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MENTHA PIPERITA: A COMPREHENSIVE REVIEW OF PEPPERMINT'S MANY BENEFITS

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ABSTRACT

This comprehensive analysis delves into the numerous health benefits associated with Mentha piperita, commonly known as peppermint. An increasing body of scientific research is shedding light on the diverse applications of peppermint, an herb steeped in rich traditional history. This article aims to provide an overview of the current knowledge surrounding the aromatic, culinary, and medicinal uses of peppermint, as well as its potential therapeutic uses. It explores the phytochemical composition of peppermint, its pharmacological effects, and its wide-ranging applications in aromatherapy, digestive health, and various other areas. The primary objective of this review is to offer a thorough examination of the manifold advantages of Mentha Piperita, serving as a valuable resource for scholars, healthcare professionals, and individuals seeking to harness the health-promoting potential of this remarkable plant. Peppermint (Mentha piperita L.) is one of the most popular herbal teas, or tisanes, known for its exceptional therapeutic properties. This botanical marvel contains various bioactive compounds, such as phenolic, which include rosmarinic acid, as well as several flavonoids, notably hesperidin, luteolin, and eriocarpin. The essential oil of peppermint primarily consists of menthol and menthone, contributing to its distinctive aroma and taste. Research conducted in vitro (in a test tube) reveals that peppermint exhibits potent antioxidant and anticancer properties. Moreover, it displays remarkable antibacterial and antiviral attributes, along with some anti-allergic properties. Peppermint is a multifaceted herb, renowned for its diverse health benefits, including but not limited to antioxidant, anticancer, antibacterial, antiviral, analgesic, anesthetic, immunomodulatory, and chemo preventive properties. Peppermint

(Mentha piperita L.) is one of the most popular herbal teas, or tisanes, known for its exceptional therapeutic properties. This botanical marvel contains various bioactive compounds, such as phenolic, which include rosmarinic acid, as well as several flavonoids, notably hesperidin, luteolin, and eriocitrin.

KEYWORD: Mentha piperita; peppermint oil; menthol; herbal tea, tisane, dyspepsia, anticancer, antibacterial, analgesic.

INTRODUCTION

Traditional or indigenous medicines, which are the primary means of treating various medical conditions for approximately 80% of the world's population. The majority of medical treatments today make use of plant extracts, often in aqueous solutions. Unlike herbal solutions, none of the plant-based foods are employed as medications. Natural remedies, typically prepared by heating or steeping raw plant materials, have a long history of use in medicine spanning centuries. In the present day, physicians in Europe and Asia frequently prescribe herbal teas as part of their treatment recommendations. Peppermint (Mentha piperita L.) stands out as a highly favored herbal tea known for its single ingredient simplicity. Its reputation is grounded in a rich history of alleged health benefits and traditional applications as a complementary or alternative treatment for various gastrointestinal issues. These conditions encompass enteritis, dyspepsia, biliary diseases, intestinal colic, gastritis, flatulence, and spasms affecting the digestive (GI) tract, gallbladder, and bile duct.

In this review, we delve into the body of scientific research pertaining to peppermint tisanes, or infusions derived from peppermint leaves. Our focus extends to exploring the potential health advantages and bioactivity associated with these infusions. Additionally, we analyze the impact of the essential oil and other constituent elements present in peppermint leaves. A wealth of information concerning the nutritional content and phytochemical composition (**L. McKay B. Blumberg, 2006).**

BOTANICAL DESCRIPTION, DISTRIBUTION AND TAXONOMY

Botanical Description

Mint (Mentha × piperita), as identified by The Plant List (www.theplantlist.org), is a fragrant and rhizomatous perennial herb. Its scientific name, Mentha × piperita L., is the sole recognized designation according to the aforementioned source. This plant, depicted in Figure 1, boasts upright, quadrangular stems that can attain heights ranging from 30 to 90 cm. The stems, characterized by a reddish or violet tinge, often branch out. The leaves, typically 4 to 5 cm in length, exhibit shades of dim or light green, are arranged oppositely, and feature serrated margins and short petioles. The blooms, measuring 8 mm in length, present hues of purple or scarlet, resembling false spikes adorned with numerous small bracts. Comprising the fruit are four ellipsoidal nutlets, as detailed by **(Singh *et al.* 2015).**

Table 1: Synonyms of Mentha×piperita L.

S.NO	SYNONYM
1	Mentha piperita var. balsamea (Willd.) Rouy
2	Mentha × piperita var. beckeri Briq.
3	Mentha × piperita var. braousiana (Pérard) Briq.
4	Mentha × piperita var. calophylla Briq.
5	Mentha × piperita var. calvifolia Briq.
6	Mentha × piperita subsp. citrata (Ehrh.) Briq.
7	Mentha × piperita var. citrata (Ehrh.) Briq.
8	Mentha piperita var. citrata (Ehrh.) Briq.
9	Mentha piperita subsp. citrata (Ehrh.) Briq.
10	Mentha ×piperita var. crispa (L.) W.D.J. Koch
11	Mentha×piperita var. crispula (Wender.) Heinr.Braun
12	Mentha ×piperita var. durandoana (Malinv. ex Batt.) Briq.
13	Mentha ×piperita var. globosiceps Briq.
14	Mentha ×piperita var. hercynica (Röhl.) Briq.
15	Mentha ×piperita var. heuffelii (Heinr.Braun) Topitz
16	Mentha ×piperita var. hispidula Briq.
17	Mentha ×piperita var. hudsoniana Heinr.Braun
18	Mentha ×piperita var. inarimensis (Guss.) Briq.
19	Mentha ×piperita var. langii (Geiger ex T. Nees) W.D.J. Koch
20	Mentha ×piperita var. officinalis Sole
21	Mentha ×piperita var. ouweneelii Lebeau & Lambinon
22	Mentha ×piperita var. pennsylvanica Briq.
23	Mentha ×piperita var. pimentum (Nees ex Bluff & Fingerh.) Nyman
24	Mentha ×piperita var. piperoides (Malinv.) Rouy
25	Mentha ×piperita var. poicila Topitz
26	Mentha ×piperita f. puberula Topitz
27	Mentha ×piperita f. rotundella Topitz
28	Mentha ×piperita var. subhirsuta Benth

GEOGRAPHIC DISTRIBUTION

The species peppermint (Mentha × piperita), native to Europe, is widely distributed across eastern and northern Europe, the United States, and Africa. However, it has been consistently cultivated throughout the world **(Singh *et al.*, 2015).**

TAXONOMY

Peppermint belongs to the Lamiaceae family, which encompasses a diverse array of trees and shrubs comprising over 7,200 species across 260 genera. Within this extensive family, the genus containing peppermint encompasses approximately 61 species alongside thirteen naturally occurring hybrids **(Kumar, Mishra, Malik, & Satya, 2011; Benabdallah *et al.*, 2018).**

TRADITIONAL USES AND ETHNOPHARMACOLOGY

Traditional Uses

Peppermint, scientifically known as Mentha × piperita, has a rich historical and cultural significance, evident in its diverse applications across various civilizations. Egyptians were among the earliest cultivators of M. × piperita, as evidenced by its presence in the Icelandic pharmacopoeia, where it served as a flavoring agent for tea and food **(Singh *et al.*, 2015).**

The utilization of peppermint extends across continents and cultures, with its medicinal properties documented in Egyptian pyramids and its role as a flavoring and scent enhancer in "Touareg tea" in the Arab world and northern Africa **(Singh *et al.*, 2015; Singh, Pandey, & Tripathi, 2012).**

In traditional Iranian medicine, peppermint is esteemed for its antiviral, antifungal, stimulant, tonic, and carminative properties (Herro & Jacob, 2010). Both Western and Eastern traditional medicinal practices acknowledge the therapeutic potential of M. × piperita and its essential oils, utilizing them to address various ailments such as antispasmodic conditions, toothaches, cramps, nausea, colds, and diarrhea **(Briggs, 1993).**

Peppermint finds a place in the customs of Greek, Roman, and Egyptian medicine and cuisine (Balakrishnan, 2015). Its leaves and oil are valued not only for their flavor but also for their cosmetic and medicinal applications (Foster, 1996). Infusions of peppermint tea are recognized remedies for bronchitis, coughs, and throat and mouth inflammation (Hoffman, 1996). Additionally, the essential oil derived from peppermint leaves is employed in traditional medicine to alleviate rheumatism, muscle discomfort, and menstrual cramps **(Fleming, 1998; Tyler, 1992).**

The decoction of M. × piperita leaves serves as a natural remedy for inflammation, bronchitis, and coughs (Boon & Smith, 2004; Fleming, 1998). Its potent aroma and diverse biological activities make it a valuable ingredient in cosmetic products and dental healthcare **(Herro & Jacob, 2010; Schmidt *et al.*, 2009; Tandan, Anand, & Yadav, 2013).**

Recognized by the British Herbal Compendium, peppermint leaf is officially acknowledged for its medicinal properties and is incorporated into medications aimed at alleviating intestinal colic, flatulence, biliary problems, and dyspepsia (Bradley, 1992). The European Scientific Cooperative on Phytotherapy (ESCOP, 1997) recommends peppermint for the

treatment of intestinal problems and enteritis, while the German Standard Licence advocates its use in teas for gastrointestinal and gall bladder conditions. Moreover, the clinical preparation of herbal tea combining chamomile flowers and peppermint leaves has been utilized in conventional medicine to alleviate stomach discomfort and ulcers **(Khayyal *et al.*, 2006).**

Peppermint oil plays a significant role in various formulations aimed at addressing respiratory issues in children, such as coryza and nasal catarrh. One such application involves its inclusion in an inhalation mixture alongside eucalyptus oil and pumilio pine oil, with proportions of 10% peppermint oil, 45% eucalyptus oil, and 45% pumilio pine oil **(Schilcher, 1997).**

In American traditional medicine, peppermint oil serves multiple purposes as documented by **Briggs (1993**) and **Tyler *et al.*** (1988). It acts as a carminative in antacids, an anti-pruritic in sunburn creams, a counterirritant in topical analgesics, a decongestant in inhalants and lozenges, and an antiseptic or flavoring agent in mouthwash, gums, and toothpaste.

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

LOCAL NAME	TRADITIONAL USES	PART USED	MODE OF PREPARATION	COUNTRY	REFERENCES
Nane	Food	Leaves	Tea and eaten dry	Turkey	Uysal, Onar, Karabacak, and Celik (2010)
Hortela	Wound healing (external use)	Leaves	Juice	Brazil	Di Stasi *et al.*, (2002).
Naenaye felfeli	Food digestion	Aerial parts	Boiled	Iran	Ahmadipour *et al.*, (2016)
Mint	Carminative (stomach upset)	Leaves	Decoction	Cameroon	Jiofack et al., (2010)
Potomania Paprena	Increased digestion	Aerial parts	Tea	Bosnia	Saric-Kundalic et al., (2010)
Torongil	Gastro-intestinal afflictions	Aerial parts	Decoction	Eastern Cuba	Cano and Volpato (2004)

PHYTOCHEMICAL AND NUTRIENT CONTENT

The chemical composition of peppermint leaves and oil can exhibit variations influenced by factors such as the specific variety of the peppermint plant, its age, and the processing methods employed. These factors can lead to differences in the types and quantities of chemical compounds present in peppermint leaves and the essential oil derived from them. Different varieties of peppermint, such as Mentha × piperita or Mentha × aquatic, can contain

varying chemical profiles. These differences may result in variations in the concentration of specific compounds, which can affect the aroma and taste of peppermint leaves and oil. The age of the peppermint plant can influence its chemical composition. Younger plants may contain different levels of essential oils and secondary metabolites compared to mature ones. Generally, essential oil content tends to increase as the plant matures, impacting the oil's flavor and fragrance. The processing of peppermint leaves to obtain essential oil can introduce additional variability. Factors such as the method of extraction (e.g., steam distillation or cold pressing) and the handling of the harvested leaves can impact the final composition of the oil. For instance, the temperature and duration of distillation can affect the balance of volatile compounds in the oil. Key chemical constituents found in peppermint leaves and oil include menthol, menthone, methyl acetate, and various terpenes. However, the proportions of these compounds can differ based on the aforementioned factors. Menthol, in particular, is responsible for the characteristic cool and refreshing sensation associated with peppermint. the chemical composition of peppermint leaves and oil is subject to variation due to the peppermint plant's variety, age, and the specific methods employed during processing. These variations result in different sensory qualities and potential applications for peppermint products, making them suitable for a range of culinary, medicinal, and aromatic purposes. **(Clark and Menary, 1981; Maffei and Scannerini, 1992; Rohloff, 1999; Gherman *et al.*, 2000; Blanco *et al.*, 2002; Pino *et al.*, 2002; Ruizdel Castillo *et al.*, 2003; Xu *et al.*, 2003).**

Peppermint leaves contain a non-polar lipid component that primarily consists of linoleic acid and palmitic acid (16:0). Additionally, 18:2 (linoleic acid) and 18:3 (linoleic acid) is present in this lipid component, as reported by Maffei and Scannerini in 1992. The essential oil of peppermint, which is rich in volatile compounds, contains a variety of substances, with the following major components:

Menthol: This compound makes up a substantial portion of the essential oil, typically ranging from 33% to 60%, 1,8-Cineole: This component is present in quantities between 2% and 8% in peppermint essential oil.

Menthone: Peppermint essential oil contains 15% to 32% menthone. Menthyl Acetate: Typically found in concentrations ranging from 2% to 11% in the oil. Eucalyptol: Also known as cineole, it accounts for approximately 5% to 13% of the essential oil. Limonene: Peppermint oil contains about 1% to 7% limonene. Menthofuran: This compound is found in

concentrations ranging from 1% to 10% in peppermint essential oil. β-Myrcene: Present in the oil in varying amounts. β-Caryophyllene: Typically found in quantities of 2% to 4%. (**L. McKay B. Blumberg, 2006).**

PHARMACOLOGICAL ACTIVITIES OF M.× PIPERITA

Several studies have described many biological activities of M. ×piperita, which are due to the presence of several bioactive compounds or phytochemical constituents that response through various modes of action **(Brahmi *et al.*, 2017).**

1. **ANTI-BACTERIAL ACTIVITY:** The emergence of antibacterial resistance to prescribed antibiotics has become a significant health issue. The detection and treatment of bacterial infections heavily rely on synthetic antibacterial medications. It is noteworthy that the majority of antibiotics available in today's market are either synthetic or derived from microbes **(Wright *et al.*, 2014).**

Furthermore, a significant risk to public health persists in the form of increasing microbial resistance, prompting researchers to explore innovative therapeutic alternatives for detecting bacterial diseases effectively. The paper highlights that in the last decade, more than 300 naturally occurring secondary metabolites have been recognized as antimicrobial agents **(Saleem *et al.*, 2010; Taylor, 2013).**

2. **ANTI-FUNGAL ACTIVITIES:** Several studies have utilized peppermint leaves and oils for their anti-fungal properties.

Nilo *et al.*, (2017) reported on the activity of essential oil (2–5 mg/ml) extracted from M. × leaves.

According to **Zaidi and Dahiya (2015**), peppermint (M. × piperita) essential oil inhibits the growth of Aspergillus fumigatus, Aspergillus niger, and Fusarium moniliforme at concentrations of 2.50 ± 0.0, 1.25 ± 0.0, and 2.50 ± 0.0 mg/ml, respectively. In their study, the essential oil derived from commercial peppermint oil was tested for its anti-fungal properties against two strains of Rhizopus nigricans and Candida albicans, resulting in inhibition zones measuring 11.7 ± 0.12 mm and 8.3 ± 0.05 mm, respectively.

Similarly**, Desam *et al.*, (2017)** conducted an anti-fungal assay and found that peppermint essential oil exhibited inhibitory effects against Penicillium spp. (34.10 ± 0.02 mm),

Fusarium tabacinum (35.24 ± 0.03 mm), Alternaria alternaria (38.16 ± 0.10 mm), and Fusarium oxyporum (33.44 ± 0.06 mm) at a concentration of 1.0 µl/disc.

3. **ANTI-OXIDANT ACTIVITY:** The pharmacological investigations have revealed that the volatile oil and extracts of Mentha piperita (peppermint) possess robust antioxidative properties. The authors employed the DPPH (1,1-diphenyl-1-picrylhydrazil or 2,2-diphenyl-1-picrylhydrazil) ILPA method to assess the capability of peppermint essential oils or extracts to scavenge reactive oxygen species.

The following assays were utilized to evaluate various aspects of the antioxidative properties:

1. **DPPH Assay:** This assay measures the ability of peppermint essential oils or extracts to neutralize DPPH radicals, indicating their antioxidative potential.
2. **Lipid Peroxidation Assay:** This assay evaluates the capacity of peppermint components to inhibit the oxidative degradation of lipids, a process known as lipid peroxidation.
3. **Inhibition of Superoxide Radicals (ISRA):** This assay assesses the ability of peppermint extracts to inhibit the formation or activity of superoxide radicals, which are reactive oxygen species.
4. **Inhibition of Hydroxyl Radicals (IHRA):** Peppermint extracts are tested for their ability to inhibit the formation or activity of hydroxyl radicals, which can cause damage to biomolecules.
5. **ABTS Assay:** The ABTS assay measures the ability of peppermint components to scavenge ABTS radicals, providing insight into their antioxidative capacity.
6. **β-carotene-linoleic Acid Bleaching Assay (BCLBA):** This assay evaluates the ability of peppermint extracts to prevent the oxidation of β-carotene in the presence of linoleic acid.
7. **Phosphomolybdenum Assay (PM):** Peppermint extracts are tested for their total antioxidant capacity by assessing their reducing ability against a molybdenum reagent.
8. **NORSC (Nitric Oxide Radical Scavenging Activity):** This assay determines the ability of peppermint components to scavenge nitric oxide radicals, which play a role in various physiological processes.
9. **FRAP (Ferric-Reducing Power Assay):** The FRAP assay measures the ability of antioxidants in peppermint extracts to reduce ferric ions to ferrous ions, indicating their ferric-reducing power.

These assays collectively provide a comprehensive understanding of the antioxidative properties of peppermint essential oils and extracts, shedding light on their potential health benefits and applications in combating oxidative stress-related conditions.

4. Anti- Headache (Migraine Activity)

A comprehensive evaluation of herbal treatments for migraine is crucial to ascertain both their safety and efficacy. Following the guidelines outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and employing the Cochrane Collaboration's risk of bias assessment tool, we conducted a systematic literature review of randomized, controlled human trials focusing on single-ingredient herbal treatments for acute or prophylactic migraine management. These studies investigated the effects of various herbal remedies such as feverfew, butterbur, curcumin, menthol/peppermint oil, coriander, citron, Damask rose, chamomile, and lavender.

Upon analysis, the efficacy of feverfew appeared inconclusive, while there was limited yet positive evidence supporting the use of butterbur. Additionally, promising preliminary findings surfaced regarding curcumin, citron, and coriander for migraine prophylaxis, along with menthol and chamomile as acute treatments. Nonetheless, a notable proportion of studies exhibited a high risk of bias. In light of our systematic review, several herbal medicines exhibit potential in augmenting migraine treatment owing to their multifaceted physiological effects. However, it is imperative to underscore the necessity for further high-quality research to thoroughly scrutinize both the efficacy and safety profiles of these herbal treatments in managing migraine.

DISCUSSION

Peppermint (Mentha piperita) is a versatile herb that has been used for centuries due to its various therapeutic properties and health benefits. Here, we will explore a comprehensive review of peppermint's many benefits and create a discussion around its uses and applications. Digestive Health Peppermint is well-known for its ability to soothe digestive issues such as indigestion, bloating, and gas. The menthol component in peppermint helps relax muscles in the gastrointestinal tract, promoting digestion and relieving discomfort. Relief from Headaches Peppermint oil, when applied topically or inhaled, can provide relief from tension headaches and migraines. Its cooling effect and analgesic properties help alleviate pain and promote relaxation. Respiratory Benefits Peppermint is often used to relieve symptoms of respiratory conditions such as colds, coughs, sinus congestion, and

bronchitis. Its menthol content acts as a decongestant, helping to clear nasal passages and ease breathing. Mental Clarity and Alertness The aroma of peppermint has been shown to enhance cognitive function, improve concentration, and increase alertness. Many people use peppermint essential oil or drink peppermint tea to boost mental clarity and productivity. Relief from Muscle Pain Peppermint oil applied topically has analgesic and anti-inflammatory properties that can help alleviate muscle pain, soreness, and tension. It is commonly used in massage oils, balms, and creams for its soothing effects. Oral Health Peppermint is often found in toothpaste, mouthwash, and oral care products due to its antimicrobial properties and ability to freshen breath. It helps kill bacteria in the mouth and can relieve symptoms of gum inflammation and oral infections. Weight Loss Aid. Some studies suggest that the aroma of peppermint may help reduce appetite and cravings, making it a potential aid in weight management efforts. Skin Care Peppermint oil has antiseptic and anti-inflammatory properties that can help soothe irritated skin, reduce redness, and calm itching or burning sensations. It is commonly used in skincare products for its cooling and refreshing effects.

CONCULSON

In conclusion, Mentha piperita, commonly known as peppermint, offers a wide array of benefits backed by scientific research and historical use. Its versatility spans from culinary applications to medicinal uses, making it a valuable herb in various aspects of life. Peppermint's potent medicinal properties, including its ability to alleviate digestive issues, relieve headaches, and reduce symptoms of irritable bowel syndrome (IBS), make it a popular choice in natural remedies and alternative medicine practices. Its cooling and soothing effects on the digestive system are particularly noteworthy, providing relief from discomfort and promoting overall gastrointestinal health. Furthermore, peppermint's antimicrobial and analgesic properties contribute to its efficacy in combating infections and alleviating pain associated with various conditions. It’s refreshing aroma and flavor also make it a common ingredient in oral care products and aromatherapy blends, enhancing both physical and mental well-being.

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