Review article
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Benefits of mint for the improvement of health based on its usage in pharmaceutical and food industry

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Abstract
Aromatic herbs' market values have risen because of rise in food, biotechnology, medicines and cosmetics. Mentha piperita L. is famous for its therapeutic properties whose health advantages are well recognized by the pharmaceutical and food processing sectors. Despite the fact that it is employed as a flavoring component in foods, it is best known for its antibacterial and antioxidant properties. Toothpaste, jellies, candies, drinks, teas, mouth fresheners, alcoholic liqueurs, syrups, ice creams, detergents chewing gums, insect repellents and soaps are all made from peppermint oil and its by-products. It should be preserved to keep it available year around as it is perishable in nature. This herb is dried to extend depository period, reduce packing, and reduce transportation costs. Various research on mint drying were gathered and the drying kinetics were evaluated in order to administer the influence of various drying techniques on drying rate, time and quality of colour and other characteristics.

Keywords: Peppermint, health benefit, human disease, medicinal plants.

Highlights:

- ✓ Medicinal plant
- ✓ Health benefits
- ✓ Therapeutic properties
- ✓ Food colorant
- ✓ Antibacterial and antioxidant
- ✓ flavoring component

1. INTRODUCTION

Herbs have garnered more consideration in recent years (Nabavi et al., 2015) due to many beneficial properties like anti-infectious properties (Akbari et al., 2012). Natural therapies that have been used to cure human ailments (Xiao, 2016) are referred to as "medical plants' (Jaberian et al., 2013). Such plants could be viewed as a useful ingredient for the production of pharmaceuticals (Farzaei et al., 2016). Medical plants, on the other hand, have had a significant influence on human existence worldwide as shown in Fig -1, (Li et al., 2012). Herbal medicine is the most extensively utilized therapeutic strategy to heal catastrophic human diseases in the Middle East, Europe, and other advanced nations (Ahmad et al., 2016) According to WHO data, advanced nations have made substantial use of medicinal plants in clinical care and the food industry (Farnsworth et al.,1985). Medicinal plants offer a lot of promise for human society, and they're used by people all around the world (Hong Kong 2013).

Figure 1: Mint

1.1 Chemical properties

Peppermint essential oil is shown to include a variety of secondary metabolites, according to several research Choi et al., 2016). To the conventional perspective (Edris, 2007), monoterpenes, cineole and menthyl are among the principal components of beneficial oils and frequent secondary metabolites and have therefore been seen as metabolic deadlock (Shaaban et al., 2012). Fig-2 components and 3 shows how peppermint monoterpene-derived chemicals are separated from main metabolism by converting isopentenyl diphosphate and dimethylallyl diphosphate to geranyl diphosphate (Kunnumakkara, 2009), which is then cyclized to produce limonene (4S) by the aid of limonene synthase (Mahboubi and Kazempour 2014). In peppermint, a molecule of oxygen is added by microsomal cytochrome P450 limonene- 3-hydroxylase (Shaikh et al., 2014) for the production of trans-isopiperitenol in an allylic position. (Almajano et al., 2008). Table-1 given below gives different names used worldwide.

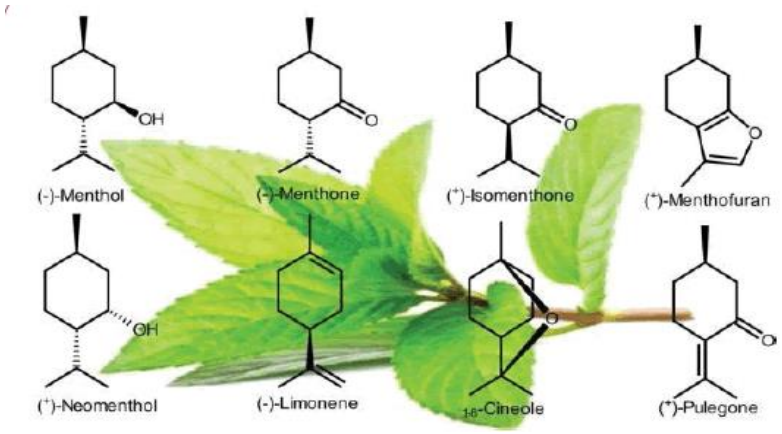

Figure 2: components of mint

Table 1: Different names of mint

Iran	Nanafelfeli
Brazil	Nortela pimento
USA	Lab Mint, mint
Norway	Peppermynte
Poland	Pepparmunta
Spain	Mentainglesa
Portugal	Hortelana pimentosa
Swedish	Pepparmynt
China	Po Ho
India	Urdu, mint, Pudina, Pudyana, Puthina
Turkey	Nana
Russia	Myata perechnaya
Uruguay	Menta
French	Menthe
Iraq	Nana
Bogota	Yerba Beuna
Denmark	Pebermynte
Germany	Peppermint
England	Brandy Mint
Mexico	Menta piperita

1.2 Antibacterial Properties

Secondary metabolites from plants are gaining popularity as antimicrobial agents (Uribe et al., 2016) since medicinal plants are widely employed in common medicine (Riachi & De Maria., 2015). Biologically active chemicals derived from peppermint sources have always piqued the curiosity of infectious disease researchers. (Ansari et al., 2000). PO and extracts have strong antibacterial action against the following bacteria: 1) Escherichia coli, 2) Salmonella pullorum 3) Acinatobacter sp, 4) Streptococcus thermophiles, 5) Lactobacillus bulgaricus, (Chen, & Zhong, 2015) 6) Staphylococcus pyogenes, 7) Staphylococcus aureus, 8) Salmonella typhi,9) Proteus vulgaris, (Hawthorn et al., 1988) 10) Enterobacter aerogenes, 11)

Shigella dysenteriae (Peat et al., 2016). Peppermint leaves extract shows antibacterial processes to Gram negative bacteria than peppermint stem extract, according to studies (Arab Ameri et al., 2016). A number of studies have shown that essential oil from peppermint leaves has the strongest antibacterial activity, with zones of inhibition ranging from 11.58 to 17.24 mm 0.87 SD (Oktemer et al., 2015) whereas extract from peppermint stem has an average zone of inhibition of 15.82 mm 3.56 SD, respectively (Babaeian et al. 2017). PO exhibits significant antimicrobial activity against Staphylococcus aureus (Mucciarelli et al., 2007), Bacillus subtilis (Bohnert T, Patel A, Templeton I, Chen Y, Lu C., 2016), Enterococcus faecium ATCC10541 (Rodrigues & Dupret, 2002) and Salmonella choleraesuis (Sun et al., 2014). Distinct portions of the structure of peppermint essential oil have different chemical compositions (Chen, & Zhong, 2015). As previously stated, these variations may have an impact on peppermint species' antibacterial activity (Hawthorn et al., 1988). Mint oil and menthol have mild antibacterial activity against Gram-positive and Gram-negative bacteria in general (Saeed et al., 2006). Peppermint seems a promising new target for enhancement of plant-derived therapies to combat a wide range of multidrug-resistant bacteria.

1.3 Allelopathy Effects

It is a type of biological phenomena that has a substantial impact on the development, quality, and quantity of crops in agro-ecosystems (Janjua et al., 2015). It has been found that peppermint water extract (at a concentration of 10% v/v) slows the development of tomato seedlings (Buyukuslu et al., 2010) . In sunflower, Peppermint aqueous extracts were observed to minimize non-photochemical (Fukui, 1982) and photochemical quenching, as well as the photosystem II vitality index (Yamaguchi et al., 2014).

1.4 Anti-headache activity

Herbal medicine has been utilized to treat headache issues since ancient time (Levin, 2012). The best target for headache treatment is peppermint and derivatives (Gobel et al., 1994). Combination of Peppermint and eucalyptus oil relieved headache discomfort in some patients (Yamaguchi et al., 2014).

1.5 Effect on hepatic enzymes

Peppermint aqueous extract (at a concentration of 2% v/v) has been shown to influence phase I and II drug which helps the enzymes to metabolize (Anjali, & Nardev, 2016). A number of enzymes work in phase I to attach substrates with reactive and polar groups (Rita, & Animesh, 2011). In drug metabolism, phase II biotransformation events usually function as a detoxifying step (Anonymous., 2016). According to study, the detrimental effects were low in quantity specifically on the growth rate and working of liver caused by CCl4. This will decrease the oxidative stress-induced hepatotoxicity in broilers. (Katzer, 2016).

1.6 Marketing

The global PO market is separated into two categories, local and international customers. Small customers and enterprises from the chemical, food, pharmaceutical and flavoring sectors were among the local purchasers. Foreign clients like aromatherapy, cosmetics, food and personal health who buy in big numbers (Kavrayan, & Aydemir, 2001). In the United States, this business is considered as the greatest commercial herb. Many dosage formulations for the treatment of various human lifestyle disorders are available in the market, taking into account the varied advantages of peppermint.

Fig-3 represent different products of mint.

Figure 3: Mint products

1.7 May Improve Irritable Bowel Syndrome

It is an illness of digestive system that affects humans. It is marked by digestive symptoms such as stomach discomfort, gas, bloating, and stool irregularities. Although dietary modifications and medication are commonly used to treat IBS, research suggests that consuming peppermint oil as an herbal cure may also be beneficial. Peppermint oil includes a chemical known as menthol, which is considered to help relieve IBS symptoms by relaxing the muscles in the digestive tract. Peppermint oil capsules relieved IBS symptoms much more than placebo capsules, according to a study of nine research involving over 700 individuals with IBS.

1.8 May Help Relieve Indigestion

Mint may also help to relieve other digestive issues including indigestion and upset stomach. When food lingers in the stomach for too long before travelling through the remainder of the digestive tract, it can cause indigestion (Kavrayan, & Aydemir, 2001). Multiple studies have indicated that when people consume peppermint oil with their meals, food passes through the stomach faster, perhaps alleviating feelings of indigestion (Fitsiou et al., 2016). In a clinical investigation of persons with indigestion, a capsule containing a mixture of peppermint oil and caraway oil demonstrated benefits similar to indigestion drugs (Wang et al., 2016). This alleviated stomach discomfort and other digestive issues. Peppermint oil, rather than fresh or dried leaves, was utilised in trials demonstrating mint's capacity to treat indigestion, similar to IBS (Gaurav, 2016).

1.9 Could Improve Brain Function

In addition to eating mint, breathing the perfume of the plant's essential oils is said to provide health advantages, including better brain function (Nogueira et al., 2016). Research involving 144 young adults found that inhaling the scent of peppermint oil for five minutes before to testing improved memory significantly (Çoban, & Baydar, 2016). Another study discovered that inhaling these oils while driving improved alertness and reduced annoyance, anxiety, and exhaustion (Mallick et al., 2016). Peppermint oil, on the other hand, hasn't been proven to improve brain function in all research. According to one research, the oil's scent was energizing and reduced weariness, but it had no effect on cognitive performance. To further comprehend this, more research is required (Gras et al., 2016).

1.10 May Decrease Breastfeeding Pain

Sore and cracked nipples are prevalent among nursing women, making breastfeeding uncomfortable and challenging. Applying mint to the skin has been found in studies to help reduce discomfort associated with nursing. After each feeding, the moms in these experiments applied several types of mint to the region surrounding the nipple. They usually utilised an essential oil on its own or in combination with a gel or water (Bokhari et al., 2016).

According to one study, using peppermint water after nursing was more successful than using expressed breast milk at avoiding nipple and areola cracks, resulting in reduced nipple soreness (Mahmoudi et al., 2016). In a separate trial, just 3.8 percent of moms who used peppermint gel developed nipple cracks, compared to 6.9 percent of mothers who used lanolin and 22.6 percent of mothers who used a placebo (Diop et al., 2016). In addition, a separate study found that when moms used menthol essential oil after each feeding, the discomfort and severity of nipple cracks reduced (SajiN, 2016).

1.11 Subjectively Improves Cold Symptoms

Menthol, a major ingredient in peppermint oil, is found in many over-the-counter cold and flu remedies (Bharti et al., 2016). Many individuals feel that menthol is a good nasal decongestant that may help them breathe better and clear their sinuses. Multiple studies, however, reveal that menthol has no decongestant properties (Yingying et al., 2016). However, studies have shown that menthol can enhance nasal breathing subjectively. This means that, while menthol is not a decongestant, it might make individuals feel like they can breathe more easily through their nose. Those suffering from a cold or the flu are likely to get some relief from this (Nair, 2000).

1.12 May Mask Bad Breath

When it comes to preventing or treating bad breath, individuals often opt for mint-flavored chewing gum and breath mints (Jenner et al., 1964). Most of these solutions, according to experts, can cover foul-smelling breath for a few hours (Wraith et al., 2005). However, they just mask foul breath and do little to address the bacteria or other substances that cause it in the first place (Douhan, & Johnson, 2001). Drinking peppermint tea and chewing on fresh leaves, on the other hand, may be able to conceal foul breath while also killing germs, according to test-tube research (Maffei, 1999).

1.13 Easy to Add to Your Diet

- Mint is simple to include into green salads, sweets, smoothies, and even water. Another common approach to include it in your diet is to drink peppermint tea (Clark, & Menary, 1981). Many of the studies that prove mint's health advantages, however, did not include consuming the leaves with meals (Rohloff, 1999). Mint was instead ingested as a pill, applied topically, or breathed through aromatherapy. When utilising mint for health, think about

what you want to achieve and how the plant was utilised in the research for that aim. The list below should help summarize some of the research discussed above (Areias et al., 2001)

- **Consumption of Leaves:** Controls breath.
- **Application of oil:** Brain function and common cold may be enhanced.
- **For skin:** Breastfeeding nipple soreness can be relieved using this product.
- **Using capsules with diet:** IBS and indigestion may be helped with this supplement.

1.14 Allergies

Rosmarinic acid is an antioxidant and anti-inflammatory compound found in mint plants. In 2019, a rat study was published. Trusted Source revealed that rosmarinic acid improved asthma symptoms when compared to a control group that did not take a supplement. On the other hand, mint extract in oils and ointments may be substantially stronger than eating mint. The benefits of dietary mint on allergy symptoms have received comparatively little research (Umezu et al., 2001).

1.15 Managing common cold

Mint is comprised of menthol. It's an aromatic stimulant that could help break phlegm and mucus and facilitate discharge. (Clark, & Menary, 1980). Children with a common cold may benefit from the use of menthol ointments or vapor rubs (Croteau, & Venkatachalam, 1986). According to the American Lung Association, experiments showed that methanol use is not linked for the treatment of cold symptoms. Despite this, some people report feeling better after applying a menthol vapour rub (Mascher et al., 2001). Its oil might cause irritation and redness. Parents and caregivers are advised not to use the cream immediately to a patient's chest or face due to the possibility of hazardous side effects. (Park et al., 2016).

1.16 Diet

Mint leaves have delicate stems and are a fragile plant (Mahmoud, & Croteau, 2002). Pour it uncooked or at the end of the cooking procedure. It ensures that exquisite flavour and texture are preserved (Rios-Estepa et al., 2008). When purchasing mint, seek for leaves that are bright and free of blemishes. Keep them refrigerated for up to a week in a reusable plastic bag. Mint is a (Rios-Estepa et al., 2008) sustainable method to add flavour to meals because it is reasonably easy to produce and nurture at home Take a knife and cut mint lightly when making it. Mint is frequently used in Middle Eastern meals like soups, lamb and salads (Tan et al., 2016). Other ideas include (Turner et al., 2000). Mint limeade is made by combining lime juice, sugar, and muddled mint leaves. Finish with purified water and ice.

1. In a fresh fruit salsa, mint is combined with chopped apples, lemon, and honey. Serve with cinnamon pita chips or on top of grilled chicken.
2. To make a refreshing drink, combine mint leaves and cucumber with water.
3. Add a few chopped mint leaves.
4. For homemade mint tea, pour boiling water over mint leaves and simmer for 5-6 minutes.
5. For a fast snack, chop mint and combine with fresh pineapple.

1.17 Risks

Mint, like many other plants, can have a negative impact on certain people. Mint should not be used to relieve digestive problems in those who have gastroesophageal reflux disease (Mills et al., 2004). Mint is a prominent culprit for GERD symptoms, according to a Trusted Source review from 2019 (Cunha et al., 2011). Large dosages of peppermint oil can be poisonous Trusted Source. It's critical to keep to the suggested peppermint oil dosages (Vennila et al., 2016). Pure menthol is harmful and should not be consumed. To disperse vapours, it should only be applied to a surface, or by a pillow (Prabavathi et al., 2012). Although peppermint is regarded a therapeutic herb for the treatment of human ailments, it was observed that at dosages of 40-100 mg/kg per day for 3 months, PO induced cyst-like alterations in the white matter of the cerebellum and nephropathy in rats (Nash et al., 1986). Hypersensitivity response, stomach discomfort, heartburn, and bradycardia are all possible side effects of enteric coated PO capsules (Kline et al., 2001). Pre-inhalation of menthol lowers cough sensitivity to inhaled capsaicin and alters inspiratory flows in individuals with chronic cough (Shah, & Mello, 2004). Atonia, weight loss, reduced blood creatinine content, and histological alterations in the liver and white matter of the cerebellum were seen in rats given dosages of 80 and 160 mg of pulgeone for 28 days (Mitchell, & Crowe, 1996). In rats, menthol promotes hepatocellular alterations (Millqvist et al., 2013).

2. CONCLUSION

Conventional therapies include peppermint obtained from the plant's leaves. This herb's therapeutic efficacy is examined using evidence-based research. Rosmarinic acid and various flavonoids are among the phenolic elements of the leaves. The essential oil's primary volatile components are menthol and menthone. Peppermint possesses bacteriostatic and bactericidal properties, along with antioxidant and antiallergenic properties. Peppermint and its components were studied in humans for gastrointestinal, respiratory, and recreational effects. There have been a few specific tests investigating the impact of

peppermint oil on the signs of irritable bowel syndrome (IBS). Human research of peppermint leaf are rare, and there are no diagnostic tests of peppermint tea yet. There haven't been any recorded adverse reactions to peppermint tea yet.

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