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The effects of mindfulness-based interventions on mothers' stress reduction and breastfeeding self-efficacy: A randomized controlled trial

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Abstract:

BACKGROUND: In spite of the crucial role of breast milk for infant growth and immune development, the initiation of breastfeeding immediately after birth and the continuation of exclusive breastfeeding have declined. This issue is often attributed to several factors including maternal concerns due to competency to breastfeed and sufficiency of her breast milk that affect her perceived self-efficacy to initiate and continue breast feeding. To address these challenges, the present study aimed to assess the effects of a mindfulness-based intervention on reducing maternal stress and enhancing breastfeeding self-efficacy in nulliparous women.

MATERIALS AND METHODS: This randomized clinical trial involved 66 pregnant women from Talesh, Iran. The intervention group received progressive muscle relaxation training and guided imagery starting at 30 weeks of gestation. The training program was given in two group sessions and then followed by in an individual session to check their practices for better results. Both groups were followed for 2 months after giving birth. Data were collected using the Breastfeeding Self-Efficacy Scale-Short Form, the Breastfeeding Performance Checklist, and the Breastfeeding Adequacy Questionnaire in three turns. Statistical analysis was conducted using SPSS software version 27, with a significance level set at $P < 0.05$.

RESULTS: In the control group, breastfeeding self-efficacy scores increased from 62.88 ± 3.75 to 66.24 ± 4.20, while in the intervention group, scores rose significantly from 64.18 ± 3.75 to 84.58 ± 3.54 ($P < 0.001$). Similar trends were observed for breastfeeding adequacy and performance, with significant improvements in the intervention group. The mean breastfeeding adequacy score in the first and third visits was 62.88 ± 3.75 and 66.24 ± 4.20 in the control group and 64.18 ± 3.75 and 84.58 ± 3.54 in the intervention group, respectively ($P < 0.001$). The mean breastfeeding performance scores in the first and third visits were 62.88 ± 3.75 and 66.24 ± 4.20 in the control group and 64.18 ± 3.75 and 84.58 ± 3.54 in the intervention group, respectively ($P < 0.001$). Additionally, infant growth metrics, including height, weight, and head circumference, showed greater increases in the intervention group compared to the control group.

CONCLUSION: A mindfulness-based intervention effectively reduces maternal stress, significantly enhancing breastfeeding self-efficacy, adequacy, and performance, as well as improving infant growth indices.

TRIAL REGISTRATION: This study was registered in the Iranian Registry of Clinical Trials under the IRCT20231028059885N1 Number.

Keywords:

Breastfeeding, cognitive-behavioral therapy, guided imagery, muscle relaxation

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Introduction

Exclusive breastfeeding (EBF) during the first 6 months of life is recognized as the most complete source of nutrition for infants.[1] Breastfeeding offers numerous health benefits for both the mother and the infant. Key maternal benefits include a reduced incidence of postpartum depression and chronic diseases, such as type 2 diabetes, hypertension, and cardiovascular disease. Moreover, its infant benefits involve a reduced incidence of allergies and infections during infancy and a lower likelihood of developing chronic diseases in adulthood.[2]

However, only 43% of infants under 6 months of age are exclusively breastfed,[3] and efforts to promote mothers for the initiation of breastfeeding in the early hours postpartum have shown a declining trend over the past 15 years.[4] A recent large-scale cross-sectional study involving 232,920 live births in tribal populations of India demonstrated that initiating breastfeeding within the first hour after birth significantly reduces the risk of neonatal mortality. Infants who began breastfeeding later than the first hour had a 30% higher risk of death compared to those who were breastfed immediately after birth.[5]

In Iran, EBF has also experienced a significant decline in recent years compared to 2 decades ago. A meta-analysis (2019) reviewing 32 studies from various provinces of Iran reported minimum and maximum EBF rates of 18.9% and 99.7%, respectively, with an overall prevalence of 53%.[6] This is while the Global Breastfeeding Collective has set a target of 70% for EBF by 2030. Despite the World Health Organization (WHO) recommendations that exclusively breastfeed from birth to 6 months of age, there is sometimes false information and commercial advertising in the media about exclusive breastfeeding, including the need to feed the baby with formula in the first days after birth, the insufficiency of breast milk for the baby's growth, or the decline in the quality of breast milk as the infant's age increases, which causes mothers to doubt and despair about their ability to breastfeed their babies and to turn more toward feeding with breast milk substitutes. According to the Collective's report, EBF rates in Iran have decreased by 5–10% between 2017 and 2023.[7-9]

Several factors influence breastfeeding duration, including age, education level, and family income,[10] family support, the decision to breastfeed during pregnancy, number and mode of childbirth,[11] and maternal self-esteem and self-efficacy.[12] Some evidence suggests a close relationship between the two main hormones responsible for milk production and let-down, that is, prolactin and oxytocin, and cortisol, which increases in the mother's body under stressful conditions; these hormones are significantly reduced under the influence of cortisol.[13] For instance, an increase in maternal salivary cortisol levels is associated with a decrease in prolactin levels, and maternal anxiety culminates in reducing oxytocin release.[14]

Cognitive-behavioral interventions (CBTs), including muscle relaxation, are effective in increasing prolactin and oxytocin secretion by reducing cortisol, epinephrine, and norepinephrine levels through endocrine and autocrine mechanisms. Progressive muscle relaxation is thought to affect the pituitary-adrenal axis of the hypothalamus, preventing overproduction of cortisol and improving mood, resulting in a relaxing response, as well as complementary therapies. It acts as a neuroendocrine mediator in neural circuits, which are responsible for regulating mood and emotion. This technique can enhance the level of self-esteem and self-efficacy.[15]

Self-efficacy is a crucial psychological factor influencing breastfeeding duration. A mother's confidence in her ability to breastfeed is termed breastfeeding self-efficacy.[16] According to Bandura, people who have strong beliefs about their abilities put in more effort and persistence in completing tasks than people who have doubts about their abilities, and as a result, their performance on tasks is better.[17] Based on this model, self-efficacy is influenced by four main sources of information:

1. Performance achievements (e.g., previous breastfeeding experience);
2. Vicarious or substitute experiences (e.g., observing other breastfeeding women);
3. Verbal persuasion (e.g., encouragement from friends, family members, etc.);
4. Physiological responses (e.g., fatigue, stress, anxiety, and sleep disturbances).[18]

In one meta-analysis study, the results indicated that educating mothers based on enhancing self-efficacy could lead to improved breastfeeding performance.[19] Nevertheless, studies' findings indicate that some mothers do not feel competent and self-efficacious in breastfeeding their newborns and in their parenting roles.[20,21]

Utilizing mindfulness-based stress reduction techniques (MBSRTs) can assist in mitigating psychological stress. Mindfulness is the ability of individuals to cope with daily life stressors through self-regulation of brain activity and modification of stress physiology and negative emotional signals.[22,23]Various methods for achieving mindfulness, control, and focus on the problem have been described in different studies, including yoga, cognitive restructuring, and muscle

relaxation.[24] Among these, muscle relaxation does not require strenuous physical activity; mental relaxation is performed in sitting or lying positions. Mothers do not need to learn complex skills to repeat these exercises and can easily implement them without the need for special equipment.[25] Thus, it appears that using these methods in pregnant and breastfeeding women, while effective in stress reduction, does not culminate in maternal fatigue. Several studies suggest an increase in milk production following muscle relaxation and guided imagery.[26,27]

On the other hand, guided imagery facilitates relaxation by visualizing various mental images. This method is a comprehensive mind–body technique and is recognized as a cognitive-behavioral therapy (CBT).[28] In this method, the occipital part of the individual's brain is activated by visualizing a specific image without performing any physical movement, giving rise to the improvement of psychological disorders.[29]

It is believed that by mitigating perceived maternal stress and concerns, the effective mechanism of both the aforementioned cognitive strategies can positively influence the mother's perception of self-efficacy and increase breastfeeding.[30] Many routine consultations and training sessions provided to women for breastfeeding in health centers and hospitals across the country during pregnancy or postpartum do not specifically target to enhance maternal self-confidence and the educational content of childbirth preparation classes does not take into account the reduction of mother's anxiety and stress for this reason. In addition, one of the reasons for the failure of the postpartum breastfeeding training programs is not paying attention to the appropriate time of providing training, while studies notice that the best time to train mothers is during pregnancy.[31,32]

The current study was conducted to test two hypotheses: first, to assess the effects of a mindfulness-based intervention on reducing maternal stress in order to enhancing breastfeeding self-efficacy, and second, how breastfeeding adequacy and breastfeeding performance improve if maternal self-efficacy increases. Subsequently, anthropometric indicators of infants up to 2 months after birth, as the main indicators of breast milk adequacy, were evaluated as the main outcome indicators.

Materials and Methods

Study design and setting

This randomized controlled clinical trial was conducted on a sample of eligible nulliparous Iranian pregnant women referring to Shahid Nourani Teaching Hospital, affiliated to Guilan University of Medical Sciences, located in Talesh County, Iran, in 2023.

Study participants and sampling

The inclusion criteria included residency in the city of Talesh; possession of a prenatal care record at a comprehensive health center or urban health center under the coverage of the Talesh County Healthcare Center; elementary reading and writing literacy; a gestational age of 30–32 weeks; singleton pregnancy; absence of substance abuse, smoking, and alcohol use; and no debilitating chronic diseases or conditions that contraindicate breastfeeding according to national protocols, including human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), active herpes, untreated active tuberculosis in the mother, breast abscess, or extensive breast burns.

The exclusion criteria for mothers included maternal strong disinclination toward breastfeeding postpartum; the occurrence of physician-diagnosed psychological or physical disorders during the study requiring referral and necessary medical/surgical interventions that would disrupt or contraindicate continued breastfeeding; withdrawal from the study or concurrent participation in another research study with similar training interventions; performing relaxation and guided imagery exercises for less than 60 days; concurrent daily use of galactagogues; and childbirth prior to 37 weeks of gestation (in which case, outcomes would be reported as prenatal outcomes). Additionally, the exclusion criteria for infants involved admission to the neonatal intensive care unit (NICU), any craniofacial anomalies interfering with normal infant breastfeeding, and lack of presence or incomplete development of rooting and sucking reflexes by 3–5 days of age. Accordingly, if a participant did not participate in the first session of the educational intervention or did not attend the second follow-up visit, another participant was replaced based on the inclusion criteria [Figure 1].

The sample size for this study was determined to be 26 participants per group using G-Power software, with a 5% Type I error and 95% Type II error (power). Considering a 15% attrition rate, the final sample size was set at 30 participants per group, as follows:

Tail(s) = Two Effect size d = 1.0196623 α err prob = 0.05.

Power (1-β err prob) =0.95 Allocation ratio N2/N1 = 1 Output: Noncentrality parameter δ =3.6764447 Critical t = 2.0085591 df = 50.

Sample size group 1 = 26, Sample size group 2 = 26, and Total sample size = 52.

Data collecting tool and technique

The instruments utilized in this study encompassed demographic and obstetric questionnaire, the

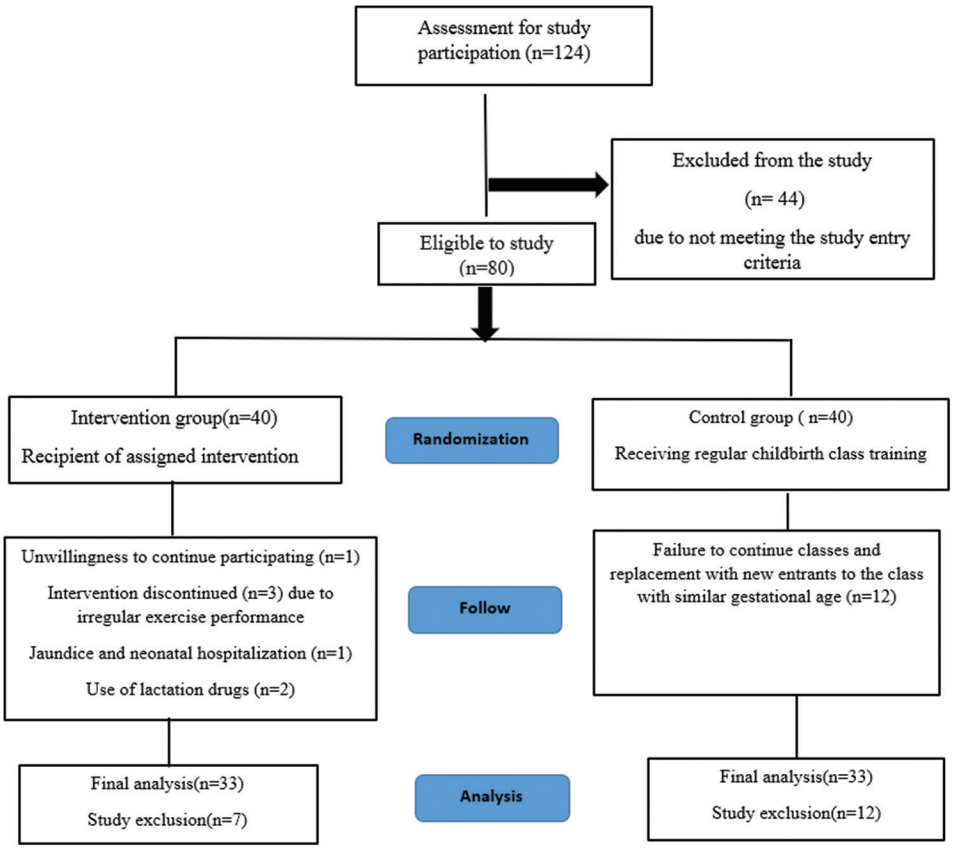

Figure 1: Participation flowchart

Breastfeeding Self-Efficacy Scale-Short Form (BSES-SF), the Breastfeeding Performance Checklist, the Breastfeeding Adequacy Questionnaire, a weighing scale, and a measuring tape.

1. **The Demographic and Obstetric Questionnaire:** This questionnaire comprises 35 questions, with 9 questions pertaining to demographic information and 26 questions concerning obstetric (reproductive and breastfeeding) information. The validity of this questionnaire was conducted using a qualitative validity method by 10 faculty members of the Department of Midwifery and Reproductive Health at Shahid Beheshti University of Medical Sciences.
2. **The BSES-SF:** This scale consists of 13 five-point Likert-type items ("completely sure, sure, perhaps, not sure, and not at all sure"). The validity and reliability of this questionnaire were determined by Asgarian (2020) using 174 postpartum women. Confirmatory factor analysis confirmed the single-factor structure of the instrument. Construct validity was established through a significant negative correlation with postpartum depression scores. Internal consistency was confirmed with a Cronbach's alpha of 0.92.[33]
3. **The Breastfeeding Performance Checklist:** This checklist comprises three sections. The first section pertains to indicators of properly cradling an infant; the second section concerns indicators of effective infant breast grasp, each consisting of 5 items; and the third section addresses indicators of effective sucking from the mother's breast, consisting of 7 items. All items in this checklist are in a binary yes/no format.
4. **The Breastfeeding Adequacy Questionnaire:** This questionnaire contains 21 five-point Likert-scale questions ("never, rarely, sometimes, often, and always"). The face and content validity of this questionnaire was recently examined in a study in a population of 20 postpartum women, and its stability and internal consistency were also examined by calculating the intraclass correlation coefficient (ICC) and Cronbach's alpha coefficient, respectively. The results showed that this tool has acceptable reliability.[34]
5. **The Weighing Scale and Measuring Tape:** In order to determine the reliability of the weighing scale, a 1 kg control weight was initially weighed and was recalibrated after every 10 weighing with the same standard weighing scale. In all instances, the weighing scale's calibration was checked before use. To prevent random error, a nonelastic measuring tape was employed to measure infant head and chest circumferences.

After coordinating with the authorities of the centers and instructors of the childbirth preparation classes at Shahid Nourani Hospital in Talesh, the researcher maintained a consistent presence on the days the classes were held and invited eligible pregnant women to participate in the study. Moreover, subsequent to explaining the study objectives, and providing a comprehensive description of the study procedures and anticipated benefits for reducing mental stress and focusing on pregnancy and breastfeeding, willing participants were selected and enrolled in the intervention group after obtaining written informed consent. Sampling was initially conducted among participants in the childbirth preparation classes using a purposive sampling method based on the inclusion criteria. Participants were then allocated to either the intervention or control group using block randomization with blocks of 6. Ten blocks of 6, with varying intervention and control sequences, were determined, and the first block was selected randomly. Subsequently, the remaining blocks, each containing 3 participants from the intervention group and 3 from the control group, were selected. After providing necessary explanations regarding the study procedures and anticipated benefits for reducing mental stress and focusing on pregnancy and breastfeeding, written informed consent was obtained from eligible pregnant women who were willing to participate in the research. Before the intervention commenced, a demographic and obstetric questionnaire was completed by the researcher for all participants (both the intervention and control groups). In order to prevent information exchange between the two study groups, training classes for the intervention group were held in different days than the control group to ensure minimal communication between the individuals in the two groups.

Intervention protocol

The intervention group

The first training session was conducted in a group setting, utilizing films, photographs, and PowerPoint presentations. The second session involved the same training in an individual, face-to-face manner to address any questions, reinforce learning, and gather feedback in childbirth preparation classes [Table 1]. At the end of the second session, participants received an audio-visual file in the form of a compact disc (CD) containing relaxation training. A schedule was provided to participants for home practice, recommending exercises at least twice a day. The procedure for performing the progressive muscle relaxation technique is detailed in Table 2.

After a maximum of 2 weeks, the third session was held in a group setting within the childbirth preparation classes to instruct the guided imagery technique [Table 2]. Prior to commencing the training in this session, the content of the first and second sessions was reviewed individually with each mother to ensure their comprehension. It is worth noting that all training was delivered face-to-face to the mothers by the researcher (NF). During these sessions, in addition to emphasizing the importance of initiating early breastfeeding in the postpartum period, the researcher (NF) also instructed the mothers on simplified breastfeeding techniques.

Participants performed a combination of these exercises concurrently at home twice a day (morning and evening) for at least 20 minutes, until the childbirth and then for 60 days postpartum. Additionally, using a readily accessible local messaging platform (Eitaa), a virtual group was created, inviting participants in the intervention group to respond potential questions and disseminate reminder text messages (twice weekly)

Table 1: Content of training classes

Meetings	Education topic	Training duration (minutes)	Training focus
First	Muscle relaxation techniques	60	1. Introduction to the researcher. 2. Learning the muscle relaxation technique andPhysiology of breastfeeding. 3. Group Practice of relaxation techniques by participants.
Second	Practical repetition	60	1. Participants perform techniques individually at home. 2. Ensure proper learning.
Third	Guided imagery technique	60	1. Review the previous session's exercises. 2. Understanding the guided imagery technique. 3. Relaxation with mental imagery.

Table 2: Steps and mechanism of action of relaxation and guided imagery techniques

Technique	Steps	Mechanism of Action
Muscle relaxation	Assume a comfortable position Close eyes Focus on deep breathing Repeat calming word Reopen eyes after 10-15 mins Ignore Distracting thoughts Using relaxation music	Direct: Reduces cortisol, activates parasympathic system. Indirect: Reduced psychological stress through behavioral factors and increasing lactation hormones.
Guided imagery	Assess emotional response to imagery Ensure full physical comfort Play matching instrumental music Close eyes, focus on voice Deep breathing Visualize calm scene (e.g., holding baby) Return to normal state	Focus attention on neutral stimuli and diverting attention from stress, Brain self-regulation, and improved oxytocin secretion

related to relaxation and guided imagery. Participants were followed up through in-person sessions for 60 days postpartum.

The control group

Participants in this group received simplified breastfeeding techniques from the researcher (NF) in addition to the standard breastfeeding training provided by instructors of the childbirth preparation classes.

Following the completion of the intervention, all participants in both groups visited the research setting initially between days 3 and 5, then between days 30 and 42, and finally 60 days postpartum for evaluation by the researcher (NF). During each of these visits, besides receiving routine mother–infant care, participants completed the BSES-SF, the Breastfeeding Adequacy Questionnaire, and the Breastfeeding Performance Checklist. Infant anthropometric indices, including weight, height, and head circumference, were also assessed by the researcher and recorded in the respective questionnaires. Ultimately, the EBF rate up to 60 days postpartum was ascertained in both study groups through telephone contact or in-person appointments with each participant and documented in their respective records.

Ethical considerations

This study was registered in the research ethics committee of the School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences with the IR.SBMU.PHARMACY.REC1402.073 ethics code in 2022-12-18 and the Iranian Registry of Clinical Trials (IRCT) with the IRCT20231028059885N1 Number and the Project ID is 43006308. At the beginning of the study, the researcher acquired the participants' written informed consent and assured them that participation would impose no cost and that their information would remain confidential and would only be used for research purposes. Furthermore, the participants were allowed to withdraw from the study at any stage. They were also required to contact the researcher and seek guidance in the case of any question, ambiguity, or problem during the study or refer to the hospital if necessary.

Statistical analysis method

Statistical data analysis was performed using SPSS software version 27. Descriptive and inferential statistics were employed for data analysis and interpretation, and central variables and dispersion measures, such as mean, standard deviation, and frequency (percentage), were calculated for quantitative and qualitative variables, respectively. Additionally, based on the results of the Kolmogorov–Smirnov (K-S) test to assess the normality of data distribution, parametric tests, such as Fisher's exact test, the two-independent samples *t*-test, one-way analysis of variance (ANOVA), Chi-square test, and repeated measures ANOVA were employed, depending on the study objectives. The two-independent samples *t*-test was also used to compare the study groups regarding breastfeeding self-efficacy, adequacy, and performance, and infant weight, height, and head circumference. The significance level for all tests was set at $P < 0.05$ with a 95% confidence interval.

Results

Based on the research findings, the majority of participants in both the intervention and control groups had a high school diploma (42.4%), were housewives (66.7%), had self-employed husbands (54.5%), possessed a sufficient economic status (54.5%), lived in rented housing (66.7%), reported lower-than-expected marital satisfaction (90.9%), cited fetal distress as the reason for cesarean sections (73.7%), initiated breastfeeding within 2 hours postpartum (57.6%), exclusively breastfed their infants (66.7%), reported receiving family support (48.8%), had male infants (54.5%), and reported the infant's sex matching the parental preferences (84.5%). As shown, these certain characteristic variables did not show any statistically significant differences between the two groups at baseline ($P > 0.05$).

Table 3 presents the means and standard deviations of breastfeeding self-efficacy, adequacy, and performance indices between the two groups across the intended time points. As shown, there were no significant differences between the two groups in the three indices before the intervention ($P > 0.05$). However, after the first visit, the changes between the two groups were statistically significant, with all indices being significantly higher in the intervention group ($P < 0.001$). Figures 2-4 illustrate the changes in breastfeeding self-efficacy, adequacy, and performance indices between the two groups over the study period. After controlling for potential confounders, such as mother's education level, weight, age, and occupation, repeated measures ANOVA also demonstrated statistically significant changes between the two groups over the study period ($P < 0.001$).

Table 3: The comparison of mean and deviations of breastfeeding self-efficacy, adequacy, and performance

	Educational session	Control	Intervention	*P*
Self-efficacy	Visit 1	26.36±4.66	26.58±4.07	0.844
	Visit 2	28.88±4.05	49.15±2.94	<0.001
	Visit 3	31.97±3.77	59.61±4.08	<0.001
Adequacy	Visit 1	62.88±3.57	64.18±3.75	0.153
	Visit 2	63.42±3.73	78.88±3.96	<0.001
	Visit 3	66.24±4.20	84.58±3.54	<0.001
Practice	Visit 1	10.09±1.55	10.00±1.94	0.834
	Visit 2	14.48±1.86	19.67±2.72	<0.001
	Visit 3	17.09±2.58	25.64±0.78	<0.001

Table 4 presents the means and standard deviations of infant weight, height, and head circumference between the two groups over the study period. Based on these findings, there were no significant differences between the groups regarding these indices before the intervention ($P > 0.05$). However, repeated measures ANOVA revealed statistically significant differences between the two groups in terms of changes in infant weight ($P < 0.001$) and height ($P = 0.032$) over the study period. Changes in head circumference also approached significance between the two groups ($P = 0.052$), with the intervention group exhibiting better outcomes, similar to the other two indices.

Discussion

The current research was conducted to determine the effects of mental relaxation techniques on breastfeeding self-efficacy, adequacy, and performance in nulliparous women. The results demonstrated that mental relaxation techniques in the intervention group had a significant effect on breastfeeding self-efficacy, adequacy, and performance, as well as on infant anthropometric indices.

According to the present study findings, breastfeeding self-efficacy significantly improved in the intervention group compared to control group that confirm the first study's hypothesis. Consistent with the present study, the results of Farley *et al*.'s[35] study aimed at improving self-efficacy in individuals with chronic illnesses found that increasing patients' perceived self-efficacy improved their compliance with self-care training and treatment adherence. In another study aimed at determining the relationship between social support, self-efficacy, and EBF among women in Northern Uganda, Miller *et al*.[36] suggested that social support and self-efficacy were two modifiable factors that, if improved, contributed to increased EBF rate. Therefore, the findings of these studies indicate that strengthening the cognitive-behavioral pathway to elevate individuals' self-reliance for personal care and confidence in their capabilities can help improve individual beliefs in performing tasks that may be perceived as difficult or impossible, culminating in a greater understanding of individuals' capabilities and strengthened self-efficacy. Since one of the intervening factors in maternal self-efficacy over the postpartum period is the presence of real or perceived stress by the mother, which disrupts the mother–infant emotional bond, the relaxation and guided imagery exercises used by the mothers in this study were apparently largely helpful in mitigating this issue.[37]

This study also demonstrated that increased self-efficacy can gave rise to increased breastfeeding adequacy.

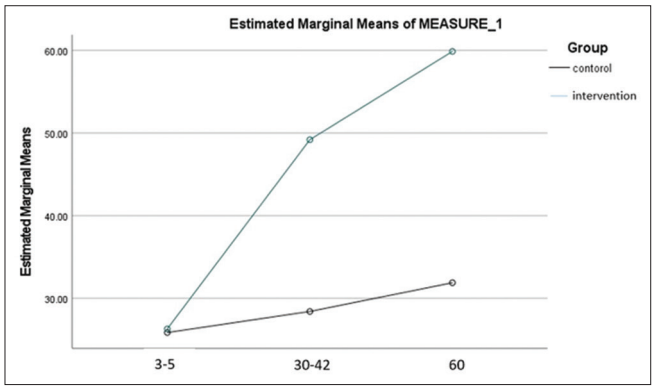

Figure 2: Comparison of the mean breastfeeding self-efficacy score in the intervention and control groups

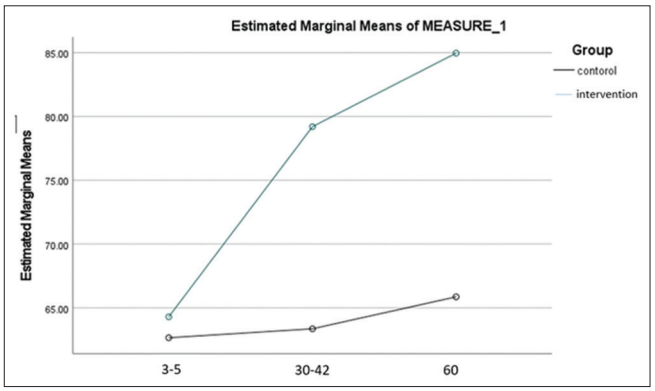

Figure 3: Comparison of the mean score of breastfeeding adequacy in the intervention and control groups

Table 4: Comparison of mean and deviations of weight, height, and head circumference of newborns in the two study groups

Variables	Group	Control mean±SD	Intervention mean±SD	Intergroup comparison result
Weight	Visit 1	507.24±3366.67	472.38±3357.35	*P**: 0.940
	Visit 2	754.78± 4050.00	703.98±4739.39	*P*<0.001
	Visit 3	964.39±4754.55	1011.03±5896.97	*P*<0.001
Height	Visit 1	2.01±49.44	2.09± 49.94	*P*: 0.326
	Visit 2	8.91±50.89	2.39±54.45	*P*: 0.030
	Visit 3	3.79± 55.62	3.11±58.67	*P*<0.001
Head circumference	Visit 1	1.08± 34.35	0.92±34.18	*P*: 0.487
	Visit 2	1.58±36.68	52.05±37.52	*P*: 0.278
	Visit 3	1.72±38.68	3.41±40.00	*P*: 0.052

*Two-independent samples t-test

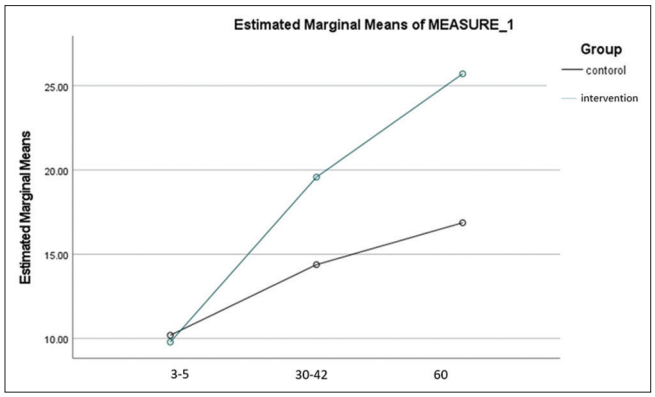

Figure 4: Comparison of mean breastfeeding performance scores in the intervention and control groups

The results of Rasaei *et al*.'s[38] study also revealed an inverse relationship between breastfeeding adequacy and maternal stress so that higher levels of maternal stress were associated with lower breastfeeding adequacy scores at 6 months postpartum. However, in the mentioned study, the individual's stress level was compared with their spirituality and no intervention was used to alleviate stress. Findings of a systematic review of 267 studies conducted from 2000 to 2021 suggested that one of the main factors influencing the continuation of breastfeeding or stopping it is the mother's understanding and perception of the insufficiency of her milk, which can prevent the mother from stopping exclusive breastfeeding with timely intervention and counseling and building the mother's confidence in her ability to produce enough milk.[39]

Furthermore, following the increase in self-efficacy, breastfeeding performance also increased that both findings confirmed the second hypothesis of the study. Aligned with the findings of the present study, similar results were obtained in the studies conducted by Gök *et al*.[40] and Azizi *et al*.[41] In a study in Taiwan, it was found that mothers with higher self-efficacy scores showed better breastfeeding management and performance when faced with breastfeeding problems.[42] Relaxation also directly affects infant feeding behavior and energy expenditure. This in turn leads to better parent–infant communication and improved breastfeeding performance measures.[43] Since relaxation by strengthening the oxytocin and prolactin hormones and controlling the level of cortisol helps to reduce the mother's perception of pain, insomnia, and anxiety, it can be expected that the lactation and breastfeeding performance will also improve.[44]

The findings also revealed a significant increase in key anthropometric indices of infants born to participants in the intervention group, as appropriate infant weight gain indicators, suggesting that continued EBF up to 2 months postpartum results in greater infant growth. The findings of a meta-analysis by Leven *et al*.[44] also demonstrated that mental relaxation techniques increased milk volume and infant weight and growth regardless of the relaxation method. Given that interventions based on relaxation and mental imagery not only seem available and acceptable but also can be easily learned and performed by lactating mothers and should be given more attention and included in the routine self-care programs of women during pregnancy and childbirth.

From a public health perspective, reducing maternal stress and enhancing breastfeeding self-efficacy contribute to improved maternal and infant health outcomes, aligning with global health goals such as the WHO's recommendations for exclusive breastfeeding (World Health Organization, 2021). Maternal and child health program planners should consider incorporating mindfulness-based interventions into maternal health programs to improve psychological wellbeing and breastfeeding success, especially in contexts where maternal stress is a major barrier.

Limitations

Considering the limitations of the present study, we can refer to the probability of under-reported mental relaxation-based interventions by the participants, though by using identical instruments and considering similar follow-ups, the researcher attempted to monitor women in both groups constantly to make the reported values less different. Moreover, due to the impossibility of blinding the researcher and participants at the beginning of the study, the fourth member of the research team ran the blinded statistical analysis of the data for the purpose of minimizing the supervision bias.

Conclusion

The instruction and regular practice of mental relaxation techniques, when initiated from mid-pregnancy, can positively influence breastfeeding self-efficacy, adequacy, and performance, potentially sustaining EBF for at least 60 days, subsequently culminating in enhanced infant growth anthropometric indices. Given that many pregnant women attend childbirth preparation classes, these techniques can be instructed to them as simple, inexpensive, and accessible methods. Providing mothers with access to trained counselors and quality services in the first hours, days, and weeks after delivery not only increases the likelihood of successful breastfeeding initiation but also leads to the continuation of exclusive breastfeeding and the reduction of common disorders in this area. Ultimately, targeted investment in the training of lactation consultants, systematic evaluation of service quality, and policymaking that is sensitive to cultural and social context are key steps in

improving successful breastfeeding rates and achieving maternal and child health goals.

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Author's contributions

NF contributed to writing the proposal and article and implementing the project. SH, the supervisor, participated in designing and writing the proposal and article. KS the adviser, contributed to designing and writing the proposal. MK, the biostatistics counselor of the research, analyzed and interpreted the data. All the authors read and approved the final manuscript.

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Conflict of interests

The authors declare that they have no conflict of interest in this study.

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