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Investigating the effect of psycho-educational intervention on preoperative anxiety in bariatric surgery candidates: a randomized controlled trial

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Abstract

Background Preoperative anxiety is prevalent and significantly impacts surgical outcomes. Emotional states, such as anxiety in people undergoing major surgery, are undeniable because surgery is perceived as an unknown and frightening fact. Therefore, the present study aimed to investigate the effect of psycho-educational intervention on preoperative anxiety in bariatric surgery candidates.

Methods A randomized clinical trial was conducted on 60 bariatric surgery candidates, who were randomly allocated to either a control group that received routine care or an intervention group that received psycho-educational interventions. Anxiety levels were assessed using the Spielberger Trait-State Anxiety Inventory. Data were analyzed using SPSS 21 software.

Results According to the findings, patients (mean age: 34.3 ± 10.4 years; BMI: 44.7 ± 6.2) were predominantly female (75%) and married (86.7%) and underwent bypass surgery (75%). State anxiety scores were comparable preoperatively ($P = 0.085$) but significantly lower in the intervention group that underwent Intraoperative ($P < 0.001$) and Postoperative ($P = 0.009$) surgery. The intervention group showed a progressive decline in state anxiety ($P < 0.001$), while the control group had higher postoperative anxiety ($P = 0.008$). Trait anxiety followed a similar pattern, with no baseline difference ($P = 0.058$) but lower scores in the intervention group Intraoperatively and postoperatively (both $P \leq 0.05$). The intervention group exhibited sustained trait anxiety reduction ($P < 0.001$), whereas the control group showed elevated postoperative scores ($P = 0.012$).

Conclusion Psycho-educational interventions might be effective in decreasing preoperative anxiety in bariatric surgery candidates. These results can be considered to facilitate postoperative recovery and minimize unwanted outcomes.

Trial registration number IRCT20100919004775N11 with the Clinical Trial Registry (12.05.2019).

Keywords Preoperative, Anxiety, Bariatric surgery

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Background

Obesity and overweight are among the major public health problems worldwide [1], ranking third after smoking and high blood pressure as a cause of illness, and are the most prevalent non-contagious diseases in affluent nations [2–5]. Globally, obesity accounts for 0.7%–2.8% of total healthcare costs, with medical costs for individuals with obesity being 30% higher than for those at a healthy weight [6]. In Iran, according to 2021 statistics, 25.8% are adults with obesity [7].

Among common comorbidities, mental disorders are a burden to individuals with severe obesity who are to undergo surgical treatment [8]. The findings of a related meta-analysis showed that the most frequent psychiatric condition among candidates seeking bariatric surgery was anxiety [9].

Preoperative anxiety is prevalent and significantly impacts surgical outcomes [10]. It remains a critical concern that can negatively impact surgical outcomes, including increased postoperative pain, length of hospitalization, and risk of psychological complications [11]. This anxiety often arises from numerous factors, including fear of surgery and anesthesia complications, amplifying the necessity for effective management strategies [12].

The relationship between preoperative anxiety and postoperative outcomes in bariatric surgery candidates is profound and multifaceted. Preoperative anxiety is prevalent in this population, with several studies indicating that nearly 25–44% of candidates display signs of anxiety or depression before the surgery [13, 14]. This psychological burden can directly influence surgical outcomes, including recovery speed, post-operative pain perception [15], and even long-term weight management success.

There are many treatments available for the widespread phenomenon of obesity, each with a different level of effectiveness [16]. Although bariatric surgery is useful in improving the physical health of the patients as well as ameliorating such psychological conditions related to weight loss and improvement in body image, it does not affect their general anxiety [17–19]. People with obesity may engage in emotional eating as a coping strategy for anxiety before and after bariatric surgery [20]. Excessive and persistent effects of emotional states such as anxiety affect the individuals' physical and psychological well-being, quality of life, and productivity that may develop into pathological states [21]. The prevalence of mood disorders and anxiety in patients with obesity before bariatric surgery is reported to be 15% to 33% and 24% to 30%, respectively [17, 22, 23]. Therefore, the emotional states such as anxiety in people who are to undergo major surgery is undeniable because surgery is perceived as an unknown and frightening fact [21].

There are many drugs available to reduce anxiety in surgery patients [24], but they have side effects on important body systems [25]. Therefore, non-pharmacological methods, such as massage therapy and music therapy, among other methods, are preferred because they bear no side effects [24, 25]. Difficulties in regulating emotions and chronic anxiety not only lead to weight gain, but also make it difficult to lose weight, contrary to the recovery goals of candidates for bariatric surgery. Therefore, managing the impacts of psychological factors on surgical outcome seems important for preventing complications, improving the efficacy of surgery [26], and rendering psycho-educational support to these people as well [20].

In a retrospective study, the most important cause of non-adherence to the modified diet in bariatric surgery candidates was work-family problems. Strengthening these two factors via education seems to be helpful to achieve optimal outcomes in this type of surgery [27].

Involving family members through education on post-operative care, potential complications, and dietary modifications can be beneficial due to the strong link between family involvement and patient health [28]. Furthermore, the time period when the interventions are performed is important. Post-operative psychological interventions on BMI and mental conditions of bariatric patients seem to be ineffective [29]. Psycho-educational interventions include a set of nursing measures to inform and empower the patients in perioperative self-care. One of the main goals is helping patients to go through the desired recovery process during rehabilitation to support them in this process [29, 30].

Psycho-educational interventions, particularly cognitive behavioral therapies administered preoperatively and at critical postoperative checkpoints, have been shown to significantly reduce preoperative anxiety among bariatric surgery candidates while enhancing psychological functioning [31]. A systematic review of non-pharmacological interventions conducted by Tola et al. [32] highlights various techniques, including music therapy and aromatherapy, which have shown substantial efficacy in reducing anxiety for patients undergoing surgery.

There is a substantial body of evidence advocating the implementation of non-pharmacological techniques as primary or adjunctive therapies for managing preoperative anxiety. The integration of such strategies not only aligns with a more patient-centered model of care but also promises to enhance surgical experiences and outcomes.

The current literature reveals a significant research gap in psycho-educational interventions targeting preoperative anxiety in bariatric surgery candidates [31, 33]. Hence, there is a pressing need for tailored psychological strategies that specifically address the unique challenges faced by this patient population during the preoperative

phase. The present study was conducted to evaluate the effect of a psycho-educational intervention on preoperative anxiety in bariatric surgery candidates. We hypothesize that candidates receiving the psycho-educational intervention would exhibit lower levels of preoperative anxiety compared to those in the control group.

Methods

Design, sample, and setting

Participants

This randomized clinical trial includes an intervention group and a control group. The study population consisted of patients who were candidates for bariatric surgery at 'Madar va Koodak Ghadir Hospital' of Shiraz, the largest minimally invasive surgery hospital in the region, from September 2019 to April 2020.

Sample size calculation

In the absence of prior similar studies, the sample size was estimated assuming a medium effect size appropriate for repeated measures analysis of variance (Cohen's $f = 0.25$). A statistical power of 80% and a two-sided alpha level of 0.05 were considered. To account for a potential attrition rate of 15%, a total sample size of 80 participants was initially planned. The sample size calculation was performed using G*Power software.

Sample size

At the beginning of the study, 80 individuals were assessed. Of these, 14 participants were excluded due to not meeting the inclusion criteria ($n = 11$), cancelled surgery ($n = 5$), and other reasons ($n = 4$). The inclusion criteria were as follows: 1. Being willing to participate in the study;

2. Being a candidate for one of the following types of bariatric surgery: Bypass, Sleeve, Mini Bypass, or SASI; 3. Being ability to read and write, ensuring proper comprehension of study procedures, the participant or a family member; 4. Having no disorders of internal secretory glands (e.g., thyroid, adrenal, or pituitary disorders); and 5. Having no other treatable obesity-related diseases (e.g., diabetes mellitus, hypertension). The exclusion criterion was a diagnosis of severe and well-known mental illnesses [27, 34] (Fig. 1). Ultimately, 60 participants met the inclusion criteria and were randomly allocated to the study groups, and 30 individuals were included in each of the control and intervention groups for analysis.

Randomization

Sampling in this study was conducted in two stages. In the first stage, the obesity clinic of the Madar va Koodak Ghadir Hospital was selected using convenience sampling. In the second stage, random allocation to the two study groups was performed using block randomization

with a block size of 4, stratified by sex to control for potential effect. Random Allocation Software v2.0 was used to generate random sequences, allowing all possible permutations within each block. This procedure ensured unbiased allocation to the control and intervention groups [35]. In this way, the two sexes (women and men) were used in two separate classes. In each sex, the order in each random block was the criterion used for placing people in the control and intervention groups. The reason for controlling the effect of sex in these patients was that, according to studies, anxiety is higher in women than in men, and this factor was controlled to reduce confounding factors. Given the higher prevalence of anxiety in females than males, we decided to control for the sex effect to reduce the effects of confounding variables [26].

Measures

Patient assessment for trial entry is shown in the CONSORT diagram (Fig. 1).

Blinding

Due to the nature of the intervention, blinding of participants was not feasible. However, the clinical staff responsible for patient care and outcome assessment, as well as the statistician who performed the data analysis, were blinded to group assignments. Blinding was maintained throughout the study period, and allocation concealment was ensured by concealing the randomization sequence from the researcher who enrolled the participants until assignment.

Ethical considerations

The present study commenced after obtaining ethical approval from the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1398.129). At the outset, the study objectives were explained to the patients who participated in the study, and written informed consent was obtained. Additionally, the participants were assured of the confidentiality of their information and the voluntary nature of their participation.

Demographic questionnaire

The candidates' demographic questionnaire was developed by the researchers to obtain data about age, sex, marital status, education, and income level.

Spielberger Trait-State Anxiety Inventory (STAI)

STAI was developed by Spielberger, Gorsuch, Lushene, Vagg, and Jacobs in 1983 [36]. The internal consistency reliability of Cronbach's alpha coefficients ranges from 0.86 to 0.95 [37]. Reliability has been confirmed with a Cronbach's alpha coefficient of 92% for the state anxiety scale and 90% for the trait anxiety scale [38]. The STAI

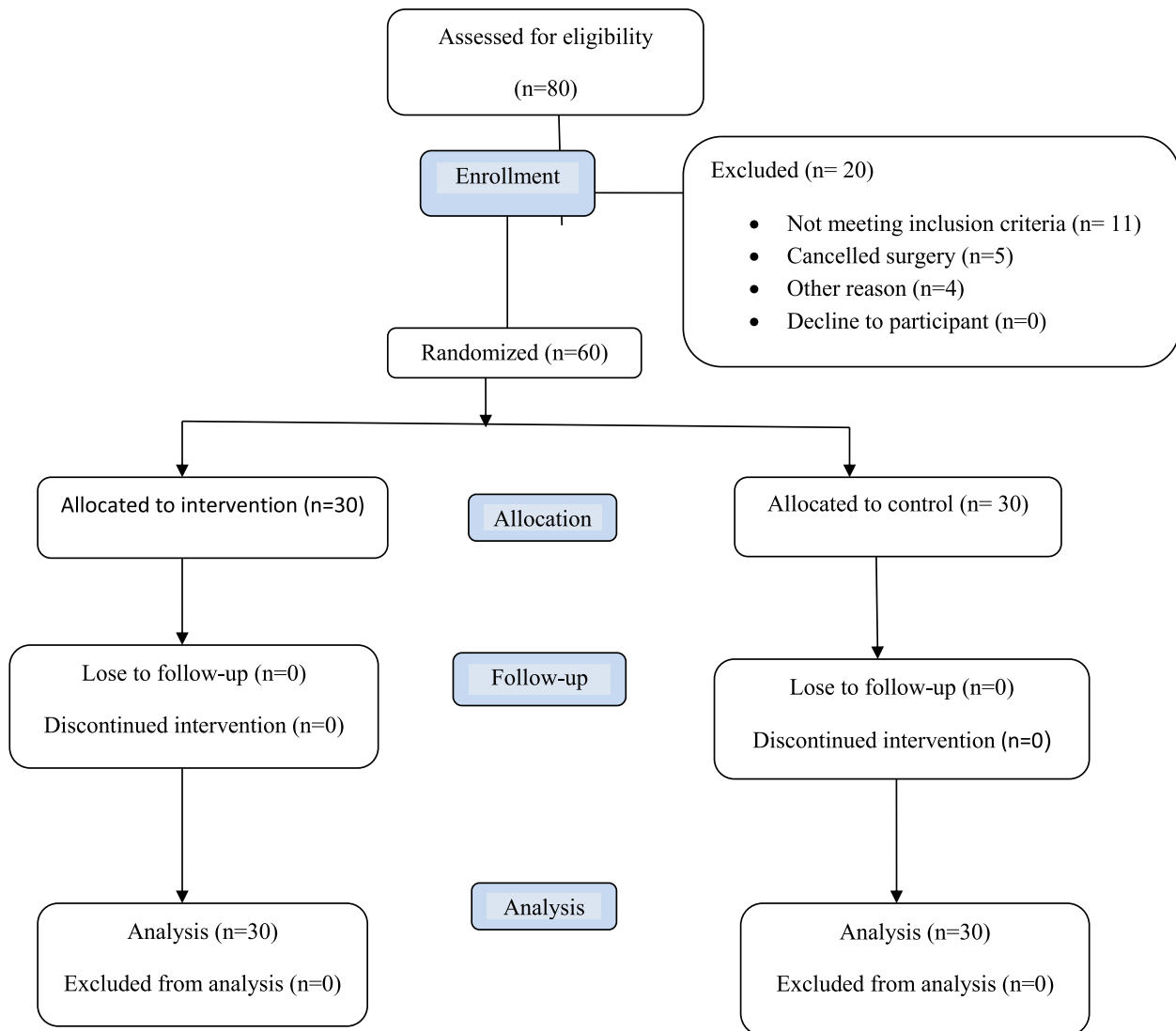


Fig. 1 The participant CONSORT flow diagram

is a commonly used measure of trait and state anxiety. Validity and reliability of the STAI were assessed in previous studies in Iran [39, 40]. This questionnaire contains 40 questions; questions 1 to 20 are dedicated to state anxiety, and questions 21 to 40 are about trait anxiety. Questions related to state anxiety are scored on a four-option Likert scale, including not at all, sometimes, usually, and very much, and questions related to trait anxiety are scored in the same way, including almost never, sometimes, most of the time, and almost always). The scoring weights are reversed for statements that indicate no anxiety. Finally, two scores are obtained, the first one indicating state anxiety and the second indicating trait anxiety. Each person can also obtain scores between 20 and 80 in these two types of anxiety. The Persian version of the State-Trait Anxiety Inventory (STAI-Y) was used to assess the participants' state and trait anxiety. Prior

studies in Iranian populations have confirmed acceptable psychometric properties for this version; for instance, in a sample of 492 high-school students, internal consistency (Cronbach's α) was 0.846 for the state subscale and 0.886 for the trait subscale. Convergent validity of the Beck Anxiety Inventory (BAI) was 0.643 (state) and 0.612 (trait) [41]. In the test standardization in Iran, the test-retest validity for the anxiety trait scale was 0.65–0.86, and the Cronbach's alpha coefficient for state anxiety was 0.92 [42]. In the study by Momensaraei et al., the internal consistency of the questionnaire was determined using Cronbach's alpha method; it was estimated 0.87 for patients undergoing coronary artery surgery [43].

Procedure

The psycho-educational intervention was performed using small-group, and face-to-face sessions were

conducted in a private clinical setting. Each group consisted of 5–7 participants to facilitate the interaction and peer support.

All sessions were conducted by a graduate student with a master's degree in nursing, who had received specific training on Johnson's Behavioral Model of Information Provision and perioperative psycho-educational interventions before the study. The intervention content was based on a standardized, pre-developed protocol, and the facilitator delivered all sessions under the supervision of an experienced faculty member to ensure consistency and fidelity.

Supplementary individual support was provided via telephone and social media platforms (WhatsApp and email) to address the participants' questions and concerns; however, the core educational sessions were conducted in person and in a group format.

Psycho-educational interventions

Johnson's Behavioral Model of Information Provision is a well-established theoretical framework developed to guide the design of psycho-educational interventions for patients undergoing stressful medical procedures, such as surgery [44]. According to this model, the patient's anxiety and psychological responses are significantly influenced by the type and amount of information they receive before the event [45, 46]. The model emphasizes the delivery of two major types of information:

Procedural (Cognitive) Information – which helps the patient understand what will happen and how events will unfold.

Sensory Information – which prepares the patient for how they might feel physically and emotionally during and after the procedure.

Johnson's model proposes that providing both types of information can enhance the patient's sense of predictability and control, leading to reduced anxiety, better cooperation with medical staff, and improved recovery outcomes. Given that bariatric surgery is a major surgical intervention often associated with significant preoperative anxiety, we designed the psycho-educational component of our intervention based on Johnson's model. This model was selected for its evidence-based structure, patient-centered focus, and proven effectiveness in various surgical settings [45, 47]. By systematically providing sensory and procedural information in a structured format, we aimed to reduce uncertainty and improve psychological readiness among candidates for bariatric surgery.

Intervention group

The intervention was delivered in three structured sessions starting two weeks before the surgery. Each session lasted 30–45 min and was conducted face-to-face in a private setting. Educational content was provided through oral explanation, multimedia presentations, and interactive discussions.

Session 1 – procedural information

In this session, the following items were explained and discussed in plain language: bariatric surgery and its process, complications, risk factors, effects of failure in treatment plan, methods of prevention and control of complications, and performance of self-care behaviors (adherence to diet, medication, and physical exercise), explanation of the hospital admission process, the surgical day schedule (admission, preoperative preparation, anesthesia, recovery room, ward), a description of the surgical steps and postoperative monitoring, and the roles of the healthcare team. Afterwards, the participants' questions were answered.

Session 2 – sensory information

In this session, anxiety and its causes were discussed, and reactions to anxiety and methods of managing it were taught. Relevant booklets and brochures were also provided to the patients. The educational content of this session included common physical and emotional experiences (pain, nausea, venipuncture, tubes), environmental sensations (light, sound of equipment, surgical gown), the use of guided imagery and breathing techniques, and the presentation of files including soothing sounds, photos of the simulated environment and breathing training.

Session 3 – Coping Strategies and Q&A

This session was held 1–2 days before surgery for 30 min. The content of this session included creation of emotional readiness, clarification of doubts, correction of misconceptions, an introduction to simple anxiety reduction strategies, and an opportunity for open discussion and peer concerns with a structured Q&A session. During this session, the participants shared their concerns and knowledge about perioperative care and corrected each other's flaws. Throughout the study, the researchers were in touch with patients via social networks (telephone, WhatsApp, and email) to address ambiguities and potential concerns. The candidates in the intervention group were in touch with the researchers and others, via a WhatsApp group from 15 days before bariatric surgery to two weeks after it. This group also included three former patients who had undergone Sleeve or Bypass surgery successfully and responded to the candidates' concerns.

The STAI was completed in the operating room immediately prior to anesthesia induction. Specifically, participants filled out the questionnaire approximately 10–15 min before induction. The questionnaire was completed independently by the patient (research staff were available only to provide standardized instructions and ensure completion). The assessment was conducted under routine pre-induction operating room conditions. During questionnaire completion, only the research assistant was present was present.

Control group

The control group received only brief, routine hospital training that did not provide an opportunity for volunteers to discuss issues such as their concerns and fears. Following completion of the third phase, brochures and educational videos on relaxation techniques and anxiety management were made available to the control group.

The STAI was completed in three stages. The first stage was completed fifteen days before bariatric surgery by the patient in the presence of the researcher. The rationale for choosing this date was that we wanted to control the baseline trait-state anxiety and reduce the effects of possible intervening variables. The second stage was performed in the operating room by the patient with the presence of a fixed surgical nurse, and the third stage was performed by the patient with the presence of the researcher fifteen days after bariatric surgery. The rationale to choose this date was the fact that the patients were assumed to have recovered

enough to be able to better evaluate the impacts of our interventions. Before beginning the interventions, the candidates signed written informed consent in both intervention and control groups.

Statistical analysis

All analyses were conducted using SPSS, version 21. Base-line characteristics are summarized as means and standard deviations, or by percentage for continuous and discrete variables, respectively. Independent t-tests and chi-square (Fisher's exact) tests compared quantitative and qualitative variables between the groups. Repeated measures tests assessed changes in quantitative variables over time (Preoperative, Intraoperative, and Postoperative).

Results

Patients had a mean age of 34.33 ± 10.40 years and a mean BMI of 44.74 ± 6.23 . Most were female (75%) and married (86.7%), had a high school education or less (58.35%), and had undergone bypass surgery (75%). Because *P*-values in Table 1 exceeded 0.05 for all listed variables, the groups were homogeneous.

Table 2 presents state anxiety scores in the case and control groups across preoperative, intraoperative, and postoperative periods.

Between-group comparisons showed that preoperative state anxiety scores were slightly higher in the case group than the control group, but this difference was not statistically significant ($p = 0.085$, Cohen's $d = 0.45$). During the

Table 1 Comparison of demographic characteristics of the participants in the two groups

Variables		Total N=60 Number (percentage)/ Mean $\pm$ Standard Deviation	Groups		P-value
			Intervention N=30 Number (percentage)/ Mean $\pm$ Standard Deviation	Control N=30 Number (percentage)/ Mean $\pm$ Standard Deviation	
Sex	Female	45 (75)	22 (73.3)	23 (76.7)	0.76**
	Male	15 (25)	8 (26.7)	7 (23.3)	
Marital Status	Single	8 (13.3)	5 (16.7)	3 (10)	0.71***
	Married	52 (86.7)	25 (83.3)	27 (90)	
Education	Illiterate	2 (3.35)	1 (3.3)	1 (3.3)	0.995***
	Cycle	33 (55)	17 (56.7)	16 (53.3)	
	Bachelor's	23 (38.3)	11 (36.7)	12 (40)	
	Master's and above	2 (3.35)	1 (3.3)	1 (3.3)	
Surgery	Bypass	45 (75)	23 (76.7)	22 (73.3)	0.052***
	Sleeve	12 (20)	6 (20)	6 (20)	
	Sasi	2 (3.3)	1 (3.3)	1 (3.3)	
	Mini Bypass	1 (1.7)	0	1 (3.3)	
Age		34.33 ± 10.40	34.73 ± 11.08	33.93 ± 9.85	0.77*
BMI		44.74 ± 6.23	44.27 ± 5.86	45.22 ± 6.65	0.56*

N (%); Mean $\pm$ Standard Deviation

*Independent Sample T-test

**Chi-Square Test

***Fisher Exact Test

Table 2 Comparison of the mean State anxiety score at different time period in two groups

		Time			Diff Before vs. During Mean $\pm$ SE	Diff Before vs. After Mean $\pm$ SE	Diff During vs. After Mean $\pm$ SE
		Before Mean $\pm$ SD	During Mean $\pm$ SD	After Mean $\pm$ SD			
Group	Intervention	55.73 $\pm$ 15.42	39.17 $\pm$ 9.98	35.83 $\pm$ 8.44	-16.56 $\pm$ 3.14***	-19.90 $\pm$ 3.26***	-3.33 $\pm$ 2.57
	Control	49.07 $\pm$ 14.05	54.57 $\pm$ 12.87	42.27 $\pm$ 10.03	5.50 $\pm$ 3.54	-6.80 $\pm$ 3.25*	-12.30 $\pm$ 3.53**
P-value between group†		0.085	< 0.001	0.009	< 0.001	0.006	0.045

In Intervention: F value Statistic for Repeated measures ANOVA = 37.15; P -value < 0.001

In Control: F value Statistic for Repeated measures ANOVA = 8.05; P -value = 0.008

* P < 0.05, ** P < 0.01, *** P < 0.001

†: Independent sample T-test

Table 3 Comparison of the mean Trait anxiety score at different time period in two groups

		Time			Diff Before vs. During Mean $\pm$ SE	Diff Before vs. After Mean $\pm$ SE	Diff During vs. After Mean $\pm$ SE
		Before Mean $\pm$ SD	During Mean $\pm$ SD	After Mean $\pm$ SD			
Group	Intervention	56.06 $\pm$ 12.81	37.50 $\pm$ 9.89	34.80 $\pm$ 7.56	-18.56 $\pm$ 3.16***	-21.26 $\pm$ 2.73***	-2.70 $\pm$ 2.26
	Control	49.43 $\pm$ 13.74	53.20 $\pm$ 12.97	42.43 $\pm$ 10.47	3.76 $\pm$ 3.16	-7.0 $\pm$ 3.72	-10.77 $\pm$ 3.42**
P-value between group†		0.058	< 0.001	0.002	< 0.001	0.003	0.049

In Intervention: F value Statistic for Repeated measures ANOVA = 64.53; P -value < 0.001

In Control: F value Statistic for Repeated measures ANOVA = 7.14; P -value = 0.012

* P < 0.05, ** P < 0.01, *** P < 0.001

†: Independent sample T-test

intraoperative period, the case group exhibited significantly lower state anxiety scores compared with the control group (p < 0.001, Cohen's d = 1.34). Postoperatively, the case group also had significantly lower anxiety scores (p = 0.009, Cohen's d = 0.69).

Within-group repeated measures ANOVA indicated a significant effect of time in both groups. The effect of time was very large in the case group ($F(2,58)$ = 37.15, p < 0.001, partial η^2 = 0.56) and large in the control group ($F(2,58)$ = 8.05, p = 0.008, partial η^2 = 0.22).

Post-hoc pairwise comparisons revealed significant reductions in state anxiety in the case group from preoperative to intraoperative (-16.56 $\pm$ 3.14, p < 0.001) and preoperative to postoperative (-19.90 $\pm$ 3.26, p < 0.001), with a smaller reduction from intraoperative to postoperative (-3.33 $\pm$ 2.57, p = 0.045). In the control group, anxiety increased from preoperative to intraoperative (5.50 $\pm$ 3.54, p = NS), decreased slightly from preoperative to postoperative (-6.80 $\pm$ 3.25, p = 0.006), and decreased further from intraoperative to postoperative (-12.30 $\pm$ 3.53, p < 0.01) (Table 2).

Table 3 presents trait anxiety scores for the case and control groups at preoperative, intraoperative, and postoperative time points.

Between-group comparisons showed that preoperative anxiety was higher in the case group than the control group; however, this difference was not statistically significant (p = 0.058, Cohen's d = 0.50). During the intraoperative period, the case group exhibited significantly lower

trait anxiety scores than the control group (p < 0.001, Cohen's d = 1.36). Postoperatively, a significant between-group difference was also observed (p = 0.002, Cohen's d = 0.84).

Within-group repeated measures ANOVA revealed a significant effect of time in both groups. The case group demonstrated a very large effect ($F(2,58)$ = 64.53, p < 0.001, partial η^2 = 0.69), whereas the control group showed a significant but smaller effect ($F(2,58)$ = 7.14, p = 0.012, partial η^2 = 0.20).

Post-hoc pairwise comparisons indicated significant reductions in the case group from preoperative to intraoperative (-18.56 $\pm$ 3.16, p < 0.001) and preoperative to postoperative (-21.26 $\pm$ 2.73, p < 0.001), with a smaller reduction from intraoperative to postoperative (-2.70 $\pm$ 2.26, p = NS). In the control group, anxiety increased slightly from preoperative to intraoperative (3.76 $\pm$ 3.16, p = NS) but decreased significantly from preoperative to postoperative (-7.00 $\pm$ 3.72, p < 0.01) and intraoperative to postoperative (-10.77 $\pm$ 3.42, p < 0.01) (Table 3).

Discussion

Preoperative anxiety is a common and clinically relevant phenomenon among patients undergoing major surgery, including bariatric procedures. Therefore, the present study aimed to investigate the effect of psycho-educational intervention on preoperative anxiety in bariatric surgery candidates.

According to the results of the present study, the state anxiety score of the control group was significantly higher than that of the intervention group, which is consistent with the findings of previous studies [48–50].

Importantly, the anxiety reduction observed in the intervention group appears to be not only statistically significant but also clinically meaningful. The results of the studies show that even moderate reductions in state anxiety scores are associated with improved patient cooperation, reduced perioperative stress responses, and better postoperative experiences [51, 52]. Therefore, the magnitude of anxiety reduction observed in the present study may have practical implications for perioperative care in bariatric surgery candidates.

In this regard, studies have shown that targeted interventions such as nursing preoperative education, virtual reality-based preoperative preparation, mindfulness programs, and music therapy significantly reduce state anxiety scores in the intervention groups compared to control groups. Specifically, a randomized clinical trial conducted by Chiu et al. (2023) using virtual reality-based training showed a statistically significant reduction in preoperative anxiety scores in the intervention group compared to the control group [48]. Similarly, Ruiz Hernandez et al. (2021) conducted a systematic review and meta-analysis focusing on nursing interventions to reduce preoperative anxiety in adults undergoing surgery [50]. The pooled mean difference in preoperative state anxiety was significantly in favor of the intervention group, indicating lower anxiety scores compared to the control group. Also, Pan et al. (2023) demonstrated that an 8-week prenatal mindfulness program reduced anxiety scores longitudinally compared to standard prenatal care [49]. The intervention group showed significant reductions in pregnancy-related anxiety and stress, reinforcing the evidence that structured interventions lower anxiety scores. Conversely, some interventions, such as ICU diaries, did not reduce pain scores but did reduce depression and improve quality of life [53]. This highlights that not all interventions targeting psychological distress necessarily reduce anxiety scores significantly. Overall, the results of various studies have shown that intervention groups receiving anxiety-targeted therapies exhibit significantly lower state anxiety scores than control groups. The amount of the difference varies with the intervention type, duration, and population but is statistically and clinically significant in well-conducted studies.

The current study demonstrated that the trait anxiety score of the control group was significantly higher than that of the intervention group, both Intraoperative and Postoperative. Trait anxiety, as a stable personality characteristic reflecting the propensity to experience anxiety, is a critical measure in perioperative research. However, the lack of significant anxiety reduction in some studies underscores

the complexity of anxiety as a multidimensional construct influenced by the intervention specificity, patient characteristics, and timing. Notably, trait anxiety, as a relatively stable personality characteristic, may be less amenable to rapid modification than state anxiety, yet repeated or comprehensive interventions appear capable of producing measurable changes. In this regard, Aydal et al. (2023) [54] conducted a randomized controlled clinical trial in laparoscopic surgery and compared anxiety and pain levels between the groups trained by operating room nurses (intervention) versus service nurses (control). In this study, overt anxiety scores in the intervention group were significantly reduced after training. Also, Yahagi et al. (2024) [55] investigated the effect of an AI chatbot (ChatGPT) intervention on preoperative anxiety in surgical patients. The findings suggest that innovative technological interventions can modulate anxiety during the perioperative period. In the study by Chevik and Rizallar (2023) [56], while preoperative situational anxiety scores were similar, postoperative situational anxiety was significantly reduced in the intervention group. This randomized controlled study provides direct evidence that educational interventions can reduce situational anxiety during the procedural care. In general, the results of various studies [57] show that psychological interventions reduce intraoperative and postoperative anxiety, including components of trait anxiety. In contrast, Xavier et al. (2020) [58] assessed anxiety in parents of children undergoing cardiac surgery. Despite standardized nursing guidelines, no significant differences were found in trait or state anxiety between intervention and control groups, indicating that not all educational interventions yield anxiety reduction, highlighting the complexity of anxiety modulation.

In summary, the findings suggest that targeted interventions, such as preoperative nursing visits, physiotherapy assistance, psychological education, and technological tools effectively, reduce trait anxiety scores in intervention groups compared with control groups in Intraoperative and Postoperative surgery or procedures. There are exceptions that indicate variation in the intervention effectiveness, depending on the setting, patient population, and type of intervention.

We found that psycho-educational interventions could have positive impacts on preoperative anxiety among the candidates awaiting bariatric surgery. These results support those of previous studies showing that psycho-educational interventions may lead to positive changes and be beneficial for candidates of bariatric surgery. Most studies in this area have focused on the effect of psycho-educational interventions on caregivers' psychological condition merely [59]. However, the originality of our study was not only in educating family alongside the patient but also using the power of family presence in supporting the patients and improving his/herself-confidence in postoperative self-care.

It seems that awareness of what will happen during the surgery and what needs to be done after that, enables the candidates to cope with preoperative anxiety in major surgeries. Vahedian-Azimi et al. (2016) concluded that the implementation of psycho-educational interventions was effective on the anxiety level, perceived stress, and quality of life in myocardial infarction patients before surgery [60]. The impact of psycho-educational interventions on bariatric candidates' anxiety appears to be in the same line with the result of this study.

According to the findings, anxiety level in the intervention group candidates decreased in the operating room compared with their prior anxiety. It can be said that, as they had been informed about what was happening, what they should expect and do, and learned how to recognize and manage their negative emotions, their fear of the unknown subsided; the fear could be the main cause of anxiety before surgery. It seems that the results of this study might be used to reduce preoperative anxiety in bariatric surgery candidates.

Conclusion

Informing and educating patients is an integral part of the treatment process. Implementation of psycho-educational interventions in health centers is a strategy that can help patients overcome their anxiety in preoperative care and beyond the surgery. In the present study, we aimed to implement interventions to help the candidates who were awaiting bariatric surgery. In this regard, the interventions were applied to patients and their families during the fifteen days leading up to the bariatric surgery in three sessions and four steps, and the patients were monitored for up to two weeks after bariatric surgery. Although the STAI-T is commonly conceptualized as a relatively stable personality characteristic, the present study observed meaningful reductions over a short perioperative timeframe. Therefore, these changes should be interpreted cautiously. It is plausible that the intervention primarily reduced situational, anticipatory, or context-dependent anxiety that participants experienced at assessment time points, rather than reflecting enduring trait-level transformation.

Strengths and limitations

One of the major strengths of the present study is the use of a theory-based psycho-educational intervention, grounded in Johnson's Behavioral Model of Information Provision, which enhances the conceptual rigor and reproducibility of the intervention. Additionally, the structured, multi-session design, group-based delivery, and inclusion of family support distinguish this study from prior research that primarily focused on patients or caregivers alone. The assessment of anxiety at multiple perioperative time points further strengthens the validity

of the findings. However, several limitations should be acknowledged. First, the study was conducted at a single center, which may limit the generalizability of the results. Second, anxiety outcomes were assessed over a relatively short postoperative follow-up period; therefore, the long-term sustainability of the intervention effects remains uncertain. Third, physical outcomes such as postoperative complications, length of hospital stay, or adherence to postoperative self-care behaviours were not evaluated, limiting conclusions regarding the broader clinical impact of anxiety reduction.

Clinical and translational implications

From a translational perspective, the findings of this study suggest that low-cost, structured psycho-educational interventions can be feasibly integrated into routine preoperative care for bariatric surgery candidates. Reducing preoperative anxiety is clinically relevant, as elevated anxiety has been associated with increased anaesthetic requirements [61], higher postoperative pain levels [62], delayed recovery, and reduced adherence to postoperative recommendations, as reported in previous studies [63, 64].

The group-based and protocol-driven nature of the intervention allows it to be delivered by trained health-care personnel under supervision, making it scalable within surgical care pathways. Furthermore, involving family members may enhance the patients' confidence in postoperative self-care, potentially improving adherence to dietary, physical activity, and follow-up regimens after bariatric surgery.

Future studies should investigate whether the observed reductions in state and trait anxiety continue over longer follow-up periods, such as three to six months after the surgery. This study demonstrated moderate to large intervention effects; however, because of the relatively small sample size, the analysis may have been underpowered to detect smaller but clinically meaningful effects. In addition, the use of repeated-measures ANOVA with multiple time points in a modest sample increases the risk of unstable statistical estimates and may affect the precision of parameter estimation. These limitations should be considered when interpreting the findings. Future studies with larger sample sizes and advanced modeling approaches are recommended to confirm and extend these results.

Additionally, examining the relationship between anxiety reduction and objective clinical outcomes, including postoperative pain, complication rates, length of hospital stay, weight loss trajectories, and adherence to lifestyle modifications, would provide stronger evidence for the broader benefits of psycho-educational interventions.

Abbreviations

SPSS	Statistical Package for Social Sciences
STAI	Spielberger Trait-State Anxiety Inventory
QA	Questions and Answers
SASI	Single Anastomosis Sleeve Ileal bypass
BMI	Body Mass Index

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

ZM, NA and GS formulated the research question. ZM, MA and GS designed the study. FM carried out the study. SG and AM. K performed the data collection; AM. K and SG performed the data analysis. FM, NA, SG, and GS contributed to the writing of the article. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki (IR.SUMS.REC.1398.129). This project is registered at Shiraz University of Medical Sciences. This trial was prospectively registered in the Iranian Registry of Clinical Trials (IRCT; registration number: IRCT20100919004775N11) before participant enrollment. The registration date was [12. 05, 2019], and participant recruitment commenced on [20.09. 2019].

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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