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A comprehensive review of essential oils for depression management

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Abstract

Essential oils, derived from aromatic plants, have been used for thousands of years across cultures for their therapeutic, cosmetic, and spiritual benefits. Aromatherapy, harnessing the power of these oils, has gained recognition in modern medicine as a complementary therapy for various conditions, including depression, anxiety, and sleep disorders. These oils contain a diverse range of chemical constituents and interact with the body and mind through complex mechanisms, including neurotransmitters and neurotrophic factors. Notable essential oils like lavender, jasmine, sandalwood, Roman chamomile, frankincense, and peppermint have been extensively studied for their positive effects on mental health, offering relaxation, stress reduction, and mood enhancement. However, it is crucial to use essential oils cautiously due to potential sensitization and allergies. While essential oils offer a holistic approach to improving mental well-being, consulting a qualified healthcare professional or aromatherapist is advisable, particularly in cases involving pre-existing medical conditions or medication interactions.

Keywords: Depression, essential oils, anxiety, sleep disorder

Introduction

Essential oils have been used for medical purposes since ancient times, especially in the form of Aromatherapy. Aromatherapy uses different fragrances in the treatment of diseases through healing the mind and soul. Ancient civilizations such as Egypt, and India have been using essential oils for the last 6000 years. ^[1] Essential oils have not only gained their importance in therapeutics, cosmetics, aromatics, and spiritual activities but also are used as supportive therapy in many complex disease conditions such as cancer, migraine, and Alzheimer's disease ^[5]. It is accepted as nursing care in the UK, the nurses are trained to use the essential oils in both inhalational and topical routes of administration ^[2]. Essential oils are used in multiple ways as antibacterial, Antifungal, Antimicrobial, Antitumor, and Mosquito repellent, it is also used in hormonal regulation and stabilizing mental conditions. The major role of essential oils is observed for depression and anxiety conditions. These can effectively reduce postoperative conditions for relieving the pain. Essential oils are highly concentrated extracts, extracted from different parts of plants such as flowers, barks, peels, fruits, roots, etc. ^[3]. They are colourless liquids with high refractive index with pleasant fragrance. These are esters, ethers, alcohols, phenols, and aldehydes ^[4]. These can be administered in the form of inhalers or nebulizers for respiratory conditions; applied topically and massaged on the body, or used in water baths for relieving muscle pain or body aches. Many times, some essential oils like clove oil are used in dentistry for their analgesic effect.

Worldwide statistics for depression cases

Depression, identified as a major depressive disorder, is a mental health condition that has adverse impacts on an individual's emotions, thoughts, and behaviors. According to the Global Health Data Exchange, an estimated 251-310 million people across the globe experience depression. Despite its prevalence, it is reassuring to know that depression is a treatable condition. Depression impacts approximately 1 in 15 adults each year, and 1 in 6 individuals will encounter depression at some point in their lives. According to a study conducted by Our World in Data, it is estimated that around 3.4% (with a margin of error between 2-6%) of the global population is affected by depression, equating to roughly 264 million people worldwide.

Top 10 countries with the highest rates of depression

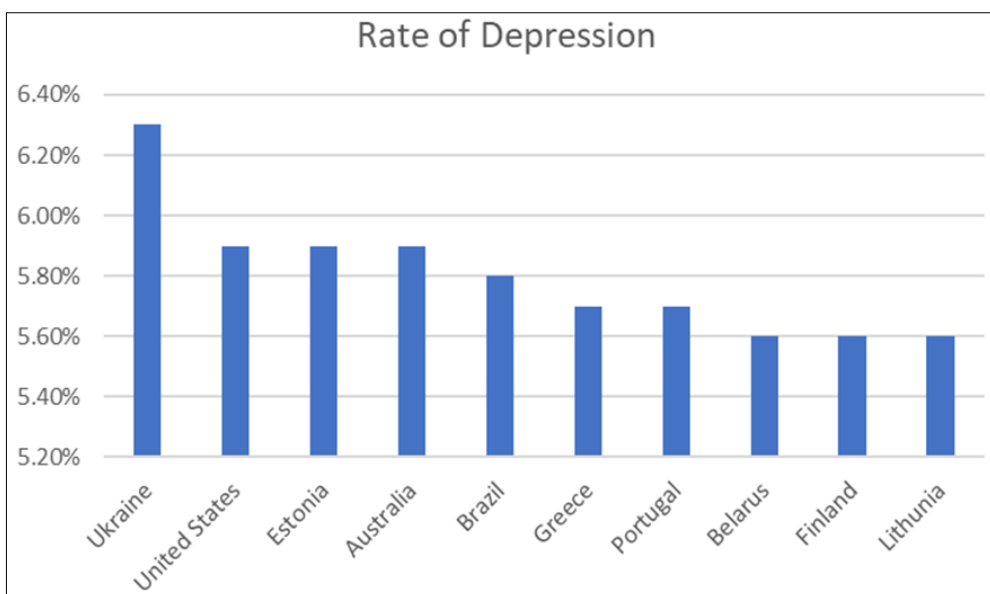


Fig 1: Rates of depression worldwide

The numbers provided above are important, but it is essential to recognize that the actual rates are likely much higher, especially in less developed countries. Depression tends to be diagnosed more in highly developed countries with better healthcare systems. This does not mean that depression is less common in less developed nations—they often prioritize other urgent needs like food, health, and sanitation over mental health care. The World Health Organization suggests that 76-85% of individuals with mental disorders in low- and middle-income countries do not have access to necessary treatment. Additionally, in developed nations, many cases of mental illness remain unidentified and unreported because patients might feel ashamed or not realize that it is a treatable condition [54].

Causes of depression [68]

Depressive disorder, commonly referred to as depression, is a prevalent mental disorder characterized by persistent feelings

of sadness, and a diminished capacity to experience pleasure or interest in activities, and it has the potential to affect individuals from diverse backgrounds. Notably, individuals who have endured abuse, significant losses, or challenging life events are at an elevated risk of developing depression, with women being more prone to it compared to men.

Various patterns of depressive episodes exist, encompassing: [69].

1. Single episode depressive disorder, denoting an individual's initial and sole episode of depression.
2. Recurrent depressive disorder, signifying a history of at least two separate episodes of depression.
3. Bipolar disorder, characterized by alternating depressive episodes with manic symptoms, including euphoria or irritability, heightened activity or energy, and additional manifestations such as increased talkativeness, racing thoughts, elevated self-esteem, reduced sleep, distractive nature, and impulsive behavior.

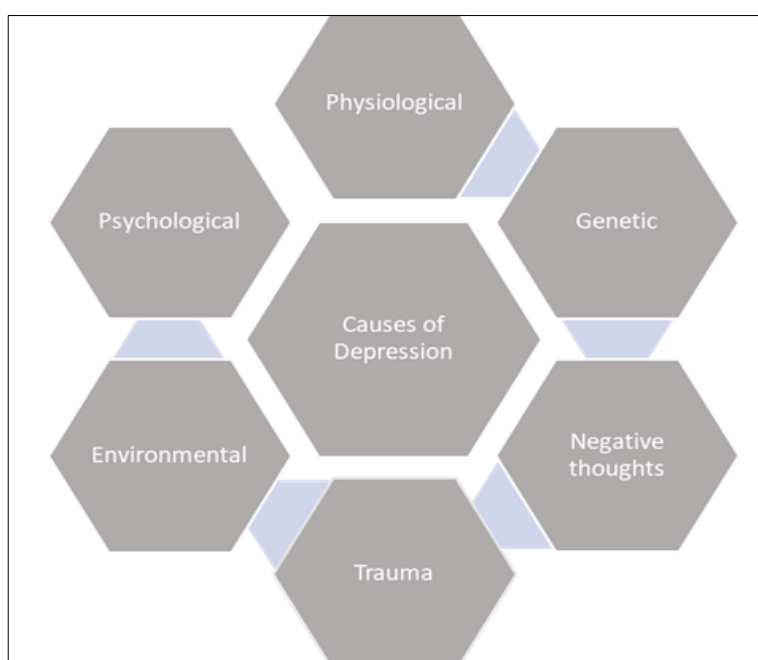


Fig 2: Causes of Depression

Depression arises from a multifaceted interplay of social, psychological, and biological elements. Individuals who have navigated adverse life events, such as unemployment, bereavement, or traumatic experiences, are at a heightened risk of developing depression. Moreover, depression can create a self-perpetuating cycle, compounding stress and dysfunction, thereby exacerbating both the affected person's life circumstances and the depressive condition itself. Notably, depression maintains a close association with physical health. Many of the factors influencing depression, such as physical inactivity or excessive alcohol consumption, also serve as established risk factors for conditions like cardiovascular disease, cancer, diabetes, and respiratory ailments. Consequently, individuals grappling with these diseases may also encounter depression due to the added challenges in managing their health conditions. The development of major depression appears to involve genetic, neurological, hormonal, immunological, and neuroendocrinological mechanisms. Many of these factors revolve around responses to stressors and the processing of emotional information, with potential modifications influenced by gender and developmental factors.

Environmental stressors contributing to depression encompass acute life events, persistent chronic stress, and early-life exposure to adversity. Personal susceptibilities associated with depression span cognitive, interpersonal, and personality factors. Which may give rise to depression, anxiety, schizophrenia, and Parkinson's disease [9]. In addition to the monoaminergic pathway and BDNF, other mechanisms that may be involved in depression are GABAergic system alteration, increased expression of postsynaptic serotonin receptors (5-HT1A), decreased calcium influx, and increased expression of astrocytes.

It's noteworthy that depression seldom occurs in isolation but rather frequently co-occurs with other psychological disorders, including anxiety, substance abuse, Behavioral issues, and personality disorders, as well as various medical illnesses. This concurrent presence of psychological and medical conditions magnifies the clinical and societal repercussions of depression, making its treatment a more intricate and challenging endeavor.

Type of Depression [63]

Table 1: (Types of depression)

Type of Depression	Description
Major Depression	Symptoms of persistently depressed mood or loss of interest for at least 2 weeks, significantly impacting daily activities
Persistent Depressive Disorder (Dysthymia)	Milder depressive symptoms lasting an extended period, typically at least 2 years which is called Dysthymia.
Perinatal Depression	Depressive episodes occur during or after pregnancy. The one that starts during pregnancy is prenatal, while the one that occurs after childbirth is postpartum
Seasonal Affective Disorder	Recurrent depressive symptoms are tied to changing seasons, often beginning in late fall/winter, and improving in spring/summer.
Depression with psychosis	Severe depression with psychosis symptoms such as disturbing false beliefs (delusions) or sensory perceptions (hallucinations) not experienced by others

Bipolar disorder, formerly called manic depression, includes depressive episodes where individuals feel sad, indifferent, or hopeless alongside periods of elevated mood (manic or hypomanic episodes) characterized by increased activity levels, intense happiness, or irritability.

Additional depressive disorders include disruptive mood dysregulation disorder, primarily diagnosed in children and adolescents, and premenstrual dysphoric disorder, which affects women around their menstrual cycle.

Conventional antidepressant medication

Conventional antidepressants work by boosting levels of certain chemicals in the brain called monoamines. These drugs do this by stopping these chemicals from being removed too quickly, preventing their breakdown, or affecting how they are released in the brain [64]. There is a theory suggesting that depression might happen when these chemicals, like noradrenaline, serotonin, and dopamine, are not working properly in the brain [65]. Even though these antidepressants start affecting these chemicals quickly, it usually takes a few weeks for people to feel better. This delay suggests that the way our brain processes information might be more involved in depression than just having low levels of these chemicals. Interestingly, these medications also increase something called Brain-Derived Neurotrophic Factor (BDNF) in certain brain parts, especially in the hippocampus. BDNF helps positively change the brain, making it more adaptable and flexible, which helps with improving depressive symptoms. It has been found that the growth of new brain

cells in the hippocampus is needed for these antidepressants to work properly [66]. Treating depression with medication can be expensive, and even though many doctors prescribe these drugs, fewer than half of the patients who take them feel completely better. Some people only feel a bit better or not better at all, and some cannot handle the side effects of the treatment. This shows why it is important to find new types of antidepressants [67]. The main issue with current antidepressants is the side effects caused by quickly increasing certain chemicals in the brain. These side effects include things like more anxiety, stomach problems, sexual issues, and feeling less alert. The goal for new antidepressants is to work quickly, help more people, and have fewer of these uncomfortable side effects [67].

Essential Oil and Depression

Essential oils are liquid extracts of aromatic plants, which have various applications in the industry. Essential oils are highly concentrated extracts derived from various plant components, including leaves, bark, peels, twigs, and seeds. These oils are obtained through a variety of extraction methods, including solvent extraction, supercritical extraction, steam distillation, hydro distillation, microwave-assisted extraction, and more. Indeed, the history of essential oils and distillation has deep roots in the East, particularly in ancient civilizations like Egypt, Persia, and India. The process of distillation, which forms the basis of the essential oil industry, was first conceived and employed in these regions. However, it was in the Western world that these early attempts at

distillation reached their full development. Historical records about distillation methods and the use of essential oils in ancient times are limited and vague. Turpentine and camphor are among the few essential oils for which there is definite evidence of preparation through crude distillation. Herodotus, Pliny, and Dioscorides, prominent historical figures, mentioned the oil of turpentine and provided partial information about how it was produced. They did not describe the production of other essential oils. During the early Middle Ages and beyond, distillation was primarily used for creating distilled water. When essential oils precipitated during this process, as seen in the crystallization of rose oil on the surface of distilled rose water, these oils were likely seen as unintended by-products rather than valued commodities. The essential oil industry, as we know it today, evolved with advancements in distillation techniques and a growing appreciation for the aromatic and therapeutic properties of these oils. There are various methods used to extract the essential oils, each method has advantages and determines the biological and physicochemical properties of the oils. Essential oils from different plant species contain more than 200 constituents which are volatile and non-volatile components. The methods of extraction are classified as Conventional methods and Modern methods. The oils utilized, however, were not essential oils, and they were not created by blending them with fatty oils. Instead, they were derived by immersing flowers, roots, and other botanicals in high-quality fatty oils. These glass bottles containing these blends were exposed to the sun's warming influence, ultimately leading to the separation of the fragrant oil from the solid components. On occasion, the flowers and other materials were soaked in wine before adding the fatty oil, and the resulting product obtained through this infusion process was filtered and then condensed to a honey-like consistency [51].

Advances in extraction methods

Advances in the extraction of volatile oils, such as essential oils, have been driven by a combination of technological innovations, improved understanding of plant chemistry, and the growing demand for these natural products. The conventional processes are modified or some novel processes for extraction are derived which have advantages over the conventional methods, modern techniques.

Supercritical Fluid Extraction

The fundamental principle of supercritical fluid extraction (SFE) involves the interaction of the feed material with a supercritical fluid, causing the volatile components to transfer into the supercritical phase. Once the soluble substances are dissolved, the supercritical fluid, now containing the dissolved compounds, is extracted from the feed material. Subsequently, the separated component is completely isolated from the supercritical fluid through adjustments in temperature and/or pressure [36].

Microwave-assisted water distillation (MAHD)

Employing water as a solvent, stands as an eco-friendly and sustainable approach for extracting volatile oils from plants. In recent years, MAHD has gained widespread recognition as a technique characterized by its brief extraction duration, minimal energy usage, and remarkable efficiency [37].

Ultrasonic-assisted extraction

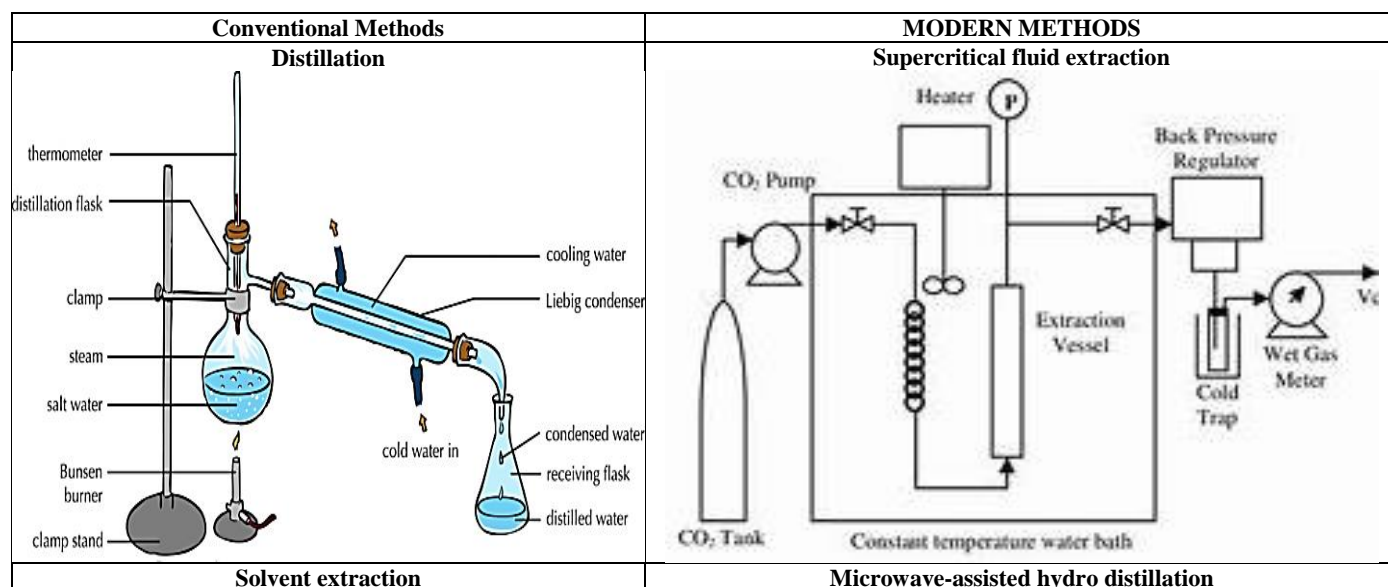
Essential oil from a medicinal plant could be a good option. Ultrasound-assisted extraction, the plant's raw material is immersed in water or another solvent (Methanol or ethanol or any one of the solvents), and at the same time, it is subjected to the work of ultrasound. This technique is used to extract many essential oils, especially from the flower, leaves, or seeds. The application of Ultrasound during the extraction of essential oil from medicinal plants uses less solvent as compared to conventional methods such as mechanical extraction and Soxhlet method [38, 39, 40].

The solvent-free microwave extraction

Technique for obtaining essential oils pertains to methods that utilize microwave assistance. Its benefits can be likened to those of the latest advancements. Some of these advantages encompass a swift distillation rate and the production of a pure extract [41].

Microwave Hydro Diffusion (MHG)

Is distinct from other techniques, such as modified microwave-assisted extraction (MAE), which involves the use of organic solvents, solvent-free microwave extraction (SFME), which evaporates essential oil along with in situ water, or modified hydrodistillation, which consumes significant quantities of water and energy [42].



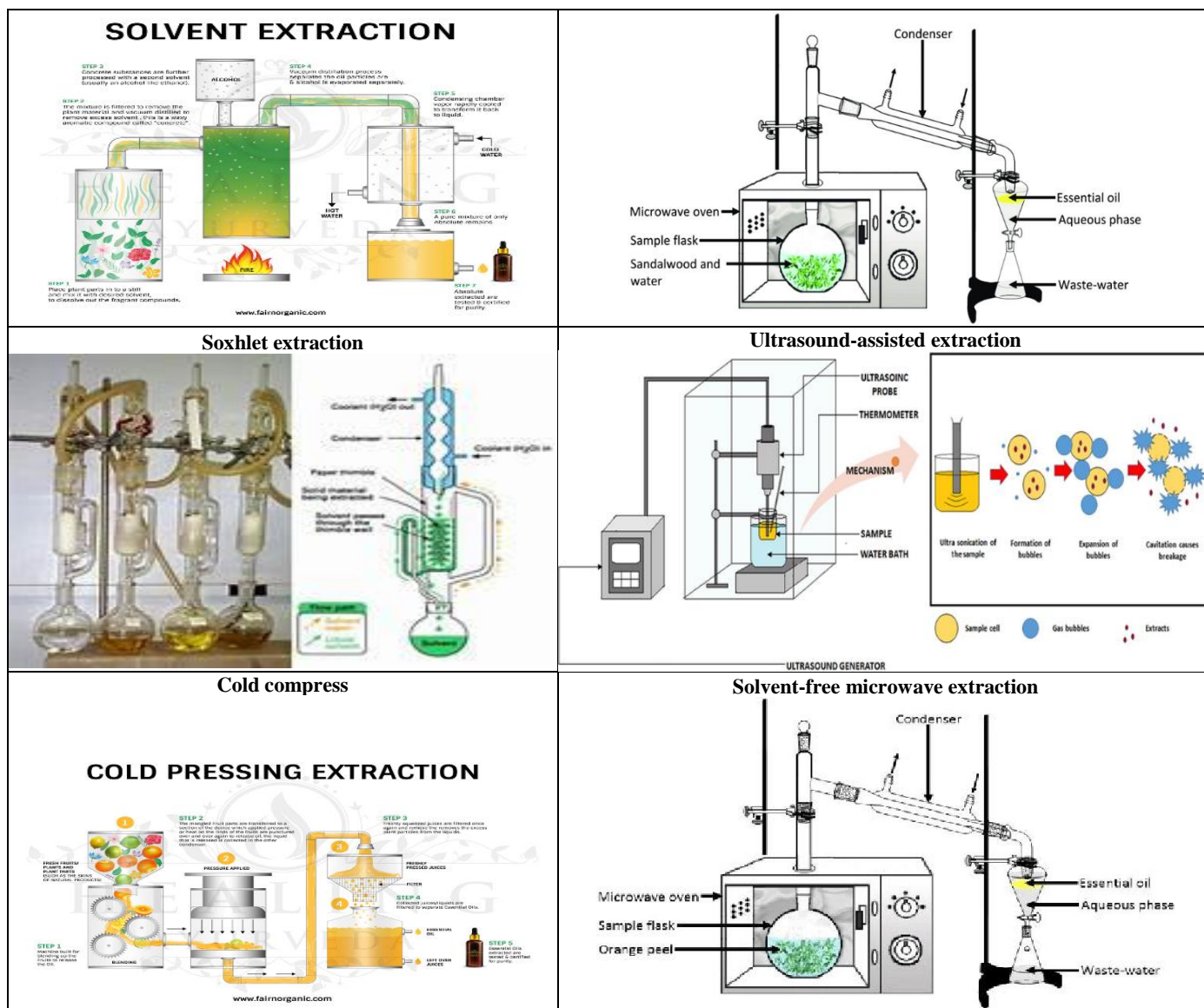


Fig 3: Extraction Methods

How does essential oil work?

Depression

Essential oils are traditionally used as a complementary therapy in various diseases. They can be administered orally but the drawback is that they undergo first-pass metabolism which becomes a barrier to administering them orally. In past decades studies have proven that essential oils can be used in mental disorders, to improve mood and feelings of physical and mental health of well-being. The oils of Rose, lemongrass, and sandalwood are popularly used for relieving anxiety and depression. Lavender oil is the most popular and most studied essential oil which is being used for depression and anxiety [6]. It has the chemical constituent monoterpenes which are proven to give some antidepressant action [7]. Studies done on essential oils have given the many different mechanisms of action of essential oils. However, the monoaminergic pathway which involves the neurotransmitters DA and 5-HT is the most given action, maybe because of the monoamine theory concerning the most discussed pathway linked to depression. The second most discussed mechanism of action is the involvement of neurotrophic factors such as the Brain-Derived Neurotrophic Factor (BDNF). BDNF is related to synaptic plasticity and neurogenesis [8]. Thus, studies report that a decrease in BDNF can cause different changes in the nervous system

Anxiety

Anxiety disorders are the most common mental health condition globally, with a prevalence that varies between 2.4% and 20% from one nation to another. According to the World Health Organization (WHO), approximately 3.6% of the world's population, equivalent to around 264 million people, experiences anxiety disorders [23]. This condition arises as a form of apprehension triggered by potentially hazardous or stress-inducing situations and stems from the intricate interplay of biological, psychological, temperamental, and environmental factors [37]. Anxiety disorders encompass a range of conditions, including but not limited to panic disorder/agoraphobia (PDA), generalized anxiety disorder (GAD), social anxiety disorder (SAD), and obsessive-compulsive disorder (OCD) [3]. Among these, panic disorder (with or without agoraphobia) stands as the most prevalent, representing 6.0% of all cases, followed by social phobia at 2.7%, and GAD as the most common type of phobia at 2.2% [25]. Numerous biological irregularities have been linked to the development of anxiety disorders. The gamma-aminobutyric acid (GABA), norepinephrine, and serotonin (5-HT) systems play crucial roles in regulating the emotional circuits associated with both anxiety and depression, and these two conditions are closely interconnected [26]. Primary treatments for anxiety encompass lifestyle adjustments, cognitive-

behavioral therapy (CBT), as well as the use of selective serotonin reuptake inhibitors (SSRIs) or serotonin-norepinephrine reuptake inhibitors (SNRIs). There is an urgent demand for safe and effective treatments and medications to address anxiety. Recently, there has been a notable increase in research on the use of inhalation aromatherapy for anxiety disorders. There is an urgent demand for safe and effective treatments and medications to address anxiety. Recently, there has been a notable increase in research on the use of inhalation aromatherapy for anxiety disorders [27].

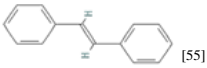
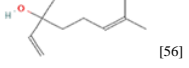
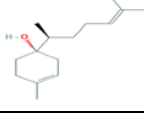
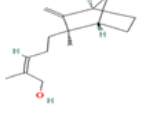
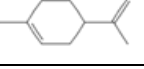
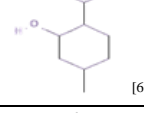
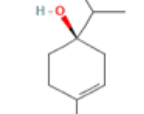
Sleep Disorder

Sleep is crucial for maintaining both physiological and psychological well-being. There exists a bidirectional relationship between several mental disorders and sleep disorders. Individuals experiencing anxiety, depression, and various mood disorders often struggle with consistent, restful sleep. Sleep disturbances can also increase the risk of developing mental health conditions. Aromatherapy has been employed as a natural and effective remedy for sleep issues

since ancient times, with massage and inhalation of essential oils being the primary techniques. Various essential oils have been utilized in addressing sleep disturbances, with examples including lavender oil and peppermint oil [28, 29]. Additionally, studies have demonstrated that jasmine and frankincense can be beneficial in alleviating restless sleep and enhancing overall sleep quality. Zhong and colleagues conducted research into the compatibility of Compound Anshan essential oils with lavender, sweet orange, and sandalwood, all of which have sedative and hypnotic properties. Their findings demonstrated an enhancement in sleep quality when these essential oils and blends were combined. In general, aromatherapy has proven effective in improving sleep quality for both healthy individuals and those facing health challenges, particularly when administered through inhalation rather than massage therapy [30]. The molecules from essential oils enter the limbic system of the brain via the nasal passages and simultaneously influence GABA receptors in the hypothalamus, which play a crucial role in regulating sleep. As a result, aromatherapy is widely popular and commonly used to manage sleep quality [31].

Essential oils used in Depression (Parts of the plant used)

Table 2: Plants in depression

Sr. No.	Name of Plant	Part of the Plant	Phytoconstituent	Structure	Use
1.	Lavender (<i>Lavandula angustifolia</i>) Family: Lamiaceae	Petals	Linalool, b-stilbene, linalyl acetate	 [55]	Burns, cuts, dermatitis
2.	Jasmine (Jasmine Sambac) Family: Oleaceae	Petals	linalool, benzyl propanoate, benzyl acetate	 [56]	Carminative, antispasmodic, antimicrobial
3.	Roman chamomile (<i>Anthesis nobilis</i>) Family: Asteraceae	Petals	Pino carvone, pinene, bisabolol	 [57]	Menstrual disorder
4.	Sandalwood (<i>Santalum album</i>) Family: Santalaceae	Heart Wood	α and β santalol, santanone	 [58]	Alzimers, reduce stress
5.	Frankincense (resin obtained from <i>Boswellia</i> species) Family: Burseraceae	Resin	-pinene, α -limonene, p-cymene	 [60]	Labor pain, asthma
6.	peppermint (<i>Mentha piperita</i>) Family: Lamiaceae	Leaves	Menthol, Carvone, Menthone	 [61]	antispasmodic, arthritis
7.	Tea Tree (<i>Melaleuca alternifolia</i>) Family: Myrtaceae	Leaves	Terpinen-4-ol, γ -terpinene	 [62]	Anti-bacterial

Essential oils used in mental health

1. Lavender oil



Biological source: Flowers of *Lavandula angustifolia* fam. Lamiaceae

From ancient times the lavender flower tips were used to get the essential oil. Lavender is a famous herb that has a long history in folk medicine and is still therapeutically used today. The constituents of lavender oil have a high content of linalool and linalyl acetate, a moderate amount of terpinene-4-ol, lavandulyl acetate, and lavandulol, and variable levels of eucalyptol (1,8-cineol) and camphor [21]. The chemical constituents may vary or change according to the different species of the plant [11]. A study determined that the constituent range and amount differ in two species of lavender

such as linalool, linalyl acetate, and β stilbene was abundant in *Lavandula angustifolia*. In contrast to that the higher concentration of linalool, camphor, eucalyptol, α -pinene, α -terpineol, and α -bisabolene were found in *Lavandula latifolia* [12]. The effect of lavender oil on the central nervous system with well-established targets are as follows MAO-A, SERT, GABA, and NMDA receptors as well as *in vitro* models of neurotoxicity. The results showed that lavender oil and its main components exert affinity for the glutamate NMDA receptor in a dose-dependent manner with an IC₅₀ value of 0.04 μ l/mL for lavender oil. Furthermore, lavender and linalool were also able to bind the serotonin transporter (SERT) whereas they did not exert any affinity for GABA-benzodiazepine receptors. As different models were performed in those models of neurotoxicity, lavender did not enhance the neurotoxicity and improved viability of SH-SY5Y cells treated with hydrogen peroxide. It may be due to antagonism on the NMDA receptor and inhibition of SERT. The anxiolytic and antidepressant effects were attributed to lavender. This study concludes that lavender essential oil may exert pharmacological properties through modulating the NMDA receptor, the SERT as well as neurotoxicity induced by hydrogen peroxide. As lavender is an essential oil it is used as an aromatherapy. Lavender oil is popularly used for anxiety, headache, depression, tension, and stress. Otherwise, it can be used for burns, inflammation, cuts, dermatitis, etc. because of its other healing properties. It has been considered to possess anxiolytic, antidepressant, neuroprotective, and anti-inflammatory properties [22].

2. Jasmine oil



Biological source: *Jasminum sambac* fam. Oleaceae

The essential oil is extracted from the flowers of the jasmine plant by using the appropriate techniques. The major constituents of jasmine are linalool, benzyl propanoate, and benzyl acetate. Along with that it also contains geraniol and jasmone as the chemical constituents. Jasmine oil is widely used in perfumery for mind relaxation. Jasmine oil is a beneficial therapy for depression, and anxiety, gives a soothing effect to nerves, gives the feeling of confidence, improves memory, and boosts energy [35]. Otherwise, it is also used as a carminative, aromatic, antispasmodic, antidepressant, antimicrobial, astringent, and stimulatory [14].

3. Sandalwood oil



Biological source: *Santalum album* fam. Santalaceae

Sandalwood oil has been used in India since ancient times for medicinal value. The oil is extracted from the wood and roots of the sandalwood tree by hydrodistillation or steam distillation. India is exporting this oil on a large scale. It has been said that it helps to increase the oxygen supply to the pineal gland and pituitary gland. It has α & β santolol and santenone as the major chemical constituents. It is used to relieve depression, anxiety, stress, nervousness, and insomnia. It has been studied that it also helps in the antiviral activity against herpes simplex by interfering with the virus's ability to replicate. [15] Sandalwood oil primarily contains tricyclic α -santalol and β -santalol [48]. In 2020, a study conducted by Younis *et al.* revealed that sandalwood essential oil enhanced neurological recovery, reduced oxidative stress, and mitigated inflammatory responses in mice subjected to middle cerebral artery occlusion surgery (MCAO) [49]. Methanolic extracts of sandalwood, when administered to albino mice, displayed inhibitory effects on acetylcholinesterase and also exhibited superoxide radical scavenging activities using α , α -diphenyl- β -picrylhydrazyl (DPPH), thus demonstrating its potential to prevent dementia progression and memory loss in Alzheimer's patients [47]. Furthermore, a study in 2016 involving 32 human participants demonstrated a decrease in both blood pressure and salivary cortisol levels, indicating its effectiveness in reducing stress [50].

4. Roman Chamomile



Biological source: *Anthemis nobilis* fam. Asteraceae

This plant has been used for centuries for its calming effect and has daisy-like flowers. Roman chamomile oil has esters of angelic acid, tiglic acid, and 2-methylbutanoic acid main chemical constituents. It is rich in pinocarvon, farnesol, pinene, bisabolol, beta-caryophylline, and azulene. Its antianxiety, and stress relieving properties ease depression and an overactive mind. Its use before sleep for a bath can relax both mind and body and bring on sleep, with a peaceful and spiritual awareness. This oil is helpful in treating the Headache, insomnia, and menstrual disorders. Otherwise, it is also used in gastrointestinal disorders, menstrual disorders, muscle spasms, etc. The study has also established a connection between the activities of the hypothalamic-pituitary-adrenocortical (HPA) axis and depression. Another investigation has demonstrated that increased levels of adrenocorticotrophic (ACTH) hormones are linked to stress and anxiety [42]. Chamomile extracts have been shown to possess the activity of a neurokinin-1 receptor antagonist [43]. Furthermore, inhaling the vapors of chamomile oil has been found to decrease ACTH levels induced by stress resulting from ovariectomy in rats [44]. Additionally, there have been reports suggesting that flavonoid components in chamomile

can modify the activities of central neurotransmitters, leading to a reduction in serotonin, dopamine, and monoamine oxidase activity, while simultaneously increasing catecholamine production and enhancing noradrenaline activity.

5. Frankincense oil



Biological source: Resin obtained from *Boswellia*

It is a resin obtained from the tree of genus *Boswellia* of mainly 5 species i.e., *Carterii*, *serrata*, *papyrifera*, *sacra*, and *frerana*. Chemical studies reveal that it has more than 200 different natural products including terpenoids, polyphenols, and tannins [16]. It helps in relieving stress anxiety, and insomnia [56]. It is also used in the decreasing intensity of labour pain and asthma for ease of breathing [18, 19]. In a recent animal study, adult male rats, that had been subjected to sleep deprivation, were administered frankincense essential oil to assess its potential anxiolytic properties and its impact on sleep and wakefulness behaviors [53].

6. Peppermint Oil



Peppermint (*Mentha piperita* Linn.) is a perennial plant belonging to the family of Lamiaceae which is grown widely in Europe and North America. There are many species of the plant, out of which peppermint (*M. piperita*) and spearmint (*M. spicata*) are the two most important species. Spearmint's oil constituents include carvacrol, menthol, carvone, methyl acetate, limonene, and menthone. It has a strong aroma with a sharp menthol undertone [20]. The pharmacological action of Peppermint is due to menthol, which constitutes around 44% of the total constituents present. Mainly used to relieve pain spasms and arthritic problems. It has also found its use during the menstrual cycle as it has antispasmodic properties. It can also heal headaches when superficially applied around the head and is also used in the treatment of irritable bowel syndrome. Peppermint oil is a popular essential oil for treating sinus and lung congestion. When inhaled, its fresh minty scent can elevate mood. However, it is important to use essential oils like peppermint with caution, as they are potent and can be toxic and even lethal at excessive dosages. However, peppermint oil is contraindicated during pregnancy as it is used to trigger

menstruation. Common adverse effects of peppermint oil are allergic reactions, heartburn, perianal burning, blurred vision, nausea, and vomiting which have been reported in clinical trials [21]. The antispasmodic effect of peppermint oil, which varies based on the dosage, is primarily driven by its menthol component. It is suggested that peppermint oil induces relaxation in the smooth muscles of the gastrointestinal tract and reduces contractile responses by decreasing the influx of extracellular calcium ions. In experiments involving rabbit jejunum smooth muscle cells using the whole-cell clamp configuration technique, peppermint oil was observed to inhibit potential-dependent calcium currents in a manner that corresponds to its concentration. This inhibition is characterized by a decrease in peak current amplitude and an acceleration in the current decay rate, resembling the pharmacological activity of dihydropyridine calcium antagonists. In a study conducted on rat small intestines, peppermint oil, when present in the intestinal lumen, hindered the uptake of glucose by enterocytes through a direct impact on the brush border membrane, also inhibiting intestinal secretion. Additionally, there is evidence suggesting that menthol acts as an antagonist for L-type Ca^{2+} channels by interacting with dihydropyridine binding sites and blocking currents of low-voltage-activated calcium channels. Peppermint oil may support hair growth by promoting the preservation of vascularization in hair dermal papillae, potentially contributing to the initiation of the early anagen stage in the active growth phase of hair follicles [53].

Safety issues in Essential oils

Generally safe with minimal adverse effects, essential oils have received approval as food additives and fall within the category of being generally recognized as safe by the U.S. Food and Drug Administration [32]. The primary adverse events typically involve irritation and sensitization of the eyes, mucous membranes, and skin, especially with oils containing aldehydes and phenols. Essential oils containing furocoumarins can lead to phototoxicity. Contact sensitization is more prone to happen due to the oxidation of monoterpenes, often stemming from improper storage conditions [33]. Allergies resulting from the inhalation of essential oils can indeed occur. Nevertheless, there is limited data available regarding exposure levels, and many of the reported cases pertain to perfumes rather than essential oils used in aromatherapy. Aromatherapy makes use of undisclosed mixtures of these essential oils, lacking specific plant source disclosure. Allergic reactions have been documented in a few cases, particularly with topical use. These oils are susceptible to oxidation over time, and changes in their chemical composition have been reported with prolonged storage [34]. Reversible prepubertal gynecomastia was reported in one study on repeated exposure to lavender and tea tree oils by topical administration [35]. There is always a big controversy that arises when the safety of these essentials is discussed. No studies have proved that these essential oils are harmful. In the case of some isolated studies, we have observed that these are not safe, but most studies have not proved these oils, if used in aromatherapy, are harmful.

Conclusion

In conclusion, essential oils have a rich history dating back thousands of years, with their usage spanning various cultures and civilizations. These aromatic extracts have found their place not only in perfumery but also in the realms of

therapeutics, cosmetics, and spiritual practices. Aromatherapy, which utilizes essential oils to promote well-being and treat various ailments, has gained recognition as a legitimate form of complementary therapy. Essential oils are derived from various plant parts and contain a diverse array of chemical constituents, making them versatile in their applications. They have been employed to address a wide range of physical and mental health conditions, including depression, anxiety, sleep disorders, and more. These oils interact with the body and mind through mechanisms that involve neurotransmitters, neurotrophic factors, and other complex pathways. Several key essential oils have been highlighted for their beneficial effects on mental health. Lavender, jasmine, sandalwood, Roman chamomile, frankincense, and peppermint oils are among the well-studied and widely used options for alleviating symptoms of anxiety, depression, and sleep disturbances. These oils offer a holistic approach to improving mental well-being, often promoting relaxation, reducing stress, and enhancing mood. While essential oils have demonstrated their potential as valuable tools in mental health support, it is essential to use them with care and consideration. Safety concerns, such as skin sensitization and allergies, should be considered, and individuals should be cautious about the quality and purity of essential oils they use. In summary, essential oils have a profound and ancient connection to human well-being, offering a natural and holistic approach to improving mental health. As research in this field continues to evolve, essential oils may continue to play a valuable role in complementing traditional therapeutic approaches and enhancing overall mental and emotional balance. However, it is advisable to consult with a qualified healthcare professional or aromatherapist when considering the use of essential oils as part of a mental health regimen, especially in cases of pre-existing medical conditions or medication interactions.

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