Non-pharmacological Interventions for Managing Pre-angiography Anxiety: A Systematic Review

Zahrasadat Abedi [iD] [1], Naser Parizad [iD] [2, *], Milad Ahangarzadeh [iD] [3]

[1] Department of Medical-Surgical Nursing, Salmas Faculty of Nursing, Urmia University of Medical Sciences, Urmia, Iran
[2] Patient Safety Research Center, Clinical Research Institute, Urmia University of Medical Sciences, Urmia, Iran
[3] Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran

*_Corresponding Author:_ Patient Safety Research Center, Clinical Research Institute, Urmia University of Medical Sciences, Urmia, Iran. Email: parizad.n@umsu.ac.ir

Abstract

Context: Coronary angiography is a crucial diagnostic procedure, yet it often induces significant anxiety in patients. Various non-pharmacological interventions have been proposed to alleviate anxiety in patients undergoing coronary angiography. Despite existing methods, comprehensive comparative reviews on their effectiveness are lacking.

Objectives: This systematic review aimed to evaluate the effectiveness of various non-pharmacological interventions in reducing anxiety for patients preparing for coronary angiography.

Evidence Acquisition: In this systematic review, articles published in both Persian and English were collected from various databases, including Web of Science, PubMed, Scopus, Medlib, Magiran, SID, Iranmedex, and Google Scholar. The search used keywords related to coronary angiography, cardiac catheterization, anxiety, and non-pharmacological methods. The search was limited to studies published between 2009 and 2024. Articles that met the inclusion criteria were then selected for review. Out of the 1,457 articles retrieved, 33 were thoroughly examined and analyzed. To ensure data accuracy, two experienced researchers simultaneously reviewed the articles while the research team's faculty members independently assessed each article's quality. This collaborative approach was implemented to enhance the validity and reliability of the study.

Results: Thirty-three articles were reviewed, revealing several effective interventions for reducing anxiety before angiography. These interventions included educational programs such as video-based education, virtual networks, and familiarization tours, as well as complementary medicine approaches like aromatherapy, herbal medicine, massage therapy, relaxation techniques, and emotional expression. Each of these methods showed promise in reducing anxiety levels among patients scheduled for coronary angiography.

Conclusions: This review concludes that educational programs and orientation tours are the most practical, cost-effective, and side-effect-free approach for reducing anxiety before coronary angiography. Aromatherapy was noted as the second most effective intervention. Additionally, acupressure and muscle relaxation are also commonly used. Limited studies exist on guided imagery and emotional expression, highlighting the need for future research to standardize methodologies and further assess the effectiveness of these interventions in reducing pre-angiography anxiety.

Keywords: Coronary Angiography, Cardiac Catheterization, Anxiety, Non-pharmacological Interventions

1. Context

Coronary artery disease is prevalent in contemporary societies and can lead to mortality if not accurately diagnosed and treated (1). Accurate diagnosis of coronary artery disease requires observing its anatomical structure and understanding its physiological function (2). Although non-invasive diagnostic methods for heart diseases are available, invasive coronary angiography remains one of the most reliable approaches for diagnosing coronary artery diseases (3). This diagnostic procedure involves injecting contrast material into the femoral, brachial, or axillary arteries to provide valuable information about

valvular heart diseases, congenital heart diseases, and cardiac function to cardiologists (4). In the United States, approximately two million people undergo cardiac angiography annually due to its validity and multiple applications (5). However, despite its accuracy and benefits, coronary angiography is associated with complications such as pain, discomfort, and anxiety (6). Many patients experience anxiety before undergoing angiography due to factors such as lack of awareness of the procedure, pain, previous unpleasant experiences, and an unfamiliar environment (7). Pre-angiography anxiety can lead to physiological changes, including increased blood catecholamine, cortisol, prostaglandins, epinephrine, and norepinephrine levels, affecting indicators such as blood pressure, cardiac output, respiratory rate, heart rate, and myocardial oxygen consumption (8). Furthermore, anxiety can delay patient recovery and increase the duration and difficulty of the procedure (9). Nurses play a crucial role in alleviating patients' pain, discomfort, and anxiety (10).

2. Objectives

Various non-pharmacological interventions have been introduced to manage pre-angiography anxiety (11); however, no general conclusion has been reached regarding their effectiveness. Thus, in order to gain a more comprehensive understanding of these interventions and considering the widespread use of this invasive diagnostic method, the present study aims to systematically review the effects of these methods in managing anxiety related to angiography.

3. Evidence Acquisition

3.1. Search Strategy

This systematic review, guided by the Cochrane Handbook (12) and PRISMA (13), examined clinical trials of complementary medicine for reducing anxiety before angiography. A PICO-based search strategy was employed using MeSH and keywords: "Coronary Angiography", "coronary artery disease", "Cardiac Catheterization", "heart catheterization", "anxiety", "stress", "non-pharmacological Methods", "alternative medicine", and "complementary medicine" in Google Scholar, Cochrane Library, PubMed, CINAHL, Science Direct, and Persian (SID, Magiran, Medilib, Iranmedex) databases. Two investigators reviewed Persian and

English clinical trials on complementary medicine for anxiety before angiography. It is important to note that the studies included in this review were conducted between 2009 and 2024. All information regarding data extraction forms, search strategies, and review protocols is available upon request.

3.2. Inclusion Criteria

Inclusion criteria for the studies were: (1) Original research, (2) conducted in clinical trials, (3) focused on patients preparing for angiography, (4) addressed anxiety and stress before angiography, (5) published in Persian or English, (6) accessible main content of the article. Descriptive and qualitative studies, inaccessible full-text articles, and those lacking transparency in reporting results and intervention methodologies were excluded.

3.3. Study Selection

In the initial search, 1,457 articles were identified, of which 621 were in English and 836 were in Persian. During the screening phase, 1,338 articles were excluded because their titles and abstracts did not relate to complementary interventions and anxiety in patients preparing for angiography, in accordance with the research objectives. After reviewing the titles and abstracts, 71 duplicate articles were removed. In the next phase, the two researchers evaluated 48 articles based on the inclusion and exclusion criteria, and 15 articles were excluded. The full texts of the remaining 33 articles were examined, and based on the study's inclusion and exclusion criteria, they were found to be fully consistent with the research and were included in the analysis. This process was carried out independently by two researchers. Meanwhile, the review was limited to studies published only in English and Persian, excluding grey literature and unpublished dissertations. Therefore, it may not fully represent all relevant papers in the field. The article selection process is illustrated in the flowchart (Figure 1).

3.4. Extracting the Data

The two researchers extracted data independently for the research objectives and final analysis, while other team members reviewed 33 studies for quality and consistency with the study objectives. The Cochrane data extraction form was utilized for the systematic review. Two researchers independently extracted data
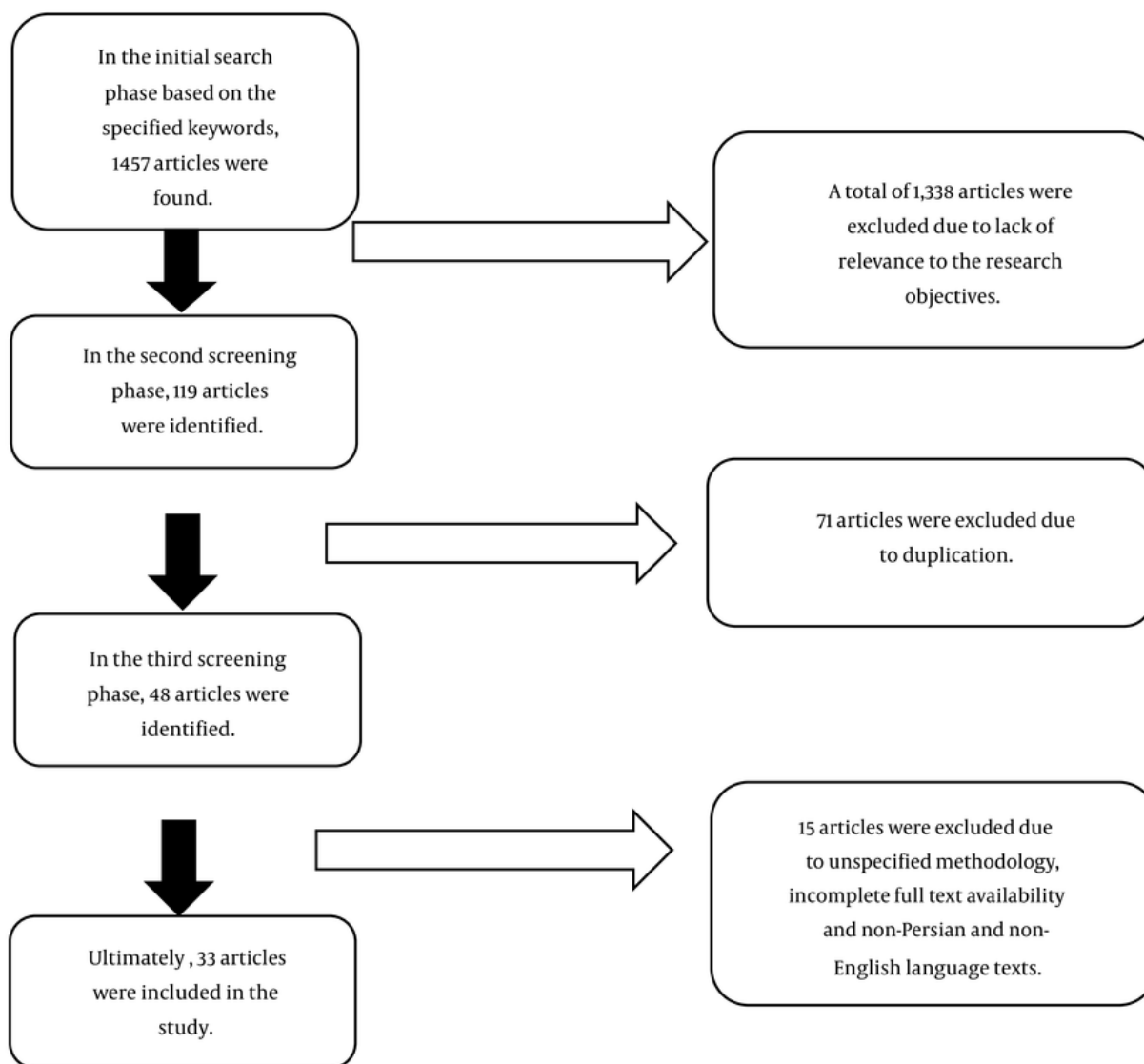
Figure 1. Flowchart of the screening process

from the included studies and reached a consensus after discussing their findings. The data extraction form included the author's name, publication year, article title, research design, sample size, type of intervention, research tools, study findings, and results.

3.5. Evaluating the Quality of Imported Studies

The research team utilized the Cochrane Risk-of-Bias (RoB 2) Tool to evaluate the quality of clinical trials with pre/post designs (Figure 2). To enhance the accuracy and reliability of the research methodology, assess the quality of the collected articles, and mitigate potential biases, two experienced researchers in systematic reviews evaluated and analyzed the articles. They focused on various sections, including the abstract, introduction, methodology, results, discussion, and references. In the quality evaluation process, essential factors included a clearly defined population, precise

The description of the symbols: ● Low risk of bias   ● Some concerns

Studies	Bias Arising from the Randomization Process	Bias due to Deviations from Intended Interventions	Bias due to Missing Outcome Data	Bias in Measurement of the Outcome	Bias in Selection of the Reported Results	Overall Judgment
Tazakori et al., 2016 (4)	●	●	●	●	●	●
Mahmoudirad et al., 2013 (14)	●	●	●	●	●	●
Shahmari et al., 2016 (15)	●	●	●	●	●	●
Hanifi et al. , 2012 (16)	●	●	●	●	●	●
Torabi et al. , 2012 (17)	●	●	●	●	●	●
Bikmoradi et al. , 2019 (18)	●	●	●	●	●	●
Afzali et al. , 2008 (19)	●	●	●	●	●	●
Jamali Nik et al. , 2015 (20)	●	●	●	●	●	●
Mohaddes et al. , 2023 (21)	●	●	●	●	●	●
Taghadosi et al. , 2016 (22)	●	●	●	●	●	●
Varaei et al. , 2013 (23)	●	●	●	●	●	●
Rajaee et al. , 2014 (24)	●	●	●	●	●	●
Abdi Joubari et al. , 2017 (25)	●	●	●	●	●	●
Monfared et al. , 2021 (26)	●	●	●	●	●	●
Koohestani Ein-O-Din et al., 2020 (13)	●	●	●	●	●	●
Aghakhani et al. , 2023 (27)	●	●	●	●	●	●

Figure 2. Evaluate the quality of clinical trials using the (RoB 2) tool (4, 13-27)

measurement of outcomes, adequate sample size, appropriate tools, and distinct inclusion and exclusion criteria. Disagreements between the two researchers were resolved through team discussion. No studies were excluded due to quality evaluations.

4. Results

In these studies, various methods were employed to reduce pre-angiography anxiety. These methods included educational programs (12 articles), aromatherapy and herbal medicine (8 articles), massage

Figure 2. Evaluate the quality of clinical trials using the (RoB 2) tool. The description of the colors: Green: Low Risk of bias; yellow: Some concerns (12, 28-43)

therapy and acupressure (9 articles), guided imagery (1 article), music therapy (1 article), relaxation techniques (1 article), and emotional expression (1 article). The tools used to assess pre-angiography anxiety included the Spielberger Anxiety Scale and hemodynamic indicator recording sheets (Table 1).

4.1. Educational Programs

Pre-angiography anxiety often stems from a lack of understanding regarding the angiography procedure and unfamiliarity with the medical environment and equipment (44). Education enhances patients' comprehension of clinical procedures and self-care practices, reducing anxiety and stress levels (45). Various educational methods have addressed this issue, including video-based education (15), virtual networks (21), and familiarization tours. The latter involves guiding patients through a 30 - 40-minute tour of the angiography unit, allowing them to become acquainted with medications and procedural equipment. This approach was shown to effectively increase patient knowledge and decrease anxiety levels, as evidenced by Varaei et al.'s study (23). Additionally, specific educational delivery methods such as mass education and distance education have been utilized to mitigate pre-angiography anxiety. In mass education, the

researcher provides individual face-to-face education sessions lasting 15 to 25 minutes, tailored to the patient's tolerance, followed by 5 to 11 minutes for essential questions and answers. On the other hand, distance education involves the researcher delivering educational content in three stages. Each lasts 11 to 15 minutes with 5 - 10-minute breaks and is presented to groups of 2 to 3 participants. Ebrahimi Jaberi et al. effectively implemented these two methods to reduce pre-angiography anxiety (35).

4.2. Complementary Medicine

4.2.1. Aromatherapy and Herbal Medicine

Aromatherapy, a prevalent complementary medicine, involves using aromatic plant essences for medicinal purposes. It can be administered through inhalation, compressing, and bathing with aromatic plants and minerals. Studies have demonstrated that aromatherapy can effectively alleviate pain, stress, and depression while improving hemodynamic variables (46, 47). Aromatherapy stimulates the parasympathetic nervous system, releasing neurotransmitters such as enkephalin, endorphins, norepinephrine, and serotonin, rapidly reducing anxiety and increasing patient comfort (48). Rose is a particularly effective plant in reducing pre-angiography anxiety, as evidenced by studies on aroma inhalation conducted by Bikmoradi et al. (18) and extract consumption in the study by Tazakori et al. (4). Previous research has also shown that the inhalation of lavender (31), orange (25), Melissa (12), peppermint (13), and the consumption of saffron capsules (49) have effectively reduced pre-angiography anxiety.

4.2.2. Massage Therapy

4.2.2.1. Reflexology and Acupressure

Massage therapy, reflexology, and acupressure all utilize pressure points to alleviate stress and promote healing. Research has shown that reflexology foot massages can effectively reduce anxiety before angiography (14, 38). For instance, a 20-minute hand reflexology massage decreases anxiety and helps alleviate post-angiography pain and fatigue (36). Reflexologists believe that specific points on the hands and feet correspond to various organs and systems in the body, and stimulating these points can have

therapeutic effects (50). Acupressure techniques, such as applying pressure to the P6 point on the inner wrist (24) or massaging the Yintang point and third eye, have also been shown to reduce pre-angiography anxiety (43). Pressure on the Yintang and Shenmen points on the ear (22) and the Hoku point on the hand have also demonstrated effectiveness in alleviating anxiety before angiography (42).

4.2.3. Relaxation Techniques

4.2.3.1. Muscle Relaxation Therapy

Muscle relaxation therapy is another non-pharmacological intervention that effectively reduces pre-angiography anxiety by consciously contracting and progressively relaxing specific muscle groups to induce calmness. Research has shown that this technique can significantly reduce anxiety levels before medical procedures, as demonstrated in a study by Afzali et al. (19).

4.2.3.2. Guided Imagery

Guided imagery is a relaxation technique where individuals engage in deep abdominal breathing, muscle relaxation, and visualization of calming scenes to promote emotional balance and well-being. This cost-effective method has been shown to help manage anxiety and stress effectively (51, 52). In a study by Foji et al., participants who listened to calming guided imagery recordings experienced reduced pre-angiography anxiety (37).

4.2.3.3. Music Therapy

Music therapy has been found to influence dopamine secretion and regulate hormone levels, which decreases catecholamines in the blood (53). This non-invasive method can effectively control pre-procedural anxiety, including before surgical interventions (54), and has been shown to lower blood pressure and heart rate in patients before angiography (55).

4.2.4. Expression of Emotions

Counseling methods involving the expression of emotions have proven to help alleviate anxiety, fear, and concerns before medical procedures. Group sessions focused on expressing emotions, led by a psychologist and involving 6 to 8 individuals, have been successful in

helping patients cope with pre-angiography anxiety. Participants have the opportunity to share their emotions and concerns, leading to a reduction in anxiety levels (20).

The review of evidence-based interventions indicates that the most effective approaches employed to reduce anxiety prior to angiography involve educational familiarization programs. Mohammadi et al. demonstrated that group education was more effective in reducing situational anxiety among patients than individual education. This may be due to increased feelings of security, shared experiences, and mutual support within the group, which resulted in lower anxiety levels than those who received individual education (34). Ebrahimi et al. conducted a study comparing distance learning to mass education methods in reducing pre-angiography anxiety. Both methods resulted in reduced anxiety levels before angiography, and there was no significant difference in mean anxiety scores between the two groups. Due to being more practical and time-efficient, mass education was recommended for pre-angiography education (35). Habibzadeh et al. found that peer-based education, video-based education, and a combination of both had similar effects in reducing pre-angiography anxiety (39).

In the realm of aromatherapy, Soheilipour et al. compared the effects of saffron and lippia on anxiety reduction before angiography, concluding that lippia, unlike saffron, was not effective in alleviating patient anxiety (40). Tahmasebi et al. demonstrated that both aromatherapy and Benson's relaxation technique equally reduced anxiety levels before angiography (30). Similarly, Babaei et al. compared the effects of Quranic recitation with aromatherapy and found that Quranic recitation was more effective in reducing patient anxiety compared to aromatherapy. This could be due to variations in the method of aromatherapy, the type of scent used, and the short duration of exposure to aromatherapy (56).

Various studies repeatedly explored the efficacy of acupressure and therapeutic massage in reducing pre-angiography anxiety. Aghakhani et al. investigated acupressure (on Fengchi, Shenmen, and Yin Tang points) and Benson's relaxation method, proving effective in reducing anxiety (27). A comparative study by Torabi et al. showed that both reflexology foot massage and Benson's relaxation method effectively reduced anxiety, with no significant difference in anxiety levels

immediately before and half an hour after intervention between the two groups (17). Pouryousef et al. confirmed that muscle relaxation and virtual reality displaying calming images reduce anxiety effectively (29). Other validated studies in anxiety reduction before angiography include emotional expression (20) and guided imagery (37). Music therapy may also serve as an effective method for reducing pre-angiography anxiety in specific cases, depending on the type of music, patient preferences, cultural factors, and anxiety levels (57).

A significant limitation of this study is that we could not include data from all relevant studies in the meta-analysis due to considerable variability in the outcome measures used across those studies. Additionally, this study did not assess publication bias. Furthermore, the review was limited to studies published only in English and Persian, excluding relevant material from grey literature and unpublished dissertations. Thus, it is essential to recognize that this review might not completely represent all relevant research.

5. Conclusions

As a result, this study found that various methods used to reduce anxiety before angiography have been effective. However, it is important to note that no single method can be definitively determined as superior or preferable over others for reducing pre-angiography anxiety. Educational and familiarization programs have been widely utilized and have shown positive effects on anxiety reduction. The following interventions are cost-effective and recommended as safe approaches for reducing anxiety prior to angiography. Aromatherapy is ranked as the second most effective intervention for reducing pre-angiography anxiety. Acupressure and muscle relaxation were the third and fourth most implemented interventions for anxiety reduction before angiography. There are limited studies on guided imagery and emotional expression in this context. Therefore, future research should be conducted to standardize and homogenize methodologies to explore further the effectiveness of these interventions in reducing pre-angiography anxiety.

Footnotes

Authors' Contribution: Study concept and design: Z. A. and N. P.; Analysis and interpretation of data: Z. A. and

N. P.; Drafting of the manuscript: F. M.; Critical revision of the manuscript for important intellectual content: Z. A., N. P., and M. A.; Statistical analysis: Z. A. and M. A.

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Table 1. Anxiety in Candidates for Coronary Angiography

Authors	Title	Design and Sample Size	Intervention Type	Tool	Finding	Statistical Result
Tazakori et al., 2016 (4)	The effect of oral damask rose extract on anxiety of patients undergoing coronary angiography	A semi-experimental study double-blind clinical trial and, 88 patients (60 males and 30 females)	Oral extract of damask rose in the form of 15 drops every 8 hours,	Spielberger Anxiety Scale and hemodynamic parameters recording sheet	There was a statistically significant difference in anxiety before and after the intervention.	Mean anxiety scores, before intervention: 33.91 ± 6.43, after intervention, 32.12 ± 6.37, P = 0.016, d = 0.59 [a], t = 1.98
Mahmoudirad et al., 2013 (14)	Effect of foot reflexology on anxiety of patients undergoing coronary angiography anxiety	A semi-experimental study, case-control clinical trial and 70 patients (41 males and 29 females),	Foot reflexology massage was performed in the area between the metatarsal heads of the plantar aspect of each foot for 10 minutes (total 20 minutes)	Spielberger Anxiety Scale	There was a statistically significant difference in mean anxiety scores between the control and intervention groups immediately and half an hour after the intervention.	Mean anxiety scores immediately after intervention, intervention group: 44.9 ± 8.73, control group: 50.43 ± 10.48, P < 0.001, d = 0.67 [a], t = 1.99
Shahmari et al., 2016 (15)	Effect of video education in native language on vital signs caused by anxiety in coronary angiography patients	Semi-experimental study, two-group pretest-posttest clinical trial and 160 patients (98 males and 62 females)	Educational film presentation about the definition, necessity, and procedure of angiography prior to the procedure lasting 11 minutes and 36 seconds	Hemodynamic parameter recording sheet	Media-based education through indigenous language film increases patients' awareness regarding angiography, consequently reducing their anxiety. This leads to the modulation of vital signs in these patients.	Mean pulse scores, 15 minutes after intervention, intervention group: 76.16 ± 9.54, control group: 79.52 ± 11.07, P = 0.001, d = 0.57 [a], t = 1.97
Hanifi et al., 2012 (16)	The effect of orientation program on stress, anxiety and depression of patients undergoing coronary angiography	Semi-experimental study, two-group clinical trial and 60 males and females	Presentation of information about the procedures and the process of angiography along with displaying relevant images	DASS-21 Questionnaire	Significant reductions in stress, anxiety, and depression were observed in the experimental group compared with the control group.	Mean pulse scores after intervention, intervention group: 7.96 ± 1.217, control group: 8.9 ± 2.40, P = 0.036, d = 0.73 [a], t = 2.00
Torabi et al., 2012 (17)	Effect of foot reflexology massage and Benson relaxation techniques on anxiety and physiological indexes of patients undergoing coronary heart angiography	Semi-experimental study, clinical trial on three groups of patients (reflexology massage group, Benson relaxation group, and control group) assessed before the intervention, immediately after the intervention, and 30 minutes post-intervention and 75 patients	Reflexology foot massage for 20 min in the reflexology massage group, audio file of Benson relaxation technique, deep breathing exercises, and muscle relaxation in the Benson relaxation group	Self-reporting sheet, Anxiety level and physiological indices checklist	A significant reduction in anxiety levels post-intervention was observed in both the reflexology massage and Benson relaxation groups (p < 0.01). Comparison of mean physiological indices 30 min before angiography among massage, relaxation, and control groups showed significant differences only in pulse rate and diastolic blood pressure.	Mean anxiety scores before/after intervention, reflexology group: before: 6.21 ± 2.1, after: 3.76 ± 1.5, p = 0.01, Benson group: Before: 5.81 ± 2.1, after: 3.2 ± 1.4, P = 0.01, d = 0.66 [a], t = 1.99
Bikmoradi et al., 2019 (18)	Impact of inhalation aromatherapy with damask rose on anxiety of patients undergoing coronary angiography	Single-blind clinical trial 98 patients (48 males and 50 females)	Inhalation of 5 drops of 40% rose essential oil for 20 min before angiography	STAI Questionnaire	The mean anxiety level in the aromatherapy group significantly decreased post-intervention	Mean anxiety scores before/after intervention, in the aromatherapy group, before intervention: 37.73 ± 13.34, after intervention: 32 ± 8.76, P < 0.001, d = 0.57 [a], t = 1.98
Afzali et al., 2008 (19)	The effect of progressive muscle relaxation program (pmr) on anxiety of patients undergoing coronary heart angiography	Semi-experimental with pre-test and post-test phases and 146 patients (97 males and 49 females)	Implementation of a muscle relaxation exercise program one week before angiography involving concentrated relaxation techniques lasting 45 minutes	Researcher-Developed Anxiety Questionnaire	A significant difference in the mean anxiety level of coronary angiography patients was observed before and after the program implementation.	Mean anxiety scores, before intervention: 96.38 ± 8.92, After intervention: 71.51 ± 6.9, P < 0.001, d = 0.46 [a], t = 1.97
Jamali Nik et al., 2015 (20)	The effect of group emotional expression on patient's anxiety about coronary angiography	Pre-post clinical trial and 41 patients (39 males and 41 females)	Emotional expression in the intervention group for 45 minutes	Spielberger Anxiety Scale	Group emotional expression significantly reduced anxiety in patients on the verge of angiography.	Mean anxiety scores after intervention, intervention group: 38.10 ± 1.06, control group: 40.88 ± 1.87, P = 0.01, d = 0.73 [a], t = 1.99
Mohaddes et al., 2023 (21)	Effect of education using mobile social networks on anxiety and satisfaction of candidates for coronary angiography	Semi-experimental clinical trial and 86 patients (52 males and 34 females)	Delivery of angiography education (film, video, textual) via messaging app WhatsApp	Beck Anxiety Questionnaire, Visual Analog Scale	The intervention group had significantly lower anxiety and higher satisfaction compared to control.	Amount of anxiety, reductio, intervention group: 5.5 ± 2.47, control group: 5.91 ± 10.77, P < 0.001, d = 0.61 [a], t = 1.98
Taghadosi et al., 2016 (22)	Effects of simultaneous					

Authors	Title	Design and Sample Size	Intervention Type	Tool	Finding	Statistical Result
	patient anxiety before coronary angiography	Single-blind randomized controlled trial and 70 patients	Pressure at the third eye and Shenmen ear points	Spielberger Anxiety Scale	Anxiety was significantly lower in the intervention group compared to control.	Mean anxiety scores after intervention, intervention group: 42.17 ± 10.42, control group: 48.80 ± 7.86, P < 0.001, d = 0.67 [a], $t = 1.99$
Varaei et al., 2013 (23)	The effect of orientation tour with angiography procedure on anxiety and satisfaction of patients undergoing coronary angiography	Pre-post clinical trial and 148 patients (86 males and 62 females)	30 - 40-minute tour of the angiography department, including familiarization with drugs, equipment, procedures	Spielberger Anxiety Scale and Visual Analog Scale for satisfaction	Anxiety was significantly lower in the intervention group post familiarization compared to control.	Mean anxiety scores after intervention, intervention group: 33.26 ± 6.64, control group: 41.22 ± 6.34, P < 0.001, d = 0.46 [a], $t = 1.97$
Rajaee et al., 2014 (24)	The effect of acupressure on anxiety of patients candidate for coronary angiography	Single-blind randomized controlled trial and 60 patients (30 males and 30 females)	Acupressure at P6 point on the inner wrist for 10 min	Spielberger Anxiety Scale	Significant statistical difference in anxiety levels post-intervention between groups; control group had higher anxiety.	Mean anxiety scores after intervention, intervention group: 39.46 ± 9.06, control group: 52.06 ± 13.38, P = 0.001, d = 0.73 [a], $t = 2.00$
Abdi Joubari et al., 2017 (25)	Effect of aromatherapy with orang e essential oils on anxiety in patients experiencing coronary angiography: A randomized control trial	Randomized pre-post clinical trial and 68 patients (36 males and 32 females)	Inhalation of 2 drops of orange essence for 20 min prior to angiography	Spielberger Anxiety Scale	Aromatherapy significantly reduced anxiety in the intervention group compared to control; there was a significant difference in anxiety levels pre and post intervention within the aromatherapy group.	Mean anxiety scores after intervention, intervention group: 36.26 ± 7.65, control group, 41.21 ± 10.10, P = 0.00, d = 0.68 [a], $t = 1.99$
Monfared et al., 2021 (26)	Effect of education with film on anxiety level of patients undergoing coronary angiography	Clinical trial and 122 patients (63 males and 59 females)	5-minute educational film on angiography procedures, pre-, during, and post-angiography actions	Spielberger Anxiety Scale	Mean anxiety score significantly decreased after the intervention in the film education group compared to control; significant statistical relationship between anxiety scores pre and post educational film.	Mean anxiety scores after intervention, intervention group: 35.06 ± 7.07, control group: 52.30 ± 7.89, P = 0.006, d = 0.51 [a], $t = 1.97$
Koohestani Ein-O-Din et al., 2020 (13)	The effect of inhalation of peppermint aroma on anxiety in patients undergoing coronary angiography	Randomized two-group clinical trial and 80 patients (51 males and 29 females)	Inhalation of 0.2 ml peppermint aroma for 20 min before angiography	Spielberger Anxiety Scale	Significant reduction in apparent anxiety in the intervention group compared to control.	Mean anxiety scores after intervention, intervention group: 47.67 ± 6.12, control group: 43.93 ± 10.33, P = 0.0001, d = 0.88 [a], $t = 2.6$
Aghakhani et al., 2023 (27)	Comparison of the effectiveness of acupressure and benson relaxation on anxiety in patients undergoing coronary angiography	Randomized three-group clinical trial and 90 patients	Acupressure on 4 points and Benson relaxation (music and muscle relaxation) for 20 min	Spielberger Anxiety Scale	Significant statistical difference was observed in mean anxiety scores post intervention compared to pre-intervention in both acupressure and Benson relaxation groups.	Mean anxiety scores after intervention, Benson relaxation group: 45.07 ± 3.59, acupressure group: 46.47 ± 4.51, control group: 46.33 ± 6.01, P = 0.0001, d = 0.33 [a], F = 3.1
Khezerloo et al., 2018 (28)	Effect of video information on anxiety level and hemodynamic parameters of patients undergoing coronary angiography	Semi-experimental pre-post study and 108 patients (51 males and 57 females)	10-minute video education about the angiography procedure, necessities, pre and post care	Spielberger Anxiety Scale	A significant difference in anxiety levels post intervention was observed.	Mean anxiety scores after intervention, intervention group: 67.42 ± 7.36, control group: 70.38 ± 60.44, P < 0.001, d = 0.54 [a], $t = 1.98$
Pouryousef et al., 2021 (29)	Comparing the effect of virtual reality and rhythmic breathing on the anxiety of the patients undergoing coronary angiography	Randomized clinical trial and 90 patients	5-min VR relaxation images/5-minute rhythmic breathing	Spielberger Anxiety Scale	Significant reduction in anxiety scores in the VR and rhythmic breathing groups compared to control.	Amount of anxiety, pre-intervention, virtual reality group: 57.56 ± 7.82, rhythmic breathing group: 57.10 ± 6.49, control group: 33.56 ± 6.74, amount of anxiety, half an hour after the intervention, virtual reality group: 41.10 ± 7.17, rhythmic breathing group: 47.63 ± 5.49, control group: 55.80 ± 6.41, P = 0.001, d = 0.38 [a], F = 3.1
Tahmasebi et al., 2015 (30)	The effect of Benson relaxation and aromatherapy on anxiety and physiological indicators in patients undergoing coronary angiography	Randomized clinical trial and 100 males and females	Audio file/3 drops of lavender inhalation for 3 minutes	Spielberger Anxiety Scale	Significant reduction in anxiety in the relaxation and aromatherapy groups compared to control.	Mean anxiety scores after intervention, Benson relaxation group: 43.56 ± 4.89, aromatherapy group: 44.18 ± 4.26, control group: 47.91 ± 4.54, P = 0.000, d = 0.31 [a], F = 3.09
Teymouri et al., 2019 (31)	The effects of inhaling lavender fragrance on stress and anxiety during sheath take out in patients after coronary angiography	Semi-experimental clinical trials and 70 patients (42 males and 28 females)	Inhalation of cotton with 2 drops of 100% saffron essence for 20 min	Spielberger Anxiety Scale	Significantly lower post-intervention anxiety in experimental group compared to control.	Mean anxiety scores after intervention, intervention group: 30.67 ± 7.16, control group: 41.97 ± 12.48, P = 0.001, d = 0.67 [a], $t = 1.99$
Zafari et al., 2019 (32)	The effectiveness of based-mobile education on anxiety of					

Authors	Title	Design and Sample Size	Intervention Type	Tool	Finding	Statistical Result
	patients candidate coronary angiography	Semi-experimental clinical trials and 94 patients (49 males and 45 females)	Mobile clips on angiography, pre/postcare care, nutrition via smartphone app	Spielberger Anxiety Scale	Reduction in anxiety scores in the intervention group.	Mean anxiety scores after intervention, intervention group: 46.17 ± 6.90, control group: 53.74 ± 10.04, P = 0.001, d = 0.67 [a], t = 1.98
Babai et al., 2015 (33)	Comparison of quranic recitation and aromatherapy on anxiety pre-coronary angiography	Semi-experimental clinical trials and 60 patients	Inhalation of 10% rose essence for 18 min/listening to Quran for 18 mins prior	Spielberger Anxiety Scale	Significant reduction in anxiety post-intervention in the Quranic group, no significant difference in aromatherapy group.	Mean state anxiety scores after intervention, intervention group: 41.20 ± 6.53, control group: 50.43 ± 5.63, P = 0.000, d = 0.73 [a], t = 2.00
Zahedi et al., 2021 (12)	The effect of aromatherapy with melissa officinalis L. essential oil on anxiety level and physiological parameters of patients undergoing coronary angiography	Randomized clinical trial and 72 patients	Inhalation of 3 drops of bitter orange essence for 20 min	Spielberger Anxiety Scale	Mean anxiety reduction was greater in the intervention group, but not statistically significant.	Mean anxiety, reduction, intervention group: 3.83 ± 3.37, control group: 5.83 ± 4.29, P = 0.62, d = 0.77 [a], t = 1.99
Mohammadi et al., 2012 (34)	Face-to-face education vs. group education on knowledge and anxiety of patients undergoing coronary angiography	Semi-experimental comparative study and 84 patients (52 males and 32 females)	Individual/group educational content on angiography	Spielberger Anxiety Scale	Anxiety reduction in both groups and group education more effective in situational anxiety reduction.	Mean anxiety scores after intervention, group education group: 39.02 ± 3.18, individual education group: 40.69 ± 4.37, P = 0.049, d = 0.61 [a], t = 1.98
Ebrahimi Jaberi et al., 2019 (35)	The effect of spaced and mass education on stress and anxiety of candidates for coronary angiography	Interventional comparative study and 60 patients (33 males and 27 females)	Individual face-to-face vs. group (3 - 6 people) sessions	Cohen Stress Scale and Spielberger Anxiety Scale	Before and after intervention, there was no statistically significant difference between two groups in anxiety scores.	Trait anxiety scores after intervention, mass education group: 39.42 ± 12.91, spaced education group: 40.62 ± 1219, P = 0.37, d = 0.73 [a], t = 2.00
Abdeen Ali et al., 2023 (36)	Effect of hand reflexology in ameliorating anxiety, pain, and fatigue among patients undergoing coronary angiography	Semi-experimental study and 60 patients (34 males and 26 females)	10-min hand reflexology, alternating pressure on right/left hand	Visual Analog Scale for Fatigue, Spielberger Anxiety Scale	Significant reduction in anxiety, pain, and fatigue score post-reflexology.	Scores of moderate anxiety levels, intervention group: before = 33.3%, after 2 h = 13.3%, and after three, days = 16.7%, control group: before = 26.7%, after 2 h = 30%, after three days = 30%, P1 = 0.003 (after 2 h), P2 = 0.034 (after, 3 days), d = 0.78 [a], t = 2.00
Foji et al., 2015 (37)	The study of the effect of guided imagery on pain, anxiety and some other hemodynamic factors in patients undergoing coronary angiography	Clinical trial and 62 patients (37 males and 25 females)	Listening to guided imagery for 18 min	STAI Anxiety Scale scores	Significant reduction in anxiety levels post-intervention in guided imagery group.	Trait anxiety scores after intervention, intervention group: 44.09 ± 7.75, control group: 49.22 ± 5.27, P = 0.023, d = 0.72 [a], t = 2.00
Molavi Vardanjani et al., 2013 (38)	The effects of reflexology on anxiety of patients undergoing coronary angiography	Randomized controlled trial and one hundred male patients	Foot massage and reflex point stimulation (solar plexus, pituitary gland, heart) for 30 min	Spielberger Anxiety Scale	Reflexology significantly reduces anxiety during pre-coronary angiography.	Amount of anxiety, reduction, intervention group: 8 ± 3.8, control group: 5.9 ± 3.5, P = 0.014, d = 0.56 [a], t = 1.98
Habibzadeh et al., 2017 (39)	Effects of peer-facilitated, video-based and combined peer-and-video education on anxiety among patients undergoing coronary angiography	Randomized controlled single-blind clinical trial and 120 patients (64 males and 56 females)	Peer education/video education/combined peer and video	STAI Anxiety Scale scores	Significant reduction in anxiety post-intervention in all three groups.	Mean anxiety scores after intervention, peer intervention group: 34.30 ± 7.21, video intervention group: 36.23 ± 7.29, combined intervention group: 30.73 ± 5.56, control group: 42.86 ± 11.64, P = < 0.01, d = 0.38 [a], F = 2.68
Soheilipur et al., 2021 (40)	Comparing the effects of saffron, lippia, and saffron-lippia combination on anxiety among candidates for coronary angiography	Randomized double-blind controlled trial using placebo and 120 patients (64 males and 56 females)	Saffron/ lippie/and saffron-lippia combination 4 hours before angiography	STAI Anxiety Scale scores	Significant reduction in anxiety scores with saffron consumption.	Mean anxiety scores after intervention, saffron group: 65.20 ± 19.17, lippie group: 99.13 ± 11.42, saffron-lippia group: 90.20 ± 22.75, placebo group: 102.13 ± 26.13, P < 0.001, d = 0.30 [a], F = 2.68
Çetinkaya et al., 2018 (41)	Effect of listening to music on anxiety and physiological parameters during coronary angiography	Randomized single-blind clinical trial and 171 patients (98 males and 73 females)	Listening to music during angiography for 15 - 20 minutes	STAI Anxiety Scale scores	No significant effect on anxiety levels was observed.	Mean anxiety scores after intervention, intervention group: 39.09 ± 9.75, control group: 40.4 ± 9.8, P = 0.326, d = 0.43 [a], t = 1.97

Authors	Title	Design and Sample Size	Intervention Type	Tool	Finding	Statistical Result
Ister and Altinbas, 2022 (42)	The effect of acupressure on anxiety and pain among patients undergoing coronary angiography	Randomized controlled trial and 80 patients	Acupuncture at Hegu, Shenmen, and Yintang points for 11 min	Spielberger Anxiety Scale Visual Analog Scale for Pain	Statistically significant reduction in state anxiety after acupuncture.	Mean anxiety scores after intervention, intervention group: 41.50 ± 3.88, control group: 47.92 ± 4.96, P = 0.00, d = 0.74 [a], t = 1.99
Mansoorzadeh et al., 2014 (43)	The effect of acupressure on anxiety and dysrhythmia in patients undergoing cardiac catheterization	Double-blind clinical trial and 70 patients (36 males and 34 females)	Acupuncture at the third eye and Shenmen points	VAS	Significant reduction in anxiety score post-acupuncture.	Mean anxiety scores immediately after intervention, intervention group: 4.28 ± 1.44, control group: 4.80 ± 1.18, P = 0.001, d = 0.67 [a], t = 1.99

Abbreviation: VAS, Visual Analog Scale for Anxiety.

[a] d = effect size.