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Short Communication

Phytopharmacological Updates on *Mentha longifolia*: A Comprehensive Review

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ABSTRACT
Wild mint, or *Mentha longifolia*, is a well-known folk treatment. This plant's parts have been employed in Iranian and other traditional medicines. Numerous researches have demonstrated the plant's numerous pharmacological and medicinal properties. In order to review the traditional applications of *M. longifolia* as well as the pharmacological and therapeutic properties of its complete extract and key components, we prepared this study. An herb called *Mentha longifolia* has a wide range of pharmacological activities, including effects on the neurological system, gastrointestinal tract, and bacteria. Using Google, PubMed, Scholar, and other web resources, data were gathered.

Keywords: *Mentha longifolia*, Medicinal, Gastrointestinal, Neurological, Herb.

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INTRODUCTION

Medicinal plants are those that contain compounds that can be utilised to treat ailments in one or more of their constituent components.[1] Plant-based medicines are well known for their efficacy, accessibility, and affordability.[2] Herbal remedies can be made from complete plant parts or mostly from the leaves, roots, bark, seeds, and flowers of various plants. They are applied topically, orally, or through inhalation.[3] The importance of medicinal herbs to both individual and collective health is greater. These plants' medical usefulness comes from their bioactive phytochemical components, which have defined physiological effects on the human body.[4] Alkaloids, essential oils, flavonoids, tannins, terpenoids, saponins, phenolic compounds, and many others are among the most significant bioactive phytochemical components.[5] These organic substances laid the groundwork for today's prescription medications.[6] As long as human civilization has existed, people have employed plant-based medicines to treat a variety of illnesses. By trial and error, the early man began to discern between beneficial and dangerous or deadly plants. Tribal people created a well-defined herbal pharmacopoeia based on knowledge gathered from the indigenous flora, religion, and culture. The cornerstone for traditional medicine around the world was the gradual development and transmission of knowledge about medicinal plants.[7]

In the Mediterranean region, Europe, Australia, and North Africa, wild mint (*Mentha longifolia* L. family *Lamiaceae*) is a common plant.[8-10] The plant is a variegated perennial that smells like peppermint. It has a creeping rhizome and 40–120 cm tall, straight to creeping stems. The leaves are green to greyish-green above and white below, oblong-elliptic to lanceolate, sparsely to thickly tomentose. Lilac, purplish, or white flowers measuring 3 to 5 mm long are produced in numerous clusters on spikes that are tall, branching, and tapered. *M. longifolia* is particularly utilised in cosmetics as well as the food, cigarette, and pharmaceutical industries. Various plant parts, such as the leaves, flower, stem, bark, and seeds, have also been used extensively in traditional folk medicine as antimicrobials, carminatives, stimulants, and antispasmodics as well as for the treatment of a wide range of illnesses, including migraines and digestive problems.[11] Many common ailments, including indigestion, flatulence, irritable bowel syndrome, coughs, the flu, nausea, gallbladder infections, skin and respiratory infections, headache, and many others, have historically been treated with extracts from *Mentha* species.[12]

Scientific Classification[13]

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Eudicots

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Clade: Asterids

Order: Lamiales

Family: Lamiaceae

Genus: *Mentha*

Species: *M. longifolia*

Synonyms: *Mentha spicata var. longifolia, Mentha spicata subsp. longifolia, Mentha incana, Mentha sylvestris.*[14]

Common name: Silver mint, horse mint, 欧薄荷

Habitat: Terrestrial, wetlands.[15]

Distribution

M. longifolia var. asiatica is native to Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan and Uzbekistan), Western Asia (Afghanistan, Iran and Iraq) and China (South Central China, Tibet and Xinjiang).[16]

Agriculture

The perennial herb known as Asian mint normally thrives in full sun to some shade. Asian mint thrives best on soil that retains moisture well throughout the year. It produces fragrant, beautiful purple blooms. Asian mint develops unusually coloured leaves that are opposite and evergreen, unlike the other members of the *Lamiaceaceae* family. Asian mint does well with transplanting and is appropriate for winter sowing. Similar to other mints, they rarely sprout from seed since mint seeds can vary greatly and some types are sterile. Cuttings from the roots, division, or even runners (stolons) from fully developed plants are easier methods of propagation.[17]

Traditional uses

M. longifolia is traditionally used as a treatment for colic, menstrual disorders, indigestion, flatulence, pulmonary infections and congestion, headaches, fever, coughs, colds, and urinary tract infections. *M. longifolia* is also used to relieve swelling and treat sores and minor wounds of the skin.[18] Margaret Roberts describes the various applications of *M. longifolia* and *M. aquatica*, which are great in salads and vegetable dishes, in her book Traditional healing herbs. She also cites the usage of *M. longifolia* subsp. capensis to deter mosquitoes by rubbing its potent scent across the body and bedding.[19,20]

Plant description

Wild mint, or *M. longifolia* (Figure 1), , is a perennial plant with a creeping rootstock that grows quickly. Although it is typically between 0.5 and 1 m height and even shorter in dry conditions, it can grow up to 1.5 m high in ideal circumstances. The leaves, which have a strong perfume, grow in pairs directly across from one another along the square stem. The lanceolate, velvety leaves range in size from 45 to 100 mL in length and measure 7 to 20 mL in width. The edges of the leaves often have few teeth and are coarsely hairy. The leaves range in hue from light to dark green to grey. *M. longifolia* produces spikes of tiny flowers at the ends of its stems. This wild mint blooms from November to April, and its blossoms range in colour from white to mauve.[21]

PHARMACOLOGICAL INVESTIGATION AND MOLECULAR ANALYSIS

Anti-microbial activity

M. longifolia is frequently used to treat mouth, throat, and throat irritation.[22] According to studies, the oxygenated monoterpenes present in the chemical makeup of *Mentha* plants provide them substantial antibacterial properties.[23-27] *M. longifolia* essential oil has demonstrated intriguing antimicrobial activity against *Escherichia coli, Salmonella typhimurium, Listeria monocytogenes, Botrytis cinerea, Fusarium oxysporum, Pseudomonas aeruginosa, Aspergillus niger, Trichophyton longifusus, Microsporm canis*, and *Mucor ramamnianus*, among other micro-organisms.[28-31] The essential oil of *M. longifolia* possesses anti-bacterial action that is stronger and more broad-spectrum than the methanolic extract, according to a clinical research comparing the two substances. Another *in vitro* investigation assessed the anti-protozoal activity of *M. longifolia* ethanolic extract against *Entamoeba histolytica* and *Giardia duodenalis trophozoites.*[32]

Effects on nervous system

The aqueous leaf extract of *M. longifolia* has been demonstrated in a study to have antinociceptive and antipyretic effects. The plant extract was administered to mice orally and intraperitoneally, and comparatively high LD_{50} values were found to validate this.[33] In another study, methanolic extracts of *M. longifolia* were tested for their possible protective effects against hydrogen-peroxide-induced toxicity in PC12 cells, antioxidant activity (by 2,

Figure 1: *Mentha longifolia*.

2'-azinobis (3-ethylbenzothiazoline-6-sulfonic acid) [ABTS] and xanthine/xanthine oxidase methods) and neurochemical properties (monoamine oxidase A (MAO-A) inhibition, acetyl cholinesterase inhibition and affinity to the gamma-amino butyric acid (A) receptors). Both antioxidant and MAO-A inhibitory effects were demonstrated by this plant.[34] A more potent Central Nervous System (CNS) depressive action was demonstrated by *M. longifolia* essential oil.[35] On CNS function, the effects of *M. longifolia* crude ethanol extract and fractions rich in apigenin, luteolin, and phenolic acids have also been studied. It has been discovered that phenolic acids have notable spasmodic, choleretic, and CNS-stimulating effects.[36]

Effects on gastrointestinal system

For herbal remedies for gastrointestinal ailments, *M. longifolia* leaves are employed. Here, *M. longifolia* leaves are either powdered or given to youngsters with green tea or they are locally boiled in water with cardamom seeds. It is employed as an antiemetic, especially in cases of chronic diarrhoea. *M. longifolia* is consumed as chutney, especially in the summer, together with butter to treat diarrhoea and is used as a carminative in cases of gas discomfort.[37-39] Similar uses include the management of abdominal discomfort.[40] The traditional usage of the plant to treat gastrointestinal diseases including colic and diarrhoea is supported by the fact that the leaf extract of *M. longifolia* has relaxing effects on intestinal smooth muscle. Due to the presence of calcium channel blocking components, this plant mostly demonstrates spasmolytic effects by variable calcium mobilization and somewhat through potassium channel activation.[41,42]

Antioxidant Activity

A study to assess the antioxidant properties of *M. Longifolia* essential oil and methanol extract was developed by Gulluce *et al.*[43] In the antioxidant activity experiments used, the extract demonstrated significantly greater activity than the essential oil, such as in the suppression of free radical 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and -carotene/linoleic acid systems. According to other studies, phenolic chemicals are the primary reason why methanol extract has a stronger antioxidant impact than essential oils.[29] The potential for antioxidant action is positively correlated with the concentration of phenolic chemicals.[44] Apigenin derivatives are recognised as antioxidative compounds in several investigations.[45-47]

Cytotoxic Activity

Using *E. coli* WP2 genotoxicity assay-directed fractionation techniques, three flavonoids-apigenin-7-O-glucoside, apigenin-7-O-rutinoside, and apigenin-7-O-glucuronide-were recovered from *M. longifolia*. The same genotoxicity experiment was used to assess each flavonoid's mutagenic and anti-mutagenic characteristics. The anti-mutagenic properties of apigenin-7-O-glucoside, apigenin-7-O-rutinoside, and

Table 1: Various phenolic compounds present in different species of *Mentha*[22,62,63]

Sl. No.	*Mentha* spp.	Phenolic components	Compounds name
1.	*M. spicata*	Phenolic acids	Protocatechuic acid, homovanillic, hydroxybenzoic, syringic, 4-hydroxy cinnamic, trans-hydroxycinnamic, veratric acid, 2-hydroxy cinnamic, Caffeic.
		Flavonoids	5-desmethoxynobiletin, 5,6-dihydroxy-7,8,30,40-tetramethoxyflavone, thymonin, sideritiflavone, 6,40-trihydroxy-7,30-dimethoxyflavone, 5-hydroxy-30,40,6,7-tetramethoxyflavone, diosmetin, diosmin, thymonin, chrysoeriol, 5, 6-dihydroxy-7, 8, 30, 40-tetramethoxyflavone.
2.	*M. pulegium*	Phenolic acids	Caffeic acid, vanillic acid, ferulic acids, and rosmarinic acids.
		Flavonoids	Thymonin, jaceosidin, pectolinaringenin, ladanein, sorbifolin, pedalitin, diosmin etc.
3.	*M. haplocalyx*	Phenolic acids	Rosmarinic, caffeic acid, lithospermic acid B, magnesium lithospermate B, sodium lithospermate B, and danshensu.
		Flavonoids	Eriocitrin, luteolin-7-o-glucoside, and isoraifolin,
4.	*M. longifolia*	Phenolic acids	Rosmarinic, salvianolic acid, dedihydro-salvianolic Acid.
		Flavonoids	methylated luteolin-glucuronide, luteolin-glucuronide etc.
5.	*M. rotundifolia*	Phenolic acids	Caffeic, p-coumaric, chlorogenic, and rosmarinic acids, p-hydroxybenzoic.
		Flavonoids	Thymonin, thymosin, jaceosidin, hispidulin, ladanein, sorbifolin, nodifloretin, apigenin, luteolin, genkwanin, esculetin, apigenin etc.

apigenin-7-O-glucuronide against 2-AF and N-methyl-N-nitro-N′nitrosoguanidine-induced mutagenicity was demonstrated. The inhibition rates ranged from 25.3% (apigenin-7-O-glucoside with S9-2.0 M/plate) to 59.0% (apigenin-7-O-rutinoside without S9-2.0 M/plate) and the response was dose-dependent. Since apigenin derivatives did not exhibit mutagenic activity at the studied concentrations, they can be considered genetically safe.[47-49]

INSTRUMENTATION

A bench top TXRF system (S2 PICOFOX, Bruker AXS Microanalysis GmbH, Berlin, Germany) is used to conduct TXRF analysis. It is outfitted with a multilayer monochromator (17.5 keV) and a Mo anode tube of 40W. A silicon drift detector with a 30 mm^2 area and a resolution of 139.43 eV (Mn K), operating at 50 kV and 750 A in the air, is used to detect the distinctive radiation given off by the elements present in the sample. A 300 sec measurement live is used. Spectrometer software (Spectra 4.0, Bruker) is used to do qualitative analysis and spectradeconvolution.[50-58]

BIOACTIVE CONSTITUENTS OF *MENTHA* SPP.

Phenolic compounds, a wide class of physiologically active substances, are frequently found as secondary metabolites in plants.[22] Over 8000 of its molecules have at least one aromatic ring with a link between one or more hydroxyl groups. Esters and glycosides are the origins of these substances in nature. Various substances, including glycoside, cinnamic acids, aglycon, and/or acylated flavonoids, are present in Mentha spp. Mentha sp.'s aqueous extract included derivatives of flavonoids and phenolic acid esters (Table 1).[59,60]

FUTURE PROSPECTS

The plant *M. longifolia* has a variety of primary and secondary metabolites that are used to treat a variety of acute and chronic illnesses; thus, there are a variety of pharmacological actions that have not yet been characterised. It may be straightforward for new researchers to comprehend those activities for the best plant study. Numerous phytochemicals have been discovered in various *M. longifolia* locations; they might one day be used to cure diseases and open up new avenues for research.

CONCLUSION

Currently, the majority of the human population uses herbal treatments to treat illnesses, and they prefer herbal drugs simply because they have less negative effects. Despite being a beautiful decorative plant with a lot of pharmacological action, *M. longifolia* has been found to be safe at various levels of research. Treat a range of conditions, such as digestive issues, and inflammatory diseases. The plant possesses crucial traits that form the basis of several research topics, necessitating rigorous sociological investigation.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ABBREVIATION

M. longifolia: *Mentha longifolia*.

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