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ANTIBACTERIAL AND ANTIOXIDANT ACTIVITY OF MENTHA PIPERITA Linn. – A REVIEW

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ABSTRACT

The herbs Mentha piperita belongs to family Lamiaceae. It is cultivated in Japan, England, and many other countries, and it grows wild in Europe. It has a long history of usage in traditional medicine and therapeutic uses. Mentha piperita oil and extracts demonstrated antioxidant and antibacterial properties. The disc diffusion methods were used to assess antimicrobial activity. Its juice has therapeutic value for the management of infectious diseases and diabetes. In addition to being a mild carminative, peppermint oil is used to prevent and relieve intestinal gas and could also assist in reducing intestinal spasms. Its functions as an antioxidant, antidiabetic, hepatoprotective, antibacterial, and anti-inflammatory have also been demonstrated by experimental research. Mentha species are used as tincture or infusion to treat intestinal colic, liver problems, gastritis, jaundice, headaches, and migraines. Microencapsulated peppermint essential oil, or MPEO, is also utilised to manage microbes in different situations. The purpose of this review is to provide an overview of antibacterial and antioxidant effects of Mentha piperita Linn.

KEYWORD: Mentha piperita Linn., peppermint, Mentha oil, Antibacterial, Antioxidant.

INTRODUCTION

Plant Profile

Mentha piperita l., also referred to as peppermint, is a significant medicinal plant that is a member of the Lamiaceae family. The aromatic plant peppermint (Mentha piperita L.), which belongs to the Lamiaceae family, produces an essential oil that is high in menthol (30–50%) and menthone (14–32%).[1,2] Medicinal plants contain a variety of phytochemical compounds that exert distinct physiological effects on the human body and may serve as a source for novel antimicrobial agent. It is utilised for flavouring and scent in pharmaceuticals, meals, cosmeceuticals, and personal hygiene products. It is also used to treat inflammation and irritation. It is also used in aromatherapy, mouthwashes, bath preparations, toothpaste, chewing gum, and topical preparation.[3,4,5] Because peppermint is so widely distributed worldwide, it is also produced in a large number of nations, including Germany, Russia, Italy, Bulgaria, Norway, Slovakia, and Poland, as raw material and essential oil.[6] Mentha piperita L. is known for its characteristic strong mint odour provided by menthol.[7,8]

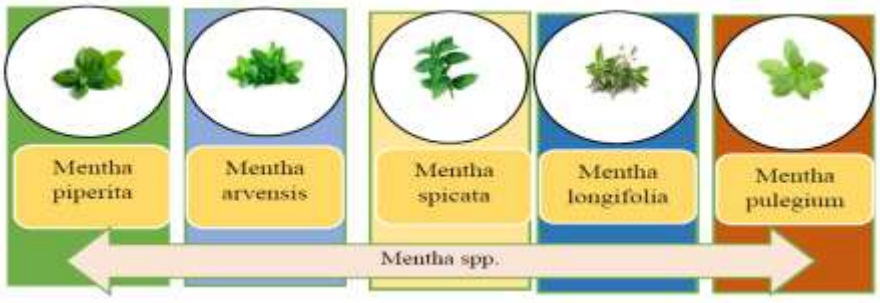


Fig. 1: Common species of Mentha.

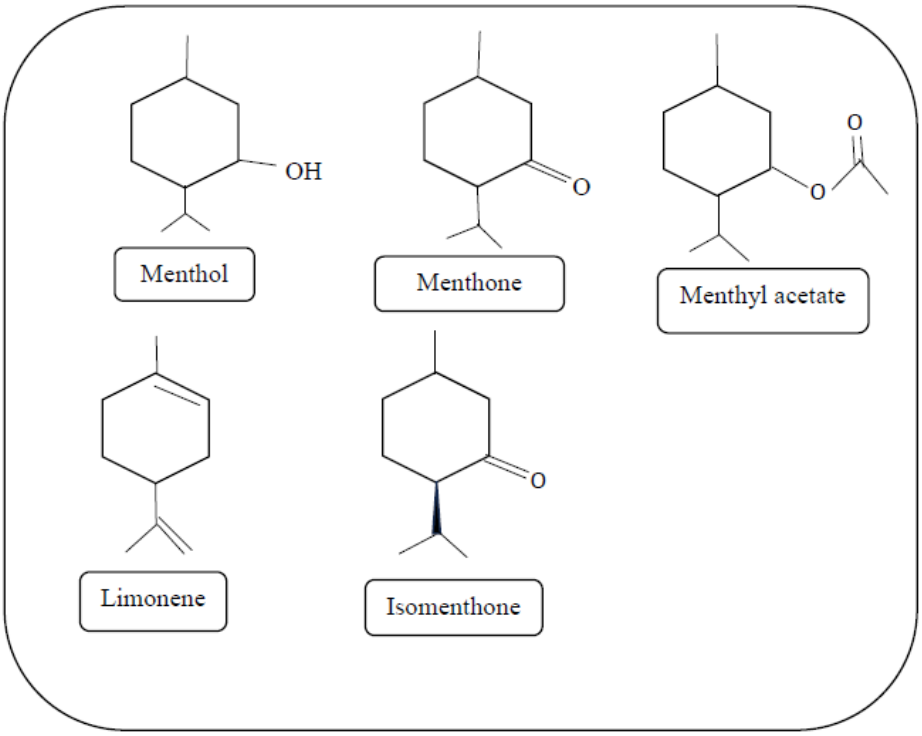
Nomenclature

Peppermint (Mentha piperita L.) is a perennial herb native to temperate areas of the world, particularly in Europe, North America and North Africa but nowadays cultivated throughout all regions of the world.[9,10] Peppermint, a hybrid of water mint (M. aquatica L.) and spearmint (M. spicata L.), grows in soil that has a good water-holding capacity. Best known for its flavouring and fragrance properties, peppermint leaves (fresh and dried) and the essential oil extracted from the leaves are used in many food, cosmetic and pharmaceutical products.

Table 1: Phytochemical and nutrients content in peppermint from various studies.

S.No.	Phytochemical components	Chemical constituents
1	Fatty acid	Linoleic acid, Linolenic acid, Palmitic acid etc.
2	Volatile oils	Menthol, Menthone, Isomenthone etc.
3	Vitamins	Vitamin A, Vitamin C etc.
4	Minerals	K, Ca, Mg, Na, Fe, Mn, Zn etc.
5	Others	Carotenoids, Chlorophylls, Flavonoids, salicylic acid, α and β tocopherols etc.

Chemical structure of some constituents of Mentha.



General properties of peppermint and its role in disease managements

Antioxidant, antibacterial, antiviral, antiseizure, antitumor, anti-allergic, anti-cancer, anticoagulant, analgesic, and insect-repellent are some of its general properties.[11,12] Due to the high concentration of phenolic compounds and flavonoids in mint oils, these compounds may be used therapeutically to treat a number of diseases in humans as well as animals, including intestinal inflammation, diarrhoea, and abnormalities of the nervous system.[13,14,15] Mentha species are used as an infusion or tincture to treat intestinal colic, liver problems, gastritis, jaundice, headaches, and migraines in many different nations.[16,17] It is known that western diets, especially that of Brazilians, contain increasingly high concentrations of saturated fats, favoring increased levels of total cholesterol, triacyl glycerides, low HDL-c, high blood pressure and altered fasting glycemia, which determine increased risks of developing heart diseases.[18] Depending on the ecological circumstances in which the medicinal plants to be produced in various locations are grown, it is necessary to determine the best time to harvest.[19]

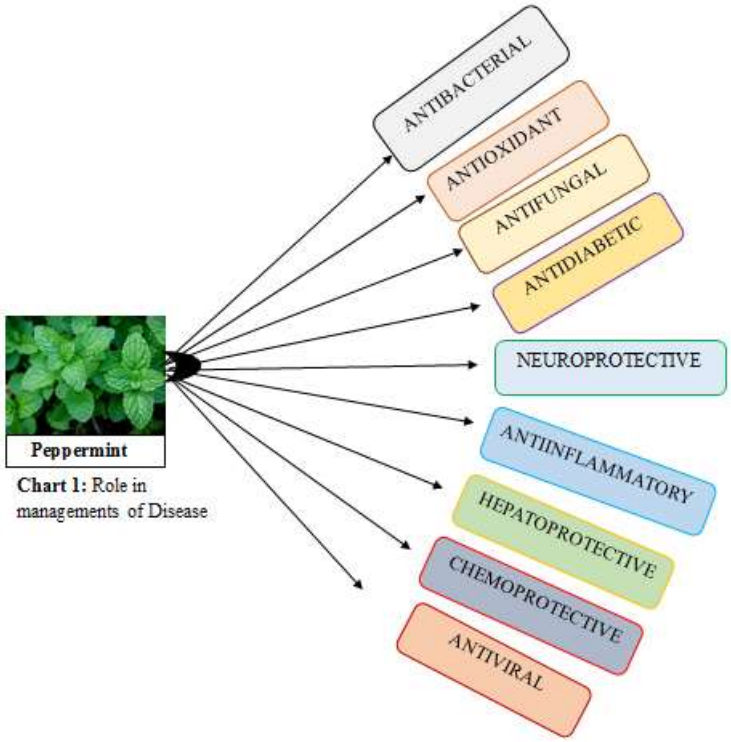


Chart 1: Role in managements of Disease

Antibacterial Activity

The favourable antibacterial activity of essential oils against a variety of microorganisms is one of the major benefits of utilising them in food products. Peppermint Water is a flavouring ingredient or scent component. Peppermint oil had stronger antibacterial activity than S. aureus against Candida albicans and E. coli.[20]

In tissue cultures and embryonated eggs, an alcohol extract of M. piperita along with four additional herbs (Thymus serpyllum, Viscum album, and Glycyrrhiza glabra) reduced influenza virus reproduction. With some changes, the broth dilution method was used to estimate the minimal inhibitory concentration (MIC) of the essential oils for the suppression of six bacterial strains.[21] Peppermint oil has a wide range of medicinal benefits, including antifungal and antibacterial effects. Because of these actions, microencapsulated peppermint essential oil, or MPEO, is also utilised for controlling microorganisms in different areas. In the last few decades, the use of EOs in agriculture, as agents protecting crops from bacterial and fungal diseases, has been extensively researched.[22] The activity of the oils against clinical specimens is mostly unquantified; there are very few minimal inhibitory concentrations or minimal bactericidal/fungicidal concentrations available. Furthermore, the oils toxicity to both tumours and non-tumour cells was evaluated.[23]

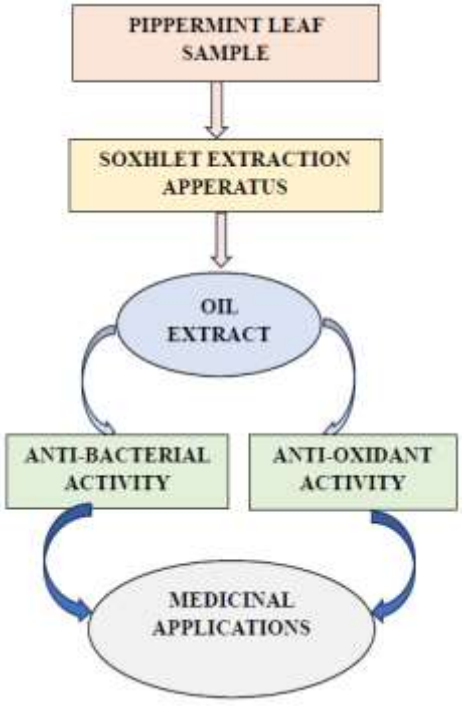


Chart 2: The antibacterial and antioxidant properties of peppermint oil extract make it suitable for therapeutic applications.

Anti-oxidant Activity

It is possible to enhance the shelf life of food by using essential oils that are high in phenolic compounds and other phytochemicals, as they have strong antioxidant and free radical scavenging activities.[24,25] On the other hand, the storage conditions of the separated oil may alter the composition of essential oils. Essential oil

constituents are often heat-sensitive, and the degree of alterations depends on the amount of duration and storage temperature.[26] Transition metals catalyse hydroperoxide decomposition and Fenton chemistry-type reactions which can lead to initiation and propagation of free radical chain reactions in susceptible media, so the ability to chelate-inactivated such species is an important antioxidant property.[27] Many different assay techniques have been used to determine peppermint's antioxidant capability. In a research study of popular medicinal plants, Zheng and Wang (2001) observed that the oxygen radical absorbance capacity (ORAC) value for an aqueous solution of previously frozen fresh M. piperita leaves (supernatant of 2.0 g homogenised in 15 mL buffer) was among the highest.[28]

The antioxidant activities of the essential oils were determined by various antioxidant assays, including 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, β-Carotene/linoleic acid assay, and nitric oxide (NO) radical scavenging assay.[29]

EOs and extracts from mint species are frequently applied as natural ingredients in herbal remedies and cosmetic preparations. The application of EOs in food commodities (instead of synthetic products with potentially proven harmful effects such as butylated hydroxy anisole (BHA) and butylated hydroxytoluene (BHT)) can serve as an authentic alternative to prevent oxidative damages and elongate the lifespan.[30,31] Many kinds of phenolic chemicals, such as flavones, flavanols, flavanones, phenolic acids, terpenes, lignans, and stilbenes, are abundant in peppermint. Due to its phenolic parts, peppermint has been shown in several studies to possess antioxidant properties.[32,33,34] The antioxidants also contribute to the reduction of oxidative stress in obese and diabetic persons.[35]

Antispasmodic and carminative Activity

Due to its antispasmodic and carminative qualities, Mentha piperita has long been used to treat intestinal dyspepsia and colic. It has anti-spasmodic properties on the gastrointestinal and vascular systems and can be used therapeutically for disorders including flatulence, nausea, colitis, anorexia, liver, bronchitis, and ulcerative conditions.[36]

Antiallergic activity

A 50% ethanol extract of M. piperita leaves and stems administered orally to rats with nasal symptoms (induced by antigen challenge in actively sensitized animals) significantly inhibited sneezing at a dose of 300 mg/kg and nasal rubbing at 1000 mg/kg.[37,38] Allergic contact dermatitis has been reported to herbal remedies using patch testing. The action of L-menthol and D/L- menthol on patients with different skin conditions such as dermatoses, eczematous lesions, contact dermatitis and mucosa/skin reactions may evoke sensitivity reactions (0-6.1%). Nevertheless, the overall, sensitizing effect of menthol isomers has tended to be generally low.[39,40]

Insecticidal activity

There are three basic techniques used for the in vitro assessment of the insecticidal activity of essential oils. In the first, insects are exposed to direct touch with the essential oil (EO) in an experiment known as the contact toxicity assay. In the second assay, known as a fumigant assay, insects are exposed to EO vapours but are not in close contact with them. The final test is an acute toxicity experiment, where the EOs are combined with grains or green roughage—food for insects. The experiments are usually performed in Petri dishes, vials, or jars of different volumes, depending on the species of insect and the developmental and Larvicidal and mosquito repellent activities.[36,41]

Anti-inflammatory Activity

Preclinical in vitro research was done to examine the anti-inflammatory properties of L-menthol and mint oil. L-menthol significantly lowered the amount of each inflammatory mediator that monocytes produced in vitro. On the other hand, the production of PGE subset2 was impacted by mint oil: PGE subset2 was as much as six-fold higher at lower concentrations of 10 superset-10 to 10 superset-8 g/ml than at baseline, whereas PGE subset2 production was inhibited by around 50% at concentrations of 10 superset-7 g/ml. These findings using human monocytes imply that at therapeutically relevant concentrations given in enteric coated capsules, L-menthol has better anti-inflammatory properties than mint oil.[42]

Anti-epileptic Activity

A wide variety of bioactive phytochemicals, including flavonoids, phenolics, stilbenes, lignans, and essential oils, are probably responsible for the effects of aroma. With the World Health Organization’s permission, the medicinal plants’ treatment of epilepsy is gaining popularity due to the plants’ fewer side effects and diverse beneficial ingredients. Different essential oils (EOs) derived from different plants have long been used as an alternative treatment for disorders of the central nervous system (CNS).[43]

Analgesic activity

The analgesic properties of Mentha spicata (spearmint) stem from the presence of Rosmarinic acid. High levels of rosmarinic acid help in reducing osteoarthritis pain. Carvone, limonene, and menthol all have analgesic properties and help to lessen pain.[44]

Table 2: Traditional uses of Mentha × piperita (Peppermint).[36]

S.No.	Traditional uses	Part used	Mode of preparation	Country	Reference
1	Food	Leaves	Tea and eaten dry	Turkey	Uysal, Onar, Karabacak, and Çelik (2010)
2	Wound healing (external use)	Leaves	Juice	Brazil	Di Stasi et al. (2002)
3	Anxiety, insomnia and stomach disorders	Herb	Infusion and spice	Serbia	Savikin et al. (2013)
4	Cough, flu, cold and pharyngitis	Leaves	Decoction	Turkey	Ugulu, Baslar, Yorek, and Dogan (2009)
5	Common cold, diuretic, and spasmolytic	Leaves	-	Greece	Karousou, Balta, Hanlidou, and Kokkini (2007)
6	Hypotension dyspepsia, liver disorders, stomach disorders calmative, headache	Leaves	Infusion	Cyprus	Karousou and Deirmentzoglou (2011)

CONCLUSION

Peppermint leaf extraction has revealed the existence of several significant and therapeutic phytochemicals, including phenolic compounds and flavonoids. Furthermore, it has demonstrated an appropriate proportion of the necessary trace elements, including Cu, Zn, and Se. Humans can benefit from the usage of peppermint juice in the treatment and prevention of disease-related risk factors.

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