

## ***The Effectiveness of Orange Essential Oil Aromatherapy on Blood Pressure, Pulse Rate, and Respiratory Rate of Patients Scheduled for Coronary Angiography: A Clinical Trial***

Tahmasebi H<sup>1\*</sup>, Abasi E<sup>2</sup>, Pourhosein S<sup>3</sup>

<sup>1</sup>Instructor, Department of Nursing, School of Nursing and Midwifery, Islamic Azad University, Sari Branch, Sari, Iran

<sup>2</sup>MSc, PhD Candidate in Reproductive Health, School of Nursing and Midwifery, Islamic Azad University, Sari Branch, Sari, Iran

<sup>3</sup>MSc, Department of Nursing, School of Nursing and Midwifery, Islamic Azad University, Sari Branch, Sari, Iran

**\*Corresponding Author:** Islamic Azad University Sari Branch, Nursing and Midwifery Faculty, Sari, Iran

**Tel:** 0098- 9112514100

**Email:** htahmasebi@iausari.ac.ir

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### **Abstract**

**Background:** Patients scheduled for angiography experience pre-operative anxiety, which affects vital signs.

**Objectives:** The current study aimed to investigate the effectiveness of orange essential oil aromatherapy on blood pressure, pulse rate, and respiratory rate of patients before coronary angiography.

**Methods:** In this clinical trial, 70 patients scheduled for coronary angiography were separated into two groups of intervention and control. For those in the intervention group, two drops of orange essential oil were drip by emitters on a polyethylene handkerchief attached to the collar of the participants. Then, they were asked to breathe normally for 20 minutes. Vital signs were recorded before and after providing the intervention. Data were analyzed using SPSS version 16 using Chi-square, Fisher's exact test, independent t-test, U Mann-Whitney, Paired Wilcoxon, and paired t-test.

**Results:** There was no significant difference between the two groups concerning the mean vital signs before providing the intervention. However, after providing the intervention, a significant difference was found concerning pulse rate ( $71.3 \pm 26.79$ ), respiratory rate ( $15.2 \pm 11.04$ ), and systolic blood pressure ( $117.9 \pm 31.47$ ) between the two groups ( $P < 0.001$ ). In the control group, no significant difference was found concerning the pulse rate ( $75.3 \pm 06.72$ ), respiratory rate ( $17.2 \pm 18.28$ ), and systolic blood pressure ( $123.8 \pm 91.91$ ) before and after providing the intervention ( $P > 0.001$ ), and this difference was significant between the two groups ( $P < 0.001$ ). Also, there was no significant difference between the two groups concerning the diastolic blood pressure ( $P > 0.001$ ).

**Conclusion:** This study demonstrated that orange essential oil, as a complementary method, can reduce pulse rate, respiratory rate, and systolic blood pressure in people undergoing coronary angiography. Therefore, it can be considered as a safe and cheap alternative therapeutic option.

**Keywords:** orange essential oil; pulse rate; respiratory rate; coronary angiography

### **Introduction**

Coronary angiography is a definitive, reliable, and invasive method to diagnose coronary artery diseases [1]. It's the most widely used diagnostic modality for cardiac patients [2]. In 2010, over 3 million angiographies are performed in the United States [3]. In Iran, more than 260,000 cases of coronary angiography are performed annually [4]. Although it has several advantages, it also contains disadvantages such as high anxiety, mainly due to its invasive nature, which in turn

affects the vital signs, such as increased pulse rate, respiratory rate, and systolic and diastolic blood pressure [5]. Vital signs are objective criteria for assessing essential physiological functions of the body, which are also useful for assessing the need for angiography [6]. Increased vital signs is common before angiography that worsens the patient's health condition and thereby affects the angiography outcomes [7]. Anxiety stimulates the sympathetic nervous system causing an increase in heart rate, heart

excitability, and blood pressure, which in turn increases the heart's need for oxygen and disrupts blood supply to heart cells [2]. Anxiety and vital signs are mutually supportive [6]. There are pharmaceutical and non-pharmaceutical strategies to control anxiety [8]. Since pharmaceutical strategies may cause side effects, the tendency towards non-pharmaceutical strategies is increasing (e.g. complementary medicine) [9]. Aromatherapy is a common method in complementary medicine [10], that, if needed, can be used by nurses.

Complementary medicine is a low-risk, cost-effective treatment with limited side effects, which its application is increasing [11,12]. Orange essential oil, also known as Citrus aurantium, is widely used for aromatherapy [13]. It stimulates the central nervous system and has sedative, anti-inflammatory, antispasmodic, and anti-bloating effects. Besides, it can reduce blood pressure and dilation [14]. Also, some studies mentioned the anxiolytic effects of orange essential oil during labor [15] and for dentistry services [16]. Findings about the effects of orange essential oil on vital signs are controversial [17,18] and further studies are needed. Furthermore, based on the field observations of the researcher, in most cases, the respiratory rate and heart rate of patients increases before angiography, which in some cases results in delaying or canceling angiography. On the other hand, monitoring and controlling vital signs are among important nursing care. The current study aimed to investigate the efficacy of orange essential oil aromatherapy on blood pressure, pulse rate, and respiratory rate of patients before coronary angiography in Fatemeh Zahra Hospital in the city of Sari in 2019.

## Methods

The current clinical trial is confirmed by the Ethics Committee of the Islamic Azad University Sari Branch (code:11-1397 R.IAU.SARI.REC). In the present study, 70 patients scheduled for coronary angiography admitted to the angiography ward of Fatemeh Zahra Hospital in the city of Sari, which is the referral center of Mazandaran province, in 2018 are investigated. Inclusion criteria were complete consciousness, coronary angiography for the first time, not receiving invasive procedures before angiography, and not using sedatives or other

therapeutic interventions (e.g. herbal essential oils and medications) six weeks before angiography. Exclusion criteria were sudden changes in vital signs, dangerous cardiac dysrhythmias, and unwillingness to continue the study. The sample size was calculated using the following formula [19]:

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 (S_1^2 + S_2^2)}{(\mu_1 - \mu_2)^2}$$

Type one error and type two error were considered as 5% and 2%, respectively. The study power was also considered to be 80%. Participants were randomly divided into two groups of 35 subjects: control and intervention. Two subjects of the control group were excluded because they couldn't fill the questionnaire due to chest pain and receiving sedatives. Data were collected using a questionnaire on demographic (i.e. age, gender, married status, history of diseases, and type of health insurance) and disease information, vital sign sheet, and medical equipment such as barometer. Information were recorded before and immediately after the angiography. The validity of the mercury barometer was assessed by calibrating the device and its reliability was assessed using the test-retest method. For this purpose, the blood pressure of 10 randomly selected patients was measured two times with a distance of five minutes. Then, their mean correlation was compared to the correlation coefficient of the lower 95% of the instrument. Blood pressure was measure after a short rest in laying down position. Also, pulse and respiratory rates were manually recorded for one minute.

The orange essential oil was obtained from the Gorgan Essence Company. For those in the intervention group, one hour before the angiography, two drops of orange essential oil were drip by emitters on a polyethylene handkerchief attached to the collar of the participants. Then, they were asked to breathe normally for 20 minutes [20]. Subjects of the control group received two drops of distilled water (placebo), with similar color as the orange essential oil. The vital signs were measured before and after the intervention. It worth noting that a cardiologist supervised the study.

Data were analyzed using SPSS version 16 by chi-square, Fisher's exact test, independent t-test,

U Mann-Whitney, paired Wilcoxon, and t-tests. Statistical significance was considered when  $p\text{-value} < 0.05$ . The chi-square and Fisher's exact tests were used to compare qualitative variables. As data were not normally distributed, U Mann-Whitney and paired Wilcoxon tests were used for intra- and inter-comparison of groups before and after the intervention, respectively.

### Results

In total 70 subjects participated in the present study, but in the control group, two subjects were

removed due to incompleteness of questionnaires, because of chest pain and receiving sedatives. Therefore, data of 35 subjects in the orange essential oil and 33 subjects in the control group were analyzed. The mean age of participants was  $58.8 \pm 6.4$  and most of them were female (56.4%) and married (77.2%). Most of the participants were educated up to primary only (46.5%) and 89.1% of them had background diseases. There was no significant difference between the two groups concerning demographic information (Table 1).

**Table 1: Demographic information of participants separated by the group**

Property	Orange essential oil 35=n	Control 33=n	P	
Gender*	Male	(4.51)18	(4.42)14	457.0
	female	(6.48)17	(6.57)19	
Marriage status**	Married	(9.2)1	(1.6)2	405.0
	Single	(6.88)31	(8.75)25	
	other	(6.8)3	(2.18)6	
Education level**	Illiterate	(0.40)14	(5.51)17	244.0
	Primary	(6.28)10	(2.21)7	
	Tertiary	(6.28)10	(2.15)5	
	University	(9.2)1	(1.12)4	
Background disease**	Yes	(6.8)3	(1.9)3	00.1
	No	(4.91)32	(9.90)30	
Age (Year)***	21.6±80.57	11.6±64.58	498.0	

U Mann-Whitney\*\*\*; Fisher's exact test\*\*; Chi-square\*.

Vital signs (pulse rate, respiratory rate, and systolic and diastolic blood pressure) were measured on the day that the patient was scheduled for angiography (before any intervention). Based on the results there was no significant difference between the two groups

before providing the intervention; however, after providing the intervention, the two groups were significantly different concerning pulse rate, respiratory rate, and systolic blood pressure (Table 2).

**Table 2: Comparison of blood pressure, pulse rate, and respiratory rate in control and intervention groups before and after the intervention**

Variable	Time	Control ±SDMean	Orange essential oil ±SD Mean	P**
Pulse rate	Before	85.5±0.74	64.3±20.74	633.0
	After	73.3±06.75	79.3±26/71	001.0
	P*	368.0	000.0	
Respiratory rate	Before	27.2±33.17	41.2±63.17	444.0
	After	28/2±18/17	04.2±11.15	000.0
	P*	529.0	000.0	
Systolic blood pressure	Before	40.10±48.123	80.12±09.123	560.0
	After	91.8±91.123	47.9±31.117	001.0
	P*	501.0	000.0	
Diastolic blood pressure	Before	50.6±12.77	34.8±71.77	949.0
	After	59.7±61.77	89.7±86.77	939.0
	P*	713.0	862.0	

\* Intra-group comparison using the paired Wilcoxon test

\*\* Comparing groups using Mann-Whitney U test

## Discussion

This study demonstrated that inhaling orange essential oil could significantly reduce systolic blood pressure, pulse rate, and respiratory rate in the intervention group compared to the control group. Mi-Ra et al. (2018), in a study entitled "Effectiveness of aromatherapy on vital signs, physical, and physical Stress relief and sleep quality of students", concluded that aromatherapy had a positive physiological effect on vital signs, physical, and physiological stress relief, and sleep quality of students [21]. Also, Jafari et al. (2013), in a study entitled "effect of aromatherapy with orange essential oil on salivary cortisol and pulse rate in children during dental treatment", reported a significant association between decreasing anxiety and heart rate [16]. In another study, Moradi et al. (2015), in a study entitled "effects of Lavender aromatherapy on the anxiety and vital signs of patients with ischemic heart diseases hospitalized in cardiac intensive care units" showed that this intervention could reduce anxiety level in patients with ischemic heart disease and had a positive effect on vital signs [22]. Yadegari et al. (2015) in a study aimed to investigate the effect of inhaling jasmine flower on some physiological parameters in patients before laparotomy in the general surgery ward, reported a significant difference between the two groups concerning physiological variables such as pulse rate, respiratory rate, and systolic and diastolic blood pressure [11]. These studies demonstrated

the positive effect of aromatherapy on reducing anxiety and improving vital signs of patients before providing medical interventions. In contrast, Cevik (2017) reported that inhaling orange and lavender essential oil didn't affect the anxiety and vital signs of nursing students while giving an injection for the first time [17]. Also, Hekmat Poe et al. (2017) investigated the effect of orange essential oil on pain and vital signs of patients with limb fractures and concluded that although the blood pressure was lower in the intervention group, it was not statistically significant compared to the control group [18]. As mentioned before, findings concerning the effect of aromatherapy with orange essential oil are controversial. This difference can be attributed to various reasons such as using different oils, duration of the study, and the administration method. Therefore, the authors suggest performing further studies on special patients and different groups.

## Conclusion

This study demonstrated that aromatherapy can be used as a complementary method along with routine treatments or even as an alternative method. Therefore, aromatherapy can be used as an effective and uncomplicated strategy for reducing anxiety in anxious situations. Hence, nurses can use this method for stabilizing vital signs.

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### Conflict of interest

The authors declare no conflict of interest.

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