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REVIEW

Pharmacological activity of Mentha longifolia and its phytoconstituents

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Abstract

Current paper reviews the pharmacological activities, therapeutic indications and phytochemicals of M. longifolia. This herb has been consumed traditionally for the treatment of various diseases, including gastrointestinal disorders, respiratory disorders, infectious diseases, inflammatory diseases, as well as menstrual disorders. In the modern era, various pharmacological activities have been confirmed for M. longifolia, such as anti-parasitic, antimicrobial, anti-insect, antimutagenic, antinociceptive, anti-inflammatory, antioxidant, keratoprotective, hepatoprotective, anti-diarrhea, and spasmolytic effects. The plant showed therapeutic benefits in irritable bowel syndrome, amenorrhea and oligomenorrhea, and oxidative stress-associated diseases as well. A vast variety of natural components such as flavonoids, phenolic acids, cinnamates, ceramides, sesquiterpenes, terpenes, and terpenoids have been suggested to be responsible for the pharmacological action of M. longifolia. These natural products can be considered as novel medicinal sources for developing new drugs. Further investigations to explore therapeutic efficacy, tolerability, and pharmaceutical properties of M. longifolia phytochemical agents are recommended.

Keywords: Mentha; Phytochemicals; Ethnopharmacology; Review

INTRODUCTION

Restrictions in the conventional medical management of diseases indicate an obvious necessity for safe and efficacious treatments. Herbal medicines and their elicited natural products could provide future treatments for various diseases.[1,2] One of the most beneficial medicinal plants with pharmacologically confirmed natural agents is Mentha longifolia L. [Lamiaceae (Labiatae)], commonly known as wild mint or horse mint. The plant's habitat is Southeast Asia, but it is also found in Iran, where called "Fudanaj" or "Pooneh" and is commonly consumed as a green vegetable and spice or additive with various foods.[2,3] Considering the widespread medicinal and nutritional use of M. longifolia in addition to the various other modern pharmacological and biological activities related to this plant and its phytochemicals, this study was conducted to discuss all medicinal and phytochemical aspects of M. longifolia.

Ethnopharmacological uses

M. longifolia has been consumed traditionally for the treatment of various diseases including gastrointestinal disorders, respiratory disorders, infectious diseases, inflammatory diseases, as well as menstrual disorders in different cultures of all over the world. In Turkish folk medicine, M. longifolia was used as an anti-parasitic, anthelmintic, antimicrobial, emmenagogue, carminative, and anti-emetic substance, and also for nausea, bronchitis, ulcerative colitis, and liver disorders.[4,5] In Jordanian folk medicine, it is used for constipation, fever, common cold and general weakness.[6] In Iraq, people use the leaves for sore throat, minor mouth and throat irritation, aches and sprains, and in nasal decongestants. It also possesses anti-pruritic, carminative and anti-septic properties.[7] Egyptians used the plant as an analgesic, anti-pyretic, sedative, digestive, wound-healing and anti-inflammatory medicament. M. longifolia is also believed to be useful in common cold and eye diseases and as insect repellent.[8] The plant is also consumed for diarrhea, gut spasm and other gastrointestinal disorders in Pakistani folk medicine.[9] In Iranian traditional and folk medicine, it has been consumed for sinusitis, bronchitis, common cold, cough, fever, indigestion, nausea, intestinal colic, gastroenteritis, peptic and intestinal ulcer, and menstrual disorders, and used as an appetizer, digestive, anti-spasmodic, antimicrobial and anti-diarrhea medicament.[2,3,10]

Phytochemicals

Table 1 shows the isolated secondary metabolites of M. longifolia in detail. In addition, Figure 1 illustrates the chemical structure of the main biologically active constituents of M. longifolia. Below are the main categories of the chemicals.

Flavonoids

Flavonoids, including apigenin-7-O-glucoside, apigenin-7-O-rutinoside, apigenin-7-O-glucoronide,[11] iso-orientin, hypolaetin,[12] 5, 3′ , 4′-trihydroxy-6,7,8-trimethoxyflavonen,[13] 5,7-dihydroxychromone 7-rutinoside, eriodictyol-7-rutinoside,[14] and longitin[15] were isolated from methanol extract of M. longifolia aerial parts. Some identified flavonoids of the plant are in glycosylated form. In addition to luteolin 7-O-neohesperidoside, three new flavone glycosides-tricetin 3′-O-rhamnosyl-(1 → 4)-rhamnoside, tricetin 3′-O glucoside 5′-O-rhamnoside and tricetin 7-O-methylether 3′-O glucoside 5′-O-rhamnoside, were first isolated by Sharaf *et al.* [12] Shaiq Ali *et al* [15] were able to isolate another new flavone glycoside, longitin. Krzyzanowska *et al* [16] studied polyphenolic glycosides including luteolin-glucopyranosyl-rhamnopyranoside and eriodictyol-glucopyranosyl-rhamnopyranoside in field plants, *in vitro* plants, callus tissues, and cell suspension cultures; though, the *in vitro* samples showed a significant decrease in the detected components. Lucenin-1, vicenin-2,[12] luteolin-diglucoronide, luteolin 7-O-rutinoside, luteolin 7-O-glucuronide, and luteolin 7-O-glucoside are other known glycosides found in M. longifolia.[17]

Essential oil components

Yields of essential oils in callus tissue (0.4% v/w) and *in vitro* plantlets (0.2% v/w) were lower than field plants (2.2% v/w for stems and 1.5% for leaves). Limonene and carvone were primary components of stem and leaf essential oils. Monoterpenes such as α-pinene, β-pinene, 1,8-cineole and ocimene were more readily found in stem rather than leaf.[18] Other monoterpenes, including menthol, menthone, menthofuran, menthyl acetate, myrcene, piperitenone, piperitone, sabinene, terpinene, terpineol, piperitenone oxide, p-cymene, linalool, γ-terpinene, iso-menthone, carvone oxide, carveol, borneol and carene have been identified in the oil. Sesquiterpenes like bicyclogermacrene, caryophyllene oxide, δ-cadinene, germacrene A, germacrene D, globulol, spathulenol, α-humulene, β-bourbonene, β-caryophyllene and β-elemene are among the detected volatile oil components. Terpenoids including pulegone (the precursor of menthol, menthone and menthofuran), dihydrocarvone, iso-pulegone and longifone, and terpenes like 4-terpineol, camphene, epi-α-cubenol, verbenone and α-cadinol, as well as methyl salicylate, allo-ocimene, cis-hexenyl iso-valerate, eugenol, camphelinone and dihydrotagetone are other detected components of M. longifolia essential oils.[15,18,19]

Miscellaneous constituents

The phenolic fraction of methanolic extract of aerial parts contains two cinnamates, salvianolic acid L and dedihydrosalvianolic acid, as well as rosmarinic acid, which is a phenolic compound.[16]

Longifoamide A {6'-tetracosenamide, (6'-Z)-N-[2, 3-dihydroxy-1-(hydroxymethyl) octadecyl]} and B {6'-tetracosenamide, (6'-Z)-N -[2,3,4-trihydroxy-1-(hydroxymethyl) octadecyl]} are two ceramides recently identified in methanolic extract of M. longifolia.[20]

Pharmacological activities and medicinal uses

Table 2 shows pharmacological effects and medicinal uses of M. longifolia and its phytochemicals in detail.

Antimicrobial, anti-parasitical and insecticidal effects

The essential oil exhibits strong and wide-spectrum antimicrobial activity against more than 16 types of bacteria and 15 types of fungi. Maximal inhibition zones and minimum inhibitory concentration (MIC) values of the essential oil against fungi species ranged 12-35 mm and 31.25-125 μg/mL, respectively. The ranges of maximal inhibition zones and MIC values of essential oil against sensitive bacteria were 8-22 mm and 15.62-125 μg/mL, respectively. Gulluce *et al* [4] suggested that cis-piperitone epoxide, piperitenone oxide, pulegone and menthone are the main active components of essential oil for this function. Al-Bayati *et al* [7] confirmed