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A review article on essential oils

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Abstract
Aromatherapy treatments are widely available and often offered in hospitals, while essential oils can be purchased in every town. This change in attitude has bought so many benefits, but it is worth also considering the dangers that have emerged with the commercialization of aromatherapy. Although essential oils are all wholly natural substances, they can be subject to adulteration, so it is important to always buy them from a reputable supplier. It is also vital to check that any specific safety guidelines are followed with care at home. The Scientific trials and clinical research have continued to confirm the potentiality of essential oils, they have become increasingly respected within the medical arena. This has been accompanied by a steady increase of public interest in holistic therapies and a sociological trend towards embracing all things 'natural' over the past two decades in Europe and the United State. Essential oils and their volatile constituents are used widely to prevent and treat human disease. The possible role and mode of action of these natural products is discussed with regard to the prevention and treatment of cancer, cardiovascular diseases including atherosclerosis and thrombosis, as well as their bioactivity as antibacterial, antiviral, antioxidants and antidiabetic agents. Their application as natural skin penetration enhancers for transdermal drug delivery and the therapeutic properties of essential oils in aroma and massage therapy will also be outlined.

Keywords: Essential Oils, benefits, review, therapeutic activities.

Introduction
Aromatic plants had been used since ancient times for their preservative and medicinal properties, and to impart aroma and flavor to food. Hippocrates, sometimes referred to as the 'father of medicine', prescribed perfume fumigations. The pharmaceutical properties of aromatic plants are partially attributed to essential oils. The term 'essential oil' was used for the first time in the 16th century by Paracelsus von Hohenheim, who named the effective component of a drug, 'Quinta essential' (Guenther, 1950) [21]. By the middle of the 20th century, the role of essential oils had been reduced almost entirely to use in perfumes, cosmetics and food flavorings, while their use in pharmaceutical preparations had declined. Essential oils are natural, complex, multi-component systems composed mainly of terpenes in addition to some other non-terpene components. Several techniques can be used to extract essential oils from different parts of the aromatic plant, including water or steam distillation, solvent extraction, expression under pressure, supercritical fluid and subcritical water extractions.

Essential Oils and Carcinoma
The diverse therapeutic potential of essential oils has drawn the attention of researchers to test them for anticancer activity, taking advantage of the fact that their mechanism of action is dissimilar to that of the classic cytotoxic chemotherapeutic agents. Monoterpenes have been shown to exert chemopreventive as well as chemotherapeutic activities in mammary tumor models and thus may represent a new class of therapeutic agents. The mechanism of action of monoterpenes is based on two main approaches, chemoprevention and chemotherapy. The mechanism of action of monoterpenes is based on two main approaches, chemoprevention and chemotherapy. Chemoprevention occurs during the initiation phase of carcinogenesis to prevent the interaction of chemical carcinogens with DNA, by induction of phase I and phase II enzymes to detoxify the carcinogen. Chemotherapy works during the promotion phase, in which inhibition of tumor cell proliferation, acceleration of the rate of tumor cell death and/or induction of tumor cell differentiation may occur.

Essential Oils and Cardiovascular Diseases

Atherosclerosis

Atherosclerosis is a process in which deposits of plaque build up in the innermost layer of the artery, the intim. Plaque can eventually significantly reduce blood flow, leading to serious health problems. Essential oils and their aroma volatile constituents have shown an antioxidative activity against LDL oxidation. Terpinolene, a monoterpene hydrocarbon, can effectively inhibit the oxidation of both the lipid part and the protein part of LDL. This inhibition is due to a retarded oxidation of intrinsic carotenoids of LDL, and not, as is the case with some flavonoids, to the protection of intrinsic α-tocopherol. Essential oils rich in phenolic constituents such as eugenol and thymol have the highest antioxidative activity against LDL oxidation and these components can also change the affinity of the LDL particles for the LDL receptor. A relationship was found between the quantity and quality of phenolic components in the oil and its protection against LDL oxidation: for instance, copper-catalysed oxidation of human LDL *in vitro* is inhibited by 50%– 100% when eugenol is the major component of the essential oil (as in clove oil). While inhibition was only 10%–50% for essential oils containing moderate amounts of the phenolics, thymol, carvacrol or cuminol. In addition to the phenolic constituents, the monoterpene hydrocarbon γ- terpinene, was also found to inhibit LDL oxidation, even in the propagation phase. γ-Terpinene generated an antioxidative effect on the Cu2+ -induced and AAP Hinduced oxidation of human LDL *in vitro* Tea tree essential oil is considered to be a rich source of γ-terpinene (23.0%) and γ-terpinene is also found in considerable amounts in some citrus peel essential oils such as bergamot (14%), mandarin (17%) and lemon (10%) It has been recommended as an addition to foods and beverages to protect against LDL oxidation and to reduce plaque formation.

Thrombosis

Thrombosis is usually associated with platelet activation and the release of eicosanoids which contribute to initiation and aggravation of thrombosis. The antiplatelet agents currently used for this purpose are effective in the prevention of thromboembolic disease, but many have side effects such as gastric erosion (e.g. aspirin) The essential oil of lavender, (Lavandula hybrida Reverchon cv.), showed a broad spectrum antiplatelet effect and was able to inhibit platelet aggregation induced by ADP, arachidonic acid, collagen and the stable thromboxane receptor agonist U46619 with no pro hemorrhagic properties (Ballabenia *et al*., 2004) [9]. Linalyl acetate (36% of lavender oil) seemed to be the main active antiplatelet agent. Onion (Allium cepa) is well known for promoting cardiovascular health, and populations with a high consumption of onions are associated with decreased rates of atherosclerosis or thrombotic disease. This activity is due to inhibition of platelet aggregation and thromboxane formation by the organo-sulfur components in the essential oil. The mechanism of the antiplatelet effect of onion includes TXA2 synthase inhibition and TXA2/PGH2 receptor blockade. However, garlic was found to be more potent than onion in lowering TXB2 levels. Organosulfur components such as allicin, isolated from garlic essential oil, showed a potent inhibition of platelet aggregation. llicin is formed from alliin when garlic cloves are crushed or chewed and the enzyme alliinase is released from the cell walls. However, ajoene has the highest specific antithrombotic activity compared with any other organo-sulfur compounds from garlic. Ajoene is formed from allicin during steam or water distillation of the essential oil from garlic cloves, or during storage in ethanol. The presence of vinyl groups attached by a disulfide bond makes ajoene a highly reactive molecule which can inhibit the release of both dense granules and α-granules. Ajoene can reduce platelet aggregation induced by 0.1 U/mL thrombin by 94.7% after a pre-stimulation incubation time for one minute at a dose of 25 μM. The mechanism of action of ajoene differs to that of other known inhibitors of platelet aggregation. Ajoene penetrates the membrane of intact platelets and reduces the viscosity of the inner part of the lipid bilayer, thus interfering with the expression of the fibrinogen receptor αIIB β3 at the cell surface, thereby inhibiting fibrinogen binding.

Essential Oils as Antibacterial Agents

The Ancient Egyptians used aromatic plants in embalming to stop bacterial growth and prevent decay, an effect attributed to a great extent to their essential oils. Strong *in vitro* evidence indicates that essential oils can act as antibacterial agents against a wide spectrum of pathogenic bacterial strains including Listeria monocytogenes, *L. innocua*, Salmonella typhimurium, Escherichia coli O157:H7, Shigella dysenteriae, Bacillus cereus, Staphylococcus aureus and Salmonella typhimurium and many more (Deans and Ritchie, 1987) [19]. Thyme and oregano essential oils can inhibit some pathogenic bacterial strains such as E. coli, Salmonella enteritidis, Salmonella choleraesuis and Salmonella typhimurium, with the inhibition directly correlated to the phenolic components carvacrol and thymol. The same correlation was also confirmed for oils rich in carvacrol alone. Eugenol and carvacrol showed an inhibitory effect against the growth of four strains of Escherichia coli O157:H7 and Listeria monocytogenes. The presence of a phenolic hydroxyl group, in carvacrol particularly, is credited with its activity against pathogens such as Bacillus. Some essential oils demonstrated antibacterial activity against zoonotic enteropathogens including Salmonella spp., Escherichia coli O157, Campylobacter jejunii and Clostridium perfringens. Thus, these oils could possibly be used as an alternative to antibiotics in animal feed. Essential oils with high concentrations of thymol and carvacrol e.g. oregano, savory and thyme, usually inhibit Gram-positive more than Gram-negative pathogenic bacteria. However the essential oil of Achillea clavennae exhibited strong antibacterial activity against the Gram (−)-ve Haemophilus influenzae and Pseudomonas aeruginosa respiratory pathogens, while Gram (+)-ve Streptococcus pyogenes was the most resistant to the oil.

Essential Oils as Antiviral Agents

Herpes simplex virus (type I, II) causes some of the most common viral infections in humans, and can be fatal. Synthetic antiviral drugs have been used to treat Herpes infection, but not all are efficacious in treating genital herpes infections. HSV-1 and HSV-2 have also developed resistance to one of these (acyclovir) mainly in immuno-compromised hosts. Plant extracts, especially essential oils, may afford a potential alternative to synthetic antiviral drugs: they have demonstrated virucidal properties, with the advantage of low toxicity compared with the synthetic antiviral drugs [11]. Incorporation of Artemisia arborescens essential oil in multilamellar liposomes greatly improved its activity against intracellular Herpes simplex virus type-1 (HSV-1). Melissa officinalis L. essential oil can inhibit the replication of HSV-2, due to the presence of citral and citronellal (Allahverdiyev *et al*., 2004) [6] and the ability to replicate of HSV-1 can be suppressed by incubation with different essential oils *in vitro*. Of these,

lemongrass essential oil possessed the most potent anti-HSV-1 activity and completely inhibited viral replication after incubation for 24 h, even at a concentration of 0.1%.The antiviral activity of the oil was confirmed when the virus was pretreated with the essential oil prior to adsorption. The essential oil of Lippia junelliana and Lippia turbinate showed a potent inhibition against Junin virus. Australian tea tree essential oil and to a lesser extent, eucalyptus essential oil, demonstrated antiviral activity against HSV-1, 2. Both oils affected the virus before or during adsorption, but not after penetration into the host cell. The essential oil of Santolina insularis showed an antiviral activity in toto against HSV-1 and HSV-2 *in vitro* and was capable of preventing cell-to-cell virus spread in infected cells. The oil directly inactivated virus particles, thus preventing adsorption of virion to host cells. Isoborneol, a common monoterpene alcohol, showed dual virucidal activity against HSV-1 and specifically inhibited glycosylation of viral polypeptides. Unfortunately, no literature was found concerning the antiviral applications of essential oils against epidemic viruses such as HIV or hepatitis C viruses, but the promising results illustrated here may promote further investigations in this area.

Essential Oils as Antioxidants

Free radicals and other reactive oxygen species cause oxidation of biomolecules including proteins, amino acids, unsaturated lipids and DNA, and ultimately produce molecular alterations related to aging, arteriosclerosis and cancer, Alzheimer's disease, Parkinson's disease, diabetes and asthma (Zarkovic, 2003) [33]. The human body is equipped with an inherent defense system which can quench free radicals present in almost all cells (Halliwell and Gutteridge, 1990) [22]. An imbalance between free radical production and their removal by the body's antioxidant system leads to a phenomena known as 'oxidative stress' [1]. In' this situation, an external supply of antioxidants is necessary to regain a balance between free radicals and antioxidants. Essential oils, as natural sources of phenolic components, attract investigators to evaluate their activity as antioxidants or free radical scavengers. The essential oils of basil, cinnamon, clove, nutmeg, oregano and thyme have proven radical-scavenging and antioxidant properties in the DPPH radical assay at room temperature. The order of effectiveness was found to be: clove >> cinnamon > nutmeg > basil ≥ oregano >> thyme. The essential oil of Thymus serpyllum showed a free radical scavenging activity close to that of the synthetic butylated hydroxytoluene (BHT) in a β-carotene/linoleic acid system The antioxidant activity was attributed to the high content of the phenolics thymol and carvacrol (20.5% and 58.1%, respectively). Thymus spathulifolius essential oil also possessed an antioxidant activity due to the high thymol and carvacrol content (36.5%, 29.8%, respectively. The antioxidant activity of oregano (*Origanum vulgare* L., ssp. hirtum) essential oil was comparable to that of α-tocopherol and BHT, but less effective than ascorbic acid. The activity is again attributed to the content of thymol and carvacrol (35.0%, 32.0%, respectively).

Although dietary supplementation of oregano oil to rabbits delayed lipid oxidation, this effect was less than that of supplementation with the same concentration of α- tocopheryl acetate. However, when tested on turkeys it showed an equivalent performance to the same concentration of α-tocopheryl acetate in delaying iron-induced, lipid oxidation. The essential oils of *Salvia cryptantha* and *Salvia multicaulis* have the capacity to scavenge free radicals. The activity of these oils was higher than that of curcumin, ascorbic acid or BHT. The essential oil of Achillea millefolium subsp. millefolium (Asteraceae) exhibited a hydroxyl radical scavenging effect in the Fe3+ –EDTA–H2O2 deoxyribose system and inhibited the non-enzymatic lipid peroxidation of rat liver homogenate. In addition, Curcuma zedoaria essential oil was found to be an excellent scavenger for DPPH radical. The antioxidant activity of essential oils cannot be attributed only to the presence of phenolic constituents; monoterpene alcohols, ketones, aldehydes, hydrocarbons and ethers also contribute to the free radical scavenging activity of some essential oils. For instance, the essential oil of *Thymus caespititius*, *Thymus camphoratus* and *Thymus mastichina* showed antioxidant activity which in some cases was equal to that of α-tocopherol. Surprisingly, the three species are characterized by high contents of linalool and 1, 8-cineole, while thymol or carvacrol are almost absent. The essential oil of lemon balm (*Melissa officinalis* L.) shows an antioxidant and free radical scavenging activity with the most powerful scavenging constituents comprising neral/ geranial, citronellal, isomenthone and menthone.

Essential Oils, Aromatherapy and Massage Therapy

The word 'aromatherapy' combines two words: aroma (a fragrance or swee smell) and therapy (a treatment). Aroma and massage therapy are the practice of using essential oils for psychological and physical well-being via inhalation or massage. Via inhalation or massage. The term 'aromatherapy' may be confusing to nonspecialists because it is used to describe a wide range of practices involving odorous substances. Thus, massage therapy, even when using essential oils, cannot be considered as aromatherapy. Only aroma delivery through inhalation, to induce psychological or physical effects, can be defined as. Nevertheless, the clinical use of essential oils and their volatile constituents via inhalation or massage has expanded worldwide.

Conclusions

This review attempts to shed light on the therapeutic potential of essential oils and their aroma volatile constituents in the prevention or therapy of disease. The results reviewed in this article are aimed at attracting the attention of researchers seeking new drugs from natural products as well as those investigating the pharmaceutical diversity of essential oils. The data presented provide a basis for reviving the old art of 'essential oil therapy' based on our modern scientific knowledge of their mode of action, supported by safety issues described here. Thus essential oils and their constituents can hopefully be considered in the future for more clinical evaluations and possible applications, and as adjuvants to current medications.

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