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# Impact of psycho-educational interventions on patients undergoing Coronary Artery Bypass Grafting Surgery

Shahpar Bagheri[1], Zahra Dadashpouromrani[2], Giti Setoodeh[3], Zahra Hadian Shirazi[1], Azadeh Amiri[2,4*] and Rozhan Ghobadimoghaddam[5]

## Abstract

**Background** Postoperative period of Coronary Artery Bypass Grafting can be challenging, with physical and psychological problems and symptoms. We conducted this study to explore the effect of a psycho-educational intervention on anxiety, pain and physiological parameters among Coronary Artery Bypass Grafting surgery patients.

**Methods** A randomized clinical trial design included one experimental and control group. Data were collected from 56 candidates for coronary artery bypass surgery ($n=28$) in the intervention and ($n=28$) in the usual care groups. Settings were the cardiac centers of the three teaching, specialty, and subspecialty Nemazee, Faghihi, and Al-Zahra hospitals affiliated with Shiraz University of Medical Sciences (SUMS). The data were collected using a demographic information form, the Short-Form McGill Pain Questionnaire, the Spielberger State-Trait Anxiety Inventory, and the physiological parameters form (systolic and diastolic blood pressure, heart rate, respiratory rate, and peripheral oxygen saturation). Psycho-educational interventions were performed individually through face-to-face sessions. All tests were two-tailed, and the statistical level was considered 0.05.

**Results** The mean scores of state anxiety and pain decreased significantly after the intervention ($p<0.05$). Also, psycho-educational interventions affected peripheral oxygen saturation percentage, and breathing rate mean scores ($P<0.05$). But, they did not affect the blood pressure and pulse rate ($P>0.05$). At the same time, there was no significant difference in the control group.

**Conclusion** This study indicated that the pre-operative psycho-educational interventions facilitated intrapersonal caring, reduce state anxiety, relieve pain and stabilize physiological parameters such as peripheral oxygen saturation percentage and breathing rate after surgery among Coronary Artery Bypass Grafting surgery patients. Hence, this intervention is recommended for developing care programs in same population.

**Trial registration** https://www.irct.ir/trial/55652: IRCT20090908002432N8 (**2021-09-17**).

**Keywords** Anxiety, Coronary artery bypass grafting, Pain, Psycho-Educational intervention, Physiological parameters

*Correspondence:
Azadeh Amiri
azadehamiri600@gmail.com

Full list of author information is available at the end of the article

## Background

Coronary Artery Bypass Grafting (CABG) is a common major surgery performed on patients with Coronary Artery Disease [1]. This surgical procedure has the highest number of heart surgeries in Iran, and a large number of open-heart surgeries are performed every year [2, 3]. Coronary Artery Bypass Grafting (CABG) has been the gold standard treatment for revascularization in complex multi-vessel coronary artery disease, and its long-term survival benefits have been demonstrated [4]. However, the postoperative period can be challenging, with physical and psychological problems and symptoms such as anxiety and depression, immobility issues, respiratory complications, insufficient sleep, fatigue, pain, and discomfort [5, 6].

Anxiety manifestations, posttraumatic stress disorder, postoperative delirium, acute adaptive disorder, and stress-induced worsening of cardiovascular parameters are expected. When patients are unable to cope with the stress that they experience, this can lead to mental stress reactions, which, in their further course, can adversely affect physiological and mental parameters that have an impact on the recovery from illness and surgery [6]. Patients feel anxious before surgery because they have not received enough information concerning pain control, postoperative complications management, and recovery period peculiarities [7–9]. Approximately 94% of all patients feel anxiety before surgery, and patients demonstrating significant anxiety levels range between 20% and 35% [10]. Elevated anxiety increases the probability of aggravating the postoperative period [10]. Anxiety and fear experienced by patients during the preoperative period are directly connected to postoperative recovery after cardiac surgeries [10, 11].

On the other hand, studies have shown that preoperative anxiety is related to postoperative pain. Patients with anxiety before cardiac surgery experienced higher pain scores in the postoperative period [12]. Stress changes physiological indicators and endocrine and psychological reactions [13]. The patients experience changes in physiological parameters after surgery [14]. Following the increase in the activity of sympathetic nerves, the increase in the reactivity of the vessels, and the increase in heart rate and blood pressure, these changes lead to intra-tissue damage and platelet accumulation [13, 15]. It seems that anxiety caused by surgery with physiological changes such as increased blood pressure, breathing rate, and heart rate, as a potential risk factor, can endanger the health of the patient [10].

Postoperative pain is a significant healthcare issue. Several factors, such as patient's expectations and opinions and non-continuous management of pain, are involved in the insufficient control of pain after surgery. Acute pain is accompanied by neuro-humoral responses that can significantly increase heart rate, blood pressure, and respiratory rate [16]. Postoperative adult cardiac care requires appropriate physiological monitoring to assess adequate Perfusion and oxygen delivery. Use of monitoring of vital signs and peripheral pulse oximetry are first-line and non-invasive hemodynamic modalities [17–19].

Nurses can offer Psychotherapeutic interventions as non-pharmacological treatment to reduce mental symptoms in the perioperative and postoperative setting [6]. Optimal management of patients' problems enables the patients who have undergone CABG surgery to learn the nature of the disease, and self-care methods reduce psychological distress may improve operative proficiency, accelerate their recovery and reduce the frequency of postoperative complications and shorten the length of hospitalization [5–7, 20–22]. Studies have shown that preoperative interventions can affect the severity of postoperative pain and the patient's response to pain [23–25]. Coronary artery bypass graft (CABG) patients require educational interventions to support recovery and prevent surgical complications [26]. We conducted this study to investigate whether psycho-educational interventions affect anxiety, pain, and physiological parameters in patients undergoing coronary artery bypass graft (CABG) surgery.

### Hypotheses

The hypotheses of this study were as follows:

- H1: Psycho-educational interventions affect anxiety in patients undergoing CABG surgery.
- H2: Psycho-educational interventions affect pain in patients undergoing CABG surgery.
- H3: Psycho-educational interventions affect physiological parameters in patients undergoing CABG surgery.

### Research objective

The primary aim of this study was to investigate the impact of psycho-educational interventions on anxiety among CABG surgery patients. The secondary aim was to examine its effect on pain and physiological parameters (heart rate, breathing rate, blood pressure, and peripheral oxygen saturation).

## Methods

### Study design

This study was a randomized controlled trial. The Consolidated Standards of Reporting Trials statement

for the study design and reporting was adopted from a previous study [27].

### Setting

This study was conducted in cardiac centers of the three teaching, specialty, and subspecialty Nemazee, Faghihi, and Al-Zahra hospitals affiliated with Shiraz University of Medical Sciences (SUMS). These three hospitals are the main centers in southern Iran and offer specialized heart and vascular disease services, which are equipped with Coronary Care Units, Post CCU, Post Angiography, Cardiac Operating Room, and ICUs [28].

### Participants

The participants included all patients over 18 years of age who were candidates for coronary artery bypass grafting surgery, and their records were available at the heart centers. Sampling continued until the intended number of participants for each group was achieved. Study enrollment started on 25 October 2021 and ended on 15 January 2022.

### Inclusion and exclusion criteria

The study's inclusion criteria were 18 to 65 years old, being able to speak and write in Persian, being willing to give written consent and having no history of cardiac surgery. The exclusion criteria were not understanding the study methods, being diagnosed with a psychiatric disorder according to DSM-5, having taken part in structural interventions related to patient caring during the past six months, fever and infection after the surgery, and occurrence any problem during surgery and anesthesia, such as causing complications.

### Sampling and sample size

Based on the study conducted by Abbaszadeh et al. [29], using G*Power3 software and considering the power of 0.8, error of 0.05, and loss rate of 10%, effect size Cohen's d = 0.796, 56-subject sample size was estimated for the study. The participants were randomly allocated in 14 blocks of 4 into intervention and control groups using a computerized random number generator (Random allocation software), ensuring a 1:1 allocation ratio. Each block, therefore, resulted in the allocation of 28 individuals to each of the two groups.

A trained nurse, who was blinded to the study groups, conducted face-to-face interviews to complete the questionnaires. At first, the nurse explained the information regarding the study process and intervention program to participants and ensured that they received sufficient information and understood the nature of the study to enable them to feel less doubtful about accepting the intervention program. Participants gave informed consent voluntarily and were comfortable and able to accept or reject the information presented. Participants were assured that they could withdraw from the study anytime without interfering with standard care. Then, the participants' informed consent forms were obtained, and their basic information, including demographic and pre-assessment data, was collected by data collection instruments. Based on the study design one day before the operation, the McGill pain and Spielberger's StateAnxiety Inventory were completed by the intervention and control groups. Physiological indicators (blood pressure, heart rate, breathing rate, arterial blood oxygen percentage) were measured via monitoring and recorded by the trained nurse in the same situation on the same day. The information related to the post-assessment was collected from all the study participants by McGill pain and Spielberger's State-Anxiety Inventory and measurement of the physiological indicators via monitoring. Once patients showed signs of recovery, usually 48 h after surgery, they were transferred to the cardiac surgery ward. Post-assessments were performed 24 h after transfer to the ward, before discharge. Patients were usually discharged 24 h after transfer to the ward.

Data were gathered by the same researcher to maintain reliability.

Full blinding of researchers and participants was not possible in this psycho-educational trial; however, blinding was applied to data collection, data management, and statistical analyses.

### Intervention

The intervention was provided individually with face-to-face interviews, consultation, and training for each participant in the intervention group through three 30-min psycho-educational sessions with 3-4-hour intervals on the one day before the surgery in cardiac ward. The content of psycho-educational interventions was evaluated and validated by the research team and nursing specialists. Also, the educational booklet and pamphlet, which included a summary of the intervention, were provided to the patients.

Educational interventions included practical breathing exercises after heart surgery and how to use spirometry, self-care training, and nutritional care after surgery, giving information about the period of the disease and treatment, common medications after surgery and their side effects, and how to take care of the surgical site, stitches and chest tube. Psychological interventions included teaching mindfulness breathing exercises. The psychological protocol was done again in a one-hour meeting 48 h after the surgery at the time of transferring the patient from ICU to the ward and before discharging from the ward. At the end of

each session, clarification with further teaching was provided if necessary. In this study, the control group participants received the usual care protocols, which included brief verbal instructions on post-surgery care, such as medications, nutrition, activities, and surgical site care. However, after the study, the control group was provided with educational content, including audio files and pamphlets. The CONSORT flow diagram of the study is depicted in Fig. 1.

## Instruments

### *Demographic information form*

Demographic information form included age, sex, marital status, occupation, and education level.

### *Short-Form McGill pain questionnaire (SF-MPQ)*

The McGill Pain Questionnaire (MPQ) was created in 1975 [30] and has become one of the most widely used tests for pain measurement. It provides valuable information on the sensory, affective, and evaluative dimensions of pain experience and can discriminate among different pain problems [31]. In 1987, the short form-MPQ (SF-MPQ) was designed and proven to have excellent validity and reliability [32]. The SF-MPQ was further revised in 2009 for various pain conditions (SF-MPQ-2). SF-MPQ-2 includes 22 items with 0–10 numerical response options. Based on the results of these EFAs, four SF-MPQ-2 subscales were established. The results of the CFA demonstrated a good fit for the SF-MPQ-2 subscale. Internal consistency reliability, a Cronbach's alpha of $r > 0.75$, has been reported [33].

The Persian translation of the SF-MPQ-2 is a reliable and valid instrument for evaluating pain in Iranian patients with and without neuropathic etiology [34]. Exploratory factor analysis has revealed four components similar to the original SF-MPQ-2. Cronbach's alpha was reported to be above 0.80, which showed high internal consistency [34]. Interclass correlation coefficient (ICC) of more than 0.90 has demonstrated adequate test–retest reliability. There was also a high correlation between the

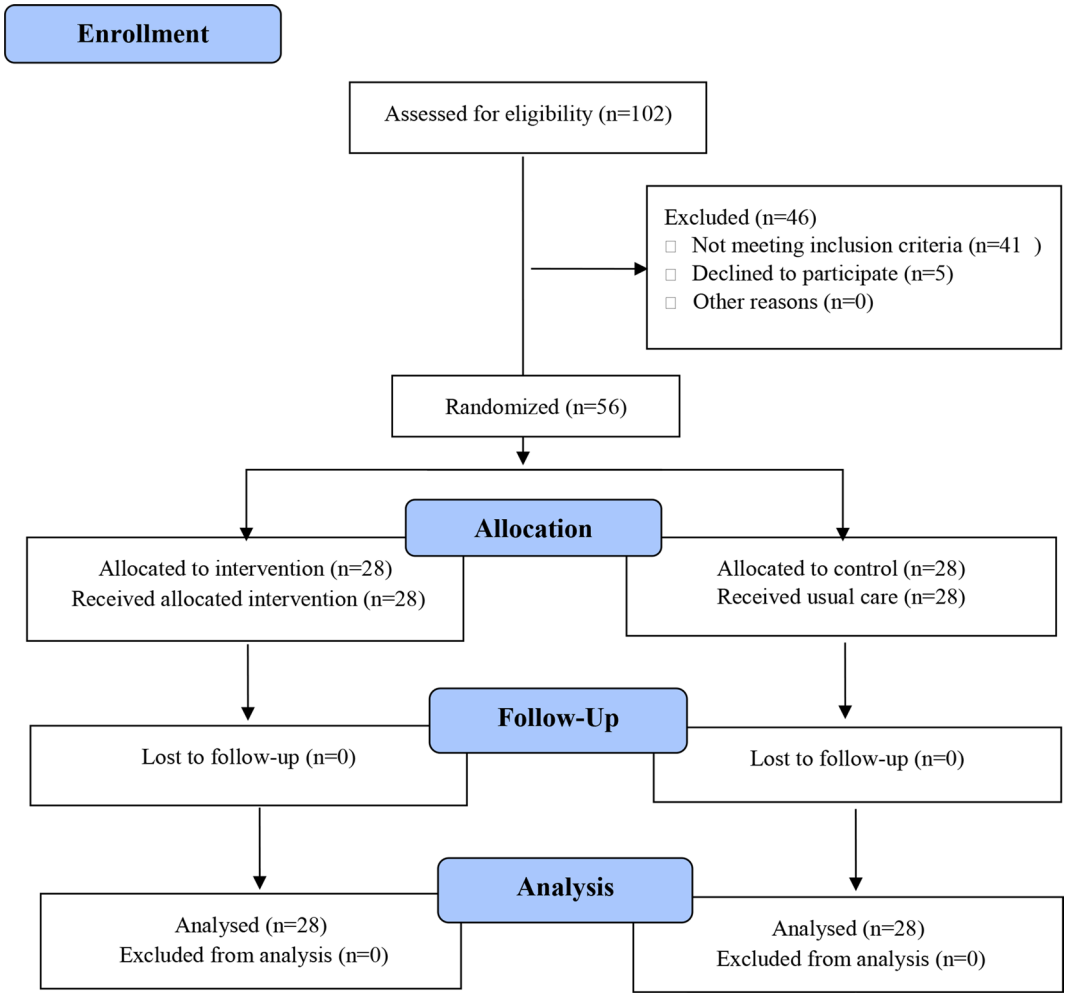


**Fig. 1** Flow chart of the study

mean VAS and the mean total score ($r = 0.92$) [34, 35]. In this study, Cronbach's alpha approved the scale's internal consistency of 0.82.

#### *Spielberger's State-Trait anxiety inventory (STAI)*

Spielberger and colleagues developed the State-Trait Anxiety Inventory in the USA in 1970 [36]. It has 40 items, 20 of which evaluate the state anxiety, and the remaining items analyze the trait anxiety. The State Anxiety Inventory (SAI) consists of 20 phrases, which assess the feelings of the respondent at the moment and at the time of response. The Trait Anxiety Inventory (TAI) has 20 items, which evaluate the general and normal feelings of the respondents. The internal consistency coefficient of STAI has been confirmed at Cronbach's alpha of 0.92. Items scored on a 4-point Likert scale. The lowest score is 20, and the highest is 80 [37]. Internal consistency coefficients for the scale have ranged from 0.86 to 0.95; test-retest reliability coefficients have ranged from 0.65 to 0.75 over a 2-month interval (Spielberger et al., 1983). Test-retest coefficients for this measure in the present study ranged from 0.69 to 0.89. Considerable evidence attests to the construct and concurrent validity of the scale (Spielberger, 1989). The STAI scores of $< 40$ reveal no or minimal symptoms, and $\geq 40$ indicate the presence of moderate or severe symptoms [38]. The STAI has established validity and reliability in Iranian society. Mahram verified scientific reliability using Cronbach's a, which was 0.9452 in the normal community and 0.9418 in the standard community [39]. In research by Khanipour, the internal consistency coefficient of the instrument was estimated at the Cronbach's alpha of 0.66 [40]. In study by Gholami Booreng et al. (2017), reliability was 0.87 via Cronbach's alpha and 0.76 via re-test after seven days [41]. In this study, the State Anxiety Inventory (SAI) was used to measure anxiety levels. Its reliability was assessed, and Cronbach's alpha confirmed a strong internal consistency ($\alpha = 0.79$). The SAI scores range from 20 to 80, with higher scores indicating greater levels of anxiety.

**Table 1** Demographic characteristics at the beginning of the study

| Variable | | Intervention $n = 28$ | Control $n = 28$ | *P*-value |
|---|---|---|---|---|
| Age | Mean (SD) | 54.89 ± (6.70) | 58.61 ± (10.26) | 0.115 [a] |
| Gender | Female (%) | 11 | 9 | 0.577 [b] |
| | Male (%) | 17 | 19 | |
| Occupation | Employed (%) | 14 | 12 | 0.481 [b] |
| | Jobless (%) | 13 | 16 | |
| Education level | Below diploma (%) | 16 | 19 | 0.659 [b] |
| | Diploma (%) | 7 | 6 | |
| | Academic (%) | 5 | 3 | |
| Married status | Married (%) | 23 | 22 | 0.737 [b] |
| | Single (%) | 5 | 6 | |

The data have been expressed as Mean + SD or n (%). Significant differences between the groups were determined by independent samples t-test[a], and chi-square test[b]. The level of significance was set at 0.05

### Data analysis

SPSS version 21 was used for data analysis. Descriptive data were presented using tables and charts (mean and standard deviations). Independent samples t-test and chi-square test were used to determine the homogeneity of the study groups by comparing participants' characteristics and scores. Additionally, an independent t-test was conducted to assess potential differences between participants at baseline (pre-test).

In the post-test, an independent samples t-test was used to evaluate differences between the two study groups in terms of the mean scores of study variables. Changes in the outcome variable from pre-test to post-test were analyzed using a paired t-test.

All tests were two-tailed, and the statistical significance level was set at 0.05.

### Ethics

The Institutional Human Ethics Committee of Shiraz University of Medical Sciences approved this study (IR.SUMS.REC.1400.175). Then, the researchers started the sampling after trial confirmation at the Iranian Registry of Clinical Trials (IRCT) with the code IRCT20090908002432N8 (2021-09-17). Voluntary participation informed consent written forms were obtained from all the participants included in the study after providing complete information about the study objectives and procedures. Moreover, all the participants were assured about the confidentiality of their data and that they could withdraw from the study at any time without interfering with standard care. All procedures performed in this study complied with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## Results

Twenty (35.7%) of participants were female, and 36 (64.3%) were male. The participants' ages ranged from 41 to 72 years, with a mean age of 56.75 ± 8.78 years. Both groups were homogeneous in demographic variables. Statistical analysis showed no statistically significant difference ($p > 0.05$) (Table 1).

No significant difference between the state anxiety mean scores in the intervention and control groups before the intervention ($p > 0.05$) (Table 2). Therefore, the two groups were similar and could be compared.

**Table 2** Comparison of the mean score of state anxiety, between-group and Within-groups

| Group | | Intervention | Control | Difference of means | 95% CI | | *p*-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| State anxiety | Before the intervention | 47.03 ± (5.21) | 46.96 ± (4.22) | 0.71 | -2.47 | -2.61 | 0.955 |
| | After the intervention | 43.10 ± (2.80) | 47.25 ± (4.46) | -4.14 | -6.14 | -2.14 | 0.000 |
| *p*-value | | 0.003 | 0.752 | | | | |

**Table 3** Comparison of the mean score of pain and physiological parameter, between-group and Within-groups

| Variable | Time | Intervention | Control | Difference of means | 95% CI | | *p*-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| Pain | Before the intervention | 41.64 ± (7.87) | 43.28 ± (8.12) | 1.64 | -5.93 | 2.64 | 0.446 |
| | After the intervention | 35.14 ± (7.66) | 43.82 ± (7.77) | -8.67 | -12.8 | -4.54 | 0.000 |
| *p*-value | | 0.000 | 0.745 | | | | |
| Blood pressure systolic | Before the intervention | 125.36 ± (12.44) | 124.96 ± (13.87) | 0.39 | -6.67 | 7.45 | 0.912 |
| | After the intervention | 113.96 ± (11.74) | 122.71 ± (14.75) | -8.75 | -15.89 | -1.6 | 0.17 |
| *p*-value | | 0.000 | 0.474 | | | | |
| Blood pressure diastolic | Before the intervention | 79.28 ± (9.46) | 78.85 ± (7.72) | 0.42 | -4.19 | -5.05 | 0.853 |
| | After the intervention | 75.60 ± (8.92) | 78.96 ± (8.10) | -3.57 | -7.92 | 1.20 | 0.146 |
| *p*-value | | 0.106 | 0.956 | | | | |
| The number of pulse rate | Before the intervention | 77.10 ± (10.03) | 76.78 ± (10.13) | 0.32 | -5.08 | 5.72 | 0.90 |
| | After the intervention | 73.14 ± (6.01) | 76.92 ± (8.88) | -3.78 | -7.85 | 0.28 | 0.67 |
| *p*-value | | 0.63 | 0.951 | | | | |
| Peripheral oxygen saturation percentage | Before the intervention | 96.21 ± (1.66) | 96.14 ± (1.45) | 0.71 | -0.76 | 0.90 | 0.865 |
| | After the intervention | 97.78 ± (1.66) | 96.46 ± (1.34) | 1.32 | 0.64 | 1.99 | 0.000 |
| *p*-value | | 0.000 | 0.047 | | | | |
| Breathing rate | Before the intervention | 18.82 ± (1.41) | 18.64 ± (1.52) | 0.17 | -0.60 | 0.96 | 0.651 |
| | After the intervention | 16.71 ± (1.60) | 18.78 ± (1.49) | -2.07 | -2.90 | -1.23 | 0.000 |
| *p*-value | | 0.000 | 0.161 | | | | |

There was a significant difference between the state anxiety mean score in the intervention and control groups after the intervention ($p < 0.05$). In the control group, the state anxiety means scores before and after the intervention were not significantly different ($p > 0.05$) (Table 2).

There was no significant difference between the pain and physiological parameter mean scores in the intervention and control groups before the intervention ($p > 0.05$) (Table 3).

There was a significant difference between the pain and also some physiological parameters (peripheral oxygen saturation percentage and breathing rate) mean scores in the control and experimental groups after the intervention ($p < 0.001$) (Table 3). However, the two groups had no significant difference regarding the blood pressure and pulse rate after the intervention ($p > 0.05$) (Table 3).

In the control group, the pain and all physiological parameter mean scores were not significantly different before and after the intervention ($p > 0.05$) (Table 3). However, in the intervention group before and after the intervention, the mean pain and also some physiological parameters (blood pressure systolic, peripheral oxygen saturation percentage, and breathing rate) scores were statistically significant difference ($p < 0.001$) (Table 3), but there was no significant difference before and after the intervention regarding the diastolic blood pressure and pulse rate in the intervention group ($p > 0.05$) (Table 3).

As show Fig. 2, in the intervention group, the state anxiety means scores before and after the intervention were statistically significant differences ($p < 0.05$).

## Discussion

Due to the nature of the disease and surgery, many patients undergoing CABG surgery experience various challenges. Effective educational interventions provided by nurses can help alleviate many of their concerns. The present study aimed to investigate the impact of a psycho-educational intervention program on anxiety, pain and physiological parameters among in CABG surgery patients. The results showed that psycho-educational interventions reduced state anxiety (Table 2), and pain and improved physiological Parameters (Table 3). This can be due to the comprehensive psycho-educational interventions that included practical breathing exercises and mindfulness exercises, as well as information about the disease, treatment, and self-care. Consistently, studies have shown the positive effects of intervention programs for patients undergoing CABG surgery [42–46].

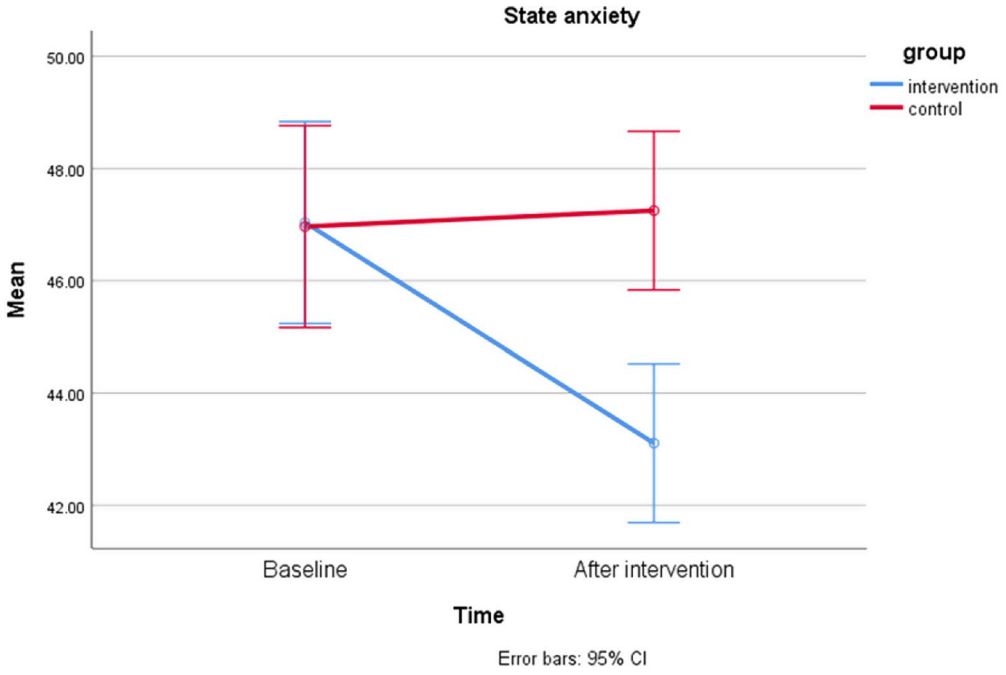


**Fig. 2** Comparison of the mean State anxiety at the baseline and after intervention in both groups (blue for intervention group; red for control group)

Abbaszadeh et al. (2018) indicated that support intervention may be used by nurses as an adjunct to standard ICU care to reduce anxiety and stabilize physiological parameters in patients undergoing coronary artery bypass graft surgery [29]. Reduction of anxiety in heart patients is of great importance because anxiety can cause heart disease and also can worsen the condition of heart patients. Ramesh et al. found that most patients undergoing CABG surgery (84%) experienced anxiety [47]. The current research findings revealed a decrease in the mean score of anxiety due to psycho-education intervention (Table 2). According to the results of this study, as well as findings by Molotkove and Raškeliene (2021), Ali et al. (2021), Kalogianni et al. (2016), Cygnarowicz and Milaniak (2024), and Sadeghi et al. (2024), nurse-led preoperative education significantly reduced anxiety in patients after coronary artery bypass grafting (CABG). Therefore, this intervention should be incorporated into clinical practice [43–45, 48].

Additionally, a systematic review and meta-analysis by Ng et al. (2022), which included 22 trials involving 3,167 patients undergoing cardiac surgery, demonstrated that education had a significant impact on reducing post-intervention anxiety [49]. Højskov et al. (2016) and Ng et al. (2022) also reported that psycho-educational interventions aimed at improving health outcomes in cardiac surgery patients showed high inclusion, feasibility, and safety [49, 50].

In contrast to the findings of the present study, Golchoubi et al. (2024) investigated Benson's relaxation technique and found that while it significantly reduced anxiety within the intervention group, it did not have a significant effect on state anxiety reduction compared to routine care ($P = 0.579$) [51]. This discrepancy may be due to their exclusive use of relaxation techniques, whereas our study implemented a more comprehensive psycho-educational approach.

Savio and Hariharan (2020) demonstrated that psychosocial interventions improved the prognosis of post-CABG patients by reducing psychological distress. Postoperative pain remains a major healthcare concern [22]. Since CABG is a major surgical procedure involving chest opening and cardiac manipulation, pain management plays a crucial role in improving both physical and psychological health outcomes. Therefore, pain management is considered a key nursing responsibility [52]. The results of the present study showed that participants' pain levels decreased significantly after the intervention. Similarly, Nasirnejad et al. (2020) found that patients benefited from rhythmic breathing education, which effectively reduced pain and anxiety after CABG surgery [46]. A randomized study also found that interventions, were effective in reducing both state anxiety and pain in the immediate postoperative period after CABG [53].

Furthermore, Sadeghi et al. (2024) demonstrated that in-person preoperative education significantly reduced pain severity in patients undergoing CABG surgery. By equipping patients with knowledge about pain management strategies, they are empowered to actively participate in their care and gain a greater sense of control over their pain [54].

In another study by Hillis et al. (2018) have shown that providing appropriate educational interventions to patients reduces the need to prescribe painkillers after general surgeries [25]. The current study, consistent with the mentioned research, emphasizes the need to reduce the anxiety and pain of patients through providing psycho-educational interventions.

Babaee et al. (2007) demonstrated that health education helped patients with CABG recover after the surgery [55]. Tigges-Limmer et al. (2021) reported that because psychosocial factors are essential, psycho-education interventions to reduce mental symptoms can be offered in the perioperative setting [6]. However, some studies are not in line with the results of the present study; for example, the results of a survey by Shuldham et al. (2002) demonstrate that preoperative education didn't effect on anxiety and pain in patients with CABG surgery [56]. This can be due to the differences in the duration of the intervention and the tools for examining the variables.

The present study results indicated a significant difference between the intervention and control groups concerning the mean peripheral oxygen saturation percentage and breathing rate scores.

Although the systolic blood pressure before and after the intervention was different and became more stable, there was no significant difference between the two groups regarding blood pressure (Table 3). Also, the findings demonstrate no benefit to be gained from intervention on the heart rate (Table 3). Consistent with these results, the research by Abbaszadeh et al. (2018) indicated that foot reflexology intervention affects some physiological indicators but not the heart rate in patients with CABG.

### Limitations and strengths

Despite the coincidence of this research with the Coronavirus pandemic, the face-to-face individual training method was used, which is a more effective way to convey and influence the content. The routine clinical protocols were considered as much as possible in the study process.

Also, because patients were hospitalized in other rooms, it might be possible that the same conditions were not established for all patients when performing the training and taking vital signs.

## Conclusion

Overall, the results of the present study showed that psycho-educational interventions positively affected the patients undergoing Coronary Artery Bypass Grafting. Anxiety and also pain decreased significantly. Also, psycho-educational interventions positively affected the breathing rate and peripheral oxygen saturation percentage. Thus, training courses should be held in line with the psycho-educational interventions before CABG for patients. Also, further investigation is recommended in this regard.

#### Abbreviations

| | |
|---|---|
| CABG | Coronary Artery Bypass Grafting |
| CCU | Cardiac Care Unit |
| ICU | Intensive Care Unit |
| SF-MPQ | Short-Form McGill Pain Questionnaire |
| STAI | Spielberger's State-Trait Anxiety Inventory |

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#### Author contributions

AA, SB, BD, GS and ZHS contributed to the study conception and design. Material preparation, data collection and data analysis were performed by RG, SB, BD, ZHS, GS and AA. The manuscript was written by SB, AA, BD, ZH and RG. All authors read and approved the final manuscript.

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This study was financially supported by the Research Vice-Chancellor of Shiraz University of Medical Sciences. The funders had no role in study design, data collection, analysis, decision to publish, or manuscript preparation.

#### Data availability

No datasets were generated or analysed during the current study.

## Declarations

#### Ethical approval

The Institutional Human Ethics Committee of Shiraz University of Medical Sciences approved this study (IR.SUMS.REC.1400.175). Then, the researchers started the sampling after trial confirmation at the Iranian Registry of Clinical Trials (IRCT) with the code IRCT20090908002432N8 (2021-09-17). Voluntary participation informed consent written forms were obtained from all the participants included in the study after providing complete information about the study objectives and procedures. Moreover, all the participants were assured about the confidentiality of their data and that they could withdraw from the study at any time without interfering with standard care. All procedures performed in this study complied with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no competing interests.

#### Author details

[1]Community Based Psychiatric Care Research Center, Department of Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Student Research Committee, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[3]Mental Health and Psychiatric Nursing Department, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[4]Department of Surgical Technologists, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[5]Department of Biological Sciences, Middle East Technical University, Ankara, Turkey

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