





Aromatherapy with Lavender Essential Oil in Patients with Surgery-Related Anxiety: a Systematic Review

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Abstract

Today, complementary and alternative treatment strategies, including massage therapy, and aromatherapy, are extensively applied to reduce and manage anxiety in the patients with various diseases. Aromatherapy as one of the main therapeutic strategies has gained significant attention in most countries compared to other complementary treatments for surgery-related anxiety treatment. Here, we decided to conduct a systematic review and report the results about the effects of aromatherapy with lavender (*Lavandula angustifolia* L.) in patients undergoing various types of surgery. Five English databases including Web of Science, Scopus, PubMed, ScienceDirect, and Google Scholar were used to find published clinical papers related to the effects of aromatherapy with lavender in patients undergoing various types of surgery without time limitation. All searches were based on the 06- PRISMA guideline and registered in the CAMARADES-NC3Rs Preclinical Systematic Review and Meta-Analysis Facility (SyRF) database. Out of 3974 papers, 20 papers from the year 2000 up to April 2021, met the inclusion criteria for discussion in this systematic review with the data extracted. The most studies were carried out on the effect of aromatherapy with lavender on the anxiety of patients with coronary artery bypass surgery (8 papers, 40%). Based on the results of the articles reviewed, it can be suggested that aromatherapy management particularly with lavender, has the potential to be used as a complementary therapy to reduce anxiety and stress in patients undergoing various types of surgery. However, more studies are required to confirm the accurate mechanisms and side effects of the complementary treatment.

Keywords: anxiety; aromatherapy; essential oil; inhalation; *Lavandula angustifolia*; surgery

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Introduction

Surgery is one of the most important traumatic treatments that is generally related to bleeding, pain, risk of morbidity, or even death. Anxiety is a displeasing emotional condition that can cause patients undergoing planned surgery to avoid

such techniques [1,2]. Preoperative anxiety is principally defined as unpleasant symptoms such as hypertension, pounding heart, an increase of heart rate, abnormal heartbeat, nervousness, nausea and sleep disorders which are the result of

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the fears and doubts of patients [3-5]. Today, the complementary and alternative treatment strategies, including homeopathy, massage therapy, acupuncture, and aromatherapy are extensively applied to reduce and manage anxiety in patients with various diseases and conditions [6,7]. Aromatherapy as one of the main therapeutic strategies has gained significant attention in most countries compared to other complementary treatments for surgery-related anxiety [8,9]. Aromatherapy includes inhalation of essential oils that are concentrated materials isolated from different parts of the plants [10-12]. Investigations have been performed to assess the activity of aromatherapy with essential oils as a safe nursing medication in conditions such as anxiety in cardiovascular diseases, cancers, hemodialysis, general surgery, reduction of cortisol and for reducing cardiac factors including pulse rate and blood pressure [12-15]. Lavender (*Lavandula angustifolia* L.), from Lamiaceae family, is an herbaceous, aromatic, and evergreen plant, which is broadly applied in aromatherapy [16]. Previous animal and human studies have reported anxiolytic, pain-relieving, and neuroprotective effects for this plant [17]. The significant scientific interest in recent years into the efficacy of aromatherapy with lavender on pain, anxiety, hypertension and heart rate, sleep disorders in patients with cardiovascular diseases, cancers, hemodialysis, and surgery has been reported by various researchers; therefore, we decided to conduct a systematic review and determine the efficacy of aromatherapy with this plant in patients undergoing various types of surgery.

Methods

Database search

This review was conducted according to the 06-PRISMA guideline and registered in the CAMARADES-NC3Rs Preclinical Systematic Review and Meta-Analysis Facility (SyRF) database [18]. Several databases in English including Google Scholar, PubMed, Scopus, Web of Science, and ScienceDirect to were searched concerning the efficacy of aromatherapy with lavender in people undergoing various types of surgery without date limitation. The searched keywords in this study were “Lavender”, *Lavandula angustifolia*”, “aromatherapy”, “surgery”, “anxiety”, and “stress”.

Evaluation of quality and the selection of articles

The articles which assessed the effects of

aromatherapy with lavender in patients undergoing various types of surgery were evaluated. After importing studies into EndNote X9, repeated papers were deleted. Then, the title and abstract of the articles were assessed by three independent authors; they nominated the qualified articles that sufficiently met the inclusion criteria for further analysis.

Cochran checklist [18] and Nicholson et al. [19] criterion was used to assess the quality of experimental and quasi-experimental studies. Thus, if a study covered all or part of the criteria, it was given a score of 2 or 1, respectively, and if a study did not meet any of the criteria or the article did not mention any of the required items, it received zero points. Finally, zero quality studies were excluded from the present review. Exclusion criteria in the present review were articles with insufficient data and the papers in which the summary was just submitted in conferences as preceding articles, and papers with no full text. In addition, studies with poor methodology, inadequate data, inappropriate analysis, inconsistency between methods and results, too much emphasis on importance of results and confusing presentation were excluded from this review (Figure 1).

Data extraction

The required information from the designated articles was extracted by three independent authors and, if required, the dissimilarities were fixed after consultations with the corresponding researcher. The acquired data were the names of authors, year, control group, type of surgery, measurement scale, dosage, intervention process, results, and reference.

Results and Discussion

Out of 3974 papers, 20 papers up to April 2021, met the sufficient standards to enter this study (Table 1). Most studies examined the efficacy of aromatherapy with lavender essential oil in patients with surgery-related anxiety (8 papers, 40%).

Cesarean-section

In a clinical study, Abbasi Jahromi et al. [20] evaluated the efficacy of aromatherapy with Damask rose and lavender on pain and anxiety in pregnant women who were to give birth by cesarean-section.

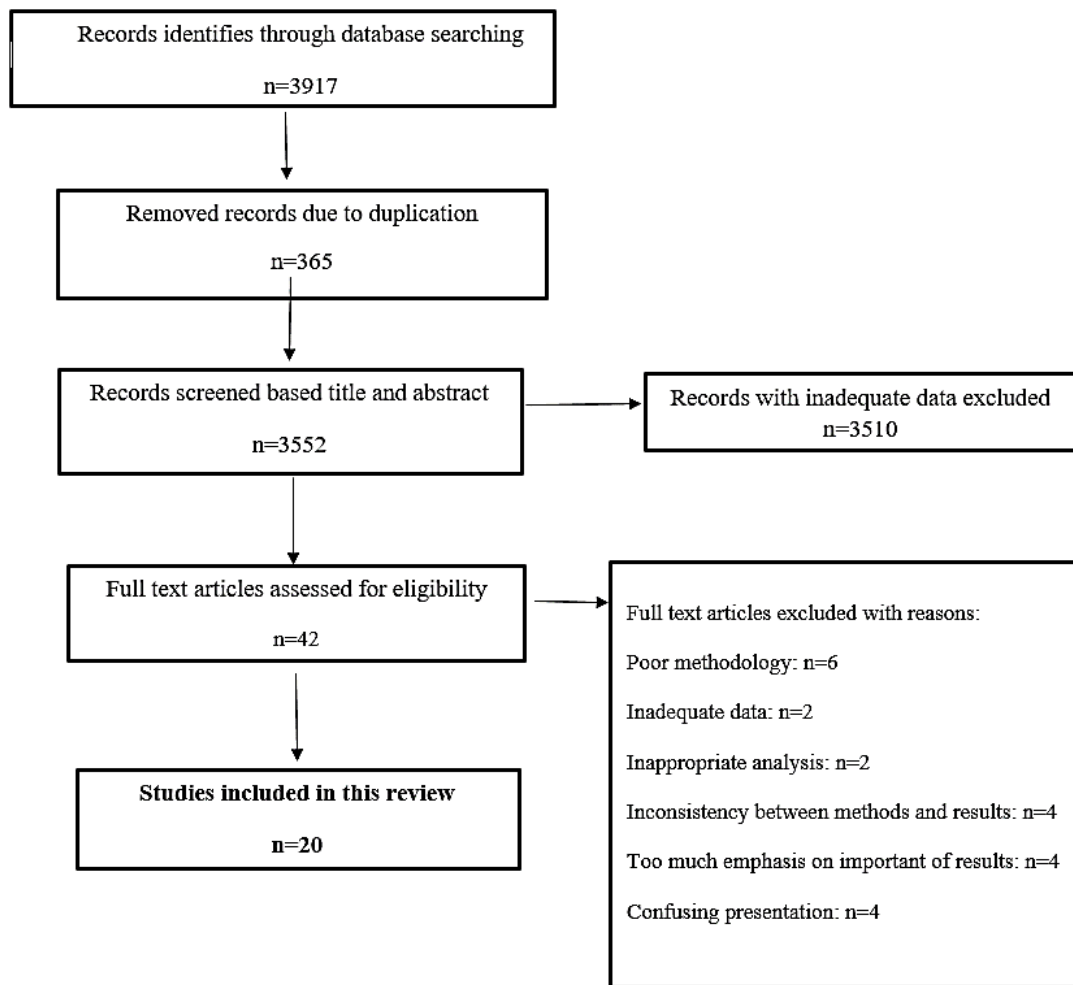


Figure 1. Flowchart indicating the review design process

In this study, 90 mothers were allocated into three groups. Each mother was given a cotton pellet soaking in 3 drops of lavender oil or damask rose oil and requested to inhale the oils for 30 minutes from a distance of 10 cm. The control group received normal saline in the same way. Five minutes after inhalation, the severity of pain and anxiety in each patient was measured by visual analogue scale (VAS) and Spielberger State-Trait Anxiety Inventory. Evaluating the results showed that the intensity of pain and anxiety were considerably improved compared to the control group.

Biopsy

Recently, Abbaszadeh et al. [21] have conducted a study on the effect of lavender aromatherapy on the severity of anxiety in 80 patients who were to have a bone marrow biopsy. The control group

used a cotton soaked in distilled water, and the intervention group a cotton soaked in 3 drops of lavender essential oil. Control group and the intervention group were requested to inhale the cotton for 15 minutes (before the biopsy and at a distance of 7 cm). Then, the level of anxiety was determined using the VAS score. Analyzing the obtained data, it was found that, the mean severity of anxiety was 1.05 ± 3.75 and 6.3 ± 1.92 in the intervention and control groups, respectively. The researchers found that variables such as biopsy location, age, sex, physician history, and biopsy history affected the severity of anxiety and there was a significant difference between the control and intervention groups ($p < 0.05$). According to the results, inhaling lavender essential oil effectively reduces anxiety in patients who want to have a bone marrow biopsy.

Table 1. The list of studies on the effect of aromatherapy with lavender on patients undergoing surgery

Authors	Year	Control group	Type of surgery	Measurement scale	Dosage	Administration	Results	Ref
Abbasijahromi et al.	2020	Normal saline	Cesarean section	Visual analogue scale (VAS) and the Spielberger State-Trait Anxiety Inventory (STAI)	3 Drops	30 Minutes	Reduction of anxiety and pain	[19]
Abbaszadeh et al.	2020	Distilled water	Bone marrow biopsy	Demographic questionnaire and Visual Anxiety Scale (VAS)	3 Drops	15 Minutes at a distance of 7-10 cm before the biopsy	Reduction of anxiety	[20]
Babatabar Darzi et al.	2020	Distilled water	Open-heart surgery	Spielberger State Anxiety questionnaire	3 Drops	15 Min after surgery	Reduction of pain and anxiety	(21)
Bikmoradi et al.	2015	Distilled water	Coronary artery bypass surgery	Depression Anxiety and Stress Scale questionnaire (DASS 21)	2 Drops	20 Minutes on the second and third days after surgery	Reduction of mental stress but may increase systolic blood pressure	[22]
Hasanzadeh et al.	2016	None	Cardiac surgery	Modified-McGill pain questionnaire (SFM-MPQ) and the Spielberger situational anxiety level inventory (STAI)	1-2 Drops	20 Minutes	Reduction of anxiety and pain intensity	[23]
Heidari et al.	2013	Distilled water	Open-heart surgery	Spielberger State Anxiety questionnaire	2 Drops	20 Minutes	Reduction of pain and anxiety	[24]
Hosseini et al.	2016	Distilled water	Open-heart surgery	Spielberger State Anxiety questionnaire	2 Drops	20 Minutes	Reduction anxiety score and plasma cortisol levels	[25]
Pourmovahed et al.	2016	Distilled water	Coronary artery bypass graft surgery	Spielberger State Anxiety questionnaire	2 Drops	20 Minutes	Reduction of anxiety	[26]
Rajai et al.	2016	None	Coronary artery bypass graft surgery	Depression Anxiety Stress Scale (DASS) questionnaire	2 Drops	On the morning of surgery	Reduction of anxiety and the heart rate	[27]
Seifi et al.	2014	Distilled water	Coronary artery bypass graft surgery	Spielberger State Anxiety questionnaire	2 Drops	20 Minutes on the second and third days after surgery	No significant effect on reducing anxiety	[28]
Arslan et al.	2020	None	Dental surgery	Face image scale (FIS), Face, Legs, Activity, Cry, Consolability (FLACC) and Wong-Baker pain rating scale (WBS)	2 Drops	3 Minutes before the interventions	Reduction of pain and anxiety	[29]
Kritsidima et al.	2010	None	Dental surgery	State Trait Anxiety Indicator (STAI-6) and Modified Dental Anxiety Scale (MDAS)	5 Drops	4 h in the morning and afternoon clinics for 4 weeks	Reduction of pain and anxiety.	[30]
Ayik et al.	2018	None	Colorectal surgery	State Anxiety Inventory (SAI) and Richard-Campbell Sleep Questionnaire (RCSQ)	5% Lavender oil	10 Minutes before surgery and the morning of surgery	Reduction of anxiety and increasing the sleep quality	[31]

Table 1. Continued

Authors	Year	Control group	Type of surgery	Measurement scale	Dosage	Administration	Results	Ref
Saritaş et al.	2018	None	Laparoscopic cholecystectomy surgery	State Anxiety Inventory (SAI)	5 Drops	20 Minutes	Reduction of anxiety	[32]
Bagheri et al.	2020	Oxygen	Inguinal hernia surgery	Individual demographic data questionnaire and the visual analog scale for pain (VAS pain)	4 Drops	20 Minutes	Reduction of pain severity and anxiety	[33]
Beyliklioglu et al.	2019	None	Breast surgery	Spielberger State Anxiety questionnaire	3-4 Drops	20 Minutes inhalation on the day of the surgery	Reduction of stress	[34]
Lola Franco et al.	2016	None	Breast surgery	Spielberger State Anxiety Inventory	2 Drops	10 Minutes before surgery inside a plastic oxygen face mask	Reduction of anxiety	[35]
Genc et al.	2020	None	Benign prostate hyperplasia (BPH) surgery	State and Trait Anxiety Inventory (STAI)	5 Drops	5 Minutes	Reduction of anxiety and improving patient's vital signs	[36]
Stanley et al.	2020	Grape seed oil	Cataract surgery	State-Trait Anxiety Inventory (STAI)	20 Drops	20 Minutes	Reduction of anxiety	[37]
Hasanpour et al.	2017	Distilled water	Upper Limb Reconstruction Surgery	Spielberger State Anxiety questionnaire	3 Drops	20 Minutes	Reduction of anxiety	[38]

Open heart surgery

Babatabar Darzi et al. evaluated the efficacy of aromatherapy with Damask rose and lavender essential oils on the intensity of anxiety, surgical pain, and postoperative pain [22]. Patients (160 people) were divided into four groups. The first group was not given any medication and only routine care was provided. The second group was given placebo-impregnated cotton (water) and the third and fourth groups were given three drops of Damask rose or lavender essential oil impregnated, respectively. They were requested to apply these essential oils 15 minutes after surgery. They then collected the data using the Spielberger State Anxiety questionnaire. After analyzing the data, they concluded that after inhalation, the pain intensity in the third and fourth groups was significantly reduced compared to the first and second groups. The lowest pain intensity was in the groups that inhaled Damask rose and lavender essential oil, respectively. The results displayed that aromatherapy with Damask rose and lavender essential oils is able to reduce the severity of pain and anxiety after open heart surgery.

In 2015, Bikmoradi et al. [23] carried out a study on 60 patients who were divided into control and intervention groups that used lavender essential

oil to evaluate the effects of aromatherapy on patients' anxiety after coronary artery bypass graft (CABG) surgery. Intervention group received two drops of 2% lavender essential oil for 20 minutes after two and three days of surgery. The Depression Anxiety Stress Scale (DASS)-21 questionnaire was used to measure their anxiety before and after the intervention. Evidence suggested that aromatherapy with lavender can increase systolic blood pressure but has little effect on reducing mental stress.

Hasanzadeh et al. [24] have performed the effects of lavender essential oil on 80 patients after CABG transplantation; whereas they found that aromatherapy with lavender could reduce anxiety levels.

Another study was conducted by Abedin et al. [25] on 90 patients undergoing open heart surgery. This study assessed the efficacy of aromatherapy on anxiety levels. Subjects in the intervention group inhaled lavender essential oil (two drops) on a piece of gauze for 20 minutes. Spielberger's anxiety form was used to determine patients' anxiety. The findings revealed that lavender aromatherapy considerably decrease the anxiety score from 56.37 ± 5.6 to 54.73 ± 5.42 , while the level of anxiety increased in the control group who did not use the essential oil.

In 2016, Hosseini et al designed a clinical trial study to measure anxiety and blood cortisol in 90 patients undergoing open heart surgery by [26]. Lavender aromatherapy reduced the anxiety score from 56.73 to 54.73 and could also reduce plasma cortisol levels from 16.76 to 14.88. In this study, the intervention group inhaled two drops of lavender essential oil and the control group inhaled distilled water for 20 minutes. Before and after the intervention, 2 mL of blood was taken from patients to measure blood cortisol. Spielberger anxiety questionnaire was used to determine the level of anxiety in patients.

In 2016, Pourmovahed et al. [27] conducted a study on 64 patients undergoing CABG surgery. Patients were divided into intervention and control groups. The intervention and control groups inhaled lavender essential oil (2 drops) and distilled water, respectively for 20 minutes. A questionnaire was used to measure patients' anxiety levels before and after the intervention. The results showed that the use of fragrance treatment with lavender oil reduced the level of anxiety from 45.71 ± 14.27 to 39.53 ± 9.28 .

In 2016, Rajai et al. studied the effect of aromatherapy on anxiety and stress in patients undergoing coronary artery surgery [28]. This study included 60 patients admitted to the Army Hospital, Tehran, Iran. The obtained findings exhibited that aromatherapy had no effect in terms of stress or other physiological variables, but it reduced heart rate and anxiety in patients before coronary artery surgery. This intervention can be used as a relaxation method effectively and safely before aggressive interactions.

Seifi et al [29] evaluated the effects of lavender essential oil on reducing anxiety in patients after coronary artery bypass graft surgery. This study was a double-blind randomized controlled trial and was performed on 60 patients. The intervention group was asked to inhale two drops of 2% lavender essential oil on days 2 and 3 after surgery for 20 minutes. The level of anxiety was recorded before and after the intervention with a questionnaire and also evaluating the vital signs. The acquired data revealed no significant difference in the mean anxiety scores among the aromatherapy and control groups.

Dental surgery

Arslan et al. [30] conducted a study on the effect of lavender oil on the severity of pain and anxiety during dental surgery in children. The study was

performed on 126 children (54 girls and 72 boys) who were randomly selected and ranged in age from 6 to 12 years. They were divided into control and intervention groups. The intervention group was asked to inhale medical packs soaked in two drops (0.1 mL each) of lavender essential oil for three minutes before surgery, but the control group was not given any substances to inhale. The pain and anxiety of both groups were measured by face image scale (FIS), face legs activity cry Consolability (FLACC) and Wong Baker pain rating scale (WBS). After analyzing the obtained data, the researchers found that lavender essential oil was effective in reducing pain and anxiety in pediatric dental surgeries and can be used as a sedative in such surgeries.

In 2010, Kritsidima et al. [31] in a randomized, controlled cluster study examined the effect of lavender essential oil aromatherapy on the severity of anxiety in 340 people seeking dental care. In this study, the patients were divided into control (n: 170) and intervention (n: 170) groups. In the morning and afternoon, when the patients in the intervention group entered the clinic, they were given five drops of lavender extract mixed with 10 mL of water which was heated for 4 hours to spread the perfume. The duration of the study was four weeks. The same method was performed for the control group using water instead of lavender extract. Patients' anxiety data were then collected using the six-item State Trait Anxiety Inventory (STAI-6) and Modified Dental Anxiety Scale (MDAS). After analyzing the data, it was found that according to MDAS, there was no significant difference between the two groups in the severity of anxiety ($p > 0.05$), but based on STAI-6, the severity of anxiety in the intervention group (7.41) decreased compared to the control group (10.71) and there was a significant difference ($p < 0.001$) indicating that aromatherapy with lavender essential oil can reduce the severity of anxiety in dental patients.

Gastrointestinal surgery

Cahid Ayik et al. [32] studied the effect of aromatherapy massage on anxiety severity and sleep quality before colorectal surgery. The intervention group inhaled 5% lavender oil 10 minutes before surgery and in the morning of surgery. The obtained results of State Anxiety Inventory (SAI) and Richard-Campbell Sleep Questionnaire (RCSQ) demonstrated that aromatherapy with lavender oil before colon

surgery can improve sleep quality and decrease anxiety.

In 2018, Saritaş et al. evaluated the effect of aromatherapy with lavender oil on the severity of patients' anxiety before laparoscopic cholecystectomy [33]. For this study, 110 patients were selected divided into control and intervention groups. The intervention group was first asked to complete the State Anxiety Inventory (STA) form and then was given sterile snuff (5×5 cm) impregnated with five drops of lavender oil to inhale for at least 5 minutes. After 20 minutes, the patients were again asked to complete the STA form. In the control group, the same process was repeated but they were not given lavender oil and just received standard nursing care. By examining the data collected by the STA method, it was observed that the mean anxiety scores in the intervention group were 56.10 ± 8.61 before inhalation and 52.0 ± 8.26 after inhalation, which indicate a significant difference ($p < 0.05$); also, the mean scores of anxiety in the control group before and after the test were 55.20 ± 8.49 and 58.34 ± 8.34 , respectively, which indicate a significant difference ($p < 0.05$). Based on the results, it was concluded that aromatherapy with lavender essential oil could reduce the severity of anxiety in laparoscopic cholecystectomy patients.

Brain Surgery

In 2020, Bagheri et al [34] demonstrated the effect of lavender essential oil aromatherapy on pain after cerebral hernia surgery in a controlled trial. For this study, 90 patients were divided into two groups of 45 intervention and control. The intervention group was asked to inhale four drops of 2% lavender essential oil with oxygen for 20 minutes, but the control group was asked to inhale only oxygen. Data were then collected by visual analog scale (VAS) with a schedule of 0 minutes, 2 hours, 6 hours and 24 hours after surgery. Data analysis showed that the mean scores of pain in the intervention group were lower than the control group ($p < 0.001$). Examining these results, it was found that aromatherapy with lavender essential oil can be effective in reducing pain after cerebral hernia surgery.

Breast surgery

In June 2019, a study was conducted by Ayşe Beyliklioğlu et al. [35] on the effect of

aromatherapy of lavender essential oil on the severity of anxiety before breast surgery. In this study, 80 female patients were randomly selected and divided into 2 groups of 40 (control and intervention). The intervention group was given a gauze soaked in 3-4 drops of lavender essential oil and asked to inhale it for 20 minutes on the day of surgery, but the control group was not given any essential oil. Patients' anxiety information was then collected at the time after inhalation and before surgery using the Spielberger State Anxiety questionnaire. Data analysis showed that the mean STAI scores in the intervention group before and after the test were 43.00 ± 11.48 and 37.28 ± 9.93 , respectively ($p < 0.05$) while the mean STAI scores in the control group before and after the test were 44.6 ± 11.45 and 42.43 ± 11.48 , respectively ($p > 0.05$). The results showed that aromatherapy with lavender essential oil before breast surgery can reduce the patient's anxiety.

In 2016, a study on the effect of aromatherapy with lavender oil on patients' anxiety before breast surgery was conducted by Lola Franco et al. [36]. Analysis of the obtained data demonstrated that inhalation of lavender essential oil reduced the severity of anxiety before surgery ($p < 0.05$).

Prostate surgery

In 2019, a quasi-experimental study was conducted by Hasan Genc et al. to investigate the effect of lavender oil aromatherapy on vital signs and severity of patients' anxiety before benign prostatic hyperplasia (BPH) surgery [37]. This study was done on 110 patients. The patients were divided into control and intervention groups with an equal number (55 patients). The intervention group was first asked to complete the Vital Signs form and STAI and then to inhale the odor of five drops of lavender oil for 5 to 10 minutes. After 20 minutes, the vital signs and STAI forms were again completed. The control group did not receive anything and only recorded their vital signs at 20-minute intervals. Analyzing the obtained data showed that the level of anxiety decreased in both groups after inhalation. Also, after reviewing the post-test results of the respiratory symptoms of the groups, it was found that there was a significant difference in the number of breaths and the percentage of oxygen saturation ($p < 0.05$).

Eye surgery

Stanley et al. in a randomized controlled trial evaluated the effect of lavender essential oil on the severity of patients' anxiety before cataract surgery [38]. In this study, 75 patients who were to have for cataract surgery were randomly divided into two groups of control (n: 36) and intervention (n: 39). All patients were asked to complete the STAI questionnaire and, in addition to the questionnaire, their vital signs were recorded. In the lavender group, 20 drops of lavender essential oil were placed in the room steamer and the patients were asked to inhale for 20 minutes. After each breath of the essential oil of the essential oil, information on vital signs and severity of anxiety (with the STAI questionnaire) was recorded. Analysis of data showed that the mean changes in anxiety scores in the intervention and control groups were 4.5 and 0.8, respectively. After examining the vital signs of the patients, it was found that except for diastolic blood pressure, other signs had returned to normal.

Upper Limb Reconstruction Surgery

In 2017, a controlled non-randomized clinical trial on the effect of lavender oil aromatherapy on the severity of patients' anxiety before upper limb reconstruction surgery was performed by Hasanpour et al. [39]. In this trial, 100 patients were selected by convenience sampling method and then divided into two groups of control (n: 50) and intervention (n: 50). Prior to the intervention, each group was requested to fill the Spielberger State Anxiety form. The intervention group was given non-sterile gauze impregnated with 3 drops of lavender oil and they were asked to inhale for 20 minutes. The same was done for the control group with distilled water instead of lavender oil. Five minutes after the intervention ended, both groups were again asked to complete the Spielberger State Anxiety questionnaire. Before and after the intervention, vital signs (blood pressure, respiration, etc.) of each group were also recorded. It was found that the mean of state and characteristic anxiety in the intervention group before inhalation were 55.80 ± 4.91 and 53.92 ± 5.79 , respectively, while they were 41.86 ± 4.03 and 45.66 ± 4.49 , respectively after inhalation. In the control group, the mean of state and specificity anxiety before inhalation were 55.76 ± 4.86 and 55.90 ± 4.85 , and after

inhalation they were 55.56 ± 4.74 and 55.90 ± 4.90 , respectively. After reviewing the results, it was found that lavender can reduce patients' anxiety before upper limb reconstruction surgery.

Possible mechanisms of aromatherapy

Considering the possible mechanisms of aromatherapy, reviews have reported three possible mechanisms in which aromatherapy with essential oils can affect brain functioning. (1) the activation of nasal olfactory chemoreceptors and then effect of olfactory signals on the brain. The olfactory system is considered a unique system among the sensory systems for having direct anatomical and functional contacts with the limbic system. Accordingly, olfactory stimuli are able to have a potent effect on mood; (2) direct diffusion of essential oil molecules through the olfactory nerve into connected brain parts and the stimulation of cellular and molecular procedures; (3) the alveolar absorption of essential oil molecules into the blood circulation, passing the blood-brain barrier (BBB) to act with particular brain areas [40]. Recently, Schneider et al (2019) have proven that aromatherapy with essential oils can increase serotonin reuptake, endorphin, serotonin and noradrenaline secretion, inhibition of regulatory receptors controlling HT1B-5 in presynaptic cells, nerve irritability and neurogenesis which results in improving the severity of anxiety conditions [41].

Conclusion

Based on the results of this review, it can be suggested that aromatherapy management, particularly with lavender essential oil has the potential to be used as a complementary therapy to reduce anxiety and stress in patients undergoing various types of surgery. However, more studies are required to confirm the accurate mechanisms and side effects of the alternative treatment.

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None.

Author contributions

Arash Amin designed the study; Morteza Amraei, Mohammad Kalantari Shahijan and Kimia Karami collected data; Nasrollah Moradifar and Sedigheh Nadri drafted the manuscript; Arash Amin, Kimia Karami, and Morteza Amraei

revised the manuscript for intellectual content.

Declaration of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

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Abbreviations

SyRF: CAMARADES-NC3Rs preclinical systematic review and meta-analysis facility; VAS: visual analogue scale; CABG: coronary artery bypass graft; DASS: depression anxiety stress scale; SAI: state anxiety inventory; RCSQ: Richard-Campbell sleep questionnaire; FIS: face image scale; FLACC: face legs activity cry consolability; WBS: Wong Baker pain rating scale; STAI-6: Trait anxiety inventory; MDAS: modified dental anxiety scale