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Review Article

AN OVERVIEW ON MENTHAE PIPERITAE (PEPPERMINT OIL)

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ABSTRACT

Aetheroleum Menthae Piperitae is the essential oil obtained by steam distillation of the fresh overground parts of *Mentha* x *piperita* L. (Lamiaceae). It colourless, pale yellow or pale greenish-yellow liquid, The monoterpene content determined by gas chromatography should be 1,8-cineole (6–14%), limonene (1–5%), menthone (14–32%), menthofuran (1–9%), isomenthone (2–10%), menthyl acetate (3–5%), menthol (30–55%), pulegone. The major constituents are menthol (30–55%) and menthone (14–32%). Menthol occurs mostly in the free alcohol form, with small quantities as the acetate (3–5%) and valerate esters. Other monoterpenes present include isomenthone (2–10%), 1,8-cineole (6–14%), a-pinene (1.0–1.5%), b-pinene (1–2%), limonene (1–5%), neomenthol (2.5–3.5%) and menthofuran (1–9%). Internally for symptomatic treatment of irritable bowel syndrome, and digestive disorders such as flatulence and gastritis dysentery, diabetes, dysmenorrhoea, fevers, jaundice, urinary infections. Externally for treatment of myalgia and headache.

Keywords: Mentha, essential oil, menthol.

INTRODUCTION

Aetheroleum Menthae Piperitae[1] is the essential oil obtained by steam distillation of the fresh overground parts of *Mentha* x *piperita* L. (Lamiaceae)[1], which is found on the under sides of the leaves and is generally followed by rectification and fractionation before use and the yield is 0.1-1.0%. The oil is found on the undersides of the leaves, is extracted by steam distillation and is generally followed by rectification and fractionation before use.[2]

Synonyms: *Mentha piperita* (L.) Huds., *M. piperita* Stokes, *M. balsamea* Willd.

Selected Vernacular Names: Amentha, american mint, balm mint, brandy mint, cabra-caa, curled mint, dounmenta piperita, hierbabuena, hortela pimenta, Katzenkraut, lamb mint, lamenta, lamint, mentapiemonte, mentea peperina, mentha pepe, menthe, menthe anglaise, menthepoivrée, moto yuyo, nána, ni naa, ni'na el fulfully, pepermin, pepper mint, peppermint, Pfefferminze, Pfefferminzblätter, piperita, pudeena, pum hub, yerba mota.

Geographical Distribution: Commercially cultivated in eastern and northern Europe and the United States of America, and is found in Africa.

Description: A perennial herb, 30–90cm high. Stems square erect or ascending, branched, the upper portion always quadrangular. Leaves opposite, petiolate, ovate-oblong to oblong-lanceolate, serrate, pointed; dark green on the upper surface. Flowers purplish, occur in thick, terminal, spicoid racemes of verticillasters; each flower shows a tubular calyx with 5 sharp, hairy teeth, a purplish, irregular, 4-cleft corolla, 4 short stamens, a 4-celled ovary and a projecting style ending in a bifid stigma. Fruit consists of 4 ellipsoidal nutlets.

STANDARDS[1]

Peppermint Oil contains less than 4.5%w/w and not more than 10%w/w of esters, calculated

asmethyl acetate, $C_{12}H_{22}O_2$, not less than 44% w/w of free alcohols, calculated as menthol, $C_{10}H_{20}O$, and not less than 15%w/w and not more than 32%w/w of ketones, calculated as menthone, $C_{10}H_{18}O$.

EVALUATION: ESSENTIAL OIL
International Pharmacopoeia monograph[3]

General appearance: A colourless, pale yellow or pale greenish-yellow liquid.

Organoleptic properties: Odour: characteristic, penetrating; taste: characteristic, pungent, followed by a sensation of cold.
Acid value: not more than 1.5, determined on 5.0g diluted in 50ml of the prescribed mixture of the solvents.
Relative density: 0.900-0.916
Reflective Index: 1.457-1.467
Optical rotation: -10° to-30°

Fatty oils and resinified essential oil: complies with the test for fatty oils and resinified essential oils.

Solvent solubility: miscible with ethanol (96%), ether and methylene chloride.

General identity tests: Thin-layer and gas chromatography for characteristic monoterpene profiles.

Chemical assays: The monoterpene content determined by gas chromatography should be 1,8-cineole (6–14%), limonene (1–5%), menthone (14–32%), menthofuran (1–9%), isomenthone (2–10%), menthyl acetate (3–5%), menthol (30–55%), pulegone (not more than 4.0%) and carvone (not more than 1.0%). The ratio of 1, 8-cineole to limonene should be greater than 2.0.

MAJOR CHEMICAL CONSTITUENTS[3]
The major constituents are menthol (30–55%) and menthone (14–32%). Menthol occurs mostly in the free alcohol form, with small quantities as the acetate (3–5%) and valerate esters. Other monoterpenes present include isomenthone (2–10%), 1,8-cineole (6–14%), a-pinene (1.0–1.5%), b-pinene (1–2%), limonene (1–5%), neomenthol (2.5–3.5%) and menthofuran (1–9%).

CHROMATOGRAPHY[4]
Support-coated open-tubular (SCOT) glass capillary column (43 m x 0.5mm I.D.) coated with SP-1000 was fitted into an aluminium support cage. A Packard-Becker 419 gas chromatograph equipped with dual flame ionization detectors and dual injectors was used. The injection port temperature was 190°C and detector temperature 190°C. The multilinear temperature programmer was used as follows. Initial temperature of 64°C was held for 3 min, then the temperature was raised at 0.5ºC/min to 80ºC, then at 5ºC/min to the final temperature of 155ºC, with an isothermal hold of 12 min at 155°C. The carrier gas was helium at a flow-rate of *cu.* 2 ml/mm with nitrogen (18 ml/min) as make-up gas. Air flow was 300 ml/min and hydrogen flow 30 ml/min. The velocity of the carrier gas was about 21.5 cm/sec whilst the capacity ratio (k) of the column was 6.5 using docosane at 185C.

MEDICINAL USES
Uses supported by clinical data: Internally for symptomatic treatment of irritable bowel syndrome, and digestive disorders such as flatulence and gastritis. Externally for treatment of myalgia and headache.

Uses described in pharmacopoeias and in traditional systems of medicine: Internally and externally for the symptomatic treatment of catarrh and coughs.

Uses described in folk medicine, not supported by experimental or clinical data*:* Treatment of dysentery, diabetes, dysmenorrhoea, fevers, jaundice and urinary infections.

PHARMACOLOGY OF AETHEROLEUM MENTHAE PIPERIATA (PEPPERMINT OIL)
Experimental Pharmacology
Antimicrobial And Anti-Plasmid Activity[5]**:** The antimicrobial activities were determined on the Gram (+) Staphylococcus epidermidis and the Gram (-) Escherichia coli F'lac K12 LE140, and on two yeast Saccharomyces cerevisiae 0425 delta/1 and 0425 52C strains. Aetheroleum Menthae Piperitae inhibited the growth in vitro of *Staphylococcusaureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Enterococcus faecalis* and *Escherichia coli,* but did not affect the growth of *Bacillus cereus*, *Penicillium cyclopium*or or *Aspergillus aegyptiacus.* The essential oil inhibited the growth in vitroof *Trichophyton equinum* and *T. rubrum* (at a concentration of 0.4mg/ml) *Aspergillus flavus*, *A. fumigatus* and *A. niger.* The antiplasmid activities were investigated on E. coli F'lac bacterial strain. Each of the oils exhibited antimicrobial activity and three of them antiplasmid action. Experiments proved the antiplasmid activity of peppermint oil and its main constituent, menthol, which means that

mentholcontaining substances are potential agents that could eliminate the resistance plasmids of bacteria.

Antispasmodic Activity[6]: Peppermint oil exhibited antispasmodic activity on rat trachea involving prostaglandins and nitric oxide synthase. The essential oil had smooth muscle relaxant activity in guinea-pig ileum (ED_{50} 26.0mg/l) and trachea (ED_{50} 87.0mg/l) in vitro, and inhibited electrically induced contractions of guinea-pig ileum (IC_{50} 0.176mg/ml) in vitro. The essential oil decreased both the number and amplitude of spontaneous contractions, and inhibited spasms induced by barium chloride, pilocarpine and physostigmine in isolated segments of rabbit and cat ileum (inhibitory concentrations 0.05mg/ml). The essential oil (0.5mmol/l) inhibited smooth muscle contractions of guinea-pig ileum in vitro induced by barium chloride, carbachol, histamine and potassium chloride. Both the essential oil and menthol act as calcium antagonists, since they inhibited the influx of calcium ions through smooth muscle of guinea-pig ileum and taenia coli isolated from humans. The essential oil and menthol inhibited smooth muscle contractions of guinea-pig ileum induced by potassium chloride (IC_{50} 28.1 and 21mg/ml, respectively) and induced electrically (11.5 and 7.7mg/ml, respectively). Both also inhibited Ca^{2+}uptake induced by potassium ion-dependent depolarization in brain synaptosomes and retinal neurons, and inhibited specific binding of [^{3}H] nitrendipine to ileal smooth muscle, synaptosomes and retinal neurons. The essential oil relaxed carbachol-contracted guinea-pig taenia coli (IC_{50}22.1mg/ml), and inhibited spontaneous contractions in isolated guinea-pig colon (IC_{50}25.9mg/ml) and rabbit jejunum (IC_{50}15.2mg/ml). The essential oil also attenuated contractile responses in guinea-pig taenia coli induced by acetylcholine, histamine, serotonin (5-hydroxytryptamine) and substance P. Contraction of Oddi's sphincter induced by morphine was reversed after intravenous administration of the essential oil to guinea-pigs (1.0mg/kg body weight). However, intravenous injection of the essential oil to guinea-pigs (25mg/kg body weight) was found to increase spasms of the sphincter. Intragastric administration of the essential oil exhibited cholagogic activity in rats. This activity was attributed to (-)-menthol, a major constituent of the essential oil.

Hot Flushes In Women[7]

A single-blind randomized control crossover study was performed to look at the effect of a peppermint and neroli hydrolat spray on hot flushes in women being treated for breast cancer.

Only 18 of the 44 patients (41%) preferred the hydrolat spray to a plain water spray, which was less than the 80% required to offer this spray as a standard suggestion for hot flush management. However a small number of those choosing it found it extremely helpful. Both sprays appeared to lessen hot flush annoyance. Previous chemotherapy appeared to be a factor influencing the choice of spray.

CLINICAL PHARMACOLOGY

Antispasmodic Activity

Irritable bowel syndrome[8]: Small intestine bacterial overgrowth and lactose intolerance are associated with increased gas production, which may sometimes trigger abdominal discomfort and bloating which are also considered the cardinal symptoms in IBS.

Aetheroleum Menthae Piperitae is a carminative with antispasmodic activity that reduces intracolonic pressure. In an open study of 20 patients, an aqueous suspension of peppermint oil (British Pharmacopoeia Standard) injected along the biopsy channel of a colonoscope relieved colonic spasms within 30 seconds, allowing easier passage of the instrument or facilitating polypectomy. The essential oil relaxed the oesophageal sphincter when administered orally (15 drops [about 0.88ml] oil in 30ml water), decreasing the pressure differential between the stomach and oesophagus, and allowing reflux to occur.

Administration of the essential oils to patients undergoing barium enemas relieved the associated colonic spasms. However, two earlier trials failed to confirm the antispasmodic and analgesic activity of the essential oil in the treatment of irritable bowel syndrome. A double-blind, placebo controlled trial assessed the effects of peppermint oil in 34 patients with symptoms of irritable bowel syndrome. After 4 weeks of treatment with two capsules containing either 0.2ml essential oil or a placebo three times daily, patients treated with the essential oil showed no significant difference in their overall symptoms, as compared with those who received the placebo treatment[9].

Postoperative Nausea

Tate[10] demonstrated that inhalation of peppermint oil vapors significantly reduced postoperative nausea and the requirement for pharmacologic antiemetics following gynecologic surgery. Inhalation of isopropyl alcohol vapors is a South American folk remedy for nausea. More recently, its use has been

advocated for transport-related nausea1 as well as for PONV in children and adults.[11] Winston et all[12] found that isopropyl alcohol inhalation relieved PONV more rapidly than ondansetron 4 mg IV, but a placebo group was not studied. A randomized, double blind, placebo-controlled study[13] on 33 surgery patients indicate that initial treatment of postoperative nausea with aromatherapy reduces patients' subjective perception of nausea and IV antiemetic use in the PACU by nearly 50%.

GENOTOXICITY

Anderson and Jenson[14] (1984) found no mutagenicty of peppermint essential oil in the salmonella/ microsomes assay. Essential oil of menthe spicata L. appeared to be slight genotoxic[15]. In human lymphocytes peppermint oil was found to be cytotoxic and induced chromosomes aberrations only when inhibition of mitotic activity was 70% or higher

CONTRAINDICATIONS[16]

Preparations of Aetheroleum Menthae Piperitae should not be used internally by patients with inflammation of the gastrointestinal tract or gall bladder, or with impaired liver function. Hypersensitivity to the essential oil has been reported.

INDIGESTION[17]

Adding few drops of peppermint essential oil in a glass of water and drinking it after meals gives relief from indigestive properties. This oil acts as carminative and helps effectively in removing the gas.

PRECAUTIONS

Peppermint oil is non-toxic and non-irritant in low dilutions, but sensitization may be a problem due to the menthol content.It can cause irritation to the skin and mucus membranes and should be kept well away from the eyes. It should be avoided during pregnancy and should not be used on children under seven.[16] Peppermint oil in any form is not recommended for those with hernia, gallbladder disease or while pregnant
or nursing.[17] Overdose symptoms of peppermint oil[18] are Slow breathing, Rapid breathing, Abdominal pain, Diarrhea, Nausea, Vomiting, Blood in urine, No urine production, Convulsions, Depression, Dizziness, Twitching, Unconsciousness, Uncoordinated movement and Flushing.

ADVERSE REACTIONS

Case report of 58 years women smoked heavily changed to menthol containing cigarettes. After three months she became irritable and quarrelsome, in contrast to her former placid good-natured state, and had gastrointestinal upset with occasional vomiting. Her speech became thick and she developed a tremor of the hand and an unsteady gait. On one occasion mental confusion and depression occurred and she was admitted to hospital with a toxic psychosis that was considered to be due to menthol addiction. Within 17 days of the withdrawal of menthol cigarettes, she became normal in every respect without
specific treatment.[19]

One more case report of acute lung injury[20] following IV injection of peppermint oil by 18 year old women developed fulminant pulmonary edema, presumably due to direct toxicity and a resultant increase in pulmonary vascular permeability.

DOSAGE FORMS[21]

Average daily dose: 6-12 drops
For inhalation: 3-4 drops in hot water
For irritable colon: Average single dose 0.2 ml

CONTRAINDICATIONS[22]

Obstruction of bile ducts, gall bladder inflammation, severe liver damage. In case gall stones, to be used only after the consultant of physician.

ADULTERATION[23]

Peppermint oil can be adulterated by addition of much cheaper cornmint oil (Mentha arvensis).

STORAGE[24]

Store in well-filled, tightly-closed, light-resistant containers in a cool place.

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