameter.

Syzygium cumini stem bark powder :

Light brown; shows fragments of thin- walled cork cells, aseptate fibres; single or in groups, oval to angular, elongated, stone cells; rosette and prismatic crystals of calcium oxalate and simple round to oval starch grains, measuring 5-11 μ in diameter.

PHYTOCHEMISTRY :

'Phyto' is the Greek word for plant. There are many families of phytochemicals and they help the human body in a variety of ways. Phytochemicals may protect human from a host of diseases. Phytochemicals are non nutritive plant chemicals that have protective or disease preventive properties.

Fruit of *Syzygium cumini* 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.⁷ Fruit contain sugar (8.09%), nonreducing sugar (9.26%) and sulfuric acid (1.21%).⁸ Glucose, Fructose, mannose and galactose are the principal sugars ⁹ The mineral constituents reported to be present (mg/100g of edible pulp) are Ca, 15, Mg, 35; P,15 (phytin P,2); Fe, 1.2 (ionisable Fe, o.1) ; Na, 26.2; K 55; Cu, 0.23; S,13 and Cl,8. The vitamins present (in 100g. edible pulp) are vit.A, 80 IU; thiamine,0.03 mg, riboflavin,0.01mg; nicotinic acid ,0.2 mg; vit.C, 18 mg; choline,7 mg; Folic aid, 3 μ g.⁷

Seed contains a glucoside jamboline, a new phenolic substance, a trace of pale yellow essential oil, chlorophyll, fat, resin, albumen,¹⁰ tannins (19%),⁷ Phenolic such as ellagic acid, gallic acid (1-2%), caffeic and ferulic acids and derivatives, guaicol, resorcinol dimethyl ether and corilagin.⁹ The seeds are fairly rich in protein and calcium.⁷ Monoterpenoids like β -pinene, γ -terpinene, terpinolene, borbeneol, β -phellandrene, α -terpineol and eugenol⁹ and flavonoid such as rutin, quercetin.¹¹ β -sitosterol also present syzygium cumini seed.¹² Oil of *Syzygium cumini* found to contain lauric (2.8%), myristic (31.7%), palmitic (4.7%), stearic (6.5%), oleic (32.2%),linoleic (16.1%), malvalic (1.2%) and vernolic (3%) acids.¹³ Novel compounds such as 5,6 dihydroxy-3-[(4-hydroxy-6-(hydroxymethyl)-3,5-di[3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2h 2pyranyl]oxy]2-methoxy-10,13 dimethylperhydrocyclopenta [a] phenanthren-17-yl (phenyl) methyl acetate,¹⁴ 3,15- dihydroxy γ -³ androstene [16, 17-C](6'methyl , 2'-1,3-dihydroxy-1-propene) 4H pyran and 3-hydroxy androstane [16,17-C](6'methyl , 2'-1-hydroxy -isopropene-1-yl) 4,5,6 H pyran.¹⁵

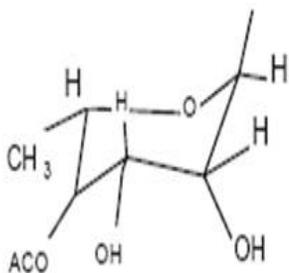
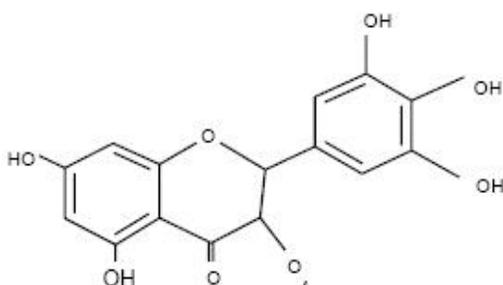
Stem bark of *Syzygium cumini* contains betulinic acid, β -sitosterol, friedelin, epi-friedelanol,⁷ and new ester of epi-friedelanol (eugenin).¹⁶ It also contains β -sitosterol-D-glucoside, kaempferol-3-o glucoside, quercetin,¹⁷ myricetin, astragalins and gallic acid.⁹

Gupta and Sharma isolated sitosterol, betulinic acid and crategolic (maslinic) acid and also detected n-hepatcosane, n-nonacosane, n-hentriacontane, n-octacosanol, n-triacontanol and n-dotricontanol by GLC and sugars – glucose, fructose ,acids-oxalic,citric,glycolic acids and aminoacids – glycine, alanine, tyrosine and leucine by co-paper chromatography in the leaves of *E. jambolana*.¹⁸ Quercetin (0.0085%), myricetin (0.023%), myricitrin (0.009%),myricetin 3-0-(4''-acetyl)- α -L-rhamnopyranoside (0.059%)

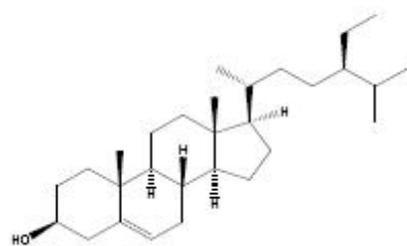
also found to contain in *E.jambolana* leaves.¹⁹ A complicated mixture of polyphenols such as gallic acid, methylgallate, kaempferol, ellagic acid, 3-O-methylellagic acid, myricetin 4'-methyl ether 3-O- α -L rhamnopyranoside (quercetin), kaempferol 3-O- β -D-glucuronopyranoside, myricetin 3-O- β -D-glucuronopyranoside, ellagitannin, nilocitin and two acylated flavonol glycosides such as mearnsetin 3-O-(4''-O-acetyl)- α -L rhamnopyranoside and myricetin 4''-O-acetyl-2''-O-gallate reported in *E. jambolana* leaves.²⁰ Steam distillation of leaves give an essential oil with pleasant odour. The oil contains terpenes, 1-limonene and dipentene.⁷

Oleanolic acid, erategolic acid (maslinic acid), flavonoids - isoquercitrin, quercetin, kaempferol and myricetin were found in the flowers of *Syzygium cumini*.²¹

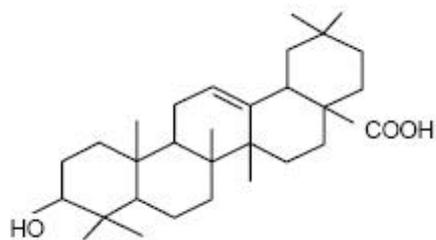
Structure of some isolated phytoconstituents :



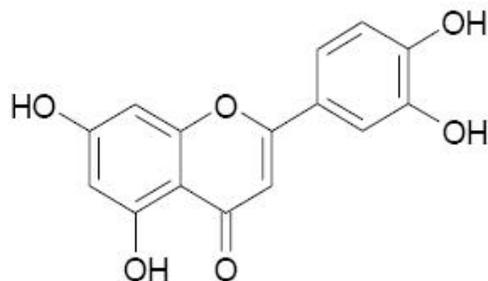
Myricetin 3-O-(4''-acetyl)- α -L-rhamnopyranosides.



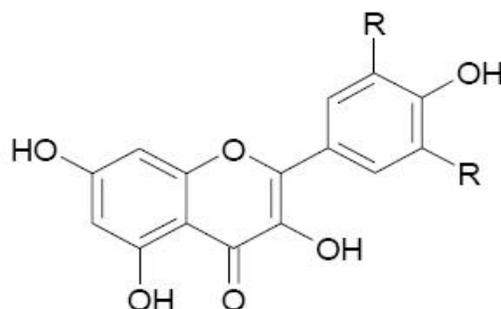
β -sitosterol



Oleanolic acid



Quercetin



Kaempferol R= H

Myricetin R = OH

TRADITIONAL AND MEDICINAL USES :

Entire plant of *Syzygium cumini* such as seed, fruit, leaves, flower, bark used in folk medicine. Charaka used seeds, leaves and fruits in 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.²² The bark is astringent, its juice is given (56-112 ml) doses in chronic diarrhoea, dysentery, 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.²³ The bark is used in dyeing and tanning and for colouring fishnets. 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.²⁴

The juice of Jambu, Amra and Amalaka leaves mixed with goat milk and honey prescribed in diarrhoea with blood.²² Leaf juice is taken orally to treat diabetes. The juice is taken mixed with milk every morning. Fresh leaf juice is taken orally for stomach pain.²⁵

A syrup prepared from the juice of the ripe fruit is a very pleasant drink. Syrup or vinegar prepared from the ripe fruit is useful in spleen enlargement and efficient astringent in chronic diarrhoea.¹⁰ Hot water extract of dried fruits is used for stomach ulcers,²⁶ reduce acidity and for diabetes.²⁷

The ethanolic extract of *Syzygium cumini* seeds decreased blood sugar level in alloxan induced diabetic rats.²⁸ Seed powdered in combination with mango kernels were administered with card to overcome problems of diarrhoea and dysentery, enlargement of spleen

and as diuretic in scanty or suppressed urine²⁹ and seed also having antibacterial activity.¹⁴

PHARMACOLOGY :

Syzygium cumini having pharmacological activity like anti-diarrhoeal, antioxidant, gastroprotective, antiallergic, astringent, analgesic, anti-inflammatory, antiplaque, antimicrobial but the most important activity is anti-diabetic.

1. Anti-diabetic Activity :

Diabetes is a chronic metabolic disorder affecting a major population world wide . A sustained reduction in hyperglycaemia will decrease the risk of developing micro vascular diseases and reduce their complications.³⁰ The conventional therapies for diabetes may have many shortcomings, such as side effects and high rate of secondary failure. On the other hand herbal extracts are expected to have similar efficacy, without side effects, to that of conventional drugs.

A number of scientific studies in animals have substantiated the role of jambul in the management of diabetes.³¹ According to Khan et al., decoction of aerial parts, taken orally by adults at a dose (500mg/ person) was active as an anti-hyperglycemic agent.³² Sigogneau-Jagodzin-ski et al., showed constituents isolated from ethanolic extract had hypoglycemic effect on alloxan induced diaetic rats.³³ Jain et al. studied antidiabetic effect of hot water extract of dried fruit pulp of *S. cumini* (5 gm) when administered by gastric intubation.³⁴ According to Ratsimamanga et al., 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.³⁵ Bansal et al., reported hypoglycaemic activity of oral administration of *E.jambolana* seed due to the increasing activity of cathepsin B.³⁶ Achrekar et al.,reported the oral administration of pulp extract of fruits of *S. cumini* to streptozotocin induced diabetic rats exhibited hypoglycaemic effect in 30 minutes which was possibly due to the stimulation of insulin secretion.³⁷

According to Prince et al.,increased activity of hexokinase and decreased activity of aqueous seed extract (2.5g/kg, b.w. for one month) to alloxan diabetic rats. Aqueous seed extract (2.5 & 5g/kg, b.w. for 6 weeks) has been observed to produce hypoglycemic activity, in rats.³⁸ Alcoholic seed extract injection (20mg, intraperitoneally) reduced the blood sugar level to 37.17% at 3 hour and 46.68% at 6 hour of administration in alloxan diabetic mice along with enhanced insulin secretion.³⁹ According to Grover et al., daily administration of lyophilized powder of *E. jambilana* seeds (200 mg/kg)showed maximum reduction of blood glucose level to 73.51, 55.62 and 48.81% as compared to their basal value in mild (21 days), moderate (120 days) and severe (60 days) in diabetic condition in rats. In addition the treatment also partially restored altered hepatic and skeletal muscle glycogen content and hepatic glucokinase, hexokinase, glucose-6-phosphate and phospho-fructokinase levels.⁴⁰ Pepato et al., treated streptozotocin diabetic rats for 17 days with decoction of *E.jambolana* leaves (15 % w/v) as a substitute for water and reported that, *E. jambilana* leaf decoction had no antidiabetic activity.⁴¹ Vats et al., has reported that treatment with aqueous extracts of *E. jambilana* at 400 mg per day for 15 days substantially prevented hyperglycaemia and hyperinsulinemia induced by high fructose diet in rats.⁴² Pandey et al., observed that the hypoglycaemic effect of *S. cumini* seeds is due to water-soluble gummy fiber and not because of water insoluble

neutral detergent fiber and other constituents of the seeds.⁴³

Ravi et al., evaluated hypoglycaemic activity of different parts of *E. jambilana* 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. Whole seed showed a moderate hypoglycaemic effect and seed coat did not show any hypoglycaemic effect. The hypoglycaemic efficacy was compared with that of glibenclamide, a standard hypoglycaemic drug.⁴⁴ Saravanan G.,reported that ip. administration of streptozotocin to normal rats effectively induced diabetes as reflected by glycosuria, hyperglycaemia and body weight loss and after treatment with. *S. cumini* bark extract exhibited potent blood glucose lowering property both in normal and diabetic rats.⁴⁵ Shankar et al., studied antidiabetic activity of novel androstane derivatives from etanolic extract of seeds of *S. cumini*. Pitchai et al. studied a novel compound 5,6 dihydroxy-3-[(4-hydroxy-6-(hydroxymethyl)-3,5-di[3,4,5 trihydroxy-6-(hydroxymethyl) tetrahydro-2h-2pyranyl] oxy tetrahydro-2h-2-pyranyl)oxy] -2-methoxy-10, 13 dimethylperhydrocyclopenta [a] phenanthren-17-yl (phenyl) methyl acetate from *Syzygium cumini* having antidiabetic effect.¹⁵ According to the Singh and Gupta ethanolic extract of seed of *S. cumini* decreased blood sugar level and increased body weight after 30 days feeding of extract .They also showed definite improvement in the histopathology of islets and the important finding is that the blood sugar level , which once dropped to normal levels after extract feeding was not elevated when extract feeding was discontinued for 15 days.²⁸ Sharma et al., studied antihyperglycaemic activity of flavonoid rich extract of seed of *E. jambilana*.¹¹

Bose et al., proved the clinical effectiveness of the *E. jambilana* seeds in diabetes.⁴⁶ Karnick et al., reported a polyherbal preparation containing *E.jambolana* to be clinically effective in the treatment of diabetes.⁴⁷ Kohli et al., has carried out clinical trial of *E. jambilana* seed powder in NIDDM. ⁴⁸Mitra observed the effect of composite of tulsi (*Ocimum Sanctum*) leaves, bitter ground (*Momordica charantia*) , Amla(*Embllica officinalis*),Gurmur(*Gymnema sylvestre*)leaves and jamun (*Syzygium cumini*) fruit and its seed on mild diabetic patients application of the composite results in reduction of fasting blood sugar.⁴⁹

Mechanism of action :

Many scientist studied probable mechanism of action of *S. cumini* . According to Achrekar et al., extract of jamun fruit pulp of *E. jambilana* showed hypoglycaemic activity through stimulation of insulin secretion.³⁷ Bansal et al. reported that the increase in plasma insulin brought about by seeds of *S. cumini* may be attributed to proinsulin to insulin conversion possibly by pancreatic cathepsin B and or its secretion.³⁶ *S. cumini* exerts a dual effect namely a combination of mechanism of action of sulfonyleurea and biguanids.⁴⁰ B. Sharma et al. showed that anti-hyperglycaemic effect of flavonoid rich extract of *S. cumini* seed due its direct insulinotropic action.¹¹ In vivo study using Goto-kakizaki (GK) rats, Shinde et al. studied , the acetone extract was potent inhibitor of alpha glucosidase hydrolysis of

maltose when compared to untreated control animals. Therefore this result point to the inhibition of alpha glucosidase as a possible mechanism.⁵⁰ Kumar et al., isolated mycaminose from methanol extract of *S. cumini* seed having antidiabetic activity. The possible mechanism of action may be due to the potentiation of insulin effect of plasma by increasing either pancreatic secretion of insulin from β -cells of islets of Langerhans or its release from the bound form. Mechanism of mycaminose similar to the glibenclamide.⁵¹

Effect on Diabetic Complication :

Grover et al., observed plasma glucose concentration in streptozotocin induced diabetic mice were reduced by administration of extract of *E. jambolana* by 20.84% .*E. jambolana* treatment significantly prevented the rise in urinary albumin level from 0-40 , polyuria and renal hypertrophy compared to diabetic control.⁵² Rathi et. al., concluded efficacy of lyophilized aqueous extract of *E. jambolana* to 200 mg/ kg in the prevention of murine alloxan diabetic cataract. Alloxan was used as a diabetogenic agent. Cataract examined in the rat with both naked eye and through slit lamp. After two months of treatment of *E. jambolana*, 59.85% cataract was prevented.⁵³ Chirvan- Nia et.al., have reported regression of cataract and hyperglycaemia in diabetic rats having received an extract of *E. jambolana*.⁵⁴ In streptozotocin induced diabetic rats, Pepato et.al., concluded that fruit pulp extract of *E. jambolana* 50 mg/ day for 41 days showed no observable difference in body weight, food or water intake, urine volume, glycaemia, urea and glucose level in urine, hepatic glycogen and serum level of total cholesterol, as compared to untreated controls.⁵⁵ Retinopathy, neuropathy and nephropathy are major complications which make diabetes more severe . Accumulation of sorbitol in different organs due to higher activity of aldose reductase is main cause of these complications.⁵⁶ Therefore inhibition of aldose reductase activity can provide better recovery from diabetes related complications. In this respect aldose reductase expression level in kidney and there was a clear decrease in its expression in diabetic treated mice with seeds of *E. jambolana* compared to diabetic mice.¹¹

2. Antiallergic Activity :

According Brito et al., *Syzygium cumini* skeels shows anti-allergic effect and indicate that its edematogenic effect is due to the inhibition of mast cell degranulation and of histamine and serotonin effects where as the inhibition of eosinophil accumulation in the allergic pleurisy model is probably due to an impairment of CCL11/ eotaxin and IL-5 production.⁵⁷

3. Gastroprotective Activity :

Chaturvedi et al., studied effect of ethanolic extract of seed *E. jambolana* against gastric ulcers induced by 2 h cold restraint stress, pylorus ligation-ethanol and aspirin induced gastric ulcers in rats. The ulcer protective activity of *Eugenia jambolana* may be due to its effects on both offensive and defensive factors. The antioxidant properties of *Eugenia jambolana* contribute towards its activity.⁵⁸

4. Antioxidant Activity :

Food rich in antioxidant plays essential role in the prevention of diseases. Banerjee et al., reported antioxidant activity of the fruit skin with the use of different assay such as hydroxyl radical scavenging assay, based on the benzoic acid hydroxylation method, superoxide radical –scavenging assay, based on photochemical reduction of nitroblue tetrazolium (NBT) in the presence of a riboflavin light –NBT

system, DPPH radical scavenging assay and lipid peroxidation assay, using egg yolk as the lipid rich source the antioxidant property of the fruit skin may come in part from the antioxidant vitamins, phenolics or tannins and anthocynins present in the fruit.⁵⁹ Zhi Ping Ruan et al., studied antioxidant activity of leaves of *Syzygium cumini* using 2,2 diphenyl -1-picrylhydrazyl (DPPH) free radical scavenging and ferric –reducing antioxidant power (FRA) assays. The methanolic extract and its four water, ethyl acetate, chloroform and n-hexane fraction were prepared and subjected to antioxidant evaluation. The ethyl acetate fraction were had stronger antioxidant activity than other ones. HPLC data indicated that *Syzygium cumini* leaf extract contained phenolic compounds such as ferulic acid and catechin responsible for antioxidant activity.⁶⁰

5. CNS Activity :

De Lima et al. studied, different extracts, fractions and subfractions from the seeds of *Syzygium cumini* Linn. Skeels, for behavioural effects in mice, particularly in relation to their sedative and anticonvulsant actions. Oral treatment with the hydroalcoholic extract showed an anticonvulsant activity in pentylenetetrazol- and maximal electroshock-induced convulsions, besides a hypothermic effect.. The ethyl acetate fraction and its subfractions enhanced latency and duration of the first convulsion induced by pentylenetetrazol. *S. cumini* has some active principles with central depressant properties, and some of them also present an anticonvulsant action.⁶¹ Kumar et al., reported the seed extracted with ethyl acetate and methanol investigated on albino mice in rota rod and actophotometer at a dose of 200mg/kg and 400mg/kg exhibited significant CNS activity. The significant CNS activity due to the presence of saponins.⁶²

6. Anti-inflammatory Activity :

Muruganandan et.al.,reported the ethanolic extract of bark of *S. cumini* was investigated for anti-inflammatory activity. The extract did not show any sign of toxicity up to a dose of 10-125 g/kg.i.p. in mice. This study demonstrated *S. cumini* bark extract has a potent anti-inflammatory activity against different phase of inflammation without any side effect to gastric mucosa.⁶³

7. Antihyperlipidemic Activity

Abnormalities in lipid profile are one of the most common complication in diabetes mellitus, which is found in about 40% diabetics. Kasiappan et al., showed oral administration ethanolic extract of *E. jambolana*-kernel (100mg/kg body weight) antihyperlipidemic activity on streptozotocin induced diabetic rats and standard drug was glibenclamide.⁶⁴

8. Antifertility Activity :

Rajasekaran et al., has revealed antifertility effect of oleanolic acid isolated from the flowers of *E. jambolana* significant decreased the fertilizing capacity of the male albino rats without any significant change in body or reproductive organ weights. It causes significant reduction in conversion of spermatocytes to spermatides and arrest of spermatogenesis at the early stages of meiosis leading to decrease in sperm count without any abnormality to spermatogenic cells, leydig interstitial cells and sertoli cells.⁶⁵

9. Anti-diarrhoeal activity :

Mukherjee et al., evaluated antidiarrhoeal activity of ethanol extract of *Syzygium cumini* against different experimental models

of diarrhoea in rats. It produced significant inhibition of castor oil induced diarrhoea and PGE- induced entero - pooling and a significant reduction in gastrointestinal motility in charcoal meal tests in rats.⁶⁶

10. Antiplatelet activity:

Namba et.al., have studied aqueous, methanolic and methanol-water(1:1) extracts of the bark were able to suppress plaque formation in vitro. All were active against *Streptococcus mutans* at 260,120 and 380 µg per ml respectively.⁶⁷

11. Antipyretic activity :

According to Chaudhari et al., chloroform extracts of dried seeds showed antipyretic activity⁶⁸ and Mahapatra et al., studied methanol extracts of dried seeds administered intraperitoneally to rats at doses of 50 mg per kg were active versus yeast induced pyrexia.⁶⁹

12. Antispasmodic activity:

According to Dhawan et al., ethanol-water(1:1) extract of the aerial parts was inactive in guinea pig ileum vs. acetyl choline and histamine induced spasms.⁷⁰ Mokkhasmit et. al., studied ethanol water (1:1) of dried bark of a concentration of 0.01 gm per ml, was active on guinea pig ileum.⁷¹

13. Antihistamine activity :

Mahapatra et al., found the methanol extract of dried seeds, administered intraperitoneally to rats was active vs. histamine induced pedal edema.⁶⁹

14. Antiviral activity :

According to Rana et al., ethanol water (1:1) extract of dried entire plant, at a concentration of 0.1 mg/ml in cell culture, was inactive on Ranikhet virus and vaccinia virus. For Ranikhet virus, infected chorioallantoic membrane viral titre decreased 10% and for vaccinia virus 0%. The extract when injected into chick embryo at a dose of 1.0 mg/animal was inactive on Ranikhet and vaccinia viruses. Infected chick embryo viral titre decreased 10% and 0%, respectively.⁷² Dhawan et al., reported ethanol/water (1:1) extract of the aerial parts at a concentration of 50.0 mcg/ml in cell culture was inactive on Ranikhet and vaccinia viruses.⁷⁰ Singh et al., studied water extract of the bark was active on potato X virus.⁷³

15. Antibacterial activity :

Shaikh et al., have investigated antibacterial activity of ethanolic extracts of *Eugenia jambolana* against gram positive and gram negative organisms.⁷⁴ Bhuiyan et al., reported antibacterial activity of methanol and ethyl acetate extracts of the seeds of *E. jambolana* at a concentration of 200 µg/disc against five Gram positive bacteria (*Bacillus creus*, *B. subtilis*, *B. megaterium*, *Streptococcus β* – haemolyticus, *S. aureus*) and nine Gram negative bacteria (*Shigella dysenteriae*, *Sh. Shiga*, *Sh. boydii*, *Sh. flexneriae*, *Sh. sonnei*, *E. coli*, *S. typhi* B, *S. typhi* B- 56 and *Klebsiella* species) by disc diffusion method.⁷⁵ Shafi et al. has reported good antibacterial action from essential oil of *E. jambolana* leaves.⁷⁶ Pitchai Daisy et al., have worked on the antibacterial activity of the extract of *Syzygium cumini* by disc diffusion method using extended spectrum beta lactamase (ESBL) producing bacteria. Methanol, acetone and hexane extract of *Syzygium cumini* seeds were examined for antibacterial activity on *Aeromonas hydrophila*, *Acinetobacter baumannii*, *Citrobacter freundii*, *E. coli*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus mirabilis*. Methanol extract of *Syzygium cumini*

seeds exhibited significant antibacterial activity against bacteria.¹⁴

Other Uses :

Ganesh et.al., studied radioprotective activity of hydroalcoholic extract of jamun seed on different doses of gamma radiation. The drug was more effective when administered through the i.p. route at equimolar doses than oral route. The presence of flavonoids and ellagic acid in *S. cumini* extract might have been responsible for its radioprotective activity. The *Syzygium cumini* extract treatment protected mice against the gastrointestinal as well as bone marrow deaths.⁷⁷ Krikorian et.al., found anorexigenic power of *E. jambolana* which was approximately equal to that of amphetamine.⁷⁸

DOSES :⁸

Juice - 56-112 ml.

Bark powder - 0.5-1 gm.

Seed powder - 1-3 gm.

IMPORTANT FORMULATION : Pusyanuga Curna, Usirasava³

PRECAUTIONS AND ADVERSE REACTION :²³

No health hazards or side effects are known in conjunction with proper administration of designated therapeutic dosages.

CONCLUSION :

Indian literatures like Ayurveda have already mentioned herbal remediation for a number of human ailments. *Syzygium cumini* commonly known as 'jamun' also having various pharmacological activity such as antidiarrhoeal, astringent, digestive, antibacterial, antioxidant, antiviral but most important activity is antidiabetic. Most of the herbal formulations example, Diabecon, Jambalsava containing *Syzygium cumini* as main ingredient for diabetes. Although most of the studies of *Syzygium cumini* as antidiabetic agent with its possible mechanism of action and delaying complications of diabetes such as cataract, neuropathy have been conducted but detailed research on isolation of bioactives through clinical trials followed by standardisation is seriously required to know potential of plant. Most of the pharmacological work was carried out on seeds of *Syzygium cumini* but the pharmacological potential of other parts also required to be explore.

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