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Efficacy of Mindfulness-Based Counseling in Managing Preoperative Anxiety in Women Undergoing Cesarean Section: An Interventional Study

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Abstract

Background: *Preoperative anxiety significantly impacts women undergoing cesarean sections, contributing to increased perioperative morbidity, mortality, poor treatment satisfaction, and adverse obstetric outcomes. This study examined the effectiveness of mindfulness-based counseling in alleviating preoperative anxiety.*

Methods: *Conducted on 134 pregnant women with prior cesarean deliveries at Babol University of Medical Sciences, Iran, between May 2021 and October 2022, participants were randomly divided into intervention and control groups. The intervention group underwent five Mindfulness-Based Stress Reduction (MBSR) sessions. Anxiety levels were measured using the State-Trait Anxiety Inventory (STAI), while stress levels were assessed with the Perceived Stress Scale (PSS-14) before and after the intervention.*

Results: *The intervention group showed significant improvements. Trait anxiety scores decreased from 40.32±7.63 to 30.51±3.87, compared to an increase in the control group from 38.72±6.26 to 61.64±4.72 [MD=-9.8, F=1879.2, η^2=0.934, P-value<0.001]. State anxiety scores in the intervention group declined from 50.02±7.53 to 30.70±4.28, while the control group's scores rose from 49.55±6.70 to 62.02±5.36 [MD=-19.32, F=1572.2, η^2=0.923, P-value<0.001]. Perceived stress scores in the intervention group dropped from 28.78±5.74 to 11.89±3.34, contrasting with an increase in the control group from 29.06±6.28 to 36.08±4.83 [MD=-16.89, F=1332.9, η^2=0.911, P-value<0.001].*

Conclusions: *MBSR counseling effectively reduces anxiety and stress in women undergoing cesarean sections. Its application could extend to other surgical patients to enhance psychological well-being; though further randomized controlled trials are needed to validate these findings.*

Keywords: Trait anxiety, Cesarean section, Mindfulness, Preoperative stress, Pregnant women.
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Introduction

Preoperative anxiety is an unpleasant emotion marked by internal distress, influenced by preoperative conditions, and classified as a state or a trait[1, 2].

State anxiety is a temporary form of anxiety triggered by a specific event, which subsides once the event concludes. Trait anxiety, conversely, is a lifelong personality characteristic[2]. According to the WHO, the ideal rate is 10–15%[3]. Current scientific evidence suggests a recommended cesarean delivery rate of 15-20%[4]. In Iran, the overall rate of cesarean sections was 42%[5], which presents enduring risks to the mother, newborn, and breastfeeding process.

The prevalence of preoperative anxiety is higher during cesarean delivery, especially in developing countries, than in other surgeries[6, 7]. Preoperative anxiety affects 73.3-86% of women undergoing cesarean delivery, with rates as high as 84.9% reported in Iran[8-10].

Preoperative anxiety contributes to higher patient mortality rates during anesthesia and surgery[6]. Preoperative anxiety can indeed negatively impact a patient's hemodynamics, leading to increased heart rate and blood pressure, which can be detrimental, especially in those with pre-existing cardiac conditions. This can potentially contribute to myocardial infarction, heart failure, pulmonary edema, and ultimately, an increased risk of cardiac mortality[11] Additionally, this anxiety can elevate the chances of experiencing hypotension after spinal anesthesia[12] necessitating the use of vasopressors and extra fluids[13].

Preoperative anxiety can lead women to refuse cesarean delivery, potentially causing life-threatening consequences for both the mother and the fetus, as well as complications related to anxiety[8, 11].

It also negatively affects neonatal outcomes, lowering the APGAR score (appearance, pulse, grimace, activity, and respiration)[7].

Beyond its physiological effects, anxiety strains healthcare systems. Preoperative anxiety leads to increased readmissions[6], hospitalization, infections, and an increased demand for pain relief, all of which elevate hospital costs and diminish overall maternal satisfaction with perioperative services[6, 14-16].

According to the World Health Organization (WHO), managing preoperative anxiety is considered an essential aspect of maternal care, particularly for women undergoing cesarean sections. The WHO emphasizes the importance of mental health support during pregnancy and childbirth as part of its guidelines on improving maternal and newborn health outcomes[17]. Therefore, managing preoperative anxiety, especially for cesarean section patients, is a key nursing priority worldwide. Post-cesarean mothers need both physical and mental relaxation for optimal infant care. Hence,

preoperative preparation is essential to ensure postoperative peace for mothers undergoing a cesarean section.

One common method to manage pre-surgery anxiety is through pharmacological interventions such as benzodiazepines, although they are often linked to side effects[18, 19].

Hence, the creation of a non-invasive, affordable, and simple technique to alleviate preoperative anxiety appears to be essential. Preoperative anxiety management strategies are divided into two categories: pharmacological and nonpharmacological methods. The nonpharmacological approach is favored due to its lower risk of complications[20].

Mindfulness-Based Interventions (MBIs) combine cognitive therapy with practices like meditation and breathing exercises to enhance focus, self-awareness, and acceptance, while disrupting negative thought patterns to build resilience against stress and depression. However, their effectiveness in reducing preoperative anxiety remains uncertain, as studies like Kuang-Mou Tung et al.'s meta-analysis suggest further research is needed[21]. Kuang-Mou Tung et al., in their meta-analysis, suggested the need for additional research in this field[22]. This research evaluated the impact of mindfulness-based counseling on preoperative anxiety in pregnant women getting ready for a cesarean section.

Primary outcome: anxiety.

Secondary outcome: perceived stress.

Materials and Methods

The interventional study included 134 pregnant women, selected from 176 individuals assessed at 35 weeks' gestation, who were referred to the perinatology clinic at Babol Educational-Treatment Hospital, affiliated with Babol University of Medical Sciences in Iran, between May 10, 2021, and October 20, 2022. Participants were randomly assigned to either a control group or a counseling group (n=67), with the latter receiving five counseling sessions. Importantly, no participants dropped out during the intervention, ensuring the group sizes remained constant (n=67 for both the intervention and control groups). Data for the first measurement analysis is presented in Figure 1, which outlines the study's Consolidated Standards of Reporting Trials (CONSORT) flow chart.

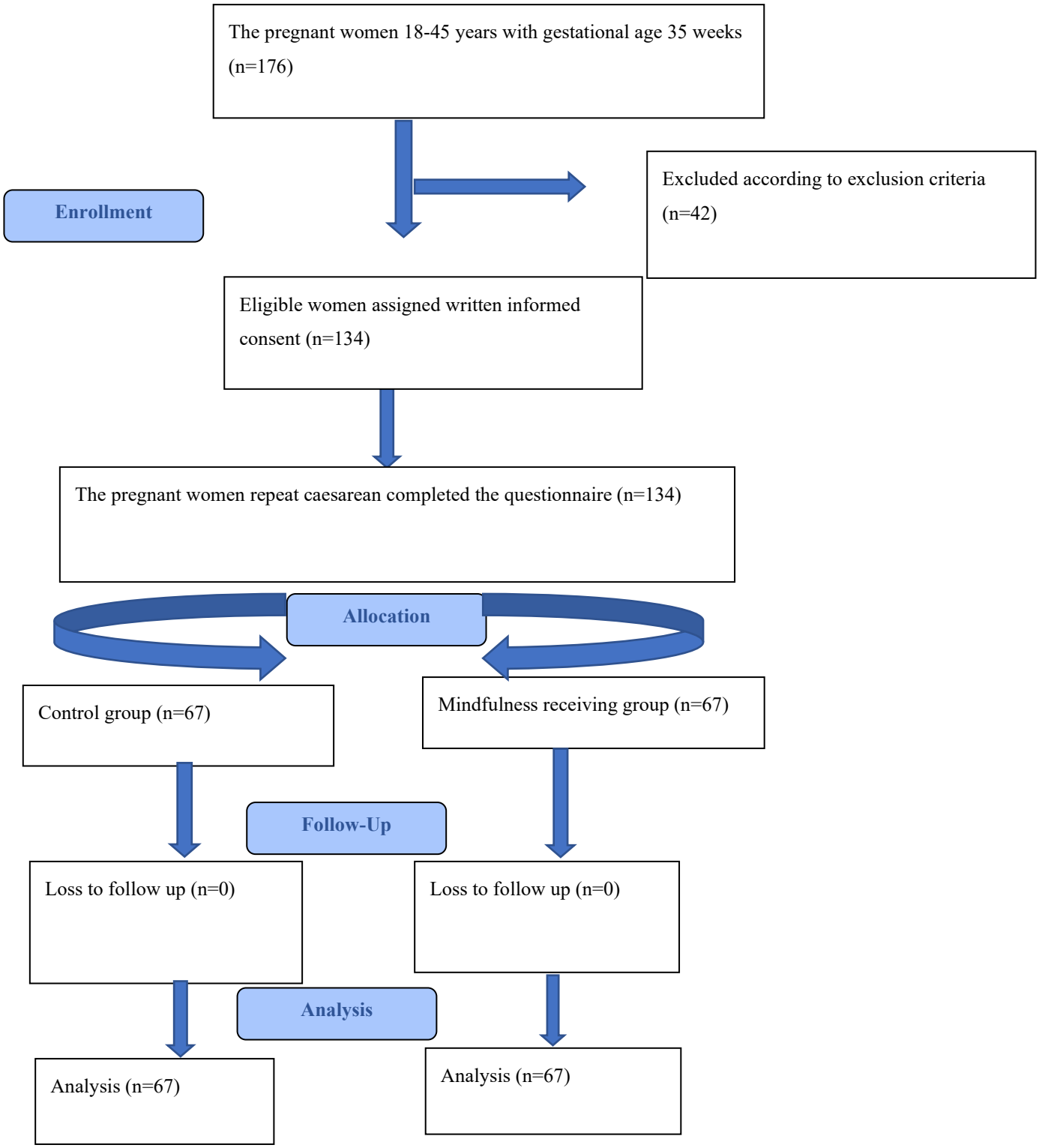

Figure 1. CONSORT flow diagram of patients included in the study

The study targets pregnant women aged 18–45 years with a history of cesarean delivery, currently at 35 weeks of gestation, and planning to deliver at designated hospitals. Participants must provide informed written consent, have access to

WhatsApp on their mobile devices, and be carrying a singleton pregnancy. Eligibility requires scheduling an elective cesarean section and agreeing to engage in mindfulness-based counseling sessions.

Exclusion criteria include a history of psychiatric disorders, current use of psychotropic medications, prior experience with MBIs, or undergoing emergency cesarean sections. Women with significant medical complications affecting pregnancy, inability to understand or comply with the mindfulness counseling protocol, unwillingness to participate, reliance on other anxiety management techniques during the preoperative period, or communication barriers are also excluded. Preoperative complications further disqualify candidates.

Participants were randomly assigned to either the intervention or control groups. The intervention group underwent five mindfulness-based counseling sessions. The anxiety and stress questionnaires were completed via interview at 35 weeks of pregnancy and on the day of surgery.

WhatsApp was utilized to deliver mindfulness-based counseling sessions in a convenient and accessible manner, leveraging its widespread use among participants. The platform was selected as a practical solution for conducting online sessions, particularly during periods when in-person interactions were restricted due to logistical challenges or health-related concerns, such as the COVID-19 pandemic. While this approach may introduce potential bias related to technology accessibility, it was chosen to ensure effective participant engagement without adding unnecessary barriers. To further minimize selection bias caused by digital access limitations, alternative participation methods—such as paper-based questionnaires or phone interviews—were offered to enhance inclusivity for individuals lacking reliable digital access. By integrating these alternatives, the study aimed to reduce bias and improve the generalizability of its findings.

The sample size was determined according to Zakerimoghadam's study, the sample size was obtained by using G*power software for analysis of covariance (ANCOVA) and analysis of variance (ANOVA) for two repetitions of pre-post measurements and two intervention groups, and considering an effect size of 0.15, an error of 0.05, and a power of 80%, equal to 56 people in each group. Assuming a 20% dropout rate, the minimum sample size in each group will be 67 people[23].

Baseline comparability between groups was thoroughly assessed in terms of age, parity, and education to ensure the validity of the study findings. Statistical tests were employed to confirm that there were no significant differences between the groups at the baseline level. Additionally, before applying parametric tests, assumptions of normality and homogeneity were rigorously evaluated using appropriate statistical methods such as the Shapiro-Wilk test for normality and Levene's test for homogeneity of variances. These evaluations ensured that the data met the necessary criteria for accurate and reliable analysis. Outcomes between the two groups were compared using ANCOVA and independent t-tests.

The study was approved by the ethics committee of Babol University of Medical Science (IR.MUBABOL.REC.1400.040). This research was conducted according to the principles of the Statement of Helsinki. The authors explained the aim of the study to all the women. Verbal and written informed consent were obtained from each participant before they joined the study. Additionally, researchers informed mothers that participation was voluntary and they could withdraw at any time without affecting their care. The confidentiality of personal data was strictly upheld during the online sessions. Privacy protocols ensured participants' information remained anonymous, with secure platforms used for mindfulness-based counseling. No identifiable details were disclosed beyond the study's scope, maintaining ethical compliance and participants' trust throughout the intervention. The lead researcher, a senior midwifery counseling student certified in mindfulness-based counseling, reviewed the inclusion criteria at the hospital's specialized perinatology clinic. Eligible women were invited to an in-person session at the clinic, where the study's objectives and methods were explained in detail. Written informed consent was acquired from women who agreed to participate. Obstetric and sociodemographic characteristics, Spielberger State-Trait Anxiety Inventory (STAI), and perceived stress questionnaires were completed during face-to-face counseling sessions.

Participants were randomized 1:1 to mindfulness-based counseling (intervention) or control groups using blocked randomization (block size of 4) via Random Allocation Software (RAS). Allocation types were recorded and concealed in sequentially.

numbered, opaque envelopes. Blocking was carried out by an impartial individual in sampling and analysis. The hospital clinic manager, an unbiased party involved in sampling, opened the envelopes in front of the mother.

The mindfulness intervention group participated in five weekly counseling sessions, each lasting 45 minutes, including four online and one in-person session. Intervention fidelity was maintained by assigning homework to ensure consistency throughout the mindfulness-based counseling sessions. Furthermore, trained professionals provided supervision to monitor adherence to the intervention protocol and address any deviations. The researcher also reviewed the mothers' homework and offered constructive feedback (Table 1).

Table 1. The content of consultation

Session	Topic
First (self-treatment exercises, removal of obstacles)	Introducing, explaining mindfulness as a way of life, a brief explanation of the 5 treatment sessions, performing a meditation by eating a raisin and then doing a body scan meditation for 30 minutes and talking about how it feels, the necessity and logic of presence of mind therapy, sitting meditation, the task of eating a raisin with body scan and mindfulness as a daily activity and examining the obstacles to doing this, giving feedback and discussing on mindful eating and body practice24. Homework: Dedicate 45 minutes to meditation practice, and focus daily on mindful self-care activities such as intentional

	bathing and eating meals attentively throughout the week.
Second (breathing with mindfulness and staying in the moment)	Discussing the interaction between mindful activities, quiet movement and mindfulness as a way to calm physical symptoms, practice non-judgmental, familiarizing with homework, seeing and hearing for 2 minutes, introducing sitting meditation and breathing with attention to body sensations, giving feedback and discussing sitting meditation25. Homework: Practice 45 minutes of meditation therapy, dedicate 10 minutes to mindful breathing, and consciously observe daily routines to document the experience of a pleasant event during the day.
Third (accept and allow)	Introduce and perform body mindfulness and sitting meditation, three-minute breathing exercise, introduce meditation exercises, walking, and select a combination of meditations based on personal preference for homework, perform a three-minute breathing pause during an unpleasant event, and mindfulness during a new daily activity26. Homework: Practice breathing exercises on Sundays, Tuesdays, and Thursdays. Focus on conscious movement exercises on Saturdays, Mondays, and Wednesdays. Record pleasant experiences daily and complete three three-minute breathing sessions each day.
Fourth	Overview of four-dimensional meditation, including mindfulness toward breathing, body, sounds, and thoughts, finding the best way to take care of oneself, creating a schedule with pleasant approaches that is comfortable enough for the individual, discussing ways to deal with meditation obstacles, and the mindful attitude, including acceptance and relinquishment, addressing problematic emotions27. Homework: Three minutes breathing—offering exercises to use when we experience difficult emotions, walking with mindfulness.
Fifth	Reviewing the exercises from the previous session, asking participants to use all mindfulness techniques to reduce their current stress and perform four-dimensional meditations. Homework: Select various forms of exercises, establish a consistent routine for the individual to follow after the program ends, and focus on proper and practiced breathing techniques.

The control group received standard care, which typically included routine preoperative procedures and no additional MBIs.

Participants completed a socio-demographic/obstetric questionnaire, STAI, and PSS-14 at baseline and follow-up. Both groups underwent an initial face-to-face assessment around week 35 of pregnancy, prior to group assignment, and a second assessment after the intervention on the day of surgery.

The data were gathered using the socio-demographic and obstetric characteristics questionnaire, Spielberger STAI, and Perceived Stress Scale (PSS-14). Both groups completed a socio-demographic and obstetric characteristics questionnaire, the Spielberger STAI, and the PSS-14 prior to intervention. Participants completed the STAI and PSS-14 questionnaires post intervention the day of surgery.

The questionnaire collected data on education, family income, age, occupation, place of residence, ultrasound-determined gestational age, height, weight, gravidity, parity, and abortion history.

Content and face validity were utilized to assess the validity of the obstetrics and socio-demographic characteristics questionnaire. Three psychology and obstetrics experts assessed the questionnaire's content validity using Lawshe's (1975) Content Validity Ratio (CVR). Items with a CVR above the critical value of 0.99 (for three experts) were retained. A pilot study with 10 women undergoing elective cesarean section confirmed the questionnaire's clarity and comprehensibility, resulting in no further changes.

Faculty members received the questionnaire, and the tool was adjusted based on their feedback.

The STAI is a 40-item self-report scale assessing state and trait anxiety (Table 2).

Table 2. Scale Components

Category	Items	Range	Interpretation
State anxiety	Specific situational items	1–4 (Likert scale)	Higher scores indicate greater
Trait anxiety	General predisposition items	1–4 (Likert scale)	Higher scores indicate greater

The S-Anxiety Scale, measuring current anxiety levels (e.g., fear, stress, nervousness), and the T-Anxiety Scale, assessing trait anxiety or anxiety proneness (e.g., placidity, self-assurance)[28, 29].

Anxiety levels, typically measured on a scale of 20-80[30], range from minimal (20-31) to mild (32-42), moderate (43-52), and severe (53+), with 20 representing the lowest and 80 the highest anxiety. Scoring is reversed for anxiety-indicating expressions[31].

The scoring interpretation (mild/moderate/severe) used in the study has not been specifically validated for the Iranian population. It was adopted directly from the original manual without any population-specific validation.

The Iranian version of this questionnaire is a valid and reliable anxiety assessment tool, demonstrating high reliability (Cronbach's alpha=0.90)[30, 32].

Table 3. Scoring for the PSS-14[33]

Item type	Item numbers	Scoring method
Forward-scoring	1, 2, 3, 8, 11, 12, 14	Use the score as it is (0–4)
Reverse-scoring	4, 5, 6, 7, 9, 10, 13	Reverse the score: 0→4, 1→3, 2→2, 3→1, 4→0

Total Score Range: 0–56.

Interpretation: Higher total scores indicate greater perceived stress (Table 3).

The original PSS-14 and translated versions demonstrate sufficient internal consistency (α=0.71-0.91), test-retest reliability (r>0.70), and construct validity[34, 35]. Concurrent validity, assessed using anxiety and depression scales, showed moderate to strong correlations[34]. The Iranian version exhibits similar reliability, with a reported Cronbach's alpha of 0.73, suggesting its validity for assessing anxiety in Iranian populations[28, 36].

Data were analyzed using SPSS 26. Normality of quantitative outcomes (trait anxiety, state anxiety, and perceived stress) was assessed using the Kolmogorov-Smirnov test. Descriptive statistics are presented as Mean±SD for normally distributed quantitative data and frequency (percent) for qualitative data. Between-group differences were examined using chi-square and t-tests. To evaluate the intervention's impact on trait anxiety, state anxiety, and stress, controlling for the baseline scores, we used ANCOVA.

Results

The participants' mean age was 33.54±3.36 years. Nearly seventy-three percent of patients had a university degree. Table 4 shows the demographic characteristics of the groups.

Table 4. The socio-demographic and obstetrics characteristics of participants

Maternal characteristics	Counselling group (N=67) Mean ± SD	Control group (N=67) Mean ± SD	P-value
Maternal age, y*	33.22±3.36	33.86±3.37	0.27
Gestational age at study entry, week	35.82±0.79	35.65±0.64	0.20
Gestational age at birth, week	39.05±0.91	39.08±0.90	0.85
BMI, kg/m2*	32.08±4.67	34/93±4.27	0.89
Education	N (%)	N (%)	
<Diploma	18 (26.9%)	19 (28.4%)	0.89
≥Diploma	49 (73.1%)	48 (71.6%)	
Economic Status			
Low	21 (31.3%)	20 (29.9%)	0.85
Middle/Good	46 (68.7%)	47 (70.1%)	
Gravida			
2	37 (55.2%)	39 (58.2%)	0.72
2<	30 (44.8%)	28 (41.8%)	
Parity			
1	44 (65.7%)	45 (67.2%)	0.82
1<	23 (34.3%)	23 (22.8%)	
Abortion			
0	44 (65.7%)	44 (66.7%)	0.90
≥1	23 (34.3%)	22 (32.8%)	
Stillbirth			
No	66 (98.5%)	62 (93.9%)	0.20
Yes	1 (1.5%)	4 (6.1%)	
Planned pregnancy negative			
No	43 (64.2%)	41 (61.2%)	0.85
Yes	24 (35.8%)	26 (38.8%)	

The intervention significantly reduced trait anxiety (MD=-9.8, on a 20–80 scale P-value<0.001), state anxiety (MD=-19.32, on a 20–80 scale P-value<0.001), and perceived stress (MD=-16.89, on a 0–56 scale P-value<0.001) compared to baseline. Conversely, in the control group, trait anxiety, state anxiety, and perceived stress increased by 22.92, 12.47, and 7.02, respectively (all P-value<0.001). Baseline levels of trait anxiety did not differ significantly between the intervention and control groups (40.32±7.63 vs. 38.72±6.26, P-value=0.186) for trait anxiety, (50.02±7.53 vs 49.55±6.70, P-value=0.703 for state anxiety and perceived stress (28.78±5.74 vs. 29.06±6.28 P-value=0.853). See Table 5.

ANCOVA was used post-intervention to compare groups, controlling for pre-intervention scores. This approach isolates the intervention's effect and determines if adjusted group means differ significantly, enhancing result reliability and

generalizability. ANCOVA assumptions, including homogeneity of variance (confirmed via Levene's test P-value=0.335) and homogeneity of regression slopes, were verified prior to analysis.

Table 6 shows that the intervention group exhibited significantly lower mean trait anxiety (F=1879.174, P-value<0.001, η^2=0.934), state anxiety (F=1572.207, P-value<0.001, η^2=0.923), and perceived stress (F=1332.892, P-value<0.001, η^2=0.911) compared to the control group. These results indicate that 93.4%, 92.3%, and 91.1% of the variance in these respective variables was explained by the intervention. The statistical power was 0.99. See Table 5.

Table 5. Comparison of the means of the anxiety variables and perceived stress in the two study groups before and after the intervention

	Groups	N	Before Mean±SD	After Mean±SD	MD***	P-value*
Trait anxiety	Intervention group	67	40.32±7.63	30.51±3.87	-9.8±-3.76	<0.001
	Control group	67	38.72±6.26	61.64±4.72	22.92±-1.54	<0.001
	P-value**		0.186	<0.001	-	-
State anxiety	Intervention group	67	50.02±7.53	30.70±4.28	-19.32±-3.25	<0.001
	Control group	67	49.55±6.70	62.02±5.36	12.47±-1.34	<0.001
	P-value**		0.703	<0.001	-	-
Perceived stress	Intervention group	67	28.78±5.74	11.89±3.34	-16.89±-2.4	<0.001
	Control group	67	29.06±6.28	36.08±4.83	7.02±-1.45	<0.001
	P-value**		0.853	<0.001	-	-

*** Paired t test ** independent t-test *** Mean difference**

Table 6. The results of the ANCOVA comparing the scores before and after the intervention of the Anxiety variable and Perceived stress in the two study groups before and after the intervention

	Source	Mean Square	F	P-value	Partial Eta Squared	Observed Power	Test of homogeneity of variances*
Trait anxiety	Trait anxiety (Before Intervention)	191.416	11.031	<0.001	.078	0.909	0.335
	Groups	32609.898	1879.174	<0.001	0.934832	1.00	
State anxiety	State anxiety (Before Intervention)	356.710	16.964	<0.001	0.115	0.983	0.557
	Groups	33060.258	1572.207	<0.001	0.923	1.00	
Perceived stress	Perceived stress (Before Intervention)	367.530	25.101	<0.001	0.161	0.999	0.062
	Groups	19516.158	1332.892	<0.001	0.911	1.00	

*** Levene's Test of Equality of Error Variances**

Discussion

Preoperative anxiety in women undergoing cesarean sections can hinder postoperative recovery and affect both mother and infant. Managing this anxiety is therefore essential for minimizing surgery time and anesthesia-related complications. While pharmacological interventions often come with side effects and limitations, alternative approaches like mindfulness-based counseling offer a promising solution. These techniques not only alleviate anxiety but also enhance overall well-being, making them an invaluable addition to clinical practice[37-39].

Pharmacological methods are available for managing preoperative anxiety; however, sedation during pregnancy poses specific risks that require careful evaluation. These risks include potential respiratory depression in the mother, altered uteroplacental blood flow, and neonatal complications such as sedation or withdrawal symptoms after delivery. Furthermore,

certain sedative medications may increase the likelihood of adverse effects, including hypotension or allergic reactions. Given the potential fetal risks associated with medication transfer through the placenta, non-pharmacological approaches are generally preferred for pregnant women. This study examines the efficacy of non-pharmacological strategies, such as mindfulness-based counseling, as a safe and effective method for managing preoperative anxiety. Mindfulness-based counseling offers a non-invasive alternative that reduces anxiety without the risks associated with pharmacological interventions[40, 41].

The significant differences between the intervention and control groups in post-test results suggest that the mindfulness-based counseling intervention was effective in reducing anxiety and stress levels among women undergoing cesarean sections. This implies that participants who received mindfulness-based counseling experienced greater improvements in managing preoperative anxiety and stress compared to those in the control group, highlighting the potential benefits of this approach in clinical practice.

Mindfulness may be particularly effective in this population due to its ability to enhance emotional regulation, enabling women to better manage stress and anxiety. By encouraging focus on the present moment and fostering a non-judgmental perspective, mindfulness helps reduce the tendency to dwell on fears or uncertainties related to the cesarean procedure. Moreover, mindfulness practices have been shown to lower sympathetic arousal, which is often heightened during episodes of anxiety. This decrease in physiological stress responses—such as reduced heart rate and cortisol levels—can contribute to a calmer and more composed preoperative state. Additionally, mindfulness supports improved coping strategies by cultivating self-awareness and resilience, empowering women to feel more in control and confident during what might otherwise be an overwhelming experience.

Since multiple studies have demonstrated the effectiveness of MBSR in enhancing psychological well-being, this finding aligns with our research. For example, Ibrahim et al.[42] highlighted the benefits of MBSR in improving psychological health.

Zhang et al.[43] showed its positive impact on well-being in head and neck cancer patients.

Komariah et al.[44] demonstrated that a 4-week, 15-minute daily MBSR program significantly reduced depression, anxiety, and stress in university students.

Turer et al.[45] found that a 20-minute mindfulness meditation intervention rapidly decreased surgical anxiety in dental implant patients.

Şener et al.[46] demonstrated that a Mindfulness-Based Stress Reduction (MBSR) program led to notable improvements in menopausal symptoms and overall quality of life among postmenopausal women. Midtest evaluations revealed significant differences between the experimental and control groups in total MRS scores and psychological complaints (P-value<0.05), as well as in vasomotor, psychosocial, and sexual domains (P-value<0.05). Posttest assessments further confirmed substantial improvements in Menopause-Specific Quality of Life (MENQOL) scores across vasomotor, psychosocial, and physical domains (P-value<0.05) between the groups. This study has shown that mindfulness interventions effectively reduce anxiety and improve emotional regulation in menopausal women and cancer patients. These findings suggest that similar mechanisms—such as enhanced focus, reduced stress reactivity, and improved coping strategies—can be beneficial for pregnant women facing preoperative anxiety[46].

Liu et al. reported that MBIs significantly reduced stress (SMD=−0.84) but did not show a notable effect on anxiety in menopausal women compared to controls. However, this result should be interpreted with caution due to substantial statistical heterogeneity stemming from variations in sample sizes (ranging from 27 to 197 participants), intervention types and durations (8–16 weeks, 30–300 minutes per week), control group conditions, measurement tools, and cultural contexts. Additionally, high dropout rates exceeding 20%, likely caused by poor participant compliance, may have influenced motivation and contributed to missing data, which could explain the absence of anxiety reduction. Subgroup analysis indicated that the effectiveness of MBIs varied by continent and intervention duration. MBIs are more effective in reducing anxiety in Asia than in Europe, likely due to cultural differences in mindfulness, such as Asia's emphasis on "Vipassana," which focuses on present-moment awareness[47].

The variance in mindfulness understanding between Eastern and Western cultures, stemming from distinct ideologies and political systems, results in a disparity in mindfulness levels[48].

This study's limitations include its single-center design focused solely on cesarean section patients, a small sample size, time constraints, a limited number of counseling sessions (fewer than 8), the lack of long-term follow-up, self-reported bias (from questionnaires) and the exclusion of partners from the intervention.

Mindfulness-based counseling effectively reduces stress and anxiety and, due to its accessibility, offers a cost-effective wellness intervention. Our study supports its incorporation into preoperative care for pregnant women, promoting relaxation through independently implemented practical activities guided by MP3 or MP4 files. Integrating a mindfulness application into prenatal care can empower women and improve their focus, maximizing intervention effectiveness. Mindfulness-based interventions show promise, but digital delivery methods can limit accessibility and effectiveness for women with low digital literacy or without smartphone access. This disproportionately affects women from lower socioeconomic backgrounds or those in areas with poor internet connectivity. Future research should explore alternative delivery methods like in-person counseling or printed materials to ensure inclusivity for all women undergoing cesarean sections. Assessing and addressing participants' digital literacy levels could further enhance intervention effectiveness.

This research suggested that mindfulness-based counseling reduces stress and anxiety in expectant mothers. Therefore, integrating mindfulness-based counseling into prenatal care can promote mental well-being, reduce stress, and enhance coping skills for pregnant women, ultimately fostering a healthier pregnancy and potentially having a positive impact on both

mother and child. It is recommended that future research consider exploring larger, more diverse samples to improve generalizability and investigate long-term effects to understand sustained impacts.

Ethical Considerations

This study is approved under the ethical code: IR.MUBABOL.REC.1400.040. All participants were ensured about the matter of confidentiality. Also, informed written consent was obtained from all participants and parent/legally authorized representatives of illiterate participants. We confirm all methods were performed in accordance with the relevant guidelines and regulations.

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Conflict of Interest

The authors declare that they have no competing interests.

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