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Syzygium cumini L. (Jamun): A comprehensive review of its traditional and modern therapeutic relevance in the context of Unani medicine

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Abstract
Syzygium cumini from family myrtaceae, is a multipurpose medicinal plant. The fruit, seed, bark and leaves of this plant possess medicinal properties like *Qābiz* (astringent), *Musaffī-e-Dam* (blood-purifying), *Muqawwi-e-Meda* (stomachic) and *Mufattiḥ-e-Sudad* (deobstruent) etc.
In classical *Unani* literature all parts of this tree are used to treat a various diseases, especially the seeds in diabetes mellitus. It has been reported that it possess antioxidant, anti-allergenic, radio protective, anti-inflammatory, neuropsycho pharmacological and antimicrobial activities.
The present review has been prepared to compile the existing information about its botany, traditional uses, phytochemical constituents and pharmacological activites of *Syzygium cumini*.

Keywords: Jamun, *Syzygium cumini*, *Unani* medicine, *Anti-diabetic* and disease

Introduction
Jamun (*Syzygium cumini L.* Skeels) is an evergreen tree native to the Indian subcontinent and naturalised across tropical Asia [1]. In *Unani* compendia including *Makhzan al-Adwiyah* (Najmul Ghani Khan 1920), *Tibb-e-Akbar* (Akbar Arzani 1772) and *Kitāb al-Mansūrī* (Zakharia al-Rāzī 925 CE) Jamun is characterised as a potent *Qābiz* and *Muqawwi-e-Meda* agent, correcting excessive *Rutūbat (e-moisture)* and *Harārat (e heat)* in the humoral system. Contemporary studies validate these empirical observations. Phenolics such as ellagic acid and jambosine exhibit antidiabetic and antioxidant activity [2, 3]. while clinical evidence confirms its glucose-lowering effects in type 2 diabetes [4, 5]. This review synthesises classical wisdom and modern research to rationalise Jamun's therapeutic relevance within the *Unani* epistemology.

2 Classical Unani Perspective
2.1 Names and Identification

Arabic	Jamun / Zayzafūn
Persian	Jaman
Hindi	Jamun / Jambool
French	Jamblon
German	Jambulbaum
English	Black plum
Sanskrit	Jambu
Urdu	Jamun
Marathi	Jambul
Kannada	Narale
Telugu	Neredu
Malayalam	Njaval
Tamil	Nagai [6, 7]

Taxonomic classification	
Kingdom	Plantae planta, plantes, plants, vegetal
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Order	Myrtales
Family	Myrtaceae
Genus	Syzygium
Species	*Syzygium cumini L*[7]

2.2 Mizāj (Temperament)
Cold and dry (*Bārid wa Yābis*) in second degree [8]. Such temperament counteracts excess *Dam* and *Balgham*, producing astringent and absorptive actions [9].

2.3 Afaʿl (Actions)
Qābiz (Astringent), *Musaffī-e-Dam* (Blood Purifier), *Dāfiʿ-i-Daḥan* (Antiseptic), *Munajjif* (Desiccant) and *Mufattiḥ Sudad* (Deobstruent) [10, 11].

2.4 Istemālāt (Therapeutic Uses)
Jamun is recommended for *Ziābetus Shakarī*, *Ishāl*, *Bawāsir*, *Sufrā* (jaundice), *Waram-e-Kabid* (hepatitis), and *Qulanj* (colic) [12, 13]. Also in the form of *Safoof-e-Jamun* and *Sharbat-e-Jamun* [14].

Table 1: Phytochemicals present in the jamun plant

Sr. No.	Plant part	Chemicals present
1.	Seeds	Ambosine, gallic acid, ellagic acid, corilagin, 3,6-hexahydroxy diphenoylglucose, 1-galloylglucose, 3-galloylglucose, quercetin, β-sitoterol, 4,6 hexahydroxydiphenoylglucose [15, 16].
2.	Stem bark	Friedelin, friedelan-3-α-ol, betulinic acid, β-sitosterol, kaempferol, β-sitosterol-Dglucoside, gallic acid, ellagic acid, gallotannin and ellagitannin and myricetine [15, 16]
3.	Flowers	Oleanolic acid, ellagic acids, isoquercetin, quercetin, kampferol and myricetin [15]
4.	Fruit pulp	Anthocyanins, delphinidin, petunidin, malvidin-diglucosides [15, 17]
5.	Leaves	β-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)-α Lrhamnopyranosides [15, 17]
6.	Essential oils	α-terpeneol, myrtenol, eucarvone, muurolol, α-myrtenal, 1, 8-cineole, geranyl acetone, α-cadinol and pinocarvone [18]

3. Pharmacognostic Identity
A medium-sized evergreen tree (12-15 m) with grey bark and glossy opposite leaves bearing oil glands [19]. Microscopy reveals parenchymatous cortex with calcium oxalate crystals and tannin cells.

Physicochemical standards (*UPI*, 2008): Total ash 4.3%, acid-insoluble ash 0.5%, alcohol-soluble extractive 16%. TLC shows gallic acid (Rf 0.33) and ellagic acid (Rf 0.41) [20].

4. Phytochemical Profile
Jamun is rich in polyphenols (gallic acid, ellagic acid), flavonoids (quercetin, kaempferol), alkaloids (jambosine), tannins (ellagitannins), anthocyanins (cyanidin-3-glucoside) and terpenoids (α-pinene, β-pinene, eugenol) [21, 22].
These metabolites correlate with classical Unani functions: tannins produce *Qabiz* effect (astringency → protein precipitation → reduced intestinal fluid loss), while polyphenols support *Musaffi-e-Dam* through antioxidant detoxification [19, 23].

Phytochemicals of Jamun with reported radioprotective activities

S. No.	Agent	Chemopreventive effects and the mechanisms operating
1.	Oleanolic acid	Acid inhibits the growth of ascitic tumors and enhances the recovery of hematopoietic system in irradiated mice [24]
2.	Quercetin	Protected yeast cells from γ-radiation damage by reducing DNA damage [25]. Effective inprotecting against γ-radiation-induced DNA damage to the human peripheral blood lymphocytes *in vitro*, and plasmid DNA. The protective mechanisms were mediated by the antioxidant and inhibition of lipid peroxides [26]. Intraperitoneal administration of quercetin 100 mg·kg/kg for 3 consecutive days before and/or after irradiation prevented radiation induced DNA damage in WBC of mice. Pronounced effects were when querecetin was administered before radiation [26, 27]
3.	Gallic acid	Inhibits radiation-induced damage to DNA and lipid peroxidation in both *in vitro* and *in vivo* conditions [29].
4.	Ellagic acid	Protects yeast cells from γ-radiation-induced damage by reducing DNA damage [30] Inhibits γ-radiation induced lipid peroxidation in a concentration-dependent manner *in vitro* [31] Enhances the cytotoxic effects of radiation in neoplastic cells (Ehrlich ascites carcinoma and Hela) by inducing free radicals, reducing antioxidant enzymes and altering the mitochondrial potential, but protects the normal cells (splenic lymphocytes) of tumor-bearing mice against the radiation damage [32].

5. Pharmacological and Experimental Studies
5.1 Antidiabetic Activity
Jamun seed extracts show significant reductions in FBS, HbA1c and improved β-cell integrity in diabetic models [33, 34]. Mechanisms include α-amylase and α-glucosidase inhibition, insulin-mimetic effects and glycogen storage enhancement [35]. Clinical studies report comparable glycaemic benefit [36].

5.2 Antioxidant and Anti-inflammatory Effects
Polyphenolic fractions exhibit strong DPPH and ABTS radical-scavenging (IC 20 µg/ml) [22]. Jamun bark attenuates carrageenan-induced paw oedema via COX and LOX pathway inhibition [37].

5.3 Hepatoprotective and Renoprotective
Hydro-alcoholic seed extracts reverse CCl-induced liver

damage and normalize ALT and AST [39]. Gentamicin-induced nephrotoxicity was ameliorated through Nrf-2 mediated antioxidant response [39].

5.4 Antimicrobial, Anticancer and Cardioprotective

Ethanolic extracts inhibit *S. aureus*, *E. coli* and *C. albicans* [40]. Cytotoxic assays show apoptosis in leukaemia cells [41]. Anthocyanin-rich juice improves lipid profiles and reduces LDL [37].

6. Therapeutic Applications in Unani Formulations

Formulation	Dosage Form	Indication	Source
Safoof-e-Jamun	Powder	*Ziābetus Shakarī*	10
Majūn-e-Jamun	Confection	*Bawāsir, Ishāl*	11
Arq-e-Jamun	Distillate	*Waram-e-Kabid*	14
Dawā-ul-Misk Motadil	Compound tonic	*Musaffi-e-Dam*	6

The Unani Pharmacopoeia Committee (2012) standardised the drug profile of Jamun, confirming its acceptance across AYUSH formulations for metabolic and hepatic disorders.

7. Clinical Evidence and Human Studies

Randomised trials show Jamun seed powder (5 g BID, 3 months) significantly reduces FBS and PPBS [4, 42]. Adjunct therapy with metformin further lowers HbA1c [5]. Anthocyanin-rich juice (30 ml daily, 12 weeks) improves lipid profiles and antioxidant capacity [37]. No serious adverse effects reported.

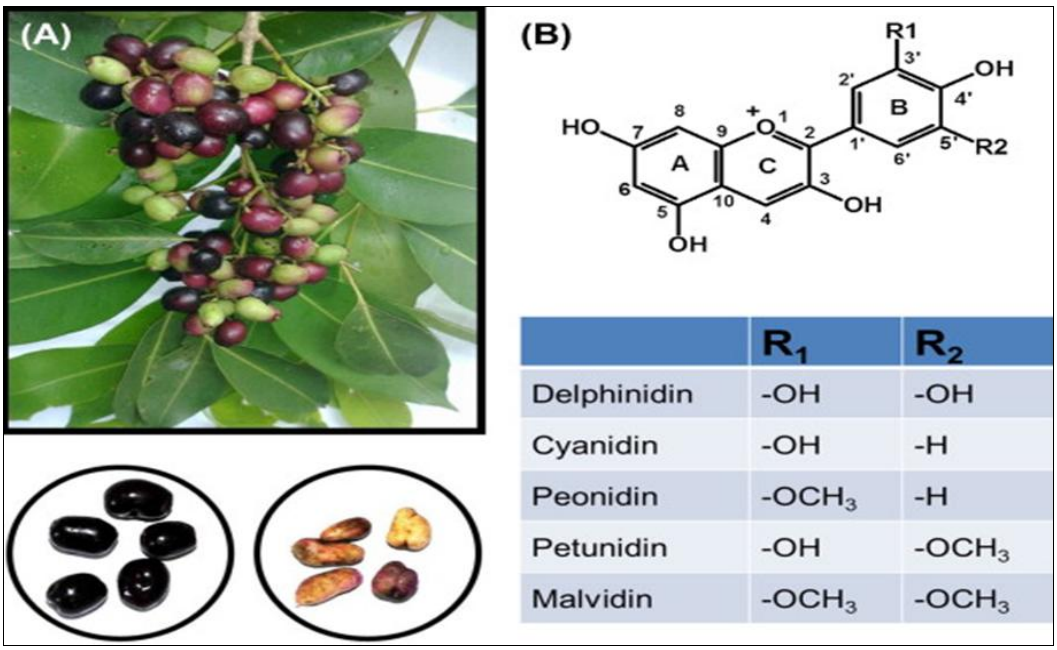
8. Toxicity and Safety

Rodent studies show no mortality up to 2 000 mg/kg [39]. Long-term administration causes only mild constipation due to tannins [2]. Human clinical data confirm hepatic and renal safety parameters within normal limits [4].

9. Discussion

Jamun embodies a model drug where Unani concepts of *Mizāj* and *Afaʿl* parallel modern biochemical mechanisms. The cool-dry temperament (*Bārid wa Yābis*) opposes the hot-moist dominance of *Dam wa Balgham*, thereby restoring homeostasis [43]. Tannins and polyphenols explain its *Qābiz* and *Musaffī-e-Dam* effects through astringency and free-radical neutralisation [44]. Modern insights into its antioxidant and insulin-sensitising pathways [45] scientifically validate classical observations in *Ziābetus Shakarī*.

Thus, Jamun serves as a benchmark for translating Unani pharmacodynamics into evidence-based nutraceuticals and clinical interventions aligned with CCRUM and AYUSH frameworks.



	R_1	R_2
Delphinidin	-OH	-OH
Cyanidin	-OH	-H
Peonidin	$-OCH_3$	-H
Petunidin	-OH	$-OCH_3$
Malvidin	$-OCH_3$	$-OCH_3$

Fig 1: Fruits and seeds of the plant showing different stages of ripening. (B) Basic anthocyanidin structure with variations in R_1 and R_2 groups, illustrating major anthocyanidin types such as delphinidin, cyanidin, peonidin, petunidin, and malvidin.

10. Conclusion

Jamun (*Syzygium cumini L.*) demonstrates how traditional Unani knowledge and modern science can coexist synergistically. Its historical roles as *Qābiz*, *Musaffī-e-Dam* and *Mufattiḥ-e-Sudad* are validated by antioxidant, antidiabetic and hepatoprotective mechanisms. Standardisation of its extracts and formulations, supported by rigorous clinical evaluation, can strengthen its position as a model Unani nutraceutical for metabolic and gastro-hepatic health.

11. Declaration of Conflict of Interest

No conflict of interest to declare.

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