Peppermint

Mentha x *piperita* L.

[Fam. *Lamiaceae*]

Overview

Peppermint is one of the most popular herbs for use in teas, flavorings, and candies. Both peppermint leaf and peppermint oil are official in the U.S. *National Formulary,* while peppermint water and peppermint spirit have official monographs in the *United States Pharmacopeia*. The U.S. is the world's leading producer of peppermint oil, supplying more than 4,000 metric tons of oil annually. Three peppermint products are ranked among the top ten best-selling single-herb teas. Although the traditional use of peppermint is primarily as a tea to improve digestion, most clinical studies have investigated the actions of peppermint oil in enteric-coated capsules used internally to treat irritable bowel syndrome and externally to treat tension headache.

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Primary Uses

Internal

Gastrointestinal

Crude Preparations

- Indigestion and relief of bloating due to excess gas production
- Spastic complaints of the gastrointestinal tract, gallbladder, and bile ducts

Essential Oil

- Non-ulcer or functional dyspepsia
- Irritable bowel syndrome

External

Neurology

Essential Oil

- Tension headaches (solutions rubbed on forehead and temples)

Other Potential Uses

Internal

Essential Oil

- Catarrh of the respiratory tract and inflammation of the oral mucosa
- Colonic spasm during barium enema
- Colonic spasm during colonoscopy

External

Essential Oil

- Myalgia and neuralgia
- Fecal odor in patients with colostomies

Pharmacological Actions

Internal

Crude Preparations: Antispasmodic action on the smooth muscles of the digestive tract; choleretic; carminative.

Essential oil: Antispasmodic; carminative; cholagogic; antibacterial; secretolytic/mucolytic; relaxes smooth muscle; relieves colonic spasms; carminative on lower esophageal sphincter.

External

Essential oil: Analgesic in tension headache; menthol vapors stimulate cold receptors in nose.

Dosage and Administration

The Health Canada labeling standard warns patients not to take peppermint internally for more than two weeks, or if symptoms recur when treating indigestion, unless directed by a healthcare provider. [Editors' note: In Canada, all non-prescription drugs are given a duration use related to the indicated condition. This is based on the reasoning that the patient should be checked by a healthcare practitioner to look for underlying causes if the symptoms have not cleared up in the specified time.] The German Standard License monograph warns that for acute gastrointestinal complaints that last for more than one week or recur periodically, the patient should see a healthcare provider.

Internal

Crude Preparations

Dried leaf: 1–4 g, 3 times daily after meals for flatulent digestive pains.

Infusion: Approximately 150 ml of boiled water poured over 1.5 g of dried leaf, steeped for 5–10 minutes in a covered vessel, tea bag squeezed over the cup, can be administered 2–5 times daily on an empty stomach to relieve upset stomach.

Tincture: 2–5 ml, 3 times daily [1:5 (*g/ml*), 45% ethanol].

Essential Oil

ESSENTIAL OIL: 6–12 drops total daily dose [EDITORS' NOTE: Caution: Peppermint oil is highly concentrated; therefore, divide into 3 doses and dilute in water or juice.]; 0.05–0.2 ml 3 times daily.

ESSENTIAL OIL IN ENTERIC-COATED CAPSULE: 0.2 ml oil (187 mg), 3 times daily with water before meals, for irritable colon.

INHALANT: 3–4 drops of essential oil added to hot water and the steam vapor inhaled deeply.

Combination Preparations

ESSENTIAL OIL: 90 mg peppermint oil and 50 mg caraway oil, 1 enteric-coated capsule, 3 times daily, before meals, for non-ulcer dyspepsia.

External

Essential Oil

ESSENTIAL OIL: Drops, diluted with lukewarm water or vegetable oil, rubbed in the affected skin areas.

ESSENTIAL OIL: 10 g in ethanol 90% solution, spread across forehead and temples. Repeated application after 15–30 minutes for tension headache.

NASAL OINTMENT: Semi-solid preparation containing 1–5% essential oil.

TINCTURE: Aqueous-alcoholic preparation containing 5–10% essential oil for local application.

CONTRAINDICATIONS

CRUDE HERB: Gallstones, esophageal reflux.

ESSENTIAL OIL: Achlorhydria (absence of free hydrochloric acid in gastric juice), obstruction of bile ducts, gallbladder inflammation, and severe liver damage. A healthcare provider should be consulted before using peppermint oil in cases of gallstones. Peppermint oil should not be used on the faces (particularly the noses) of infants and small children. Peppermint oil is contraindicated for infants and small children due to the potential risk of spasms of the tongue or respiratory arrest.

PREGNANCY AND LACTATION: No known restrictions.

ADVERSE EFFECTS

Twelve cases of oral-contact sensitivity to peppermint oil and/or menthol have been reported in patients with intra-oral symptoms in association with burning-mouth syndrome, recurrent oral ulceration, or a lichenoid reaction.

DRUG INTERACTIONS

Menthol-containing preparations may interfere with gastrointestinal-stimulant drugs (e.g., cisapride) used to treat nighttime heartburn due to the reflux of stomach acid into the esophagus. Concurrent administration of peppermint oil with antacids or ingestion during meals can cause the oil to be released from capsules prematurely, resulting in a loss of effectiveness.

CLINICAL REVIEW

In twenty-three clinical studies on peppermint conducted on a total of 1,186 participants, all but one demonstrated positive results for various gastrointestinal and neurological conditions. These include 14 double-blind (DB) studies investigating the treatment of non-ulcer or functional dyspepsia, irritable bowel syndrome, spasm during barium enema, and tension headaches. In 1998, a meta-analysis of DB, placebo-controlled trials concluded that peppermint oil could provide symptomatic relief of irritable bowel syndrome, though the authors cited methodological flaws in most of the studies. In 2000, a systematic review of randomized, controlled trials concluded that using peppermint oil to treat irritable bowel syndrome requires further study.

Peppermint

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[Fam. *Lamiaceae*]

Overview

Peppermint is one of the most popular herbs in teas, candies, and chewing gums. The U.S. is the world's leading producer of peppermint oil, making an average of 4,117 tons annually. Although the traditional use is as a tea to improve digestion, most clinical trials have studied the oil in enteric-coated capsules used internally to treat irritable bowel syndrome and externally to treat tension headache.

Uses

INTERNAL: Peppermint leaf: General indigestion and non-ulcer dyspepsia. Peppermint oil: Irritable bowel syndrome (enteric-coated capsules); colonic spasm during barium enema and during colonoscopy; catarrh of upper respiratory tract and inflammation of mucous linings of the mouth.

EXTERNAL: Peppermint oil: Tension headaches (oil solution rubbed on forehead and temples; use extreme caution with undiluted peppermint oil); for muscle and nerve pain (usually in the form of liniments).

Dosage

Internal

CONCENTRATED PEPPERMINT WATER: 0.25–1.0 ml.

DRIED LEAF: 1–4 g, 3 times daily after meals for flatulent digestive pains.

INFUSION (TEA): Pour about 150 ml of boiled water over 1.5 g of dried leaf, steep for 5–10 minutes in a covered vessel, squeeze tea bag over the cup, and take 2–5 times daily on an empty stomach to relieve upset stomach.

PEPPERMINT SPIRIT: 20 drops (1 ml) with water.

TINCTURE: 2–5 ml; 3 times daily [1:5 (*g/ml*), 45% ethanol].

ESSENTIAL OIL: 6–12 drops total daily dose [EDITOR'S NOTE: Caution: Peppermint oil is highly concentrated; therefore, divide into 3 doses and dilute in water or juice.]; 0.05–0.2 ml 3 times daily.

ESSENTIAL OIL IN ENTERIC-COATED CAPSULE: 0.2 ml oil (187 mg), 3 times daily with water before meals for irritable colon.

INHALANT: 3–4 drops of essential oil added to hot water and the steam vapor inhaled deeply.

Combination Preparations

ESSENTIAL OIL: 90 mg peppermint oil and 50 mg caraway oil, 1 enteric-coated capsule, 3 times daily, before meals, for non-ulcer dyspepsia.

External

ESSENTIAL OIL: Spread on forehead and temples. Repeat after 15–30 minutes for tension headache.

ESSENTIAL OIL: Drops rubbed in the affected skin areas, should be diluted with lukewarm water or vegetable oil.

NASAL OINTMENT: Semi-solid preparation containing 1–5% essential oil.

TINCTURE: Aqueous-alcoholic preparation containing 5–10% essential oil for local application.

Contraindications

CRUDE HERB: Gallstones, esophageal reflux.

ESSENTIAL OIL: Achlorhydria (absence of free hydrochloric acid in gastric juice), obstruction of bile ducts, gallbladder inflammation, and severe liver damage. Consult with a healthcare provider before using peppermint oil in cases of gallstones.

Peppermint oil should not be used on the faces (particularly the noses) of infants and small children. Peppermint oil is contraindicated for infants and small children because of the potential risk of spasms of the tongue or respiratory arrest.

PREGNANCY AND LACTATION: No known restrictions.

Adverse Effects

No adverse effects are known. Oral-contact sensitivity to peppermint oil and/or menthol has caused side effects of burning-mouth syndrome, recurrent oral ulceration, or a skin condition known as lichenoid reaction.

Drug Interactions

Peppermint preparations may interfere with gastrointestinal-stimulant drugs (e.g., cisapride) used to treat nighttime heartburn. Use of peppermint oil capsules with antacids or during meals can cause the oil to be released prematurely, resulting in a loss of effectiveness.

Comments

When using a dietary supplement, purchase it from a reliable source. For best results, use the same brand of product throughout the period of use. As with all medications and dietary supplements, please inform your healthcare provider of all herbs and medications you are taking. Interactions may occur between medications and herbs or even among different herbs when taken at the same time. Treat your herbal supplement with care by taking it as directed, storing it as advised on the label, and keeping it out of the reach of children and pets. Consult your healthcare provider with any questions.

Peppermint

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Overview

Peppermint is one of the most popular herbs for use in teas, flavorings, and confections (e.g., chewing gum and candies). Both peppermint leaf and peppermint oil are official in the U.S. *National Formulary,* while peppermint water and peppermint spirit have official monographs in the *United States Pharmacopeia* (USP, 2002). The U.S. is the world's leading producer of peppermint oil (Fugmann *et al.,* 1997), supplying more than 4,000 metric tons of oil annually (NASS/USDA, 2000). Three peppermint products are ranked in the top ten list of best selling single-herb teas (SPINS, 2000). Although most traditional uses of peppermint are based on teas used as a digestive aid, most clinical studies have investigated the actions of peppermint oil in enteric-coated capsules used internally to treat irritable bowel syndrome (IBS) and externally to treat tension headache.

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Description

Peppermint leaf preparations consist of the fresh or dried leaf of *Mentha* x *piperita* L. [Fam. *Lamiaceae*]. The whole, dried leaf must contain not less than 1.2% (ml/g), and the cut leaf must contain not less than 0.9% volatile oil (Ph.Eur., 1997). Peppermint oil consists of the essential oil, obtained by steam-distilling freshly harvested, flowering sprigs (Blumenthal *et al.*, 1998), and is neither partially, nor wholly dementholized (USP, 2002).

Primary Uses

Internal

Gastrointestinal

Crude Preparations

- Indigestion and relief of bloating due to excess gas production (Health Canada, 1996)
- Spastic complaints of gastrointestinal tract, gallbladder, and bile ducts (Blumenthal *et al.*, 1998; Braun *et al.*, 1996)

Essential Oil

- Non-ulcer or functional dyspepsia (Freise and Köhler, 1999; Madisch *et al.*, 1999; May *et al.*, 1996, 2000)
- Irritable bowel syndrome (IBS) (Liu *et al.*, 1997; Carling *et al.*, 1989; Lawson *et al.*, 1988; Nash *et al.*, 1986; Dew *et al.*, 1984; Rees *et al.*, 1979; Pittler and Ernst, 1998)

External

Neurology

Essential Oil

- Tension headaches (Göbel *et al.*, 1994, 1996)

Other Potential Uses

Internal

Essential Oil

- Catarrh of the respiratory tract and inflammation of the oral mucosa (Blumenthal *et al.*, 1998)
- Colonic spasm during barium enema (Sparks *et al.*, 1995; Jarvis *et al.*, 1992)
- Colonic spasm during colonoscopy (Duthie, 1981; Leicester and Hunt, 1982)
- Fecal odor in patients with colostomies (McKenzie and Gallacher, 1989)

External

Essential Oil

- Myalgia and neuralgia (Blumenthal *et al.*, 1998)

Dosage

Crude Preparations

Internal

CONCENTRATED PEPPERMINT WATER (BP): 0.25–1.0 ml (BP, 1980; Karnick, 1994).

DRIED LEAF: 3–6 g (Blumenthal *et al.*, 1998); 2–3 g, 3 times daily after meals for flatulent digestive pains (Bradley, 1992) 2–4 g, 3 times daily (Health Canada, 1996).

INFUSION: Approximately 150 ml of boiled water poured over 1.5 g of dried leaf, steeped for 5–10 minutes in a covered vessel, tea bag squeezed over the cup, can be administered 2–5 times daily (Morant and Ruppanner, 2001; Braun *et al.,* 1996; Hänsel *et al.*, 1992–1994; Meyer-Buchtela, 1999), on an empty stomach to relieve upset stomach (Robbers and Tyler, 1999).

NOTE: Peppermint tea infusion yields ca. 21% of total available essential oil (Duband *et al.*, 1992). At 10 minutes of steeping time, the maximum amount of volatile oil is obtained including ca. 24% of the menthol and 19.5% of the menthone (Hänsel *et al.*, 1992–1994; Meyer-Buchtela, 1999). Steeping time limited to 5 minutes maximizes yield of menthol and menthone, as they volatilize rapidly (Niesel, 1992). After 5 minutes of steeping, 42–55% of the available rosmarinic acid is released, depending on the leaf particle size or surface area (Carius, 1990; Meyer-Buchtela, 1999).

PEPPERMINT SPIRIT USP: 20 drops (1 ml) with water (Robbers and Tyler, 1999).

TINCTURE [1:5 (*g/ml*), 45% ethanol]: 5–15 ml (Blumenthal *et al.,* 1998; Erg.B.6, 1953); 2–3 ml, 3 times daily (Bradley, 1992; Health Canada, 1996).

Essential Oil

Internal

ESSENTIAL OIL: 6–12 drops total daily dose, according to German Commission E (Blumenthal *et al.*, 1998) [EDITORS' NOTE: Caution: Peppermint oil is highly concentrated; therefore, divide into 3 doses and dilute in water or juice.]; 0.05–0.2 ml 3 times daily (Health Canada, 1996).

ESSENTIAL OIL IN ENTERIC-COATED CAPSULE: 0.2 ml oil (187 mg), 3 times daily with water before meals, for irritable colon (Morant and Ruppanner, 2001; Blumenthal *et al.*, 1998; Krogh, 1989; Liu *et al.*, 1997).

External

ESSENTIAL OIL: Drops rubbed in the affected skin areas, should be diluted with lukewarm water or vegetable oil (Blumenthal *et al.*, 1998). 10 g in ethanol 90% solution, spread across forehead and temples. Repeated application after 15–30 minutes for tension headache (Göbel *et al.,* 1996).

INHALANT: 3–4 drops of essential oil added to hot water and the steam vapor inhaled deeply (Blumenthal *et al.*, 1998).

NASAL OINTMENT: Semi-solid preparation containing 1–5% essential oil (Blumenthal *et al.,* 1998).

TINCTURE: Aqueous-alcoholic preparation containing 5–10% essential oil for local application (Blumenthal *et al.*, 1998*).*

Combination Preparations

Internal

ESSENTIAL OIL: 90 mg peppermint oil, 50 mg caraway oil, in enteric-coated capsule, 1 capsule 3 times daily, with water before meals, for non-ulcer dyspepsia (Freise and Köhler, 1999; Madisch *et al.*, 1999).

DURATION OF ADMINISTRATION

The Health Canada labeling standard warns patients not to take peppermint internally for more than two weeks, or if symptoms recur when treating indigestion, unless directed by a healthcare provider (Health Canada, 1996). [EDITORS' NOTE: In Canada, all non-prescription drugs are given a duration use related to the indicated condition. This is based on the reasoning that the patient should be checked by a healthcare practitioner to look for underlying causes if the symptoms have not cleared up in the specified time.] The German Standard License monograph warns that for acute gastrointestinal complaints that last for more than one week or periodically recur, see a doctor (Braun *et al.,* 1996).

CHEMISTRY

Peppermint leaf contains up to 7% phenolic acids (caffeic, chlorogenic, and rosmarinic) (Bruneton, 1999); 3.5–4.5% labiate tannins; 0.5–4.0% terpene rich volatile oil, and flavonoids (glycosides of apigenin, diosmetin, and luteolin) (Hänsel *et al.*, 1992–1994; Meyer-Buchtela, 1999). Peppermint oil (European pharmacopeial grade) must contain 30–55% menthol, 14–32% menthone, 2.8–10.0% menthyl acetate, 3.5–14.0% cineole, 1.5–10.0% isomenthone, 1–9% menthofuran, 1–5% limonene, and no more than 4% pulegone or 1% carvone (Ph.Eur., 1997).

PHARMACOLOGICAL ACTIONS

Internal

Human

CRUDE PREPARATIONS: Antispasmodic action on the smooth muscles of the digestive tract, choleretic, carminative (Blumenthal *et al.*, 1998; Bradley, 1992).

ESSENTIAL OIL: Antispasmodic, carminative, cholagogic, antibacterial, secretolytic/mucolytic (Blumenthal *et al.*, 1998); relaxes smooth muscle (Micklefield *et al.*, 2000); relieves colonic spasms (Leicester and Hunt, 1982); carminative on lower esophageal sphincter (Sigmund and McNally, 1969).

External

Human

ESSENTIAL OIL: Analgesic in tension headache (Göbel *et al.,* 1994, 1996); menthol vapors stimulate cold receptors in nose (Burrow *et al.*, 1983).

Internal

Animal

Peppermint tea increases bile secretion (Steinmetzer, 1926); peppermint oil applied locally suppresses free acid flow (Necheles and Meyer, 1935); peppermint oil shortens emptying time of stomach by 46% (Sapoznik *et al.,* 1935); and inhibits serum cholinesterase (Caujolle *et al.*, 1944); flavonoids are choleretic (Pasechnik, 1966; Pasechnik and Gella, 1966); aqueous extract acts as a sedative and diuretic (Della Loggia *et al.*, 1990).

In vitro

Oil is bacteriostatic against *Candida albicans*, *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* (Koscik, 1955); and bactericidal against *Bacillus anthracis* and swine erysipelas bacteria (Abdullin, 1962) and isolated human coli (Taylor *et al.,* 1984b). Leaf extract is antiviral against Newcastle disease (NDV), herpes simplex, vaccinia, Semliki Forest, and West Nile viruses (Herrmann and Kucera, 1967); flavonoids inhibit ileum muscular contractions and relax gastrointestinal smooth muscle (Lallement-Guilbert and Bézanger-Beauquesne, 1970; Hill and Aaronson, 1991); alcoholic extract is antispasmodic (Forster *et al.*, 1980; Forster, 1983); and inhibits colonic motility (Taylor *et al.*, 1984a).

MECHANISM OF ACTION

- The pharmacological actions are due partly to the volatile oil (Harries *et al.*, 1978), to flavonoids and phenolic acids (Bruneton, 1999; Steinegger and Hänsel, 1988), and to the labiate tannins (Schilcher, 1997).
- Some studies have proposed that the mechanism for the carminative action is peppermint's ability to reduce the tonus of the esophageal sphincter, releasing entrapped air (Demling and Steger, 1969; Giachetti *et al.*, 1988).
- Based on *in vitro* experiments, the antispasmodic effect of the volatile oil is due to the inhibition of smooth muscle contractions through blocking calcium influx into muscle cells (Hawthorne *et al.*, 1988; Hills and Aaronson, 1991; Taylor *et al.*, 1984b).
- Peppermint inhibits enterocyte glucose uptake by direct action at the brush border membrane. In serous membranes, it inhibits the response to acetylcholine without reducing the effect of mucosal glucose. This is consistent with a reduced availability of calcium, which causes a relaxing effect on the intestinal smooth muscle (Beesley *et al.,* 1996).

- After ingestion of an enteric-coated capsule, the menthol is not metabolized in the small or large intestine, but it reaches the colon. A third of the menthol is reabsorbed, and the rest acts locally on the smooth muscle. About 35% of the applied menthol is found in the urine after 24 hours (Morant and Ruppanner, 2001).

Contraindications

CRUDE HERB: Gallstones (Blumenthal *et al.,* 1998; Braun *et al.*, 1996); esophageal reflux (Sigmund and McNally, 1969).

ESSENTIAL OIL: Achlorhydria (absence of free hydrochloric acid in gastric juice) (Morant and Ruppanner, 2001; Rees *et al.*, 1979); obstruction of bile ducts, gallbladder inflammation, and severe liver damage. In case of gallstones, to be used only after consultation with a healthcare provider. Peppermint oil should not be used on the faces (particularly the noses) of infants and small children (Blumenthal *et al.,* 1998). Peppermint oil is contraindicated for infants and small children due to the potential risk of spasms of the tongue or respiratory arrest (Schulz *et al.*, 1998).

PREGNANCY AND LACTATION: No known restrictions (Blumenthal *et al.*, 1998; McGuffin *et al.*, 1997).

Adverse Effects

None known according to Commission E (Blumenthal *et al.,* 1998; Braun *et al.*, 1996). Twelve cases of oral-contact sensitivity to peppermint oil and/or menthol have been reported in patients with intra-oral symptoms in association with burning-mouth syndrome, recurrent oral ulceration, or a lichenoid reaction (Morton *et al.*, 1995).

Drug Interactions

None known (Braun *et al.*, 1996; Blumenthal *et al.*, 1998; ESCOP, 1997). Menthol-containing preparations may interfere with gastrointestinal-stimulant drugs (e.g., cisapride) used to treat nighttime heartburn due to the reflux of stomach acid into the esophagus (Austin *et al.*, 2000). Concurrent administration of peppermint oil with antacids or ingestion during meals can cause the oil to be released from capsules prematurely resulting in a loss of effectiveness (Morant and Ruppanner, 2001).

American Herbal Products Association (AHPA) Safety Rating

CLASS 1: Herb that can be consumed safely when used appropriately (McGuffin *et al.*, 1997).

Regulatory Status

AUSTRIA: Dried leaf official in *Austrian Pharmacopoeia*, ÖAB 1990–1996 (Meyer-Buchtela, 1999; Reynolds *et al.*, 1993; Wichtl, 1997*).*

BELGIUM: Permitted as Traditional Herbal Medicine (THM) digestive aid (Bradley, 1992; WHO, 1998).

CANADA: Peppermint Leaf Labeling Standard: Schedule OTC Traditional Herbal Medicine as an aid to digestion (Health Canada, 1996). Also permitted as a homeopathic drug. In both cases requires premarket authorization and assignment of a Drug Identification Number (DIN) (Health Canada, 2001). Food ingredient without claim (Health Canada, 1997).

EUROPEAN UNION: Whole, dried leaf containing no less than 1.2% essential oil; cut, dried leaf containing not less than 0.9% essential oil; and steam-distilled oil from fresh, flowering, aerial parts are official in the *European Pharmacopoeia* (Ph.Eur., 1997).

FRANCE: Dried leaf official in *French Pharmacopoeia*, Ph.Fr. X (Bradley, 1992; Reynolds *et al.*, 1993). Traditional Herbal Medicine for internal and external use with specific indications listed in the French Expl. Note, 1998. (Bradley, 1992; Bruneton, 1999; WHO, 1998). Oil is aromatherapy drug (Goetz, 1999).

GERMANY: Peppermint leaf and oil are approved drugs of the Commission E monographs (Blumenthal *et al.*, 1998). Peppermint leaf tea is an approved drug in the German Standard License monographs (Braun *et al.*, 1996).

ITALY: Dried leaf official in *Italian Pharmacopoeia* (Reynolds *et al.*, 1993).

RUSSIAN FEDERATION: Dried leaf official in the *State Pharmacopoeia of the Union of Soviet Socialist Republics*, Ph.USSR X (Bradley, 1992; Reynolds *et al.*, 1993).

SWEDEN: Classified as a natural remedy intended for self-medication, requiring premarketing authorization. A monograph for a peppermint-containing muliple-herb product, Uva-E tablet, is published in the Medical Products Agency (MPA) "Authorised Natural Remedies" (MPA, 1998, 2001; WHO, 1998).

SWITZERLAND: Dried leaf official in *Swiss Pharmacopoeia* Ph.Helv.VII (Reynolds *et al.*, 1993; Wichtl, 1997). Peppermint oil is a Category C nonprescription drug with sale limited to pharmacies. Peppermint tea is a Category D nonprescription drug with sale limited to pharmacies and drugstores (Morant and Ruppanner, 2001; WHO, 1998).

U.K.: Herbal medicine for oral use. *General Sale List*, Schedule 1, Table A (Bradley, 1992; Wichtl and Bisset, 1994). Peppermint leaf and oil official in the *British Pharmacopoeia*, BP 1993 (Health Canada, 1996).

U.S.: Generally Recognized as Safe (GRAS) (US FDA, 1998). Dietary supplement or conventional food depending on label claim statement (USC, 1994). Peppermint leaf and oil have official monographs in the *National Formulary*. Peppermint water and peppermint spirit have official monographs in the *United States Pharmacopeia* (USP, 2002).

Clinical Review

Twenty-three studies (1,185 total participants) are outlined in the following table, "Clinical Studies on Peppermint." All but one of these studies (Nash, *et al.,* 1986) demonstrated positive results for various gastrointestinal and neurological conditions. Included are 14 double-blind (DB) studies investigating treatment of non-ulcer or functional dyspepsia (Freise and Köhler, 1999; Madisch *et al.*, 1999; May *et al.*, 1996, 2000), IBS (Liu *et al.,* 1997; Carling *et al.*, 1989; Lawson *et al.*, 1988; Nash *et al.*, 1986; Dew *et al.*, 1984; Rees *et al.*, 1979); spasm during barium enema (Sparks *et al.*, 1995); and tension headaches (Göbel *et al.*, 1994, 1996). In 1998, a meta-analysis of DB, placebo-controlled trials indicated that peppermint oil could provide symptomatic relief of IBS, though the authors cited methodological flaws in most of the studies (Pittler and Ernst, 1998). In 2000, a systematic review of randomized, controlled trials concluded that peppermint oil for irritable bowel syndrome requires further study (Jailwala *et al.*, 2000).

Branded Products*

Colpermin®: Tillotts Pharma AG / Hauptstrasse 27 / CH–4417 Zeifen / Switzerland / Tel: +41–61–935–2626 / Fax: +41–61–935–2625. Enteric-coated capsules containing 187 mg (0.2 ml) peppermint leaf oil with 368 mg excipients per capsule, and E 132 coloring agent.

Enteroplant®: Dr. Willmar Schwabe Pharmaceuticals / International Division / Willmar Schwabe Str. 4 / D-76227 Karlsruhe / Germany / Tel: +49-721-4005 ext. 294 / www.schwabepharma.com / Email: melville–eaves@schwabe.de. Enteric-coated capsules containing 90 mg peppermint leaf oil and 50 mg caraway seed oil.

Euminz®: Lichtwer Pharma AG / Wallenroder Strasse 8-14 / 13435 Berlin / Germany / Tel: +49-30-40-3700 / Fax: +49-30-40-3704-49 / www.lichtwer.de. Liquid preparation containing 10 g of peppermint leaf oil and ethanol (90%).

Peppermint oil BP: Manufacturer information unavailable.

*American equivalents, if any, are found in the Product Table beginning on page 398.

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Clinical Studies on Peppermint (*Mentha* x *piperita* L.)

Gastrointestinal

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Tate, 1997	Postoperative nausea	R, PC, Cm n=18 patients undergoing major gynecological surgery	3 days (day of operation and 2 postoperative days)	Essential peppermint oil vs. peppermint essence (placebo) vs. no treatment	Peppermint oil vs. peppermint essence (placebo) vs. no treatment	Statistically significant differences were demonstrated on day of operation using Kruskal-Wallis test ($p=0.0487$). Using Mann-Whitney U-test, a difference between placebo and experimental groups was shown ($U=3$; $p=0.02$). Experimental group required less conventional antiemetics and received more opioid analgesia postoperatively. Author concludes that peppermint oil may improve postoperative nausea in gynecological patients.
Liu *et al.*, 1997	Irritable bowel syndrome (IBS)	P, R, DB, PC n=110	4 weeks	1 capsule, 3–4x/day, 15–30 minutes before meals vs. placebo	Colpermin® enteric-coated capsule containing 187 mg peppermint oil vs. placebo	Using Mann-Whitney U-test, symptom improvement in peppermint oil group was significantly better ($p<0.05$) compared to placebo. In peppermint group 79% experienced alleviation of severity of abdominal pain (29 were pain-free); 83% had less abdominal distension, 83% had reduced stool frequency; 73% had fewer borborygmi; 79% had less flatulence. Colpermin® peppermint leaf oil was effective and well-tolerated.
Sparks *et al.*, 1995	Spasm during barium enema	R, DB, C n=141 mean age=60 years	3 days bowel preparation before 1 day treatment and examination	Barium suspension with added peppermint oil, 1x/day vs. standard barium sulfate	Barium suspension with 370 ml water and 30 ml peppermint preparation (16 ml peppermint oil BP and 0.4 ml polysorbate) plus 10 ml peppermint preparation added to enema tubing	Significant decrease in spasm was observed in treatment group (60%) compared with control group (35%) ($p<0.001$). Fewer in peppermint group required intravenous buscopan (5 vs. 9) or exhibited spasm (23 vs. 39). Authors concluded that addition of peppermint oil to barium suspension appears to reduce incidence of colonic spasm during examination. Technique is simple, safe and economical and may lessen the need for intravenous administration of spasmolytic agents.
Shaw *et al.*, 1991	Irritable bowel syndrome (IBS)	R, C n=35	Average of 6, 40-minute sessions with physiotherapist over 6 months	40 minutes of stress management with physiotherapist vs. Colpermin® 3x/day	Stress management program vs. treatment with Colpermin® enteric-coated capsule containing 187 mg peppermint oil vs. conventional management	Two-thirds of patients enrolled in the stress management program found it effective in relieving symptoms ($p<0.002$) and experienced fewer attacks ($p<0.004$), of less severity, with benefit maintained for at least 12 months compared to the Colpermin® group.
Fernández, 1990	Irritable bowel syndrome (IBS)	O, MC n=50	4 weeks	1 capsule, 3x/day 30 minutes before meals	Capsule containing 0.2 ml peppermint oil	Evaluation of all signs and symptoms, both pre-treatment and post-treatment, confirmed statistically significant decrease of symptoms.
McKenzie and Gallacher, 1989	Trial 1: Fecal odor in colostomy bags; Trial 2: Effect on colostomy acceptance	O, U Trial 1: n=10 patients, Trial 2: n=20 patients	Trial 1: 1 day Trial 2: 3 days starting on third post-operative day	1 capsule, 3x/day	Enteric-coated capsule containing peppermint oil in a thixotropic paste (brand not stated)	Trial 1: Contents of colostomy bags were checked for intact or partially digested capsules and for smell of peppermint. Only one patient passed capsule unchanged. Trial 2: 14 of 20 patients found odor improved and 1 found it worse. 15 found their colostomies more acceptable and wished to continue taking peppermint. Consistency of feces and frequency of bag-changing appeared to improve.
Carling *et al.*, 1989	Irritable bowel syndrome (IBS)	R, DB, CO n=40	2 weeks		Enteric-coated capsule containing 0.2 ml peppermint oil vs. 0.2 mg hyoscyamine or placebo	Peppermint oil treatment tended to have more pronounced effect on symptoms than placebo or hyoscyamine but was not statistically significant. Findings favor the short-term use of enteric-coated peppermint oil as an antispasmodic for IBS.

KEY: C – controlled, **CC** – case-control, **CH** – cohort, **CI** – confidence interval, **Cm** – comparison, **CO** – crossover, **CS** – cross-sectional, **DB** – double-blind, **E** – epidemiological, **LC** – longitudinal cohort, **MA** – meta-analysis, **MC** – multi-center, **n** – number of patients, **O** – open, **OB** – observational, **OL** – open label, **OR** – odds ratio, **P** – prospective, **PB** – patient-blind, **PC** – placebo-controlled, **PG** – parallel group, **PS** – pilot study, **R** – randomized, **RC** – reference-controlled, **RCS** – retrospective cross-sectional, **RS** - retrospective, **S** – surveillance, **SB** – single-blind, **SC** – single-center, **U** – uncontrolled, **UP** – unpublished, **VC** – vehicle-controlled.

Clinical Studies on Peppermint (*Mentha* x *piperita* L.) (cont.)

Gastrointestinal (cont.)

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Lawson *et al.*, 1988	Irritable bowel syndrome (IBS)	R, DB, CO n=18	4 weeks	3 capsules, 3x/day	Enteric-coated capsule containing 0.2 ml peppermint oil (brand not stated)	Peppermint group had small, but statistically significant increase in frequency of defecation but no significant change in scores for global severity of symptoms or scores for specific symptoms of pain, bloating, urgent defecation, and sensation of incomplete evacuation.
Nash *et al.*, 1986	Irritable bowel syndrome (IBS)	R, DB, PC, CO n=34	4 weeks	2 capsules, 3x/day	Capsule containing 0.2 ml peppermint oil vs. placebo Colpermin®	In terms of overall symptoms, patients' assessments at end of 2 and 4 weeks of treatment showed no significant difference between peppermint oil and placebo.
Dew *et al.*, 1984	Irritable bowel syndrome (IBS)	R, DB, PC, CO, MC n=29 mean age 42 years	2 weeks	1–2 capsules, 3x/day depending on severity of symptoms	Elanco LOK gelatin capsules containing 0.2 ml peppermint oil coated with cellulose acetate phthalate vs. placebo capsules containing 0.2 ml of arachis oil.	Patients in peppermint group were relieved of symptoms, while the number of their daily bowel movements was unaffected. Patients felt significantly better while taking peppermint compared with placebo ($p<0.001$) and considered peppermint better than placebo in relieving abdominal symptoms ($p<0.001$). Study suggested beneficial effect of peppermint for treatment of IBS based on patient data.
Somerville *et al.*, 1984	Pharmacokinetics of peppermint oil in spastic colon syndrome	Cm, U n=12 6 healthy volunteers (17–37 years) and 6 ileostomy patients (22–49 years)	24 hours	2 capsules, 3x/day	Colpermin® enteric-coated capsule containing 187 mg peppermint oil vs. peppermint oil in soft-gel capsules	Total 24-hour urinary excretion of menthol was similar in both preparations, but peak menthol excretion levels were lower and were delayed with enteric-coated capsule vs. soft gelatin capsules. Menthol excretion was reduced in ileostomy patients taking enteric-coated capsules, and moderate amounts of unmetabolized menthol were recovered from ileostomy effluent. Enteric-coated capsules can deliver unmetabolized oil directly to the colon.
Leicester and Hunt, 1982	Colonic spasm during endoscopy	U n=20	1 day	Peppermint oil injected along the biopsy channel of colonoscope into lumen of colon, 1x	Peppermint oil BP	Peppermint oil caused a relaxant effect on gastrointestinal tract that relieved colonic spasms within 30 seconds after injection in all 20 patients, allowing easier passage of the instrument or assisting in polypectomy.
Duthie, 1981	Colonic motility	R, PC, CO n=6	1 day	Peppermint oil injected into the lumen of the colon, 1x	Peppermint oil 0.2 ml in 50 ml of 0.9% sodium chloride with 1 in 10,000 polysorbate as suspending agent vs. vehicle alone (placebo)	Period of inhibition of all motor activity in all 6 subjects began within 2 minutes of peppermint oil administration lasting 7–23 minutes (mean 12 minutes). Decrease in percentage activity and motility index seen in all 6 subjects during first 10 minutes after introducing oil. Differences were statistically significant (actual statistics not stated). Decrease in motility index 10–20 minutes after oil was also statistically significant.
Rees *et al.*, 1979	Irritable bowel syndrome (IBS)	DB, PC, CO n=16	6 weeks (3 weeks each)	1–2 capsules, 3x/day depending on severity of symptoms	Elanco LOK gelatin capsules containing 0.2 ml peppermint oil coated with cellulose acetate phthalate vs. placebo capsules containing 0.2 ml of arachis oil	Overall assessment showed that patients felt significantly better ($p<0.01$) during peppermint treatment period compared to placebo and considered peppermint oil more effective than placebo in relieving abdominal symptoms ($p<0.005$).

KEY: C – controlled, **CC** – case-control, **CH** – cohort, **CI** – confidence interval, **Cm** – comparison, **CO** – crossover, **CS** – cross-sectional, **DB** – double-blind, **E** – epidemiological, **LC** – longitudinal cohort, **MA** – meta-analysis, **MC** – multi-center, **n** – number of patients, **O** – open, **OB** – observational, **OL** – open label, **OR** – odds ratio, **P** – prospective, **PB** – patient-blind, **PC** – placebo-controlled, **PG** – parallel group, **PS** – pilot study, **R** – randomized, **RC** – reference-controlled, **RCS** – retrospective cross-sectional, **RS** - retrospective, **S** – surveillance, **SB** – single-blind, **SC** – single-center, **U** – uncontrolled, **UP** – unpublished, **VC** – vehicle-controlled.

Clinical Studies on Peppermint (*Mentha* x *piperita* L.) (cont.)

Gastrointestinal

Combination Preparations

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Micklefield *et al.*, 2000	Gastro-duodenal motility	P, C, Cm, CO n=6 healthy volunteers (24–40 years)	1 day	1 capsule/day	Enteroplant® enteric-coated capsule; 90 mg peppermint oil and 50 mg caraway oil vs. non-enteric-coated capsule of peppermint-caraway oil combination	Both enteric-coated and non-enteric-coated preparations have effects on migrating motor complex (MMC), primarily a decrease in the number of contractions and contraction amplitudes. Non-enteric-coated preparation shows effect mainly during first MMC after administration, and enteric-coated preparation has a temporarily delayed effect during the second MMC after administration. Authors conclude that both preparations are safe, acting locally to cause smooth muscle relaxation. No adverse effects were noted.
Freise and Köhler, 1999	Non-ulcer dyspepsia	P, Cm, R, DB, C, MC n=223	29 days plus a 1-week washout phase before study	1 capsule, 3x/day with water before meals	Enteroplant® enteric-coated capsule; 90 mg peppermint oil and 50 mg caraway seed oil vs. enteric-soluble formulation containing 36 mg peppermint oil and 20 mg caraway oil	Statistically significant decline in pain intensity observed in both groups. Equivalent efficacy of both preparations was demonstrated ($p<0.001$). Concomitant variable results were similar in both groups. Test preparation significantly better ($p= 0.04$) in pain frequency. Authors conclude that the enteric-coated capsule provides an advantage over the acid-soluble formulation because it not only reduces pain intensity, it also potentially decreases the number of side effects, including nausea and eructation, with peppermint taste.
Madisch *et al.*, 1999	Functional dyspepsia	Cm, R, DB, C, MC n=118	4 weeks plus a 1-week washout phase before study	1 capsule, 2x/day with water, morning and noon, plus 1 placebo capsule/day in evening vs. 10 mg cisapride, 3x/day before meals	Enteroplant® enteric-coated capsule; 90 mg peppermint oil and 50 mg caraway seed oil vs. prokinetic agent Propulsid® cisapride	Reduction in visual analogue scale (VAS) pain intensity scores was comparable with drop of 4.62 points in peppermint/caraway group and 4.60 points in cisapride group ($p=0.021$). Reduction in frequency of VAS pain scores was equivalent by week 4 ($p=0.0034$). Flatulence decreased in peppermint group by 71.8% and 65.7% in cisapride group. Treating physicians concluded that 78.6% of peppermint group were very much or much improved compared to 70.9% in cisapride group. Peppermint/caraway oil preparation provides comparable effect to cisapride, is well-tolerated, is only one quarter the cost of cisapride therapy, and has fewer potential side effects.
May *et al.*, 1996	Non-ulcer dyspepsia for at least 14 days	R, DB, PC, PG, MC n=45 mean age Enteroplant group=42 years, mean age placebo=47 years	4 weeks	1 capsule, 3x/day with water before meals	Enteroplant® enteric-coated capsule; 90 mg peppermint oil and 50 mg caraway seed oil vs. placebo	Clinical Global Impression (CGI) values were improved in 94.7% of treatment group vs. 55% placebo group ($p=0.004$). In treatment group, 63.2% were pain-free compared to only 25% in placebo group ($p=0.005$). Improvement in pain intensity was 89.5% in treatment group vs. 45% in placebo group ($p=0.015$). Authors conclude that treatment was equally successful for patients diagnosed with IBS and dyspepsia and that Enteroplant® has a risk-to-benefit ratio more favorable than standard treatment with synthetic chemical medicaments.
May *et al.*, 2000	Functional dyspepsia	R, DB, PC n=96	4 weeks	1 capsule, 2x/day with water before meals	Enteroplant® (PCC) enteric-coated capsule; 90 mg peppermint oil and 50 mg caraway seed oil vs. placebo	Primary efficacy variables were the intra-individual change in (1) pain intensity, and (2) sensation of pressure, heaviness, and fullness between days 1 and 29, and the investigators' rating of (3) global improvement (Clinical Global Impressions [CGI] item 2) on day 29. The average intensity of pain was reduced by 40% vs. baseline in the PCC group and by 22% in the placebo group. Regarding pressure, heaviness, and fullness, a 43% reduction was observed for PCC vs. 22% for placebo. In CGI item 2, 67% (PCC) vs. 21% (placebo) of patients were described as much or very much improved. In all three target parameters, the superiority of PCC over a placebo was statistically significant.

KEY: C – controlled, **CC** – case-control, **CH** – cohort, **CI** – confidence interval, **Cm** – comparison, **CO** – crossover, **CS** – cross-sectional, **DB** – double-blind, **E** – epidemiological, **LC** – longitudinal cohort, **MA** – meta-analysis, **MC** – multi-center, **n** – number of patients, **O** – open, **OB** – observational, **OL** – open label, **OR** – odds ratio, **P** – prospective, **PB** – patient-blind, **PC** – placebo-controlled, **PG** – parallel group, **PS** – pilot study, **R** – randomized, **RC** – reference-controlled, **RCS** – retrospective cross-sectional, **RS** - retrospective, **S** – surveillance, **SB** – single-blind, **SC** – single-center, **U** – uncontrolled, **UP** – unpublished, **VC** – vehicle-controlled.

Clinical Studies on Peppermint (*Mentha* x *piperita* L.) (cont.)

Neurology, Psychiatry

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Sullivan *et al.*, 1998	Effects on vigilance performance in brain injury	R, C n=40 patients with brain injury	30-minute vigilance task	Periodic whiffs of peppermint-scented air delivered by pumps that force air through plastic tubing into a glass reservoir	Peppermint-scented air vs. unscented air	Under fragrance conditions, controls reduced frequency of commissive errors (false alarms) over course of vigil, an adaptive strategy given the low probability of signals employed. False alarm rate of observers with brain injury increased precipitously toward end of vigil in unscented air condition. Exposure to scent of peppermint rendered false alarm scores of observers with brain injury similar to controls, a result that is consistent with evidence that olfactory stimulation activates brain areas vital for planning and judgement.
Göbel *et al.*, 1996	Tension headaches	R, DB, PC, Cm, CO n=41 male and female patients (18–65 years)	Four headache episodes per patient	Topical application of peppermint oil or placebo solution to forehead and temples, repeated 1x after 15 or 30 minutes vs. oral 1,000 mg acetaminophen or 1,000 mg placebo vs. simultaneous application of 1,000 mg acetaminophen and 10% peppermint oil in ethanol solution	Euminz® (containing 10 g peppermint oil with ethanol 90%) vs. Paracetamol® (500 mg acetaminophen) vs. 90% ethanol solution with traces of peppermint oil for blinding purposes	Study involved analyses of 164 headache attacks of patients suffering from tension headaches. Compared to placebo, peppermint leaf oil significantly reduced clinical headache intensity within 15 minutes ($p<0.01$) with a continuing effect over the one hour observation period. No significant difference between acetaminophen and peppermint. Simultaneous acetaminophen and peppermint use did not result in significant additive effect. Authors conclude that peppermint oil efficiently alleviates tension-type headaches as well as acetaminophen. It is well-tolerated and a cost-effective alternative to conventional therapies.
Göbel *et al.*, 1994	Neurophysiological, psychological, and experimental algesimetric parameters	Cm, CO, R, DB, PC n=32 healthy subjects	1 day	Oil and ethanol mixture applied to forehead and temples with small sponge	Peppermint oil and ethanol vs. peppermint oil with eucalyptus oil and ethanol vs. placebo (brands not stated)	Peppermint oil demonstrated significant analgesic effect with reduction in sensitivity to headache. Peppermint oil with eucalyptus oil had little influence on pain sensitivity but increased cognitive performance and had a muscle-relaxing and mentally relaxing effect.
Warm *et al.*, 1991	Effects on signal detectability in tasks demanding sustained attention	R, C n=36 college students (men and women with normal or corrected-to-normal vision)	40 minutes divided into 4 consecutive 10-minute periods	Repeated exposure time of 150 milliseconds per 10-minute period	Peppermint-scented air vs. muguet-scented air (International Flavors and Fragrances, Inc.) vs. unscented air	A statistical difference was found between groups exposed to air scented with fragrance of peppermint ($p<0.05$) or muguet ($p<0.05$) vs. placebo. Authors concluded that this scented air can enhance rate of signal detections in a vigilance task without a concomitant increase in errors of commission vs. placebo. It is suggested that exposure to fragrance may serve as an effective form of ancillary stimulation in tasks demanding close attention for prolonged periods.

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