The Effect of Benson Relaxation Technique and Lavender Aromatherapy on Anxiety and Hemodynamic Indices of Patients Undergoing Coronary Artery Bypass Grafting: A Randomized Clinical Trial

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ABSTRACT

Introduction: Anxiety and changes in hemodynamic indices are common problems of patients undergoing coronary artery bypass grafting (CABG). These problems can affect the outcome of the surgery.

Objective: This study aimed to determine the effect of the Benson relaxation technique and lavender aromatherapy on anxiety and hemodynamic indices of patients undergoing CABG.

Materials and Methods: In this randomized, nonblinded, parallel-group controlled trial, 105 candidates for CABG were randomly selected by convenience sampling and then allocated to relaxation (n=35), aromatherapy (n=35), and control (n=35) groups by a six-block random assignment. Benson relaxation technique was used in the relaxation group. In the aromatherapy group, the inhalation of five drops of lavender essential oil with a concentration of 20% was used, and the control group only received routine nursing care before surgery. Data were collected using demographic characteristics form, checklist of hemodynamic indices, and Spielberger state-trait anxiety inventory before and after the intervention. The obtained data were analyzed using descriptive and inferential statistics (the chi-square test, the Kruskal-Wallis test, the Wilcoxon test, one-way ANOVA, the paired t-test, post hoc Mann-Whitney U test, and the Bonferroni test).

Results: The Mean±SD ages of the patients were 58.46±12.45 years in the relaxation group, 61.54±11.93 years in the aromatherapy group, and 60.17±14.76 in the control group. After the intervention, the respiratory rate, pulse rate, systolic blood pressure, and mean trait-state anxiety scores significantly differed in the intervention groups compared to the control group (P<0.05). However, oxygen saturation and diastolic blood pressure were not significantly different in the two intervention groups from the control group. Benson relaxation technique was significantly superior only on systolic blood pressure compared to lavender aromatherapy (P=0.001).

Conclusion: Benson relaxation and lavender aromatherapy as non-invasive, easy, and cheap complementary therapies can effectively reduce anxiety and stabilize hemodynamic indices of patients undergoing CABG surgery in clinical settings.

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Highlights

• The Benson relaxation technique is effective on anxiety and hemodynamic indices.

• The lavender aromatherapy is effective on anxiety and hemodynamic indices.

• Regarding systolic blood pressure, the Benson relaxation technique is significantly more effective than lavender aromatherapy.

• Effective complementary therapies can be used in nursing care.

Plain Language Summary

Anxiety and changes in hemodynamic indices are common problems of patients undergoing coronary artery bypass grafting (CABG). These factors can affect the outcome of the operation. This study aimed to determine the effect of the Benson relaxation technique and lavender aromatherapy on the anxiety and hemodynamic indices of patients undergoing CABG. In this study, 105 candidates for CABG were randomly selected by convenience sampling and then allocated to relaxation, aromatherapy, and control groups. Benson relaxation technique was used in the relaxation group. In the aromatherapy group, the inhalation of five drops of lavender essential oil with a concentration of 20% was used, and the control group only received routine nursing care before surgery. Respiratory rate, pulse rate, systolic blood pressure, and mean trait-state anxiety scores were significantly different in the two intervention groups compared to the control group. However, oxygen saturation and diastolic blood pressure were not significantly different in the two intervention groups from the control group. Benson relaxation technique was significantly superior only on systolic blood pressure compared to lavender aromatherapy. Benson relaxation and lavender aromatherapy are non-invasive, easy, and cheap complementary therapies that can effectively reduce anxiety and stabilize the hemodynamic indices of patients undergoing CABG.

Introduction

Cardiovascular diseases account for 70% of deaths in people over 75 years old and 25% of deaths in people over 30 years old [1]. Approximately 80% of deaths due to coronary artery diseases occur in countries with low- or middle-income economies [2]. In 2035, the leading cause of death in males and the second leading cause of death in females in Iran will be diseases of the circulatory system [3]. Patients with cardiovascular diseases experience physiological and psychological problems [4]. Often, in the preoperative stage, physical issues such as pain, immobility, unstable hemodynamics, and psychological disorders such as anxiety arise [5]. In recent years, more attention has been paid to the role of anxiety and depression in the occurrence and development of coronary heart diseases [6]. Approximately one million cardiac surgeries are performed around the globe in roughly 4000 cardiac surgery centers every year [7]. Coronary artery bypass grafting (CABG) is a recommended surgical intervention for patients with coronary artery disease [8]. In Iran, CABG accounts for about 60% of open-heart surgeries [3].

The highest prevalence of anxiety is seen before cardiac surgery because the correct functioning of the heart is vital for the continuation of a person's life [9]. Anxiety is an internal feeling characterized by a state of turmoil and a sense of unease [10]. The incidence of anxiety before surgery was 34%, and after surgery was 24.7%. The intensity of anxiety before CABG is higher than that after the operation [11]. The prevalence of preoperative anxiety in adults ranges from 11% to 80% [12]. Patients' anxiety before coronary artery bypass surgery is significantly related to post-surgery problems and cerebrovascular accidents 1 to 8 years after surgery [13]. Aggravation of anxiety before surgery is associated with high blood pressure, dysrhythmias, refusal of surgery, aggravation of symptoms of coronary artery disease, slow wound healing, fluid, and electrolyte imbalance and increased risk of infection, postoperative pain, impaired quality of life, increased complications and mortality [14]. Optimum control of anxiety before surgery helps maintain hemodynamic stability and proper conditions during surgery and faster recovery and discharge from the hospital [15]. In addition to being expensive, drugs have many adverse physical and psychological effects, such

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as drowsiness, immune system suppression, imbalance, mild amnesia, and dose-dependent severe sedation. So complementary treatments with less harm can be used alone or in combination with other methods [16].

Nurses in more than 30 countries use complementary therapies, including aromatherapy, in comprehensive nursing care [17]. Aromatherapy is a relaxing technique that uses plant essential oils [18]. The Lavandula genus is native to the southern area of Europe and the Mediterranean region [19]. Lavender belongs to the genus Lavandula and the Lamiaceae family [20]. Aromatherapy has attracted considerable attention in managing anxiety and sleep disorders [21]. Benson relaxation technique was introduced in 1975 to reduce depression, anxiety, and stress [22]. This technique is straightforward to learn and implement. We only need to focus on two things to create a relaxation response: Meditation and repetition of words, phrases, prayers, or specific movements [23]. This technique definitely reduces anxiety and mood disorders, promotes physical activity, and improves sleep quality, quality of life, and pain intensity in hemodialysis patients and candidates for cardiac surgeries [24]. Unlike other relaxation methods, muscle contraction is not used in this method. Obviously, muscle contraction increases heart rate, blood pressure, respiratory rate, and heart workload [25].

On the other hand, Davari et al. reported that lavender aromatherapy did not affect physiological parameters such as heart rate, blood pressure, respiratory rate, and O_2 saturation [26]. Another study showed that Benson relaxation and lavender aromatherapy did not significantly reduce anxiety in patients with acute coronary syndrome [25]. Considering the importance of anxiety control and the stability of hemodynamic indices in patients who are candidates for CABG, we aimed to determine the superiority of complementary therapies over each other in the optimal control of anxiety and hemodynamic indices. Because of the conflicting results on the impact of complementary therapies in various studies, this study compared the effect of the Benson relaxation technique and aromatherapy with lavender essential oil on anxiety and hemodynamic indices of patients undergoing CABG.

Materials and Methods

This study was a randomized, nonblinded, parallel-group controlled trial. Following the CONSORT (consolidated standards of reporting trials), it was reported for parallel-group randomized trials among CABG candidates in a Cardiovascular Hospital in Hamadan City, Iran, from June to November 2022.

According to a similar study by Tahmasbi and Hasani [27], who reported the Mean±SD of anxiety in the aromatherapy and control groups as 44.18±4.26 and 47.91±4.54, respectively, and considering the confidence level of 95%, α=0.05, and the power of the test as 90%, 31 patients were required for each group. With regard to the possibility of a 10% dropout, 35 patients were finally allocated to each group (105 patients in total).

The inclusion criteria were the patient's age of over 30 years, not suffering from mental illnesses, lacking hearing problems or musculoskeletal system disorder, being aware of time, place, and person, having no history of cardiac surgery, lacking disturbance in the sense of smell, having no history of plant sensitivity, not abusing alcohol and drugs, not participating in other psychological interventions (not receiving pre-medication to control anxiety), not using neuropsychiatric drugs, not being familiar with Benson-like relaxation sessions, willing to participate in research and signing written informed consent, lacking a history of thyroid disease, seizures, and not using the medicine for these diseases, not suffering from asthma or other respiratory problems, not being candidates for CABG and valve replacement or repair at the same time, and not taking part in other studies (according to the statements and medical records of the patients). The exclusion criteria were having cognitive disorders and mental illness after starting the study, being unwilling to continue the study, and expiring.

The randomized block method with a block size of six and a 1:1 ratio was used to allocate the patients to different study groups. Various forms of the three groups were written on six cards, and each was placed inside a sealed opaque envelope. These envelopes were placed in a box. Unaware of the study process, a nurse chose an envelope, and this work continued until the desired number of samples was selected.

Data were collected with demographic characteristics form (consisting of gender, education level, job, marital status, family history of cardiac surgery, age, body mass index, and days of hospitalization), the Spielberger state-trait anxiety inventory (STAI), and checklist of hemodynamic indices. STAI has 40 items; 20 questions measure state anxiety and 20 measure trait anxiety. Each question is scored on a Likert scale from 1 to 4. Anxiety is scored by 4, 3, 2, 1, and the absence of anxiety is scored in reverse order. The minimum score is 20 (absence of anxiety), and the maximum score is 80 (highest level of anxiety). Other score ranges are 21-39 (mild anxiety), 40-59 (moderate anxiety), and 60-80 (severe anxiety) [28]. The Persian version of STAI was used in this study [29]. The cardiac monitoring device Alborz B9

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Saadat and the Q&Q stopwatch made in Japan were used to measure the hemodynamic indices in all patients. Blood pressure was measured in a non-invasive way from the left arm. The pulse oximeter probe was attached to the right hand, pointing the finger of all patients to measure the oxygen saturation. All devices were calibrated by a medical engineer at the hospital.

Before starting the study, the researcher explained the study goals and procedure, and then informed written consent was obtained from patients to participate. Confidentiality of information, anonymity, and right of withdrawal were respected during the study. Before the intervention, the patients completed the demographic characteristics form. One day before the surgery (before the intervention) and one hour before going to the operating room (after the intervention), the STAI and the checklist of hemodynamic indices were completed for all three groups. Of 148 investigated patients, 43 were not eligible to be included in the study. All 105 included participants were randomly allocated to three groups and were included in the final analysis (Figure 1).

In the control group, there was no intervention, and all routine nursing care before the surgery, including the patient's fasting, shaving the operation site, and completing the patient's file, were performed.

In the Benson relaxation group, the relaxation method was taught face-to-face and individually to the patients through simple and understandable sentences by the researcher. The patients performed this intervention one day before CABG (from 05:00 PM) in the presence of the researchers and repeated it at least three times until 1 hour before the surgery. Benson relaxation technique is as follows: The patients lie in a comfortable position in a quiet environment; they close their eyes, take deep and regular breaths, inhale through the nose, and exhale through the mouth. They are aware of their breathing and, in each exhalation, repeat a word that reminds them of peace (God, love, sea, etc.) in their mind. In the same position, they release their muscles from the tips of their toes and continue this work towards the upper body muscles until all muscles reach full relaxation. The patients maintain this position for 2 minutes; after completing the technique, they remain there for a few minutes. The audio file related to relaxation exercises is also provided to the patients. The duration of relaxation is about 20 minutes, and the intervention ends about 1 hour before surgery.

In the aromatherapy group with lavender essential oil, one day before the surgery (from 05:00 PM), five drops of lavender essential oil with a concentration of 20% (Barij Essence Pharmaceutical Co., Kashan, Iran) [16] was poured on the absorbent cloth using a dropper and pinned next to the patients' pillows at a distance of 5 cm. The patients were asked to inhale it at least three times up to 1 hour before surgery in the presence and under the control of the researchers. The patients of other groups were not present in the room of the aromatherapy group and did not inhale the smell of lavender. The lavender essential oil used in this study was extracted from the Lavandula angustifolia species. Because there was a suitable time from the end of the intervention until the patient entered the operating room, there was no interference with the patient going to the operating room and surgery.

Data analysis was performed using descriptive and inferential statistics in SPSS software, version 22. To examine the normal distribution of data, we used the Shapiro-Wilk test. The chi-square test, Kruskal-Wallis test, Wilcoxon test, one-way ANOVA, paired t-test, post hoc Mann-Whitney U test, and Bonferroni test were used to compare the study variables. The Chi-square test was used to compare qualitative demographic variables between the three groups. The Kruskal-Wall test was used to compare quantitative demographic variables between the three groups. The Kruskal-Wallis, Wilcoxon test, paired t-test, and one-way ANOVA were used to compare anxiety levels and hemodynamic indices between the three groups before and after the intervention. The Mann-Whitney U and Bonferroni tests were used to compare the anxiety levels and hemodynamic indices in the two groups before and after the intervention. A $P<0.05$ was considered significant in all analyses.

Results

The demographic characteristics of the participants are shown in Table 1. In the pre-intervention phase, there was no significant difference between the three groups in state-trait anxiety and hemodynamic variables. In the post-intervention phase, a significant difference was observed between the three groups in state-trait anxiety, respiratory rate, oxygen saturation percentage, pulse rate, and systolic blood pressure variables ($P<0.05$) based on the Kruskal-Wallis and Wilcoxon tests. However, no significant difference was observed between the study groups in the diastolic blood pressure variable (by the paired t-test and one-way ANOVA test). These results are shown in Table 2.

Table 1. Demographic characteristics of the participants in three groups

Variables		Mean±SD/No. (%)			P
		Benson Relaxation (n=35)	Lavender Aromatherapy (n=35)	Control (n=35)	
Age (y)		58.46±12.45	61.54±11.93	60.17±14.76	0.54*
Body mass index (kg/m²)		29.08±0.49	28.94±0.51	29.01±0.48	0.45*
Days of hospitalization		3.11±0.58	3.17±0.66	3.09±0.74	0.86*
Gender	Female	16(45.71)	17(48.57)	15(42.85)	0.89**
	Male	19(54.28)	18(51.42)	20(57.14)	
Education level	Illiterate	3(8.57)	0	4(11.43)	0.43**
	Under diploma	6(17.14)	8(22.86)	6(17.14)	
	Diploma	4(11.43)	6(17.14)	5(14.29)	
	Associate	10(28.57)	3(8.57)	5(14.29)	
	Bachelor	10(28.57)	12(34.29)	12(34.29)	
	Master	2(5.71)	5(14.29)	2(5.71)	
	Doctoral and higher	0	1(2.86)	1(2.86)	
Job	Unemployed	4(11.42)	3(8.57)	5(14.29)	0.79**
	Housewife	10(28.57)	6(17.14)	6(17.14)	
	Employed	3(8.57)	8(22.86)	6(17.14)	
	Self-employed	12(34.28)	11(31.42)	10(28.57)	
	Retired	6(17.14)	7(20)	8(22.86)	
Marital status	Single	14(40)	17(48.57)	20(57.14)	0.35**
	Married	21(60)	18(51.42)	15(42.85)	
Family history of cardiac surgery	Yes	4(11.42)	7(20)	5(14.29)	0.59**
	No	31(88.57)	28(80)	30(85.71)	

*The Kruskal-Wallis test, **The chi-square test.

Based on the Mann-Whitney U test, Benson relaxation technique and aromatherapy with lavender essential oil were significantly superior to the control group regarding the respiratory rate, pulse rate, systolic blood pressure, and state-trait anxiety (P<0.05). However, there was no significant difference between the control and intervention groups regarding oxygen saturation percentage and diastolic blood pressure variables (by the Mann-Whitney U and Bonferroni tests). Based on the Mann-Whitney U test, the Benson relaxation technique was significantly superior to aromatherapy regarding systolic blood pressure (P=0.001). However, the Benson relaxation technique was not significantly superior to aromatherapy with lavender essential oil in other variables, based on the Mann-Whitney U and Bonferroni tests (Table 3).

Discussion

This study aimed to investigate the effect of the Benson relaxation technique and lavender aromatherapy on anxiety and hemodynamic indices of patients who are candidates for CABG.

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Table 2. Comparing mean scores of anxieties and hemodynamic indices between three groups before and after the intervention

Variables	Mean±SD			P
	Benson Relaxation (n=35)	**Lavender Aromatherapy (n=35)**	**Control (n=35)**	
Respiratory rate 1	21.54±3.02	20.77±2.71	21.51±2.87	0.485***
Respiratory rate 2	19.89±2.94	19.37±2.65	21.77±2.60	0.002***
P	0.001*	0.001*	0.089*	
O_2 saturation 1 (%)	96.37±2.00	96.54±1.83	96.23±1.89	0.905***
O_2 saturation 2 (%)	97.29±1.46	97.06±1.41	96.26±1.94	0.134***
P	0.001*	0.002*	0.564*	
Pulse rate 1	82.26±9.23	81.94±6.81	84.37±10.24	0.483***
Pulse rate 2	77.94±8.34	79.51±6.87	84.91±10.07	0.003***
P	0.001*	0.001*	0.092*	
Systolic blood pressure 1	130.54±7.83	127.20±6.97	130.20±8.80	0.171***
Systolic blood pressure 2	119.83±7.65	126.26±6.98	130.80±8.67	0.001***
P	0.001*	0.001*	0.065*	
Diastolic blood pressure 1	84.09±6.93	83.31±7.55	85.54±7.09	0.424****
Diastolic blood pressure 2	82.23±6.74	82.69±7.34	85.89±7.28	0.070****
P	0.001**	0.001*	0.076*	
Trait anxiety 1	57.03±7.91	53.91±6.60	55.80±6.77	0.186***
Trait anxiety 2	49.00±8.48	49.06±6.90	56.06±6.95	0.001***
P	0.001*	0.001*	0.066*	
State anxiety 1	55.77±7.84	52.46±6.41	53.80±6.72	0.171***
State anxiety 2	47.14±8.18	47.69±6.73	54.00±6.97	0.001***
P	0.001*	0.001*	0.102*	

1=Before the intervention, 2=After the intervention.

*The Wilcoxon test, **The paired t-test, ***The Kruskal-Wallis test, ****One-way ANOVA test.

The results of this study indicate a significant reduction in patients' anxiety in the Benson relaxation and aromatherapy with lavender essential oil groups after the intervention. The anxiety level increased in the control group, although it was not significant. A significant difference was observed between the three groups in state-trait anxiety.

The results of this study are consistent with the findings of Heidari et al. [30], who examined the effect of lavender aromatherapy on anxiety and depression in patients with acute coronary syndrome and concluded that patients receiving the aromatherapy showed a significant decrease in depression and anxiety compared to the placebo group. So, aromatherapy with lavender can reduce anxiety and depression in acute coronary syndrome patients. Şentürk and Kartin [31] concluded that the mean total and subdimension scores of the Hamilton anxiety assessment scale of the intervention and control groups were significantly different, consistent with the present study. The study of Karadag [32] shows that lavender essential oil improves sleep qual-

Table 3. Comparing the anxiety and hemodynamic indices mean scores two by two in the study groups before and after the intervention

Variables	P		
	Benson Relaxation & Lavender Aromatherapy	Benson Relaxation & Control	Lavender Aromatherapy & Control
Respiratory rate 1	0.342*	0.915*	0.264*
Respiratory rate 2	0.460*	0.011*	0.001*
O_2 saturation 1 (%)	0.867*	0.759*	0.675*
O_2 saturation 2 (%)	0.603*	0.056*	0.153*
Pulse rate 1	0.729*	0.282*	0.340*
Pulse rate 2	0.210*	0.002*	0.012*
Systolic blood pressure 1	0.071*	0.706*	0.172*
Systolic blood pressure 2	0.001*	0.001*	0.012*
Diastolic blood pressure 1	0.999**	0.999**	0.595**
Diastolic blood pressure 2	0.999**	0.103**	0.190**
Trait anxiety 1	0.081*	0.498*	0.218*
Trait anxiety 2	0.837*	0.001*	0.001*
State anxiety 1	0.060*	0.320*	0.390*
State anxiety 2	0.609*	0.001*	0.001*

Note: 1=Before the intervention, 2=After the intervention.

*The Mann-Whitney U test, **The Bonferroni test.

ity and reduces anxiety in patients with coronary artery disease, which is consistent with this study. Sahrayi Zarghi et al. [25] concluded that the Benson relaxation technique and lavender aromatherapy did not significantly reduce anxiety in patients with acute coronary syndrome, which is inconsistent with the results of this study. This difference may be related to the study population and the intervention protocols.

One of the benefits of reducing anxiety before surgery is balancing hemodynamic indices. Moreover, this study showed that after the Benson relaxation technique and lavender aromatherapy, the intervention group's pulse rate, respiratory rate, systolic blood pressure, and diastolic blood pressure decreased, and oxygen saturation increased. In the post-intervention phase, a significant difference was observed between the three groups in respiratory rate, oxygen saturation, pulse rate, and systolic blood pressure. However, no significant difference in diastolic blood pressure was observed between the study groups. In this regard, Teimouri et al. [33] concluded that after the Benson relaxation, a significant

difference between the groups was reported in terms of all physiological variables. They reported significant differences between the two groups before and after the intervention regarding all physiological variables except diastolic blood pressure. Also, Cahyati et al. [34] reported increased oxygen saturation after progressive muscle training in coronary heart disease patients. Likewise, Ebrahimi Hosein Abadi et al. [16] showed that the patient's blood pressure was decreased after aromatherapy with lavender essential oil following CABG.

In our study, the Benson relaxation technique and aromatherapy with lavender essential oil were significantly effective in all hemodynamic indices except oxygen saturation and diastolic blood pressure compared to the control group. Benson relaxation was significantly superior to lavender aromatherapy in systolic blood pressure. In other variables, Benson relaxation had a relative superiority over aromatherapy, but this advantage was not significant. However, the study of Madadkar Dehkordi and Noorian [12] showed that progressive muscle relaxation and aromatherapy were not superior to each
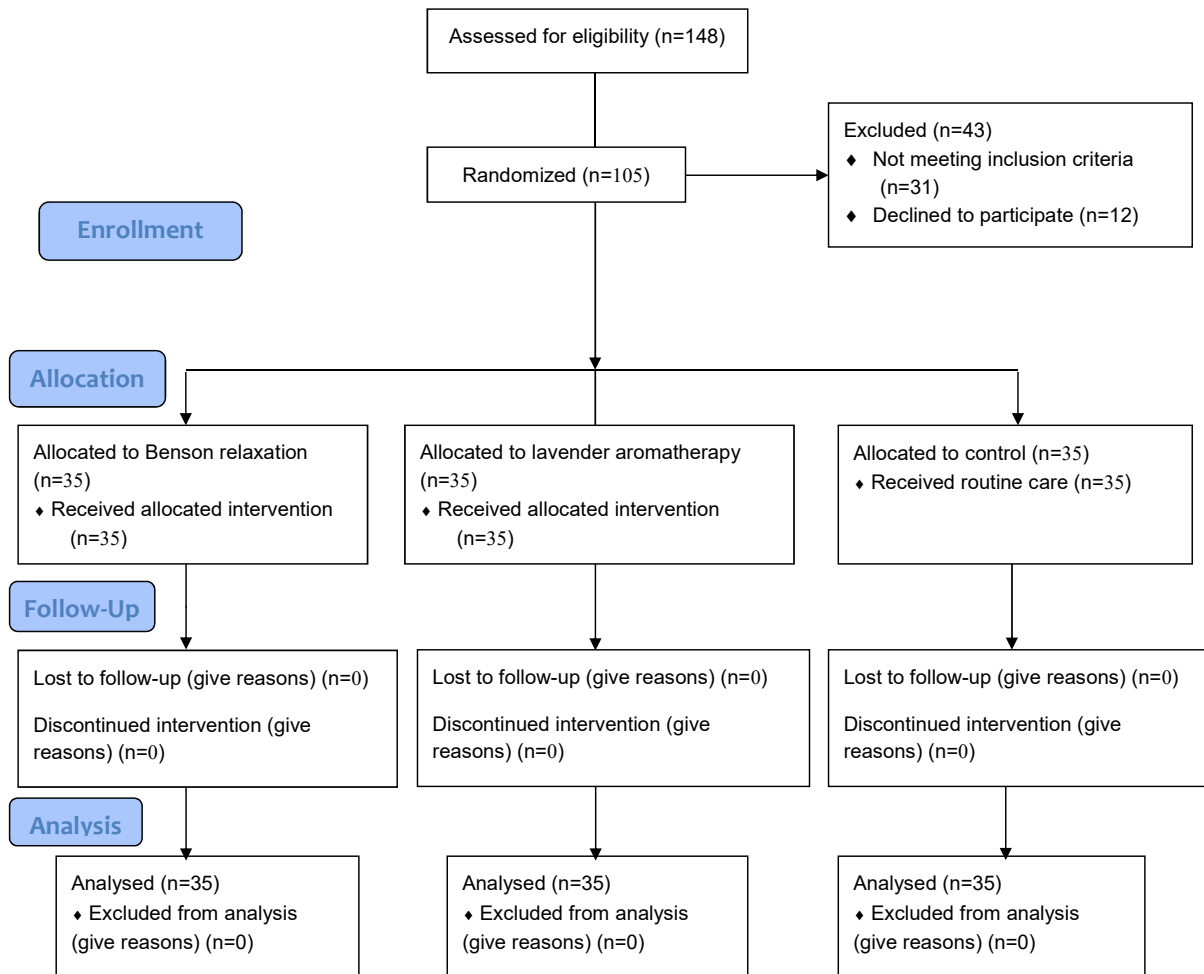
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Figure 1. The study process based on the CONSORT flow diagram

other, which is inconsistent with the results of this study is consistent with it. Differences in the results of studies can be attributed to differences in the research population, intervention protocols, and the nature of anxiety.

Results of this study show that Benson relaxation and aromatherapy with lavender essential oil have a positive effect on reducing state-trait anxiety and stability of hemodynamic indices in patients who are candidates for coronary artery bypass grafting surgery. Considering its non-pharmacological nature, low cost, and easy usage, Benson relaxation and lavender aromatherapy can be used by patients during stressful situations like the CABG to improve clinical conditions.

One of the limitations of this study was the lack of a blinding process due to the type and nature of the intervention. This study was conducted on a small sample of Iranian candidates for CABG, which was another limitation of this study.

Also, the short-term effect of Benson relaxation and lavender essential oil was evaluated on anxiety and hemodynamic indices of patients before surgery, and a long-term follow-up after surgery could not be performed. It is recommended to conduct studies with a larger sample size and longer follow-up to evaluate the effect of Benson relaxation and lavender aromatherapy on anxiety and hemodynamic indices of patients after surgery, the surgical outcomes, length of hospital stay, and timing of extubation of the tracheal tube.

Ethical Considerations

Compliance with ethical guidelines

The study protocol was approved by the Ethics Committee of Hamadan University of Medical Sciences, Hamadan, Iran (Code: IR. UMSHA.REC.1401.130) and was registered by the Iranian Registry of Clinical Trials (IRCT) (Code: IRCT20220521054945N1).

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