The Therapeutic Potential of Herbal Medicine and Essential Oils

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Abstract

In herbal medicine, certain active phytochemicals are used for therapeutic purposes. For instance, it has been observed that using medicinal herbs for treating patients with cardiovascular disease has no adverse effects. Prior research shown that tetramethylpyrazine, a chemical present in botanical products, inhibited the heart disease-associated phosphodiesterase. It also demonstrated the cardio-protective properties of other herbal medicines that were utilized to prevent ischemia-reperfusion injury in rat hearts. Herbal remedies individually exhibit antipyretic, analgesic, anti-inflammatory, and anti-cancer properties. The active ingredients in herbal medicine are also utilized in dietary supplements for cardiovascular disease, in addition to their various therapeutic uses. The complex combinations of hydrocarbons and their oxygenated derivatives that come from two distinct isoprenoid routes are known as essential oils. Essential oils (EOs), derived from various plant sources, have been widely promoted due to their alleged biological properties that promote health. The essentials oils are made up of intricate blends that contain numerous distinct chemicals that have been extracted using a variety of techniques. These various compounds exhibit notable biological activities, including antioxidant and antimicrobial effects, via different mechanisms. However, their limited water solubility, susceptibility to oxidation, and volatility restrict their application. To address these challenges, encapsulation is considered one of the most effective strategies for maintaining the biological activities of essential oils (EOs) while reducing their impact on the sensory qualities of food.

Keywords: Cardiovascular disease, Aromatic liquids, Antidepressant, Antimicrobial, Antioxidant activity

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Introduction

The first recorded oral history of the use of herbal products to make medications was discovered on a 5000-year-old Sumerian clay slab from Nagpur. It offered 12 drug production techniques that referenced more than 250 different plants, some of which were alkaloid, including mandrake, henbane, and sunflower (Kelly, 2009).

Writte by Emperor Shen Nung in 2500 BC, the Chinese book "Pen T'Sao" on roots and grasses shows 365 medications, or dried sections of medicinal plants, many of which are still in use today. Examples include the following: Camphor, Podophyllum, Theae folium, ephedra, ginseng, jimson weed, Podophyllum, Rhei rhisoma, and ephedra (Wiart et al., 2006).

Indian history underwent a significant transformation because of Black pepper among other spices which earned it the title “The home of spices.” (Ramkumar & Karuppusamy, 2021)

Medical organizations faced a critical danger during the last quarter of the nineteenth century and the first decade of the twentieth century because they lost access to herbal medicines for therapeutic uses. Various experts documented how enzymatic effects cause essential alterations throughout medicinal plant drying however this active mechanism blocks therapeutic agents thus leading to multiple negative effects in resulting medications. Since ancient times human beings have unquestionably used medicinal plants. Since early humanity started to use plants for energy needs and fabric production and house construction together with food consumption they began to understand plant characteristics to varying degrees. The history of medicinal plants evolved into ancient knowledge within China and Greece as well as Egypt and India. In ancient Persia, The ancient world employed plants both as pharmaceutical agents and germ-fighting substances and scented components (Ganeson, 2008).

The pharmaceutical domain used plants as the primary medicinal source but natural medicines now used in synthetic medicines derived from plant origins. When pharmaceuticals evolved into a leading therapy field medical herbalism faced a sudden downfall because it utilized only plant-made medicines for healthcare. Most healthcare institutions in English-speaking areas eliminated herbalism from therapeutic practices one century ago. Among the plant species over 50 000 have been identified for their pharmaceutical and cosmetic uses. Medicinal

herbs are mostly extracted from the wildlife ecosystem although medicinal plant distribution varies worldwide. The annual demand for wildlife sources grew between 8%-15% each year since the last few decades in Asia and North America and Europe (Hassan, 2012).

A medicinal plant represents one of many plants that demonstrate healing benefits for human use. The plants function as a substantial medicinal resource. The compounds contained in these plants create possibilities for drug development through synthesis processes. A method exists which uses the complete herbal extract as the active component. The accuracy of these investigations can be enhanced by providing proper descriptions of the extracts. The extraction standardization process often uses a vital compound for calibration (such as the active substance or suitable marker compound). Human beings mostly depend on unprocessed plant materials to address medical requirements for healthcare maintenance and disease treatment (Verma & Singh, 2008).Essential oils (EOs), also referred as phantom oils, are spontaneously produced aromatic liquids that can be obtained from various plant parts, such as leaves, seeds, wood, bark, roots, flowers, fruits, and rhizomes (Aumeeruddy-Elalfi et al., 2018). Figure 1a and 1b depict a variety of herbal medicines commonly used for their therapeutic properties in traditional and modern healthcare practices.

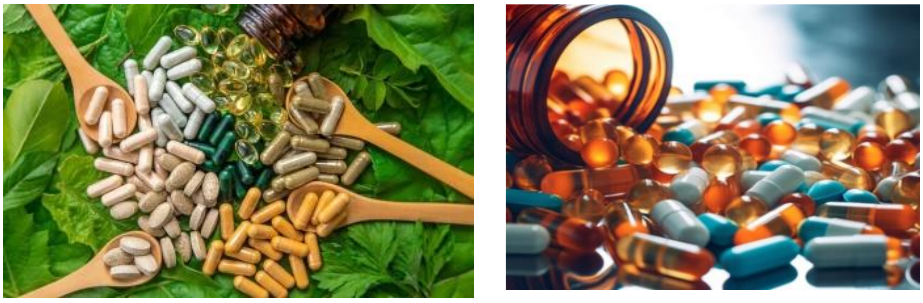

Fig. 1: Herbal Medicine

The 16th-century term "essential oil" was used to describe the "Quinta essentia" theory put out by the well-known German-Swiss physician and chemist Paracelsus (1493–1541), who was born Theophrastus Philippus Aureolus Bombastus von Hohenheim. By producing medicinal plants and extract from plants, Paracelsus established the objective of alchemy. By separating the "essential" components from the "nonessential," he suspected that the process of distillation extracted the most vital component of the plant, the "quintessence for healing" or "plant's soul."(Dhifi et al., 2016).

Both fixed and essential oils are produced by plants. Triacylglycerols, frequently referred as triglycerides, are persistent oils, which are esters of a glycerol molecule joined to three fatty acids. Essential oils (EOs) are complex organic mixtures of volatile, lipophilic, and odoriferous compounds that are typically found in plants with aromatic compound. They are sometimes referred to as essences, volatile oils, etheric oils, or aetheroleum. Almost all essential oils, without the exception of cinnamon, sassafras, and vetiver, are colorless or pale yellow liquid at low temperature, and are lighter in weight than water. Aside from having a low molecular weight (below 300), many of the different chemical compounds of essential oils are visually active, soluble in the majority of organic solvents (ether, alcohol, and acetone), and do not dissolve in water (Shell, 2020).

EOs can be obtained using a variety of processes, among which include steam, hydro distillation, and steam/water distillation. Aqueous infusion, solvent extraction, cold or hot pressing, supercritical fluid extraction, and effleurage are further techniques (Djilani & Dicko, 2012).

EOs serves as antivirals, antimicrobials, and insecticides in plants in addition to providing protection against predators. Out of the 3000 EOs, about 300 have applications in dentistry, farming, sanitary, and cosmetic items, perfumery, and as perfumes in cleaning supplies and industrial solvents. Typically, they are often employed as food flavorings, herbal remedies, and healing therapies, where they are blended with vegetable oils for aromatherapy, massages treatment, and baths (Burt, 2004).

Fig. 2: The Health Benefits of Essentials Oils

Essential oils are complex, volatile, natural substances with a distinctive smell that are produced by aromatic plants as secondary metabolites. They are often obtained via steam or hydro-distillation, which Arabs established in the course of the Middle Ages. They are used in food preservation, embalming, and as antibacterial, analgesic, sedative, anti-inflammatory, spasmolytic, and locally anesthesic treatments. They are distinguished by their aroma, medicinal qualities, and antiseptic qualities, such as bactericidal, virucidal, and fungicidal effects. Other for the fact that we now know greater detail about some of their modes of action, especially at the antibacterial level, these traits haven't changed significantly over time. Essential oils serve as antibacterials, antivirals, antifungals, insecticides, and deterrents from herbivores by suppressing their appetite for these plants. Additionally, they may draw some insects to aid in the spread of seeds and pollen or drive away unwanted ones (Bakkali et al., 2008). Figure 2 illustrates the various health benefits of essential oils, highlighting their therapeutic roles in promoting physical and mental well-being.

Mechanism of Actions

Pharmacological Properties of Herbs and Oils

Approximately 3000 aromatic plant species are known to produce essential oils as an important outcome of their second metabolism process; 300 of them have application to the business community because of their economic and commercial properties. They are used in a variety of fields, including dentistry, agriculture, municipal applications, cosmetics, perfumes, pharmaceuticals, and food and agriculture (Xiang et al., 2018).

Anti-Cancer Activities

The three major categories of liver disease lead to more than two million annual deaths with Cirrhosis, Viral hepatitis and Liver cancer among the fatalities. Statistics show that liver disease is responsible for approximately 4% of worldwide deaths because 1 out of 25 deaths result from this illness while one-third of these fatalities occur in females. Liver cancer stands behind 600,000 to 900,000 deaths within this total number. The latest mortality statistics rank liver disease as the eleventh-leading cause but it might have greater fatalities than reported (Asrani et al., 2019).

The major risk elements involved in liver cancer formation consist of hepatitis B virus along with hepatitis C virus, fatty liver disease, alcohol-related cirrhosis, smoking, obesity, diabetes, iron overload and dietary exposures.The diseases related to viral hepatitis B and C triggered 1.1 million fatalities at the global level in 2020 which matched the tuberculosis death toll of 1.3 million victims but exceeded the 0.68 million deaths from HIV and 0.627 million deaths from malaria (Tanaka et al., 2019).

Plant-derived chemicals seem more attractive for liver condition treatment because their availability avoids lengthy pharmaceutical manufacturing processes. Advanced nations witness a growing interest from specialist medical professionals and non-professionals about herbal remedies even with the substantial advancements in traditional medicine practice during previous decades. Traditional Chinese herbal medicine demonstrates increasing global acceptance in healthcare promotion while disease prevention and applies as conventional or complementary therapies to treatable and irreversible diseases in Asian and Western regions. The article presents laboratory evidence and clinical trial research on Chinese herbal treatments that include small molecule compounds for liver disease conditions extending from fibrosis into liver cancer (Luk et al., 2008)

As an herbal medication Milk Thistle (MT) belongs to the Asteraceae family under the scientific name Silybum marianum and shows therapeutic value that has existed for 2000 years. Medical practitioners have used MT as a therapeutic agent for more than two thousand years to address kidney issues together with spleen, liver and gallbladder conditions (Abenavoli et al., 2018).

The malignant tumor HCC (Hepatocellular carcinoma) occupies position among the primary causes of cancer-related deaths throughout the world. The condition exists when continuous liver inflammation continues and its strongest associations appear in three areas: chronic viral hepatitis infection and alcohol exposure and metabolic liver disease. This medical condition requires better treatment options which is why herbal medicinal products emerged as promising therapies. Several in vitro and in vivo tests evaluated the antiliver-cancer mechanisms of silymarin alongside its main component silybin. Various research has documented that silymarin combined with silybin successfully inhibited cancer liver cell proliferation (Bae et al., 2017).

The bactericidal, virucidal, fungicidal, antiparasitic, and insecticidal attributes of essential oils make them widely employed in the food, pharmaceutical, sanitary, cosmetic, and agricultural industries. Over a hundred essential oils from more than twenty plant families have been calculated on more than twenty different kinds of cancer in the past decade. Scientists are increasingly more interested in studying EOs at the fundamental level due to their extensive use. In recent years, research has focused on antimicrobial, antioxidant, and maybe anti-cancer properties (Mimica-Dukic et al., 2004).

Over 3000 natural oils have been employed therefore, three hundred of which are utilized in a wide range of industrial processes, including food flavoring and conservation, pesticides, medications, cosmetics, and allelopathic characteristics (Cutro et al., 2021).

Both *Rosa indica* (REO) and *Eucalyptus citriodora* demonstrated promising cytotoxic action against HepG2 cells at doses of 100 and 200 µg/ml. EEO and REO were identified as potent anti-cancer drugs against the liver cancer cell line based on their IC50 values. These essential oils also have strong anti-metastatic qualities, which are necessary for efficient chemotherapy medication (Javed et al., 2023).

Because of its delicate, elegant, soft, and sweet aroma, rose essential oil—which is come from the flowers of *Rosa indica*, or rose—has long been known to be the most very interesting of all the essential oils. Additionally, to its relaxing and anti-inflammatory attributes, it additionally has the capability to produce new cells, which has a soothing feature (Javed et al., 2021).

Antimicrobial and Antioxidant Activity

The need to control the harmful effects of microbes is growing as worries about the sustainability of human life increase. Although a

variety of microorganisms coexist in biological balance with the human body and its surroundings, unchecked and fast microbial growth can result in some serious issues (Scheepmaker et al., 2019).

The human body uses antimicrobial agents as antibiotics to treat infections, but they can have a number of negative effects, most notably elevating human being's reactive oxygen species. ROS are extremely harmful to human health and wellbeing, contributing to the development of cancer and raising the risk of other illnesses (Shaikh et al., 2019).

A broad range of plant species have been utilized as pharmaceutical agents for medical purposes. Several medicinal products exhibit therapeutic properties, including antiviral, antibacterial, anti-inflammatory, anticancer, or antioxidant activities. Additionally, these natural substances may also be vital for the creation and production of new drugs. These chemical compounds play an important part in a variety of biological fields, including wound healing, cancer treatment, cardiovascular disease treatment, and cerebral therapy (Pohl et al., 2016).

In ancient cultures in Africa, Europe, the Americas, and particularly Asia, herbal therapies served as the principal foundation of medical care. Across many nations that are developing, the main treatment for infections is traditional herbal medicine. Extracts from herbal plants represent ongoing efforts to find novel chemicals that may have antibacterial properties (Kennedy et al., 2016).

Clove, portulaca, tribulus species, eryngium, cinnamon, turmeric, ginger, thyme, pennyroyal, mint, fennel, chamomile, burdock, eucalyptus, primrose, lemon balm, mallows, and garlic are examples of herbal remedies that work as free radical scavengers to destroy bacteria. The antibacterial characteristics of herbal products vary depending on the type of bacteria they are aimed to treat, as do the extracts and essential oils they contain (Percival et al., 2012).

As they tend to be more benign and have no adverse side effects than artificial antibacterial agents, herbal medications are subsequently commonly used. Given their potent antibacterial and antioxidant properties, these herbal remedies may help treat a wide range of injuries. Additionally, herbal remedies have a strong antibacterial potential and are also affordable (Radünz et al., 2019)

The most important parameter to evaluate the medical advantages associated with herbal medication for people is the biological absorption. The notion that natural cures are safer than prescribed drugs has gained popularity in recent years and helped to fuel a sharp increase in the use of phyto pharmaceuticals (Percival et al., 2012).

Satureja montana L., commonly referred to as winter savory, is historical medicinal plant that is used frequently in local spices. Its richer fragrant persona makes its essential oil taste and smell similar to commercial wheat and rosemary oils. *S. montana* is known to possess various pharmacological properties, which are linked to the presence of phenolic compounds (Skočibušić and Bezić, 2003; Bezić et al., 2005).

Cardiovascular Activity

Heart problems serve as a top mortality risk across industrialized as well as developing nations and simultaneously reduce personal life quality thus resulting in substantial social and economic impacts on society at large. The onset of diseases like atherosclerosis, stroke, peripheral artery disease, and heart failure is greatly influenced by hypertension, a global medical problem that cause severe morbidity. Having a systolic blood pressure of 140 mmHg and a diastolic blood pressure of 90 mmHg is considered hypertension. A rise of 20/10 mmHg in blood pressure readings indicates an increased risk of hypertension, classified into stage 1 (140–159/90–99 mmHg) and stage 2 (≥160/100 mmHg). The second stage requires prompt medical intervention (Lin et al., 2015).

Numerous herbal remedies or their constituents, including ginseng, motherwort, garlic, red yeast rice, danshen, the herb Ginkgo biloba, tanshinone, and ginsenoside, have been employed in medical and experimental research for the treatment of cardiovascular diseases. Similar biologically active molecules with various ingredients, such as flavones, triterpenic acids, and phenol carboxylic acids, are present in these herbal medications and have demonstrated beneficial effects against cardiovascular diseases. There are different feedbacks regarding the effectiveness of herbal remedies in treating health conditions (Li et al., 2015).

Aromatic flowers generate essential oils (EO), which are intricate secondary metabolites known for their intense odors. Current study on essential oils and their separated constituents has prompted scientists to examine these natural compounds and assess their impact on the heart and lungs. Research suggests that certain essential oils and their chemical constituents can significantly support the cardiovascular system by promoting vasodilation, reducing heart rate, and producing a hypotensive effect. Several hypotheses that explain how Essential oils and its primary active compound boots cardiovascular health (Saljoughian et al., 2018).

Mental health issues like depression, anxiety, and sleeplessness are very frequent, and they frequently coexist. These well-known mental illnesses have been affecting a large number of people around the world. Herbs alone or in conjunction are widely indicated as treatments for mental health conditions. Giving sufficient therapy through conventional herbal remedies can help with physical as well as mental health problems Due to chemical treatments' the detrimental reactions and difficulties, many patients prefer herbal remedies (Fujiwara et al., 2018)

Muscle tension, headaches, twitching or shaking, fast breathing and heartbeat, dry mouth and difficulty swallowing, abdominal pain, sweating, blurred vision and dizziness, diarrhea or frequent urination, irritability, including losing one's temper, decreased concentration, sexual difficulties, and phobias are some of the most significant symptoms of anxiety (Adwas et al., 2019). Table 1 summarizes the biological activities of various herbal medicines and their potential therapeutic effects on mental health conditions.

Table 1: Biological activities of herbal medicine in mental health

Herbal Plant	Scientific Name	Family	Biological Function	References
Ginseng	*Panax ginseng*	Araliaceae	Antidepressant activity	Zheng et al., 2014
Herbal Tea			Reduce severe insomnia and improve quality of life.	Chen et al., 2009
Chamomile	*Matricaria recutita*	Asteraceae	Decrease anxiety symptoms with no side effects.	Amsterdam et al., 2009
Saffron	*Crocus sativus*	Iridaceae	Its petal and stamen decrease depression. Having dopamine, norepinephrine, serotonin reuptake inhibition and anxiolytic effects.	

Multiple research studies demonstrate numerous advantages that essential oils (EOs) provide to human mental health, such as their anxiolytic/antidepressant properties, cognitive processing enhancement, attention enhancement, psychostimulant consequences, and improvements in memory, are supported by a large amount of research(Shahrajabian et al., 2021).

Many patients choose to use herbal medicine as an approach for treating several forms of diseases and health issues. When used to treat common colds and flu Echinacea and elderberry show effectiveness at shortening and minimizing symptoms by strengthening the immune system. Combined use of peppermint and chamomile tea helps control irritable bowel syndrome symptoms particularly through peppermint oil medications while also treating digestive problems like bloating and nausea. Lavender serves alongside ashwagandha for stress reduction purposes while ashwagandha works by lowering bodily cortisol levels that stress increases. Medical science shows that fenugreek combined with bitter melon decreases blood glucose while making insulin more effective as a means of natural blood sugar management (Chaughule & Barve, 2024). Table 2 presents the extraction of oils from different parts of plants and their applications in the treatment of various diseases.

Table 2: Oil extraction from different parts of plants for treatment of diseases

Species Name	Oil Extraction	Biological Activity	References
Cananga odorata (Ylang ylang)	Oil extracted from flower of tree	Used in aroma industry. Produce, anxiety reducing effects, antidepressant and relaxing effects.	(Tan et al., 2015; Zhang et al., 2018)
Cinnamomum verum (cinnamon)	extracted from the brown bark of *Cinnamomum verum*.	Antidepressant-like effects, manage blood sugar level and boost the immune system	(Sohrabi et al., 2017)
Citrus aurantium (Neroli)	EO extracted from the flower of the bitter orange tree	Reduced level of stress, potential relief from menopause and improved overall wellness.	(Choi et al., 2014)
Cymbopogon citratus (lemongrass)	EO is obtained from the leaves of *Cymbopogon citratus*	Reduced anxiety and tension, decreasing cholesterol, antifungal and anti- inflammatory properties,	(Costa et al., 2011)
Ocimum tenuiflorum Tulsi	leaf	Reduce cold and cough	(Ravven et al., 2011)
Azadirachta indica Neem	Leaf stem bark seed used	Used for treatment of intestinal worms, stomatch upset and diabetes	(Ríos et al., 2020)

Future Perspectives

Infectious diseases (especially viral diseases like HIV), osteoarthritis, disorder of liver, diabetes, cancer, age-associated illness (such as autoimmune condition, dementia memory loss, and osteoporosis), hypertension, sexual dysfunction, and high cholesterol levels are conceivably interesting areas of study for the development of plant based medicines and novel chemical substances derived from plants. Over fifty percent of the multiple plant-based antiviral therapies that have received legally approved in recent years are intended to treat HIV infections (AIDS). Herpes virus, hepatitis B and C, and the influenza virus are among the viruses that others have been authorized to treat. Hemorrhagic fever virus, picorna virus viral infections, pappiloma virus, adenovirus, and viruses such as pox (variola, vaccinia) are among the numerous viral illnesses for which effective antiviral drugs have not yet been found (Pan et al., 2013).

Plants continue to be a potential source of medicinal substances and are used as an intermediate for the seperation of semisynthetic organic compounds used in the food industry, beauty care products and aroma industries (Modak et al., 2007). Additionally, the usage of natural medical healthcare remedies is growing in the beauty sector in addition to their growing popularity. Consequently, herbal remedies significantly contribute to the overall economy by serving both as a means of healthcare treatment and as a source of commercial income. Sales of herbal medicines and cures are expected to increase in the coming decades, and meeting this need will be economical for botanical experts. It also suggests that investigators, healthcare providers, and drug companies are growing turning to nations such as China, India, and other newly developed nations for their supply needs. Those nations boast the highest diversity of medicinal plant species and are leading producers of herbal raw materials. As herbal remedies gain traction for being perceived as safe and cost-effective alternatives to conventional medications, the utilization of plants, whether in their natural form or as pharmaceutical products, is expected to rise in the future (Barnes & Bloom, 2007).

Essential oils, another significant category of phytogenic feed additives (PFA), are considered to be a secure and inexpensive alternative for antibiotics as growth stimulant. In animal diets, Essential oils are a significant complement for antibiotics. The use of EOs has improved the longevity of raw feed ingredients and had a number of beneficial effects on both the health and performance of domesticated animals. It is projected that PFA and EOs would be a widespread element in livestock food, which is vital for the expansion of the poultry and livestock sectors. Yet a number of things affect how they affect animals. Therefore, it is essential to standardization and maximizing the structure and purity of essential oils (EOs) to be employed as nutritional additives. This procedure is dependent on a number of different factors which impact the production of plant secondary metabolites, as well as the method of production involved in creating additives for agriculture. As a consequence, it is crucial to find out communicate with these substances and other components in the food matrix, as well as their absorption in the intestinal tract. Finding effective bioactive chemicals and developing techniques to ascertain their full modes of action are necessary for PFA's continued usage as trustworthy growth promoters. In a comparable manner, it is crucial to establish a strong correlation between in vitro findings and results from animal trials, particularly emphasizing the need for standardization in in vivo studies that assess the effectiveness of essential oils (EOs) (Sharifi-Rad et al., 2017).

Conclusion

The therapy power of herbal drugs combined with essential oils brings multiple therapeutic advantages towards many health diseases.

Traditional healthcare practitioners used these natural remedies throughout generations, so contemporary medical professionals began using them because they successfully preserve health and treat various diseases. Herbal compounds Echinacea, peppermint and turmeric provide anti-inflammatory properties while offering antimicrobial defense and immune augmentation capabilities to the body and essential oil ingredients lavender, peppermint and tea tree display antimicrobial qualities together with stress-relieving effects. More and more research studies have emerged to show how herbal medicines and essential oils affect pain reduction while assisting nervous system conditions and digestive health and enhancing skin well-being. These substances offer therapeutic benefits that should inspire practitioners to use them cautiously since improper dosing can lead to adverse side effects as well as reactions with medications. Future investigations must concentrate on both safety guarantees and maximum operational performance through research into work mechanisms of these substances. Proper application of herbal medicine together with essential oils functions as valuable complementary therapeutic treatments for achieving enhanced overall health results.

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