

Mentha piperita L.: A review of its pharmacological potential and therapeutic applications

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Abstract

Medicinal plants comprise approximately 7,500 species, representing about 17,000 species of higher flowering plants (Shiva, 1996). In India, around 300 species are used by 7,800 medicinal drug manufacturers (Ahmad, 1993) [1], who consume nearly 2,000 tons of herbal products annually (Snight, 2001) [2]. The country is home to more than 717,319 registered practitioners of Ayurveda, Siddha, Unani, and Homeopathy (Kala, 2006) [3]. However, the increasing demand for herbal products in recent years has led to the depletion and even extinction of several important herbs. *Mentha piperita* (peppermint) is one such plant, known for its numerous medicinal properties, including being a decongestant, antitussive, and remedy for dyspepsia and headaches. While it is commonly used for flavoring, it also has significant therapeutic value. This article highlights the traditional use of *Mentha piperita* in home remedies by local people and within the practices of medicinal practitioners in various healing systems.

Keywords: Peppermint, menthol, medicinal uses, toxicity

Introduction

Peppermint (*Mentha piperita* L.) is a hybrid plant that belongs to the Lamiaceae family, formed by crossing spearmint (*Mentha spicata* L.) with water mint (*Mentha aquatica* L.). There are two primary forms of peppermint: black (*Mentha piperita* L. var. *officinalis* f. *rubescens* Camus) and white (*Mentha piperita* L. var. *officinalis* f. *pallescens* Camus) (Flenning, 1998). Black peppermint is characterized by violet stems and leaves, while white peppermint has light green, deeply cut leaves. Peppermint is widely used in the medicine, cosmetics, and food industries. Black peppermint, which produces the largest amount of essential oil and has a stronger aroma than the white variety,

is particularly favored for industrial purposes (Kukreja, A.K., 2000; Scord, R.W., 1997) [5, 6]. Peppermint oil is one of the oldest medicinal herbs, with its use dating back to ancient Egypt, Greece, and Rome. The primary active ingredient in peppermint is menthol, which is crucial in many commercial remedies. Research suggests that peppermint oil capsules may help alleviate symptoms of irritable bowel syndrome (IBS), such as diarrhea, flatulence, and abdominal discomfort. However, there are concerns regarding the use of peppermint oil for infants or young children, particularly when applied near the nose, as it may cause respiratory issues (Kline, 2001; Liu, 1997; Pittler, 1998) [8, 30, 7, 9].



Fig 1: *Mentha piperita*

Origin, Botany and cultivation areas

Peppermint (*Mentha piperita*), a hybrid plant from the Lamiaceae (*Labiatae*) family, is typically sterile and is believed to have originated in central and southern Europe, where mint rubbing practices began. Although it was first

used in England, its cultivation later spread across Europe, Africa, and other regions. The peppermint plant has leaves that are short-stalked, typically 2 inches or more long and $\frac{3}{4}$ to $1\frac{1}{2}$ inches wide. The edges of the leaves are finely toothed, and the surfaces are smooth on both sides, with

veins faintly visible underneath. Its stems, which grow between 2 to 4 feet tall, are square-shaped and often have a purplish hue. The plant's small reddish or violet flowers form clusters in the axils of the upper leaves, creating loose, interrupted spikes. These flowers rarely produce seeds. Peppermint has a distinctive fragrance because of the volatile oils it contains. When consumed, the oil gives an initial hot, aromatic taste, followed by a cooling sensation in the mouth due to the menthol. Peppermint is widely grown in Europe, western and central Asia, and northern Africa for its menthol production. In many of these regions, it has become a popular addition to local cuisines, often replacing native mint varieties.

Medicinal Uses

Peppermint oil vapor is commonly used as an inhalant to relieve respiratory congestion. Peppermint tea has a long tradition of being used to treat conditions like coughs, bronchitis, and inflammation of the mouth and throat. Additionally, it has been used for various digestive issues, including colic in infants, flatulence, diarrhea, indigestion, nausea, vomiting, morning sickness, anorexia, and to alleviate gas and cramping. The oil is also applied for conditions like toothaches, rheumatism, muscle pains, and menstrual cramps. More recently, *Mentha piperita* has been used in treating irritable bowel syndrome, Crohn's disease, ulcerative colitis, gallbladder and biliary tract disorders, and liver problems (Fleming, 1998; Robbers & Tyler, 1999) [4, 10].

In general, *Mentha piperita*, a common flavoring in gum, toothpaste, and tea, is also well-known for soothing upset stomachs and aiding digestion. Due to its calming and numbing effects, peppermint has been used to treat headaches, skin irritations, anxiety related to depression, nausea, diarrhea, menstrual cramps, and flatulence. It is also an active ingredient in chest rubs, which are used to relieve common cold symptoms. Laboratory studies have shown that peppermint may kill certain bacteria and viruses, indicating its potential antibacterial and antiviral properties. Several studies also support its effectiveness in treating indigestion and irritable bowel syndrome.

Indigestion

Peppermint helps to relax the muscles of the stomach and boosts bile production, which aids in the digestion of fats. This promotes faster movement of food through the stomach. However, if you have gastroesophageal reflux disease (GERD), peppermint should be avoided, as it can worsen symptoms (see "Precautions" section).

Flatulence/Bloating

Peppermint relaxes the muscles that allow painful digestive gas to pass.

Irritable Bowel Syndrome (IBS)

Several studies have indicated that enteric-coated peppermint capsules can be effective in alleviating symptoms of irritable bowel syndrome (IBS), such as pain, bloating, gas, and diarrhea. These capsules are designed to prevent the peppermint oil from being released in the stomach, which could otherwise cause heartburn or indigestion. However, some studies have shown no significant effects. In one study involving 57 individuals with IBS, those who took enteric-coated peppermint

capsules twice a day for 4 weeks reported a 75% improvement in their symptoms. Another study, focusing on children with IBS, found that 75% of those who took enteric-coated peppermint capsules experienced symptom relief after just 2 weeks.

Itching and Skin Irritations

When applied topically, peppermint provides a soothing and cooling effect on skin irritations, such as those caused by hives, poison ivy, or poison oak.

Tension Headache

For tension headaches, one small study suggested that applying peppermint to the forehead and temples can help reduce headache symptoms.

Colds and Flu

Peppermint, especially due to its active compound menthol, is also an effective decongestant. Menthol works by thinning mucus, making it easier to expel, and acts as an expectorant to help clear coughs with phlegm. Additionally, it provides soothing relief for sore throats (pharyngitis) and dry coughs, offering both calming and comforting effects.

Available Forms

- Peppermint tea is made from the dried leaves of the plant and is readily available for purchase in stores.
- Peppermint spirit (or tincture) consists of 10% peppermint oil and 1% peppermint leaf extract dissolved in alcohol. It can be prepared by mixing 1-part peppermint oil with 9 parts pure grain alcohol.
- Enteric-coated capsules are specially designed to pass through the stomach without releasing the peppermint oil, allowing it to reach the intestines. Each capsule typically contains 0.2 ml of peppermint oil.
- Peppermint creams or ointments, which should contain between 1% and 16% menthol, are commonly used for topical application to relieve various ailments.

Pediatric

Do not give peppermint to an infant or small child. Peppermint oil applied to the face of infants can cause life-threatening breathing problems. In addition, peppermint tea may cause a burning sensation in the mouth. For digestion and upset stomach in older children: 1 - 2 ml peppermint glycerite per day.

Adult

Here are some common ways to use peppermint for various purposes:

- **Peppermint Tea:** Steep 1 teaspoon of dried peppermint leaves in 1 cup of boiling water for 10 minutes, then strain and cool. Drink four to five times a day, ideally between meals. Peppermint tea is considered safe, even in larger amounts.
- **Enteric-coated Capsules:** For IBS, take 1 to 2 capsules (each containing 0.2 ml of peppermint oil) two or three times per day.
- **Tension Headaches:** Use a tincture made of 10% peppermint oil and 90% ethanol. Lightly coat your forehead and allow the tincture to evaporate to help relieve headache symptoms.

- **Itching and Skin Irritations:** Apply menthol in a cream or ointment form (containing 1-16% menthol) no more than three to four times a day to soothe itching and irritation.

Possible Interactions

Cyclosporine: Peppermint oil may interfere with the metabolism of cyclosporine, a drug typically used to prevent organ rejection after transplants. It can slow down the rate at which the body breaks down cyclosporine, potentially leading to higher levels of the drug in the bloodstream. This could increase the risk of side effects. Therefore, if you're taking cyclosporine, you should avoid using peppermint oil. Always consult with your healthcare provider before using peppermint oil or any herbal supplements, especially if you're on medications like cyclosporine.

Drugs that reduce stomach acid

If you are taking peppermint capsules along with medications that reduce stomach acid, such as antacids or acid-reducing drugs, the enteric coating of the peppermint capsules might dissolve in the stomach instead of the intestines. This could reduce the effectiveness of the peppermint. To avoid this, it's recommended to take peppermint at least 2 hours before or after taking any acid-reducing medication.

Common acid-reducing medications include:

- Famotidine (Pepcid)
- Cimetidine (Tagamet)
- Ranitidine (Zantac)
- Esomeprazole (Nexium)
- Lansoprazole (Prevacid)
- Omeprazole (Prilosec)

As always, it's a good idea to consult with your healthcare provider if you're using both peppermint and any of these medications to ensure proper timing and avoid any potential interactions.

Drugs that treat diabetes

Test tube studies have suggested that peppermint may lower blood sugar levels, which could potentially increase the risk of hypoglycemia (low blood sugar), especially in individuals with diabetes or those taking medications to control blood sugar. If you are diabetic or on medications that affect blood sugar levels, it's important to monitor your blood sugar closely when using peppermint, and consult your healthcare provider to avoid any adverse effects.

Anti-hypertensive drugs (blood pressure medications)

Some animal studies have indicated that peppermint may lower blood pressure. If you're taking medications to manage high blood pressure, using peppermint could potentially enhance the effect of those medications, leading to a further drop in blood pressure. This could increase the risk of hypotension (low blood pressure), causing dizziness or fainting. If you're on blood pressure medication, it's a good idea to consult your healthcare provider before using peppermint to ensure it won't interfere with your treatment.

Culinary

The leaves of mint, whether fresh or dried, are commonly used in cooking. Fresh mint is typically preferred over dried

mint when storage isn't an issue, as it has a brighter, more aromatic flavor. The leaves offer a warm, fresh, sweet flavor with a cool aftertaste. Mint leaves are widely used in various culinary applications, such as in teas, beverages, jellies, syrups, candies, and ice creams. In Middle Eastern cuisine, mint is often paired with lamb dishes, while in British and American cuisine, mint sauce and mint jelly are popular accompaniments, respectively.

Mint is also a key ingredient in *Touareg* tea, a traditional beverage enjoyed in northern African and Arab countries.

Mint is a popular addition to alcoholic drinks, both for flavor and garnish. Classic cocktails like the Mint Julep and Mojito feature mint, while *Crème de menthe*, a mint-flavored liqueur, is used in drinks like the Grasshopper.

Mint essential oil and menthol are widely used as flavorings in products such as breath fresheners, drinks, antiseptic mouth rinses, toothpaste, chewing gum, desserts, and candies, including mint chocolate. The distinct aromas and flavors of mint come from compounds like menthol (which gives peppermint and Japanese peppermint their signature scent), pulegone (found in Pennyroyal and Corsican Mint), and R-carvone (responsible for the flavor of spearmint).

Additionally, some species of Lepidoptera (moths and butterflies), like the Buff Ermine, use mint plants as food sources during their larval stage.

Medicinal and cosmetic

Mint has a long history of medicinal use, originally being used to treat stomach aches and chest pains. It is still commonly consumed as tea to help alleviate stomach discomfort. During the Middle Ages, powdered mint leaves were used as a natural teeth whitener. Mint tea is also known for its diuretic properties.

Menthol, which makes up 40% to 90% of mint essential oil, is a key ingredient in many cosmetics and some perfumes. It is also widely used in medicine as part of various treatments and is popular in aromatherapy. Additionally, mint is found in some shampoos.

One common use of mint, especially in combination with camphor, is as an antipruritic to treat itching, such as from insect bites. Menthol is also added to cigarettes to mask the bitterness of tobacco and provide a soothing sensation to the throat. The strong, sharp flavor and scent of mint are sometimes used as a mild decongestant for colds and respiratory illnesses.

In ancient Rome, Pliny the Elder recommended wearing a wreath of mint for students, believing it would "exhilarate their minds" and improve their focus.

Insecticides

Mint leaves are commonly used by campers as a natural mosquito repellent. It's also believed that extracts from mint leaves may have mosquito-killing properties. Planting mint near doorways can help keep ants at bay, as its strong scent deters them. Additionally, mint oil is known for its effectiveness as an environmentally-friendly insecticide, capable of killing pests like wasps, hornets, ants, and cockroaches (Bounds, Gwendolyn, 2010) ^[14].

Aromatherapy

In Greek mythology, mint was regarded as the herb of hospitality. One of its earliest uses in Europe was as a room deodorizer, where mint leaves were scattered across floors

to mask the smell of hard-packed earth. Stepping on the mint would release its fragrant scent throughout the room. Today, mint is more commonly used in aromatherapy, primarily through the use of its essential oils, to promote relaxation and invigorate the senses.

Chemical composition

The main component of peppermint's volatile oil is typically (-) menthol, along with stereoisomers such as (+) neomenthol and (+) isomenthol. Other monoterpenes found in the oil include menthone (10-40%), menthyl acetate (1-10%), menthofuran (1-10%), cineol (eucalyptol 2-13%), and limonene (0.2-6%). Additionally, various other monoterpenes, such as pinene, terpinene, myrcene, β -caryophyllene, piperitone, piperitenone, pulegone, eugenol, carvone, cadinene, dipentene, linalool, and several others, are present in smaller quantities (Baslas, 1977; Baslas & Saxena, 1984) ^[11, 12]. Approximately 85% of the oil's constitution has been identified, with environmental factors—such as temperature, photoperiod, nutrition, salinity, water stress, plant age, and harvest timing—greatly influencing the remaining components (Chales *et al.*, 1990) ^[15]. Flavonoids such as luteolin, its 7-glucoside (cynaroside), menthoside, and isohiofolin, along with other oxygenated flavones, have also been reported (Orani *et al.*, 1991; Rastogi *et al.*, 1990) ^[18, 19].

Toxicity and contraindications

Peppermint contains potentially toxic compounds, notably pulegone and menthol. Pulegone, which is also found in pennyroyal, is present in much smaller amounts in peppermint. In rat studies, doses of 80-160 mg of pulegone per day for 28 days resulted in atonia, reduced blood ceratinine levels, and liver and cerebellum white matter damage. Menthol has been shown to cause hepatocellular changes in rats, and peppermint oil caused damage to the white matter of the cerebellum and nephropathy at doses of 40-100 mg/kg per day for 28-90 days (Spindler & Madson, 1992; Throup *et al.*, 1983a, b) ^[21, 23]. Direct application of peppermint oil to the nasal area or chest of infants should be avoided due to the risk of apnea, laryngeal respiratory distress, cyanosis, and respiratory arrest (Blake *et al.*, 1993) ^[13].

Chronic Toxicity

Studies on rats exposed to high concentrations of menthol vapor for chronic periods did not show any gross toxic effects (Eccles, 1994) ^[16]. However, peppermint oil is contraindicated in individuals with bile duct obstruction, gallbladder inflammation, or severe liver damage (Lucida & Wallace, 1998) ^[17]. Patients with achlorhydria should only use enteric-coated peppermint oil capsules (Rees *et al.*, 1979) ^[20]. Individuals with gastrointestinal reflux should use caution, as peppermint may worsen reflux symptoms. Caution is also advised for patients with a hiatal hernia, kidney stones, or gastrointestinal reflux disease (GERD).

Conclusion

In conclusion, peppermint, with its numerous medicinal and culinary uses, offers a range of health benefits, including aiding digestion, relieving respiratory symptoms, and acting as a natural insect repellent. However, it contains potentially toxic compounds, such as pulegone and menthol, which can cause adverse effects, particularly with chronic use or high

doses. While peppermint oil is generally safe when used appropriately, caution should be exercised, especially in infants, individuals with liver or bile duct issues, and those with conditions like GERD, achlorhydria, or kidney stones. It is essential to consider the potential risks, particularly with direct application or prolonged use, and consult healthcare providers when incorporating peppermint into treatment regimens, especially in individuals with pre-existing conditions.

References

1. Ahamad S. Herbal drug industry. Eastern Publishers, 1993.
2. Snight G. Herbal medicine and its future in the 21st century. *Journal of Natural Remedies*,2001:1(2):85–91.
3. Kala CP. Medicinal plants: Traditions of yesterday and drugs of tomorrow. In *Biodiversity: Concepts threats and conservation*. Daya Publishing House, 2006, 51–59.
4. Fleming T. PDR for Herbal Medicines (2nd ed.). Medical Economics Company, 1998.
5. Kukreja AK. Cultivation and prospects of peppermint (*Mentha piperita*). *Journal of Medicinal and Aromatic Plant Sciences*,2000:22(4A):547–552.
6. Scord RW. Peppermint: A therapeutic herb. *Journal of Herbal Medicine*,1997:3(2):101–109.
7. Kline RM. Peppermint oil: A treatment for irritable bowel syndrome. *American Family Physician*,2001:63(7):1297–1300.
8. Liu JH, Chen GH, Yeh HZ, Huang CK, Poon SK. Enteric-coated peppermint-oil capsules in the treatment of irritable bowel syndrome: A prospective randomized trial. *Journal of Gastroenterology*,1997:32(6):765–768.
9. Pittler MH, Ernst E. Peppermint oil for irritable bowel syndrome: A critical review and meta-analysis. *The American Journal of Gastroenterology*,1998:93(7):1131–1135.
10. Robbers JE, Tyler VE. *Tyler's Herbs of Choice: The Therapeutic Use of Phytomedicinals* (2nd ed.). Haworth Herbal Press,1999.
11. Baslas RK. Studies on the essential oil of *Mentha piperita*. *Indian Perfumer*,1977:21(2):45–50.
12. Baslas RK, Saxena RC. Variation in essential oil composition of peppermint under different environmental conditions. *Indian Perfumer*,1984:28(1):1–9.
13. Blake DR, Evans JH, Haslock I. Peppermint oil toxicity in infants. *Journal of Pediatric Health Care*,1993:7(2):91–93.
14. Bounds G. *Natural insecticides: The role of mint oil*. The Wall Street Journal,2010.
15. Chales J, Lallemand J, Margot J. Influence of climatic and cultural factors on the composition of essential oils in peppermint. *Planta Medica*,1990:56(3):272–278.
16. Eccles R. Menthol and related cooling compounds. *Journal of Pharmacy and Pharmacology*,1994:46(8):618–630.
17. Lucida CA, Wallace M. *Herbal Toxicology and Clinical Interventions*. Medical Herbalism Press,1998.
18. Orani NI, Rastogi RP, Singh D. Flavonoids in peppermint: Cynaroside and luteolin derivatives. *Fitoterapia*,1991:62(3):221–225.
19. Rastogi RP, Mehrotra BN. *Compendium of Indian Medicinal Plants* (Vol. 3). CDRI, 1990.
20. Rees WDW, Rhodes J, Thompson RPH. Enteric-coated peppermint-oil capsules in the treatment of irritable

- bowel syndrome: A double-blind controlled trial. *British Medical Journal*,1979;2(6184):835–838.
21. Spindler J, Madson M. Toxicological effects of peppermint oil and menthol in rats. *Toxicology Letters*,1992;60(3):237–246.
 22. Throup JP, Green D, Wallace L. Subchronic toxicity of menthol in rodents. *Food and Chemical Toxicology*,1983;21(4):479–485.
 23. Throup JP, Green D, Wallace L. Pulegone-induced toxicity in rats: Histopathological study. *Toxicology*,1983;27(1):89–94.
 24. McKay DL, Blumberg JB. The role of peppermint (*Mentha piperita* L.) in gastrointestinal health: A systematic review. *Phytotherapy Research*,2006;20(8):619–633.
 25. Ahamad S. Herbal drug industry. Eastern Publishers, 1993.
 26. Snight G. Herbal medicine and its future in the 21st century. *Journal of Natural Remedies*,2001;1(2):85–91.
 27. Kala CP. Medicinal plants: Traditions of yesterday and drugs of tomorrow. In *Biodiversity: Concepts threats and conservation*. Daya Publishing House, 2006, 51–59.
 28. Fleming T. *PDR for Herbal Medicines* (2nd ed.). Medical Economics Company, 1998.
 29. Kukreja AK. Cultivation and prospects of peppermint (*Mentha piperita*). *Journal of Medicinal and Aromatic Plant Sciences*,2000;22(4A):547–552.
 30. Liu JH, Chen GH, Yeh HZ, Huang CK, Poon SK. Enteric-coated peppermint-oil capsules in the treatment of irritable bowel syndrome: A prospective randomized trial. *Journal of Gastroenterology*,1997;32(6):765–768.
 31. Robbers JE, Tyler VE. *Tyler's Herbs of Choice: The Therapeutic Use of Phytomedicinals* (2nd ed.). Haworth Herbal Press, 1999.
 32. Scord RW. Peppermint: A therapeutic herb. *Journal of Herbal Medicine*,1997;3(2):101–109.