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The Effect of Aromatherapy Lavender Essential Oils on the Quality of Life of Patients with Chronic Diseases and Pain

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ABSTRACT: This study aims to examine the therapeutic benefits of lavender essential oil (LEO) on pain management and its potential to improve the quality of life in patients with chronic diseases. Chronic pain is a common and incapacitating illness that profoundly affects physical and mental health, leading to increased interest in complementary and alternative therapy. Lavender essential oil, recognized for its soothing aroma and therapeutic benefits, has garnered interest for its analgesic, anxiolytic, and anti-inflammatory characteristics. These advantages are thought to be facilitated by several physiological processes, including the regulation of transient receptor potential (TRP) channels, which are involved in sensory perception and pain signalling. This study utilizes a systematic literature review technique, concentrating on both clinical and experimental studies to investigate the effectiveness of lavender essential oil in alleviating pain. The analysis includes many chronic illnesses such as neuropathic pain, arthritis, cancer-related pain, and fibromyalgia. The studies incorporated in the review investigate several administration modalities, including inhalation, topical application, and aromatherapy massage. Inhalation has consistently been linked to decreased pain perception, enhanced respiratory patterns, and increased mental well-being, underscoring the many advantages of lavender essential oil in holistic care environments.

Keywords: Lavender Essential Oil, Chronic Pain, Aromatherapy, Quality of Life, Complementary Medicine.

INTRODUCTION

Disease classifies as acute and pain. Acute disease can be described as relatively severe disorder with an abrupt onset and brief symptom duration. When a disease lasts no longer than three months, it is often referred to as "acute," especially in relation to acute pain. Some scholars define acute illness as a temporary condition that generally resolves within six months. Infectious agents mostly becoming the main causes of acute disease such as viral, bacterial, or parasitic. And as well

as additional reasons include non-infectious acute disease can due to physical agent, chemical agents, allergic, metabolic, organ dysfunction, and acute exacerbation of chronic infectious disease. Acute disease divided into four distinct divisionss; acute minor or self-limiting disease, acute major disease that could be self-limiting or require treatment, acute exacerbation of existing major disease, acute presentation of a new chronic disease (El-Gilany et al., 2023).

Chronic disease is a condition that are at least one year in duration, that restrict daily life activities, need continuous medical care, or both defined by The Centers for Disease Control and Prevention (CDC). Chronic disease may be affected by a mix of genetic factors, lifestyle choices, social habits, elements of the healthcare system, community influence, and environmental health factors. These risk factors frequently coexist and can interact with one another (Airhihenbuwa et al. 2021).

Obesity, rising blood lipids, elevated blood pressure, and elevated blood glucose are all symptoms of unhealthy eating habits and inactivity. These factors are classified as metabolic risk factors and have the potential to contribute to cardiovascular disease, the chronic condition associated with the highest incidence of premature mortality. Chronic diseases; are often associated with elder age demographics; however, approximately 18 million fatalities due to chronic illnesses occur before the age of 70. According to the World Health Organization (WHO), it is estimated that 82% of deaths occur in low- and middle-income countries.

According to the International Association for the Study of Pain (IASP), pain is an unpleasant emotional and sensory experience that is linked to or defined in terms of existing or potential tissue damage. As it is known, pain based on the length of time it has been present, might be categorized as either acute or chronic pain. Acute pain tends to occur quickly, begin sharply or intensely, and act as a warning indication of sickness or hazard to the body, often improving with healing and rest. Chronic pain is defined as pain that continues longer than the typical issue healing period, generally considered three months in the absence of other factors. Other studies have identified six months or longer as the threshold for chronic pain. Chronic pain is not simply an extension of acute pain, as it does not possess the protective function of physiological nociception, and it is sustained by factors that are distantly related to the initial cause, including central sensitization, altered pain modulation, glial activation, and neuroimmune signalling (Raffaeli et al., 2021).

Chronic pain is acknowledged as a public health challenge that impacts the quality of life of its patient in physical, psychological, and social dimensions (Raffaeli et al., 2021). Individuals experiencing chronic pain are more prone to psychological distress. Stress, fatigue, fear, worry, avoidance, and catastrophization represent significant emotional distress factors that may contribute to psychological issues, including anxiety and depression, in individuals experiencing chronic pain.

(Reis et al. 2019)demonstrated that chronic pain has an impact not just on perception and attention but also on the patient's day-to-day life, including how the patient perceives themselves, how they concentrate, and how well they are able to deal with the pain. In terms of health aspects, hypertension, asthma, and diabetes were more likely to increase in individuals with chronic pain and a decrease in muscle strength and the strength of the immune system. This indicates a significant impact on individuals' quality of life.

Aromatherapy is a popular form of complementary alternative medicine for the prevention and treatment of various health conditions (Algristian et al., 2022). Aromatherapy is the utilization of concentrated essential oils derived from plants and flowers to address various ailments. Aromatherapy has several advantages, including ease of use, rapid efficacy, and non-invasiveness. The method of action in aromatherapy starts with inhalation, during which essential oil molecules are absorbed by the nasal membrane. Pleasant odours increase tidal volume and reduce respiratory rates. Therefore, deep and slow breathing pattern caused by aromatherapy can be a mechanism to reduce pain (Abbaszadeh et al., 2017). According to what has been mentioned by (Lakhan et al. 2016) aromatherapy can effectively alleviate pain associated with certain medical disorders. Individuals experiencing many types of pain often see massage as alleviating and tranquilizing. An agreeable fragrance may be essential for patient happiness, alongside the health benefits of aromatherapy. The majority of subjects who had aromatherapy experienced advantages from additional treatment sessions beyond the standard regimen. It is more cost-effective and has less adverse effects compared to conventional analgesics.

According to (Girão et al. 2024) essential oils are natural substances with many uses and advantages. They are defined as volatile, fragrant, and frequently bioactive compounds derived from diverse plant components, including flowers, leaves, bark, roots, seeds, or peels. A literature stated by (de Melo Alves Silva et al., 2023). that lavender essential oil, which belongs to the Lamiaceae family and the genus Lavandula, is the most frequently cultivated of the essential oils that may be used as a supplementary medicine. Lavender essential oil is derived from the species of Lavandula angustifolia, often known as lavender or real lavender. The pharmacological actions of Lavandula angustifolia oil are well-known and well recognized. These activities include healing, sedative, depressive, antiseptic, antifungal, relaxing, and antiemetic qualities. Stated by (Yasa Ozturk et al., 2021).aromatherapy oil lavender is also being used more and more for this reason because it relieves pain, reduces inflammation, and calms people down.

It can be concluded that numerous biological activities and therapeutic qualities that are advantageous for pain management are displayed by aromatherapy lavender essential oil. Various applications of aromatherapy lavender essential oils for chronic pain patient including inhalation, topical application, massage, are possible based on the user's condition and preferences. However, aromatherapy lavender essential oil is utilized to help individuals manage their pain through inhalation. Some of the primary ways that essential oils reduce pain and inflammation are represented by these system. Nevertheless, additional investigation is necessary to completely comprehend the exact mechanisms, dosages, routes, and combinations of essential oils for different kinds of pain.

METHOD

This research utilizes a thorough and organized literature review method to explore the influence of Lavender Essential Oil (LEO) on pain relief and the quality of life for those with chronic illnesses. The approach was crafted to ensure the inclusion of high-quality, evidence-based references by drawing from a variety of data sourced from trustworthy and respected databases. The review process concentrated on discovering, assessing, and synthesizing current knowledge

derived from clinical and experimental research, meta-analyses, and reputable journal articles that addressed the therapeutic benefits of LEO in relation to chronic pain and associated conditions.

To gather pertinent information, an extensive electronic database search was performed, encompassing PubMed, Google Scholar, ScienceDirect, and Scopus. These databases were chosen for their extensive and authoritative coverage of biomedical, clinical, and health-related literature. The search strategy utilized specific keywords and Boolean operators, such as "lavender essential oil," "chronic pain," "quality of life," "aromatherapy," "neuropathic pain," "cancer pain," and "analgesic effects," to filter down the relevant publications. Additional criteria, such as publication date, language (English), and peer-reviewed status, were applied to further narrow the search results.

The key inclusion criteria for the studies selected were carefully established to ensure the relevance, reliability, and scientific rigor of the review. First and foremost, all research included in the review had to be published between 2015 and 2024, to guarantee that the findings reflected the most current and up-to-date understanding of lavender essential oil's therapeutic applications. This timeframe was chosen to incorporate recent advancements in aromatherapy research, evidence-based medicine, and clinical methodologies. Secondly, each study had to directly investigate the application of lavender essential oil (LEO) with respect to chronic pain management, emotional well-being, or improvements in quality of life areas that are strongly aligned with the objectives of this review.

Moreover, the selected studies needed to focus on populations experiencing chronic illnesses or persistent pain-related conditions, such as neuropathic pain, arthritis, fibromyalgia, or cancer-related pain, to ensure the applicability of findings to the target group. Eligible studies also required a clearly defined methodology, whether derived from randomized controlled trials, observational cohort studies, case-control studies, quasi-experimental designs, or systematic reviews. This ensured that the data extracted was based on transparent, reproducible, and scientifically validated procedures. On the other hand, studies that did not focus specifically on lavender essential oil or failed to assess its effects on pain perception, mood, or quality of life were excluded. Research published prior to 2015 was also omitted to avoid outdated or potentially obsolete findings. Furthermore, non-scientific articles such as editorials, letters to the editor, anecdotal reports, and opinion pieces were excluded to uphold academic integrity and ensure the review was grounded in peer-reviewed empirical research.

The data extraction process was rigorous and structured to maintain consistency and objectivity. Abstracts and full texts of the eligible studies were reviewed in detail. Key data points extracted included the research objectives, study design, sample size, characteristics of participants, intervention protocols (e.g., dosage, route of administration such as inhalation or topical application, frequency and duration), control conditions (if any), measurement tools (e.g., pain scales, quality of life assessments), and statistical results. Thematic analysis was applied to synthesize findings across studies, with an emphasis on common mechanisms of action. These included the modulation of sensory pathways via the transient receptor potential (TRP) channels, the regulation of respiratory and autonomic functions, and the influence of lavender's active

compounds particularly linalool and linalyl acetate—on neural and hormonal pathways related to pain, stress, and relaxation.

The final synthesis aimed to integrate all relevant evidence into a comprehensive narrative that highlighted the clinical potential and therapeutic promise of lavender essential oil in pain management and well-being enhancement for individuals with chronic health conditions. Patterns of consistency and variation across the studies were noted, and special attention was given to identifying gaps in the literature, areas of methodological weakness, and opportunities for future research. Ultimately, this thorough and organized review methodology provides a strong foundation for informing clinical practice, supporting patient-centered care, and shaping future scientific inquiry into the use of aromatherapy and essential oils in chronic disease management.

RESULT AND DISCUSSION

Chronic Pain

Chronic pain is can be interpreted as persistent discomfort that longer than the typical issue healing period, generally considered three months in the absence of other factors. Other studies have identified six months or longer as the threshold for chronic pain (Raffaeli et al. 2021). The International Classification of Diseases (ICD) divided chronic pain into seven groups; chronic primary pain, chronic cancer pain, chronic posttraumatic and postsurgical pain, chronic neuropathic pain, chronic headache and orofacial pain, chronic visceral pain, and chronic musculoskeletal pain.

Chronic primary pain is pain in one or more body parts that lasts or recurs for more than three months, is linked to a substantial functional disability (meaning it interferes with everyday activities and social roles), and cannot be sufficiently elucidated by an other chronic pain disorder. Common diseases include fibromyalgia, irritable bowel syndrome, chronic generalised pain, and back pain that is not classified as musculoskeletal or neuropathic pain are covered in this section. There may or may not be molecular discoveries that contribute to the pain issue (Treede et al. 2015).

An explanation stated by(Treede et al. 2015),chronic cancer pain is characterized by pain originating from the disease itself (the primary tumor or metastases) as well as pain resulting from cancer treatments (chemotherapy, radiation, surgery, and other modalities). Cancer-related pain will be categorized as sensorimotor (neuropathic), bone (or musculoskeletal), or visceral, depending on its location. If associated with physical movement or medical procedures, it will be classified as either intermittent (episodic pain) or chronic (background pain). The sections on neuropathic pain and postsurgical pain will be cross-referenced with treatment-related pain.

Chronic postsurgical and posttraumatic pain defined as pain that appears with surgery or a tissue injury (including burns) and lasts for at least three months following treatment. Chronic postoperative pain is frequently neuropathic pain, which varies from 6% to 54% and more, and accounts for 30% of cases on average, depending on the kind of operation. Pain with a neuropathic component is typically more intense than nociceptive pain and has a greater negative impact on quality of life (Treede et al. 2015).

According to (Treede et al. 2015). chronic neuropathic pain results from a lesion or disorder of the somatosensory nerve system. Neuropathic pain, whether spontaneous or induced, may present as hyperalgesia, an exaggerated response to painful stimuli, or allodynia, a painful response to normally nonpainful stimuli. A neuroanatomically plausible distribution of pain, together with a history of nervous system injury—such as from a stroke, nerve damage, or diabetic neuropathy is essential for diagnosing neuropathic pain. To definitively identify neuropathic pain, it is necessary to demonstrate the lesion or sickness impacting the nervous system by methods such as imaging, biopsy, neurophysiological testing, or laboratory analysis. Both peripheral and central neuropathic pain disorders will be categorized as diagnostic entities under this classification.

Chronic headache and orofacial pain are characterized as orofacial pain or migraines that occur on at least 50% of the days over a minimum of three months. Temporomandibular disorders are among the most prevalent chronic orofacial aches. This is uncommon in tension-type headaches, less frequent in migraines, and prevalent in trigeminal autonomic cephalalgias. There are several chronic orofacial pains that are related to primary chronic pain and neuropathic pain, such as burning mouth syndrome, persistent idiopathic orofacial pain, and post-traumatic trigeminal neuropathic pain (Treede et al. 2015)

According to (Treede et al. 2015). chronic visceral pain refers to persistent or recurrent pain that originates from the internal organs of the head, neck, thorax, abdomen, and pelvis. Referred visceral pain occurs when pain is frequently felt in the somatic tissues of the body wall (skin, subcutis, muscle) in regions that share sensory innervation with the internal organ causing the symptom. The degree of internal injury or unfavorable visceral stimulation may not be reflected in the severity of the symptom. Secondary hyperalgesia, which is defined as increased sensitivity to painful stimuli in places apart from the initial nociceptive source, frequently appears in these areas.

(Treede et al. 2015). on their study also stated that persistent or recurring pain that develops as a medical issue is known as chronic musculoskeletal pain impacting one or more bones, joints, muscles, or related soft tissues. This approach includes entities characterized by persistent inflammation of viral, autoimmune, or metabolic origin, such as rheumatoid arthritis, together with Structural alterations impacting bones, joints, tendons, or muscles, as represented by symptomatic osteoarthrosis. Neuropathic pain will be contrasted with musculoskeletal pain of neuropathic origin.

Chronic Disease

Non-communicable diseases (NCDs), another name for chronic diseases, are long-term illnesses that often worsen over time in nature and persist for more than three months. Unlike acute illnesses, chronic diseases are often not curable but can be managed with appropriate healthcare interventions. According to (Beaglehole et al., 2014). Chronic diseases are defined by their extended duration, gradual progression, and the requirement for ongoing management instead of immediate medical intervention. These diseases are the primary contributors to mortality and

disability globally, accounting for more than 70% of deaths, as indicated in the Global Burden of Disease Study (GBD 2019 Diseases and Injuries Collaborators, 2020).

The etiology of chronic diseases is multifactorial, involving a complex interplay of genetic, environmental, behavioral, and social determinants. (Bauer et al. 2014) stated that it was stressed that the most important modifiable risk factors are bad lifestyle choices, which include not being physically active, A bad diet, smoking, and drinking too much booze are all examples of bad habits. Individuals who engage in these activities are more likely to experience physiological changes such as obesity, hypertension, dyslipidaemia, and insulin resistance. These changes, in turn, contribute to an increased risk of developing chronic illnesses such as diabetes, cardiovascular problems, and certain malignancies. Additionally, the World Health Organization (2018) noted that social determinants, such as income inequality, educational disparities, and limited access to healthcare, further compound these risks, particularly in low- and middle-income countries.

Stated by (NCD Risk Factor Collaboration, 2021) chronic illnesses are categorized into many principal classifications according to organ systems and physiological effects. Cardiovascular illnesses (CVDs) are a significant category, encompassing hypertension, coronary artery disease, heart failure, and stroke. These are frequently linked to atherosclerosis and inflammatory processes, and continue to be the primary cause of worldwide death. According to (Jackson-Morris and Nugent 2020)chronic respiratory diseases, such as asthma and chronic obstructive pulmonary disease (COPD), are common and frequently linked to environmental pollutants and tobacco use. Cancers, including lung, breast, and colon types, constitute a substantial segment of the chronic disease burden, arising from both genetic and lifestyle-related factors. Neurodegenerative and mental health disorders, including Alzheimer's disease and depression, are increasingly acknowledged as chronic diseases due to their prolonged effects on health and quality of life.

Recent years have seen an increasing acknowledgment of the coexistence of multiple chronic conditions, often referred to as multimorbidity. This presents a new challenge for healthcare systems, as it complicates diagnosis, treatment, and long-term care planning. It highlights the need for integrated, person-centered care rather than disease-specific interventions. Moreover, chronic diseases not only affect physical health but also have profound implications for emotional and social well-being, reducing the quality of life and increasing healthcare costs globally.

To summarize, chronic illnesses are a substantial and rising public health problem globally. Their multifaceted etiology, influenced by behavioural, genetic, environmental, and societal variables, necessitates a comprehensive approach to prevention and treatment. Understanding their categorization allows for more tailored clinical interventions and policy solutions. Moving forward, increased investment in research, preventive, and community-based healthcare is required to lower the burden of chronic illnesses and enhance global health outcomes.

Pain Mechanism and Neurotransmitter Pathways

Pain is a fundamental physiological function that has evolved to alert the individual to detrimental stimuli, thereby reducing the likelihood of tissue injury and preventing additional damage. Nerves or tissues are injured, resulting in pathological pain. It is common for the pain system to become

sensitized when it is activated. It is recognized that sensitization occurs at the nociceptor level and centrally in the dorsal horn of the spinal cord. Peripheral sensitization is the process by which peripheral nociceptive neurons become more receptive and have a lower activation threshold. Central sensitization is the term used to describe the increased reactivity of the nociceptive neurons in the central nervous system. According to (Liu and Kelliher 2022) nociceptor neurons are the main sensory neurons that sense and send pain. Nociceptors have two main jobs: one is to identify and store painful events and send signals from the sensory system to the brain and spinal cord; the other is to make and release neuropeptides.

According to (Souza Monteiro de Araujo et al. 2020).via cell membrane ion channels, unspecialized free nerve terminals called nociceptors transduce local "noxious" information into afferent action potentials. Important two kinds of ion channels are voltage-gated ion channels and transient receptor potential (TRP), which help to generate and magnitudes of an action potential. Local tissue homeostasis breaks following damage. Inflammatory mediators, such as hydrogen ions (protons), sodium ions, serotonin, cytokines, bradykinin, histamine, prostaglandins, and leukotrienes, are released by damaged tissue, triggered mast cells, neutrophils, and macrophages. They activate and sensitize nearby TRP channels on nociceptors. Additionally, heat and pressure may directly activate the TRP channels. Recent analgesia research has concentrated on specific TRP channels, such as TRP ankyrin 1 (TRPA1), as potential therapeutic targets. This is due to their expression in glial cells, which are non-neuronal support cells that are present throughout the peripheral and central nervous system and are essential for the maintenance of chronic pain. This is due to their mediation of prolonged hypersensitivity.

In recent studies by (Liu and Kelliher 2022).had been found that the systemic amplification of the inflammatory response may also activate the sympathetic nervous system, resulting in the production of catecholamines such as noradrenaline. Activation of nociceptors by noradrenaline can establish a positive feedback loop. Nociceptor activation initiates the pain pathway. The inflammatory, neurological, and endocrine systems that are subsequently activated can amplify and alter the reaction through many complex biochemical changes. Early intervention in the local inflammatory response is essential to avoid peripheral sensitization. Simultaneous targeting of the inflammatory, neurological, and endocrine systems may be necessary for individuals with complex analgesic needs.

Active Ingredients of Lavender Essential Oils and Their Effects on TRP Receptors

In recent studies by (Batiha et al. 2023). aromatherapy practitioners make use of essential oils, which contain bioactive components that have the ability to selectively attach to certain sites inside the body, so exerting an influence on the physiological processes that occur. It is well known that lavender, also known as Lavandula sp., has medicinal benefits. The use of lavender has been shown to have a number of positive effects on the body's processes. Aromatherapy, the food industry, the cosmetics industry, and the perfume industry are all major consumers of lavender, in addition to the herbal medicine industry. Lavender has around one hundred different components, some of which include linalool, perillyl alcohol, linalyl acetate, camphor, limonene, tannin, triterpene, coumarin, cineole, and flavanoids. Essential oil, anthocyanins, ursolic acid, valeric acid,

phytosterols, sugars, coumaric acid, glycolic acid, minerals, herniarin, coumarin, and tannins are all components that may be found in lavender, also known as L. angustifolia. It is possible to find a variety of various macronutrients in lavender, depending on the variety.

TRP Ankyrin 1 (TRPA1) and TRP Vanilloid 1 (TRPV1) channels, non-selective cation channels are well-known as nociceptors in peripheral nerves and play important roles in transmitting pain signalling to the central nervous system (Hashimoto et al., 2023). The receptor most extensively examined in the context of nociception is the expansive family of transient receptor potential (TRP) channels, which consists of six distinct categories: TRP vanilloid (TRPV), ankyrin (TRPA), mucolipin (TRPML), polycystin (TRPP), canonical (TRPC), and melastatin (TRPM) (Di Maio et al. 2023). While TRPV1 and TRPA1 are considered to be the major receptors of this superfamily involved in nociception, in particular, TRPV1 and sensitized TRPA1 are activated by heat and cold, respectively, and as such are important for the detection of noxious temperature changes (Takayama et al. 2019).

(Takayama et al. 2019)also stated that TRPV1 is a well-known TRP channel that plays a part in pain. It is found in main sense neurons. TRPV1 activity is boosted when Protein Kinase A (PKA) and Protein Kinase C (PKC) phosphorylate A-kinase anchor protein in Dorsal Root Ganglion (DRG) neurons that are turned on by GPCRs. The P2X ionotropic ATP receptor may also change the activity of protein kinases that target TRP channels. This is shown by the fact that P2X3 and P2X2/3 receptors activate cytoplasmic PLA2 during neuropathic pain. In addition (Di Maio et al. 2023). explained TRPV1 receptors are present on C-fiber nociceptors and identify pain stimuli linked to harmful heat and the onset of heat hyperalgesia. TRPV1 receptors participate in the perception of harmful pinch stimuli. They are stimulated by capsaicin, camphor, allicin, low pH, and hypertonicity.

TRPA1 receptors are activated by calcium and are activated and sensitized by inflammatory factors (such as bradykinin) in dorsal root ganglion neurons (Di Maio et al. 2023).In recent studies by Takayama et al. (2019), Inflammatory substances, including bradykinin produced by tissue injury, activate and sensitize TRPA1 in dorsal root ganglion (DRG) neurons. The activation of TRPA1 leads to hyperalgesia during inflammatory processes. Protein kinase A (PKA) and phospholipase C play a crucial role in the sensitization of TRPA1 within this pathway. A comparable mechanism enhances pain perception through the activation of purinergic P2Y receptors present in dorsal root ganglion neurons. P2X receptors contribute to neuropathic pain through phospholipase A2 (PLA2) signalling, which activates protein kinase C (PKC) and sensitizes TRPA1.

(Girão et al. 2024)also explained that the mechanisms of action that essential oils have on pain and inflammation are complex and multidimensional, and they include interaction with a number of different body systems and pathways. Essential oils are able to affect the way in which pain signals are received and conveyed since they have the ability to influence both the central and peripheral nerve systems. There are a variety of receptors, channels, and neurotransmitters that fall under this category. Some of them include opioids, cannabinoids, TRP, sodium, potassium, calcium, glutamate, GABA, serotonin, and dopamine. Linalool has been shown to stimulate TRPA1 in certain cases. In both endogenously and heterogeneously produced channels, linalool nearly equally blocked TRPA1 activation brought on by AITC and carvacrol (Hashimoto et al. 2023).

Effects of Aromatherapy Lavender Essential Oils on Chronic Disease and Chronic Pain Management

Conventional medications can in certain cases have undesirable consequences in patients. As a consequence of these unfavourable consequences, patients could seek solace in alternative medical practices such as nonpharmacological exercise, mind and body treatment, acupuncture, massage therapy, and aromatherapy. Aromatherapy is one of the few holistic and traditional therapeutic therapies that has held up over the course of several centuries and continues to flourish in the present day. Aromatherapy is now acknowledged and utilized worldwide, extending beyond traditional and alternative medicine to encompass clinical and integrative healthcare environments.

Additionally, the case study by Jaelani (2017) over time, there has been a steady rise in the community's interest in aromatherapy, along with their acceptance and positive response to it. Aromatherapy is a gentle yet potent remedy that attracts a diverse range of folks. Aromatherapy is gaining popularity as individuals seek natural, non-invasive, and cost-effective alternatives or complements to conventional treatments. This medication is commonly utilized for stress relief, mood enhancement, pain management, and the promotion of overall well-being. Aromatherapy, despite its apparent simplicity, has some substantial advantages compared to other treatment techniques. When utilized appropriately, it is generally safe, exhibits little adverse effects, and may be simply administered at home through many techniques, including inhalation, topical application, or diffusion. Diffusion is regarded as the most efficient technique. Moreover, it aligns well with the increasing global focus on preventive and holistic health strategies, positioning it not just as a conventional remedy but also as an integral part of contemporary wellness initiatives that are both pertinent and adaptable.

Essential oils derived from lavender are one of the components that are most frequently utilized in aromatherapy. Lavender oil, an aromatherapeutic agent, is also increasingly used for this purpose due to its analgesic, anti-inflammatory, and anxiolytic effects (Yasa Ozturk et al., 2021). Lavender has a long history of medicinal usage and a vast number of uses. When it comes to pain relief and relaxation, lavender is the most popular unmixed essential oil. Long used as a traditional herbal therapy, it has been demonstrated to have anti-seizure, anti-depressant, anti-anxiety, sedative, and tranquilizing properties. It is also used to treat pain and tremors (Abbaszadeh et al., 2017).

While there are many other kinds of essential oils, lavender oil is particularly well-suited for usage in medical settings. The 39 species that make up the genus Lavandula in the Lamiaceae family include, among others, the most popular varieties grown in gardens, *Lavandula angustifolia* (lavender or true lavender), *L. latifolia Medik.* (spike lavender), *L. stoechas L.* (Spanish lavender), and *L. x intermedia Emeric ex Loisel.* (lavandin). The main components of lavender oils are the monoterpenoids linalool, linalyl acetate, 1,8-cineole, β-ocimene, terpinen-4-ol, and camphor. *Lavandula angustifolia Mill.* essential oil is one of the greatest and most sought-after lavender oils in the cosmetic and aromatherapy sectors because to its high linalool and linalyl acetate content and low camphor concentration. Perillyl alcohol and limonene, two monoterpenes found in lavender oil, are potent anti-cancer agents. Furthermore, the presence of phenolic chemicals like carvacrol, eugenol, and thymol in their composition gives them their well-known antibacterial qualities, and some terpenes can also help prevent cardiovascular illnesses. Because of its therapeutic uses and

capacity to enhance the quality of life and well-being of individuals who eat it, lavender is becoming more and more prominent in the medical area. It offers a good experience while encouraging health (de Melo Alves Silva et al. 2023).

According to (de Melo Alves Silva et al. 2023the practice of inhaling lavender oil is useful in alleviating pain, according to research. A study that was conducted not too long ago on animals shown that breathing lavender oil for a duration of one hour had powerful analgesic effects at concentrations that did not result in drowsiness. There is a possibility that inhaling lavender oil will not have a direct analgesic impact; nonetheless, it may encourage a more favourable appraisal and subsequently positive retrospective evaluation of treatment-related pain by the patient when reporting on pain relief associated with lavender aromatherapy. Inhalation is the first step in the aromatherapy action process, as the nasal membrane absorbs the molecules of essential oils. Olfactory molecules are converted into chemical signals, which then make their way to the olfactory bulb and other limbic system regions. These signals cause the brain to release a potent neurochemical into the bloodstream. Social, biological, and psychological ramifications result from this. By altering the activity of certain brain regions linked to pain, odour may reduce pain. Odour is a special kind of perception. The amygdala, a part of the limbic system, is linked to pain mechanisms. Pain alleviation may be linked to odor's entry into the limbic regions. The alteration of respiratory patterns brought on by stimulating fragrance is one of aromatherapy's additional analgesic benefits. Each inhale triggers the limbic olfactory areas and molecules carrying the scent to the receptors in the nose and throat. Stimulating the limbic system alters breathing patterns without conscious awareness. Tidal volume is increased and respiratory rate is decreased by pleasant smells. Thus, the slow, deep breathing patterns brought on by aromatherapy may serve as a pain-reduction strategy(Abbaszadeh et al. 2017).

Recently, lavender essential oil (LEO) has garnered significant interest as a holistic method for pain management, particularly in patients receiving treatment for chronic conditions like cancer. The analgesic, anti-inflammatory, and anxiolytic effects are primarily responsible for its widespread therapeutic application. These characteristics enhance the administration of pain in both physical and psychological realms. Numerous clinical and quasi-experimental research have investigated the efficacy of lavender essential oil in mitigating various forms of pain, yielding positive results that advocate for its incorporation into patient treatment.

A quasi-experimental investigation was implemented by (Yayla and Ozdemir 2019)demonstrated that there was a considerable reduction in the amount of discomfort experienced by individuals who were undergoing treatment for acute myeloid leukaemia (AML) when they inhaled lavender essential oil. Participants in this trial were required to inhale a concentration of two drops of LEO nightly for a period of three consecutive nights while they were undergoing chemotherapy. According to the findings, the level of discomfort was significantly lessened. that was self-reported, which suggests that even a brief exposure to lavender aromatherapy can be useful in treating pain that is associated with procedures and treatments in cancer patients. The inhalation of LEO most likely promoted a relaxing impact on the neurological system, which helped to diminish the patient's perception of pain and enhanced the patient's sensation of comfort throughout a treatment procedure that was quite upsetting.

Despite the promising outcomes observed in several studies, it is important to note that the effectiveness of lavender essential oil for pain relief may be different based on how it is applied, how often it is used, how much is taken, and how each patient reacts. As an example, a research by (Yayla and Ozdemir 2019)examined the effects of a back massage that lasted for thirty minutes and contained one percent lavender essential oil. The massage was given to cancer patients who were receiving palliative care once a week for a period of four weeks. It was not anticipated that this intervention would have a statistically substantial influence on the stage of pain experienced by the participants. This gap may be the result of variables such as inadequate dose, infrequent use, or the late stage of illness development in the group that was studied, all of which have the potential to impair the body's response to supplementary therapies.

The available research suggests that lavender essential oil has the ability to be a useful pain treatment added on management in clinical settings that does not need any intrusive procedures and is also cost-efficient. It has been demonstrated that inhalation, in particular, is capable of providing prompt and effective relief from acute and chronic pain that is associated with medical treatments, surgical operations, and persistent illnesses. It appears that the components of lavender, including as linalool and linalyl acetate, play a key role in mediating these effects through neural pathways that influence the experience of pain, the reaction to stress, and the regulation of emotions. Therefore, it is vital to do further study in order to create standardized processes for suitable concentration, frequency, and administration modalities. This will ensure that the findings obtained from the various patient groups are reliable and consistent.

Among the key references, (Girão et al. 2024) essential oils are beneficial for a variety of pain and inflammation conditions, including nociceptive, neuropathic, acute, and chronic pain, due to their numerous biological activities and therapeutic qualities. The transmission of pain signals, inflammatory reactions, and hormonal equilibrium is influenced by their capacity to modify the immunological, endocrine, and neurological systems. Essential oils offer both short-term and long-term treatment, as well as the ability to enhance mood, increase sleep, and reduce inflammation. The variety of application techniques, such as inhalation, topical usage, massage, bath, and compress, enables customization to be achieved in accordance with the user's desires and conditions.

Lavender essential oils serve a significant function as a supplementary therapy for chronic illnesses. Lavandula angustifolia, or real lavender, is a therapeutic plant that occupies a significant role in traditional herbal therapies in several countries, including Northern Jordan. This region is well farmed and esteemed for its medicinal and cosmetic uses. Among its several pharmaceutical applications, a particularly significant one is its function in the conventional treatment of type 2 diabetes mellitus (T2DM), a persistent metabolic condition marked by insulin resistance, hyperglycaemia, and dyslipidaemia Lavender has been historically utilized in Jordanian herbal medicine for millennia as a natural cure to regulate blood sugar levels, enhance lipid metabolism, and promote overall metabolic health.

The medicinal value of lavender essential oil (LEO) and botanical preparations in the control of diabetes is now being researched via scientific study. This research is validating traditional knowledge with empirical facts. LEO is made up of a wide variety of bioactive components,

including as linalool, linalyl acetate, flavonoids, and terpenes, all of which have the ability to reduce fat levels, as well as antioxidant and anti-inflammatory properties. In particular, the alleviation of oxidative stress and the regulation of important metabolic enzymes related with glucose and lipid metabolism are expected to be enhanced by these components, which are thought to increase the potential anti-diabetic benefits of lavender.

A key study by (Batiha et al. 2023) explored the effects of methanol extracts from Lavandula angustifolia on diabetic dyslipidemia, a common complication of type 2 diabetes. The study demonstrated that lavender extract significantly reduced the activity of two important enzymes involved in fat metabolism: hormone-sensitive lipase (HSL) and pancreatic lipase (PL). HSL plays a crucial role in breaking down stored triglycerides in adipose tissues, while PL is responsible for digesting dietary fats in the gastrointestinal tract. By inhibiting these enzymes, lavender may help regulate lipid levels in the body, a critical factor in managing diabetes-related complications such as cardiovascular disease and obesity. Interestingly, the inhibitory pattern observed with lavender extract was comparable to that of orlistat, a clinically approved anti-obesity drug that reduces fat absorption by inhibiting pancreatic lipase. This finding suggests that lavender may offer a natural alternative or adjunct therapy in the dietary management of diabetes and obesity. While orlistat is associated with gastrointestinal side effects, lavender's gentle profile and traditional use may offer a more tolerable and holistic option, especially when integrated into a lifestyle-oriented treatment plan.

Besides enzyme inhibition, the antioxidant properties of lavender essential oil may also play a role in its efficacy for diabetes treatment. Oxidative stress is a recognized factor in insulin resistance and beta-cell impairment in diabetes individuals. The substantial antioxidant activity of lavender oil can counteract free radicals, diminish inflammation, and safeguard pancreatic cells from oxidative harm. This activity aids in regulating blood glucose levels and enhances overall metabolic resistance. Furthermore, initial animal research and in vitro investigations indicate that lavender extract may promote insulin sensitivity, facilitate glucose absorption by cells, and diminish hyperglycaemia. These first data indicate a multifaceted therapeutic potential of LEO in diabetic management. In addition to alleviating physical symptoms, the soothing and anxiolytic properties of lavender significantly contribute to diabetes management, as psychological stress is recognized as a component that might exacerbate glycaemic control.

Future study should investigate the comparative efficacy of LEO in conjunction with conventional diabetes drugs and dietary treatments. In conclusion, Lavandula angustifolia, particularly in its essential oil or extract form, may function as a beneficial supplementary therapy for the management of type 2 diabetes. This plant is important in phytomedicine for its capacity to inhibit critical metabolic enzymes, reduce oxidative stress, enhance lipid profiles, and maybe aid in glycaemic management. These features make it possibly beneficial. The therapeutic importance of lavender in diabetes management may gain wider acknowledgment due to the growing global interest in natural and integrative healthcare, particularly in areas with strong traditional herbal traditions.

Aside from that, lavender essential oil, which is derived from the plant *Lavandula angustifolia*, has garnered a significant amount of interest in the field of complementary and alternative medicine

due to the extensive spectrum of therapeutic capabilities it possesses, notably in the treatment of hypertension. It is a big worry for the health of people all over the world as high blood pressure, also known as hypertension, is frequently associated with stress, unhealthy lifestyle behaviours, and underlying cardiovascular disorders. The use of lavender aromatherapy has emerged as a viable intervention due to its vasorelaxant, anxiolytic, and hypotensive effects. This is due to the fact that the desire for natural and non-pharmacological therapeutic choices is increasing.

Inhalation therapy is a popular and highly effective way to provide lavender essential oil. Inhaled lavender oil stimulates the olfactory system, which in turn has direct neural connections to the limbic system—a complex region of the brain involved in emotion, memory, hormone regulation, and autonomic nervous system functions—through its volatile aromatic compounds, particularly linalool and linalyl acetate. A number of vital physiological variables, including pulse, respiration rate, and blood pressure, are under the control of the hypothalamus and amygdala, which are parts of the limbic system. Rapid relaxation, reduced tension, and decreased sympathetic nervous system activity (resulting in lower blood pressure and heart rate) can be achieved by inhalation of lavender oil.

The aroma of lavender has been shown to generate substantial decreases in systolic and diastolic blood pressure in both healthy persons and patients with hypertension when they are exposed to it for a short period of time, even if it is just for ten to twenty minutes. These effects can be attributed, in large part, to the sedative and parasympathetic-activating qualities that linalool and linalyl acetate possess. In addition to inhalation, topical application is another excellent approach for getting lavender essential oil into the body. Inhalation is the most important method. After being applied to the skin, the active molecules in lavender oil are able to work their way through the epidermal layers and the mucous membranes, eventually making their way into the bloodstream through the dermal capillaries. Because of this systemic absorption, the therapeutic chemicals are able to reach the vascular tissues and immediately begin to exert their vasodilatory effects on the blood vessels. The process of vasodilation causes the blood arteries to expand, which in turn reduces peripheral resistance and improves blood flow, which ultimately leads to a reduction in blood pressure. The use of lavender oil to the skin, particularly when paired with massage, has the potential to improve circulation, relax the muscles, and bring comfort on both a physiological and psychological level.

Clinical studies have supported the effectiveness of lavender essential oil massage therapy for hypertensive patients. For example, lavender oil used in a carrier oil and applied through gentle massage has shown to produce calming effects, significantly decreasing both blood pressure and heart rate in hypertensive individuals. The combination of mechanical stimulation through massage and the chemical influence of the oil itself creates a synergistic therapeutic effect.

The mechanism of action underlying lavender's blood pressure-lowering capabilities is multifaceted. Linalool and linalyl acetate are key anti-hypertensive agents that not only promote vasodilation but also reduce cortisol levels, decrease oxidative stress, and inhibit the sympathetic nervous response that contributes to elevated blood pressure. By targeting both the nervous system and the vascular system, lavender essential oil offers a holistic and integrative approach to managing hypertension.

In addition, lavender aromatherapy is widely regarded as safe, non-invasive, and cost-effective, which makes it affordable and accessible for long-term usage either in clinical settings or at home. Patients, particularly those who may be resistant or sensitive to traditional medicine, are more likely to comply with their treatment regimens when they are used because of their lovely aroma and relaxing effects.

The therapeutic application of lavender for these purposes is not a novel occurrence; it has been utilized in traditional medicine for centuries. Public interest and positive evaluations of this straightforward yet effective method have significantly increased over time. Despite its simplicity, lavender aromatherapy has several benefits compared to conventional treatments: it is cost-effective, non-invasive, often safe for a diverse population, and enjoyable to utilize. These attributes provide it an appealing choice for individuals pursuing natural alternatives or adjunctive treatment options.

Empirical data supports the efficacy of lavender essential oil in the management of hypertension. Numerous research have examined the physiological reactions associated with lavender inhalation, and findings typically demonstrate enhancements in stress levels, heart rate variability, and blood pressure. Clinical investigations indicate that regular use of lavender aromatherapy effectively reduces both systolic and diastolic blood pressure, particularly when integrated with additional relaxation techniques such as deep breathing or massage treatment. A study by (Rahmadhani 2022) found a considerable reduction in average systolic blood pressure from 147.63 mmHg to 135.25 mmHg, while diastolic pressure decreased from 93.19 mmHg to 83.00 mmHg following the use of lavender aromatherapy. These results underscore the potential of lavender essential oil as an effective complementary treatment for chronic illnesses specifically hypertension.

In conclusion, lavender essential oil serves as a potent natural supplement for hypertension treatment, with both inhalation and topical applications demonstrating efficacy. Its capacity to stimulate parasympathetic nervous system responses, facilitate vasodilation, and alleviate psychological stress renders it particularly effective in managing both the physiological and emotional aspects of hypertension. With the accumulation of clinical data, lavender oil may become a vital element in integrative treatment strategies designed to enhance cardiovascular health and improve the quality of life for hypertensive individuals.

Study of Emotional Influence and Patient Relaxation

Besides its little toxicity risk, lavender essential oil (LEO) is well acknowledged for its many medicinal characteristics, including sedative, depressive, antibacterial, antifungal, calming, and antiemetic actions. The diverse advantages render lavender one of the most esteemed essential oils in alternative and integrative medicine. Its esteemed record for safety and efficacy has facilitated its increasing utilization across several healthcare domains, including palliative care, pain treatment, mental health support, and wellness initiatives. The mechanisms of action of lavender essential oil have been a primary focus for researchers seeking to formulate holistic approaches to enhance the health of the patients on a physical, mental, and spiritual level.

Lavender's widespread appeal in the health and wellness field is attributed to its ability to induce a positive sensory experience, enhance quality of life, and promote relaxation and healing. Healthcare professionals are increasingly incorporating lavender essential oil into care plans for patients with chronic illnesses, recognizing its potential to alleviate stress, reduce anxiety, improve sleep, and relieve pain. The use of LEO through aromatherapy provides an accessible, non-invasive intervention that aligns with patient-centered care approaches. It contributes not only to physical symptom management but also to emotional and psychological comfort, thereby enhancing overall patient satisfaction and well-being.

Additionally, the case study by (Di Maio et al. 2023)a crucial element of lavender's medicinal effect is its interaction with the olfactory system. The volatile characteristics of lavender essential oil allow its aromatic molecules to be readily absorbed, swiftly reaching the olfactory receptor cells in the nasal cavity. These cells provide biological signals to the brain, particularly to the limbic system and hypothalamus—areas accountable for the regulation of emotions, memory, autonomic functions, and hormone activity. This cerebral stimulation results in the release of neurotransmitters, including serotonin and gamma-aminobutyric acid (GABA), which influence the parasympathetic nervous system. This reaction induces a physiological state of relaxation, reduced heart rate, decreased cortisol levels, and enhanced mood.

Lavender essential oil owes much of its therapeutic potential to its bioactive components, particularly linalool and linalyl acetate, which are its primary chemical constituents. These compounds exhibit a range of pharmacological properties, including sedative, anxiolytic, analgesic, and anti-inflammatory effects. Linalool and linalyl acetate have been shown to inhibit the release of acetylcholine, a neurotransmitter involved in stimulating the central nervous system, thereby producing a calming and muscle-relaxing effect. Their ability to stimulate parasympathetic nervous system activity contributes to improved mood states, greater emotional balance, and enhanced feelings of vitality, mental clarity, and relaxation (Algristian et al. 2022).

Scientific studies have demonstrated that these compounds exert their peak effect within seven minutes of inhalation, with rapid absorption through the respiratory tract into the bloodstream. When applied topically, both linalool and linalyl acetate can be detected in the blood within five minutes, and they are typically metabolized and eliminated from the body within approximately ninety minutes. This swift onset and elimination profile make lavender a suitable option for managing acute symptoms such as anxiety spikes or sudden pain flare-ups, while also offering cumulative benefits when used consistently over time.

Additionally, lavender contains ketones, which contribute to its anti-inflammatory and analgesic effects. These ketones help reduce muscular and joint soreness and may support tissue recovery in inflammatory conditions. They also enhance sleep quality by promoting deeper, uninterrupted rest, which is particularly beneficial for individuals with chronic illnesses who often experience sleep disturbances due to pain or emotional stress (Abbaszadeh et al. 2017). The combined action of ketones, linalool, and linalyl acetate results in a synergistic effect that targets multiple pathways involved in stress regulation, pain perception, and emotional health. Taken together, the biochemical and physiological actions of lavender essential oil support its use as a holistic adjunct to conventional therapies. By offering a natural, low-risk option to alleviate discomfort and

enhance emotional resilience, lavender essential oil continues to gain traction in clinical practice as part of a broader, integrative approach to chronic disease management and overall well-being.

CONCLUSION

This study focuses on the benefits of lavender essential oil for people who suffer from chronic pain. Several studies have found that inhaling lavender oil can have analgesic effects, indicating that it may help with pain management. Beyond its attractive perfume, lavender has been demonstrated to reduce respiratory rates while increasing tidal volume, fostering a sense of calm. This physiological reaction promotes deep, leisurely breathing, which is often associated with lower stress and increased parasympathetic nervous system activity. As a result, aromatherapy, particularly with lavender essential oil, may be used not just to relieve pain but also as a comprehensive way to promote general well-being by promoting both physical and mental relaxation.

In practical applications, lavender essential oil aromatherapy serves as a promising complementary therapy that healthcare providers can integrate into pain management strategies for patients with chronic conditions. Its calming properties and potential analgesic effects make it a valuable, non-invasive option to support traditional medical treatments. Incorporating aromatherapy into clinical practice may not only assist in alleviating physical discomfort but also enhance emotional well-being, reduce anxiety, and promote relaxation factors that are especially important for individuals coping with long-term illnesses. To maximise therapeutic benefits, it is essential to tailor the method of application to suit every individual needs, choices, and medical circumstances. Personalised approaches such as inhalation through diffusers, the application of topical substances utilizing carrier oils, or incorporation into massage therapy can significantly enhance patient comfort and engagement. Healthcare professionals should assess elements including the intensity of manifestations, sensory sensitivities, and lifestyle habits when determining the most suitable method of delivery. Furthermore, patient education and informed consent are crucial to ensure safety, especially for individuals with allergies, respiratory conditions, or sensitivities to essential oils. With thoughtful integration, lavender essential oil aromatherapy can contribute meaningfully to holistic, patient-centred care and improve overall quality of life in chronic disease management.

In research practice, it is essential to conduct more comprehensive and methodologically rigorous clinical trials to fully evaluate the long-term effects of lavender aromatherapy on chronic pain management and overall quality of life. While existing although many research are constrained by small sample numbers, many indicate encouraging results, short intervention periods, or narrow participant demographics. To establish the efficacy and reliability of lavender aromatherapy as a complementary treatment, future research should include longitudinal studies that monitor outcomes over extended periods, allowing for the assessment of sustained therapeutic effects, potential side effects, and the development of tolerance or sensitivity to essential oils.

Furthermore, a broader range of chronic conditions should be examined beyond the commonly studied cases, such as fibromyalgia or arthritis. Investigating its impact on pain associated with neurological disorders, cancer, autoimmune diseases, and post-surgical recovery could provide

more comprehensive insight into its clinical utility. It is also critical to include diverse participant populations in terms of age, gender, socioeconomic status, and cultural background. Cultural perceptions of scent, as well as physiological and psychological responses to aromatherapy, may vary widely and influence the effectiveness of treatment. By incorporating a wide spectrum of demographics and health conditions, future studies will be better equipped to generalise findings and support the integration of lavender aromatherapy into a wide range of healthcare settings. This evidence base will be instrumental in guiding clinical guidelines, informing policy, and promoting the integrative and traditional medical fields can benefit from aromatherapy safely.

Despite the promising potential of lavender essential oil in pain management, this study acknowledges several limitations that must be addressed in future research. One of the primary challenges lies in the methodological heterogeneity across existing studies. Variations in study design, sample size, intervention duration, and participant characteristics hinder the ability to draw consistent and generalisable conclusions. In addition, inconsistencies in the composition and quality of lavender essential oil used in different trials further complicate the interpretation of results. Essential oil formulations may vary significantly depending on factors such as plant species, cultivation conditions, extraction methods, and storage practices—all of which can influence the concentration of active compounds and, consequently, the therapeutic outcomes.

To improve the quality and applicability of future research, it is crucial to establish standardised protocols and guidelines for essential oil use in clinical settings. This includes defining dosage parameters, identifying suitable delivery methods for different patient populations, and assessing long-term safety and efficacy. Addressing these limitations through well-designed, controlled studies will help build a more robust evidence base and support the integration of aromatherapy into evidence-based pain management strategies.

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