

Therapeutic Applications and Multifaceted Benefits of Peppermint Oil in Medicine: A Mini-Review

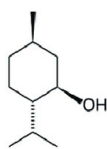
ABSTRACT

Peppermint oil, a natural product derived from the *Mentha × piperita* plant, has gained significant attention for its therapeutic versatility across various medical fields. This review examines clinical trials published on PubMed from 2016 to 2024, focusing on its efficacy and safety. Using a systematic approach, studies were selected based on their relevance to human clinical applications. The results highlight peppermint oil's effectiveness in managing gastrointestinal conditions such as irritable bowel syndrome (IBS), reducing chemotherapy-induced nausea, alleviating postoperative pain and anxiety, and enhancing cognitive function and mood. Additionally, its role in improving colonoscopy procedures, preventing pressure injuries, and supporting mental clarity showcases its broad potential. While the evidence supports its application in many areas, the review also identifies limitations, particularly in respiratory health and physical performance enhancements. Overall, peppermint oil emerges as a safe, cost-effective, and accessible complementary therapy with potential for broader use in patient care. decrease medical as well as financial burden, hence improving the management of cirrhotic patients. These predictors, however, need further work to validate reliability.

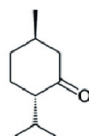
Keywords: Peppermint oil; irritable bowel syndrome; nausea relief; pain management; cognitive enhancement; essential oils; clinical trials; complementary medicine; natural therapies.

1. INTRODUCTION

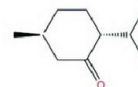
Peppermint oil is an essential oil extracted from the leaves of the peppermint plant (*Mentha × piperita*), a hybrid species created by crossing water mint (*Mentha aquatica*) and spearmint (*Mentha spicata*) (Charrois, Hrudehy, Gardiner, & Vohra, 2006). The plant is known for its distinctive, fresh aroma and its characteristic cooling sensation, which comes from menthol, one of its key chemical components (Göbel, Heinze, Heinze-Kuhn, Göbel, & Göbel, 2016). The oil is derived through a process called steam distillation, where the plant material is heated to release volatile compounds. These compounds condense back into liquid form, separating into oil and water layers, with the essential oil collected as the top layer. High-quality peppermint oil typically contains a balanced proportion of menthol (30-50%) and menthone (10-30%), along with other constituents like limonene and cineole, which contribute to its therapeutic properties (Chumpitazi, Kearns, & Shulman, 2018).



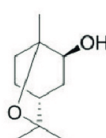
Menthol



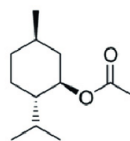
Menthone



Iso-Menthone



1,8-Cineole



Menthyl acetate

Figure 1. *Major components of Peppermint oil*

Peppermint oil is a highly adaptable natural remedy that healthcare professionals can recommend for treating various conditions, thanks to its pain-relieving, muscle-relaxing, and antimicrobial properties. A common application is for gastrointestinal issues, especially irritable bowel syndrome (IBS)(Khanna, MacDonald, & Levesque, 2014). Enteric-coated peppermint oil capsules are often prescribed to ease symptoms like bloating, cramping, and abdominal discomfort by relaxing the smooth muscles in the digestive tract. For patients experiencing indigestion or dyspepsia, peppermint oil may also be suggested to support digestion and reduce gas. When managing tension headaches, diluted peppermint oil can be applied to the temples or forehead, as menthol helps provide a cooling sensation while relaxing muscle tension (Saps & Miranda, 2017). In respiratory conditions such as colds or sinus congestion, inhaling peppermint oil through steam or a diffuser can help open nasal passages and improve breathing due to its decongestant and antimicrobial effects (Bielory, 2004).

Peppermint oil is also valuable in addressing mild muscle and joint pain or post-exercise soreness. When mixed with a carrier oil, it can be massaged onto the affected area to help reduce inflammation and create a soothing, cooling effect. For dental health, dentists and oral health practitioners often recommend peppermint oil in products like toothpaste or mouthwash because of its antibacterial properties, which combat harmful bacteria, and its refreshing flavor. In aromatherapy, peppermint oil is frequently used by caregivers and nurses to boost mental clarity, reduce stress, and combat fatigue. However, healthcare professionals must ensure it is used correctly, for example, diluting it before topical application and avoiding use in individuals with sensitivities, allergies, or conditions like gastroesophageal reflux disease (GERD)(McKay & Blumberg, 2006). By tailoring recommendations to each patient's needs, peppermint oil can be a safe and effective therapeutic option.

2. MATERIAL AND METHODS

The author reviewed clinical trials published on PubMed between 2016 and 2024 to assess the therapeutic potential of peppermint oil. The search strategy included keywords and MeSH terms like "peppermint oil," "clinical trials," "therapeutic applications," "gastrointestinal disorders," "neurological effects," "pain management," and "nausea." Studies were considered if they were peer-reviewed, conducted on human participants, focused on peppermint oil or its derivatives. Excluded were non-clinical research, reviews, meta-analyses, case reports, and editorials. The review extracted data on study design, participant details, intervention methods, outcomes, and side effects. Findings were grouped into themes such as gastrointestinal health, neurological effects, pain and anxiety relief, respiratory benefits, and emerging applications, presenting a comprehensive analysis of peppermint oil's clinical efficacy and safety.

3. RESULTS AND DISCUSSION

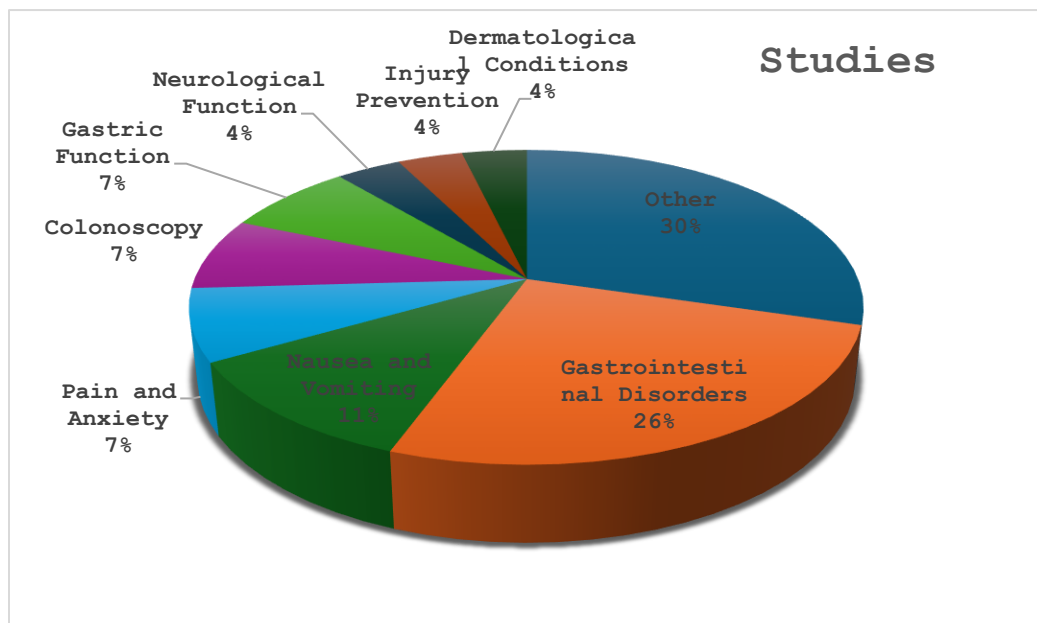


Figure 2. Summary and percentages of Clinical Trial Studies on peppermint oil

Research on peppermint oil for gastrointestinal disorders, particularly its application in managing irritable bowel syndrome (IBS), has produced significant findings. Nee et al. (Nee et al., 2021) demonstrated that peppermint oil significantly alleviated IBS symptoms, leading to notable improvements in patient's quality of life compared to placebo, establishing its effectiveness as a treatment option. Similarly, Weerts et al. (Weerts et al., 2021) confirmed the safety and efficacy of peppermint oil in reducing abdominal pain and discomfort, key symptoms affecting IBS patients. Further, Weerts et al. (Weerts et al., 2018) conducted an economic evaluation that highlighted peppermint oil as a cost-effective treatment, offering substantial symptom relief while being accessible and practical for broader clinical use. Advances in delivery systems were examined by Cash et al. (Cash, Epstein, & Shah, 2016), who introduced a novel peppermint oil formulation that effectively targeted symptoms, providing enhanced and sustained symptom control for IBS patients. Building on these innovations, Weerts et al. (Weerts et al., 2020) conducted Phase I trials on ileocolonic-release peppermint oil capsules, which showed promising results in targeting the digestive tract more effectively and managing symptoms. In addition to physical symptom relief, Ballou et al. (Ballou et al., 2022) investigated the psychological dimensions of IBS treatment, finding that psychological factors, including the baseline severity of extraintestinal symptoms such as anxiety and depression, significantly influenced treatment outcomes. Collectively, these studies not only underscore the multifaceted benefits of peppermint oil in managing IBS but also emphasize the importance of addressing both physical and psychological aspects to optimize treatment effectiveness.

Nausea and vomiting are common symptoms associated with chemotherapy and surgical recovery, and recent studies have highlighted the therapeutic potential of peppermint oil in

managing these conditions. Efe Ertürk and Taşcı (Efe Ertürk & Taşcı, 2021) investigated the effects of peppermint oil on chemotherapy patients and found that its use led to a significant reduction in the frequency and severity of nausea, vomiting, and retching. This study underscores the oil's efficacy as a complementary therapy for patients undergoing challenging treatment regimens. Additionally, Cetin et al. (Cetin, Kose, & Gokbel, 2024) focused on postoperative nausea in patients recovering from cervical surgery. Their results showed that peppermint oil significantly reduced postoperative nausea compared to a placebo, emphasizing its utility in surgical recovery settings. Collectively, these studies provide robust evidence supporting the use of peppermint oil as a non-invasive, cost-effective approach to managing nausea and vomiting in diverse clinical contexts.

Peppermint oil has shown promise in alleviating pain and anxiety across various clinical settings, as evidenced by recent studies. Shulman et al. (Shulman et al., 2022) examined the effects of peppermint oil on children suffering from functional abdominal disorders and found that its use not only improved gut motility but also significantly alleviated abdominal pain. This highlights its therapeutic potential as a natural, non-invasive option for managing gastrointestinal discomfort in pediatric populations. Similarly, Meşe and Sarıtaş (Meşe & Sarıtaş, 2024) investigated the impact of peppermint oil inhalation on postoperative outcomes in patients undergoing lumbar discectomy. Their findings demonstrated that peppermint oil inhalation led to a significant reduction in both postoperative pain and anxiety levels, suggesting its dual benefit in managing physical discomfort and psychological stress during surgical recovery. Together, these studies underscore the versatility and effectiveness of peppermint oil in addressing pain and anxiety in diverse medical contexts.

Peppermint oil has demonstrated notable benefits in enhancing colonoscopy procedures by reducing colonic spasms and improving patient comfort. Al Moussawi et al. (Al Moussawi et al., 2017) investigated the use of peppermint oil capsules during colonoscopy and reported that they effectively reduced colonic spasms, leading to improved mucosal visibility and shorter procedure times. These findings highlight the oil's role in enhancing both the technical aspects and efficiency of the procedure. Similarly, Han et al. (Han et al., 2021) evaluated the impact of peppermint oil (specifically IBGard™) on patient comfort and procedural efficiency during colonoscopy. Their study found that peppermint oil significantly increased patient comfort and further optimized procedural efficiency, suggesting its utility in creating a smoother and more tolerable experience for patients and clinicians alike. Together, these studies affirm the value of peppermint oil as a simple and effective adjunct to improve colonoscopy outcomes.

Peppermint essential oil has shown potential for neurological support by enhancing cognitive performance and mood. Kennedy et al. (Kennedy et al., 2018) conducted a study to evaluate the effects of peppermint essential oil on cognitive function and mood. The results demonstrated that exposure to peppermint oil significantly improved various aspects of cognitive performance, including attention, memory, and processing speed. Additionally, participants reported enhanced mood states, suggesting that peppermint oil may have both stimulating and calming properties beneficial for mental clarity and emotional well-being. These findings indicate that peppermint essential oil could serve as a natural, non-invasive intervention to support neurological function and improve mental performance in diverse settings.

Peppermint-derived compounds, including L-menthol, have shown intriguing effects on gastric function and autonomic regulation. Masuy et al. (Masuy et al., 2024) investigated the combined effects of L-menthol and caraway oil on gastric activity and appetite. Their findings revealed that these compounds increased sensations of hunger without altering gastric motility or function, emphasizing their role in sensory modulation rather than direct physiological changes in the

stomach. In a related context, Kazadi et al. (Kazadi, Fletcher, & Barrow, 2018) examined the effects of gastric cooling and menthol on autonomic nervous system activity. Their results demonstrated that menthol was associated with increased cardiac parasympathetic activity, highlighting its potential to support autonomic balance. Together, these studies underscore the sensory and autonomic benefits of menthol and related compounds, offering insights into their applications for appetite modulation and nervous system regulation.

Peppermint-based interventions have demonstrated significant potential in injury prevention and the management of complications associated with trauma and scarring. Babamohamadi et al. (Babamohamadi, Ansari, Nobahar, & Mirmohammadkhani, 2019) explored the application of peppermint gel in intensive care unit (ICU) patients, particularly those with head trauma, who are at high risk for developing pressure injuries. Their findings revealed that peppermint gel effectively reduced the incidence of pressure injuries by improving local skin integrity and providing a protective barrier, highlighting its utility in critical care settings. Similarly, Wu et al. (Wu et al., 2016) investigated the effects of a combination therapy including peppermint oil on hypertrophic burn scars, focusing on pruritus, a common and distressing symptom. Their study showed that the therapy significantly alleviated pruritus, improving patient comfort and quality of life. Together, these studies underscore the versatility of peppermint-based treatments in both preventing injuries and managing post-injury complications, offering natural and accessible solutions in healthcare settings.

Peppermint oil has demonstrated diverse applications across various fields, ranging from gastrointestinal health to diagnostic advancements, though its effects can vary depending on the context. Ried et al. (Ried, Travica, Dorairaj, & Sali, 2020) evaluated a herbal formula containing peppermint oil for digestive issues, reporting significant improvements in both upper and lower gastrointestinal symptoms, highlighting its role in managing complex digestive disorders. Sahebnaasagh et al. (Sahebnaasagh et al., 2023) found that a zinc and polyherbal mouthwash, including peppermint, effectively prevented oral mucositis in patients undergoing radiotherapy, showcasing its protective benefits in oncology care. Similarly, Döner et al. (Döner, Dağ Tüzmen, Duran, & Sunar, 2024) demonstrated that aromatherapy using lemon and peppermint oils alleviated menopausal symptoms, offering a non-hormonal and natural therapeutic option. In the management of chronic pain, Kingsley (Kingsley, 2023) reported that peppermint oil significantly reduced chronic headache discomfort in youth, providing a safe alternative to standard analgesics. However, the benefits of peppermint oil are not universal; Shepherd and Peart (Shepherd & Peart, 2017) found no improvement in aerobic capacity following peppermint oil supplementation, challenging its proposed use in enhancing physical performance. Similarly, Köteles et al. (Köteles, Babulka, Szemerszky, Dömötör, & Boros, 2018) observed no significant effects on lung function from inhalation of peppermint and other essential oils in healthy individuals, suggesting its limited utility in respiratory health for non-clinical populations. Collectively, these studies illustrate the multifaceted applications of peppermint oil, with strong evidence in some areas and limitations in others.

4. CONCLUSION

Peppermint oil is a highly versatile therapeutic agent with significant benefits across various medical fields. It has proven especially effective in treating gastrointestinal conditions, particularly irritable bowel syndrome (IBS). Research consistently shows that peppermint oil provides substantial symptom relief, enhances quality of life, and is a cost-effective treatment

option. Advances in delivery systems, such as targeted release formulations, have further improved its ability to offer sustained and focused symptom control, making it even more effective for managing gastrointestinal disorders. Beyond its gastrointestinal applications, peppermint oil has shown great promise in reducing nausea and vomiting, particularly for patients undergoing chemotherapy, blood marrow transplantation, or recovering from surgery. Its non-invasive nature and minimal side effects make it a practical and appealing choice for these challenging situations. Additionally, peppermint oil is effective at reducing pain and anxiety, whether associated with surgery or functional abdominal conditions, addressing both physical and emotional aspects of patient care. It has also demonstrated benefits in colonoscopy procedures, where it reduces colonic spasms, improves patient comfort, and increases procedural efficiency. In neurological applications, peppermint oil has been shown to improve cognitive performance, enhance mood, and support mental clarity, suggesting its potential as a natural aid for mental health and cognitive function. Its role in sensory and autonomic regulation, such as increasing appetite and supporting parasympathetic activity, opens the door to its use in managing conditions related to appetite and autonomic imbalances. Peppermint oil's benefits extend further to areas like injury prevention and scar management. It has been effective in reducing the risk of pressure injuries in critical care patients and in relieving pruritus associated with hypertrophic burn scars. Moreover, it has shown success in managing menopausal symptoms and chronic headaches, providing a safe, non-pharmacological alternative for symptom relief. Additionally, peppermint oil has potential in diagnostic innovation, particularly in non-invasive breath analysis techniques, highlighting its broader applications in healthcare. However, peppermint oil does have its limitations. Studies have shown no significant effects on respiratory health or physical performance in healthy individuals, indicating the need for further research to better define its boundaries. Addressing these gaps and exploring the connection between physical and psychological factors will be key to optimizing its use. Advances in delivery technologies can also enhance its effectiveness, especially for targeted applications. In summary, peppermint oil is a safe, accessible, and effective complementary therapy that addresses both physical and psychological symptoms across a range of medical contexts. With further research and innovation, its role in holistic and patient-centered care is likely to expand, solidifying its place as a valuable tool in modern medicine.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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