Complementary Therapies in Clinical Practice 34 (2019) 201–207

Contents lists available at ScienceDirect

Complementary Therapies in Clinical Practice

journal homepage: www.elsevier.com/locate/ctcp

The effect of inhalation aromatherapy with rose essential oil on the anxiety of patients undergoing coronary artery bypass graft surgery

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ARTICLE INFO

Keywords:
Anxiety
Aromatherapy
Coronary artery bypass graft surgery
Rose essential oil

ABSTRACT

Background and purpose: Anxiety is one of the most common responses of patients awaiting coronary artery bypass graft (CABG) surgery to stressful conditions before surgery. This study is intended to examine the effect of inhalation aromatherapy with rose essential oil on the anxiety of patients undergoing CABG surgery.

Materials and methods: This was a single-blind randomized clinical trial of 66 patients undergoing CABG surgery. The experimental group inhaled three drops of 4% rose essential oil for 10 minutes one night and one hour before surgery. The control group did not receive any intervention from the research team.

Results: The level of anxiety was measured before and 30 minutes after the intervention using the Spielberger's Anxiety Inventory. Prior to surgery, an independent *t*-test showed that the mean score of anxiety was not significantly different between the experimental and control groups ($p = 0.41$). Aromatherapy with rose essential oil did not cause any significant differences in state anxiety ($P = 0.41$), trait anxiety ($P = 0.90$), and total anxiety ($P = 0.69$).

Conclusion: Our results revealed that inhalation aromatherapy with rose essential oil could not significantly reduce anxiety in CABG patients. Future research with larger sample sizes and using different concentrations of rose essential oil are needed to achieve more definitive conclusions.

1. Introduction

Cardiovascular diseases have the highest mortality rate in the developing countries [1]. According to the World Health Organization (WHO), 17.7 million people died of cardiovascular diseases in 2016, and cardiovascular diseases account for 31% of all global deaths [2]. Coronary artery diseases also account for 50% of annual deaths in Iran [3]. Coronary artery bypass graft (CABG) surgery is one of the most commonly used surgical procedures for patients with coronary artery stenosis [4]. Annually, 30,000 to 40,000 people undergo cardiac surgery, and CABG constitutes 50–60% of these surgeries [5].

Cardiac surgery is often associated with anxiety and fear in patients undergoing it [6]. According to a study, the mean levels of mild and moderate anxiety in patients before coronary artery bypass graft surgery were 36% and 61%, respectively [7]. Anxiety before cardiac surgery can lead to significant changes in the patient's heart rate and blood pressure [1], and it may have deleterious effects on the patient's recovery process [7]. Further, anxiety before surgery can prolong hospitalization [8]. A study revealed that anxiety before CABG surgery elevates the risk of mortality [9]. Therefore, management of preoperative anxiety in these patients is highly critical. Today, pharmacological agents are widely used to control anxiety in patients undergoing cardiac surgery [6]. Sedative medications are associated with complications such as respiratory depression [4], drug dependence, nausea and vomiting, drowsiness, as well as decreased blood pressure and heart rates [10]. Non-pharmacological approaches such as inhalation aromatherapy [11], massage therapy [12], and music therapy [13] have been considered for managing anxiety in such patients [14].

Aromatherapy, one of the complementary and alternative medicine (CAM) therapies, uses essential oils and herbal essences to treat several

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https://doi.org/10.1016/j.ctcp.2018.11.014
Received 3 September 2018; Received in revised form 15 November 2018; Accepted 28 November 2018

diseases and improve the health of the body [15]. In this regard, aromatherapy is used in several different ways, such as massage, compress, bath (foot bath), and inhalation [16]. Previous studies have examined the effects of aromatherapy on anxiety [11], pain [17] and wound healing [18]. A large number of plants are considered by researchers to relieve the patient's anxiety [19,20]. Rosa damascena is one of the most applicable and effective plants used in traditional medicine worldwide [21] and in Iran [22]. Rose is of the genus Rosa and has approximately 150 species [23]. The origin of this plant in Iran is Kashan, Isfahan Province [24]. It has effective compounds such as citronellol, linalool, geraniol, flavonoids, and citral [25]. Rosa damascena has anti-inflammatory, antimicrobial, anti-anxiety, anticancer, and pain-relieving effects and is useful in the treatment of heart diseases [21]. One of the beneficial effects of rose essential oil is to alleviate anxiety [22]. Inhalation of the fragrance of this plant has an impact on the autonomic nervous system, and in turn, reduces sympathetic nervous system activity and the concentration of adrenalin, resulting in relaxation [26]. The results of various studies have suggested that aromatherapy with rose essential oil is effective in reducing the patient's anxiety [27–29]. The results of a study by Dehkordi et al. showed that aromatherapy with 2% rose essential oil soothes the patient's anxiety during dialysis [30]. However, Babaii et al. in another clinical trial reported that 10% rose essential oil did not affect anxiety in patients undergoing cardiac catheterization [11]. To the best of our knowledge, no studies have yet been conducted to investigate the effect of inhalation aromatherapy with rose essential oil on the anxiety of patients undergoing CABG surgery. Therefore, this study was carried out to determine the effect of inhalation aromatherapy with rose essential oil on the anxiety level of patients undergoing CABG surgery.

2. Materials and methods

2.1. Sample and sampling method

The present study was a single-blind randomized clinical trial conducted in a hospital affiliated to Mazandaran University of Medical Sciences, Sari, Iran. The study was performed between October 2017 and January 2018. Patients undergoing CABG surgery who had been admitted to the hospital since the day before surgery were enrolled using the convenient sampling method and based on the inclusion criteria. The inclusion criteria were willingness to participate in the study, age of 18 years or older, attainment of a score higher than 32 or less than 65 from the State-Trait Anxiety Inventory, candidacy for CABG surgery, lack of olfactory problems [17], non-use of sleep medications or tranquilizers, no known history of anxiety disorders, no experience of stressful events in the past six months (i.e., death of a close relative), and the ability of verbal communication. The patients' sense of smell was evaluated by a cotton ball soaked with coffee extracts. The exclusion criteria consisted of a history of respiratory diseases and asthma, a history of allergy to plants [29], pregnancy, and drug addiction.

Based on a study in Iran [31] and using the mean and standard deviation of anxiety after intervention in the experimental (28.47 ± 5.48) and control (47.17 ± 7.17) groups, power of 80%, significance level of less than 5%, and 10% likelihood of attrition, the standard sample size was calculated to be 66 (n = 33 per group). The participants were randomly assigned to experimental (group A) and control (group B) groups using permuted block method (11 blocks) of length 6. Sequentially numbered sealed opaque envelopes were used to conceal the group assignment. Each envelope contained a card marked with letter *A* for the experimental group or letter *B* corresponding to the control group in random sequences. This was performed by an individual who was not a member of the research team. Patients were randomly allocated to one of the two groups by means of the randomization sequence (Fig. 1).

2.2. Measurement instruments

The data collection tools included a questionnaire containing socio-demographic/clinical characteristics (i.e., age, gender, marital status, occupation, educational level, history of surgery, history of hospitalization, place of residence, and history of respiratory diseases) and the Spielberger's State-Trait Anxiety Inventory. The inventory contains 40 items, the first 20 of which measure state anxiety and the second 20 questions evaluate trait anxiety. State anxiety denotes an individual's feeling in response to a specific moment, and trait anxiety is a common feeling the individual experiences in most cases [14]. A score of 20–31 reflects mild anxiety, 32–42 below moderate anxiety, 43–53 above moderate anxiety, 54–64 relatively severe anxiety, and 65–75 severe anxiety. The scores can range from a minimum of 20 to a maximum of 80. Items are scored on a 4-point Likert scale (1 = not at all/almost never; 2 = sometimes; 3 = often; 4 = almost always). The reliability of the Spielberger's State-Trait Anxiety Inventory has been calculated to be 0.90 and 0.86 in the studies by Roohy et al. [32] and Safara et al. [33], respectively. In this study, the reliability of the inventory was calculated in four stages using the Cronbach's alpha. The Cronbach's alpha was 0.80 the night before surgery (pre-intervention), 0.79 the night before surgery (post-intervention), 0.81 one hour before surgery (pre-intervention), and 0.85 one hour before surgery (post-intervention).

2.3. Procedures

Socio-demographic/clinical characteristics were collected using a pre-structured questionnaire. The level of anxiety was then measured at baseline before intervention. In the experimental group, three drops [27] of 4% rose essential oil were poured on a 5×5 cm cotton cloth, and then it was fastened to the patients' clothes at a distance of 20 cm from their nose [34]. Rose essential oil was procured from the Barij Essence Pharmaceutical Company (Kashan, Iran), and then it was diluted with propylene glycol at a ratio of 1:25. For all the patients, the same dropper (Fanavar Teb Espadana Company, Iran) was used. The experimental group underwent inhalation aromatherapy in a separate, well-ventilated room at the temperature of 25 °C for 10 minutes [28]. After the intervention, the patients were transferred to their room. The patients were asked to inhale the aroma through normal breathing. The intervention was performed the night before surgery at 9 pm and one hour before surgery by a single nurse. The control group did not receive any intervention from the research team. Before and 30 min after each intervention [17,35], the anxiety level of the patients was measured by the Spielberger's State-trait Anxiety Inventory. The questionnaires were completed by a single assessor outside the research team, who was blinded to group allocation. It should be noted that all patients were scheduled to consult the hospital's psychologist before surgery, helping them reduce psychological distress and anxiety. They were also oriented to anesthesia- and surgery-related complications.

2.4. Data analysis

The data were analyzed using SPSS 21.0 software (SPSS, Inc, Chicago, IL). An independent *t*-test was used for quantitative variables and the Chi-square and Fisher's exact tests for qualitative variables. A paired *t*-test was employed for testing the changes before and after the intervention in the two groups. A repeated measures analysis of variance (rANOVA) was carried out to analyze the changes in anxiety level over time. To examine the normal distribution of the variables, the Kolmogorov-Smirnov test was employed. A significance level of less than 0.05 and confidence interval of 95% were considered statistically significant in all the tests.

2.5. Ethical considerations

The study protocol was approved by the Bioethics Committee of

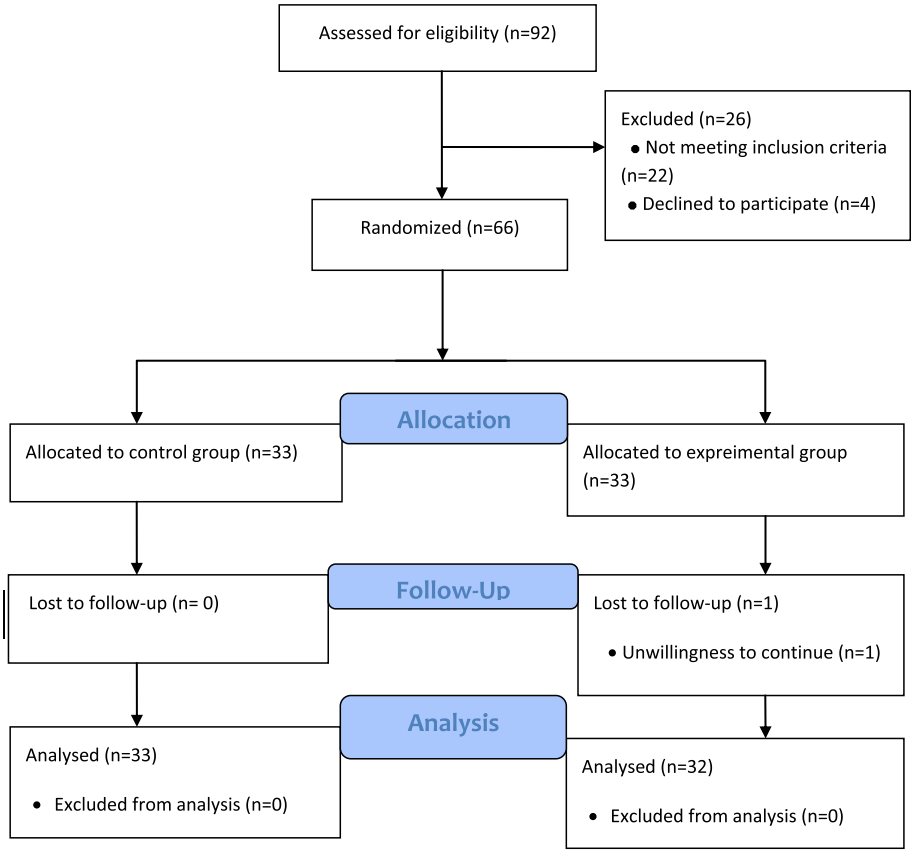

Fig. 1. CONSORT flow diagram of the study participants.

Mazandaran University of Medical Sciences (IR.MAZUS.REC.96.10234) in accordance with the Helsinki Declaration. The additional approvals were also obtained from the participating hospital. All the participants were informed of the confidential nature of the data and signed an informed consent form in which the study procedures and their rights had been delineated.

3. Results

A patient from the experimental group was withdrawn from the study because of unwillingness to remain in the trial. As a result, 33 patients in the control group and 32 patients in the experimental group were studied. The mean age of the experimental group was 63.9 ± 10.06 years (range: 36–81 years) and the mean age of the control group was 62.3 ± 8.69 years (range: 47–78 years). In both experimental (n = 18; 56.3% *vs* n = 14; 43.8%) and control (n = 20; 60.6% *vs* n = 13; 39.4%) groups the number of men was more than women. The socio-demographic/clinical characteristics of the patients are summarized in Table 1. The paired *t*-test showed that the mean scores of anxiety before the intervention in the experimental and control groups were 36.78 ± 5.48 and 36.03 ± 4.81, respectively. Furthermore, the mean scores of trait anxiety in the experimental and control groups were 36.65 ± 4.48 and 35.63 ± 3.95, respectively. The independent *t*-test did not reflect any significant differences between the two groups in the means of state anxiety (P = 0.55) and trait anxiety (P = 0.33) (Table 2). The rANOVA revealed that the effect of time on state anxiety (Fig. 2), trait anxiety (Fig. 3) and total anxiety (Fig. 4) was associated with significant changes in the experimental and control groups (P < 0.001). However, the effects of intervention as well as time and group interaction on state anxiety (P = 0.41), trait anxiety (P = 0.90) and total anxiety (P = 0.69) did not cause a significant difference (Table 3). In addition, the independent *t*-test showed

Table 1
The Scio-demographic/clinical characteristics of the participants[a].

Variables	Groups		Significance level
	Experimental (N = 32)	Control (N = 33)	
Age	62.30 ± 8.69	63.09 ± 10.06	0.73
gender			
Female	14(43.8%)	13(39.4)	0.72
Male	18(56.3%)	20(60.6%)	
History of hospitalization	28(87.5%)	27(81.8%)	0.73
History of surgery	24(75%)	27(63.6%)	0.32
Marital status			
Married	30(93.8%)	29(87.9%)	0.41
Widow(er) and divorced	2(6.3%)	4(12.1%)	
Single	0(0%)	0(0%)	

[a] Data are presented as number (percentage) or mean ± standard deviation.

a significant reduction in the mean difference of state anxiety before and after the intervention the night before surgery between the control and experimental groups (P = 0.003). The mean differences of trait anxiety (P = 0.091) and total anxiety (P = 0.167) before and after the intervention the night and morning before surgery were not significantly different between the two groups (Table 4).

4. Discussion

We sought to investigate the effect of inhalation aromatherapy with rose essential oil on the anxiety of patients undergoing CABG surgery. Our results showed no difference between the two groups in the mean score of anxiety before aromatherapy. Bikmoradi et al. in a randomized

Table 2
Mean and standard deviation of anxiety in the experimental and control groups before the intervention.

Variables	Groups	Mean ± standard deviation	Statistical test	Significance level (*t*-test)
State anxiety	Experimental	36.78 ± 5.48	0.58	0.55
	Control	36.03 ± 4.81		
Trait anxiety	Experimental	36.65 ± 4.48	0.97	0.33
	Control	35.63 ± 3.95		
Total anxiety	Experimental	73.43 ± 9.56	0.81	0.41
	Control	71.66 ± 7.94		

clinical trial examined the effect of inhalation aromatherapy with 2% lavender essential oil on the stress and vital signs of patients undergoing CABG surgery. The aromatherapy group received three drops of lavender essential oil for 20 minutes through oxygen mask, and in the control group, three drops of water were used in the same manner. The results demonstrated that the mean level of stress was not significantly different between the experimental and control groups in the three stages of before aromatherapy, two days post-operation, and three days post-operation [4]. Our findings revealed a significant reduction in the mean difference of state anxiety before and after the intervention the night before surgery between the two groups. Considering that research studies refer to the anti-anxiety effect of rose essential oil [22,36], the mean difference in state anxiety in the experimental group can be attributed to aromatherapy with rose essential oil. The inhalation of rose fragrance decreases anxiety and induces relaxation through an impact on the autonomic nervous system and limbic system, as well as the reduction of sympathetic nervous system activity [26]. In the central nervous system, the flavonoids bind to GABA receptors, like benzodiazepines, and in turn, cause sedative and anti-anxiety effects [37]. As reported by Seyyed-Rasooli et al., inhalation aromatherapy with 12% rose water significantly reduced anxiety in patients undergoing cholecystectomy [38]. In addition, the findings of current study indicated no significant difference in mean anxiety between the experimental and control groups after aromatherapy with rose essential oil. Babaii et al. in a randomized clinical trial found that aromatherapy with 10% rose essential oil could not significantly affect the mean anxiety score of patients before cardiac catheterization [11]. Conversely, Dehkordi et al. in a clinical trial investigated the effect of 2% rose essential oil on anxiety of hemodialysis patients. They found that aromatherapy with 2% rose essential oil could remarkably reduce the patients' anxiety during hemodialysis [30]. The possible cause of this discrepancy in the findings of Dehkordi et al. and Seyyed-Rasooli et al. may be different pathophysiological conditions of the participating patients, such as age and various underlying diseases [39]. Findings of some studies indicate that patients with coronary artery diseases suffer from higher levels of anxiety than other patients [40,41]. On the other hand, CABG surgery as a high-risk procedure can lead to increased anxiety and concern due to its potential complications such as renal failure and reduced physiological function of the body [39]. Adaptation to postoperative physical conditions, inability to perform past activities, and attempts to

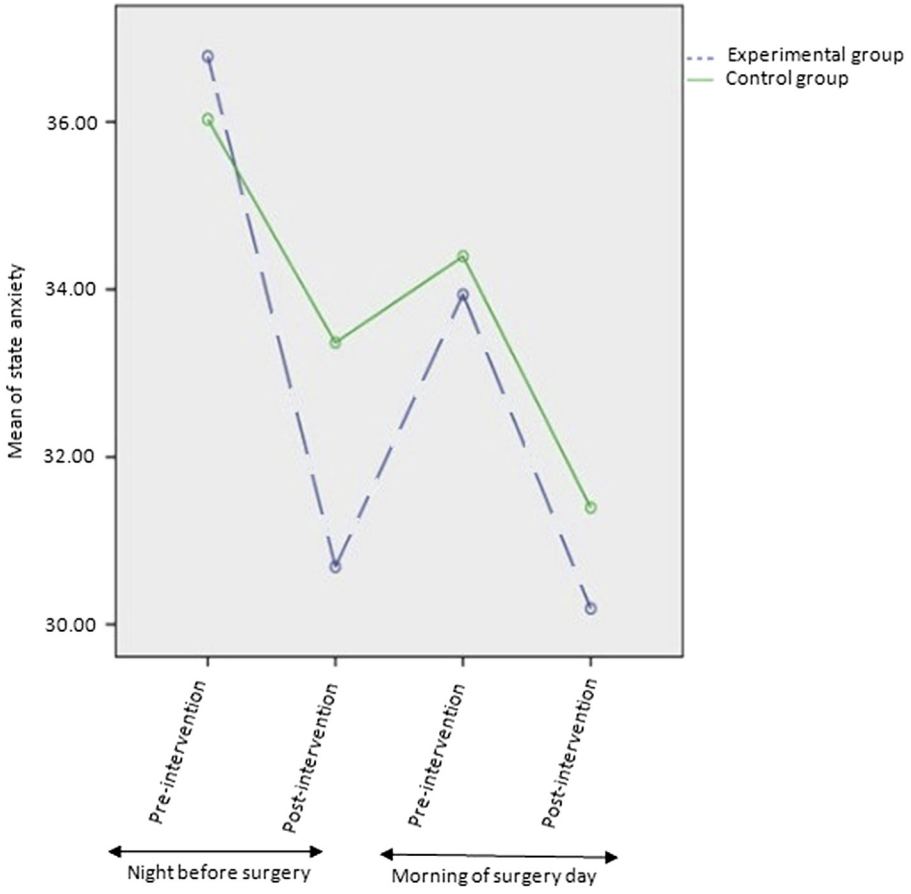

Fig. 2. Mean changes in state anxiety scores.

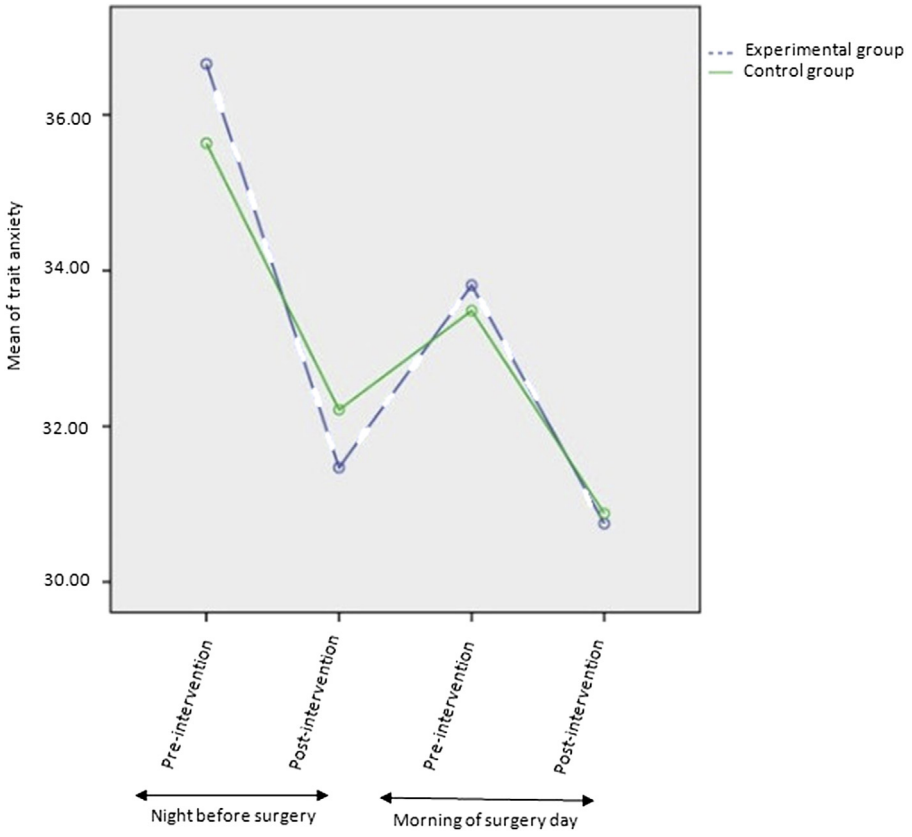

Fig. 3. Mean changes in trait anxiety scores.

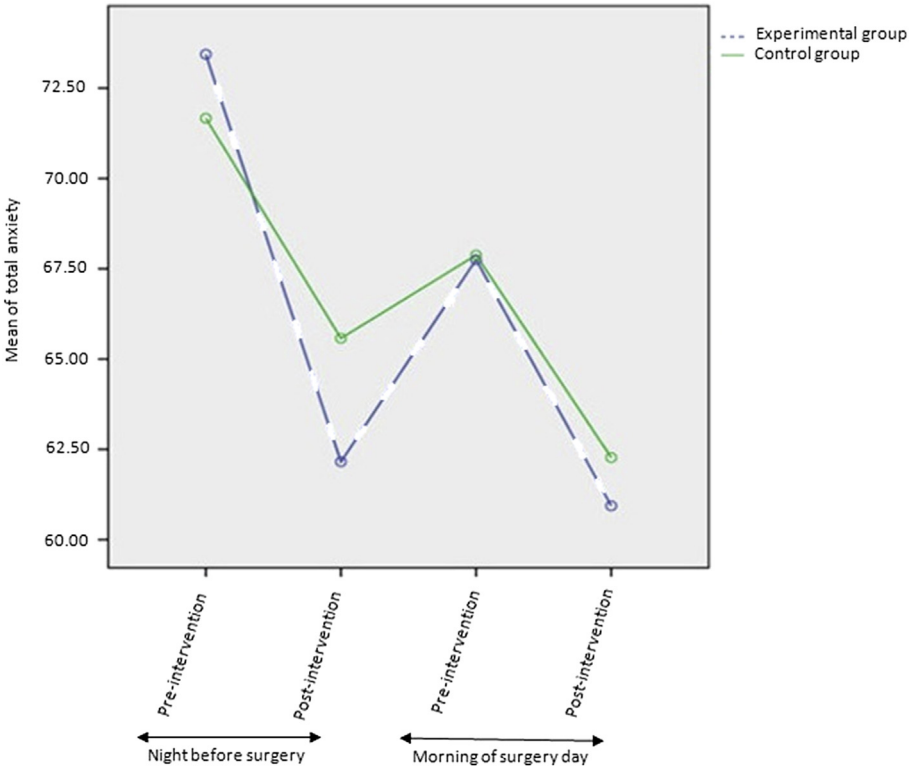

Fig. 4. Mean changes in total anxiety scores.

Table 3
Mean and standard deviation of anxiety in the two stages of pre- and post-intervention at four time points in the experimental and control groups.

Variables	Groups	Mean ± standard deviation				rANOVA[a]	
		Night before surgery		Morning of surgery day		F	P-value
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention		
State anxiety	Experimental	36.78 ± 5.48	30.68 ± 3.91	33.93 ± 3.34	30.18 ± 4.01	0.670	0.41
	Control	36.03 ± 4.81	33.36 ± 6.47	34.39 ± 6.08	31.39 ± 5.79		
Trait anxiety	Experimental	36.65 ± 4.48	31.46 ± 4.42	33.81 ± 4.09	30.75 ± 3.89	0.016	0.90
	Control	35.63 ± 3.95	32.21 ± 4.68	33.48 ± 4.50	30.87 ± 6.00		
Total anxiety	Experimental	73.43 ± 9.56	62.15 ± 7.14	67.75 ± 6.25	60.93 ± 7.26	0.160	0.69
	Control	71.66 ± 7.94	65.57 ± 10.17	67.87 ± 10.00	62.27 ± 11.54		

[a] Repeated measures analysis of variance.

Table 4
Comparison of the mean difference of anxiety in the experimental and control groups.

Variables	Groups	Mean ± standard deviation	Significance level (*t*-test)
State anxiety	Experimental	6.09 ± 4.33-	0.003
	Control	2.66 ± 4.72-	
Trait anxiety	Experimental	5.18 ± 4.38-	0.091
	Control	3.42 ± 3.88-	
Total anxiety	Experimental	12.50 ± 8.09-	0.167
	Control	−9.39 ± 9.73	

*Data are presented as mean ± standard deviation.

change lifestyle are among the main concerns of patients prior to cardiac surgery [42]. Differences in the effect of rose essential oil on anxiety in our participants and those of the study by Seyyed-Rasooli et al. (2014) can be attributed to differences in concentrations of essential oils [38]. On the other hand, the precise concentration and time for rose essential oil exposure have not yet been determined to induce anti-anxiety effects since studies have used diverse concentrations and exposure times for this purpose [11,27,30]. In the study by Seyyed-Rasooli et al. aromatherapy was performed for 30 minutes. That study investigated the impact of massage aromatherapy with lavender oil and inhalation aromatherapy with rose essential oil and lavender oil on pain and anxiety in patients with second-degree burns. The aromatherapy group inhaled three drops of rose essential oil and seven drops of lavender oil for 30 minutes. The results indicated a significant difference between the inhalation aromatherapy and massage aromatherapy groups and the control group in reduced pain and anxiety [34]. In the study by Dehkordi et al., the inhalation of rose essential oil was performed for one hour [30]. Some other possible causes of the difference in the results of the present study from those of other studies could be associated with the difference in approaches of inhalation aromatherapy administration, tools of anxiety measurement, or sample sizes.

One of the limitations of this study was that the experimental group was not blinded to the therapeutic method due to the distinct fragrance of rose essential oil. Considering the condition of the patients before heart surgery, aromatherapy could not be performed for a longer period and the patients could not be followed up for a longer period of time, which is another limitation of this study. However, this study has several strengths, including the careful selection of the participants based on the inclusion and exclusion criteria and their random placement in experimental and control groups, as well as data collection by a single assessor who was not a member of the research team and was blinded to group allocation.

5. Conclusion

Our findings suggest that inhalation aromatherapy with 4% rose essential oil cannot significantly alleviate anxiety in patients undergoing CABG surgery. However, the results of this study are a step towards further research examining the effects of inhalation aromatherapy with rose essential oil on the anxiety of patients undergoing coronary artery bypass graft surgery. Future research should focus on different concentrations of rose essential oil and a larger cohort of CABG patients. Future studies should also compare the anti-anxiety effects of rose essential oil and lavender essential oil in these patients.

Conflicts of interest

There is no conflict of interest to declare.

Acknowledgements

This study is part of a Master's thesis of Fatemeh Fazlollahpour-Rokni (Critical Care Nursing, School of Nursing and Midwifery, Mazandaran University of Medical Sciences, Sari, Iran). The study was registered in the Iranian Registry of Clinical Trials (http://www.irct.ir) with the registration number: IRCT2017091919677N5. Funding for this study was provided by the Mazandaran University of Medical Sciences.

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