Original Article

Review on Indian Originated Essential Oil with Antioxidant Properties and it's Health Benefits

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ABSTRACT:
This review explores the antioxidant properties and health benefits of essential oils derived from Indian flora. Essential oils, known for their bioactive compounds, have gained attention for their potential therapeutic applications. This review examines various essential oils, including those from turmeric, neem, and eucalyptus, highlighting their phytochemical constituents responsible for antioxidant activity. We discuss the mechanisms through which these oils combat oxidative stress, their role in chronic disease prevention, and their traditional uses in Indian medicine. Additionally, we analyze clinical studies demonstrating the efficacy of these oils in promoting health and wellness. The findings suggest that Indian-origin essential oils not only provide potent antioxidant effects but also hold promise for holistic health applications. Further research is encouraged to explore their full potential in modern therapeutic practices.
Keywords: Essential oils, Indian flora, Antioxidant properties, Bioactive compounds, Turmeric, Neem, Eucalyptus, Phytochemical constituents, Oxidative stress, Chronic disease prevention, Health benefits,Therapeutic applications

INTRODUCTION:

Overview of Essential Oil:

Essential oils (also called volatile or ethereal oils, because they evaporate when exposed to heat in contrast to fixed oils) are odorous and volatile compounds found only in 10% of the plant kingdom and are stored in plants in special brittle secretory structures, such as glands, secretory hairs, secretory ducts, secretory cavities or resin ducts.[1] Essential oils (EOs) are natural substances made by fragrant glands in different plants. These oils offer several health benefits, including helping to prevent infections, reducing inflammation, fighting germs, and acting as antioxidants, which help protect our cells from damage. [2]

Essential oil (EO) origins are believed to be from ancient China and Egypt. [3] They are extracted from various plant parts, such as wood, leaf, bark, and stem [4]. Up until now, more than 3000 EOs have been extracted, mostly from families including *Lamiaceae, Rutaceae, Myrtaceae, Zingiberaceae*, and *Asteraceae*. Among them, more than 300 EOs are commercialized in the fragrance and food markets, with anticipated growth reaching more than $15 billion by 2025. [5]

Therapeutic effect of Essential Oil:

- Antioxidant, Anti-Inflammatory, and Anti-Cancer Activities of Essential Oils
- Remedy for the Management of Metabolic Syndrome

- In Obesity
- In Diabetes
- In Hypertension
- In Dyslipidemia
- Enhance Breast Milk Production and Childcare [6]

Overview of Antioxidant:
Antioxidant means "against oxidation". Any substance at low concentrations compared to that of an oxidizable substrate that significantly delays or prevents oxidation of that substrate is called as antioxidant. Antioxidants play vital role in preserving the quality of food and maintaining health of human being. Antioxidants are essential for combating oxidative damage in both food systems and biological cells. In food, oxidation leads to rancidity, reduced nutritional quality, and safety risks due to the formation of harmful compounds. In the human body, about 5% of inhaled oxygen transforms into reactive oxygen species, which can harm lipids, proteins, and nucleic acids. To counteract this, antioxidants are necessary to neutralize these reactive species, enhancing cellular protection and supporting overall health. Thus, incorporating antioxidants into our diet is vital for maintaining well-being and preventing oxidative stress. [7]

Prominent Indian-Origin Essential Oils with Antioxidant Properties:
- Lemon oil
- Rosemary oil
- Lavender oil
- Clove oil
- Papermint oil
- Neem oil
- Turmeric oil
- Basil oil
- Carrot seed oil
- Coriander oil
- Lemongrass oil

1. Rosemary Oil:
Rosemary (Rosmarinus officinalis L., Lamiaceae) is a woody perennial herb, native to the Mediterranean region, but is now cultivated all over the world as an ornamental and aromatic plant. The leaves of rosemary are commonly used for flavoring foods as a condiment, but this plant has also been widely used for different medicinal purposes. In traditional medicine, rosemary has been used as a stimulant and mild analgesic, and it has been considered as one of the most effective herbs for treating headaches, poor circulation, inflammatory diseases, and physical and mental fatigue. Rosemary has also been used empirically as a choleretic and hepatoprotective agent in folk medicine. [8-9]
Rosemary essential oil (REO) is a colorless or pale yellow liquid, with characteristic odor of the plant, and consists mostly of monoterpenes such as 1,8-cineole, camphor and α-pinene [10]. Due to its antioxidant and antimicrobial activity [11,12], REO is capable to extend the shelf-life of food products and maintain their quality during storage. Therefore, it has already being used as a biopreservative in food industry [13].

Role in Antioxidant activity:
Most pharmacological effects of rosemary are the consequence of high antioxidant activity of its main chemical constituents, which include carnosol, carnosic acid, ursolic acid, rosmarinic acid, and caffeic acid. The potent antioxidant properties of rosemary have been mainly attributed to its major diterpenes, carnosol and carnosic acid, as well as to the essential oil components. [14]

2. Basil Oil:
Basil (Ocimum basilicum L.) is an annual plant of the Lamiaceae family, growing wild in subtropical and tropical areas of America, Africa, Asia, and in some southern regions in Europe[15]. Basil has been used as a medicinal plant in the treatment of headaches, coughs, diarrhea, constipation, warts, worms, and kidney malfunction [16]. The essential oils distilled from various basil cultivars can contain linalool, methyl chavicol, 1,8-cineole, eugenol, methyl eugenol, methyl isoeugenol, thymol, methyl cinnamate, citral, and camphor [17].

In several studies the antioxidant, antimicrobial, anti-inflammatory, antibacterial, antifungal activities as well as repellent, insecticidal, larvicidal and nematicidal activities of basil essential oils have been established [17–19].

Role in Antioxidant activity:
It has been found that basil leaves are rich in phenolic acids (rosmarinic, chicoric, caffeic, and caftaric) [20], flavonol (quercetin, kaempferol) glycosides and anthocyanins [21,22]. The phenolic compounds listed above make the main contribution to the antioxidant properties of basil leaf extracts.
It was shown that selenium biofortification increased the phenolic compound content, flavonoids and antioxidant activity in tomato fruits [23,24], broccoli [25], curly endive [26], garlic [27], and shallot [28].

3. Lemon Oil:
Lemon essential oil (LEO) is a kind of citrus EOs, which is commonly used for flavoring and fragrance. The FDA has also deemed LEO safe for use as a preservative or flavoring agent [29]. Furthermore, some researchers reported that LEO had antioxidant activity using DPPH, ABTs, and β-Carotene bleaching assays [30,31]. The antioxidant activity of the LEO is related to the preservation of food and the prevention of diseases. Thus, it has the prospect to replace synthetic preservatives [32].

The greatest impediment to the widespread use of LEO is its insolubility in water, and other disadvantages include volatility, low stability, and sensitivity to the environment.[33]

Role in Antioxidant activity:
A high level of phenolic and flavonoid components was found in lemon peel EO in the present study which is similar with some previous reports [34,35]. The phenolic and flavonoid compounds of C. lemon peel oil in this study may correlate with the antioxidant activity of the EO. The relation between total phenol content and antioxidant activity has been widely studied in different foodstuffs, such as fruit and vegetables.[36,37]

4. Lavender oil:
Lavender genus is an important member of the Lamiaceae family. Lavandula species are widely distributed in the Mediterranean region and cultivated in France, Italy and Spain. The Lavandula augustifolia Mill. specie is well known among people as a powerful aromatic and medicinal herb. The plant is used in traditional and folk medicines of different parts of the world for the treatment of

several gastrointestinal, nervous and rheumatic disorders [38,39]. Lavandula augustifolia essential oil (LEO) and its major components, (-)-linalool and linalyl acetate, also presented anti-inflammatory properties in rats [40]. In an in vitro study, (-)-linalool decreased the production and the release of nitric oxide (NO) without interference in the prostaglandin's pathway [41].

Several studies have investigated the antinociceptive, immunomodulatory and anti-inflammatory properties of compounds found in the lavender essential oil [42].

Role in Antioxidant activity:
Lavender is cultivated mainly for its essential oil, but it also contains many other compounds such as polyphenols, coumarins, triterpenes, sterols and tannins [43]. Polyphenols have antioxidant activity owing to their ability to scavenge free radicals, chelate metal ions (e.g., Fe^{2+}, Cu^{2+}) and inhibit the activity of pro-oxidative enzymes [44].

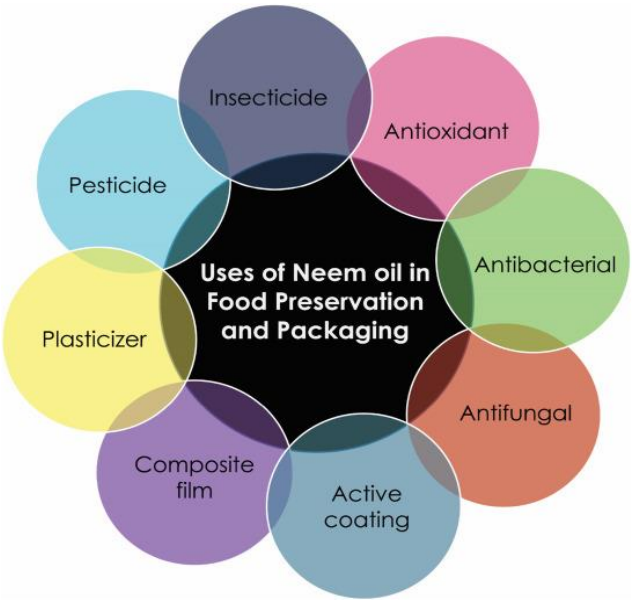
5. Clove oil:
Clove oil is obtained by distillation of the flowers, stems and leaves of the clove tree (Eugenia aromatica or Eugenia caryophyllata, Fam. Myrtaceae) [45,46]. humans have used clove oil for centuries, as an anaesthetic for toothaches, headaches and joint pain [47,48].

It is used throughout the world for applications ranging from food flavoring to local anesthaesia in dentistry profession [49]. In addition to its worldwide use as a food flavoring agent, it has also been employed for centuries as a topical analgesic in dentistry [50]. It was reported that clove oil had antilisteric activity in meat and cheese [51]. Clove oil has been used as an aromatherapy oil, mouth sterilizer or painkiller [52].

Role in Antioxidant activity:
The essential oil of clove has been shown to have strong antimicrobial and antioxidant properties [53]. It has been proven that the strong antioxidant value of clove oil is connected to the phenolic compounds found in it [54,55]. The antioxidant power of the oil is attributed to its ability to minimize oxidation reactions and reduce the number of free radicals; therefore, it can be used in the formulation of medicines against the damage and disease caused by oxidative stress [56]. Moreover, it has been demonstrated that eugenol and eugenol acetate present in clove exhibit antioxidant properties [57].

6. Neem oil:
Seeds of neem tree contains high amounts of azadirachtin, which is one of the most thoroughly investigated and used active components present in neem [58,59]. Moreover, neem oil is biodegradable, hydrophobic, low-cost, non-toxic to animals and beneficial insects that has numerous applications in food, agriculture, and health sectors, including its historic usages in Ayurveda, Unani, and homoeopathic medicines for centuries [60].

Neem oil has excellent antibacterial, antifungal, insecticidal, pesticidal, plasticizer, and antioxidant properties [fig.] due to plethora of bioactive phytochemicals such as azadirachtin, salannin, nimbidin, gedunin, nimbin, isomargolonone, margolone, nimbolide, margolonone, etc. present in neem oil [61]



Role in Antioxidant activity:

Phenolic compounds present in plant extract having high antioxidant activities are attractive alternative to food industry replacing synthetic antioxidants and they also have significant role in preventing food spoilage [62,63].

Neem oil is widely used for treating variety of diseases, and also for its antioxidant potential in different pharmaceutical industries [64]. evaluated antioxidant activity of neem oil, found 66.34% free radical scavenging activity, due to its high total phenolic content (132 μg/mL) [65].

7. Carrot seed oil:

Carrot (Daucus carota L.) is the most important crop of Apiaceae family. It is a root vegetable that has worldwide distribution. Carrots were first used for medical purposes and gradually used as food. Written records in Europe indicated that carrots were cultivated prior to the tenth century. The colors of the carrot root flesh may be white, yellow, orange, red, purple, or very dark purple. The first cultivated carrots were yellow and purple fleshed cultivars. Orange carrots, today more popular, were developed in the 15th and 16th centuries in Central Europe. A rapid rise in the popularity of orange carrots was observed with the recognition of its high provitamin A content [66] .

Among 39 fruits and vegetables carrots have been ranked 10th in nutritional value [67] . Carrot is a good source of dietary fiber and of the trace mineral molybdenum, rarely found in many vegetables. Molybdenum aids in metabolism of fats and carbohydrates and is important for absorption of iron. It is also a good source of magnesium and manganese. Magnesium is needed for bone, protein, making new cells, activating B vitamins, relaxing nerves and muscles, clotting blood, and in energy production [68] . Insulin secretion and function also require magnesium [69] [70] . Manganese is helpful in carbohydrate metabolism, in coordination with enzymes in the body [71] [72] .

Role in Antioxidant activity:

Carotenoids and anthocyanins are the major antioxidant pigments found in carrots. Cultivar differences in carrots rely in the type of pigments present. Carotenoids are the yellow, orange, or red colored phytochemicals found in most yellow and orange fleshed cultivars. The widely used orange carrot is high in α- and β-carotene and is a rich source of provitamin A. Yellow carrot color is due to lutein which plays an important role in prevention of macular degeneration [71] [72] **.**

Conclusion:

In summary, Indian-origin essential oils are a valuable source of potent antioxidants that offer significant health benefits. Their diverse phytochemical profiles contribute to their effectiveness in neutralizing free radicals and reducing oxidative stress, which are linked to various chronic diseases. The traditional uses of these oils in Indian medicine, combined with emerging scientific evidence, highlight their potential in enhancing overall health and wellness. However, further research is needed to fully elucidate their mechanisms of action, optimize extraction methods, and evaluate their efficacy in clinical settings. By integrating these essential oils into modern therapeutic practices, we can harness their benefits for preventive healthcare and holistic healing.

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