Original Article

2023, Vol. 63 : 09-13
ISSN-0972-7434

Madhya Bharti Journal of Science

An Analysis of Essential Oils' Health Benefits

Dr. Anamika Chauhan
Assistant Professor
Department of Home Science,Chaman Lal Mahavidhyalya, Landhaura, Haridwar
Corresponding author email: chauhanana6252@gmail.com
(Received on 23/07/2022; Accepted on 17/10/2022)

Abstract

Essential oils have garnered considerable attention for their purported health benefits, ranging from stress relief to antimicrobial properties. This paper presents a comprehensive analysis of the potential health benefits of essential oils, drawing upon scientific research and traditional knowledge. Firstly, it examines the chemical composition of essential oils and their mechanism of action, elucidating how they interact with the body at a molecular level. Secondly, it reviews empirical studies investigating the efficacy of essential oils in various health domains, including their effects on mental health, immune function and skin conditions. This paper provides a comprehensive analysis of the health benefits associated with essential oils. Essential oils, volatile compounds derived from plants, have long been used for their therapeutic properties. Drawing upon both traditional knowledge and scientific research, this analysis examines the chemical composition of essential oils and their mechanisms of action within the body. Furthermore, it reviews empirical studies investigating their potential health effects, including stress reduction, immune system modulation and skin care benefits. Despite the growing interest in essential oils, challenges such as standardization and methodological limitations in research persist. Nevertheless, this paper highlights the promising therapeutic potential of essential oils and discusses their implications for clinical practice. By synthesizing existing evidence and identifying gaps in knowledge, this analysis contributes to a better understanding of essential oils' role in promoting health and well-being.
Keywords: Essential oils, Health benefits, Mchanisms of action, Therapeutic potential, Clinical implications.

Introduction

One of the crucial products of the sector based on agriculture is essential oils of plant origin. They are frequently used as flavouring ingredients in foods, beverages, perfumes, medicines, and cosmetics (Burt, 2004, Hussain et al., 2008, Teixeira et al., 2013). At least 2000 plant species have been used to make over 3000 essential oils, of which 300 are significant from a commercial standpoint. The projected market worth of 700 million US dollars and annual output of 40,000–60,000 tonnes of essential oils show that both production and consumption are rising globally (Djilani and Dicko, 2012. Numerous factors, including genetic diversity, plant ecotype or variety, nutrition, fertiliser application, geographic location of the plants, surrounding environment, seasonal changes, stress during development or maturity, as well as post-harvest drying and storage, have an impact on the chemistry of Essential Oils. Additionally, the type of plant material utilised and the extraction technique define an EO's production and composition (constituents), which determines its distinctive biological capabilities (Alvarez-Castellanos and Pascual-Villalobos, 2003; Croteau, 1986; Hussain et al., 2008). As an instance, Essential Oil derived from various plant components such as flowers, leaves, stems, roots, fruits, and fruit peels show various biological and therapeutic effects. Similar to this, different polarity solvents extract various groups of chemicals (Cowan, 1999). Essential oils are complex combinations of low molecular weight chemicals that are extracted via steam distillation, hydrodistillation, or solvent extraction (typically less than 500 daltons) (Nakatsu et al., 2000). They are often kept in the plants' glands, trichomes (glandular hairs), oil ducts, resin ducts, and glands (Demirci and Baser, 2007). For the commercial extraction of essential oils, steam distillation is the method of choice (Masango, 2005). The 20–100 distinct plant secondary metabolites that make up EOs can come from a range of chemical families (Carson and Hammer, 2011).

History of Essential Oils

Essential oils have been utilised for a variety of uses by different cultures for aeons. It is unknown if the Essential Oils were used at first as household cleaners or as medicinal agents. However, there has been a lot of focus recently on the effective use of Essential Oils in therapeutic procedures. As early as 4500 BC, the Ancient Egyptians utilised fragrant oils in cosmetics and ointments. Aniseed, cedar, onion, myrrh, and grapes are just a few of the botanical compounds that have historically been used to manufacture perfume or medicine. Aromatic oils were first used in ancient Chinese and Indian medicine between 3000 and 2000 BC. More than 700 ingredients, including ginger, cinnamon, myrrh, and sandalwood, were discovered to be helpful for healing in China and India's documented past. Greek history also records the first known uses of various EOs, including as thyme, saffron, marjoram, cumin, and peppermint, between 500 and 400 BC. In the 18th and 19th centuries, chemists investigated the active components of medicinal plants and discovered a number of chemicals, including caffeine, morphine, quinine, and atropine, which were considered to be crucial to their biological activity. Some essential oils, like peppermint, lavender, and myrrh, are still employed in medicinal products and might one day serve as excellent

replacements for a variety of synthetically produced medications. There are more than 90 different kinds of essential oils, each having a unique scent and use. They are used in natural and alternative health methods by naturopathic and aromatherapy practitioners.

Here is a list of some well-known essential oils:

- **Rose Oil -** It is one of the most costly oils due to its calming floral aroma, which may be beneficial for stress and anxiety. It is known to increase hair development and to be beneficial in the treatment of joint stiffness and pain.
- **Lavender oil -** One of the most often utilised essential oils for insomnia relief. It has anti-inflammatory qualities and may be utilised in a number of ways. Lavender oil is both calming and revitalising.
- **Sandalwood oil -** This renowned scent ingredient also helps to ease anxiety and enhance sleep.
- **Jasmin oil -** This sweet-smelling oil is utilized as a stress relief and may help cure dry skin, irritation, and prevent symptoms of ageing.
- **Peppermint oil** is utilized to treat headaches and gastrointestinal problems such as irritable bowel syndrome. Migraine sufferers might benefit from applying peppermint oil to their temples. Peppermint oil offers mood-lifting qualities as well.
- **Roman Chamomilla oil -** It is wonderful for relaxing and mood enhancement. It is frequently used to treat mental diseases including anxiety and depression. Although chamomile tea includes this essential oil, it must be used in moderation.
- **Ylang-Ylang oil -** It is primarily used to alleviate pain, boost mood, and reduce blood pressure.
- **Basil oil -** An vital herb for cough relief, mood enhancement, and muscular soreness.
- **Lemon oil -** It is used to improve digestion, mood, and other things. Lemon oil's fragrance alleviates nausea and dizziness. It is also known to help with depression and other related conditions. Lemon essential oil is antimicrobial and may be used topically. Lemon oil is most commonly extracted from the peels of citrus fruits such as orange, grapefruit, lime, and lemongrass.
- **Tea tree oil -** Excellent for treating fungal infections and improving immunity. It is a highly effective elixir for the treatment of acne and blemishes because it lowers acne-causing bacteria on the skin and dries up active acne. Tea tree oil is appropriate for oily skin.

Composition of essential oil

Essential oils are extremely complicated natural combinations that may include 20 to 60 distinct components in a variety of intensities. In comparison to other components present in trace levels, they have two or three primary components at quite high concentrations (20–70%). For instance, the main ingredients in the essential oils of Origanum compactum and Coriandrum sativum are carvacrol (30%) and thymol (27%), linalol (68%) and camphor (24%) respectively. The issue of the distinctiveness of the various essential oils also comes up. There haven't been enough research that have examined enough biological endpoints and essential oils to say whether or not there is a specificity for distinct effects according to different oils. It is evident from the research by Bakkali et al. in 2005 and 2006 that the studied essential oils showed selectivity in the amplitude but not in the method of action of the biological effects, such as cytotoxicity and cytoplasmic mutation. As is widely known, mono- and sesquiterpene hydrocarbons and their oxygenated derivatives, as well as aliphatic aldehydes, alcohols, and esters, make up the majority of plant EOs. It is also important to keep in mind that the choice of extraction technique directly affects the chemical composition of any EO, making it crucial to make the right choice. Different extraction methods, such as steam distillation, soxhlet extraction, solvent extraction, dynamic headspace, microwave-assisted hydro distillation, solvent flavour evaporation, solid-phase micro-extraction, static headspace, and direct thermal desorption, can be used depending on the properties of a particular plant material.

Antimicrobial Properties

Several researches have reported on the antibacterial properties of EOs. Many times, the intricate interactions between the many types of chemicals, including the phenols, aldehydes, ketones, alcohols, esters, ethers, and hydrocarbons present in EOs, are what cause the activity. However, there are also instances when the bioactivities of EOs are strongly tied to the activity of the oils' primary constituents. When evaluated independently, several investigations have discovered that a few of these substances showed notable antibacterial activity. The interaction between various terpenoid components of EOs might decrease or boost antibacterial effectiveness. There are four main sorts of impacts that might result from the combination of EO compounds: neutral, additive, antagonistic, or synergistic effects. When the total effect equals the sum of the separate effects, an additive effect is shown. When one or both chemicals work less effectively when used together than when used alone, antagonism is present. When two substances work together, their combined effect is higher than the sum of their separate effects. In contrast, indifference is the lack of interaction.

Essential Oils for Human Diseases: Medical Applications

Several plant Essential Oils are often used in the pharmaceutical sector, aromatherapy, and other medicinal applications. Since ancient times, several plant Essential Oils have been utilised as medicines and have demonstrated a variety of therapeutic benefits, particularly impacts on infectious, chronic, and acute ailments. It is commonly acknowledged that plant EOs can be used in the treatment of human infectious diseases both as standalone agents and in drug formulations. However, in order to prevent any side effects when given to children, it is important to choose a suitable safe oil and determine the most effective amount. Several essential oils have been utilised for medicinal

purposes and are highly recommended, particularly in the treatment of various catarrhal disorders. Eugenol 3, the primary constituent of clove (Syzygiumaromaticum L. Merrill & Perry) EO, has been shown to cure systemic infections in children with fever; however, a prior investigation suggested that it was not sufficient to avoid mortality in all treated patients. Numerous studies revealed that Ocimumgratissimum L. EO decreased the number of lesions more successfully than treatments based on benzyl peroxide (papules and pustules). Lippia origanoides Kunth, Backhousiacitriodora F. Muell, M. piperita, M. arvensis, M. spicata, and Melaleuca alternifolia (Maiden &Betche) Cheel have all been used to treat methicillin-resistant S. aureus (MRSA) in vitro. Further investigation revealed that even at modest dosages. Essential oil made from citrus aurantium var.amara L. was effective in reducing Tinea corporis disease.

Essential oil	Plant part	Botanical source	Main components	% of total
Angelica	Roots	*Angelica archangelica L.*	α–pinene	24.7
			δ – 3 – Carene	10.5
			α – phellandrenetmyrcene	10.8
			Limonene	12.9
			β – phellandrene	10.4
			p-Cymene	7.7
Bergamot	Fruits	*Citrus bergamia Risso et poit*	*β* – pinene	7.7
			Limonene + *β* – phellandrene	39.4
			γ – Terpinene	8.6
			Linalool	11.1
			Linalyl acetate	28.0
Cinnamon	Inner bark	*Cinnamomun Zeylanicum Blu.*	(*E*) –cinnamaldehyde	77.1
			Eugenol	7.2
			p-cymene	6.1
			Linalool	72.0
Dill (Indian)	Seeds	*AnethumsowaRoxb*	Limonene	50.9
			Trans-Dihydrocarvone	10.4
			Carvone	20.3
			Dillapiole	36.6
Eucalyptus	Leaves	*Eucalyptus Citriodora*	Citronellal	72.8
			Citronellol	14.5
Ginger	Roots	*Zingiber officinal Rosc.*	Camphene	14.1
			Neral	4.9
			Geranial + bornyl acetate	8.1
			β – Bisabolene	22.1
			ar –Curcumene	14.5
			β – Eudesmol	5.4
Juniper	Berries	*Juniperus commuunis L.*	α –pinene	33.7
			Sabinene	27.6
			Myrcene	5.5
Orange	Peel	*Citrus sinensis L. Osbeck*	Limonene	91.5
Pepper	Fruits	*Piper nigrum L.*	α –pinene	9.0
			β-pinene	10.4
			Sabinene	19.4
			δ-3-Carene	5.4
			Limonene	17.5
			β-Caryophyllene	14.7
Rosemary	Whole plant	*Rosemarinus officinalis L.*	α–pinene	7.4
			β – pinene	5.0
			1,8-Cineole	43.6
			Camphor	12.3
Tea tree	Branches	*Melaleuca alternifolia L.*	α – Terpinene	10.4
			1,8-Cineole	5.1
			Terpinene-4-ol	40.1
			γ – Terpinene	23.0

Source: Teixeira, B.,et al.(2013). Chemical composition and antibacterial and antioxidant properties of commercial essential oils. *Industrial Crops and Products*

Antioxidant

Compounds having antioxidant activity may react with radicals or have a lowering ability to resist the oxidative stress brought on by radicals. The occurrence of oxidative stress in pathophysiology justifies the relevance of antioxidant capabilities in several EO biological processes. Additionally, environmental factors such as temperature, the botanical source of aromatic plants, and other factors may have an impact on the actual composition of extracted EOs, resulting in a variety of antioxidant activities. Oregano essential oil can increase the shelf life of sea bream and limit the development of volatile amines and TBAR compounds. Additionally, it can prevent the oxidation of extra virgin olive oil while being stored. The essential oils of sage and oregano have the power to prevent oxidation in pulverised meat.

Per-oxidation of lipids

There are three possible ways to initiate the complicated process known as lipid oxidation: Chain reactions mediated by non-enzymatic free radicals; non-radical, non-enzymatic photo-oxidations; and enzymatic processes. The initial route initiates destructive chain reactions that proceed quickly and produce hydro peroxides and volatile chemicals. This pathway typically involves three phases: initiation, propagation, and termination. The creation of an allyl radical results from the homolytic breakdown of hydrogen in the -position with respect to the double bond of the fatty acid chain during the initiation phase. These species are very unstable, transient intermediates that either immediately react with oxygen to create peroxyl radicals or stabilise themselves by removing hydrogen from another chemical species (propagation phase). Peroxyl radicals created during the propagation phase may further oxidise the lipid, resulting in hydroperoxides. Conjugated dienes and trienes are produced, which are stabilised by double-bond rearrangement (electron deslocalization). As a result of the breakdown of these intermediates, formic acid, alcohols, aldehydes, alkyl formates, ketones, hydrocarbons, and alkoxyl radicals are produced. These chemicals are all thought of as lipid oxidation's secondary products. Several lipid substrates can be employed to measure lipid peroxidation. linoleic acid, fatty acid methyl esters, and low-density lipoproteins, for example (LDLs). By monitoring the consumption of the substrate and the oxidant as well as the creation of intermediate or final products, the antioxidant activity in such systems may be identified.

Antibacterial

In comparison to the synthetic antibiotic tetracycline, Elshafie et al. (2016) assessed the in vitro antibacterial activity of three EOs extracted from SchinusterebinthifoliusRaddi (leaves and fruits) against two strains of G+ve bacteria (Bacillus megaterium de Bary and Clavibactermichiganensis Smith) and four strains of Gve bacteria (E. coli, Xanthomonas The EOs described above were able to considerably suppress the development of the tested bacterial strains as a consequence, particularly against G+ve bacteria. El-Massry and colleagues (2009).These extracts showed better antibacterial activity against S. aureus, *P. aeruginosa*, and *E. coli*, according to research on the antibacterial activity of several crude extracts from fresh leaves of S. terebinthifolius grown in Egypt. In a recent study, the EOs extracted from *V. officinalis L.*, *Majoranahortensis L.*, and *Salvia officinalis L.* were found to be able to inhibit the growth of some phytopathogenic bacteria in a dose-dependent manner, including *B. megaterium, C. michiganensis,* and *B. mojavensis* in the case of *V. officinalis*, whereas the highest reduction of C. michiganens The permeabilization of cell theory provides an explanation for how various EOs affect bacterial cells in vitro and cause the ions, leakage of macromolecules and lysis.

Antifungal

Postharvest fungus has been reported to be suppressed both in vitro and in vivo by a variety of plant EOs and their individual components. The possible use of several plant EOs in the management of harmful phytopathogenic fungi, including B. cinerea, Aspergillus spp., Fusarium spp. , Penicillium spp., and C. gloeosporioidesPenz., was reported by a number of studies. The ability of EOs derived from T. vulgaris and V. officinalis to successfully treat brown rot infections on peach fruit brought on by Monilinialaxa, M. fructicola, and M. fructigena was examined by Elshafie et al. (2015).A bioactive compound, clove essential oil (EO) derived from Syzygiumaromaticum (L.) Merr. & Perry, has been shown to be effective against B. cinerea, M. fructigena, P. expansum Link, and PhlyctemavagabundaDesm. in apples . In apples, Neofabraea alba (E. J. Guthrie) Verkley's mycelium was shown to be successfully inhibited by oregano essential oil (EO) and carvacrol, the compound that makes up the majority of it. Other studies have discovered the existence of significant potential fungicidal effects of other plant EOs, including thyme and vervain, greater than chemical formulations, in postharvest treatments against M. laxa, M. fructigena, and M. fructicola on peach fruit.s Fennel (Foeniculum sativum Mill.), marjoram, oregano, and sage all had a fungicidal activity against B. cinerea and other fungi in the same manner.

Conclusion

Numerous studies looking at the biochemical characteristics of plant EOs have produced intriguing findings in the medical, pharmacological, and agricultural domains. In conclusion, there is increased interest in using EOs as natural substitutes for synthetic microbicide medications in the pharmaceutical and agricultural sectors. The plant EOs listed in the current research are thought to be promising all-natural substitutes for common pharmaceutical medications. Additionally, there is still a need for more focused and logical study on how to use these effective EOs and each of their individual components in agriculture and the food sector to create new health-related goods as well as unique natural pharmaceuticals.

References

Adorjan, B., & Buchbauer, G. (2010). Biological properties of essential oils: an updated review. *Flavour and Fragrance Journal*, *25*(6), 407-426.

Burt, S. Essential oils: Their antimicrobial properties and potential applications in foods: A review. *Int. J. Food Microbiol.* **2004**, *94*, 223–253.

Bajpai, V.K.; Baek, K.-H.; Baek, S.C. Control of Salmonella in foods by using essential oils: A review. *Food Res. Int.* **2012**, *45*, 722–734.

Bassolé, I. H. N., Setzer, W. N., & Gori, L. Essential Oils: New Perspectives in Human Health and Wellness, Volume 2014, Article ID 467363, 2 pages

Bakkali, F., Averbeck, S., Averbeck, D., & Idaomar, M. (2008). Biological effects of essential oils–a review. *Food and chemical toxicology*, *46*(2), 446-475.

Bassolé, I. H. N., & Juliani, H. R. (2012). Essential oils in combination and their antimicrobial properties. *Molecules*, *17*(4), 3989-4006. iew. *Food and chemical toxicology*, *46*(2), 446-475.

Bhatnagar, A. (2018). Composition variation of essential oil of Cymbopogon spp. growing in Garhwal region of Uttarakhand, India. *Journal of Applied and Natural science*, *10*(1), 363-366.

Ben Arfa, A.; Combes, S.; Preziosi-Belloy, L.; Gontard, N.; Chalier, P. Antimicrobial activity of carvacrol related to its chemical structure. *J. Appl. Microbiol.* **2006**, *43*, 149–154.

Cox, S.D.; Mann, C.M.; Markham, J.L. Interactions between components of the essential oil of *Melaleuca alternifolia*. *J. Appl. Microbiol.* **2001**, *91*, 492–497.

Cosentino, S.; Tuberoso, C.I.G.; Pisano, B.; Satta, M.; Mascia, V.; Arzedi, E.; Palmas, F. *In vitro* antimicrobial activity and chemical composition of Sardinian *Thymus* essential oils. *J. Appl. Microbiol.* **1999**, *29*, 130–135.

Delaquis, P.J.; Stanich, K.; Girard, B.; Mazza, G. Antimicrobial activity of individual and mixed fractions of dill, cilantro, coriander and eucalyptus essential oils. *Int. J. Food Microbiol.* **2002**, *74*, 101–109.

Dormans, H.J.D.; Deans, S.G. Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. *J. Appl. Microbiol.* **2000**, *88*, 308–316.

Firenzuoli, F., Jaitak, V., Horvath, G., Bassolé, I. H. N., Setzer, W. N., & Gori, L. (2014). Essential oils: New perspectives in human health and wellness. *Evidence-Based Complementary and Alternative Medicine*, *2014*.

Fabian, D., Sabol, M., Domaracka, K., Bujnakova, D., 2006. Essential oils – their antimicrobial activity against Escherichia coli and effect on intestinal cell viability. Toxicol. In Vitro 20, 1435–1445 (Erratum in: Toxicol. In Vitro 2007, 21, 534).

Hammer, K.A.; Carson, C.F.; Riley, T.V. Antimicrobial activity of essential oils and other plant extracts. *J. Appl. Microbiol.* **1999**, *86*, 985–990

Kim, J.; Marshall, M.R.; Wei, C.I. Antibacterial activity of some essential oil components against five foodborne pathogens. *J. Agric. Food Chem.* **1995**, *43*, 2839–2845

Koul, O., Walia, S., & Dhaliwal, G. S. (2008). Essential oils as green pesticides: potential and constraints. *Biopesticides international*, *4*(1), 63-84.

Lambert, R.J.W.; Skandamis, P.N.; Coote, P.; Nychas, G.J.E. A study of the minimum inhibitory concentration and mode of action of oregano essential oil, thymol and carvacrol. *J. Appl. Microbiol.* **2001**, *91*, 453–462

Laird, K., & Phillips, C. (2012). Vapour phase: a potential future use for essential oils as antimicrobials?. *Letters in Applied Microbiology*, *54*(3), 169-174.

Mithöfer, A., & Boland, W. (2012). Plant defense against herbivores: chemical aspects. *Annual review of plant biology*, *63*, 431-450.

Raut, J. S., & Karuppayil, S. M. (2014). A status review on the medicinal properties of essential oils. *Industrial crops and products*, *62*, 250-264.

Owen, L., Grootveld, M., Arroo, R., Ruiz-Rodado, V., Price, P., & Laird, K. (2017). A Multifactorial Comparison of Ternary Combinations of Essential Oils in Topical Preparations to Current Antibiotic Prescription Therapies for the Control of Acne Vulgaris-Associated Bacteria. *Phytotherapy Research*, *31*(3), 410-417.

Zare Bidaki, M., Arab, M., Khazaei, M., Afkar, E., & Zardast, M. (2015). Anti-bacterial effect of zataria multiflora boiss. Essential oil on eight gastrointestinal pathogenic species. *The Horizon of Medical Sciences*, *21*(3), 155-161.