

# The effects of aromatherapy on depression and anxiety in different contexts: A literature review

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In this literature review, I wish to investigate aromatherapy and its effect on depression and anxiety in different contexts. Aromatherapy exists as a form of alternative medicine that seeks to alleviate pain and improve an individual's quality of life using essential oils. As anxiety and depression diagnoses increase drastically, it is crucial to understand the possible treatments that are most cost effective, accessible, and minimally invasive to improve the mental health of different populations. Varying essential oils deliver different effects, however, all ultimately reach the brain through the olfactory system which affects memory and emotion. Aromatherapy is unique because of the potential power that scent can have in reducing anxiety levels and improving depression in diverse populations across the globe.

## Introduction

Depression is the leading cause of disability worldwide. 1 in 13 people globally suffer from anxiety according to the World Health Organization<sup>1</sup>. Depression is frequently associated with stress and refers to “negative emotions” as presented by an imbalance of vital neurotransmitters including dopamine, serotonin, and norepinephrine<sup>2</sup>. Increased depression and anxiety diagnoses have drastically altered the view of mental health in modern day society, contributing to the current mental health crisis. According to the Centers for Disease Control and Prevention (2022), depression affects about 16 million American adults every year and anxiety disorders often go hand in hand with depression<sup>3</sup>. Therefore, defining a simple and minimally invasive treatment plan for this growing population of patients is key. Traditional methods of treating depression and anxiety continue to dominate the medical field. For decades, psychologists, psychiatrists, therapists, nurses, and physicians accustomed themselves to treating mental illnesses the same way by prescribing antidepressants such as SSRIs or using cognitive therapy. Aromatherapy includes a form of complementary medicine that takes a non-pharmacological approach to improving human's overall health and wellness. Aromatherapy has evolved for over five thousand years; however, the term “aromatherapy” was first invented by the French chemist, René Maurice Gattefossé, in 1937. After Gattefossé burned his hands during an experiment he conducted, he decided to treat his wound by submerging his hands in lavender essential oil<sup>4</sup>. As a result of his pain relief, Gattefossé was fascinated by the rapid and pain-free healing process of his wound and therefore dedicated his work to discovering the world of essential oils and aromather-

apy. Before Gattefossé named this practice, Hippocrates, “father of medicine”, advocated the use of aromatherapy because he believed that aromatic baths and scented massage were crucial to maintaining adequate health<sup>5</sup>. Despite these well-founded claims, understanding the psychological process between scent and emotion is key in evaluating the effectiveness of its use. Olfaction is a prehistoric sense for humans and animals and the sense of smell is essential in the direction of human behavior<sup>6</sup>. Inhaling an aromatic triggers a response that begins in the nasal cavity and ends in the limbic system. The biological process begins with the scent molecule entering the nose and passing through the nasal cavity. The scent stimulus transmits to the hippocampus through the olfactory nerve system where the amygdala produces a strong response to the scent initially inhaled. Fragrance is a volatile chemical component with a molecular weight of  $<300$  Da that humans perceive via the olfactory system<sup>6</sup>. When a fragrant molecule in the air binds to the cilia of olfactory receptors in the nasal cavity, the guanine nucleotide binding protein linked receptors are activated, and electrical signals are produced. Olfactory sensory neurons use the olfactory bulb to send these electrical signals to the brain. These electrical signals regulate a variety of mental processes, such as memory, cognition, and emotion. The process of the inhalation of essential oils can communicate signals to the olfactory system and stimulate the brain to exert neurotransmitters to regulate mood and behavior. The complexity of the neurological process proves how particular scents are linked to memory and emotion because odors are said to influence mood, evoke powerful experiences of pleasure or displeasure, produce alertness or relaxation, and evoke long forgotten emotional memories<sup>7</sup>. As a result, the olfactory system has even been dubbed “our most emotional sense”

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according to Ehrlichman and Bastone (1992). This literature review will focus on autoimmune diseases such as diabetes and dementia as well as chronic illnesses such as coronary artery disease, cancer, and chronic kidney disease to evaluate the effectiveness of aromatherapy across varying populations. Different studies were chosen based on patient population size and the availability of studies based on each clinical population. Studies were also chosen that use a variety of essential oils to determine which essential oils are the most effective in reducing anxiety and depressive symptoms. Lavender is the most common stress relieving essential oil which will be tested throughout multiple studies. Other essential oils such as tea tree oil, lemon balm essential oil, rose essential oil, and orange essential oil were also used throughout numerous studies. The objective is to evaluate the effectiveness of using aromatherapy to help patients experience less stress and minimize depression to promote a healthy life.

## Clinical Population Contexts

### *Coronary Artery Disease*

Coronary artery disease (CAD) is the most common cardiovascular system disease because of its high mortality and morbidity rate<sup>8</sup>. According to the American Heart Association (2022), chronic stress can cause heart trouble and heart disease if left untreated<sup>9</sup>. The study conducted by Karadag and his colleagues used a total of 60 patients where about 67% were male and about 33% were female. Of these about 32% of the patients had sleep problems. The study emphasizes how many patients with CAD in the ICU experience trouble sleeping due to the differing circumstances they are in while at the hospital from light exposure to fear of death<sup>10</sup>. In consonance with this study, lavender essential oil is commonly used in aromatherapy because of its impact on the amygdala producing relaxing, sedative effects and carminative qualities. Because of this, lavender essential oil is said to improve sleep quality and decrease stress levels. This study used the PSQI (Pittsburgh Sleep Quality Index) and the BAI (Beck Anxiety Inventory) questionnaires to measure the levels of patients' anxiety and sleep quality. As a result, patients' PSQI score rose from 2.962 - 4.850 indicating that patients' sleep quality significantly improved after inhaling lavender essential oil. The BAI mean scores of CAD patients in the ICU decreased from 0.006 - 0.001 demonstrating that their anxiety levels decreased after inhaling lavender essential oils. No significant decreases in the control group were noted. Overall, this study was conducted over a period of 15 days and the two questionnaires were completed once before and after the experiment. The statistical differences from patients before and after using aromatherapy demonstrate how this complementary form of medicine may act as a notable alternative to aid stress in pa-

tients with severe heart diseases such as coronary artery disease. Not only was aromatherapy accessible for these patients to use, but it also did not affect any medications the patients were taking and did not interfere with their normal treatments. Secondly, a study conducted by Mi. Y. Cho and E. S. Min (2017) sought to analyze aromatherapy's impact on patients diagnosed with coronary artery disease who underwent a stent insertion during coronary angiography and were admitted to the cardiovascular ICU. Many of these patients experience a reasonably high level of psychological discomfort due to the sensation of loss of identity brought on by the environment's focus on therapy and the environment's frequent change<sup>11</sup>. The study was designed to assess the effect of lavender, roman chamomile, and a neroli oil blend on anxiety, sleep, and blood pressure. The study lasted approximately 3 months and included 28 subjects in the aromatherapy group and 28 subjects in the control group. In the aromatherapy group, the method of application was the inhalation of essential oils that were dropped on aroma stones. The anxiety of patients was measured using the Spielberger's State-Trait Anxiety Inventory-form Korean. After treatment, the anxiety levels were 0.36 (SD, 0.73) in the aromatherapy group and 3<sup>10</sup>. (SD, 2.31) in the control group. The changes in anxiety level were 5<sup>11</sup>, (SD, 2.06) in the aromatherapy group and 2.07 (SD, 2.55) in the control group. These findings demonstrate how the stress and anxiety levels of patients in the aromatherapy group notably decreased. Next, one of the reducing agents for cardiovascular diseases is implementing an important technique known as coronary catheterization and angiography. Coronary angiography is an invasive investigation and is used in diagnosis of known or suspected coronary artery disease. Most hospitalized patients have some degree of anxiety, the most common of which is anxiety before coronary angiography. Tahmasebi and his colleagues conducted a clinical trial study. The sample size included 91 randomly selected patients who experienced coronary angiography for the first time and were hospitalized. The study population was divided into 46 patients in the control group and 45 patients in the experimental group. The anxiety levels of the population were measured through a demographic data questionnaire and the Spielberger State-Trait Anxiety Inventory questionnaire. After the experimental group inhaled lavender essential oil, data indicated that the covert (common feelings of individual at most cases) and overt (feeling of the individual at that specific moment) anxiety levels before coronary angiography portrayed that the covert anxiety level before the intervention in the control group was 0.50% and in the experimental group was 48.89%<sup>12</sup>. The overt anxiety levels before the intervention in the control group was 84.8% and in the experimental group was 84.44%. After the intervention was completed, data indicated that the level of covert anxiety in the control group was 45.65% and in the experimental group was zero. In compari-

**Table 1** Summary of Literature

	Authors	Sample Size	Method	Oil(s) Used	Population	Key Findings
1	Ezgi Karadag, Sevgin Samancioglu, Dilek Ozden, Ercan Bakir	60 patients	- Both groups in the study were administered the PSQI and BAI scale - Delivery method: via inhalation	2% Lavender Essential Oil	Coronary Artery Disease Patients	The experimental group experienced a reduction of anxiety levels after intervention ( $p < 0.05$ )
2	Mi-Yeon Cho, Eun Sil Min, Myung-Haeng Hur, Myeong Soo Lee	56 patients	- State and trait anxiety were assessed using the STAI-KYZ - Delivery method: via inhalation	Blend of lavender ( <i>Lavandula officinalis</i> ), roman chamomile ( <i>Chamomile roman</i> ), and neroli ( <i>Citrus aurantium</i> ) at a ratio of 6: 2: 0.5	Coronary Artery Disease Patients	Significant statistical anxiety reduction in the aromatherapy group ( $t = -4.90, P < .001$ )
3	Homyra Tahmasebi, Ghahraman Mahmoodi, Vahid Mokhberi, Soghra Hassani, Homeyra Akbarzadeh, Niloofar Rahnamai	96 patients	- Demographic data and the Spielberger state-trait anxiety inventory (STAI) - Delivery method: via inhalation	Lavender essential oil ( <i>lavandula spica L</i> )	Coronary Artery Disease Patients	Anxiety levels decreased significantly in the experimental group compared to the control group ( $P < 0.0001$ )
4	Fatemeh Fazlollahpour-Rokni, Seyed Afshin Shorofi, Nouraddin Mousavinasa, Rahman Ghafari, Ravanbakhsh Esmacili	65 patients	- Spielberger's Anxiety Inventory - Delivery method: via inhalation	4% Rose essential oil	Coronary Artery Disease Patients	No notable difference between the experimental and control group; anxiety levels did decrease
5	Mozhgan Rivaz, Monireh Rahpeima, Zahra Khademian, Mohammad Hossein Dabbaghmanesh	75 patients	- The Visual Analog Scale (VAS) and Quality of Life Questionnaire -Delivery method: via massage	3% Lavender essential oil	Diabetes Patients	Patients exposed to lavender essential oil experienced a decrease in stress and increase in quality of life ( $p < 0.001$ )
6	Ali sharifi, Minoo Motaghi, Milad	60 patients	- Spielberger State-Trait	2 drops of orange essential	Diabetes Patients	Anxiety of patients significantly decreased

	Borji and Mohsen Moradi		Anxiety Inventory and the Revised Children's Manifest Anxiety Scale - Delivery method: via inhalation	oil		in the experimental group compared to the control group ( $P < .05$ )
7	Tingting Liu, Hui Cheng, Li Tian, Yueyue Zhang, Shaotong Wang, Lu Lin	1724 patients (meta-analysis)	- The meta-analysis followed the preferred reporting items for systematic reviews and meta-analysis (PRISM) guidelines - Delivery method: via inhalation and massage	- Lavender, geranium, chamomile, bergamot and rose essential oil	Cancer Patients	Aromatherapy appeared to be effective for anxiety [SMD = -0.51, 95%CI (-0.83, -0.19), $P = 0.002$ ] and depression [SMD = -0.44, 95%CI (-0.76, -0.12), $P = 0.008$ ]
8	Dan Li1 Yuxin Li1 Xue Bai, Meijuan Wang, Jingzheng Yan Yingjuan Cao	17 studies included in the meta-analysis	-The meta-analysis followed the preferred reporting items for systematic reviews and meta-analysis (PRISM) guidelines - Delivery method: via inhalation and massage	The most used essential oil is lavender	Cancer Patients	Aromatherapy positively affected anxiety in patients (SMD = 0.49, $p < 0.05$ ) however, did not cause a change in depression symptoms
9	Clive G. Ballard, John T. O'Brien, Katharina Reichelt, Elaine K. Perry	71 patients	- The Cohen-Mansfield Agitation Inventory (CMAI) and Quality of Life Indices - Delivery Method: via massage	Lemon balm essential oil	Dementia Patients	Agitation levels in the intervention group slightly decreased
10	Tatiana-Danai Dimitriou, Eleni Verykouki, John Papatriantafyllou,	60 patients	- MMSE, ACE-R, GDS, FRSSD and NPI Delivery	Not specified	Dementia Patients	Although aromatherapy reduced the distress of patients, there are other better alternatives such

	Anastasia Konsta, Dimitrios Kazis, Magda Tsolaki		method: via massage			as Musical Therapy for dementia patients
11	Salehodoin Bouya, Sudabeh Ahmadidarehsima, Mahin Badakhsh, Abbas Balouchi, Maryam koochakzai	1087 patients (meta-analysis)	- The Jadad scale - Delivery method: via inhalation	- The two most used essential oils were lavender and tea tree oil	Chronic Kidney Disease Patients	- Improved quality of life and depression after inhaling essential oils
12	Masoumeh Bagheri-Nesami, Seyed Afshin Shorofi, Attieh Nikkhah, Fatemeh Espahbodi	72 patients	- The rANOVA - Delivery method: via inhalation	- 3 drops of lavender essential oil 5%	Chronic Kidney Disease Patients	- The severity of patient's depression decreased after receiving the intervention (p = 0.005)

son, the overt anxiety levels in the control group after intervention was 84.78% and in the experimental group was 53.33%. Therefore, the following results evince aromatherapy to act as a method to help reduce patient's anxiety before conducting diagnostic and invasive procedures, such as coronary angiography. Lastly, coronary artery bypass graft (CABG) is one of the most commonly used surgical procedures for patients with coronary artery stenosis. Cardiac surgery is often associated with anxiety in patients undergoing the procedure. Anxiety before cardiac surgery is detrimental because it can lead to significant changes in the patient's heart rate and blood pressure, and it may have deleterious effects on the patient's recovery process and prolong hospitalization time<sup>13</sup>. The study conducted by Fazlollahpour-Rokni and colleagues (2019) was a single-blind randomized clinical trial of 66 patients undergoing CABG surgery, with 33 patients in the control group and 32 patients in the experimental group. The experimental group inhaled three drops of 4% rose essential oil for 10 minutes one night and one hour before surgery, while the control group did not receive any intervention. Anxiety levels were measured before and 30 minutes after the intervention using Spielberger's Anxiety Inventory. An independent t-test prior to surgery revealed that there was no discernible difference between the experimental and control groups in terms of the mean anxiety score ( $p = 0.41$ )<sup>14</sup>. State anxiety, trait anxiety, and overall anxiety were not significantly affected by aromatherapy with rose essential oil ( $P = 0.41, 0.90, \text{ and } 0.69$ , respectively). Such results suggest that rose essential oil did not

notably decrease patient's anxiety in CABG patients. Overall, the four different studies yielded comparable results for patients diagnosed with coronary artery disease. The first three studies used lavender essential oil and all three of these studies noted a significant improvement of the patient's stress levels. However, the last study conducted by Fazlollahpour-Rokni et al. using rose essential oil did not improve stress levels. From this data, results suggest that lavender essential oil is an eminent essential oil to help decrease anxiety levels in patients with coronary artery disease.

### Diabetes

According to Rivaz and his colleagues' study (2021), diabetes mellitus exists as a dormant epidemic affecting the health of millions across the globe. It is said that by 2045, the number of diabetics will increase to 629 million from a global prevalence of 425 million in 2017<sup>15</sup>. Diabetic peripheral neuropathy (DPN) which is found in about 10% of patients with diabetes, experience microvascular complications. Neuropathic pain has been examined to lead to the most debilitating neuropathy symptoms where about 11-21% of diabetics suffer from painful diabetic polyneuropathy. This, in turn causes poor quality of life, decreased physical activity, depression, anxiety, and sleep disturbances in diabetics. This study examines how aromatherapy may benefit diabetic patients by using lavender essential oil which facilitates anti-inflammatory and anti-anxiety features. Lavender essential oil also contains linalool

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and linalyl acetate which have high absorption factors into the bloodstream and the best use of aromatherapy for diabetic patients is through massage<sup>15</sup>. To examine the effect of aromatherapy on this clinical population, 75 diabetic neuropathic patients were divided into three groups where patients in the intervention group were exposed to 3% lavender essential oil on their feet every night for a month. The Visual Analog Scale (VAS) and Quality of Life Questionnaire were used to measure patients' mental health and quality of life. As a result of this experiment, diabetic patients exposed to the lavender essential oil experienced a consequential increase in quality-of-life domains after two to four weeks ( $p < 0.001$ ). From this information alone, a warranted conclusion suggests that aromatherapy can benefit patients with diabetes who experience DPN. Patients with diabetes experience complications that can negatively affect quality of life including psychological stress and anxiety which are major causes of depression in this patient population<sup>16</sup>. Benzodiazepine is one prescribable medication that can reduce anxiety; however, side effects include nausea, vomiting, and drug dependency. In Sharifi and his teammates' study, they aimed to determine the effect of orange essence aromatherapy on anxiety in school-age children with type 1 diabetes ages 6 through 12 years old. The clinical trial enrolled 60 children with diabetes, 30 in the control group and 30 in the experimental group. Children in the experimental group were instructed to inhale deeply for two minutes while smelling two drops of orange essence which took place three times a week before bed for two weeks. Those in the control group merely received standard diabetic care. Data was collected using the Spielberger State-Trait Anxiety Inventory and the Revised Children's Manifest Anxiety Scale. After the therapeutic intervention, anxiety in the experimental group significantly decreased compared to that before the intervention ( $P < .05$ ). Data indicates that the mean physiological anxiety before the study in the experimental group measured 6.10 (2.36), whereas after the study it measured 5.10 (3.56). Therefore, based on the presented study's findings alone, aromatherapy may act as a beneficial form of therapy for decreasing anxiety in school-age diabetic children.

### **Cancer**

Cancer is a life-threatening disease that affects many across the globe. Cancer patients experience issues with psychological and mental wellbeing because of their disease and treatment which can lead to low quality of life, fear of death, and impaired interpersonal relationships causing the feeling of loss of self-control, anxiety, depression, and sleep disturbances<sup>17</sup>. According to Liu and colleagues, 70% of cancer patients exhibit mild depression and anxiety, where 33% demonstrate pathological anxiety and depression. The most common medication for cancer patient's anxiety are benzodiazepines

which also help with nausea caused by chemotherapy<sup>18</sup>. Despite this common medication used for most patient's anxiety, identifying an effective alternative solution that produces minimal side effects could benefit this specific population of patients. Cancer patients typically take a wide range of medications that can produce negative side effects. Studies show that essential oils such as lavender, chamomile, bergamot, geranium, and rose have the potential to relieve stress levels in patients. Eleven studies were included in a meta-analysis where ten studies reported the effect of aromatherapy on anxiety in cancer patients. The experiment included a total of 1724 patients. Of these, five of the studies reported the effect of depression which included 1039 cancer patients. To evaluate depression and anxiety levels, the standardized mean difference was recorded and measured through the following data [SMD = -0.51, 95%CI (0.83, 0.19),  $P = 0.002$ ] and depression [SMD = -0.44, 95%CI (0.76, 0.12),  $P = 0.008$ ]. Through the studies responses, the data indicates the effect of aromatherapy on cancer patients specifically. Implementing aromatherapy via inhalation acts as an alternative mechanism for providing relief to patients' depression and anxiety. Next, Li and his colleagues' study sought to explore the beneficial effects of aromatherapy on psychological symptoms such as anxiety and depression in cancer patients<sup>19</sup>. This study searched for randomized controlled trials and the study population included people with a diagnosis of cancer, without placing any restrictions on the type of cancer. The aromatherapy interventions included inhalation and/or massage therapy using a variety of essential oils. A total of 17 studies were included in the systematic review and 10 articles were conducted in a meta-analysis. In cancer patients, aromatherapy was successful in reducing anxiety (SMD = 0.49,  $p < 0.05$ ). Subgroup analysis suggested that most effective methods were aromatic massage (SMD = 0.70,  $p < 0.005$ ), aromatherapy with lavender essential oils (SMD = 1.12,  $p < 0.01$ ), short-time interventions (duration  $< 4$  weeks) (SMD = 0.87,  $p < 0.05$ ) and studies in Asia (SMD = 0.83,  $p < 0.05$ ). Regarding depression and psychological well being, there was no difference between aromatherapy and control groups. From this information, aromatherapy may act as a tentative solution for relieving anxiety in cancer patients, however findings suggest that there was no beneficial effect on depression and psychological well-being.

### **Dementia**

Dementia is a major healthcare challenge with about 50 million people suffering from the condition globally and there are approximately 10 million new cases each year<sup>20</sup>. Dementia is a condition that involves cognitive impairment that may be severe enough to cause difficulties partaking in everyday activities. Aromatherapy is one feasible alternative that may improve the anxiety and depression of patients with dementia as

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anxiety is a common symptom for these patients. However, oftentimes anxiety remains underdiagnosed because it is viewed as a psychological response to cognitive decline<sup>21</sup>.

Ballard and his coworkers aimed to study the agitation levels of 71 patients with clinically significant agitation in the context of severe dementia. To conduct their experiment, lemon balm essential oil was combined with lotion and applied to patient's faces and arms twice a day for 4 weeks. The Cohen-Mansfield Agitation Inventory (CMAI) and quality of life indices (percentage of time spent socially withdrawn and percentage of time engaged in constructive activities, measured with Dementia Care Mapping) were measured and compared to each other after 4 weeks from the intervention and control groups. The study concluded that 60% of the intervention group and 14% of the control group experienced a 30% reduction of CMAI scores with an overall improvement in agitation of 35% of patients receiving treatment<sup>22</sup>. This experiment deduced that agitation levels of patients with dementia decreased after inhaling lemon balm essential oils. With this underdiagnosed clinical population, aromatherapy shows positive results bringing relief through a simple and relaxing experience.

In an additional study conducted by Dimitriou and her colleagues, they evaluated three non-pharmacological interventions for the treatment of anxiety in dementia. A cross-over randomized controlled trial with 60 participants with different types and stages of dementia was conducted. The three non-pharmacological interventions that were evaluated consisted of music therapy, exercise, aromatherapy and massage. The measurements that were used included MMSE, ACE-R, GDS, FRSSD, and NPI questionnaire, and these interventions lasted five days. Between the six categories established by the sequence schemes, there were no differences between males and females ( $p = 0.753$ )<sup>21</sup>. Additionally, no differences in age ( $p = 0.245$ ), years of schooling ( $p = 0.709$ ), MMSE ( $p = 0.988$ ), ACE-R ( $p = 0.849$ ), GDS ( $p = 0.484$ ), FRSSD ( $p = 0.996$ ), NPI Result ( $p = 0.588$ ), and NPI Distress ( $p = 0.756$ ) were discovered within categories ( $p = 0.554$ ). There was no correlation between the categories and the type of dementia. Overall, the results demonstrate that music therapy is the most effective non-pharmacological intervention for the reduction of anxiety in patients with dementia. Thus, exemplifying how different therapeutic alternatives can vary depending on patient populations.

### ***Chronic Kidney Disease/ Hemodialysis Patients***

Chronic kidney disease is a widespread health problem with more than 500 million people suffering from this disease globally<sup>23</sup>. Hemodialysis is among the most pivotal treatments for people with chronic kidney disease and of 3 million patients receiving treatment, 2.5 million use hemodialysis. Hemodial-

ysis helps filter blood in patients experiencing kidney failure. This treatment is effective, however can cause negative psychological side effects such as depression, anxiety, and low quality of life. While receiving hemodialysis treatment is necessary, it is also important to address the mental consequences of undergoing this treatment. The studies by Bouya and his colleagues were conducted on 1087 hemodialysis patients where most participants were female and about 47 years old<sup>24</sup>. The two most used essential oils were lavender and tea tree oil where the most studies used aromatherapy through inhalation. The Jadad scale was used to evaluate the results of the experiment and concluded that hemodialysis patients experienced improved quality of life and depressive symptoms after inhaling different essential oils about three times a week. Lastly, in a study conducted by Bagheri-Nesami and his coworkers, the effect of lavender essential oil was examined to measure hemodialysis patient's anxiety and depression. This randomized clinical trial was conducted on 72 hemodialysis patients, where they were then divided into control and experimental groups. The experimental group received 3 drops of lavender essential oil 5% for 10 minutes every time they underwent hemodialysis over the course of one month while the control group received normal care<sup>25</sup>. Anxiety and depression were evaluated in both groups at baseline and by the end of the second and fourth weeks during the first hour of a dialysis session. By the end of the second and fourth weeks of intervention, the rANOVA displayed no significant difference between the experimental and control group in terms of the severity of anxiety in comparison to before the intervention ( $p = 0.783$ ). However, the rANOVA revealed a significant difference in the severity of depression between the two groups ( $p = 0.005$ ). This study suggests that various concentrations of lavender essential oils are necessary to relieve anxiety compared to depression.

### **Limitations**

A key limitation in existing research is the limited sample sizes from numerous studies. Most studies are small and uncontrolled, producing debatable results merely because of the population size. The lack of control groups presented within many studies creates uncertain results surrounding the effectiveness of aromatherapy. Publication bias is another critical limitation within this literature review. Most studies yielded similar results, proving how aromatherapy was an effective mechanism in decreasing patients' anxiety and depression in some capacity. However, studies with null findings are increasingly less likely to be published. Therefore, it is difficult to prove aromatherapy's benefits across differing populations when very few studies are published against its efficacy. The last main limitation presented is that blinding is a challenge in aromatherapy studies because expectancy effects could in-

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fluence subjective outcomes like anxiety. When a patient is asked to inhale an essential oil to measure their anxiety or depression levels, that patient might automatically be influenced to report feeling less stressed. When different questionnaires are involved, a study relies on the patient to report their feelings accurately. However, expectancy effects may easily change one's perception. Continually, in non-clinical settings, patients have more control over their actions and seek out treatment on their own time. A study conducted by Sibbritt and colleagues (2014) sought to discover the effects of self-prescribed use of aromatherapy oils by pregnant women. The Australian Longitudinal Study on Women's Health was used to examine women between the ages of 31 to 36 years old. The study was designed to evaluate varied factors that affect the health and wellbeing of women over a 20-year period. It was determined that 15.2% of pregnant women used self-prescribed aromatherapy out of a sample of 804 pregnant women. However, a major setback discovered during this study was the lack of research on self-prescribed aromatherapy especially with this specific population. Some essential oils such as clary sage, fennel, and frankincense are potential dangers to pregnant women in their third trimester<sup>26</sup>. However, without medical expertise and instruction from a medical professional, it is difficult for a pregnant woman to determine if using aromatherapy is safe or not. This proves how more research must be conducted to determine which essential oils are safe for use for different populations, especially when using it self prescribed. Despite the vast research available about clinical populations, there remains a lack of research in non-clinical settings. The effectiveness of aromatherapy can vary depending on the delivery and how frequently it is used. If a patient with a chronic disease uses aromatherapy daily because their doctor forces them to, their perception of success might be worse than someone who uses aromatherapy every day to experience the positive and healing effects of essential oils. However, most research findings do not track patients and their symptoms for a prolonged period. Therefore, more longitudinal studies could be implemented to better understand how aromatherapy affects an individual over an extended amount of time.

## Future Directions

Others may suggest that aromatherapy does not produce any meaningful benefits. Alternative views and opinions exist surrounding the efficacy of aromatherapy in aiding patients' depression and anxiety. In a small pilot study conducted by Komori and colleagues, they used 12 depressed men and exposed them to citrus fragrance in the air<sup>27</sup>. Another group consisting of 8 patients did not get exposed to the aromatics. Both groups were taking prescribed antidepressants, however the study was not randomized and included a small number of participants

with different doses and types of antidepressants. As a result of this study, a positive correlation does not exist between aromatherapy relieving patient's mental health and depression. Second, a literature review conducted by Bhadra (2020), exposes the alternative opinion that neither the contribution of a scent nor the treatment proves adequate for the case that an application is aromatherapeutic. This new philosophy argues that any impact inspired by an aroma must simply come from the after effect of the fragrance itself, critically addressing the idea of atom fixation<sup>28</sup>. Opposing views suggest that the relationship between scent and emotion remains unconnected. Lastly, some critics of the modern-day usage of aromatherapy claim that this alternative treatment is magic and that it connects the mind with the soul. These theorists believe that the treatment of the mind and spirit is a key concern of magical endeavor. Such alternative explanations suggest that the biological process of scent and the limbic system remains very new and must be dispersed knowledge for the general population to understand aromatherapy. There are many possibilities for the future direction of aromatherapy and studies in this field. I believe that the next step in the right direction involves conducting more extensive research on aromatherapy in non-clinical populations and discovering how this complementary form of medicine affects the average consumer of aromatherapy products. Future directions should allow individuals to better understand the positive effects of aromatherapy on depression and anxiety in comparison to solely clinical populations

## Conclusion

Aromatherapy exists as a potential treatment across different contexts. It can be concluded that the effectiveness of aromatherapy varies by population and depends on which essential oils are used. However, the essential oil most prominent in affecting depression and anxiety is lavender. The most common delivery of aromatherapy products occurs through inhalation as the scent best reaches the olfactory sensory neurons and limbic system through this manner. I suggest that the research moving forward continues to focus on a variety of different patient populations while also studying patients who solely suffer from anxiety and depression. Implementing aromatherapy in this population's daily lives while measuring the long-term outcomes of their symptoms would deliver more accurate results of how aromatherapy alleviates clinically diagnosed depression and anxiety. If more research is conducted on patients suffering from depression and anxiety alone, the results can serve as a baseline and can be used to compare the reduction of anxiety in different clinical populations. Outcomes such as aromatherapy's long-term effects on mental health and its impacts on populations of different ages should be studied. Knowledge gaps such as limited research published on aro-

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matherapy's use can be addressed. Overall, aromatherapy is a non-pharmacological alternative that can potentially be used to help cope with stress and depressive symptoms while improving the quality of life of different patient populations.

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