herba polonica
International journal edited by the Institute of Natural Fibres and Medicinal Plants
National Research Institute
Vol. 71 No. 1 2025

Received: 2024-06-29
Accepted: 2024-11-20
Available online: 2025-03-31

DOI: 10.5604/01.3001.0055.0298

REVIEW PAPER

The phytochemical, pharmacological, and medicinal properties of *Syzygium cumini* (L.) Skeels. A review

VINOTHA SANMUGARAJAH[1*], GOWRI RAJKUMAR[2]

[1]Department of *Noi Naadal Chikitchai*, Faculty of Siddha Medicine
University of Jaffna
Jaffna, 40 000
Northern Province, Sri Lanka

[2]Department of Botany, Faculty of Science
University of Jaffna
Jaffna, 40 000
Northern Province, Sri Lanka

Corresponding author: phone +94 777490634; e-mail: vsanmuga@univ.jfn.ac.lk

Summary

Syzygium cumini (L.) Skeels *(S. cumini)*, (Jambolan, *Myrtaceae* family) is commonly used to cure several diseases, particularly diabetes mellitus. Several decades ago, the plant became commercially available, and it was recognized as an antidiabetic plant. Numerous scientific studies have documented the antidiabetic properties of this plant. The aim of this study was to present an impression of current state of knowledge and scientific research about *S. cumini*, using mainstream electronic databases and textbooks. According to this review, *S. cumini* possesses notable physicochemical and phytochemical qualities, as well as pharmacological actions, along with unique morphological traits. In addition, it is verified that *S. cumini* is a versatile medicinal herb with a range of applications in nutraceuticals. To develop safer drugs for the treatment of diabetes and other illnesses, further scientific research is required to pinpoint the active principles present in *S. cumini*.

Key words: ***medicinal properties, pharmacological, phytochemical properties, Myrtaceae, review, Syzygium cumini***

Słowa kluczowe: ***właściwości lecznicze, farmakologiczne i fitochemiczne właściwości, Myrtaceae, praca przeglądowa, Syzygium cumini***

INTRODUCTION

In a traditional healthcare system, a collection of herbal preparations often comprises of many medicinal plants. Plants have been essential in the development of manhood since ancient times, and they provide an exceptional resource of natural remedies [1]. In the earlier studies it was found that the decoction of dry leaves and seeds of *Syzygium cumini* had a glycaemic effect [2–5]. The mid-nineteenth century saw *S. cumini* (*Myrtaceae*) became widely known in allopathic medicine because of its antidiabetic properties [6]. It also recognized as Jambolan, Eugenia cumini, Jambul, and Kala Jamun in India [7–9].

S. cumini, a massive evergreen tree has excellent nutritional qualities that are present throughout the entire plant. From February to May, the plant blossoms, and from April to July, the fruits mature [1]. It has undergone tests for its various pharmacological effects, including antioxidant, anti-inflammatory, anti-microbial, anti-HIV, and antifungal, free radical scavenging, antidiarrheal, antifertility, diuretic, gastroprotective, chemoprotective and cardioprotective [1, 10–11]. Moreover, the seeds, bark, leaves, and pulp are utilized for treating diabetes, allergies, viral infections, inflammation, and gastric ulcers [12–13].

The World Health Organization recommends *Syzygium cumini* (*S. cumini*) as a secure drug for a variety of ailments and it has been used for over fifty years in several nations for the management and prevention of several ailments [1]. The goal of this study was to present an impression of the current state of knowledge and scientific research about *S. cumini* using mainstream electronic databases and textbooks. Future scholars can use this review to provide a description of the current data on the specific information of the *S. cumini* plant in the traditional medical system.

METHODOLOGY

The data collected in this comprehensive review was obtained from previous and current traditional textbooks, as well as numerous electronic databases such as Google Scholar, Research Gate, Academia, DOAJ, Science Direct, PubMed, Scopus, Web of Science and various reputable scientific databases from all available sources using the keywords from January 2022 to August 2024 in Jaffna District, Sri Lanka.

Researchers designed a data entry form to gather detailed information on this medicinal plant, including its classification, morphology, habitat, therapeutic uses, biochemical constituents, phytochemical and physicochemical possessions and several pharmacological activities, based on literature.

RESULTS AND DISCUSSION

Taxonomical classification

Table 1 provides the details of the taxonomic classification of the *S. cumini* plant [1, 14-17].

Table 1.

Classification of the *S. cumini* plant

Classification	Name
Kingdom	Plantae
Order	Myrtales
Family	*Myrtaceae*
Genus	*Syzygium*
Species	*Cumini*
Binomial name	*Syzygium cumini* (L.) Skeels
Synonyms	*Eugenia jambolana* Lam.
	Myrtus cumini Linn.
	Syzygium jambolana DC.
	Syzygium jambolanum (Lam.) DC.
	Eugenia djouant Perr.
	Calyptranthes jambolana Willd.
	Eugenia cumini (Linn.) Druce
	Eugenia caryophyllifolia Lam.

Common names:	
Sanskrit	Mahajambu, Ksudrajambu
English	Jambul tree, jambolan, black plum, jamun, java plum, purple plum, Indian blackberry, Portuguese plum, Malabar plum, Jamaica and Damson plum
Tamil	Naval
Hindi	Jamuna
Sinhala	Jambu, jambul, madan, naval

Distribution of *S. cumini*

S. cumini grows throughout the South Asia such as India, Bangladesh, Burma, Nepal, Pakistan, Sri Lanka and Indonesia [18], as well as Asian subcontinent, Madagascar, Eastern Africa, and United States of America [19]. Buddhists recognize the tree in southern Asia, and it is often installed near Hindu temples because of its blessing from Lord Krishna [20]. Himalayas, Kerala, Karnataka, Andhra Pradesh, North, and East India all have the highest prevalence of *S. cumini* in India [21].

Botanical description of *S. cumini*

S. cumini plant is briefly described botanically in Table 2. Figure 1 also displays images of various parts of this plant.

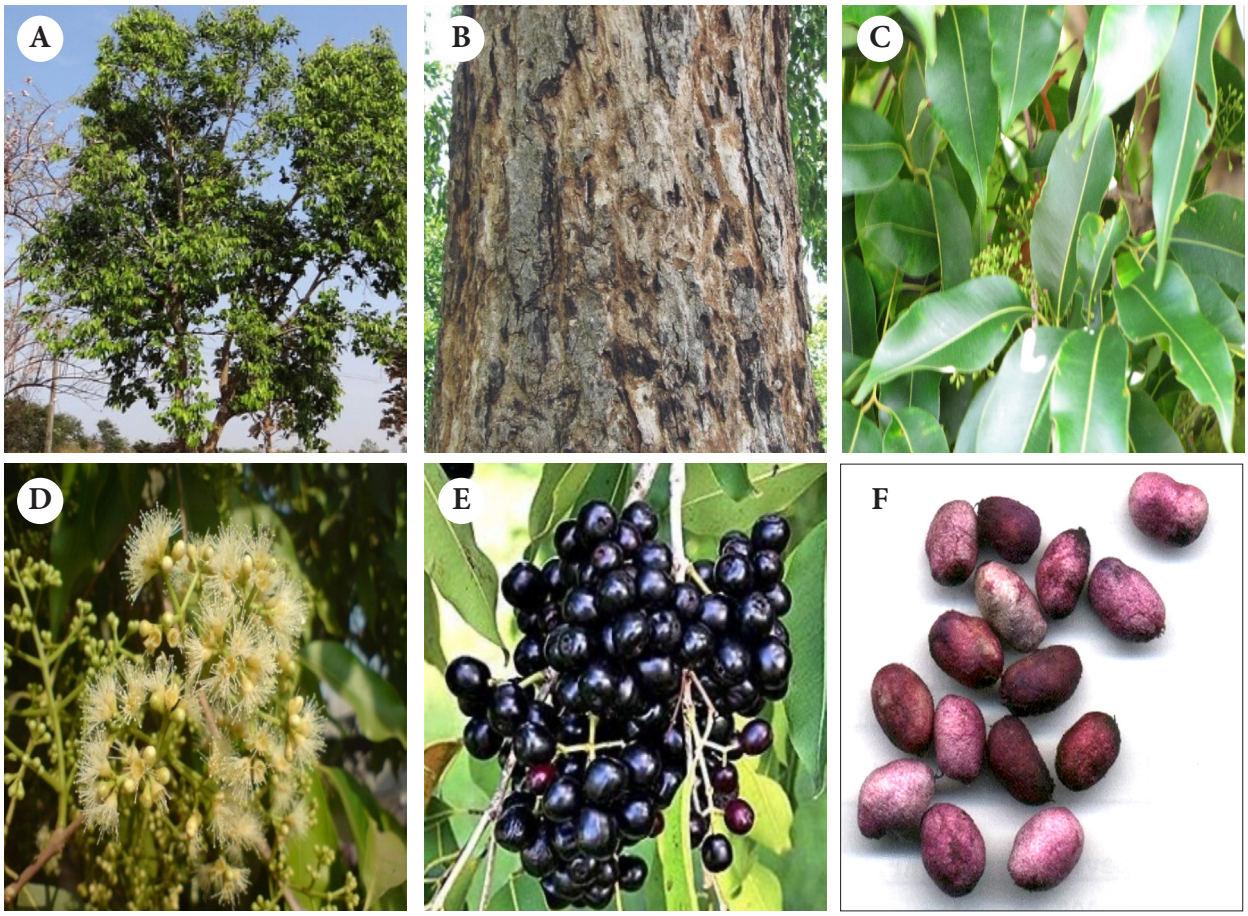

Figure 1.

Different parts of *Syzygium cumini,* A – tree, B – bark, C – leaves, D – flowers, E – fruits and F – seeds

Table 2.

Description of *S. cumini* plant

Part	Description	References
Tree	A tree that is large, evergreen, and densely foliaceous; can grow up to 50 feet tall.	[12], [18], [22–23]
Bark	The younger barks are characterized by a pale brown colour, whereas the mature ones are thicker and slightly dark brown or greyish-brown, flaking off in woody scales.	[18], [22–23]
Wood	It is characterized by a whitish, fine grain, and durability; it produces brown dyes and a gum known as Kino.	[12], [18], [22-23]
Leaves	Leathery, oblong-ovate to elliptic, with a length of 6 to 12 cm. The tip is broad and less acuminate, smooth, glossy, and fibrous in nature.	[12], [18], [22–23]
Flowers	Once a year, small, greenish-white, sessile cymes with a few or up to 40 clusters are found in dichotomous paniculate cymes. The calyx is funnel-shaped, approximately 4 mm in length and toothed. The petals cohere and fall together as a small disk.	[12], [18], [22–23]
Fruits	Clusters of 4–20 are found. It takes about 2 months to complete the fruiting process from the flowering stage. Fruits in a group do not ripen at the same time and fall off when they are fully ripe. The fruit is either round, oblong, or ellipsoid in shape, and ranges in size from 1/2 to 2 inches, with large seed situated centrally. As fruits mature, they change from green to light magenta and then to dark purple or black when fully ripe.	[12], [18], [22–23]

Phytochemical constituents

Numerous studies have confirmed that *S. cumini* has higher concentrations of phytochemical compounds in its various parts [6, 10, 12, 18, 23, 24–28]. Different parts of *S. cumini* contain numerous phytochemicals such as alkaloids, carbohydrates, tannins, flavonoids, glycosides, etc. [29]. Meanwhile, terpenoids and phytosterols were not found in the leaf extract, according to another study [30]. Phytochemicals are plant chemicals that are non-nutritive and have the ability to protect humans from diseases. The ingestion of phytochemicals from several plant families can lead to different well-being benefits, with the prevention of diabetes, obesity, cancer, cardiovascular disorders, and other conditions [16].

Table 3 displays phytochemical compounds that have been found in different parts of the plant and Figure 2 demonstrates the chemical structures of certain constituents.

Table 3.

Phytochemical compounds in *S. cumini*

Plant part	Metabolic class	Identified compounds	References
Seeds	polyphenols, including flavonoids, alkaloids, phenolic compound, tannins glycosides and fatty oils	quercetin, caffeic acid, rutin, 3,5,7,4- tetrahydroxy flavones, ellagic acid, ferulic acid, albumen, fat, jambosine, ellagic acid, lauric, myristic, palmitic, stearic, oleic acid, linoleic, malvalic, vernolic acid and phytosterols	[1], [12], [31]

Leaves	phenolic content and acetylated flavanol with new flavanol, glycosides, rhamnosides	triterpenoid, ferulic acid, catechin, cretegolic acid, n-dotricontanol, myrcetin, mycaminose, quercetin, tannic acid, BHA, and tocopherol	[24], [32–35]
Fruit	tannins, glycosides, vitamin A, C and volatile flavour components	oxalic acid, malic acid, gallic acid, cyanidine diglycosides, thiamine, riboflavin, nicotinic acid, folic acid	[16], [36]
Fruit pulp	anthocyanins, volatile oils, terpenes	petunidin, α-pinene, β-pinene, malvidin, peonidin, cyanidin, pelargonidin, delphinidin, carbohydrates, protein, calcium and minerals	[12], [36–38]
Stem bark	triterpenoids, resin, phytosterol	oleanolic acid, Eugenia triterpenoid-A, and B, ellagic acid, pentacyclic triterpenoid- betulinic acid, pentacyclic triterpenoid-friedelin, myricetine, β-sitosterol, and myricyl alcohol	[39–40]
Flower	flavonoids, tannins, triterpenoids	erategolic acid, kaempferol, isoquercetin, quercetin, and oleanolic acid	[41–42]
Root	flavonoids, glycosides	isorhamine 3-O-rutinoside, and myricetin 3-O-robinoside	[17], [43]

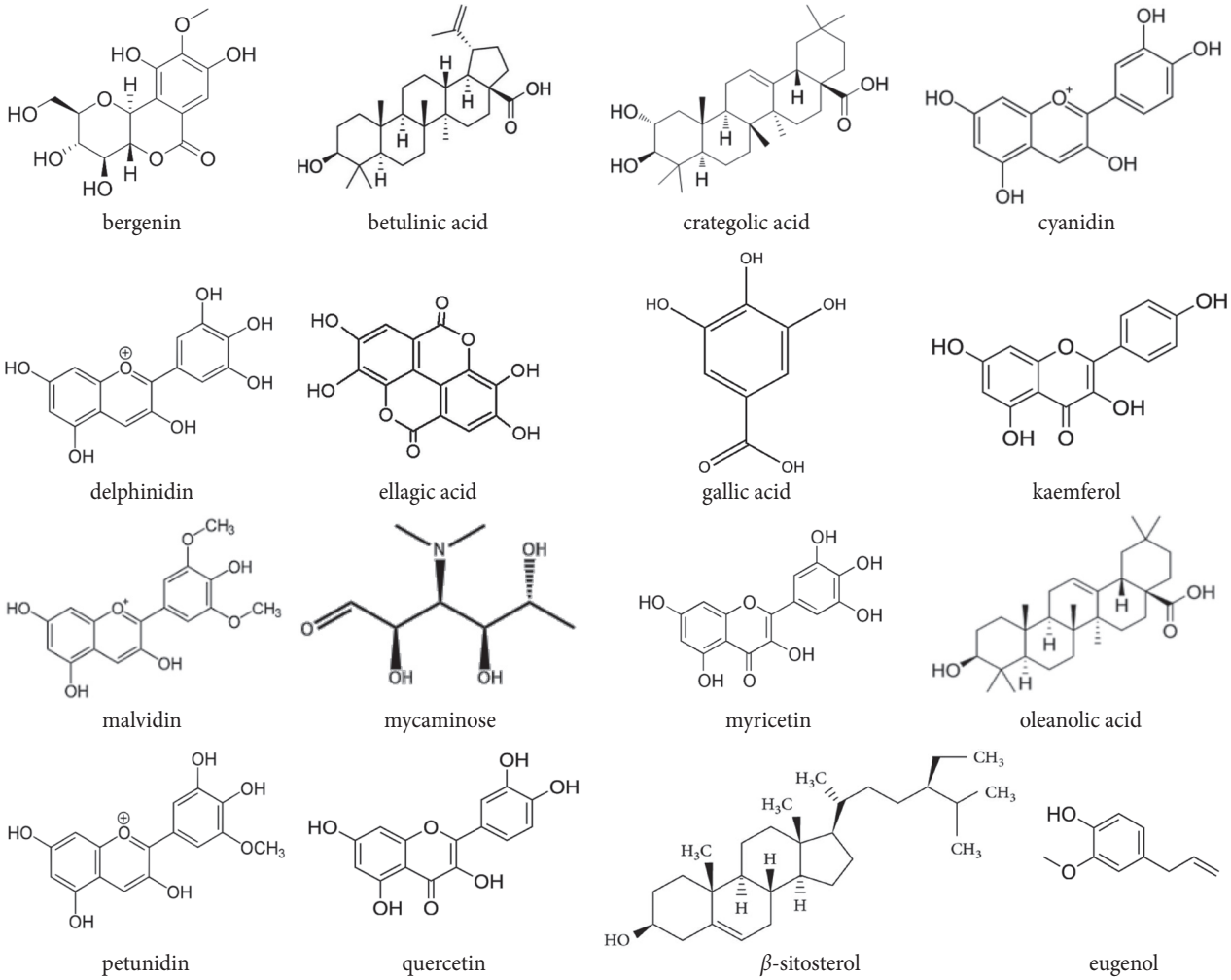

Figure 2.

Structures of chemical constituents in *S. cumini* reported to be used

Medicinal properties

Except its various parts, the *S. cumini* plant also contains a variety of medicinal properties that are responsible for managing bowel-related diseases, particularly diabetes mellitus [10] which are summarized in Table 4.

colic, indigestion, diarrhea, digestive complaints, dysentery, piles, pimples, inflammation, ringworm, stomachache, headache and repeated abortion [48-66].

When someone has jaundice, both adults and children in a Maharashtra community are given the tender leaves orally for two to three days. In addition,

Table 4.

Medicinal properties of the *S. cumini*

Parts	Medicinal properties	Management	References
Plant	astringent, sweet and sour	absorbent, useful in malabsorption syndrome and diarrhoea	[12], [44]
Bark	acrid, sweet, digestive, astringent, anthelmintic and blood purifier	sore throat, bronchitis, asthma, thirst, biliousness, dysentery and ulcers	[12], [44]
Fruit	acrid, sweet, cooling, astringent, stomachic, carminative, diuretic, antiscorbutic and antidiabetic	removes bad smell form mouth, biliousness, chronic diarrhoea and other enteric disorders	[10], [12], [44]
Seed	sweet, astringent and antidiabetic	diarrhoea and diabetes mellitus	[10], [12], [44]

Physicochemical constituents

The outcomes display that jamun fruits are a good basis of bioactive chemicals, since they include high quantities of ascorbic acid, total anthocyanin, total phenolic contents, and total flavonoid contents and they exhibited the lowest levels of copper and zinc and the highest levels of K, P, Mg, Ca, Mn, and Fe [45]. When compared to seeds and leaves, bark has higher fat content, insoluble ash level, and lower moisture content [46]. According to different study, fruits with higher levels of crude fat and carbohydrates had much lower energy values, while larger fruits had significantly higher amounts of crude fibre and protein [47].

Uses in traditional medicine

Due to the use of all parts, the *S. cumini* tree has been used medicinally for a long time [12]. Various traditional practitioners in Madagascar; North, Eastern and Southern Brazil; Bhutias, Maharastra, Andhra Pradesh, Karnataka of India use the distinct parts of the plant with variety of preparations such as infusion or decoction, juice, powder, paste employed to cure several ailments such as diabetes, ulcers in mouth and genitourinary tract cancer, centipede bites and opium intoxication are treated in Northeast Indian cities by oral administration of leaf juice. Also, leaf infusions or decoctions in water with an average content of 2.5 g/l and a mean everyday consumption of roughly one litter are used to treat diabetes in Southern Brazil [18].

Because the bark comprises carbohydrates and tannins, it's been utilized to cure diseases including dysentery. Due to the presence of glycoside, seeds are used to treat reducing blood glucose levels and also said that jamun seeds have a high concentration of ellagitannins, which have antidiabetic properties [10]. Jambolin or antimellin, a glycoside, and the alkaloid jambosine are said to be present in the seeds, and they prevent starch from being converted into sugar through this process [60]. According to reports, streptozotocin-diabetic rats treated with *E. jambolana* seed powder showed hypoglycaemic effects [49–50]. The fruits are utilized for treating many different conditions from all over the world, such as ringworm, cough, diabetes, diarrhoea, and inflammation [10, 57]. According to different research, utilizing *S. cumini* as a treatment outcome in a dose-dependent and substantial rise in body weight, indicating that the hyperglycaemic state was avoided from leading to muscular atrophy [10]. An ethnobotanical and ethnomedical survey reports

that the fruits are used to cure diabetes, the bark to treat dental issues, and the leaves to treat diarrhoea and dysentery [30].

Pharmacological activities

S. cumini has been found to have wide range of pharmacological activities, including antioxidant, antibacterial, antidiabetic, anti-obesity, anti-inflammatory, antifertility, antipyretic, antidysentery, anticancer, anticlastogenic, hepatoprotective, diuretic, antihyperlipidemic, antiallergic, antifungal, gastroprotective, antidiarrhoeal, neuroprotective in different parts [11, 18, 35, 44, 67] and several experimental and clinical studies have also validated these findings. In particular, its fruits and seeds have a promising effect on diabetes mellitus [68–77].

Table 5.

Pharmacological activities of the *S. cumini*

Pharmacological activities	Parts	Extract/s	Chemical compounds	Substance-induced animal
Antidiabetic	leaves	methanol, n-hexane	vit. C, gallic acid, tannins, anthocyanins including cyainidin, petunidin, lupeol, β-sitosterol	streptozotocin-induced diabetes in rats [78].
		ethanol		*in vitro* α-glucosidase inhibitory activity [79]
	seed	acetone extract	orally administered with glibenclamide	alloxan-induced Wistar rats [80]
Anti-inflammatory	bark	ethanol	ellagic acid, gallotannin, betulinic acid, β-sitosterol, eugenin, kaempferol	carrageenan, formaldehyde-induced paw oedema and cotton pellet granuloma in rats [81-82]
	seed	methanol, acetate	triterpenoids, saponins and tannins	carrageenin-induced paw oedema in rats [83]
		methanol, aqueous		carrageenan-induced hind paw oedema in Wistar rats [84]
	leaf	aqueous	phenolic compounds and flavonoids	indomethacin induced acute gastric ulceration [85]
		methanol		in experimental acute (carrageenan, histamine and serotonin induced rat paw oedema) and chronic models (cotton pellet induced rat granuloma) [86].
Analgesic and anti-inflammatory	stem	dichloromethane fraction, chloroform fractions and methanolic extract		carrageenan-induced inflammation in mice [87]
Antioxidant and antimicrobial or antibacterial	seed	aqueous	phenols and flavonoid	*Candida albicans*-infected diabetic rats [88]
	stem	aqueous and alcoholic		*in-vitro*-agar well diffusion [88]
Antioxidant, anti-inflammatory and antifibrotic	seed	seed powder		male Wistar rats were fed with HCHF diet ad libitum [89]

Antioxidant activity	fruit	infusion (hot)	vitamins, phenolics or tannins and anthocyanins	*in vitro* – different assays [90]
	bark	80% methanol, ethanol, and acetone extracts		inhibition of linoleic acid oxidation [91]
Antiallergic	leaves and roots	aqueous	ellagitanni, gallotannin and flavonoids	mast-cell degranulator C48/80-induced anaphylaxis oedema in mice [92]
Anti-hyperlipidaemic	plant pulp	ethanol	phenolic content – flavonoids, tannins, triterpenoids	triton X-100 induced hyperlipidaemia in rats [19]
	seed	ethanol	flavonoids, alkaloids, saponins, tannins	[93]
Anti-hypertensive	leaves	hydro-alcoholic	flavonoids, tannins, triterpenoid	rats [94]
Cardio and hepato-protective	seeds	methanol	flavonoids, phenolic contents	CCl_4-induced hepatotoxicity in rats [95]
Cardioprotective	seeds	methanol		isoproterenol-induced myocardial infarction in rats [96]
Diuretic	bark	methanol/aqueous	phenolic content – flavonoid, tannin	furosemide-induced diuretic in rats [97]
Antibacterial	seed	chloroform, petroleum ether, ethanol		*in-vitro* – disk diffusion method [98].
		methanol fraction of ethanol extract		*in-vitro* – agar cup method [99]
		methanol and ethanol	gallic acid and quercetin	disc diffusion and broth dilution assays [8]
	peel fruit	ethanol		*in-vitro* – disk diffusion method in ATCC [44]
Anticancer	fruit pulp	crude	flavonoids, alkaloids, steroids	*in-vitro* – trypan blue dye exclusion method in HeLa, SiHA [100]
		methanol	flavonoid, alkaloid, steroid	*in-vitro* – trypan blue dye exclusion method in MCF-7 cell line [101]
		chloroform-soluble extracts	quercetin, gallic acid, and oleanolic acid	ovarian cancer cell line PA-1. 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide tetrazolium assay [102]
Antifungal	leaves, fruit, stem-bark and root-bark	aqueous, ethanol and n-hexane		*Ascochyta rabiei* (Pass.) Lab, *Cicer arietinum* L. [103]
Gastro-protective and anti-ulcerogenic		tannins extract	tannins	negative control, an omeprazole group and a tannins group rat [104]
Antifertility	flowers		oleanolic acid	male albino rats [105]

It is evident from Table 5 that *in vitro* and *in vivo* studies have shown that *S. cumini* has various pharmacological properties. Based on the clinical trials, the *S. cumini* is commonly suggested to decrease blood sugar levels in patients with type 2 diabetes [106-107] and it is regarded as a plant-based antidiabetic agent [108-109]. In an interview-based study, it was found that *S. cumini* infusion is

commonly used by type 2 diabetes patients [110]. In a controlled study, it was discovered that jamun seed powder supplementation had a positive impact on the lipid profile of subjects with type 2 diabetes [111]. Another study also proved that the supplementation of jamun seed powder can improve glycaemic control and dyslipidaemia [112].

Because of its antioxidative, antidiabetic, anti-inflammatory, anticarcinogenic, and hyperlipidaemic properties, jamun has been shown in numerous clinical investigations to have ameliorating benefits against metabolic syndrome [113].

Toxicity studies

Numerous studies related to toxicity have confirmed that different extracts such as methanolic, aqueous, ethyl acetate, and hydroethanolic extracts of diverse portions of the *S. cumini* are non-toxic and safe for long-term management [114–124].

Considering the study's outcomes, rats given alloxan were able to safely receive a prolonged and sustained antidiabetic effect when gliclazide and *S. cumini* seed methanolic extract were combined [114]. When methanolic leaf extract was tested for acute toxicity in mice, the outcomes exhibited that it had a lower LD_{50} (3,873 mg/kg) than stem bark (>5000 mg/kg) [115]. The hydroalcoholic extract of *S. cumini* was tested by determining its LD_{50} in mice, and the results showed that it had neither acute hazardous effect or long-term effects when taken orally [117]. A sub chronic toxicity investigation on male albino rats using aqueous extracts of the leaves revealed no appreciable alterations and concluded that *S. cumini* leaves might be a powerful anti-diabetic drug [119]. On diabetic rats induced with alloxan, the application of an aqueous extract of *S. cumini* leaves is useful in the regulation of the changes in glucose metabolism during diabetes without causing toxicity [120]. Experimental rats received an acute oral dosage of up to 5000 mg/kg of ethanolic extract of *S. cumini* leaves, and neither toxic symptoms nor mortality resulted from the administration [121]. In oral acute toxicity investigation, there weren't any observable medical symptoms of toxicity or death associated with ethanol extract of *S. cumini* stem bark [122]. In acute trials on mice or rats, it was discovered that plant elements such as seeds, leaves, and bark were non-toxic [124]. *In vivo* studies with streptozotocin-induced diabetic rats showed that *S. cumini* preparations improved metabolic markers, conserved renal function, and, in a dose-dependent way, decreased the production of glycation adducts [125].

CONCLUSION

For the treatment of several ailments, particularly diabetes and its interrelated difficulties, *S. cumini* plant is widely employed by traditional healers. According to this review, *S. cumini* possesses notable physicochemical and phytochemical qualities, as well as pharmacological actions, along with unique morphological traits. In addition, it verified that *S. cumini* is a versatile medicinal herb with a range of applications in nutraceuticals. To develop safer drugs for the treatment of diabetes and other illnesses, more scientific research is required to pinpoint the active principles present in *S. cumini*.

Ethical approval: The conducted research is not related to either human or animal use.

Conflict of interest: Authors declare no conflict of interest.

REFERENCES

1. Veeram Anjali, Sindhu G, Girish C. A review on pharmacology and phytochemistry of *Syzygium cumini*. Indian J Pharm Biol Res 2017; 5(4): 24–28.
2. Shrotri DS, Kelkar M, Deshmukh VK, Aiman R. Investigations of the hypoglycemic properties of *Vinca rosea, Cassia auriculata* and *Eugenia jambolana*. Indian Journal of Medical Research 1963; 51:464–467.
3. Sigogneau-Jagodzinski M, Bibal-Prot P, Chanez M, Boiteau P. Contribution to the study of the action of a principle extracted from the myrtle of Madagascar (*Eugenia jambolana Myrtaceae*) on blood sugar of the normal rat. Comptes Rendus Hebdomadaries Seances Académie Sciences De 1967; 264:1223–1226.
4. Mahapatra PK, Pal M, Chaudhury AKN, Chakraborty D, Basu A. Preliminary studies on glycaemic effect of *Syzigium cumini* seeds, IRCS Medical Science Biochemistry 1985; 13(7):631–632.
5. Coimbra TC, Danni FF, Blotta RM, da Pereira CA, Guedes MD, Graf RG. Plants employed in the treatment of diabetes mellitus; results of an ethnopharmacological survey in Porto Alegre, Brazil. Fitoterapia 1992; 63(4):320–322.

6. Chagas VT, França LM, Malik S, Paes AMA. *Syzygium cumini* (L.) skeels: a prominent source of bioactive molecules against cardiometabolic diseases. Frontiers Pharmacology 2015; 6:259. https://dx.doi.org/10.3389/fphar.2015.00259

7. Gajera HP, Gevariya SN, Hirpara DG, Patel SV, Golakiya BA. Antidiabetic and antioxidant functionality associated with phenolic constituents from fruit parts of indigenous black jamun (*Syzygium cumini* L.) landraces. Journal of Food Science and Technology 2017; 54(10):3180-3191. https://dx.doi.org/10.1007/s13197-017-2756-8

8. Vijay K, Sriram S, Priti M. Fractionation of antibacterial extracts of *Syzygium cumini* (*Myrtaceae*) seeds, Research in Biotechnology 2011; 2(6):53–63.

9. Arunpandiyan J et al. Review on *Syzygium cumini* (L.). World Journal of Pharmacy and Pharmaceutical Sciences 2018; 7(4):499–507.

10. Swami S, Thakor N, Patil M, Haldankar P. Jamun (*Syzygium cumini* (L.): A Review of its food and medicinal uses. Food and Nutrition Sciences 2012; 3(8):1100–1117. https://dx.doi.org/10.4236/fns.2012.38146

11. Deepti K, Vijender S, Mohd Ali. Recent advances in pharmacological potential of *Syzygium cumini*: A review. Advances in Applied Science Research 2016; 7(3):1–12.

12. Dagadkhair AC, Pakhare KN, Todmal AD, Andhale RR. Jamun (*Syzygium cumini*) skeels: a traditional therapeutic tree and its processed food products. Indian Journal of Pure & Applied Biosciences 2017; 5(5):1202–1209.

13. Shweta S et al. A review on pharmacological activity of *Syzygium cumini* extract using different solvent and their effective doses. International Research Journal of Pharmacy 2012; 3(12).

14. Kiritikar KR, Basu BD. Indian medicinal plants. Dehradun: International Book Distributors, 1987; pp. 1052–1054.

15. Nadkarni AK. Indian Materia Medica, Popular Prakashan, Bombay, 19921; p. 157.

16. Jadhav V, Kamble S, Kadam V. Herbal medicine: *Syzygium cumini*: A review. Journal of Pharmacy Research 2009; 2(8):1212–1219.

17. Bijauliya RK, Alok S, Singh M, Mishra SB. Morphology, phytochemistry and pharmacology of *Syzygium cumini* (Linn.) – An overview. International Journal of Pharmaceutical Sciences and Research 2017; 8(6):2360–2371.

18. Ayyanar M, Subash-Babu P. *Syzygium cumini* (L.) skeels: a review of its phytochemical constituents and traditional uses. Asian Pacific Journal of Tropical Biomedicine, 2012; 2(3):240–246. https://dx.doi.org/10.1016/S2221-1691(12)60050-1

19. Lalit S, Shailendra S, Sagar BPS, Manas Das. Evaluation of antihyperlipidemic activity of ethanolic extract of *Syzygium cumini* in triton x-100 induced hyperlipidemic rats. Human Journals Research Article 2018; 12(3):40–54.

20. Morton J. Fruits of warm climates. Miami: Julia Morton Winterville North Carolina, 1987.

21. Reddy E, et al. *Syzygium cumini*: a review of its phytochemical and homoeopathic uses. International Research Journal of Medicine and Medical Sciences 2017; 5(4):1–4.

22. Shivashankara AR, Prabhu AN, Dsouza PP, Baliga BRV, Baliga MS, Palatty PL, antidiabetic and hypoglycaemic effects of *Syzygium cumini* (black plum). Bioactive Food as Dietary Interventions for Diabetes 2013; 537–554.

23. Pai RJ, Valder B, Palatty PL, Shivashankara AR, Baliga MS. Chapter 24 – gastrointestinal protective effects of *Eugenia jambolana* Lam. (black plum) and its phytochemicals. Bioactive Food as Dietary Interventions for Liver and Gastrointestinal Disease 2013; 369–382.

24. Gupta GS, Sharma DP. Triterpenoid and other constituents of *Eugenia jambolana* leaves. Phytochemistry 1974; 13:2013–2014.

25. Sah AK, Verma VK. *Syzygium cumini*: An overview. Journal of Chemical and Pharmaceutical Research 2011; 3:108–113.

26. Chaudhary B, Mukhopadhyay K. *Syzygium cumini* (L.) skeels: a potential source of nutraceuticals. International Journal of Pharma and Bio Sciences 2012; 2(1):46–53.

27. Srivastava S, Chandra D. Pharmacological potentials of *Syzygium cumini*: a review. Journal of the Science of Food and Agriculture 2013; 93(9):2084–93. https://dx.doi.org/10.1002/jsfa.6111

28. Ramteke V, Vivek K, Sonali K. Jamun: A traditional fruit and medicine. Popular Kheti 2015; 3(3):188–190.

29. Bandiola Teresa MB, Ramos IL. Phytochemical screening of *Syzygium cumini* (*Myrtaceae*) leaf extracts using different solvents of extraction. Der Pharmacia Lettre 2017; 9(2):74–78. http://scholarsresearchlibrary.com/archive.html

30. Jagetia GC, Baliga S, Venkatesh P. Influence of seed extract of Syzygium cumini (jamun) on mice exposed to different doses of γ-radiation, Journal of Radiation Research 2005; 46(1):59–65. https://dx.doi.org/10.1269/jrr.46.59

31. Rajkumar G, Jayasinghe MR, Sanmugarajah V. Comparative analytical study of phytochemicals in selected antidiabetic medicinal plant seeds in Sri Lanka. Pharmaceutical Sciences and Research 2021; 8(3):145–155.

32. Ruan ZP, Zhang LL, Lin YM. Evaluation of the antioxidant activity of *Syzygium cumini* leaves. Molecules 2008; 13(10):2545–56. https://dx.doi.org/10.3390/molecules13102545

33. Ibrahim IM, Mohamed SAM, Fatma AM, Mohamed R.El-G, Amel MKH. Acylated flavonol glycosides from *Eugenia jambolana* leaves. Phytochemistry 2001; 58(8):1239–1244.

34. Timbola AK, Szpoganicz B, Branco A, Monache FD, Pizzolatti MG. A new flavonoid from leaves of *Eugenia jambolana*. Fitoterapia 2002; 73: 174–176.

35. Jagetia GC. Phytochemical composition and pleotropic pharmacological properties of jamun, *Syzygium cumini* skeels. Journal of Exploratory Research in Pharmacology 2017; 2(2):54–66. https://dx.doi.org/10.14218/JERP.2016.00038

36. Vijayanand P, Rao LJM, Narasimham P. Volatile flavour components of Jamun fruit (*Syzygium cumini*). Flavour and Fragrance Journal 2001; 16:47–49.

37. Benherlal PS, Arumughan C. Chemical composition and *in vitro* antioxidant studies on *Syzygium cumini* fruit. Journal of the Science of Food and Agriculture 2007; 87:2560–2569.

38. Aqil F, Gupta A, Munagala R, Jeyabalan J, Kausar H, Sharma RJ, Singh IP, Gupta RC. Antioxidant and antiproliferative activities of anthocyanin/ellagitannin-enriched extracts from *Syzygium cumini* L. (Jamun, the Indian Blackberry). Nutrition and Cancer 2012; 64(3):428–438. https://dx.doi.org/10.1080/01635581.2012.657766

39. Sengupta P, Das PB. Terpenoids and related compounds. Part IV. Triterpenoids the stembark of *Eugenia jambolana* Lam. Indian Chemical Society 1965; 42:255-258.

40. Ivan AR. Medicinal Plant of World: Chemical Constituents, Traditional Uses and Modern Medicinal Uses, Human Press Totowa, New Jersey, 1999; 283–289.

41. Nair RAG, Subramanian SS. Chemical examination of the flowers of *Eugenia jambolana*. Journal of Scientific & Industrial Research 1962; 21B:457–458.

42. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy, 58th edition, Nirali Prakashan, 2023.

43. Vaishnava MM, Tripathy AK, Gupta KR. Flavonoid glycosides from roots of *Eugenia jambolana*. Fitoterapi 1992; 63:259–260.

44. Agarwal P, Gaur PK, Tyagi N, Puri D, Kumarc N, Kumar SS. An overview of phytochemical, therapeutic, pharmacological and traditional importance of *Syzygium cumini.* Asian Journal of Pharmacognosy 2019; 3(1):5–17.

45. El-Safy S, Khalifa AM, Almashad AA, Mohamed KAM, Hammad, EM, Sami R, et al. Utilization of Jamun fruit (*Syzygium cumini* L.) for value added food products. Journal of Food Quality 2023; 5460642:10.

46. Rajkumar G, Sanmugarajah V, Jayasinghe MR. Comparative phyto and physicochemical parameters of the therapeutic plant *Syzygium cumini* (L.) Skeels in Jaffna District. Current Scientia 2023; 26(02):64–77.

47. Chiteva R, Onyari JM, Njenga LW, Madadi VO. Physicochemical and nutritional properties of *Syzygium cumini* (L.) skeels fruits grown in varied microclimates in Kenya. African Journal of Pure and Applied Chemistry 2023; 17(1):1–9.

48. Jain SK. Dictionary of Indian Folk Medicine and Ethnobotany. New Delhi: Deep Publications Paschim Vihar, 1991.

49. Sridhar SB, Sheetal UD, Pai MR. Preclinical evaluation of the antidiabetic effect of *Eugenia*

jambolana seed powder in streptozotocin-diabetic rats. Brazilian Journal of Medical and Biological Research 2005; 38:463–468.

50. Ravi K, Rajasekaran S, Subramanian S. Hypoglycemic effect of *Eugenia jambolana* seed kernels on streptozotocin-induced diabetes in rats. Pharmaceutical Biology 2003; 41:598–603.

51. Natarajan B, Paulsen BS. An ethnopharmacological study from Thane district Maharashtra India traditional knowledge compared with modern biological science. Pharmaceutical Biology 2000; 38:139–151.

52. Pepato MT, Folgadol VBB, Kettelhut IC, Brunetti IL. Lack of antidiabetic effect of a *Eugenia jambolana* leaf decoction on rat streptozotocin diabetes. Brazilian Journal of Medical and Biological Research 2001; 34:389–395.

53. Sharma HK, Chhangte L, Dolui AK. Traditional medicinal plants in Mizoram India. Fitoterapia 2001; 72:146–161.

54. Chandrasekaran M, Venkatesalu V. Antibacterial and antifungal activity of *Syzygium jambolanum* seeds. Journal of Ethnopharmacology 2004; 91:105–108.

55. Jain A, Katewa SS, Galav PK, Sharma P. Medicinal plant diversity of Sitamata wildlife sanctuary Rajasthan India. Journal of Ethnopharmacology 2005; 102:143–157.

56. Chhetri DR, Parajuli P, Subba GC. Antidiabetic plants used by Sikkim and Darjeeling Himalayan tribes India. Journal of Ethnopharmacology 2005; 99:199–202.

57. Reynertson KA, Basile MJ, Kennelly EJ. Antioxidant potential of seven myrtaceous fruits. Ethnobotany Research and Applications 2005; 3:25–35.

58. Nagaraju GJ, Sarita P, Ramana Murty GA, Ravi Kumar M, Reddy BS, Charles MJ, et al. Estimation of trace elements in some antidiabetic medicinal plants using PIXE technique. Applied Radiation and Isotopes 2006; 64:893–900.

59. Udayan PS, Satheesh G, Tushar KV, and Balachandran I. Medicinal plants used by the Malayali tribe of Shevaroy hills Yercaud Salem district Tamil Nadu. Zoos' print Journal 2006; 21:2223–2224.

60. Sagrawat H, Mann AS, Kharya MD. Pharmacological potential of *Eugenia jambolana*: a review. Pharmacognosy Magazin 2006; 2:96–104.

61. Teixeira CC, Fuchs FD, Weinert LS, Esteves J. The efficacy of folk medicines in the management of type 2 diabetes mellitus results of a randomized controlled trial of *Syzygium cumini* (L.) skeels. Clinical Pharmacology & Therapeutics 2006; 31:1–5.

62. de Albuquerque UP, Muniz de Medeiros P, de Almeida AL, Monteiro JM, Machado de Freitas Lins Neto E, Gomes de Melo J, et al. Medicinal plants of the caatinga (semi-arid) vegetation of NE Brazil: a quantitative approach. Journal of Ethnopharmacology 2007; 114:325–354.

63. Braga FG, Bouzada MLM, Fabri RL, Matos MO, Moreira FO, Scio E et al. Antileishmanial and antifungal activity of plants used in traditional medicine in Brazil. Journal of Ethnopharmacology 2007; 111:396–402.

64. Ayyanar M. Ethnobotanical wealth of Kani tribe in Tirunelveli hills (PhD thesis). University of Madras Chennai India, 2008.

65. Ketylin Fernanda Migliato et al. Total polyphenols from *Syzygium cumini* (L.) skeels fruit extract. Brazilian Journal of Pharmaceutical Sciences 2009; 45(1):jan./mar.

66. Ulla A, Alam MA, Sikder B et al. Supplementation of *Syzygium cumini* seed powder prevented obesity, glucose intolerance, hyperlipidemia and oxidative stress in high carbohydrate high fat diet induced obese rats. BMC Complementary and Alternative Medicine, 2017; 17:289. https://dx.doi.org/10.1186/s12906-017-1799-8

67. Qamar M, Akhtar S, Ismail T, Wahid M, Abbas MW, Mubarak MS, Yuan Y, Barnard RT, Ziora ZM, Esatbeyoglu T. Phytochemical profile, biological properties, and food applications of the medicinal plant *Syzygium cumini*. Foods 2022; 11(3):378. http://dx.doi.org/10.3390/foods11030378

68. Grover JK, Vats V, Rathi SS. Antihyperglycemic effect of *Eugenia jambolana* and *Tinospora cordifolia* in experimental diabetes and their effects on key metabolic enzymes involved in carbohydrate metabolism. Journal of Ethnopharmacology 2000; 73:461–470.

69. Vikrant V, Grover JK. Tandon N, Rathi S, Gupta N. Treatment with extracts of *Momordica charantia* and *Eugenia jambolana* prevents hyperglycemia and hyperinsulinemia in fructose fed rats. Journal of Ethnopharmacology 2001; 76:139–143.

70. Prince PSM, Kamalakkannan N, Menon VP. *Syzigium cumini* seed extracts reduce tissue damage in diabetic rat brain. Journal of Ethnopharmacology 2003; 84:205–209.

71. Sharma SB, Nasir A, Prabhu KM, Murthy PS, Dev G. Hypoglycaemic and hypolipidemic effect of ethanolic extract of seeds of *Eugenia jambolana* in alloxan-induced diabetic rabbits. Journal of Ethnopharmacology 2003; 85:201–206.

72. Ravi K, Ramachandran B, Subramanian S. Protective effect of *Eugenia jambolana* seed kernel on tissue antioxidants in streptozotocin induced diabetic rats. Biological and Pharmaceutical Bulletin 2004a; 27:1212–1217.

73. Ravi K, Ramachandran B, Subramanian S. Effect of *Eugenia jambolana* seed kernel on antioxidant defense system in streptozotocin induced diabetes in rats. Life Sciences, 2004b; 75:2717–2731.

74. Ravi K, Rajasekaran S, Subramanian S. Antihyperlipidemic effect of *Eugenia jambolana* seed kernel on streptozotocin induced diabetes in rats. Food and Chemical Toxicology 2005; 43:1433–1439.

75. Sharma SB, Nasir A, Prabhu KM, Murthy PS. Antihyperglycemics effect of the fruit-pulp of *Eugenia jambolana* in experimental diabetes mellitus. Journal of Ethnopharmacology 2006; 104: 367–373.

76. Ayyanar M, Subash-Babu P, Ignacimuthu S. *Syzygium cumini* (L.) skeels., a novel therapeutic agent for diabetes: folk medicinal and pharmacological evidences. Complementary Therapies in Medicine 2013; 21(3):232–43. https://dx.doi.org/10.1016/j.ctim.2013.03.004

77. Baliga MS, Fernandes S, Thilakchand KR, D'souza P, Rao S. Scientific validation of the antidiabetic effects of *Syzygium jambolanum* DC (black plum), a traditional medicinal plant of India. Journal of Alternative and Complementary Medicine 2013; 19(3):191–197. https://dx.doi.org/10.1089/acm.2011.0752

78. Alam Md R, Rahman A Bin, Moniruzzaman Md, Kadir MF, Haque Md, Alvi Md, Ratan MRH. Evaluation of antidiabetic phytochemicals in *Syzygium cumini* (L.) skeels (family: *Myrtaceae*). Journal of Applied Pharmaceutical Science 2012; 2 (10):094–098. https://dx.doi.org/10.7324/JAPS.2012.21019

79. Artanti N, Maryani F, Triana Dewi R, Handayani Sri, Dewijanti ID, Meilawati Lia, Filaila E, Udin LZ. *In vitro* antidiabetic, antioxidant and cytotoxic activities of *Syzygium cumini* fractions from leaves ethanol extract. Indonesian Journal of Cancer Chemoprevention, in press, 2019.

80. Kavital A, Hiremath MB, Vishwanath Swamy AHM, Patil SB. Hypoglycemic activity of *Syzygium cumini* (L.) skeels seed extracts: an approach to *in vitro*, *in vivo*, and *in silico* studies. Journal of Biomolecular Structure and Dynamics, 2023; 11:1–11. https://dx.doi.org/10.1080/07391102.2023.2268218

81. Muruganandan S, Srinivasan K, Chandra S, Tandan SK, Lal J, Raviprakash V. Anti-inflammatory activity of *Syzygium cumini* bark. Fitoterapia 2001; 72:369–375.

82. Muruganandan S, Pant S, Srinivasan K, Chandra S, Tandan SK, Lal J, et al. Inhibitory role of *Syzygium cumini* on autacoid induced inflammation in rats. Indian Journal of Physiology and Pharmacology 2002; 46:482–486.

83. Kumar A, Ilavarasan R, Jayachandran T, Deecaraman M, Mohan Kumar R. Aravindan P. Padmanabhan N, Krishan, MRV. Anti-inflammatory activity of *Syzygium cumini* seed. Short Communication. African Journal of Biotechnology 2008; 7(8): 941-943. https://dx.doi.org/10.5897/AJB08.039

84. Modi DC, Patel JK, Shah BN, Nayak BS. Anti-inflammatory activity of seeds of *Syzygium cumini* Linn. Journal of Pharmaceutical Education and Research 2010; 1:68–70.

85. Chanudom L, Tangpong J. Anti-inflammation property of *Syzygium cumini* (l.) skeels on indomethacin-induced acute gastric ulceration. Gastroenterology Research and Practice 2015; 343642. https://dx.doi.org/10.1155/2015/343642

86. Roy A, Bhattacharya S, Pandey JN, Biswas M. Anti-inflammatory activity o S*yzygium cumini* leaf against experimentally induced acute and chronic inflammations in rodents. Alternative Medicine Studies 2011; 1:e6.

87. Abdur R, Yahya S Al, Imtaiz AK, Naveed M, Syed Uzair Ali S, Omar B, Mohammed A Al, Rohit S, Md. Mominur R. *In vivo* anti-inflammatory, analgesic, muscle relaxant, and sedative activities of extracts from S*yzygium cumini* (L.) skeels in mice, Evidence-Based Complementary and Alternative Medicine 2022; 1–7. https://dx.doi.org/10.1155/2022/6307529

88. Bitencourt PER, Cargnelutti LO, Stein CS, Lautenchleger R, Ferreira LM, Sangoi M et al. Nanoparticle formulation increases *Syzygium cumini* antioxidant activity in *Candida albicans*-infected diabetic rats. Pharmaceutical Biology 2017; 55:1,1082–1088. https://dx.doi.org/10.1080/13880209.2017.1283338

89. Ulla A, Alam MA, Sikder B et al. Supplementation of *Syzygium cumini* seed powder prevented obesity, glucose intolerance, hyperlipidemia and oxidative stress in high carbohydrate high fat diet induced obese rats. BMC Complementary and Alternative Medicine 2017; 17:289. https://dx.doi.org/10.1186/s12906-017-1799-8

90. Banerjee A, Dasgupta N, De B. *In vitro* study of antioxidant activity of *Syzygium cumini* fruit. Food Chemistry 2005; 90:727–733.

91. Bushra S, Farooq A, Roman P. Antioxidant activity of phenolic components present in barks of *Azadirachta indica, Terminalia arjuna, Acacia nilotica* and *Eugenia jambolana* Lam trees. Food Chemistry 2007; 104:1106–1114.

92. Brito ES, Araújo MCP, Alves RE, Carkeet C, Clevidence BA, Novotny JA. Anthocyanins present in selected tropical fruits: Acerola, jambolão, jussara, and guajiru. Journal of Agricultural and Food Chemistry 2007; 55: 9389–9394.

93. Modi DC, Rachh Pr, Nayak Bs, Shah Bn, Modi Kp, Patel Nm, Patel Jk. Antihyperlipidemic activity of *Syzygium cumini* Linn. seed extract on high cholesterol fed diet rats. International Journal of Pharmaceutical Sciences and Research 2009; 1(2):330–332.

94. Ribeiro RM, Pinheiro Neto VF, Ribeiro KS, Vieira DA, Abreu IC, Silva Sdo N, et al. Antihypertensive effect of *Syzygium cumini* in spontaneously hypertensive rats. Evidence-Based Complementary and Alternative Medicine 2014; 605452. https://dx.doi.org/10.1155/2014/605452

95. Nahid S, Mazumder K, Rahman Islam ZS, Rashid Md. H, Kerr PG. Cardio- and hepatoprotective potential of methanolic extract of *Syzygium cumini* (L.) skeels seeds: A diabetic rat model study. Asian Pacific Journal of Tropical Biomedicine 2017; 7(2):126–133.

96. Mastan SK, Chaitanya G, Bhavya Latha T, Srikanth A, Sumalatha G, Eswar Kumar K. Cardioprotective effect of methanolic extract of *Syzygium cumini* seeds on isoproterenol-induced myocardial infarction in rats. Der Pharmacia Lettre 2009; 1(1):143–149.

97. Chandavarkar S, Mamle Desai SN. Diuretic activity of different extracts of bark of *Syzygium cumini* (Linn.) skeels. International Journal of Research in Ayurveda and Pharmacy 2014; 5(1):102–104.

98. Bhusari MR. Antibacterial activity of *Syzigium cumini* L. (jambhul) seed extract against pathogenic bacteria. International Journal of Scientific Research 2012; 3(5):505–506.

99. Yadav Sunil S, Meshram GA, Shinde D, Patil RC, Manohar S M, Upadhye M. Antibacterial and anticancer activity of bioactive fraction of *Syzygium cumini* L. seeds. HAYATI Journal of Biosciences 2011; 18(3):118–122. https://dx.doi.org/10.4308/hjb.18.3.118

100. Barh D, Viswanathan G. *Syzygium cumini* inhibits growth and induces apoptosis in cervical cancer cell lines: a primary study. Ecancer Medical Science 2008; 2:83. https://dx.doi.org/10.3332/ecancer.2008.83

101. Tripathy G, Pradha D. *In-vitro* anti-breast cancer activity of *Syzygium cumini* against MCF-7 cell line. Journal of Innovations in Pharmaceutical and Biological Sciences 2015; 2(2):119–124.

102. Li L, Mangali S, Kour N, Dasari D, Ghatage T, Sharma V, Dhar A, Bhat A. *Syzygium cumini* (jamun) fruit-extracted phytochemicals exert anti-proliferative effect on ovarian cancer cells. Journal of Cancer Research & Therapy 2021;17(6):1547–1551.

103. Jabeen K, Javaid A. Antifungal activity of *Syzygium cumini* against Ascochyta rabiei – the

cause of chickpea blight. Natural Product Research 2010; 24(12):1158–67. https://dx.doi.org/10.1080/14786410902941154

104. Ramirez RO, Roa CC Jr. The gastroprotective effect of tannins extracted from duhat (*Syzygium cumini* skeels) bark on HCl/ethanol induced gastric mucosal injury in Sprague-Dawley rats. Clinical Hemorheology and Microcirculation 2003; 29(3–4):253–261.

105. Rajasekaran M, Bapna JS, Lakshmanan S, Nair RAG, Veliath AJ, Panchanadam M. Antifertility effect in male rats of oleanolic acid a triterpene from *Eugenia jambolana* flowers. Journal of Ethnopharmacology 1988; 24:115–121.

106. Helmstädter A. *Syzygium cumini* (L.) skeels (*Myrtaceae*) against diabetes – 125 years of research. Pharmazie 2008; 63(2):91–101.

107. Bopp A, De Bona KS, Bellé LP, Moresco RN, Moretto MB. *Syzygium cumini* inhibits adenosine deaminase activity and reduces glucose levels in hyperglycemic patients. Fundamental & Clinical Pharmacology 2009; 23(4):501–507. https://dx.doi.org/10.1111/j.1472-8206.2009.00700.x

108. Helmstädter A. Antidiabetic drugs used in Europe prior to the discovery of insulin. Pharmazie 2007; 62(9):717–20.

109. Trojan-Rodrigues M, Alves TL, Soares GL, Ritter MR. Plants used as antidiabetics in popular medicine in Rio Grande do Sul, southern Brazil. Journal Ethnopharmacology 2012; 139(1):155–63. https://dx.doi.org/10.1016/j.jep.2011.10.034

110. Salgueiro ACF, Folmer V, Bassante FEM, Cardoso MHS, da Rosa HS, Puntel GO. Predictive antidiabetic activities of plants used by persons with diabetes mellitus. Complementary Therapies in Medicine 2018; 41:1–9. https://dx.doi.org/10.1016/j.ctim.2018.08.009

111. Sidana, Singh VB, Meena BL, Beniwal S, Chandra S, Singh K, Singla R, Kumar D. Effect of *Syzygium cumini* (jamun) seed powder on dyslipidemia: a double-blind randomized control trial. International Journal of Research in Medical Sciences 2017; 4(7):2603–2610. https://dx.doi.org/10.18203/2320-6012.ijrms20161917

112. Nidhi S, Murlidhar S, Devendra KJ, Gaurav B, Ramesh K. Study of effect of jamun (*Syzygium cumini*) seed powder on glycaemic control and dyslipidaemia in type 2 diabetes mellitus a double-blind randomized control trial. Journal of Medical Science and Clinical Research 2019; 7(9):409–417.

113. Rizvi MK, Rabail R, Munir S, Inam-Ur-Raheem M, Qayyum MMN, Kieliszek M, Hassoun A, Aadil RM. Astounding health benefits of jamun (*Syzygium cumini*) toward metabolic syndrome. Molecules 2022; 27(21):7184.

114. Kumar A, Padmanabhan N, Krishnan MRV. Central nervous system activity of *Syzygium cumini* seeds. Pakistan Journal of Nutrition 2007; 6(6):698–700.

115. Mastan SK, Latha TB, Latha TS, Srikanth A, Chaitanya G, Kumar KE. Influence of methanolic extract of *Syzygium cumini* seeds on the activity of gliclazide in normal and alloxan-induced diabetic rats. Pharmacology online 2009a; 3:845–850.

116. Ugbabe GE, Ezeunala MN, Edmond IN, Apev J, Salawu OA. Preliminary phytochemical, antimicrobial and acute toxicity studies of the stem, bark and the leaves of a cultivated *Syzygium cumini* Linn. (family: *Myrtaceae*) in Nigeria. African Journal of Biotechnology 2010; 9(41):6943–6747.

117. Silva SN, Abreu IC, Silva GFC, Ribeiro RM, Lopes AS, Cartágenes MSS, Freire SMD, Borges ACR, Borges MOR. The toxicity evaluation of *Syzygium cumini* leaves in rodents. Revista Brasileira de Farmacognosia Brazilian Journal of Pharmacognosy 2012; 22(1):102–108.

118. Bharathi T, Siddaiah M, Sriharsha SN. Anti-inflammatory activity of methanol extract of *Syzygium alternifolium* in experimental rats. International Journal of Innovative Pharmaceutical Research 2012; 3(4):25–257.

119. Deb L, Bhattacharjee C, Shetty SR, Dutta A. Evaluation of anti-diabetic potential of the *Syzygium cumini* (Linn.) skeels by reverse pharmacological approaches. Bulletin of Pharmaceutical Research 2013; 3(3):135–45.

120. Prasad M, Rajyalakshmi M, Naik J. Ameliorative potential of aqueous leaves extract of *Syzygium cumini* (L.) associated metabolic alterations in alloxan induced diabetic rats. Journal of Pharmacognosy and Phytochemistry 2014; 3(3):168–172.

121. Ayyanna C, Sekar M, Kumar RN, Narendra PV, Reddy VN. Nephrotoxic effect of ethanolic extract of *Syzygium cumini* Linn. leaves on experimental animals. International Journal of Biological and Pharmaceutical Research 2015; 6(8):678–683.

122. Prasad M, Venugopal SP, Alagarsamy V, Sridevi C. The preliminary phytochemical analysis and oral acute toxicity study of stem bark of *Syzygium cumini*. International Journal of Pharmacy and Pharmaceutical Sciences 2016; 8(1):209–213.

123. Bandiola TMB, Ignacio GB, Yunson EGA, Bandiola PDB. *Syzygium cumini* (L.) skeels: a review of its phytochemical constituents, toxicity studies, and traditional and pharmacological uses. International journal of Applied Pharmaceutical and Biological Research 2017a; 2(6):15–23.

124. Endra Pujiastuti, Agung Endro Nugroho, Khoirun Nisa, and Hertiani, T. Revealing the contribution of phytochemicals in *Syzygium cumini* as diabetics: A systematic review. Indonesian Journal of Pharmacy 2023; 34(4): 519–540.

125. Nilima SB, Aditi D, Mayura MA, Rashmi ST. *Syzygium cumini* (L.) skeels mitigate diabetic nephropathy by regulating Nrf2 pathway and mitocyhondrial dysfunction: *In vitro* and *in vivo* studies. Journal of Ethnopharmacology 2024; 118684:(in press).