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"A Detailed Review of the Black Java Plum''

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ABSTRACT:
Jamun (SyzygiumcuminiSkeels), a species native to India, has been valued in traditional medicine for centuries, especially within the Unani and Ayurveda systems. Java plum, also called Jamun, is a tropical fruit that has a lot of health benefits. This study looks into how Java plum can help manage blood sugar levels. It covers the active chemicals in the fruit, how they work in the body, results from clinical studies, and how it's used for treatment. In addition,experimental research have demonstrated its chemopreventive, radioprotective, and antineoplastic potential.

This review aims to bring together all the available information about the traditional and medicinal uses of Java plum. The focus of this review is on the pharmacological features and medicinal applications of Java plum, particularly emphasizing its bioactivly constituent which are anthocyanins, flavonoids, & tannins, which play a key role in making the plant effective for therapeutic purposes. Research indicates that Java plum has antioxidant, anti-inflammatory, antidiabetic, and antimicrobial qualities. Its role in managing diabetes, especially in controlling blood sugar levels, has received a lot of attention. Moreover, the review explores its potential in addressing digestive problems and supporting oral health. It also highlights the need for more clinical studies to confirm these benefits and to better understand the full range of its uses.
Keywords :Jamblang ,Java plum, Medicinal uses, Seed.

Objective:
1) To check how well black plum can help control blood sugar,
2) A detailed study was done looking at its plant chemicals,
3) Medicine effects,
4) real-world results.

I. INTRODUCTION :

Syzygiumcumini It is an important native plant with healing uses, originally found in India and Indonesia. Now, it grows in many tropical and warm areas around the world. This tree grows quickly and can be over 30 meters tall, living for more than 100 years. It is very valuable because almost every part of it, including seeds, leaves, and wood, has both health benefits and uses in trade. The plant has many chemical compounds and strong antioxidant effects, which are good for health. These active chemicals include glycosides, anthocyanins, steroidal, phenol, flavonoid, &terpenoids. These fruit is contain sugars, vitamins, & important mineral. A pulp has a lot of manganesium, calcium ion, potassium ion, irons, zinc, & sodium.

The purple colour & black color of the fruit comes from anthocyanins. Besides the fruit, the leaf & bark of the plants are also use for health. In ancient medicine, leaf ,bark are used to help with , ringworm, and stomach issues. The bark helps with digestion and can also remove worms and increase urine. The seeds are important in Ayurvedic, Unani, and Chinese medicine. They are used for conditions like high blood sugar, stomach ulcers, stomach pain, sugar in urine, and lung problems.[1,2]

1. Bioactive Compounds :

The seeds of Java plum are abundant in bioactive substances, including jambosine, gallic acid, quercetin, and ellagic acid. These compounds have demonstrated notable antidiabetic effects. Specifically, jambosine has been reported to prevent the transformation of starch into sugar, helping to lower blood glucose levels. [3]

2. Morphological Classification of Java Plum :

Kingdom is – Plantae
Divisions – Magnoliophyta
Classes – Magnoliopsida
Orders–Myrtales
Families– Myrtaceae
Genus–Syzygium
Species– Syzygiumcumini.[4]

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3. Morphological Characteristic :

Tree Features: The Java plum tree generally grows 11–22 meters (32–65 ft) hight, having a trunk size ranging from 36–60 cm (12–24 in). Its bark is grayish-brown, smooth in texture, and firm.

Leaf Characteristics: Leaves measure 2–5 cm (0.8–2 in) in width and 5–15 cm (2–6 in) in length. The leaf apex is sharp and pointed, while the base is cuneate and gradually tapering. The margins are entire with a slightly wavy outline. Leaf surfaces are smooth and glossy, exhibiting a Green front side & a lighter green underside.

Flower Features: Flower appear in terminal panicles measuring 5–11 cm (1–4 in) long. Their color varies with white to creamy shade, accompanied by a pleasant, sweet fragrance. Individual flowers are small, with a diameter of 5–7 mm (0.2–0.3 in).

Fruit Characteristics: The fruit is a berry-like drupe, typically oval to ellipsoid in form. Size around 1–3cm (0.2–0.5 in) in length& 0.5–1 cm & 0.2–0.4 inch width. When ripe, the fruit turns purple, black, or red. A skin is thinner & edible, while pulps are juicy, sweet, and fleshy. Each fruit contains a single oblong seed about 1–2 cm (0.4–0.8 in) long.

Seed Characteristics: Seeds are oblong to ellipsoid, measuring 1–3 cm (0.2–0.6 in) longs & 0.4–1 cm (0.1–0.4 in) wide. Their color ranges from yellowish-brown to dark brown, with a smooth, glossy exterior.

4. Synonyms of java plum :

The fruit widely recognized as Jamun is known by different names in various Indian languages. In Sanskrit, it appears as Mahajambu or Ksudrajambu, and in Assamese it is termed Jam. Bengali communities refer to it as Jaam or Kalajam, while English identifies it as the Jambul tree. In Gujarati, the fruit is called Gambu or Jamun, and in Hindi it is popularly known as Jamuna. Marathi speakers use the name Jambul, and in Malayalam it is known as Njaval. The Odia name for the fruit is Jamu, whereas in Punjabi it is called Jaamun. Tamil refers to it as Naval, and Urdu also uses the name Jamun. These diverse names show the fruit's deep-rooted presence across multiple Indian regions.

Fig.1. Java Plum.

5.Characteristics of Jamun

Jamun is a big, evergreen tree with thick leaves. Its bark is grey-brown and peels off in small, woody pieces.

The wood is white, has a rough texture, and is very strong. It can be used to make red dyes and some types of Kino gum. The leaf are thick, smooth, and shiny, and they are usually 6 to 12 centimeters long. They are often shaped like a long oval or rectangle, with many veins running from the edges to the center. The ends of the leaves are wide and not very pointed. The flowers grow either in the grooves between branches or at the tips, and they are about 4 to 6 centimeters long. They smell nice and are a mix of green and white. They grow in small groups of 10 to 40 flowers, and they are usually arranged in a branching pattern.

The flower parts at the base are shaped like a funnel and are about 4 millimeters long with small teeth along the edges. The petals are all the same size and curl up into a small, flat circle. There are many small flower parts inside the flower that are almost the same length as the base of the flower. There are many types of Jamun, and they vary in how big the fruit is and what color it looks like. Some newer types have purple or white inside, and even some have no seeds. The fruit is a type of berry, usually between 1.5 to 3.5 centimeters long, shaped like a small oval, and dark purple or as black. It's juic soft, & tasty, with 1 big seed inside [5]. The tree produces small purple plums that get sweeter as they ripen, and they have a slight tart flavor after the sweet taste . When fully ripe, the fruit is a deep purple, similar in size and shape to an olive. Eating them.leaves your tongue feeling purple. They have a taste that is sweet, a bit sour, and slightly bitter .[6]

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5. Parts are used :

Leaves, flowers, fruits, and seeds are parts of plants that are studied in phytochemistry. In leaves, you can find many useful compounds. These include triterpenoids, esterase, galloylcarboxylase, quercetin, myricetine, myricitine& tannin.

Leaves :

Leaves also contain a lot of acylation Flavonoloids glycose, quenarcetin, myricetine, myricitin, myricetine 2-0-4aceyl lL-rhamnopyranoside, triterpenoids, ester, galloylic carboxylic, and tannins .[7]

Fig.2. Leaf of Java plum plant

Stem Bark :

The stem bark contains numerous bioactive compounds, including betulinical acid, friedeline, epifriedelanol, βsitosterolol, eugenine, epifriedelanol fatty acids esters, quercetin, kaempferolol, myricetin, gallicacid.[8].

Fig.3. Stem of Java plum

Flowers :

The flowers have a lot of kaempferolol, quercetin &myricetine, isoquercetine (which is quercetinin-3-glucosidase), quercetinin-2-D-myricetinin-3-L-arabinosides, galactoside, dihydromyrcetin, oleanolics acid, acetyloleanolics acid, eugenol terpenoids 1, &eugenololterpenoid 2[(9].

Fig.4. Flowers of Java plum

Fruits :

They also contain gallicacids , delphinidin-2-gentiobioside, malvidin-2-laminariboside, petunidine-2-cyanidin gentiobioside, various glycosides, petunidinose&malvidine. The acidity in fruit is primarily attributed in gallic acid, while their coloration is due to anthocyanins. Nutritionally, per 98 gm in the consume substance, fruits provide.

82.70–84.82 gm wet, 0.71–0.03 gm proteins & 0.14–1.10 gm HDL, 0.20–0.80 gm fibers, 13.00 gm carbohydrates, & 0.31–0.41 gm ash value. They are also a source of minerals such as calcium (7.30–16.00 mg), magnesium (25.00 mg), phosphorus (14.00–18.20 mg), iron (2.10–2.52 mg), sodium (25.20 mg) & potassium (45mg)

The Brazilian jamun variety is particularly noted for containing malvidin-2-glucoside and petunidin-2glycoside. Additionally, jamun seed coat powder is utilized as a natural food coloring and in medicinal formulations. Antioxidants and anthocyanin pigments extracted from fruit peels have also been investigated for their stability and application in new product formulations [10,11].

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Fig.5. Fruit of Java plum

Seed :

The seeds are rich in gallicacid, acid, corilaginase, 3,4-hexahydroxydiphenoyl glucose, galloy glucose, 5galloyl glucose, quercetinin, β-sitosterol, and 4,6-hexahydroxydiphenoyl glucose .[12]

Fig.6. Seeds of Java plum

Essential Oils:

A wide variety of phytochemical components are abundant in the essential oil extracted from freshly harvested leaves, which make up around 84% of the total oil, as well as the stem, seeds, and fruits.

In addition to these volatiles, several fatty acids have been identified, such as vernolic acids. The nonsaponifiable fraction of the seed oil has also been examined chemically, revealing further bioactive components [13].

7. Phytochemical Constituents :

- **Flavonoids :**

Flavonoids are key polyphenolic compounds with antioxidant, anti-inflammatory, anti-diabetic, and some antiviral activities. S. aqueum leaf extracts contain numerous flavonoids, mainly myrigalone-B, myrigalone-G, and derivatives like myricetin and quercetin glycosides, some showing antihyperglycemic effects. In S. campanulatum, two flavanones exhibited strong anticancer activity against HCT-115 cells. Various species also contain flavonoids such as kaempferol, rutin, ellagic acid, and caffeic acid. S. formosum leaves include several flavonoids like catechin, myricetin, and quercetin.

- **Phenols :**

Phenols are aromatic compounds known for strong antioxidant, antibacterial, and anti-inflammatory properties. Methanolic extracts of S. alternifolium stem bark contain over 40 phenolic constituents, showing its high phenolic richness. In comparison, S. cumini has fewer phenolic compounds, including gallic acid in fruits, methyl-ellagic acid derivatives in bark, ferulic acid in seeds, and ellagic and caffeic acids in leaves and flowers. HPLC analysis of S. formosum leaves identified four phenolics, such as gallic acids from S. litorale also displayed strong DPPH antioxidant activity.

- **Tannins :**

Tannins are large polyphenolic compounds are essential for reduce inflammation, antineoplastantinutritional, & heart-protective effects. The methanolicleaves component ofaqueumindicates in form of galloylquinic acid along with small quantities of other tannin-related molecules. In comparison, S. cumini contained only minimal tannin levels across its plant parts. The leaves showed traces of nilocetin, while the seeds contained hydrolysable tannins such as corilagin.[14]

8. Commercial Importance of Black Java Plum (Syzygiumcumini) :

The black Java plum has gained notable commercial value due to its wide applications across food, health, and industrial sectors.

a Food and Nutraceutical Industry :

The fruits are transformed into numerous processed products such as juices, jams, squashes, fermented beverages, vinegars, ice creams, and

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packaged drinks. Owing to its high anthocyanin concentration, the fruit peel is used as a natural coloring agent and antioxidant additive in nutraceutical preparations. Additionally, jamun seed powder is commonly sold as a dietary supplement for supporting blood glucose management.

b..Pharmaceutical and Herbal Medicine Sector :

Syzygiumcumini holds a strong position in the herbal market due to its notable antidiabetic, antioxidant, antimicrobial, and anti-inflammatory activities. Extracts obtained from its seeds and leaves are incorporated into various medicinal formulations, including syrups, capsules, and tablets. The presence of jambosine and polyphenol-rich compounds has promoted large-scale medicinal use and cultivation of the plant.

c.Cosmetic and Personal Care Industry :

The anthocyanins and phenolic compounds present in the fruit are frequently utilized in skincare products for anti-aging, pigmentation reduction, and protective benefits. Such extracts are integrated into soaps, facial masks, toners, and antioxidant-based cosmetic items.

d.Agro-Industrial and By-product Applications :

By-products from jamun processing, including seeds and pulp residues, are repurposed into biochar, natural dyes, livestock feed additives, and bio-based antioxidants. This valorization of waste materials enhances sustainability and supports income generation for rural producers.

e. Economic Contribution to Local Markets :

Cultivation and marketing of Java plum create steady income opportunities through fresh fruit sales, seed powder production, nursery development, and small-scale processing ventures. Seasonal availability of the fruit also boosts economic activity in local markets throughout India and Southeast Asia [15,16].

9. Pharmacological Activites :

i Anti-diabetic activity :

The Ayurvedic Pharmacopeia mentions that jamun has anti-diabetic properties. Jamunare used in remedy to regulate glucose spike larger than 128 years. Scientists have also studied the anti-diabetic effects of jamun in different preclinical animal species. These studies induce that different parts of jaman, like leaves, seeds, root, and stem bark, can lower blood sugar level. Research has also found that jamun leaf extract can reduce adenine deaminose& sugar on blood of diabetes patients. Above experiments with male SpragueDawley rats that had diabetes caused by alloxan, treatment with polar &methane from in different parts in jaman like leaf, seeds, roots, & stem bark, led to lower serum glucose levels [17].

ii Allergy-reducing activity:

Plant java plum has allergy reducing effects. These are because it stops mast cells from releasing chemicals like histamine and serotonin, and also prevents the buildup of eosinophils in allergic conditions. Studies have shown that this plant has antiallergicproperties.In mice that were given injections of C48/80, a substance that causes mast-cell degranulation, or ovalbumin (OVA), which causes anaphylactic swelling, researchers tested the antiallergic effects of jamun leaf extract. They found that using different dosages of jamun leaf extract helped to reduce the swelling.

iii Antioxidant activity :

Several Jamun components are similar exhibit antioxidant property through unbound radicals scattering tests. Additionally, A concentration of the Jamun leaves & seeds collect has resulted in an increase in nitric oxide

(NO) free radical scattering activity. Satya Nadella, the CEO of Microsoft, is another illustration of someone who effectively changed the company culture. Ethyl acetate was shown to be the most efficient fraction for scavenging FRAP and DPPH radicals.

Additionally, this extract reduced the production of O2 radicals, with 252 g/ml having the highest impact. The maximum effect was achieved with 82 g/ml for both radicals. It similarly equally suppressed DPPH and ABTS+ free radicals [18].

iv CardioprotectiveActivity :

Various Jamun extracts have been evaluated for their cardioprotective effects in preclinical studies. For instance, oral administration of hydroalcoholicJamun leaf extract at 0.6g per day for 6 weeks lowered blood pressure in hypertensive rats. Overall, both preclinical and clinical findings suggest that Jamun leaf possesses significant cardioprotective properties.

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v HepatoprotectiveActivity :

Hepatoprotective properties were shown when albino rats were given an aqueous extract of jamun leaves seven days before they were exposed to carbon tetrachloride. When compared to control rats who were given carbon tetrachloride alone,

vi Hair Health Activity :

The antioxidant and antimicrobial constituents of black plum play a major impact scalp health. This bioactive compounds help minimize dandruff formation, nourish the scalp, and contribute to stronger hair roots.

Benefits :

Encourages natural hair growth.
Helps control dandruff and scalp-related disorders.
Improves overall hair texture, smoothness, and shine.

Active Compounds :

Flavonoids such as kaempferol and quercetin.
Phenolic acids, including gallic acid and ellagic acid.
Essential vitamins (A, C, E)
Trace minerals like copper and zinc.

Applications for Hair Problems :

Useful in managing dandruff, hair fall, premature graying, and scalp irritation.

Precautions :

Mild allergic reactions may rarely occur
May interact with other topical hair formulationsA patch test is advised before regular application

7. Skin Treatment Activity :

Oil derived from Java plum seeds is widely utilized in cosmetic and skincare formulations due to its moisturizing, restorative, and protective qualities.

Benefits :

Exhibits anti-aging effects
Possesses strong antioxidant capacityProvides anti-inflammatory benefits

Key Bioactive Components :

Flavonoids (e.g., kaempferol, quercetin)
Phenolic acids like gallic and ellagic acid
Vitamins A, C, & E
Skin-supportive minerals like copper and zinc

Common Skincare Applications :

i. Java Plum Face Mask: Combine 2 tbsp Java plum powder with 2 tbsp honey and 1 tbsp yogurt. Apply, allow to rest for 22 minutes, then wash off.
ii. Java Plum Toner: Infuse 2 tsp Java plum leaves in hot water, let cool, and apply as a natural toner.
iii. Java Plum Seed Oil: Massage into the skin to minimize wrinkles and fine lines.
iv. Java Plum Scrub: Mix 2 tbsp Java plum powder with 4 tbsp sugar and 1 tbsp olive oil, exfoliate gently, and rinse.
v. Java Plum–Turmeric Pack: Blend 2 tbsp Java plum powder, 2 tbsp turmeric, and 3 tbsp yogurt; apply for 25 minutes and rinse.

Precautions :

Allergic reactions, though uncommon, may occur Possible interactions with existing skincare products A patch test is recommended prior to topical use.

8. Medicinal Uses :

i Consuming Jamun fruit is beneficial for individuals with diabetes and is considered an effective remedy for hypoglycemia.
ii Rich in iron, this fruit naturally purifies the blood, promoting proper circulation of oxygenated blood throughout the body.
iii Jamun contains various bilogically active compounds like oxalic acid and gallic acid, which contribute to its antibacterial and antifungal properties, and may help combat diseases like malaria.
iv It is also employed in managing respiratory conditions, including bronchitis and asthma.
v Jamun aids in treating digestive issues, such as gas, abdominal discomfort, and dysentery.
vi The plant exhibits aphrodisiac properties and are wornd for a tonic to treat tired blood & enhance erotic health.
vii Jamun offers particular benefits for women suffering from leucorrhoea.
viii It helps relieve congestion and, when combined with other herbs, supports pancreatic health.
ix The fruit also provides support for neurological conditions, including fatigue, depression, and related disorders.
x Leaf ash from Jamun strengthens teeth and gums, while helping to heal mouth ulcers and soothe throat irritation.

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xi According to Ayurvedic principles, Jamun increases vatadosha while balancing kapha and pitta doshas [19].

II. CONCLUSION

The Java plum, or Jamun (Syzygiumcumini), possesses notable anti-inflammatory, anti-cancer, & antidiabetic properties, which may contribute to enhancing the immune system. Recognized as an important herbal remedy in the Unani medical system (USM), Jamun is commonly used for its antibiotic, astringent, digestive, and antidiarrheal effects. The existing literature clearly demonstrates that jamun offers numerous therapeutic advantages, though further research is needed to determine whether these benefits can be fully realized in addressing major contemporary health conditions. Despite the wealth of studies indicating its potential as an anti-diabetic, achieving widespread therapeutic success appears to remain a distant goal.

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