

Antimicrobial Activity and Medicinal Values of Essential Oil of *Mentha Piperita* L.

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Abstract: *Essential oil of Mentha piperita are complex mixtures isolated from aromatic plants which may have antimicrobial, cooling receptor stimulator, pesticidal, anticancer, cough, asthma and use in painkiller, activities of interest in the food and cosmetic industries as well as in the human health field in pharmaceutical. In this work, a review was done on the most recent publications concerning their antimicrobial and cooling receptor stimulator activities. At the same time a survey of the methods generally used for the evaluation of antimicrobial activity and some of the mechanisms involved in the cooling receptor stimulator activities of essential oils are also reported.*

Key words: Essential Oils of *Mentha Piperita*, Antimicrobial Activity, Cooling Receptor Stimulator Activities.

I. INTRODUCTION

A. Peppermint

A study was conducted by researchers of USDA, NRCS in 2011, shows that *Mentha piperita*, also known as *M. balsa mea* Wild mint. *Mentha piperita* (1) is a hybrid mint, a cross between the water mint (*Mentha aquatica*) and spearmint (*Mentha spicata*). (2) The plant, indigenous to Europe, is now widespread in cultivation throughout all regions of the world. (3) It is found wild occasionally with its parent species (Hoffmann et al, 1984; Maffei Sacco, 1987). The entire plant has a very characteristic odor, due to the volatile oil present in all its parts, which when applied to the tongue has a hot, aromatic taste at first, and afterwards produces a sensation of cold in the mouth caused by the menthol it contains.

Peppermint (*Mentha piperita*) is a herbaceous rhizomatous, fast spreading, perennial and winter hard plant. It grows 30–90 cm tall, with smooth stems, square in cross section. The rhizomes are wide-spreading, fleshy, and bare fibrous roots. The leaves are mint green and stand crosswise opposite each other on the stem. The leaves are elongated, oval with an acute apex, coarsely toothed margins and a striking menthol smell. The oil is obtained by water vapors distillation of the leaves and bloom top. The flowers are purple, 6–8 mm long, with a four-lobed corolla about 5 mm diameter; they are produced in whorls (verticillaster) around the stem, forming thick, blunt spikes. Flowering is from mid to late summer. The chromosome number is variable, with 2n counts of 66, 72, 84, and 120 recorded (Huxley 1992; Blamey & Grey-Wilson, 1989).

B. History

Peppermint was first described in 1753 by Carolus Linnaeus from specimens that had been collected in England; he treated it as a species (Linnaeus, 1753). But it is now universally agreed to be a hybrid (Harley, 1975). Peppermint and its oil have been used in Eastern and Western traditional medicine as an antispasmodic, aromatic, and antiseptic in the treatment of cancers, colds, cramps, indigestion, nausea, sore throat, and toothaches. Today, the oil is used widely as a flavoring in chewing gum, cigarettes, mouthwash, pharmaceuticals, and toothpaste.

C. Cultivation

1. The major events of Mint Cultivation in India

1964: First roots planted in Bilaspur, district Rampur of Uttar Pradesh, India, **1966:** Green revolution, more and more farmers started to adopt the new wonder crop. According to **NMCE Report on Menthol Crystal**, a US based MNC installed first large mint crop distillation facility in India at Bilaspur in the year 1973. **In India, 90% crop grown in Uttar Pradesh, rest 10% in Punjab, Haryana and Rajasthan.** In recent years *Mentha* herb was developed in Madhya Pradesh & Gujarat but in little quantity.

2. *Mentha piperita*

According to the report presented by NMCE researchers, the USA being the main producer of *Mentha piperita* similarly it is also called American *piperita*. Though India is developing the quality of *Mentha piperita* comparing to US crop but till now we have not been able to grow successfully as in US. Peppermint generally grows best in moist, shaded locations, and expands by underground stolons. Young shoots are taken from old stocks and dibbled into the ground about 1.5 feet apart. They grow quickly and cover the ground with runners if it is permanently moist. It grows best with a good supply of water, without being water-logged, and planted in areas with part-sun to shade.

II. REVIEW

A. Antimicrobial properties

Peppermint oil is also used in some Chinese medicines, such as the medicated oil "**Po Sum On**". It is also used as an ingredient in cough and cold preparations and as a carminative for IBS. As a menthol component, it is also found in numerous antipyretic, antiseptic, and local anesthetic preparations (Briggs, 1993). Essential oils have been shown to possess antibacterial, antifungal, antiviral, insecticidal and antioxidant properties (Burt, 2004).

Essential oils are also becoming more popular and are now added to many different products for a multitude of medicinal reasons (Mitscher *et al*, 1987). Peppermint oils relaxing action acts as counter irritant and analgesic with the ability to reduce pain and improve blood flow to the affected area. It has been described in the **Fourth edition of PDR for Herbal Medicines**, peppermint has a high menthol content, and is often used as tea and for flavoring ice cream, confectionery, chewing gum, and toothpaste. The oil also contains menthone and menthyl esters, particularly methyl acetate. Peppermint and its oil have been used as a, sore throat and toothaches (Briggs, 1993).

1. Antibacterial Peppermint oil is found to be strongly effective against *Staphylococcus aureus*, *Bacillus cereus*, *Bacillus subtilis*, *Enterococcus faecium*, *Klebsiella pneumoniae*, *Escherichia coli* (Sartoratto *et al*, 2004). Peppermint oils relaxing action acts as counter-irritant and analgesic with the ability to reduce pain and improve blood flow to the affected area. Peppermint oil and menthol have moderate antibacterial effects against both Gram-positive and Gram-negative bacteria (Diaz *et al*, 1988).

A wide variety of antibiotics are commonly used for the treatment of serious infections caused by aerobic Gram-negative bacteria. The increased use of antibiotics has resulted in the development of resistant bacteria (Jacobs, 1988). In recent years, misuse of antibiotics resulting in multi-drug resistance among bacteria has accelerated the search for drugs and dietary supplements effective against such multidrug resistant bacteria. It has been reported that in 1996, sales of botanical medicines increased by 37% over 1995 (Klink, 1997).

In this connection, different parts of plants, herbs and spices have been used for many years for prevention of infections. These are easily available and can be used in domestic setting for self-medication. The present report gives an account of the antibacterial effect of different parts of plants i.e stem and leaves of *Mentha piperita* against Gram-negative bacilli isolated from different clinical specimens of stool, urine, blood and pus from wound.

The wide use of antibiotics in the treatment of bacterial infections has led to the emergence and spread of resistant strains. *Staphylococcus aureus* is recognized as one of the major cause of nosocomial infections and food poisoning (Patterson, 2000). *Mentha piperita* have traditionally been used in folk medicine as well as to extend the shelf life of foods, showing inhibition against bacteria and most of their properties are due to essential oils produced by their secondary metabolites (Adam *et al*, 1998). Essential oils and extracts from several plant species are able to control microorganisms related to skin, dental caries and food spoilage, including Gram-negative and Gram-positive bacteria (Sartoratto *et al*, 2004).

2. Antifungal Peppermint, *Mentha piperita* L. (Family, Labiatae) is aromatic and has stimulant and carminative

properties. It is currently being used for alleviating nausea, flatulence and vomiting (The Wealth of India, 1962). Mentha extract (ME) and its oil also showed antifungal activities against *Pseudomonas solanaceum*, *Aspergillus niger*, *Alternaria alternata* and *Fusarium chlamydosporum*, respectively (Lirio *et al*, 1998; Aqil *et al*, 2001). Antifungal activity of the essential oil of *Mentha piperita* was also reported (Barrera-Necha *et al*, 2008).

3. Antiviral Peppermint is also found to have antiviral activity. It is virucidal against influenza, herpes and other viruses (Mohsenzadeh, 2007). Menthol is virucidal against influenza, herpes and other viruses. Aqueous extracts of peppermint leaves were anti-viral against influenza A, Newcastle disease virus in egg and cell culture system was studied (Hirobe *et al*, 1994).

B. Anticancer

Peppermint and its oil has promising radio protective effects for cancer patients undergoing cancer treatment (Baliga & Rao, 2010).

C. Anti-diabetic

Peppermint Oil and Diabetes According to the **University of Maryland Medical Center (UMMC)**, laboratory tests show that peppermint in its various forms may produce reductions in your blood glucose. If you're diabetic and take medications designed to lower your glucose, peppermint can potentially increase their effects and heighten your chances for developing a low-glucose disorder called hypoglycemia. Because of the nature of their condition, diabetics already have significant hypoglycemia risks. Other drugs that can produce undesirable reactions in combination with peppermint oil or other forms of peppermint include blood pressure medications, cyclosporine and medications designed to decrease your levels of stomach acid.

D. In Digestive System

The most common use of peppermint oil is aiding in digestion. It helps to promote the production of digestive juices, so you can use it on a regular basis to help your body. It also can be used to get relief from digestive problems such as heartburn, nausea, gas, cramps, and even a spastic colon. It is scientifically proved by a researcher (Dalvi *et al*, 1991), 20 healthy males (ages 21-23 and 34-35) and six subjects with non – obstructive dyspepsia were fed a radio labeled solid test meal with and without peppermint oil (25 ml of water with 0.2 ml of peppermint oil). After administration of peppermint oil, gastric emptying rate accelerated in both normal and patients with dyspepsia. None of the volunteers complained of any side effects. You can use peppermint oil when you experience symptoms, but it can also be used to prevent symptoms if you have a chronic condition like irritable bowel syndrome.

E. Cold and Fever

According to the research carried out in **University of Maryland Medical Center (UMMC)**, peppermint oil has several properties that can help with your cold and flu

symptoms, along with other illnesses. Peppermint oil is an expectorant, break up chest congestion. It has also been used to reduce fever, soothe scratchy throats and, get rid of headaches. It is a great natural alternative to over the counter medications that may contain alcohol or other unwanted ingredients. Traditionally, it is used as a medicine in form of antispasmodic, aromatic, antiseptic and also in the treatment of colds, cramps, indigestion, nausea etc.

F. Mental Capabilities

The book "**Daily Aromatherapy**" advises utilizing peppermint oil for increasing general energy levels and assisting in promoting clear thinking. Rubbing some peppermint oil on your temples can help wake you up and improve your concentration and memory. This is great when studying for taking tests, or any other time you need to be alert and mentally clear. It is a great way to give brain a little boost without having to rely on coffee. This can also be beneficial to help you feel better when you feel faint or dizzy.

G. Asthma

Peppermint oil contains menthol. This is the substance used in many conventional medications that can help clear up any breathing difficulties. The vapors produced from peppermint oil can clear out a stuffy nose, help with coughing, and even help stop an asthma attack (although you should not stop conventional treatment). Exacerbation of asthma has also been associated with the use of peppermint-containing toothpaste (Spurlock & Dailey, 1990) and, when taken in a non-capsulate form, the oil may precipitate heartburn (Wilkinson & Beck, 1994).

H. Heart Problems

Peppermint oil has been used to help reduce heart palpitations. It is also used to make the heart beat better and improve circulation throughout the body. This can help ease several problems related with circulation difficulties. Peppermint oil keeps your blood pumping strong. In Human, Peppermint has traditionally been used as a rubefacient (Paula, 2000).

I. Cold Tea

According to Dr. Craig Schneider of Maine Medical Center, a report published "**American Family Physician**," (2009) states that Japanese women who consumed 5 or more cups of green tea daily had significantly less incidence of stroke. Their risk of cardiovascular disease was 31 percent less than that of those who drank little or no green tea. In addition to peppermint oil, you may also find some benefit from peppermint tea. You can even put a few drops of peppermint oil in water for a different, but effective peppermint drink. If you're applying the oil directly, it's best to dilute it in carrier oil before you apply. Peppermint oil and tea are wonderful natural cure-alls that are great to have around the house.

J. Reducing Irritable Bowl Syndrome (IBS)

Italian investigators reported that 75% of the patients in their study who took peppermint oil capsules for four weeks had a major reduction in irritable bowel syndrome (IBS) symptoms, compared with just 38% of those who took a placebo. A second study in 2010, conducted in Iran, found similar results. A research in 2011 showed that peppermint acts through a specific anti-pain channel called TRPM8 to reduce pain sensing fibers. The authors feel that this study provides information that is potentially the first step in determining a new type of mainstream clinical treatment for Irritable Bowel Syndrome. According to researchers of Bandolier Journal states, some poorly designed earlier trials found that peppermint oil has the ability to reduce colicky abdominal pain due to IBS with an NNT (number needed to treat) around 3.1, but the oil is an irritant to the stomach in the quantity required and therefore needs wrapping for delayed release in the intestine. This could also be achieved by using the whole herb or leaves rather than the volatile components alone. Peppermint relaxes the gastro-esophageal sphincter, thus promoting belching and has antibacterial properties (Paula, 2000).

Studies published by M.K. Shyu (2007), in the journal "Digestive and Liver Disease" found that peppermint may help reduce certain symptoms of irritable bowel syndrome (IBS), such as stomach pain, bloating, gas and diarrhea. In these studies, peppermint was given in enteric-coated capsules, which prevent the peppermint from being released in the stomach. According to the **University of Maryland Medical Center (UMMC)**, 75 percent of the people who took peppermint capsules experienced a reduction in symptoms.

K. Applications with Ethereal oil

Peppermint can become used hooked by ringworm, scabies, dermatitis, nerve pain, heart palpitations, stomach disorders, cold, fever, spastic cough, asthma, faint traps, vertigo, mucous membrane inflammation, winter feet, flaw at appetite, bowels complaints, tiredness, tooth and toothache, nastiness, diarrhea, trip illness, sinusitis, bad breath, shock, acne, stuffed pores, headache and migraine (Paula, 2000).

L. In Agriculture as a Biopesticide

The environmental problems caused by overuse of pesticides have been the matter of concern for both scientists and public in recent years. It has been estimated that about 2.5 million tons of pesticides are used on crops each year and the worldwide damage caused by pesticides reaches \$100 billion annually. The reasons for this are two fold: (1) the high toxicity and non biodegradable properties of pesticides and (2) the residues in soil, water resources and crops that affect public health. Thus, on the one hand, one needs to search the new highly selective and biodegradable pesticides to solve the problem of long term toxicity to mammals and, on the other hand, one must study the environmental friendly pesticides and

develop techniques that can be used to reduce pesticide use while maintaining crop yields (Suman *et al*, 2010).

Natural products are an excellent alternative to synthetic pesticides as a means to reduce negative impacts to human health and the environment. The move toward green chemistry processes and the continuing need for developing new crop protection tools with novel modes of action makes discovery and commercialization of natural products as green pesticides an attractive and profitable pursuit that is commanding attention. The concept of "Green Pesticides" refers to all types of nature-oriented and beneficial pest control materials that can contribute to reduce the pest population and increase food production. They are safe and ecofriendly. They are more compatible with the environmental components than synthetic pesticides (Isman & Machial, 2006). It also has a high concentration of natural pesticides, mainly menthone (Diaz *et al*, 1988).

M. Ornamental use

Housekeeping Culture Peppermint (or fall mint) straight with steed's leaf people to fight. Scatter fresh or dried leaf to hold around food of mice away. Impute (fall mint) on a new beehive by to pull. Use bath oil tobaccos smell to drive away. Peppermint oil as Insect Repellent: Using peppermint essential oil as insect repellents is a natural way to get rid of mosquitoes, moths, horse-flies, aphids, cockroaches, ants and more (Patricia, 2000).

N. Cosmetics

Use of strong decoction (fall mint) to cure splits in the hands. Add to bath water for a revitalizing, refreshing and found in personal care and cosmetic products such as shampoo, deodorant, lip balm or soap. Commercial fragrances of menthol however are frequently synthetic and potentially carcinogenic. Synthetic peppermint fragrance causes severe health reactions (depression, skin disorders, etc.) and should be avoided at all cost.

Facewash Most of menthol's uses are related to its stimulation of the skin's cold receptors. This property makes menthol produce a cooling effect when inhaled or applied to the skin. Similarly to the *capsaicin* chemical found in hot peppers, which stimulates heat receptors, menthol does not actually change the skin's temperature, but Peppermint oil has a high concentration of natural pesticides, mainly menthone (Mohsenzadeh, 2007). merely produces the *sensation* of temperature change. Because of its cooling effect, menthol is used in products meant to relieve skin irritation.

Hair and Skin care Dandruff makes the scalp not only flaky but also leads to hair loss and other related problems. In spite of using shampoos, some of us are still unable to fight against hair problems. Not many are aware of the fact that peppermint oil can be used for hair care and is helpful in treating dandruff and lice. To make your skin look great and flawless, you can again depend on peppermint oil, because of the presence of menthol, which is considered to be good for the skin.

III. TOXICOLOGY

The toxicity studies of the plant have received controversial results. Some authors reported that the plant may induce hepatic diseases (liver disease), while others found that it protects against liver damage that is caused by heavy metals (Akdogan *et al*, 2004; Sharma A. *et al*, 2007). In addition to that, the toxicities of the plant seem to vary from one cultivar to another (Akdogan *et al*, 2003) and are dose dependent (Akdogan *et al*, 2004). This is probably attributed from the content level of pulegone (Farley *et al*, 1980).

IV. CONCLUSION

The plant *Mentha piperita* L. and their extracts is being used in the treatment of several diseases from thousands of years. *M. piperita* also have a medicinal values in the treatment of various diseases i.e Cancer, diabetes, Asthma, heart problems etc. In addition, plant is rich in a wide variety of secondary metabolites such as tannins, phenols, steroids, flavonoids and volatile oils, which were found in vitro to have anti microbial properties. In this connection, the present study was conducted to evaluate the antimicrobial activity and medicinal values of essential oil of *M. piperita*. In this study, the conclusion obtained that the essential oil of *M. piperita* L. showed antibacterial and antifungal activities against *Pseudomonas solanacerum*, *Aspergillus niger*, *Alternaria alternata* and *Fusarium chlamydosporum*. Aqueous extracts of peppermint leaves were anti-viral against influenza A, herpes and other viruses was also studied. This study is a preliminary evaluation of antimicrobial activity of *M. piperita*. The plant extracts are also used for several purpose i.e in agriculture as a biopesticides, ornamental use, cosmetics, skin and hair care etc. The plant extracts demonstrating antibacterial activity could result in the discovery of novel antibacterial agents. Besides, the same way, also be used for self medication in domestic settings.

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