



# Comparing the Aromatherapeutic Effects of Orange and Lavender Essential Oils on Anxiety and Physiological Indicators in Patients Undergoing Coronary Angiography: A Clinical Trial Study

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## Abstract

**Background:** Anxiety is one of the common complications resulting from invasive diagnostic methods, especially coronary angiography. It affects physiological responses of the patient and jeopardizes his/her vital signs in the angiography suite. Aromatherapy has suggested to reduce anxiety.

**Objectives:** In this regard, the present study aimed at comparing the effects of orange and lavender (lavandula) essential oils on anxiety and physiological parameters of patients undergoing coronary angiography.

**Methods:** This clinical trial was performed on 101 patients undergoing coronary angiography who were admitted to the Fatemeh Al-Zahra Hospital in Sari, northern Iran in 2018. Convenience sampling was done and the subjects were randomly divided into three groups, including the control, lavender and orange groups. Data collection was done using a demographic and disease questionnaire, Spielberger's state-trait anxiety inventory (STAI), a sheet to record physiological variations, a barometer and a second timer. The obtained data were analyzed by SPSS 22 using chi-square test, Fisher's exact test, one-way ANOVA, paired *t*-test, Tukey's post-hoc test, Kruskal-Wallis test, paired Wilcoxon test and Mann-Whitney U test.

**Results:** The results indicated a significant difference in the mean anxiety score between the lavender and control groups as well as the orange and control groups ( $P < 0.001$ ); a significant difference was also observed between the orange and lavender groups after the intervention ( $P < 0.001$ ). Furthermore, systolic blood pressure, pulse rate and respiration rate decreased significantly in subjects exposed to the lavender and orange essential oils compared to the control group ( $P < 0.001$ ).

**Conclusions:** According to the findings, orange and lavender aromatherapy could relieve anxiety in patients undergoing angiography. Accordingly, this intervention can be adopted as an effective measure in anxiety-ridden situations, like diagnostic procedures.

**Keywords:** Aromatherapy, Lavandula, Citrus Sinensis, Anxiety, Angiography, Physiological Indicators

## 1. Background

Cardiovascular disease (CVD) has been one of the most critical issues in recent years and has been announced as the modern-day epidemic by the World Health Organization (1). CVD has considered to be the leading cause of mortality in Iran and worldwide (2). Given its high prevalence, many tests are used to diagnose coronary artery disease (CAD), among which angiography is one of standard procedures (3). According to the statistics reported in 2009, 99.2% of patients referring to the Kowsar Angiography Center in Golestan, northern Iran underwent angiography (4). Angiography is an invasive diagnostic method leading to anxiety and fear in patients (5). Studies have also shown that more than 72% of patients have experienced anxiety

before coronary angiography (6, 7). Bijani et al. reported that angiography is the major source of stress and anxiety, which play affect the patient to accept or reject this diagnostic procedure (8). Anxiety can lead to arrhythmia due to the increased sympathetic nerve activity; besides, by increasing arterial responsiveness, heart rate and blood pressure, it results in tissue damage and platelet aggregation (7). Following anxiety, physiological responses, such as blood pressure, heart rate and respiration rate are increased. As a result, these changes in a defective cycle cause cardiac ischemia and cardiac pain, which make patient at risk during angiography (3). Several drugs, including oxazepam and promethazine have been proposed to prevent and treat anxiety (8). Despite of their widespread prescrip-

tion, these drugs are associated with side effects, such as dizziness, confusion, drowsiness, fatigue, etc. Due to the occasionally serious complications, pharmacotherapy is not widely used (9). Considering the popularity of complementary therapies for treatment of chronic diseases and their fewer side effects compared to drug therapies, they can also administer such beneficial effects during angiography (7).

The most common types of complementary therapy include aromatherapy, meditation, massage therapy and Yoga exercise. Complementary therapies possess several advantages, including being cost-effective, easy to administer, non-invasiveness, no need to drugs use and no chemical side effects (10). Aromatherapy is one of the most important and safe methods to reduce anxiety (11). Complementary therapies, including aromatherapy are popular in holistic nursing care in more than 30 countries (10). Although their efficacy has not yet proved, aromatherapy is believed to affect the brain and nervous system similar to drug therapy (3, 12). *Lavandula* (commonly known as lavender) is a medicinal plant, which its essential oil is used in aromatherapy. It has a flowering branch known as *Lavandula cpica* L., which has strong anxiolytic, analgesic and anticonvulsant properties and also contains the linalyl acetate ingredient (13). Inhalation of lavender aroma decreases cortisol secretion from the adrenal gland, reduces sympathetic activity and increases parasympathetic function. On the other hand, it inhibits the release of acetylcholine and can have relieving effects on the nervous system (14). Its consumption improves heart function, stimulates blood circulation and also leads to mental relaxation (5). Several studies have investigated aromatherapy using lavender as a non-invasive nursing intervention in various conditions and its positive effects have confirmed on alleviating the anxiety in patients undergoing coronary angiography (15), hemodialysis (16), burn [dressing changes] (17) and coronary artery bypass grafting (3). It has also shown to be associated with reducing cortisol concentration and physiological parameters (3, 18). However, there are also contradictory results to use lavender (19, 20). Muzzarelli et al. and Graham et al. showed that aromatherapy does not affect patients' pre-surgery and radiotherapy-induced anxiety (19, 20). Nevertheless, in a systematic review by Lee et al. on the anxiolytic effects of aromatherapy in people with anxiety symptoms, it was found that in 10 out of 16 studies lavender essential oil had used and no adverse effect had been reported (21). Ziyaefard et al. (15) showed that lavender scent reduces patients' anxiety and pain before and after coronary angiography. Najafi et al. suggested that lavender aromatherapy combined with listening to Quran could reduce anxiety in patients with myocardial infarction (9).

Orange essential oil, scientifically known as *Citrus sinensis* is used in aromatherapy. It can stimulate the central nervous system (CNS) and improve individuals' mood and has also found with sedative, antispasmodic, anti-inflammatory, antinociceptive, digestive, hypotensive and diuretic effects (22). Several studies have pointed to the anxiolytic effects of orange essential oil during labor and in dentistry, as well (23). Abdi Joubari et al. indicated the effectiveness of inhaling orange in reducing explicit anxiety in patients undergoing coronary angiography (24). Given that aromatherapy is considered as a holistic nursing approach by the National Council of State Boards of Nursing and is also regarded as an accepted component of nursing practice in the UK, nurses in more than 30 countries are licensed to use complementary therapies, including aromatherapy in their holistic care procedures (25). Unfortunately, aromatherapy is not a commonly used therapeutic method in Iran and limited number of studies have done on aromatherapy. Accordingly, further investigations are needed to be done in this field. In addition, we have observed several patients before coronary angiography who have not subjected to non-pharmacological methods to reduce their anxiety.

## 2. Objectives

Therefore, due to the positive impact of aromatherapy on allaying anxiety in other countries, it seems that it can be used in Iran as a non-pharmacological method to relieve anxiety in patients undergoing coronary angiography. In this regard, the present study was performed to compare the effect of orange and lavender essential oils on mitigating anxiety in patients undergoing coronary angiography.

## 3. Methods

Following the approval of the Ethics Committee of Islamic Azad University, Sari Branch (R.IAU.SARI.REC 1397-11), this clinical trial was carried out on 105 patients undergoing coronary angiography in the Fatemeh Al-Zahra Hospital, Sari in 2018. The inclusion criteria included complete vigilance, anxiety score of greater than 80 (based on the Spielberger's scale), those undergoing coronary angiography for the first time, no history of invasive procedures before angiography, no use of sedative medications or other medicines, such as herbal essential oils six weeks before the intervention, no history of chronic obstructive pulmonary disease and those who were not studying medicine or psychology. On the other hand, the exclusion criteria were the occurrence of sudden severe changes in vital signs, cardiac dysrhythmia and unwillingness to

continue participating in the study. Based on the pilot study, 105 subjects were selected using convenience sampling and the following formula, as well (26).

Coin flipping was used to assign the subjects into the groups. Therefore, the heads were allocated to the intervention group and tails were assigned into the control group. In the next stage, the coin was flipped to specify the sub-group of patients already assigned into the intervention group, such that the heads were located in the lavender group and the tails were placed in the orange group. In each group, 35 patients were studied. Finally, 4 patients were removed due to the exclusion criteria. More precisely, 2 patients in the control group were excluded due to the chest pain and using analgesic drugs and in the lavender group, one patient failed to complete the questionnaire due to shortness of breath and another patient withdrew from the study.

Data collection tools included a demographic and disease questionnaire, a form to record physiological parameters before angiography (without any intervention) and immediately after the intervention, and the Spielberger's state-trait anxiety inventory (STAI). The validity and reliability of STAI have been confirmed (Cronbach's alpha = 0.89) by Najafi et al. (9). In the present study, its reliability was established by calculating Cronbach's alpha (0.874) regarding 20 patients.

Orange and lavender essential oils were obtained from Giah Essence Phytopharm Company, Gorgan, northern Iran. In the intervention groups, one hour before angiography, two drops of orange and lavender essential oils were separately applied by a dropper to a non-absorbent polyethylene tissue paper, which was tied to the collar of the participants. The subjects were then asked to breathe normally for 20 min (22). In the control group, the placebo (distilled water) was used and the anxiety of the subjects was measured and compared before and after the intervention. It should be noted that the intervention was controlled and supervised by a cardiologist. Statistical analysis was performed by SPSS 22 using chi-square, Fisher's exact test, one-way analysis of variance (ANOVA), paired *t*-test, Tukey's post-hoc test, Kruskal-Wallis test, paired Wilcoxon test and Mann-Whitney U test.  $P < 0.05$  was considered statistically significant.

#### 4. Results

In cases with normal distribution (anxiety), one-way ANOVA was used to compare the groups before and after the intervention and Tukey's post hoc test was applied for intragroup comparisons.

In contrast, for variables with no normal distribution (age, pulse rate, respiration rate and systolic and diastolic

blood pressure), Kruskal-Wallis test was used to assess differences between groups and the paired Wilcoxon test was employed for intragroup comparisons. In addition, Mann-Whitney U test was used to determine significant differences between groups.

The three groups ( $n = 35$ ) were subjected to the pre-test. Four patients were excluded through the study. Two patients in the control group were excluded due to the chest pain and using analgesic medications and in the lavender group, one person failed to complete the questionnaire and another subject withdrew from the study. Accordingly, the control and lavender groups contained 33 subjects and no exclusion was experienced by the orange group ( $n = 35$ ).

The mean age of patients was  $58.8 \pm 6.40$  years. The majority of subjects were female (56.4%) and married (77.2%). Moreover, 46.5% of the samples were illiterate and 89.1% had no underlying disease. The results exhibited no statistically significant difference between three groups in terms of demographic characteristics (Table 1).

Due to the normal distribution of anxiety scores, the results of ANOVA test showed no significant difference between the control, lavender and orange groups before the intervention. However, the mean score of anxiety significantly differed between these groups after the intervention. The results of Tukey's post hoc test indicated statistically significant differences between the control and lavender groups, the control and orange groups as well as the lavender and orange groups (Table 2).

Physiological variables (pulse rate, respiration rate and systolic and diastolic blood pressure) were not normally distributed, so the results of Kruskal-Wallis nonparametric test showed significant differences between three groups in terms of pulse rate, respiration rate and systolic blood pressure after the intervention. Similarly, the results of Tukey's post hoc test demonstrated significant differences between the control group and two intervention groups in pulse rate, respiration rate and systolic blood pressure (Table 3).

#### 5. Discussion

The aim of this study was to explore the effect of aromatherapy with lavender and orange essential oils on the level of anxiety in patients undergoing coronary angiography. The results confirmed the positive impact of this intervention on reducing anxiety in patients who are subjected to angiography.

In a recent study conducted in Iran, Abdi et al. (2019) examined the effect of orange essential oil on anxiety in patients undergoing coronary angiography. They randomly divided the patients into two groups. The control group

**Table 1.** Demographic Characteristics of the Subjects in the Three Studied Groups

Characteristics	Lavender (N = 33)	Orange (N = 35)	Control (N = 33)	P Value
<b>Gender</b>				0.451 <sup>a</sup>
Male	12 ± 36.4	18 ± 51.4	14 ± 42.4	
Female	21 ± 63.6	17 ± 48.6	19 ± 57.6	
<b>Marital status**</b>				0.298 <sup>b</sup>
Single	3 ± 9.1	1 ± 2.9	2 ± 6.1	
Married	22 ± 66.7	31 ± 88.6	25 ± 75.8	
Other	8 ± 24.2	3 ± 8.6	6 ± 18.2	
<b>Education</b>				0.554 <sup>b</sup>
Illiterate	16 ± 48.5	14 ± 40.0	17 ± 51.5	
Primary school	10 ± 30.3	10 ± 28.6	7 ± 21.2	
High school	5 ± 15.2	10 ± 28.6	5 ± 15.2	
Academic education	2 ± 6.1	1 ± 2.9	4 ± 12.1	
<b>Disease history</b>				0.783 <sup>b</sup>
Yes	5 ± 15.2	3 ± 8.6	3 ± 9.1	
No	28 ± 84.8	32 ± 91.4	30 ± 90.9	
<b>Age, y</b>	60.12 ± 6.79	57.80 ± 6.21	58.64 ± 6.11	0.176 <sup>c</sup>

<sup>a</sup>Chi-square test<sup>b</sup>Fisher's exact test<sup>c</sup>Kruskal-Wallis test

(n = 33) received a placebo (distilled water) and the intervention group (n = 35) inhaled orange essential oil for 20 min, dropped on a non-absorbent polyethylene tissue paper. The Spielberger's STAI was administered to measure patients' anxiety before and after the intervention. The findings showed that compared to the control group, the level of anxiety in the intervention groups decreased significantly after aromatherapy (P = 0.025). Moreover, anxiety scores in the intervention groups differed significantly before and after aromatherapy. The present study also confirmed the effectiveness of aromatherapy using orange essential oil in relieving anxiety in patients undergoing coronary angiography.

Based on the results of the current research, there was a significant difference in the anxiety score in the lavender group before and after the intervention, indicating the impact of aromatherapy on mitigating anxiety, which is consistent with the results reported by Pourmovahed et al. (3), proposing lavender aromatherapy as a nursing practice to alleviate anxiety in patients undergoing coronary artery bypass grafting.

In the same vein, Najafi et al., Cho et al. and Kamrani et al. corroborated the impact of lavender inhalation on reducing anxiety in patients with myocardial infarction (9), ICU patients during percutaneous coronary intervention (27) and those with burns (28).

However, different results have been reported in several other studies (16, 19).

Tayebi et al. probed the effect of lavender aromatherapy on depression, anxiety and stress in hemodialysis patients and found that the mean scores of depression and stress in the intervention group dropped significantly after aromatherapy. However, the decline in the anxiety score was not statistically significant and lavender aromatherapy had no effect on reducing anxiety (16).

On the other hand, the results of the present study are not consistent with the results of Neisi et al. study on the impact of lavender aromatherapy on anxiety and plasma cortisol alteration in hemodialysis patients. In fact, Neisi et al. concluded that lavender aromatherapy could not relieve anxiety in hemodialysis patients, however it was effective in reducing plasma cortisol in the studied subjects (18). Different results can be due to the differences in the used methods, the length of lavender essential oil administration and also its composition.

The incompatibility between the studies by Tayebi et al. and Neisi et al. may be attributed to the fact that angiography-induced anxiety is a transient condition which is different from hemodialysis-induced anxiety as a chronic condition.

The results of present study showed that anxiety level was lower in the orange group than that of the lavender

**Table 2.** Comparing Anxiety and Vital Signs in the Control, Orange and Lavender Groups

Variable	Control, Mean $\pm$ SD	Lavender, Mean $\pm$ SD	Orange, Mean $\pm$ SD	P Value
<b>Anxiety</b>				
Before intervention	4.79 $\pm$ 4.43	47.67 $\pm$ 4.20	45.94 $\pm$ 6.37	0.253 <sup>a</sup>
After intervention	47.91 $\pm$ 4.54	44.18 $\pm$ 4.26	37.57 $\pm$ 8.15	0.000 <sup>a</sup>
P value	0.716	0.000	0.000	
<b>Pulse rate</b>				
Before intervention	74.0 $\pm$ 5.85	74.55 $\pm$ 4.85	74.20 $\pm$ 3.64	0.681 <sup>b</sup>
After intervention	75.06 $\pm$ 3.73	70.58 $\pm$ 4.30	71.26 $\pm$ 3.79	0.000 <sup>b</sup>
P value	0.368	0.000	0.000	
<b>Respiration rate</b>				
Before intervention	18.27 $\pm$ 2.60	18.61 $\pm$ 3.17	18.86 $\pm$ 2.13	0.105 <sup>b</sup>
After intervention	18.45 $\pm$ 3.01	19.91 $\pm$ 0.80	20.40 $\pm$ 1.82	0.010 <sup>b</sup>
P value	0.529	0.006	0.000	
<b>SBP</b>				
Before intervention	123.48 $\pm$ 10.40	123.79 $\pm$ 10.23	123.09 $\pm$ 12.80	0.702 <sup>b</sup>
After intervention	123.91 $\pm$ 8.91	117.88 $\pm$ 7.37	117.31 $\pm$ 9.47	0.001 <sup>b</sup>
P value	0.501	0.000	0.000	
<b>DBP</b>				
Before intervention	77.12 $\pm$ 6.50	77.73 $\pm$ 6.51	77.71 $\pm$ 8.34	0.877 <sup>b</sup>
After intervention	77.61 $\pm$ 7.59	77.58 $\pm$ 5.61	77.86 $\pm$ 7.89	0.891 <sup>b</sup>
P value	0.713	1.00	0.862	

<sup>a</sup>Analysis of variance was used for intergroup comparison and paired *t*-test was used for intragroup comparison.

<sup>b</sup>Kruskal-Wallis test was used for intergroup comparison and paired Wilcoxon test was used for intragroup comparison.

**Table 3.** Post Hoc Test Results of Anxiety and Hemodynamic Parameters in the Three Studied Groups After the Intervention

Groups	Anxiety <sup>a</sup>	Pulse Rate <sup>b</sup>	Respiration Rate <sup>b</sup>	Systolic Blood Pressure <sup>b</sup>
Control-lavender	0.034	0.000	0.024	0.003
Control-orange	0.000	0.001	0.007	0.001
Orange-lavender	0.000	0.347	0.549	0.398

<sup>a</sup>Tukey's post-hoc test

<sup>b</sup>Mann-Whitney U test

group, demonstrating that orange essential oil is more effective to reduce patients' anxiety before angiography than lavender aromatherapy. Farshbaf-Khalili et al. also compared the effects of lavender and bitter orange on allaying anxiety in menopausal women. Their results revealed the benefits of both types of aromatherapy, however no significant difference was observed between two groups by inhaling the plants (29), which is not consistent with the present study.

Aromatherapy can modulate olfactory neurotransmitters and the limbic system, as well. To transmit sensory information to the center of the brain, all known neurotransmitters in the olfactory bulb of the olfactory pathway

and the limbic system can exert secondary effects on the behavior and status of diseases regulated by the same neurotransmitters (24).

Regarding hemodynamic variables and according to the Abdi Joubari et al. (24) results, the results of our study indicated significant differences in terms of pulse rate, respiration rate and systolic blood pressure after the intervention, however the orange group experienced more favorable results than the control group. Meanwhile, Kamrani et al. suggested that orange essential oil does not influence hemodynamic parameters in patients undergoing orthopedic surgery (30).

Our findings also showed a significant improvement in

the status of hemodynamic variables (systolic blood pressure, pulse rate and respiration rate) after aromatherapy. This finding is consistent with the reports by Rajai et al. (31), but is not in line with the results obtained by Shiina et al. (32). Lavender essential oil seems to alleviate anxiety and reduce hypotension in cardiac patients through sedative effects and decreasing adrenocorticotropin and ultimately epinephrine and norepinephrine levels (33).

### 5.1. Conclusions

The findings of this study established that aromatherapy can be adopted as a complement to other therapies or even an alternative therapeutic method. This side-effect-free intervention can be used as a practical measure in anxiety-ridden situations, such as diagnostic procedures. It is proposed to be used by nurses through their complementary therapies to reduce patients' anxiety.

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### Footnotes

**Authors' Contribution:** Homyra Tahmasebi: theoretical formulation, preparation of papers and final report (discussion and suggestions); Hava Abdi Joubari: literature review and data analysis; Amirreza Poorkhiz: data collection and research implementation.

**Clinical Trial Registration Code:** It is not declared by the authors.

**Conflict of Interests:** The authors have no conflict of interest to declare.

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