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# Jamun: An Alchemy Botanical

Payaam Vohra<sup>1</sup>, Kundan Redekar<sup>2</sup>, Sakshi Pawar<sup>3</sup>, Vaishali Patil<sup>4</sup>

<sup>1</sup>B Pharma Scholar, HK college of Pharmacy, Mumbai, Maharashtra, India.

<sup>2,3,4</sup>Final Year B Pharma Scholar, VIVA Institute of Pharmacy, Mumbai, Maharashtra, India.

## ABSTRACT

Plants have provided mankind with herbal cosmetics for many centuries and their utilization has been continuously increasing over the time. *Syzygium cumini* belonging to the family Myrtaceae commonly known as *Eugenia jambolana* is rich in phytochemicals. Jamun or Black Plum, is indigenous to the Indian subcontinent including countries such as Sri Lanka, Nepal, Pakistan. The tree flourishes in tropical and subtropical climates, often growing in forests, riverbanks and open fields. The investigations on the cosmetic values of jamun that have been conducted recently are the main topic of this review. These formulations of Jamun are characterized by incorporation of beneficial properties such as anti-aging, antioxidants, anti-inflammatory agents, and also reduce photoaging. Key phytoconstituents include tannins, flavonoids, terpenoids, saponins, phenolic acid and Essential oils. *Syzygium cumini* exhibits both Pharmacological and Ayurvedic benefits, providing a valuable component in cosmetic formulations. According to literature review and various research studies *Syzygium cumini* (leaf) and (seed) oils showed anticollagenase, anti-elastase and anti-hyaluronidase activities. Thus *S. cumini* oils should be considered for cosmetic preparations for the manifestation of healthy skin. Jamun can bring a paradigm shift in the cosmetic as well as cosmeceutical industry.

**Key words:** Jamun, *Syzygium cumini*, *Eugenia jambolana*

## INTRODUCTION

In traditional Ayurvedic system, Jamun is mentioned as Fruit of Gods and has been documented in ancient texts over 4000 years. *Syzygium cumini* has a long history and cultural significance in Indian subcontinent. The species has dispersed over south Asia and other tropical regions, where it's been integrated into various agro-ecosystems. Its historical significance is evidenced by archaeological and botanical records indicating its longstanding role in both cultural and medicinal contexts. Jamun has been valued for its

ability to improve skin health and protect skin from oxidative stress.<sup>[1]</sup> The fruits are ellipsoid or oblong, Black with pinkish mesocarp with single seed have a total weight of 25% and 75% pulp.<sup>[2,4]</sup> Botanical Name of Jamun is *Syzygium cumini* (L.).<sup>[3]</sup>

The Taxonomical classification of *Syzygium cumini* is as follows.<sup>[5,6]</sup>

Kingdom	Plantae
Subkingdom	Viridiplantae-Vascular plants
Infrakingdom	Streptophyta
Superdivision	Embryophyta
Division	Tracheophyta
Subdivision	Spermatophytina - Seed plant
Class	Mangoliopsida - Dicotyledons
Superorder	Rosanae
Order	Myrtales

### Address for correspondence:

Dr. Payaam Vohra

B Pharma Scholar, HK college of Pharmacy, Mumbai, Maharashtra, India.

E-mail: payaamvohra@gmail.com

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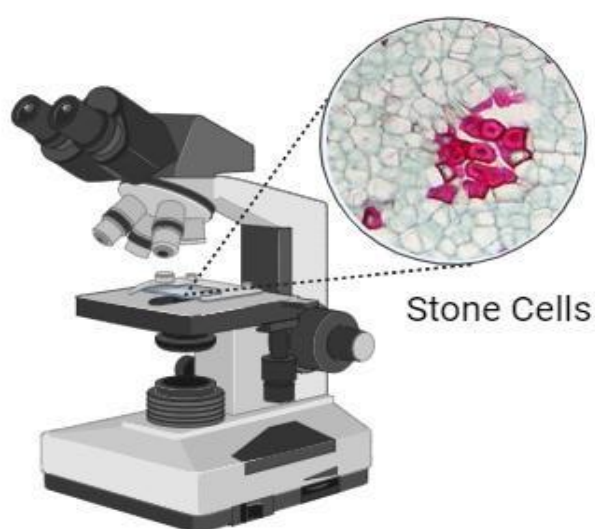
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<b>Family</b>	Myrtaceae -Myrtle
<b>Family Genus</b>	<i>Syzygium</i>
<b>Species</b>	<i>cumini</i> (L.)Skeels

**Microscopy**

1. Seed: Wavy outer layer epidermis, 1 to 3 layers of sub epidermis, a discontinuous ring of group of stone cells, tangentially elongated obliterated parenchyma cells with vascular strands.<sup>[7]</sup>



**Fig. 1 Characteristic features of Jamun**

2. Stem: Mature bark, the cork layer exhibits a broad zone of differentiated cork, which is divided into upper and lower cork zone, collectively forming Rhytidome, the cork comprises tangentially elongated rectangular cells.<sup>[3]</sup>
3. The upper layer consists of thick cells, stratified and reddish brown in color; this layer contains a group of 2-4 stone cells and crushed phloem. The lower cork zone is thin and colorless. The secondary phloem contains sieve elements and phloem rays. The phloem parenchyma is thin-walled and polyhedral. The stone cells are oval to angular and elongated, while fibers are aseptate.<sup>[8,10]</sup>
4. Leaf  
Shape: Oblong-oval.

Dimensions: 5 to 18 cm long and 2.5 to 8 cm wide.

Apex: blunt or tapering to a point.

Odour: Turpentine like.

Taste: Slightly astringent<sup>[9]</sup>

5. Powder microscopy: The powder microscopic characters of testa and seed kernel are reviewed and reported in Fig 1.<sup>[10,11]</sup>

**Adulteration in Jamun Seed Powder**

Starch or fillers: Cheaper fillers like starch are sometimes added to *Jamun* seed powder to increase volume. *Syzygium aqueum*: (*Water Apple*): Sometimes mixed with *Jamun* due to its resemblance.

**Table 1: Microscopic features of *Syzygium cumini*<sup>[12]</sup>**

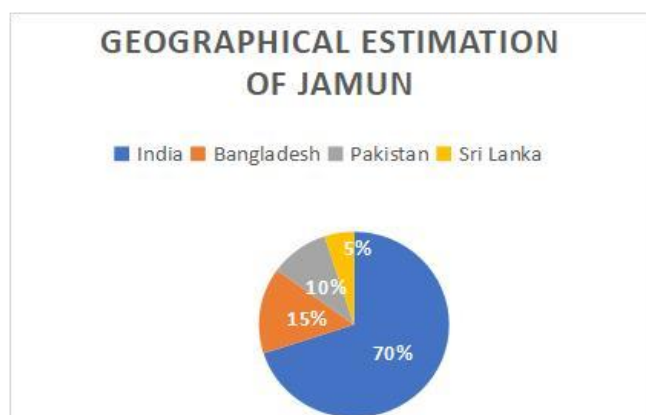
SN	Microscopic Characters	Testa	Seed Kernel
1.	Fibers	Numerous, lignified, thick walled striated with blunt end.	Absent
2.	Crystals	Absent	Calcium oxalate crystals ranging from 15-18 µm
3.	Starch Grain	Absent	Simple and abundant starch grains, round to oval, faint transverse striations, 5-45 µm in diameter.
4.	Vascular elements	Present	Present
5.	Brownish elements	Present	Present
6.	Scleroids	Elongated and mostly narrow lumen, larger in size irregular in shape and spindle shape	Absent

**Geographical Distribution**

There are over 1100 species in the genus *Syzygium* which is native to Madagascar, Africa and the Southern east Asia pacific region. The most diverse areas range from Malaysia to North- eastern Australia. 12 species reported from western ghats.<sup>[12-15]</sup>

**Table 2: Describes the geographical spread of *Syzygium cumini*.**

<i>Syzygium alternifolium</i> (Wight) Walp.	<i>Syzygium fruticosum</i> (Roxb.) D.C.
<i>Syzygium aqueum</i> (Burm.f.) Alston	<i>Syzygium paniculatum</i> Gaertn.
<i>Syzygium aromaticum</i> (Linn.) Merrill & Perry.	<i>Syzygium javanica</i> Lam.
<i>Syzygium bracteatum</i> (Willd.) Raizada	<i>Syzygium densiflorum</i> Wall ex. Wight
<i>Syzygium malaccense</i> (Linn.) Merrill & Perry.	<i>Syzygium uniflora</i> Linn.
<i>Syzygium samarangense</i> (Blume.) Merrill	<i>Syzygium zeylanicum</i> (Linn.) DC.
<i>Syzygium jambos</i> (Linn.) Alston.	<i>Syzygium guineense</i>
<i>Syzygium mappaceum</i>	<i>Syzygium travancoricum</i>
<i>Syzygium arnottianum</i>	<i>Syzygium bourdillonii</i>
<i>Syzygium claviflorum</i>	<i>Syzygium oblatum</i> (Roxb)

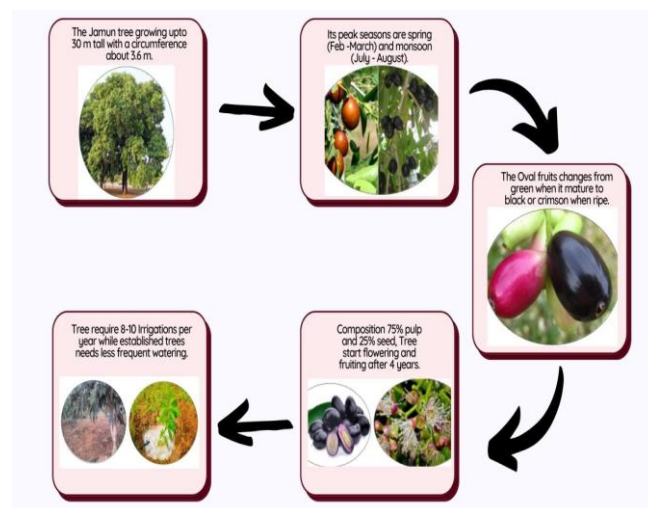


**Fig. 2: Pie Chart for Geographical availability of *Jamun***<sup>[16]</sup>

**Cultivation and Collection**

The genus *Syzygium* comprises about 1100 species in world wide and 12 species in western ghats. There is no need for agriculture to grow the plant. The tree

flourishes in Tropical and Subtropical climates, often growing in forests, riverbanks and openfield. It grows upto 30 m in height in spring (February – March) and Monsoon (July- August). The immature fruit is in Green in color and changes to Black crimson. The plant starts to flower and fruits are produced, yield about 2kg after four years. The young trees require continuous irrigation (at least 8 to 10 irrigation) per year, but after the trees get established, the irrigation can be reduced. These formulations are characterized by incorporation of beneficial properties such as antiaging, antioxidants, anti-inflammatory agents, and also reduce photoaging. Key constituents include Tannins, Flavonoids, Terpenoids, Saponins, Phenolic acid and Essential oils. As per research *Syzygium cumini* (leaf) and (seed) oils showed superior anti-collagenase, anti-elastase and anti-hyaluronidase activities.<sup>[17,18]</sup> The process of cultivation and collection is briefly described in Fig.3.



**Fig. 3: Cultivation and Collection of *Syzygium Cumini***<sup>[19,20]</sup>

**Phytoconstituents**

Pytochemicals are bioactive compounds found in plants which are nonnutritive but exhibit biological activities that can contribute to the prevention of diseases.<sup>[15,21]</sup> *Jamun* is a warehouse for phytochemicals useful for cosmetic purpose as depicted in Fig 4.

**Phenolic compounds**

Phenolic are the hydroxyl group which contains hydroxyl group (-OH) bonded directly to aromatic

hydrocarbon group. The important groups of phenolic compounds are flavonoids, phenolic acid and polyphenols. These are the plant secondary metabolites and have a defense role. It acts as antioxidants, antibacterial, and anti-inflammatory agents. Thus these compounds are used for many skin problems such as aging, healing, acne, eczema, etc.<sup>[22]</sup>

### Flavonoids

Flavonoids including quercetin, myricetin, and isoquercetin identified in different parts of *S. cumini*. Flavonoids are renowned for its anti-inflammatory, anticancer and other beneficial effects.

### Alkaloids

Alkaloids, including Jambosine and Jamboline isolated from the seeds of *Jamun*. These alkaloids are believed to play a role in the plant's lipid metabolism.

### Vitamins

*Jamun* is a good source of vitamins such as Vitamin A, Vitamin B complexes (B1, B2, B5, B6, etc) these give plants antioxidants and nutritional benefits.

### Terpenoids

Terpenoids are the five carbon isoprene units, Terpenes are found in plants as an essential oil containing Antibacterial and Free Radical Scavenging properties. Ursolic acid, widely diffused in plants and used in cosmetic preparation.<sup>[22]</sup>

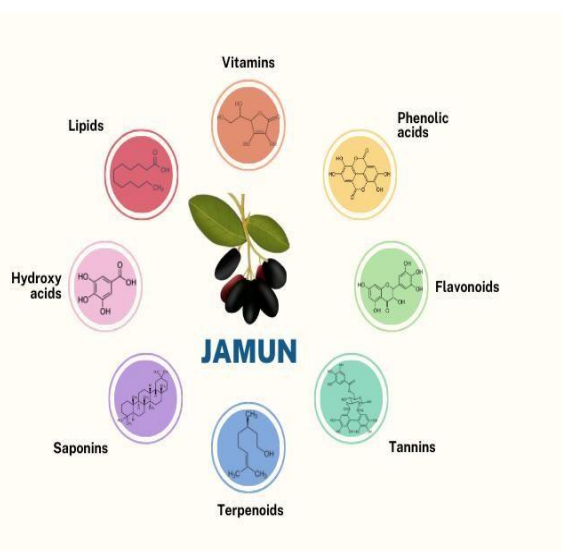


Fig. 4: Phytochemicals of *Jamun* useful as cosmetics<sup>[23]</sup>

Table 3: Part wise utilization of *Jamun* in cosmetics<sup>[21,23,24]</sup>

Part	Metabolic Class	Identified Compounds	Uses on Skin
Fruit	Flavonoid	Myricetin Myrecetin deoxyhexoside	Anti-Aging, Anti-inflammatory
	Tannins	HHDP-galloylglucose, Trigalloylglucose	Photoprotection , Astringent
	Terpenes	Citronellol, Geraniol, Hotrineol, phenylpropanal	Anti-inflammatory, Antioxidant
	Anthocyanins	Malvidin, Petunidin, cyanidin	Anti-Aging, Antioxidant, Anti-inflammatory
	Phenolic acids	Ellagic acid, Gallic acid	Skin brightening, Anti-Aging
Leaves	Flavonoids	Kaempferol, Catechin, Myricetin	Depigmentation agent
	Tanning	Nilocitin, HHDP-glucose, Pentagalloylglucose	Antipruritic/Anti-Rash agent
	Terpenes	a-pinene, a-cadinol, pinocarvone, myrtenol, Eucarvone, Cineole	Moisturizing agent, Anti-inflammatory, Anti-acne
	Phenolic acids	Ferulic acid, Caffeic acid, Chlorogenic acid, Ellagic acid, Gallic acid	Skin restoration, Wound healing, Anti-inflammatory, Antioxidant
Roots	Flavonoid glycosides	Isorhamnetin, 3-O-rutinoside	Anti-Aging, Antioxidant, Moisturizer
Seeds	Flavonoids	Quercetin 3,5,7,4-tetrahydroxy flavanone, Rutin	Photoprotective, Antioxidant, Antiinflammatory



	Tannins	3-galloylglucose Corilagin, 3,6- HHDP- glucose	Antioxidant, Cleansing agent Emulsifying agent
	Terpenes	A-Terpene Betulinic acid, Eugenol Bpinene, B- Terpinene	Skin soothing, Prevent skin irritation and redness
	Phenolic acids	Feulic acid, Gallic acid, Ellagic acid, Caffeic acid	Antioxidant, Anti- inflammatory
<b>Flower</b>	Flavonoids	Isoquercetin, Quercetin, Kaempferol	Photoprotective, Antioxidant
	Terpenes	Oleanolic acid, Eugenol	Photoprotective, Reduce dark spots, Antimicrobial
	Phenolic acids	Ellagic acid	Antioxidant
<b>Stem Bark</b>	Flavonoids	Kaempferol, Myricetin, Quercetin	Depigmentation, Wound healing
	Terpenes	Betulinic acid, B- Sitosterol Friedelin	Skin soothing, Antimicrobial
	Phenolic acids	Ellagic acid, Gallic acid 3,3-di- omethyl, ellagic acid	Antioxidant

Jamun has various mechanisms for its utilization in Cosmetics majorly showing prominent actions like Anti-inflammatory, anti-aging, anti-oxidant, anti-microbial and skin brightening effects as specified in Fig 5.

**Cosmetic Uses**

1. *Syzygium cumini* fruits have antioxidant and free radical scavenging properties due to the high anthocyanin content.
2. Majority of antioxidant action may be attributed to molecules such as flavonoids, isoflavones, flavones, and anthocyanin rather than the previously recognized vitamins C, E, and B carotene.<sup>[27]</sup>
3. Flavonoids have antioxidant and anti-aging characteristics. They also protect the skin from UV radiation.<sup>[28]</sup>
4. Phenolic antioxidant action is owing to their redox potential, which allows them to operate as hydrogen donors, singlet oxygen quenchers, and metal chelators.<sup>[29]</sup>
5. Blue light is high-energy visible light emitted from phones or screens which cause wrinkles, acne pigmentation via free radical generation induces oxidative stress in live skin which leads to damage DNA, resulting in inflammation and collagen and elastin degradation. To prevent damage caused by blue light use natural antioxidants.<sup>[30]</sup>
6. *Syzygium cumini* extract has antioxidant properties that prevent the formation of reactive oxygen species by free Radicals.
7. *Syzygium cumini* leaf extract in methanol included high levels of phenolic, saponin, flavonoids, and tannin.
8. *Syzygium cumini* methanol extract and leaf essential oil might be considered effective sources of natural antioxidants.<sup>[31]</sup>
9. *Syzygium cumini* oil is used as an antibacterial and scent in cosmetics.

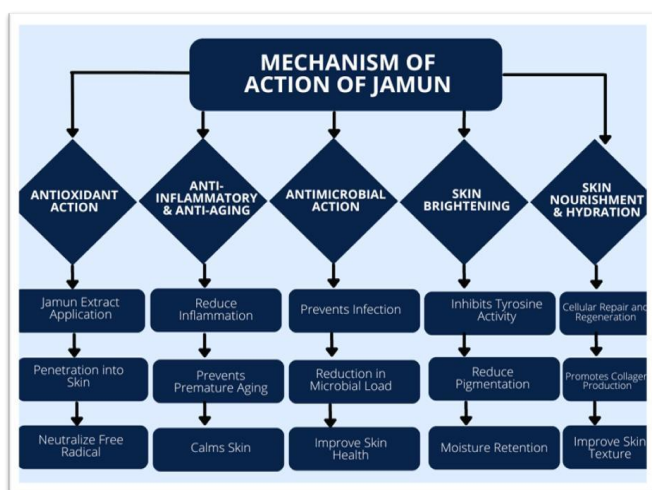


Fig. 5 Mechanism of Jamun as a Cosmetic on skin<sup>[25,26,29]</sup>

10. Jamun contains thiamine (vitamin B1) which is used as a fragrance ingredient and skin-conditioning agent.<sup>[32,33]</sup>
11. Vitamin C is beneficial to pale skin complexions. *Syzygium cumini* may help lighten skin pigmentation.
12. It helps to detoxify your blood while also keeping your skin clean and radiant.
13. It is high in iron and boosts hemoglobin levels in the body.
14. The astringency of the fruit is related to the presence of phenolic chemicals. Its astringent properties allow it to maintain greasy skin clean, smooth, and acne-free because of the presence of oxalic acid, gallic acid, malic acid, tannins, betulinic acid, and other compounds.<sup>[34,35]</sup>
15. *Syzygium cumini's* root, bark, flower, and leaves all contain terpenes, the majority of which are volatile compounds. Saponin and triterpene exhibit hydrophilic and lipophilic characteristics.<sup>[36]</sup>

#### Adverse Effects

1. Contact dermatitis: Some individuals may develop and allergic reaction when contact with *jamun* or products containing *jamun* extract. Symptoms include redness, itching, smelling and rashes at the site of contact.
2. Urticaria: In rare cases, exposure to *jamun* may cause hives, characterized by itchy, raised welts on the skin.
3. Exacerbation of Pre-existing skin conditions: individuals with sensitive skin or conditions like eczema or rosacea may experience worsening symptoms.
4. Pigmentation Changes/ Hyperpigmentation: In correct or excessive use may lead to uneven skin tone or dark spots in sensitive individual
5. Staining: The deep purple color of Jamun can stain the skin temporarily, specially in products with high anthocyanin content.<sup>[37-39]</sup>

#### Marketed Formulation:

**Table 3: Marketed Preparations of *Jamun* in Cosmetics and Cosmeceutical Industry<sup>[40,41,64]</sup>**

Brand Name	Type of formulation	Dose	Price
PLIX	Moisturizer	50g	399
PLIX	Patch	100mg	549
MOTHER SPARSH	Face wash	100ml	149
JASHVII HERBAL	Serum	30ml	134
ILLUMINATE	Sunscreen	30g	299
PLIX	Toner	150ml	199

**Table 4: List of Cosmetic Products involving *Jamun* (*Syzygium cumini*)**

Product	Primary Benefits	Key Ingredients	Target Audience	References
Face Cream	Anti-aging, Hydration, Nourishment	<i>Jamun</i> extract, Hyaluronic acid, Vitamin E	All skin types	[42]
Face Mask	Cleansing, Brightening, Rejuvenation	<i>Jamun</i> extract, Kaolin clay, Aloe Vera	Oily to Combination skin	[43]
Lip Balm	Hydration, Protection, Natural tint	<i>Jamun</i> extract, Shea butter, Beeswax	All skin types	[44]
Shampoo	Strengthening, Dandruff control, Scalp health	<i>Jamun</i> extract, Tea tree oil, Vitamin E	All hair types	[45]
Body Lotion	Moisturization, Nourishment,	<i>Jamun</i> extract, Shea	Dry to Normal skin	[42,46]

	Even skin tone	butter, Glycerin		
Scrub	Exfoliation, Cell regeneration, Smoothing	<i>Jamun</i> extract, Sugar, Walnut shell powder	All skin types	[41,47]
Face Serum	Darkspot reduction, Brightness, Elasticity	<i>Jamun</i> extract, Niacinamide, Vitamin C	All skin types	[48]
Hair Oil	Nourishment, Hair growth, Shine	<i>Jamun</i> extract, Coconut oil, Argan oil	All hair types	[45,66]
Under-Eye Cream	Dark circle reduction, Puffiness control, Hydration	<i>Jamun</i> extract, Caffeine, Hyaluronic acid	All skin types	[47]
Toner	pH balancing, Pore tightening, Refreshing	<i>Jamun</i> extract, Witch hazel, Rose water	Oily to Combination skin	[48]

*Jamun* has been incorporated in various formulations like Face creams, Lotions, Shampoo, Lip balms, Hair oils etc. Fig 6 clearly showcases various cosmeceutical formulations of *Jamun*.

### Home Made Remedies

- Jamun* Facial Pack** - Mash a few ripe *Jamuns* and add a tablespoon of yogurt. - After applying the mixture on your face, leave it on for fifteen - twenty minutes, and then rinse it off. - Rinse in lukewarm water. This can help reduce pigmentation and make your skin sparkle.<sup>[49]</sup>
- Jamun* Juice Toner**. - Extract the juice from fresh *Jamuns*. - Add a few drops of lemon juice. - Apply the mixture to your face with a cotton pad. It can help constrict pores and provide a pleasant sensation.<sup>[50]</sup>
- Jamun* and Honey Mask**. - Mash a few *Jamuns* and add a spoonful of honey. - After applying the mixture on your face, leave it on for fifteen minutes, and then rinse it off. - Rinse with warm water. This mask can hydrate and improve the texture of the skin.<sup>[51]</sup>
- Jamun* with aloe vera gel**. - Combine *Jamun* pulp with aloe vera gel. -After applying the mixture on your face, leave it on for fifteen minutes, and then rinse it off. This combination can soothe and moisturize the skin. -Always perform a patch test before using any new medication to ensure you do not experience any allergic reactions.<sup>[52]</sup>
- Jamun* Scrub**. - Combine mashed *Jamun* pulp and a tablespoon of crushed oats. - Gently apply this mixture on your face in circular strokes. - Rinse with lukewarm water. This scrub exfoliates dead skin cells and brightens your appearance.
- Jamun* with Turmeric Paste** - Mix mashed *Jamun* with a pinch of turmeric powder to make a paste. - After applying the mixture on your face, leave it on for ten - fifteen minutes, and then rinse it off. - Turmeric contains anti-inflammatory effects that can enhance the advantages of *Jamun*.<sup>[53]</sup>
- Jamun* and Green Tea Toner** - Make a cup of green tea and allow it to cool. - Mix in a few teaspoons of

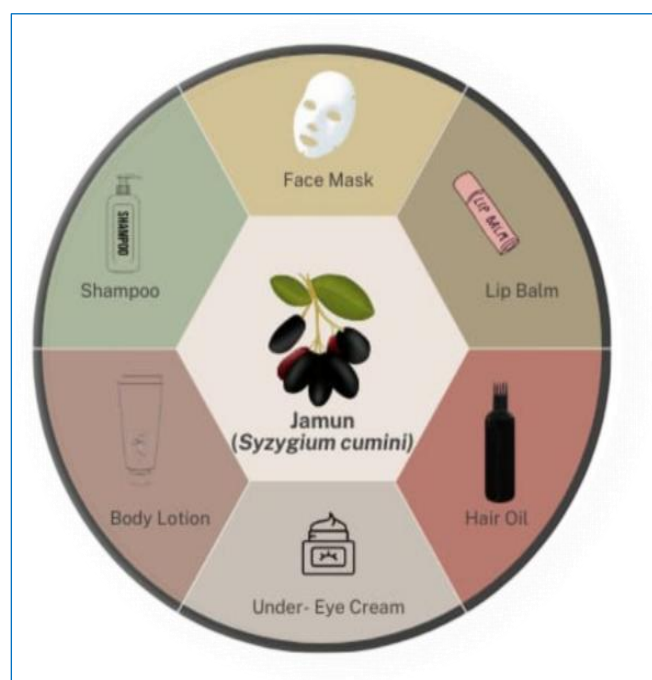


Fig. 6: Cosmetic formulations of *Jamun*



Jamun juice. - Use a cotton pad to tone and freshen your skin.<sup>[54]</sup>

8. Jamun with Almond Oil - Combine Jamun pulp and a teaspoon of almond oil. - Apply to your face and leave it on for 20 minutes before rinsing it off. - Almond oil may provide additional moisturizing advantages.
9. Jamun and Cucumber Extract. - Combine Jamun pulp and cucumber juice. - Apply to the skin and let it sit for 15 minutes before rinsing. - This combination might aid to soothe and hydrate the skin.
10. Jamun & Milk Mas - Combine ripe Jamun and a tablespoon of milk. - After applying the mixture on your face, leave it on for fifteen - twenty minutes, and then rinse it off. Rinse in lukewarm water. Milk nourishes and hydrates the skin, while Jamun contains antioxidants.<sup>[55]</sup>
11. Jamun and Sandalwood Powder - Combine mashed Jamun and a teaspoon of sandalwood powder. - Apply it to your face and leave it on for 15-20 minutes. - Rinse with warm water. Sandalwood is noted for its calming and brightening effects.<sup>[56]</sup>
12. Jamun and Rose Water Toner - Combine Jamun juice and rose water in equal parts. - Apply to your face with a cotton pad. - This toner can assist to balance skin tone and refresh the complexion.<sup>[57]</sup>
13. Jamun and Avocado Paste. - Mash the Jamun and combine with a little amount of ripe avocados. - After applying the mixture on your face, leave it on for 15 minutes, then rinse it off. - Rinse well. Avocado provides hydrating and nourishing effects to the Jamun.<sup>[58]</sup>
14. Jamun with Coconut Oil - Combine Jamun pulp and a teaspoon of coconut oil. -After applying the mixture on your face, leave it on for 20 minutes, and then rinse it off. - Rinse with warm water. Coconut oil can assist to deeply hydrate the skin and boost the benefits of Jamun.
15. Jamun and Baking Soda Scrub - Mix Jamun pulp with a pinch of baking soda to make a paste. -

Massage gently into your face, and then rinse with lukewarm water. - This can help exfoliate dead skin cells and brighten the complexion.<sup>[59,60]</sup>

16. Vitamin E Oil and Jamun - Combine a few drops of vitamin E oil with the mashed Jamun. - After applying the mixture on your face, leave it on for twenty minutes, then rinse it off Vitamin E can offer extra nutrition and aid in skin regeneration.

Table 5: Diseases associated with Jamun plant<sup>[61]</sup>

Disease	Causal organism	Plant part affected	Control Measure
Diseases Leaf rot and fruit spot	<i>Glomerella cingulata</i>	Leaf and fruit	Dithane Z -78 (0.2%).
White fly	<i>Dialeurijdes eugenia</i>	Fruits	Maintain sanitation, Destroy maggots
Leaf eating caterpillar	<i>Corea subtilis</i>	Leaf	dimethoate 30 (0.06 %) or malathion (0.05%)
Jamun leaf roller	<i>Polychorosis cellifera</i>	Leaf	Dimethoate 30 (0.06%)
Leaf webber	<i>Argyroploce aprobola</i> <i>Argyroploce mormopa</i>	Leaf	Quinalphos (0.05%)
Fruit fly	<i>Bactrocera spp</i>	Fruit	Use traps, Destroy Infested fruits
Seed Borer	<i>Anselmella kerrichi</i>	Seed	Lambda Cyhalorthrin 0.6-1ml/l

### Recent Advancements

#### Personalized cosmetics

- **Customized Serums:** Formulate serums with concentrated Jamun extract tailored to target specific skin concerns such as hyperpigmentation, acne, or fine lines.

- **Personalized Creams:** Create day and night creams that incorporate *Jamun* for different skin types (e.g., lighter formulations for oily skin, richer ones for dry skin).
- **Tailored Masks and Exfoliants:** Develop face masks and exfoliants that provide deep cleansing and rejuvenation, customized for varying skin sensitivities.
- **Bespoke Lip Balms:** Offer lip balms with personalized levels of hydration and tint, using *Jamun's* natural color and emollient properties.
- **Customized Hair Care:** Create shampoos and conditioners that address specific hair and scalp concerns, incorporating *Jamun* for its antimicrobial and antioxidant benefits.
- ***Jamun*-based personalized skincare kits:** Containing a cleanser, toner, serum, and moisturizer customized to individual skin needs.
- ***Jamun*-infused luxury skincare:** Targeting high-end consumers seeking natural and effective products.
- ***Jamun*-based supplements:** For internal support of skin health.<sup>[62-64]</sup>

#### Amalgamation of Network Pharmacology into exploration of *Jamun* as cosmeceutical

- **Compound Identification:** Identify the bioactive compounds in *Jamun*. This includes flavonoids, anthocyanins, and other phytochemicals.
- **Target Prediction:** Utilize computational tools and databases to predict potential target proteins for these compounds in the skin. These targets could include enzymes, receptors, and other proteins involved in skin functions.
- **Network Construction:** Build a protein-protein interaction network to understand the relationships between the identified target proteins.
- **Pathway Analysis:** Analyze the pathways involved in skin-related processes (e.g., inflammation, collagen synthesis, antioxidant defense) to identify

potential points of intervention for *Jamun* compounds.

- **Mechanism Elucidation:** Based on the network analysis, propose potential mechanisms of action for *Jamun* in addressing skin concerns.<sup>[65-67]</sup>

#### Network Diagram

*Jamun* Bioactive Compounds



Multiple Biological Targets



Integrated Pathways (Antioxidant, Anti-inflammatory, etc.)



Cosmetic Benefits (Anti-aging, Skin Brightening, Anti-acne, etc.)

**Table 6: List of recent patents associated with *Jamun***

Patent Id	Title	References
EP3402462B1	A nanobiocomposite formulation for wound healing and a process thereof	[68]
US20200323745A1	Topical skin care formulations comprising plant extracts	[69]
US20070086972A1	Hair growth compositions and methods for treating hair loss	[70]
US9238153B2	Transoral methods and compositions for wrinkle reduction and cosmetic lip	[71]

#### CONCLUSION

In nutshell *Jamun* (*Syzygium cumini*) holds significant potential in the realm of cosmetics due to its rich phytochemical profile and antioxidant properties. The presence of anthocyanins, flavonoids, and phenolic compounds in *Jamun* contributes to its skin-enhancing

abilities, including anti-aging, skin brightening, and anti-inflammatory effects. Incorporation of *Jamun* in various formulation can aid in alleviating wide range of skin related problems These properties make *Jamun* a promising natural ingredient for developing skincare formulations that promote skin health. Development of natural and sustainable products Utilization of *Jamun* into cosmetic formulations offers a novel approach to meet demand of herbal cosmetics while harnessing the benefits of this traditional fruit. Future research and development should focus on optimizing the extraction and stabilization of *Jamun's* active compounds to fully realize its potential in cosmetic applications. Thus we can conclude that *Jamun* has high scope in cosmeceutical industry to promote skin aesthetics as well as maintain well-being of dermatological system.

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