

Fodanj (Mentha Piperita): Clinical applications in medicine and beyond

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Abstract

Background: *Fodanj (Mentha Piperita)*, commonly known as peppermint, is a hybrid species of *Mentha aquatica* and *Mentha spicata* from the Lamiaceae family. It is widely cultivated for its medicinal, culinary and aromatic properties. Traditionally, it has been used for respiratory, gastrointestinal and dermatological conditions.

Objectives: This study aims to explore the botanical characteristics, chemical composition, pharmacological properties and clinical applications of *Mentha Piperita*, highlighting its therapeutic potential.

Methods: A comprehensive literature review was conducted, compiling data from various scientific sources, Unani medical texts and pharmacological studies. The study analyses the botanical description, active constituents and therapeutic effects of peppermint, along with its historical and modern uses.

Results: *Fodanj* contains essential oils rich in menthol, menthone, and flavonoids, which contribute to its diverse medicinal properties. It exhibits antimicrobial, antifungal, antioxidant, hepatoprotective, anti-inflammatory and antispasmodic activities. Studies have demonstrated its efficacy in managing digestive disorders, respiratory conditions, skin ailments and neurological functions. Peppermint is also effective in treating nausea, menstrual irregularities and liver dysfunction.

Keywords: *Fodanj*; *Mentha Piperita*; Peppermint; Nausea; Antispasmodic

1. Introduction

Fodanj (Mentha Piperita) belongs to the family Lamiaceae and is typically known as Pudina Menthol, Mint, Corn Mint.¹ It is a hybrid mint, a cross between Watermint and Spearmint. The plant is widely distributed and cultivated in many regions of the world. Peppermint was first described in 1753 by Carl Linnaeus from specimens collected in England. Basically, there are more than 600 varieties of mint, each having a range of flavor.² Best known for its flavorings and fragrance properties. Peppermint leaves (fresh and dried) and the essential oil extracted from the leaves are used in many foods, cosmetic and pharmaceutical products.³

Mentha Piperita, commonly identified as peppermint which has been widely used as a traditional medicine in Eastern and Western countries for the preparation of toothpaste and mouth washes, in aroma therapy, to reduce irritation and inflammation. This species has been cultivated in temperate and sub-tropical areas for more than 1,000 years. Traditionally, Peppermint infusion, leaves or essential oil was used for respiratory related diseases as anti-congestive and expectorants.⁴

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- **Botanical Name:** *Mentha Piperita* Linn.⁵
- **Common Name:** Peppermint.

Table 1 Vernaculars: ^{6,7}

Language	Name
Arabic	Fodanj, Nana
English	Mint
Greek	Pudina
Hindi	Pudinah, Paparaminta, Gamathi Phudina
Sanskrit	Rochnay
Kannada	Pudina
Tamil	Pudina, Yeehakkirai
Telugu	Igaenglikura

1.1. Taxonomy ^{2,8}

- Domain: Eukarya
- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Superdivision: Spermatohyta
- Phylum: Angiospermophyta
- Class: Magnoliopsida (Dicotyledon)
- Order: Lamiales
- Family: Lamiaceae (Mint Family)
- Genus: *Mentha*
- Species: *Mentha x Piperita*

2. Description ^{4,9,10,11}

Peppermint is a perennial 50–90 cm high, strongly scented and a prototypical member of the mint family. This perennial herb has creep regular branches and their leaves are an oval-shaped, rough surface with serrated margins. Peppermint has smooth dark green leaves with squared stems and blunt oblong bunches of pink lavender flowers. Its leaves hold resilient sweetish odor and a spicy flavor with a freshening after mastication. With the help of solons peppermint plants can be produced widely over a large area. Flowers purplish, occur in thick, terminal, spicoid racemes of verticillasters; each flower shows a tubular calyx with 5 sharp, hairy teeth, a purplish, irregular, 4-cleft corolla, 4 short stamens, a 4-celled ovary and a projecting style ending in a bifid stigma. Fruit consists of 4 ellipsoidal nutlets^{4,10,11,12}

3. Habitat

It was inborn to Europe, grows naturally in the northern USA, Canada and produced worldwide It is largely developed in the Mediterranean region as the core fragment of the vegetation. The world production of peppermint was about 92, 296 tonnes in 2014, led by Morocco contributing more than 90% of the world total (FAOSTAT, 2017). In India, Mint is generally produced in southern parts of the Himalayan zone covering Himachal Pradesh, Haryana, Punjab, Uttar Pradesh and Bihar.^{9,10}

3.1. Mahiyat (Morphology)

A herb with small, oval leaves, dark green in colour with a strong aroma. When the leaves are chewed, it gives a cold sensation in the mouth. It has got a pleasant taste. The plant grows to a height of 1 feet, with numerous branches. Flowers are purple in colour.^{7,12,13}



Figure 1 FODANJ (PUDINA-Mentha Piperita)

- **Parts used:** Leaf and stem ^{6,7}
- **Mizaj (Temperament):** Hot 2^o Dry 2^o ^{7,12,13}

Aʿal (Actions) ^{7,12,13}

- *Kāsir-i-Riyāḥ* (Carminative)
- *Hāḍim* (Digestive)
- *Dāfi'-i-Ta'affun* (Antiseptic)
- *Mudirr-i-Bawl* (Diuretic)
- *Mudirr-i-Ḥayḍ* (Emmenagogue)
- *Musakkin* (Sedative)
- *Mufarriḥ* (Refrigerant)
- *Muqawwī-i-Mi'da* (Stomachic)
- *Muḥarrik* (Stimulant)
- *Munḍij* (Maturative, Coctive)
- *Muḥallil* (Anti-inflammatory)
- *Mulaṭṭif* (Demulcent)
- *Jādhib* (Absorbent)
- *Muḥammir* (Rubefacient)
- *Mukhrij-i-Dīdān-i-Am'ā'* (Vermifuge)
- *Mu'arriq* (Perspirative)

Istemaal (Uses) ^{8,13,14}

- It is commonly used in digestive disorders like *zof-i-Mi'da* (weakness of stomach), *Dard-i-Mi'da* (stomach ache), *Riyāḥ al-Baṭn* (flatulence) and *Suqūṭ al-Shahwa* (anorexia).
- As a *Tiryāq* (antidote), it is beneficial in cholera.
- It is a strong *Mudirr-i-Ḥayḍ* (emmenagogue).
- *Arq Pudina* is used in nausea, vomiting and giddiness.
- It is also useful in jaundice.
- It eliminates *Sawdā'* (black bile) from the body.

3.2. Miqdar (Dasage)

- 3-5 grams (leaves) ¹²
- 6-12 tola (*Arq*) ¹⁵

3.3. *Muḍirr Atharāt* ¹³

- Intestine
- Kidney
- Reproductive System

3.4. *Muṣliḥ (Corrective Drug)* ^{13,16}

- *Kateera*
- *Pambadana*

3.5. *Badal (substitute)* ¹⁶

- *Aftimoon*
- *Gandana*

3.6. *Murakkabat (Compound Drugs)* ^{7,12}

- *Jawarish Pudina*
- *Jawarish Anarain*
- *Majoone Fodanji*
- *Safoof Pudina*
- *Sikanjabeen Nanayi*
- *Sikanjabeen Nanayi Murakkab*
- *Sharbat Nana Leemoni*
- *Sharbat Pudina*
- *Arq Pudina Murakkab*
- *Namak Nanayi.*
- *Arq Ajeeb*

4. Chemical constituents

The peppermint is a dynamic and good source of numerous minerals. It comprises around 0.5% to 4% essential oils, that are having the composition of about 25% to 78% menthol, 14% to 36% menthone, 1.5% to 10% isomenthone, 2.8% to 10% menthyl acetate and 3.5% to 14% cineol. The organic constituents include glycosides, phenolics/tannins, proteins, reducing sugars, resins and steroids/terpenoids, while the volatile oil primarily contains methanol. Inorganic components consist of antimony, calcium, iron, magnesium, potassium and sodium.^{10,16}

5. Flavonoids in peppermint

Flavonoids are one of the amplest polyphenols in diet and are grouped into six subgroups of flavanones, flavanols, flavanols, anthocyanins flavones and isoflavones. A total of 49 flavonoids have been isolated from different parts of peppermint⁴. Flavones (luteolin, luteolin O-diglucuronide, luteolin O-glucuronide, luteolin 7-O-β-glucuronide, luteolin 7-O-rutinoside and isorhoifolin), flavanones (eriodictyol, naringin, eriodictyol-glycopyranosyl rhamno pyranoside, naringenin 7-O-β-glucoside, hesperidin and eriocitrin), methoxyflavones (gardenin B, 5,6-dihydroxy-7,8,3,4-tetra methoxy flavone and salvigenin) and flavonols (catechin, rutin, [-]-epicatechin quercetin, quercetin-4-glucoside, kaempferol 7-O-rutinoside and myricetin O-glucoside) isolated and identified from *M. × piperita*.

5.1. Phytochemical properties

Polyphenolics constituents are an essential group of Phyto constituents with well-established biological uses such antimicrobial, antibacterial, antifungal antiplasmin, anti-inflammatory, antioxidant, antitumor, antispasmodic, antiallergenic, antidiabetic and hepatoprotective effect of peppermint.

5.2. Antibacterial activity

Researchers discovered that peppermint oil and its extracts provide a strong barrier against the growth of various microbes such as *Escherichia coli*, *Salmonella pullorum*, *Comamon asterrigena*, *Streptococcus faecalis*, *Acinetobacter* species, *Streptococcus thermophiles*, *Lactobacillus bulgaricus*, *Staphylococcus pyogenes* and *Staphylococcus aureus*.

The essential oil of *M. piperita*, at a concentration of 10-40 l/ml, has a significant antibacterial effect, and the MIC value of the oil is determined to be 1.13 mg/ml.^{10,16,17}

5.3. Antifungal activity

Researcher's statistics showed that peppermint has excellent anti-fungal properties against *Candida albicans*, *Aspergillus albus* and *Dermatophytes* fungi. In an anti-fungal activity, the essential oil obtained from *M. × piperita* was studied against *Candida albicans* and *Rhizopus nigricans* showed inhibition zones of 11.7 ± 0.12 mm and 8.3 ± 0.05 mm (Zaidi & Dahiya, 2015). Similarly, 1.0 µl/disc essential oil displayed inhibitory effect when evaluated for anti-fungal assay against *Alternaria alternata* (38.16 ± 0.10 mm), *Fusarium tabacinum* (35.24 ± 0.03 mm), *Penicillium* spp. (34.10 ± 0.02 mm) and *Fusarium oxysporum* (33.44 ± 0.06 m).^{9,10,18}

5.4. Antioxidant activity

Pharmacological studies demonstrated that the volatile oil and extracts of *M. × piperita* has strong anti-oxidative effects. The researchers investigated the capacity of peppermint essential oils or extracts to scavenge reactive oxygen species by DPPH (1,1-diphenyl-1-picrylhydrazil or 2,2-diphenyl-1-picrylhydrazil) ILPA, (inhibition of lipid peroxidation assay), ISRA (inhibition of superoxide radicals assay), IHRA (inhibition of hydroxyl radicals) ABTS (2,20 -azino-bis (3-ethylbenzothiazoline-6-sulphonic acid), BCLBA (β-carotene-linoleic acid bleaching assay), PM (phosphomolybdenum), NORSC (Nitric oxide radical scavenging activity) and FRAP (ferric-reducing power assay) were described.^{4,18}

5.5. Antispasmodic activity

Consumption of peppermint oil lowers down the calcium inflow in the large intestine as well as jejunum and thus, provides relaxation in the gastrointestinal tract. Peppermint oil can be used as a non-toxic and operative intervening action for a spastic bowel disorder. It lessens the symptoms of spastic bowel by preventing the calcium inflow in the gastrointestinal tract and potassium depolarization in the ileum. Peppermint oil facilitates decisive impressions on inflammatory itching, serotonin and cholinergic sense organ of the gastrointestinal tract and also effective against vomiting and nausea. Thus, peppermint is conspired as extensively used herb for therapy of spastic bowel syndrome.^{12,19,20}

5.6. Hepatoprotective activity

The leaves of peppermint (*M. × piperita*) could protectively affect against carbon tetrachloride (CCl₄) induced hepatotoxicity by significant decrease in Alanine Transaminase, Aspartate Transaminase, Alkaline Phosphatase, Urea, Creatinine, Uric acid, Bilirubin and Malondialdehyde and significant increase in Superoxide dismutase (SOD), Glutathione peroxidase (GPX) and Gamma glutamyl transferase at an oral dose of 0.5 ml/kg.^{3,4}

5.7. Anti-angiogenic

Methanol extract of peppermint has cytotoxic effect on L1210 cancer cells. Lin and colleagues showed that apparently menthol, in higher doses, effects on NAT activity in the human liver tumor cell line J5.²¹

5.8. Dermatologic effects

An in vitro study on human skin showed that low-dose, topically-applied peppermint oil protected the skin from the absorption of benzoic acid, though higher dose topical peppermint oil caused some compromise of the skin integrity. Topically-applied menthol decreases histamine-induced itch intensity without changing skin temperature. L-menthol increases cold perception, attenuates warmth perception and possibly stimulates high-threshold cold fibers or cold-sensitive nociceptors in humans.²²

5.9. Neurologic effects

L-menthol causes a cold sensation in the nose and a sense of increased nasal patency, although there is no change in nasal resistance to air flow, possible via major palatine nerve action. Orally menthol causes warmth enhancement and cold attenuation, although pre-treatment with menthol causes warmth attenuation.^{3,22}

5.10. Toxicity

Menthol has been shown to induce hepatocellular alterations in rats. Adverse effects associated with enteric-coated peppermint oil capsules are uncommon but may include hypersensitivity reactions, contact dermatitis, abdominal discomfort, heartburn, perianal irritation, bradycardia, and muscle tremors. Additionally, inhaling menthol can lead to apnoea and laryngoconstriction.²³

6. Conclusion

Fodanj (Mentha Piperita) is a widely utilized medicinal herb with significant applications in both traditional Unani Medicine and modern pharmacology. Its active constituents, particularly menthol and flavonoids, contribute to its well-documented antibacterial, antifungal, antioxidant, hepatoprotective and antispasmodic properties. Peppermint has demonstrated therapeutic efficacy in managing digestive disorders, respiratory ailments, neurological conditions and dermatological concerns. Despite its well-established benefits, further pharmacological studies and clinical trials are essential to determine standardized dosages and formulations for optimal therapeutic use. Integrating Unani principles with modern medical research can enhance peppermint's role in treating various health conditions. With its broad medicinal potential, *Mentha Piperita* continues to be a valuable botanical with promising future applications in health and wellness.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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