

## Review Article

## An Overview of *Myristica fragrans* (Nutmeg) - Its benefits and adverse effects to Humans

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### ABSTRACT

*Myristica fragrans* is an annual spice belonging to the family Myristicaceae. It has been cultivated throughout the world and used for food flavoring, essential oil applications and in traditional medicines. Mostly nutmeg contains terpenes and phenylpropenes. Chemical composition of these constituents varies due to different cultivation conditions. Nutmeg is considered as essential ingredient of numerous industrial applications ranging from food to cosmetics. Its pharmaceutical products are also important due to its antioxidant and antimicrobial properties. More uses and applications of nutmeg byproducts are continuously added. Nutmeg is used as a constituent in preparations of medicines such as for dysentery, flatulence, stomachache, nausea, vomiting, rheumatism, sciatica, malaria and early stages of leprosy.

**Keywords:** *Nutmeg; Myristica fragrans; Benefits; Toxicity*

**M** *Myristica fragrans* (Nutmeg) an evergreen flowering tree belonging to family Myristicaceae known by most of the taxonomist native to Asia, Africa Pacific islands, and America (1). It's a member of nutmeg family due to *Myristica fragrans* with twin spices nutmeg and mace. This genus *Myristica* has about 150 species spread in the western Pacific and Asia (2). Cross pollination is seen because of insufficient flowers of both sexes in one tree (3). *Myristica fragrans* possess different names throughout the world. In India particularly in Tamil Nadu and Kerala its known as Jathikai, Andhra it's called Jaji kaya, Northern Indian its known as Jaiphal. In other regions of world like Indonesia, it is called as Pala. In Arabic countries it's known as Josat at –Tib, Urdu it is called as jaifal, French it is called as muscade, Greek is known as moschokarido and In China it is called as roudoukou (4) (**Fig 1**).

### HISTORY

Nutmeg was discovered in 1512 by Portuguese and originated from Banda Islands (Indonesia). Later Dutch propagated its importance. The name Nutmeg comes from Latin word *nux muscatus*, meaning “musky nut” (5).

### DEMOGRAPHY

For cultivation, a hot humid climate without dry season is key requirement but usually grows in warmer environment. It also grows well in the areas with sandy loam, clay loam and red laterite soils. It is broadly cultivated in China, Indonesia, Taiwan, Malaysia, India, Grenada, South America and Sri Lanka (6). The actual production of nutmeg is difficult to obtain, World production of nutmeg on an average is approximated between the ranges of

10,000 to 12,000 tons per year but annual world requirement is approximately 9,000 tons (4). Grenada and Indonesia govern production and transport of nutmeg by sharing 20% and 75% of world market respectively (7).



**Fig 1: Myristica fragrans (Nutmeg) Source: (Gupta and Rajpurohit, 2011)**

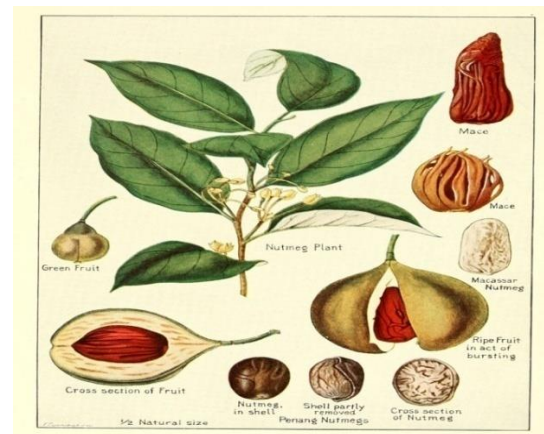
### BOTANY, MORPHOLOGY, ECOLOGY

Average nutmeg trees can grow up to 10-20m in height; they can be male or female trees. Nutmeg trees do not give flowers until they are 9 years old and after that, they continue to give flowers for 75 years (8). Male and female trees have different characteristics. The flowering of female trees can continue upto 7 months and the whole development took place in 154 days whereas male trees do it throughout the year and they just take 77days for the complete development. The best time for their flowering is from July to October and trees bear 2-3 crops in a year (9). The branches scattered in whorls. The petioles are about 30 cm long. The leaves are alternate and glabrous. They are obtuse at base, elliptical, aromatic, acuminate, glossy and dark green above, paler underside and 4-6 inches long. The flowers are dioecious and small auxiliary racemes.

Fruit is round drupe, pendulous and composed of a succulent pericarp. The seed is fleshy, firm, whitish and transverse by red-brown veins, rich in oil. The tree has strong, delightful and peculiar smell and a strong sharp aromatic flavor. Nutmeg requires a warm and humid tropical climate. Annual daytime temperature requirements are within the range of 22 - 34°C is considered optimum for its growth, but it can also tolerate 12 - 38°C.

Nutmeg requires well drained, fertile soil with high content of organic matter. It grows well in soils with pH 6.5-7.5. Its optimum growth has been

observed 2000-3500 mm rainfall. Flowers of nutmeg trees are bell-shaped and of pale yellow in color. The texture of flowers is waxy and fleshy. Fruits of nutmeg trees are 6 to 9 cm long with a longitudinal ridge. They are fleshy and smooth. The fruits consist of two parts exocarp and mesocarp. Exocarp is a shiny outer coat, whereas mesocarp is fleshy below exocarp. Exocarp and mesocarp together form the pericarp of the fruit. When it rips the mesocarp is divided into 2 parts nutmeg and mace. Nutmeg is shiny purplish-brown in color and it is 2 to 3 cm long, firm, fleshy surrounded by red-brown veins which is mace. It also has an oilseed that is inside the seed coat or endocarp, it gets detached after drying. Testa and legmen get converted into the layers of seed while perisperm has oil ducts within the endosperm which also houses the embryo. The seed becomes ready for use in 3 to 6 weeks (10, 11). (Fig 2)



**Fig 2: Myristica fragrans Plant Morphology**

### NUTRITIONAL VALUE

Though Nutmeg is used sparingly in dishes still its impact health in many ways with high nutritive contents like vitamins, minerals and organic compounds related essential oils. According to the USDA National Nutrient Database, these beneficial components include dietary fiber, manganese, thiamin, vitamin B6, folate, magnesium and copper (12, 13) (Table 1).

### CHEMICAL COMPOSITION

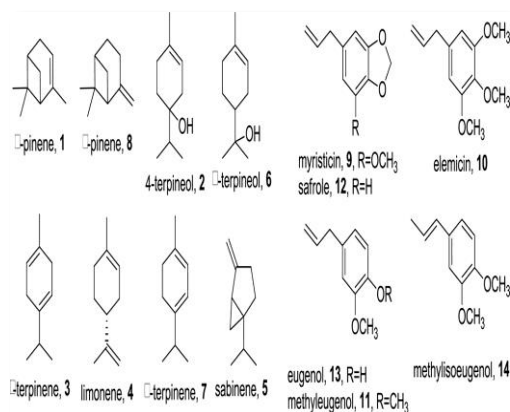
The seed contains about 10% essential oil (15,16), which is mostly composed of terpene hydrocarbons (α-pinenes, camphene, p-cymene, sabinene, β-phellandrene, g-terpinene, limonene, myrcene (60% to 90%), terpene derivatives (linalool, geraniol,

terpineol - 5% to 15%) and phenylpropanes (myristicin, elemicin, safrole-2% to 20%). The presence of myristicin and elemicin, in the seed of *M. fragrans* is one of the reasons for its intoxicating effects (17) (Fig 4).

**Table 1: Nutrient Value - Nutmeg (each 100 g)**

Nutrient	Value
Water (g)	6.23
Energy	525.00
Energy (kJ)	2196.00
Protein (g)	5.84
Total lipid (fat)(g)	36.31
Ash(g)	2.34
Carbohydrate (g)	49.29
Fiber, total dietary (g)	20.80
Sugars, total including NLEA (g)	2.99
Calcium, Ca [mg]	189.00
Iron, Fe [mg]	3.04
Magnesium, Mg [mg]	183.00
Phosphorus, P [mg]	213.00
Potassium, K [mg]	350.00
Sodium, Na [mg]	16.00
Zinc, Zn [mg]	2.15
Copper, Cu [mg]	1.03
Manganese, Mn [mg]	2.90
Selenium, Se [µg]	1.60
Vitamin C, total ascorbic acid [mg]	3.00
Thiamin [mg]	0.35
Riboflavin [mg]	0.06
Niacin [mg]	1.30
Vitamin B-6 [mg]	0.16
Folate, total [µg]	76.00
Folate, food [µg]	76.00
Folate, DFE [µg]	76.00
Choline, total [mg]	8.80
Vitamin A, RAE [µg]	5.00
Carotene, beta [µg]	28.00
Cryptoxanthin, beta [µg]	66.00
Vitamin A, IU [IU]	102.00
ocopherol, gamma [mg]	0.53
Fatty acids, total saturated [g]	25.94
Fatty acids, total monounsaturated [g]	3.22
Fatty acids, total polyunsaturated [g]	0.35
Phytosterols [mg]	62.00

Source: <https://fdc.nal.usda.gov/fdc-app.html#/food-details/171326/nutrients>



**Fig 4: Structures of some important chemicals**  
Source: Abourashed and El-Alfy (2016)

## PHARMACOLOGICAL ACTIONS

It's commonly known as nutmeg has aromatic, stimulant, narcotic, carminative, astringent, aphrodisiac, hypolipidemic, antithrombotic, anti-platelet aggregation, and antifungal, anti-dysenteric, anti-inflammatory activities, Hypoglycemic and anti-diabetic activities, Memory enhancing activity, hepatoprotective activity, aphrodisiac activity, and osteo blast proliferation stimulation activity. It is used as a remedy for stomach ache, rheumatism and vomiting of pregnancy (18, 19).

## HEALTH BENEFITS

The beneficial components include dietary fiber, manganese, thiamine, Vitamin B6, folate, magnesium, copper, and macelignan and it has benefits such as relieves pain, promotes digestion, improves brain health, detoxifies the body, oral health, treats insomnia and leukemia, hormone imbalance, and skin care, and regulates blood pressure. The woody aroma of nutmeg oil helps to remove bad breath (21). Some major benefits such as, it helps to eliminate bad breath, provides relief from insomnia, boost digestive, and bone health, helps to dissolve kidney stone, maintains optimal brain health, reduces skin inflammation and irritation and good for digestion, reduces mood swing and depression, removes toxins from liver, improves cognition, prevents heart problems, and treats respiratory problems (22).

## ADVERSE EFFECTS TO HUMANS

According to the Natural Medicines Comprehensive Database, nutmeg is probably safe when consumed

in amounts typically found in food. But overconsumption of nutmeg may be risky, causing nausea, vomiting, and hallucination (23). There are reports of nutmeg poisoning dating back to the early 1900s, with symptoms including burning pain in the stomach, pre cordial anxiety, or giddiness (24). Researchers write that the toxic effects of nutmeg are due to the presence of myristicin oil, a natural organic compound found in the spice (25). According to one published report, nutmeg poisoning is rare but probably underreported and should be considered in recreational substance users with acute psychotic symptoms as well as central nervous system symptoms (26).

### CASE REPORTS

1. Case study of a 16-year-old boy who got admitted into the emergency department. He was complaining of right-sided facial and upper limb palpitation, dry mouth having a problem in urination. When he was asked, he denied that he had any drugs or alcohol. After some investigation, the boy accepted that he is having nutmeg for approximately six months and doses are once a month but he hasn't seen any ill effect till then. He is having nutmeg as an alternative to marijuana. He purchased almost 25 grams of powder nutmeg from the supermarket and swallowed that. Initially, he wasn't feeling any difference so he went to sleep and when he woke up in the morning, he felt his right-sided body isn't responding. The doctor stated that he is having right arm paresis, par aesthesia, and palpitations. He got a cure for facial edema and paresis but his par aesthesia continued (27)

2. A case study of a 13-year-old girl who took almost 19 capsules which were brownish and reddish in color. She took almost 10 capsules in an hour also smoked almost two joints of marijuana. A friend of hers took four capsules in an hour. She described that she was seeing things flying around, her vision was not clear but she was having a sensation of temperature up and down. She was talking on her phone but actually, her phone wasn't even ringing. Her vision was so blurred, her eyes were struck. She was feeling dreamy and she doesn't know what she did in the next 8 hours. She didn't know that she slept or not. When her mother took her to the hospital it was identified that she took 19 capsules of nutmeg. And the remaining capsules were found with her friend. After she recovered successfully, she said she is not going to touch

nutmeg again even if it is the last drug on the earth (28)

3. A case study of a 23-year-old college student who got admitted into the emergency department by his friends after his behavior at the local bar he was behaving like an animal. He was complaining that he is having palpitations severe anxiety and a feeling of dread and he was behaving like an animal. he denied that he didn't take any drugs except for the occasional alcohol. The boy was not in a situation to explain anything. The tests were conducted as his blood pressure, pulse, respiratory rate, temperature, lungs, and cardiac reports were normal. The patient had no psychic history. After regaining consciousness, he explained, he explained that he has taken approximately 28 grams of powder nutmeg with coffee before 6 hours because he wanted to get high. The patient was admitted for observations and got discharged after 5 days and he was absolutely fine, he wasn't feeling anything unusual and completely recovered (29).

4. A case is presented of a young male who took an overdose of nutmeg and presented via ambulance to the Emergency Department with multiple psychiatric and neurological symptoms. The case is described in detail, especially in regard to the pre hospital and Emergency Department presentation. Emergency personnel should be aware of nutmeg toxicity due to its ability to mimic many other neurological, cardiac and psychiatric conditions (30).

### CONCLUSION

Nutmeg is a powerful ingredient that possesses many qualities. It can be a spice, a medicine, and can be a drug at some point. Nutmeg's oil has its existence because of its texture and essence. These all Chemicals have their significance and properties. Nutmeg has a complexity of many chemicals together, at some point nutmeg can be useful with the appropriate quantity but it can be very harmful if it is taken in large amounts or in the wrong way. It also has medical properties like antibacterial, antimicrobial, anti-inflammatory, chemo preventive properties, etc. Using nutmeg as a spice gives a unique flavor to dishes. Because it has a pungent and sweet taste which gives it a unique identity. When it is taken in large quantity result can be organ failure, hallucinations and several headaches. So, it depends upon us whether we make it a friend or a foe.

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