Chapter 05

Aromatherapy and Jasmine Oil Inhalation in Improving Brain Activities

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ABSTRACT

Aromatherapy is the therapeutic usage of aromatic compounds for psychological well-being, most commonly essential oils. The neurological system is stimulated by the actions of jasmine oil. The research findings demonstrated that both the anterior center and the left posterior region had increased beta wave power (13–30 Hz). On one hand, jasmine oil enhances pleasant emotions like feelings of well-being, activity, freshness, and romance. On the other hand, unpleasant feelings like feeling drowsy were also significantly reduced. Jasmine oil is helpful in the treatment of severe depressive episodes and relaxes the nerves, eliciting feelings of assurance, enthusiasm, and euphoria while revitalizing and replenishing energy and enhancing memory. Jasmine oil mostly consists of β – linalool, Benzyl propionate, and Benzyl acetate. The reported properties of volatile oils include being carminative, aromatic, antidepressant, antispasmodic, astringent, antimicrobial, and stimulatory. Theta and alpha waves increased in response to the jasmine lactone odor, reflecting a calming impact. By the stimulating effect on brain activity, methyl jasmonate, and cineole, a key ingredient in jasmine oil, enhanced beta waves while suppressing theta and alpha waves, resulting in improved brain functionality. Psychoactive drugs used to treat mood disorders can have a variety of adverse effects. Research on how aromatherapy affects mood could help scientists create drugs with fewer side effects.

KEYWORDS
Aromatherapy, Jasmine oil, Euphoria, Antidepressant, Antispasmodic, Psychoactive drugs

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INTRODUCTION

Complementary and alternative medicines (CAMs) are being used by more than 80% of people worldwide, and these treatments are becoming a finer part of the US healthcare system. Over 70% of Americans have used CAMs at least once, and if used yearly CAMs can cost highly approaching $34 billion. There has been a substantial advancement in complementary medicine, in the science of complementary and alternative medicine, helping to integrate treatments that have not only held out the test of time but have also been validated (Mainardi et al., 2009).

There are numerous broad areas of complementary and alternative medicine, including alternative medical systems, manipulative therapies, physiologically based treatments, energy therapies, and mind-body therapies (Heimall and Bielory, 2004). intrinsic hazards should be taken into account when assessing the possible danger of a drug and these may include predicted and expected adverse responses (type A) and idiosyncratic reactions (type B). Despite being considered natural, CAM also carries these same risks (Studdert et al., 1998). The common notion is that because such products or services are "natural," they are safe. The idea that "naturalness" guarantees

harmlessness is innocent and false. The universal availability of complementary medicines in health food stores and supermarkets, as well as the low incidence of complaints against CAM practitioners, has been referred to as proof of safety (Mills, 1996).

These, however, cannot be regarded as suitable safety measures, and the scientific literature is increasingly presenting more suitable ways. This is frequently supported by hard statistics in traditional medicine, with accurate figures indicating the proportion of patients suffering a negative event relative to those who benefit. However, healthcare professionals should have a schema for thinking about safety problems until more complementary and alternative medicine therapies and products are thoroughly evaluated (Barnes, 2003). Unfortunately, in contrast to medication, an extensive list of probable and possible side effects has been lacking regarding use of complementary and alternative medicine (Myers et al., 2004).

In addition to the previously mentioned intrinsic and extrinsic risks, there are other risks associated with using complementary and alternative medicine (CAM), such as discontinuing conventional therapies due to a lack of perceived necessity or direct interference with therapeutic actions, and not acknowledging treatment precautions due to incorrect assumptions that the products are "natural" and thus "safe" (Angell and Kassirer, 1998).

The practical application of aromatherapy dates back thousands of years. The father of modern medicine, Hippocrates, encouraged aromatherapy because he thought that scented massages and baths were beneficial for good health. Leaders in essential oils arose, endorsing aromatherapy as a valid and efficient treatment for the mind, body, and soul. Eight leading nursing theorists accept the historical development of essential oils use in medicine, clinical practice, and holistic healing. The use of clinical aromatherapy as a patient-centered, holistic strategy for balancing physical health, spiritual requirements, and well-being is reflected in their theoretical frameworks and ideas. The acceptance of aromatherapy by the eight scholars attests to its credibility as a complementary therapy in healthcare (Farrar and Farrar, 2020). Essential oils are the "volatile, organic constituents of fragrant plant matter that are extracted by steam distillation or expression." Aromatherapy is the regulated, therapeutic use of essential oils. There are no other extraction techniques that provide an essential oil. Aromatherapy transforms into a therapeutic practice when essential oils are utilized to treat certain illnesses and the results are measured. As a supplementary therapy, aromatherapy is recognized as one of the instruments of holistic nursing (Buckel, 2001).

The field of complementary and alternative medicine is seeing speedy growth in the area of aromatherapy. A possible interpretation of this term is "the therapeutic use of fragrances, or at least of ordinary volatiles, to cure, mitigate, or prevent diseases, infections, and indispositions exclusively through inhalation" (Buchbauer, 1995). Not even the most conventional physician could practice natural medicine without plants; in fact, they serve as the bridge that connects natural and conventional, the ancient and the innovative (Steflitsch and Steflitsch, 2008).

There are several reasons why essential oils should be added to the arsenal of disease-fighting weapons. They have numerous attractive features and benefits, with few adverse outcomes. They can be anti-inflammatory, antiseptic, appetite-stimulating, carminative, choleretic, circulation-stimulating, deodorizing, expectorant, granulation-stimulating, hyperaemic, insecticidal, insect repellent, and sedative. They are natural antimicrobial agents capable of acting on bacteria, viruses, and fungi, and several studies have been conducted in this area. Tropical countries have always employed a variety of spices in their meals, not just for taste, but also to kill microorganisms that thrive in hot climes. Essential oils are supposed to have antibacterial properties because of their lipid solubility and surface action (Rideal et al., 1928). The global health system is heavily burdened by neurological illnesses. According to the most recent estimates, 3 percent of the global burden of disease is caused by neurological disorders that were included in the Global Burden of Disease (GBD) Study. These disorders include Parkinson's disease, migraine, medication-overuse headache (MOH), multiple sclerosis, epilepsy, and dementias including Alzheimer's and other types. Dementia, epilepsy, migraine, and stroke are among the leading 50 causes of disability-adjusted life years (DALYs), even though this is a relatively low total proportion (Murray et al., 2012). India has had a considerably greater growth in the prevalence of mental, neurological, and drug use disorders than many other Asian nations, with a 44% increase from 1990 to 2013 (Patel et al., 2016).

Jasmine

The Persian term "Yasmin", which means "gift from God", is where the name "Jasmine" originates. The jasmine flower represents power, humility, purity, and simplicity in the language of flowers (Dhanasekaran, 2019). Damascus, in Syria, is referred to as the "City of Jasmine." Every home in Damascus was believed to have a jasmine plant before the most recent conflict broke out, and during waning moons, the streets would be filled with the aroma of blossoms (Mansour, 2015). China's mild areas and the Himalayas are the origins of jasmine. There are over 200 distinct species; the Arabian Jasmine, or *Jasminum sambac*, was the first to be given a name. Trade routes brought jasmine from Persia (modern-day Iran) to Europe, but for millennia, people in the East and West have been enthralled with these blossoms. The plant gained immense popularity due to its distinct and delightful scent (Jarrett, 2003).

There are around 200 different kinds of jasmine, and depending on the kind, they can resemble anything from an erect shrub to a sprawling vine. Jasmine plants like growing in well-drained soil and prefer full sun over partial shade. While most jasmine plants are deciduous, losing their leaves in the autumn, some can be evergreen, meaning they retain their leaves throughout the year. Jasmine can be deciduous, with leaves that fall in the fall, or evergreen, with leaves that

remain green all year (Boning, 2010). Although jasmine leaves can have many different patterns, they usually feature trifoliate leaves, in which each leaf splits into three leaflets, or pinnate leaves, in which the leaves grow in opposite pairs along the stem. Jasmine has been grown for its euphoric odour for hundreds of years. It may be employed in numerous ways, from essential oil to fresh blossoms (Sharangi, 2021).

Morphological Characters

The genus Jasminum had roughly 200 species that were extensively dispersed throughout tropical and subtropical climates. They come originally from Eurasia, India, and the Mediterranean. Ancestral character state reconstruction of taxonomically important traits (leaf shapes, leaf arrangement, and blossom colour) used to differentiate genus parts demonstrating homoplasy. Our findings indicate that since the split form the las common ancestor there have been at least four reversals to the unifoliate state.

Fig. 1: Arabian Jasmine flower and foliate

Jasmine Species

More than 200 jasmine species have been identified so far. Some of the most often cultivated and discovered are mentioned in Table 1.

Table 1: Different varieties of Jasmine flowers and their characteristic features

Common Name	Scientific Name	Floral characters	Ref.
Arabian jasmine	*Jasminum sambac*	White three forked cymes flowers	(Widowati et al., 2018)
Spanish jasmine	*J. grandiflorum*	Five petalled terminal or axillary flowers	(Arun et al., 2016)
Star jasmine	*J. multiflorum*	An evergreen, twinner shrub with young branches clothed with velvety pubescence flowers seen in terminal and axillary cymes	Ganatra et al., 2013)
Rosy jasmine	*J. beesianum*	Pink to deep rose colored flowers	(Green, 1997)
Gold coast jasmine	*J. dichotomum*	Vigorous climbing woody vine, red tinted outside pure white inside flowers	(Yilangai et al., 2015)
Yellow jasmine	*J. humile*	Semi-evergreen shrub holding yellow golden flowers	(Nain et al., 2011)
Juhi jasmine	*J. auriculatum*	Star shaped flowers having many flax cymes	(Bahuguna et al., 2009)
Pink jasmine	*J. polyanthum*	Evergreen strong vine with masses of intensely fragrant long-tubed white flowers opening from pink buds	(Prakkash et al., 2019)
Wild jasmine	*J. fruticans*	Yellow corolla calyx with slender lobes	(Guitian et al., 1998)

Phytoconstituents and Essential Oils in *Jasminum* Species

Several studies investigated the phytochemical contents of several *Jasminum* species. Antioxidants, coumarins, cardiac glycosides, essential oils, phenolics, saponins, and steroids were discovered during a preliminary phytochemical screening. The isolation and characterization of chemical components such as volatile oils, jasmine, indol, iridoids, secoiridoids, volatile oils, phenolics, tannins, and flavonoids, which have been determined to be significant constituents of *Jasminum*, is noted (Tharakan, 2021).

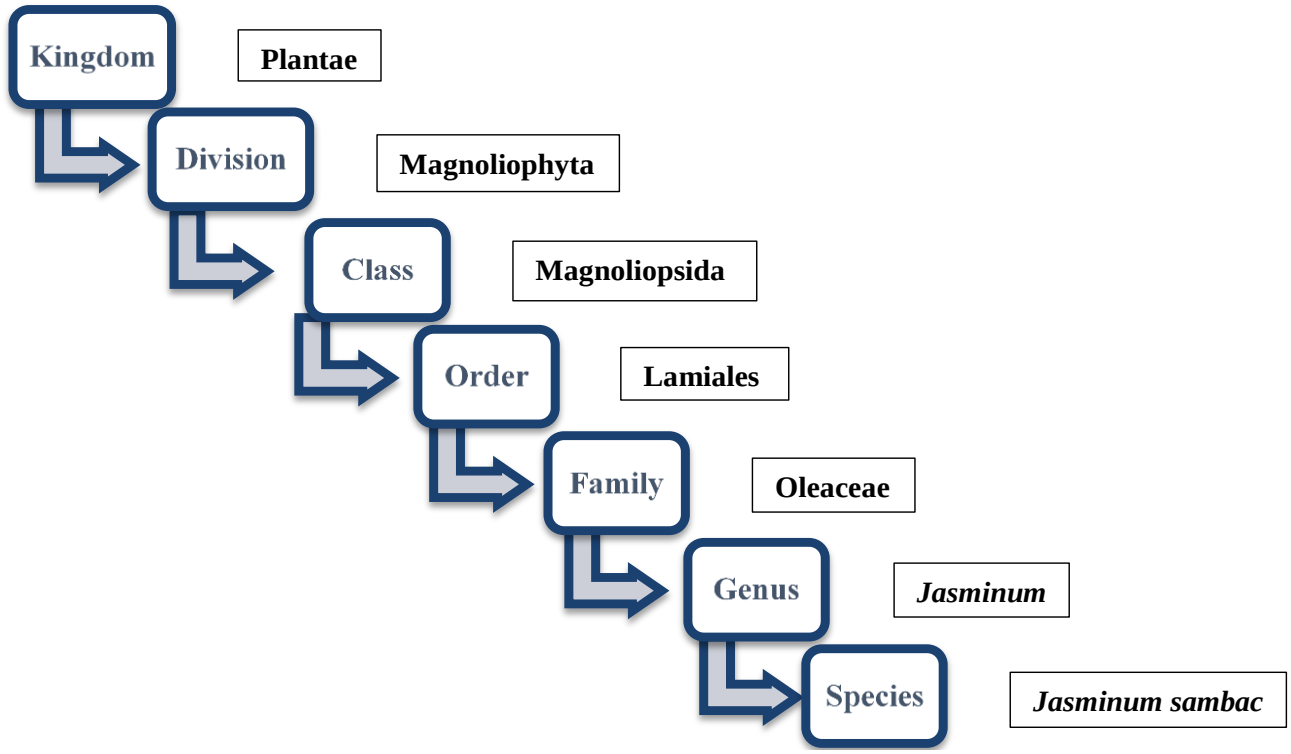

Fig. 2: Taxonomical Classification of *Jasminum sambac*

The leaves and flowers contain a high concentration of phytochemicals such as alkaloids, phenols, flavonoids, tannins, and others that can treat a variety of ailments. In this context, an experiment was carried out to determine the phytochemical components and antioxidant activity of *Jasminum multiflorum* leaves and flowers. For phytochemical screening, several solvents can be used, including methanol, ethyl acetate, ethanol, chloroform, aqueous extracts, and petroleum ether, and for antioxidant analysis methanol, ethanol, ethyl acetate, and aqueous extracts were also used. The DPPH, ABTS, and chelating potential of leaf and floral extracts were measured as part of an antioxidant experiment. The presence of alkaloids, carbohydrates, tannins, sterols and terpenoids, cardiac glycosides, flavonoids, proteins, and amino acids was indicated by phytochemical analysis of leaf and flower extracts. The quantitative determination of total phenolic, total flavonoids, and different antioxidant activities (DPPH, ABTS, and chelating potential) was carried out by the use of the colorimetric technique, and the results evaluated that total phenolic and total flavonoids were highest in the ethanol extract of leaves. The antioxidant activity was measured using the EC50 value, and the ethanol extract of leaves showed the highest decreasing percentage (Kumaresan et al., 2023).

Table 2: Phytoconstituents in various parts of *Jasminum* plant and their therapeutic effectuality

Plant Parts	Phytoconstituents	Therapeutic Effects	Ref.
Flower	Methyl jasmonate (essential oil), indole, methyl Dihydrojasmonate, isophytol, methyl palmitate, geraniol, benzyl benzoate, myrcene, alkaloids, terpenoids	Anticancerous, antileprotic, otalgia, aromatherapy	(Sandeep and Paarakh, 2009; Sharma et al., 2000)
Leaves	salicylic acid, oleanolic acid, 40-dihydroxyacetophenone, resin, isoquercitrin, oleacein, 3,4-dihydroxy benzoic acid	Anti-inflammatory, antiulcerative, antimicrobial, antioxidant	(Rastogi and Mehrotra, 1990; Arun et al., 2016)
Seed	phenyl propanoid glycoside, Iridoid glucosides	Antileishmanial, Immunomodulatory	(Tuntiwachwuttikul et al., 2003; Banerjee et al., 2007)
Bark	Alkaloids, secoiridoid glucosides	Anti-microbial	(Singh and Vyas, 2018; Solanki et al., 2021)
Stem	Loganin, sesquiterpenoids, phenylethanoids	Analgesic, anti-inflammatory	(Lyubetska,2002; Gupta and Chaphalkar, 2015)
Root	Triterpenes, saponins, flavonoids	Astringent, antiseptic, suppurative, thermogenic	(Tadiwos et al., 2017; Singh and Sharma, 2020)

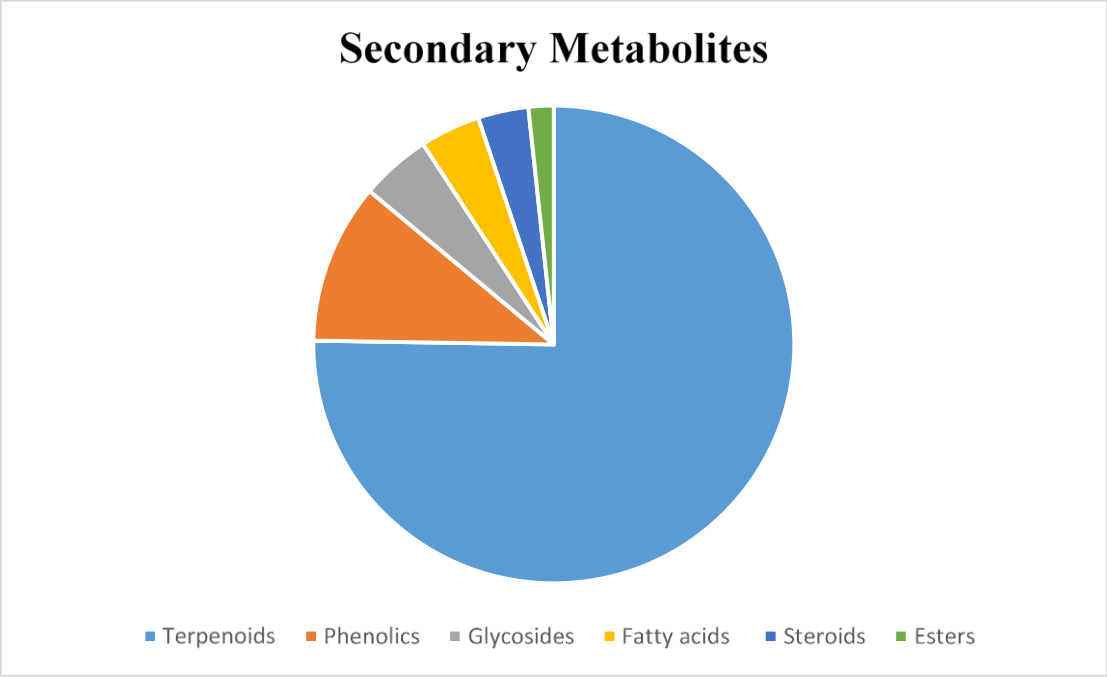

Fig. 3: Secondary Metabolites in *Jasminum*

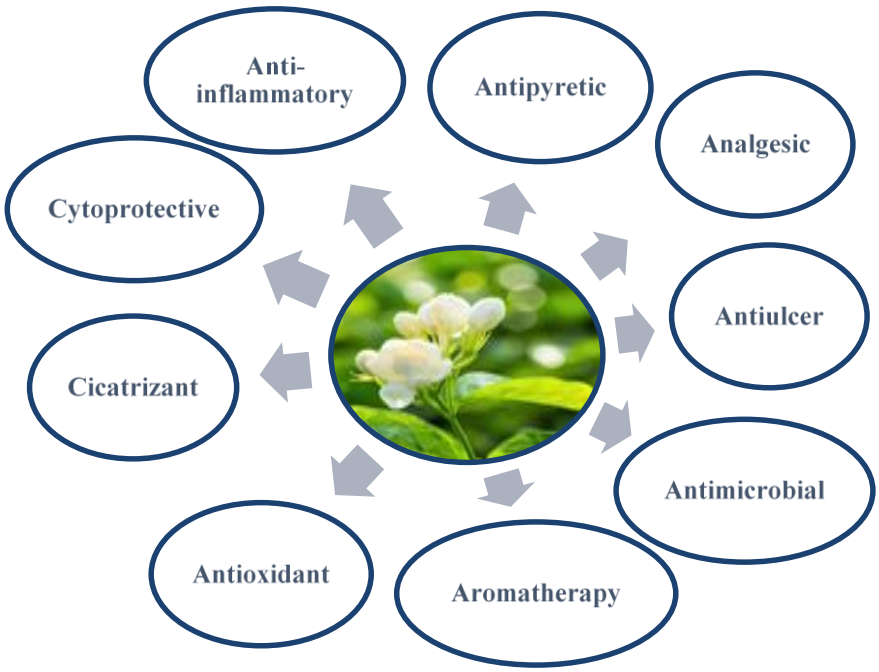

Fig. 4: Medicinal effects of *Jasminum* plant

Essential Oils in *Jasminum* Flower

Alkaloids, flavonoids, cardiac glycosides, glycosides, saponins, coumarins, phenolics, quinones, betacyanins, steroids, terpenoids, and tannins were among the phytochemical test findings acquired from the jasmine flower extract used in this study (Suaputra et al., 2021). The volatile jasmine oil comprises over 100 aromatic compounds, including linalool, benzyl acetate, benzyl alcohol, indole, benzyl benzoate, cis-jasmone, geraniol, and methyl anthranilate. Additionally, trace amounts of p-cresol, cis-3-hexenyl benzoate, farnesol, eugenol, cresol, nerol, benzoic acid, and benzaldehyde are also present in extract from jasmine (linalool, for example). Various quantities of linalool can be found in several essential oils. Jasmine is fundamentally mostly comprised of linalool, a monoterpenoid alcohol (Paibon et al., 2011).

Hexanal Extraction

Typically, jasmine essence is produced by hexane extraction. To isolate aroma molecules from undesirable extractives such as paraffins and fatty acid methyl esters, the extraction results in the formation of a "concrete" and it is then subjected to further processing (Reverchon et al., 1995). In the commercial extraction of jasmine volatile oil Hexanal extraction is the preferable method. However, this approach works against the "green" notion of modern industrial processing systems, which demands minimal emissions of carbon dioxide and energy saving (Sonobe, 2011).

Solid-phase Microextraction (SPME)

The extraction phase, often referred to as ab/adsorption of the chemicals on a fiber coated in a polymer, is the foundation of the SPME. Today, a variety of polymers with varying polarity are accessible, and thermal desorption of substances is often accomplished in gas chromatography. Polar and nonpolar substances are adsorbed on different types of fibers (Mejías et al., 2002). This method offers several benefits, such as a shorter extraction time, the elimination of the need for organic solvents, automation potential, ease of coupling with gas chromatography (GC), simplicity, sensitivity, and selectivity (Mohammad Hosseini, 2015). The variability of fibers from batch to batch, the fragility of fiber coatings, and possible matrix effects are some drawbacks of SPME (Huang et al., 2019).

Power Control Microwave Hydrodiffusion and Gravity (PC-MHG)

One of the most innovative uses of solvent-free microwave extraction is microwave hydrodiffusion and gravity (MHG). Hydrophilic phytoconstituents can be extracted from the reactor matrix with "in situ" water. Additionally, matrix is weakened and phytochemical storage cavities are ruptured. Bioactive chemicals are carried out of the plant tissues by heating in situ water in fresh marix (Mustafa et al., 2022). Using the benefit of green microwave technology, the PC-MHG extraction system may shorten the processing period while consuming less energy, both of which are favourable for the environment. With PCMHG, a significant yield of jasmine volatile oil was obtained in about 6 minutes, while SSDE took around 5 hours to get the same volatile oil. With MAE, the environmental effect was substantially decreased; at 500 and 100 W, respectively, around 50 and 100 g of carbon dioxide (CO2) had been released into the atmosphere (Sommano et al., 2015).

Simultaneous Steam Distillation Extraction (SSDE)

An effective technique for separating volatile organic compounds (VOCs) from intricate liquid mixtures. The method extracts the essential oils from the plant by combining solvent extraction (using an organic solvent like pentane) with steam distillation. According to the concept of the steam distillation process, heating a combination of two or more immiscible liquids causes the vapor pressure of the system to rise because of the combination of the vapor pressure of the two immiscible liquids (Chen et al., 2006). Steam distillation aids in the decrease of temperature-sensitive chemicals' breakdown by reducing the boiling point. For steam distillation heat must be used to produce the steam which can be energy-intensive and raise production costs (Gomez et al., 1993).

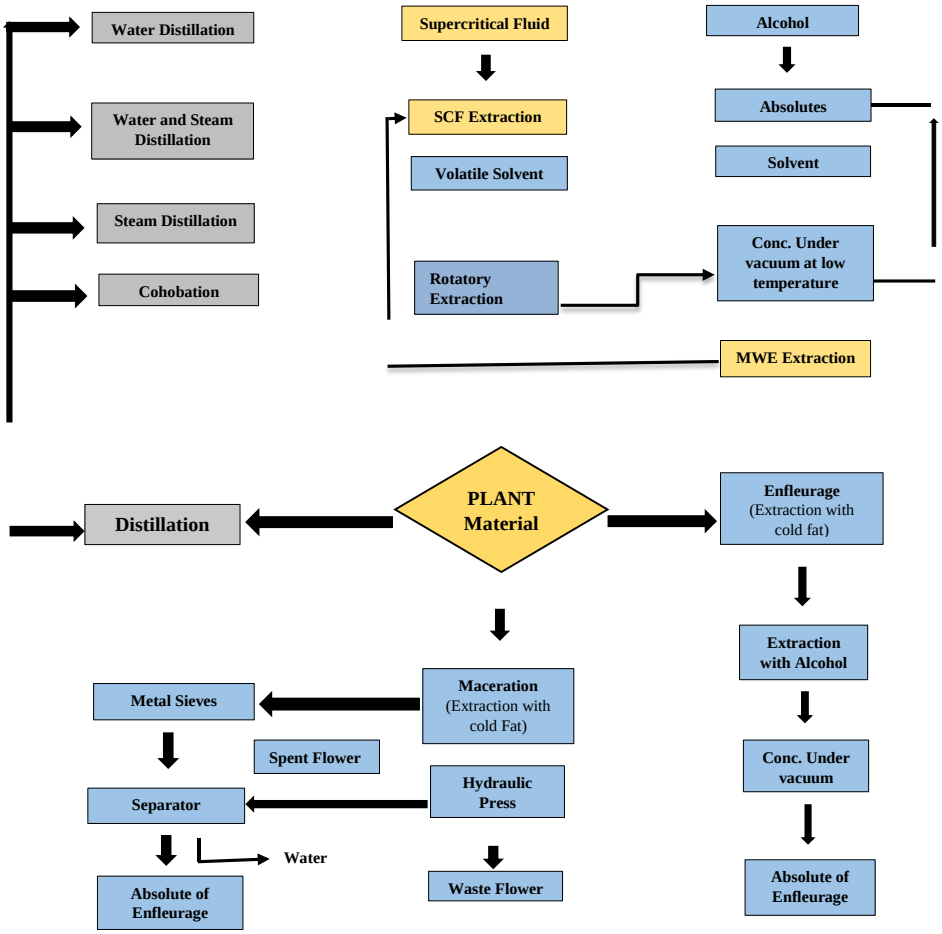

Fig. 5: Schematic flow diagram of plant material extraction

Aromatherapy

The art and science of using naturally derived aromatic essences from plants to balance, integrate, and improve the health of body, mind, and spirit is commonly referred to as aromatherapy, sometimes known as essential oil therapy. To support an individual's natural healing process, it attempts to encompass physiological, psychological, and spiritual processes (Hedaoo and Chandurkar, 2019). The history of aromatherapy was influenced by the Greeks. The main ingredient of the perfume Megallus is Myrrh. A Greek perfumer was created and named Megaleion. Hippocrates, the "father of medicine," is credited with using aromatherapy for therapeutic purposes long before the term was coined. Greek mythology put forth that the gods were endowed with the ability to smell and create perfumes (Lawless, 1995).

Little is known about the origins of aromatherapy and where it started precisely, however, the Egyptians are credited as the ones who constructed the earliest distillation machines for extracting oils from particular plants, such as cedarwood, cinnamon, and clove which were used to embalm the dead. The practice of employing infused aromatic oils to improve mood is considered to have originated in China. The Egyptian culture was among the first to gain a deeper awareness of fragrant plants. They used plants for spiritual, cosmetic, therapeutic, and mortuary purposes (Wildwood, 2006).

French chemist Rene-Maurice Gattefosse was the one who used the name "aromatherapy" originally in 1937, who became interested in the therapeutic properties of essential oils (Khan et al., 2023) after suffering a burn. Following Gattefosse's "discovery" that his burn was healed by lavender oil, French surgeon Jean Valnet also employed essential oils to treat troops' wounds during World War II and it further demonstrated the therapeutic advantages of aromatherapy (Ali, 2015). "The best therapy for health is to infuse the brain with pleasant aromas" Alexis (Lyubetska, 2002).

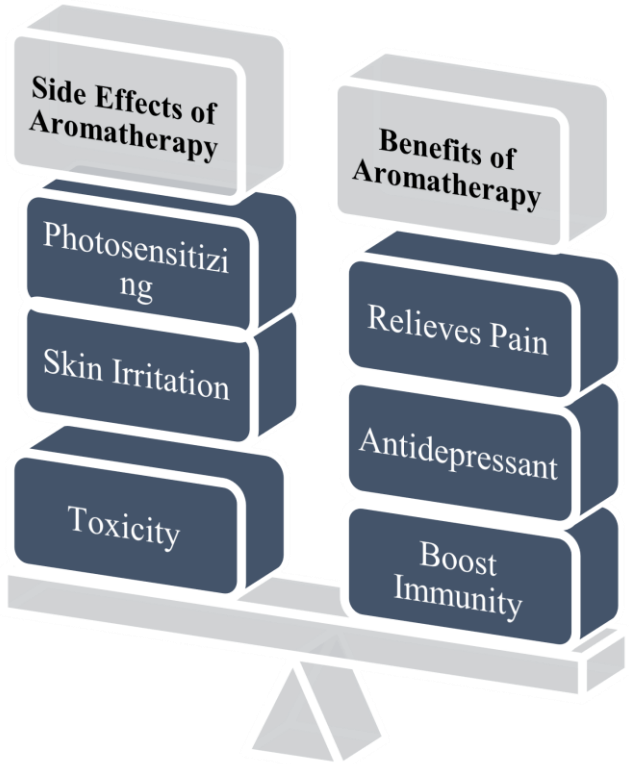

Fig. 6: Pros and cons of Aromatherapy

Jasmine Oil in Aromatherapy

Humans who use aromatherapy essential oils have physiological and psychological changes, including altered mood and sleep patterns. It is thought that pharmacological and psychological systems work together to elicit the effects of essential oils. While the psychological process functions through the sense of smell and may thus have physiological consequences, the pharmaceutical mechanism acts directly on the physical organism. The impacts on the body and mind are completely different, even though they frequently happen at the same time (Jellinek, 1997). The use of jasmine oil, particularly in aromatherapy, as a medicinally effective substance has increased significantly. In aromatherapy, Jasmine oil is incorporated as a holistic remedy for depression, fear, hysteria, and apathy, and to balance, uplift, and inspire confidence (Lis-Balchin, 2006).

Stimulating the Impact of Jasmine Essential Oil

Experiments on human attention revealed that lavender essential oil has soothing properties and jasmine essential oil has stimulating properties. Numerous essential oils are thought to be sedatives because they have been demonstrated to lower contingent negative variation (CNV) brain waves in human volunteers. Others are regarded as stimulants and raise CNV. Given that CNV amplitude elevated in individuals exposed to jasmine, it appeared to have stimulated consequences (Ilmberger et al., 2001).

Changes in the electroencephalogram were employed as indicators in research conducted at the University of Occupational and Environmental Health in Kitakyushu, Japan, for measuring the effects of essential oils. Their findings showed that the pleasant odor of jasmine had a stimulating impact, as seen by the notable rise in beta brain wave activity that occurred when the fragrance was presented (Kubota et al., 1992).

Transdermal jasmine oil administration was performed on healthy volunteers. The arousal state of the autonomic nervous system was measured using autonomic measures, such as systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate (PR), blood oxygen saturation (BOS), breathing rate (BR), and skin temperature (ST). To measure subjective behavioral arousal, individuals were also required to score their state of mental and emotional health in terms of alertness, vigor, tranquility, attentiveness, mood, and relaxation (Andreassi, 2000).

The systolic and diastolic blood pressures of the jasmine oil group were consistently higher. Since the activity of the sympathetic branch of the ANS controls blood pressure, an upsurge in blood pressure indicates an increase in sympathetic tone, or autonomic i.e. By increasing systolic and diastolic blood pressure, blood oxygen saturation, and breathing rate, transdermal absorption of jasmine oil intensified the ANS' state of consciousness. In addition to this, massaging jasmine oil caused behavioral activation, meaning that the respondents felt less relaxed, more attentive, and more active as compared to the previous administration. Based on self-evaluation, this finding implies that arousal has gotten higher. The idea of stimulating/activating effects may thus be used to characterize the effects of jasmine oil massage. Our analysis justifies the use of jasmine oil in medications intended to treat depression as well as enhance mood in people by showcasing the stimulating and activating properties of the oil (Hongratanaworakit, 2009).

In addition to relieving anxiety and inducing feelings of confidence, optimism, and happiness, jasmine oil is excellent in treating severe depression. It also rejuvenates and restores energy and strengthens memory (Sayowan et al., 2013). The number of alpha and theta waves was increased by the jasmine lactone smell, suggesting that the chemical composition had a calming effect (Hongratanaworakit, 2004). The findings indicated that following inhalation, the respondents felt improved, more energetic, fresher, and more amorous. Negative feelings, like drowsiness, have consequently diminished (Hongratanaworakit, 2010).

To investigate the underlying processes of the key components of jasmine oil, it is important to know that the second messenger for certain serotonin receptors is as well cAMP, and serotonin is thought to be involved in emotion modulation within the central nervous system. Inhaling jasmine vapor is likely to have a stimulating effect due to its absorption and subsequent pharmacological activity inside the brain, or it might simply stimulate odor receptors (Lis Balchin et al., 2002).

It is widely documented that cortisol levels are elevated in response to pain, fretting, and distress (Kurina et al., 2004). The study on animals found that long-term oral ingestion of jasmine essential oil drastically reduces anxiety, discomfort, and itching in mice (Kuo, 2017). The research found that 5 minutes of JEO inhalation per day for 10 days can considerably reduce anxiety in people with a generalized anxiety disorder (Arhanthkumar, 2013). The recommended technique of aromatherapy is inhalation, which allows for direct absorption of essential oil components via the nasal mucosal membranes into circulation (Starkweather, 2018). According to one of the study findings, a one-hour inhalation of JEO can considerably lower mean blood cortisol levels and mean anxiety scores in patients having laparotomy. This suggests that essential oil may be useful in lowering preoperative anxiety (Yadegari et al., 2021).

The effects of jasmine oil on the central nervous system were looked into after inhalation. The power beta (13-30 Hz) rose dramatically in the frontal center and left posterior brain locations. This finding demonstrated that aromas influenced cortical brain wave activity. Brain waves have been shown to alter quite sensitively depending on the subject's degree of consciousness (Sayowan et al., 2013). Jasmine essential oil works physiologically to increase the non-rapid eye movement (REM) sleep state by inducing slow delta and beta frequency oscillations in the hippocampus region. The mice that were given 0.03% jasmine essential oil were found to explore the center arena of the apparatus more than the mice in the control group, in accordance with the locomotor tracking (Cheaha et al., 2023).

Conclusion

Thus we can conclude that aromatherapy is a growing practice of people today to help reduce stress and invoke certain moods and feelings. The studies conducted using jasmine essential oil as an intervention render mesmerizing neuroprotective benefits including, modulation in the sleep-wake cycle, stimulating brain activities, revitalizing memory, degrading neuro oxidants, and eliciting pleasing neuronal effects. The study of aromatherapy is relatively new and unexplored. More research must be done to make scientific conclusions about the use and effect of aromatherapy so the field may emerge as revolutionary in contemporary scientific society.

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