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PHARMACOLOGICAL AND NUTRACEUTICAL POTENTIAL OF JAVITRI [MACE]: A COMPREHENSIVE REVIEW

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ABSTRACT

Javitri, commonly known as mace, is the dried aril of the nutmeg seed (*Myristica fragrans* Houtt.), a spice valued for its distinct aroma and medicinal benefits. Traditionally used in Ayurveda, Unani, and Chinese medicine, Javitri possesses diverse pharmacological and nutraceutical properties**.** Phytochemical studies reveal the presence of essential oils, myristicin, elemicin, eugenol, and lignans**,** which contribute to its therapeutic potential. Pharmacologically, mace exhibits anti-inflammatory, antioxidant, antimicrobial, antifungal, hepatoprotective, antidepressant, and analgesic activities. As a nutraceutical, it plays a vital role in improving digestion, appetite stimulation, cardiovascular health, and enhancing immune response**.** Modern pharmacological investigations support many of its traditional claims, highlighting its potential as a holistic remedy and functional food ingredient. Further research and clinical validation are required to explore its bioactive constituents and safety profile for pharmaceutical Applications.

KEYWORDS: Myristica fragrans; mace aril mace; phytochemicals; pharmacological activity; nutraceutical potential; antioxidant; anti-inflammatory; antimicrobial; hepatoprotective; functional food; traditional medicine.

INTRODUCTION

Historically, Javitri has remained since ancient times as a prized condiment and remedy in Ayurvedic, Unani, and Chinese systems for treating digestive disorders, pain, and inflammation.[1] It was highly prized in the medieval spice trade for its scented flavor and curative qualities.[2]

At the molecular level mace and nutmeg contain similar biologically active elements such as myristicin, elemicin, eugenol, and safrole, which contribute to their characteristic scent and drug-like action. The standard concentration of nutmeg content in the fruit is about 70–75%, while aril of nutmeg forms around 25–30% of the total fruit weight.[3]

Fig. 1: Myristica fragrans Houtt.

Javitri is not only used as a gastronomic spice but also as a nutraceutical component for promoting digestive process, vascular movement , and overall well-being.[4] Its growing importance in modern pharmacological research has drawn attention to its wide range of therapeutic and functional attributes.

Taxonomic Classification	
Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular plants)
Subdivision	Spermatophyta (Seed plants)
Division	Magnoliophyta (Flowering plants)
Class	Magnoliopsida (Dicotyledons)
Subclass	Magnoliidae
Order	Magnoliales
Family	Myristicaceae
Genus	*Myristica*
Species	*Myristica fragrans* Houtt.
Common Name	Javitri (Mace) / Nutmeg
Part Used	Aril (Javitri/Mace) and Seed (Nutmeg)

CHEMICAL COMPOSITION OF JAVITRI [MACE]

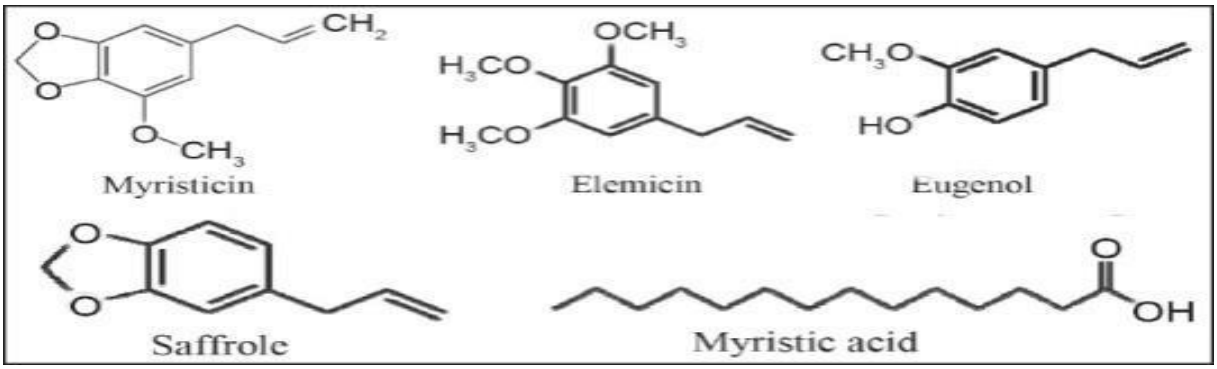

Fig. 2: Chemical Structures of javitri.

Javitri, the dried aril of *Myristica fragrans* Houtt., contains a wide range of volatile and non-volatile chemical constituents responsible for its distinctive aroma, flavor, and therapeutic properties. The essential oil content (7–14%) mainly includes myristicin (4–13%), sabinene (15–25%), α-pinene (10–15%), β-pinene, eugenol (2–4%), safrole, and camphene, which contribute to its aromatic and stimulant properties.[5,6]

The fixed oil (20–30%) portion primarily contains trimyristin, myristic acid, oleic acid, and palmitic acid,which act as emollients and energy sources.[7]Non-volatile constituents include resins, proteins, starch, mucilage, lignans, tannins, and coloring pigments like carotenoids and lycopene, which impart the characteristic reddish-orange hue to mace.[8]The presence of phenolic compounds and flavonoids also provides antioxidant and antimicrobial activity.[9-12]

Morphology and Distribution of Javitri (Mace)

Javitri, commonly called mace, is a dried aril extracted from the seed of Myristica fragrans Houtt., a member of the Myristicaceae family.[13]The tree is aromatic, evergreen, and can reach a height of 10 to 20 meters. Its leaves are glossy, dark green, simple, alternate, and lanceolate with an entire margin. The plant is dioecious, producing small, yellowish, unisexual flowers on separate male and female trees.[14]

The fruit is a fleshy, ovoid drupe measuring approximately 6 to 9 cm in length, which turns yellow when ripe and splits open to reveal a hard brown seed known as nutmeg (Jaiphal). Surrounding this seed is a bright red, net-like aril that dries to form mace (Javitri), a spice with a warm, slightly bitter taste and a strong, pleasant aroma. Under the microscope, powdered mace shows reddish aril pieces containing lignified tissues, volatile oil cells, and brownish coloring materials.[15]

Javitri originated in the Indonesian Banda Islands, also called the Moluccas or “Spice Islands,” and is now extensively cultivated in tropical regions such as India (Kerala, Tamil Nadu, Karnataka), Sri Lanka, Malaysia, Grenada, and the Caribbean islands. The tree thrives in warm, humid climates with abundant rainfall, temperatures between 20–30°C, and well-drained, loamy soils rich in organic matter. Currently, Indonesia, India, and Grenada are the major producers of mace.[16]

Collection of Javitri (Mace)

Javitri, the dried aril of *Myristica fragrans* Houtt., is obtained from the seed of nutmeg. The collection process begins when the fruits reach maturity, usually from June to October, depending on regional climatic conditions. Mature fruits turn yellowish and naturally split open, indicating readiness for harvest. The fruits are hand-picked, and the outer fleshy pericarp is removed to reveal the seed covered by the red aril (mace). The aril is carefully separated by hand, washed to remove any pulp, flattened, and shade-dried for 10–14 days until it becomes brittle and attains an orange-red to yellowish color. Proper drying is essential to retain aroma, prevent fungal contamination, and preserve volatile oil content. After drying, mace is graded and stored in airtight containers for medicinal, culinary, and commercial use.[17-20]

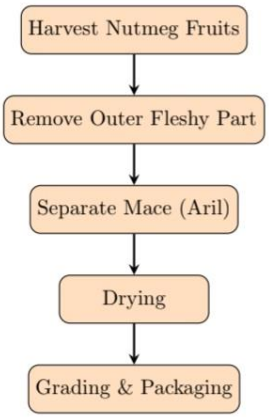

Fig. 3: Collection process of javitri.

Nutraceutical Properties

Rich Source of Nutrients

Mace contains carbohydrates (50–55%), fats (30–35%), proteins (6–7%), and fiber (~20%), making it nutritionally dense. Also rich in minerals (Fe, Ca, Mg, Mn, Zn, Cu) and vitamins A, C, and B-complex.[21]

Antioxidant Property

Presence of phenolics, flavonoids, and lignans gives strong antioxidant activity. Mace extracts scavenge free radicals and protect lipids from oxidative stress.[22]

Digestive and Carminative Effect

Stimulates gastric secretions and improves appetite and digestion. Traditionally used to relieve flatulence, nausea, and indigestion.

Antidiabetic / Metabolic Health

Exhibits α-amylase and α-glucosidase inhibition**,** reducing carbohydrate absorption. Animal studies show decreased blood glucose and HbA1c levels.[23]

Anti-inflammatory and Immunomodulatory Effect

Bioactive compounds like macelignan and myristicin suppress pro-inflammatory cytokines and modulate immune response.[24]

Lipid-lowering / Cardioprotective Potential

Regular intake reduces serum cholesterol and triglyceride levels in animal models. Helps in maintaining healthy lipid profile.[24]

Neuroprotective and Mood Enhancing

Mace and nutmeg extracts show sedative, anxiolytic**,** and antidepressant activities in mice. May enhance sleep quality and reduce stress.[24]

Antimicrobial Property

Essential oils (myristicin, eugenol) possess bactericidal and fungicidal activity.Effective against *E. coli, S. aureus*, and *Candida albicans*.[25]

Hepatoprotective Action

Ethanolic extract of mace shows liver-protective effects in toxin-induced liver injury models.

Overall Functional Food Role

Due to its antioxidant, metabolic, digestive, and antimicrobial effects, mace is considered a functional nutraceutical spice suitable for daily dietary inclusion.[25]

Pharmacological Activities of Javitri (Mace)

Inhibition of Inflammation

In animal models, mace ethanolic and methanolic extracts significantly reduce both acute and chronic inflammation. Inhibition of the cyclooxygenase (COX) and lipoxygenase (LOX) pathways reduces the generation of prostaglandins and leukotrienes.[26]

Analgesic (Relieving Pain) Action

Mace extract has analgesic properties that are similar to those of other pain relievers, both central and peripheral. It is most likely the result of suppression of pain mediators and alteration of opioid receptors.[27]

Activity Against Microbes and Fungi

Mace essential oil, which contains myristicin, safrole, and eugenol, has strong antibacterial and antifungal properties against Candida albicans, S. aureus, and E. coli.[28]

Activity of CNS Stimulants and Antidepressants

Extracts from Myristica fragrans exhibit stimulant, anxiolytic, and antidepressant properties in behavioural models. This is explained by the brain's control of serotonin, dopamine, and norepinephrine levels.[28]

Neuroprotective and Anticonvulsant Action

As a possible neuroprotective drug, mace methanolic extract guards against seizures and oxidative brain damag.

Hepatoprotective Activity

Mace extract dramatically lowers oxidative damage and liver enzyme levels (AST, ALT, and ALP) in CCl_4-induced hepatotoxicity models.[29]

Anti-Cancer Action

Apoptosis is induced and the growth of several tumour cell lines (breast, colon, and lung cancer cells) is inhibited by substances such as myristicin and malignancy.

Activity Against Diarrhoea

The reduction of intestinal motility and fluid output by extracts suggests that they may be used to treat diarrhoea.

Cardioprotective Effects

In models of induced heart damage, mace exhibits cardioprotective effects because of its anti-lipid peroxidation and antioxidant properties.[30]

Aphrodisiac and Effects on Reproductive Health

Mace extract has been shown to boost male animals' testosterone levels, fertility, and sexual behaviour in both traditional and experimental settings.

Traditional and Ethnomedicinal Uses of Javitri (Mace)

Digestive Conditions

Mace (Javitri) has been used traditionally to promote digestion and increase appetite. Its carminative and stomachic qualities aid in the relief of indigestion, diarrhoea, vomiting, nausea, and flatulence.[31,32]

Physiological Conditions

Mace is used in ancient medical systems like Ayurveda and Unani to treat bronchitis, asthma, colds, and coughs. Its expectorant qualities aid in the relief of respiratory congestion.[33]

Soreness and Inflammation

External mace paste or oil is used to treat rheumatism, muscle aches, and joint discomfort. It is well-known for having analgesic and anti-inflammatory properties.

Mental and Nervous System Health

Mace and nutmeg are used as moderate sedatives to relieve stress, anxiety, and sleeplessness. Mace is recommended by traditional healers to relieve nerve exhaustion and enhance attention.[33]

Dental and Oral Health Care

Because powdered mace has antibacterial and fragrant qualities, it has long been used in dental formulations to treat toothaches and foul breath.

Aphrodisiac and Reproductive Uses

As a natural aphrodisiac, mace is prized. It is utilised in Ayurvedic and traditional Unani medicine to cure premature ejaculation, increase libido, and promote reproductive health.[33]

Tonic for the Digestive System and Liver

To strengthen the liver and increase metabolism, decoctions made with mace are recommended as tonics. Formulations to treat liver diseases and appetite loss frequently contain it.

Wound and Skin Healing

A mixture of ground mace and oil or honey is applied externally to relieve inflammation, mend wounds, and treat skin outbreaks.[33]

Conventional Integration of Medicine and Culinary Arts

Apart from its therapeutic applications, mace has long been prized as a spice in Indian and Indonesian cuisines. Because of its antibacterial properties, it is frequently used to enhance digestion and preserve food.

Formulations of Javitri [mace]

To enhance delivery and therapeutic efficacy, recent research has concentrated on creating a variety of Javitri-based formulations, including herbal capsules, essential oil emulsions, ointments, and gels.[33.34]For example, powdered Javitri

extracts have been made into capsules and tablets for digestive and antioxidant advantages.[35]while mace essential oil has been used to topical gels and emulsions for anti-inflammatory and antibacterial uses .[36] These formulations enable Javitri's use in contemporary phytopharmaceutical and nutraceutical product development in addition to enhancing its medicinal potential.[37]

Table 1: Formulations of javitri [mace].

Formulation Type	Main Ingredients	Method of Preparation	Purpose/Application
Herbal Capsule/Tablet	Javitri powder or ethanolic extract, microcrystalline cellulose, starch magnesium stearate	Wet granulation or direct compression	Digestive stimulant, antioxidant supplement enhances systemic absorption and stability.
Topical Gel	Mace essential oil, carbopol 940 glycerin, Tween 80, preservatives (methyl paraben, propyl paraben)	Dispersion of carbopo in water, addition of oil phase neutralization and omogenization.	Antiinflammatory Analgesic, antimicrobial, used for pain relief and wound healing.
Emulstion/ Nanoemulstion	Mace essential oil, Tween 80, Span 20, PEG 400, distilled water.	High speed homogenization or ultrasonication.	Enhanced solubility skin penetration Improves bioavailability of volatile oil.
Herbal Ointment	Mace powder or oil, white soft paraffin, beeswax liquid paraffin.	Fusion method (melting and blending at 70°c)	Wound healing, anti-inflammatory, provides prolonged topical effect.
Herbal Cream	Mace oil, cetostearyl alcohol, stearic acid, lanolin water phase	Oil-in -water cream preparation	Antiseptic soothing cosmetic use Prevents microbial skin infection.
Mouthwash	Mace essential oil, glycerin, menthol, polysorbate 80, ethanol, purified water.	Emulsification and blending of aqueous and oil phases	Antimicrobial, antihalitosis, oral hygiene, Herbal alternative to chlorhexidine.
Transdermal Patch (Novel)	Mace essential oil, HPMC or PVP polymer, PEG plasticizer.	Solvent casting method	Anti-inflammatory controlled release under research for sustained Drug Delivery.

Extraction Process of javitri [Mace]

To enable effective solvent penetration, the dried arils of Myristica fragrans (Javitri) are first washed, shade-dried, and coarsely powdered. The most commonly employed technique for obtaining the essential oil is steam distillation, in which the volatile components are vaporized with steam and subsequently condensed to yield the essential oil.

Table 2: Extraction Process of javitri.

Extraction Method	Principle	Type of Compounds Extracted	Solvent / Medium Used
Steam Distillation	Based on volatility — volatile oils vaporize with steam at temperatures lower than their boiling points and condense when cooled.	Essential oils (volatile components).	Steam / Water.
Solvent Extraction	Based on the principle of "like dissolves like" — polar solvents dissolve polar compounds, while non-polar solvents dissolve non-polar compounds	Terpenoids, alkaloids, flavonoids, and phenolics.	Petroleum ether, ethanol, methanol, chloroform.
Supercritical CO_2 Extraction.	Based on the solvent power of supercritical CO_2, which exhibits both gas-like diffusivity and liquid-like solvating ability for effective extraction.	Volatile and semi-volatile bioactive compounds.	Supercritical CO_2

Identification Test of javitri [mace]

Macroscopic Features

The dried aril of Myristica fragrans (Javitri) is brittle, aromatic, and varies in color from orange-red to yellowish-brown. It possesses a strong, pleasant aroma with a slightly bitter and peppery taste.[38]

Microscopic Features

A transverse section of the mace shows parenchymatous tissues containing volatile oil globules and starch grains, along with the presence of oil cells and lignified sclereids. Occasionally, calcium oxalate crystals are also observed.[39]

Chemical Test

Table 3: Chemical test of javitri [mace].

Sr. No	Name of Test	Procedure	Observation	Inference
1.	**Test for Volatile Oil**	2 g of mace powder should be steam-distilled.	A fragrant oil that is pale yellow is produced.	Presence of volatile oil (mace oil).
2.	**Ferric Chloride Test**	To the ethanolic extract, add a few drops of 5% $FeCl_3$ solution.	Green tint develops.	Indicates presence of phenolic compounds (eugenol).
3.	**Liebermann–Burchard Test**	To chloroform extract, add acetic anhydride and concentrated H_2SO_4.	Bluish-green shading appears.	The presence of triterpenoids and steroids.
4.	**Saponification Test**	Add phenolphthalein to the heated ethanolic extract with KOH.	A lather is created that resembles soap.	Indicates presence of fixed oil.
5.	**TLC Test**	Spray anisaldehyde–H_2SO_4 reagent and perform TLC with toluene: ethyl acetate.	Spots of colour form.	Verifies presence of myristicin, safrole, and elemicin.
6.	**Solubility Test**	Combine ether and alcohol with mace powder.	Soluble in ether and alcohol but insoluble in water.	Verifies presence of fixed and volatile oils.

Safety Profile of Javitri

Fig. 4: safety Profile of javitri.

Recent Research on Javitri (Mace) (2020–2025)

Active Fraction Isolation (2024)

Mace essential oil yielded a bioactive fraction (F3) containing approximately 34.37% myristicin. This fraction exhibited potent antibacterial, antioxidant (IC_{50} = 8.49 ppm), and anti-aging properties in a yeast strain model.[40]

Activity Against Hyperglycemia (2025)

In diabetic rats, the water extract of mace (1.84 mg phenolics/kg BW) significantly decreased HbA1c (↓11.50%) and blood glucose (↓14.29%) levels. The extract also enhance glucose tolerance and improved control over starch digestion.[41]

Research on Antimicrobial and Antibiofilm Activity (2025)

Ethanolic and aqueous extracts of mace demonstrated synergistic antibacterial and antibiofilm effects. The extracts were found effective against pathogenic strains of Staphylococcus aureus.[42]

Pharmacological Review (2025)

A comprehensive review summarized the pharmacological properties of mace, including antibacterial, antioxidant, anti-inflammatory, aphrodisiac, and neuroprotective activities. The major identified phytoconstituents were myristicin, elemicin, safrole, terpenoids, and lignans.[43]

Shelf-Life Study of Functional Foods (2024)

Processing techniques were found to improve powder stability, antioxidant retention, and bioactive content of mace. The study recommended its incorporation into functional foods and neutraceutical formulation.[44]

Evaluation of Genetics and Agronomy (2025)

Thirty accessions of Myristica fragrans were evaluated in coastal Karnataka for yield performance and oil content. High-yielding genotypes suitable for commercial cultivation and phytochemical standardization.[45]

Future Prospective of Javitri [Mace]

Creation of Innovative Herbal Formulations

Javitri's bioactive components (myristicin, safrole, and eugenol) and essential oils can be investigated for new herbal formulations with antibacterial and anti-inflammatory qualities, including mouthwash, antiseptic gels, herbal creams, and lozenges.[46]

Validation of Clinical and Pharmacological Effects

Randomised controlled clinical trials should be a part of future research to scientifically establish traditional usage in cognitive, anti-inflammatory, and gastrointestinal maladies.[47]

Uses in Nutraceuticals and Functional Foods

Standardised mace extracts high in polyphenols and antioxidants can be made into functional foods and nutraceuticals to enhance cardiovascular, metabolic, and immune health.[48]

Application as Natural Preservative in Food Industry

The strong antibacterial and antioxidant properties of Javitri essential oil make it a natural preservative that can be used to prolong food shelf life and replace artificial additives.[49]

Prospects for Aromatherapy and Cosmetics

Javitri's volatile oils are aromatic, making them suitable for use in cosmeceutical and aromatherapy products such as lotions, soaps, fragrances, and natural deodorants.[50]

Sustainability and Green Extraction

Future research should concentrate on environmentally friendly extraction methods (ultrasound-assisted extraction, supercritical CO_2 extraction) in order to protect bioactives and maximise yield.[51]

Standardisation and Quality Assurance

Compliance with international pharmacopoeial standards, product consistency, and authentication will be guaranteed by the establishment of chemical fingerprints (GC–MS, HPTLC) for mace.[52]

Toxicological Assessment and Safety Evaluation

To establish safe limits and detect any potential drug–herb interactions, thorough toxicological investigations and dose–response analyses are necessary.[53]

Drug Delivery Vehicles and Nanoformulations

The development of nanoemulsion, liposomal, or polymeric nanoparticle delivery technologies to improve drug bioavailability and controlled release may be the focus of future pharmaceutical research.[54]

Growth in Industry and the Economy

Javitri has the potential to grow significantly as an export—serving as a spice, source of essential oil, and raw material for the food and pharmaceutical industries—due to the growing global demand for natural products.[55]

Marketed Preparation

Fig. 5: Marketed Preparation of Javitri.

CONCLUSION

The dried aril surrounding the seed of Myristica fragrans, commonly known as Javitri (mace), is highly valued for its dual role in enhancing flavor and promoting health. Rich in bioactive constituents such as myristicin, eugenol, safrole, and lignans, Javitri exhibits diverse pharmacological properties including antimicrobial, hepatoprotective,

neuroprotective, and antioxidant activities. Scientific studies substantiate its traditional use in Ayurveda, Unani, and various indigenous medicinal systems for the treatment of neurological, respiratory, and digestive disorders. Recent research further emphasizes its potential in the development of herbal formulations, functional foods, and cosmetic products. Moreover, the essential oil derived from Javitri is widely utilized as a natural preservative and aromatic agent in pharmaceutical and nutraceutical industries. However, to ensure its safe and effective therapeutic application, further research focusing on clinical evaluation, toxicity profiling, and standardization of dosage is essential. Overall, Javitri represents a versatile botanical resource with remarkable potential for future advancements in health, wellness, and industrial applications.

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