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ORIGINAL PAPER

The Effect of Mandala Activity and Technology-Based Breastfeeding Program on Breastfeeding Self-Efficacy and Mother-Infant Attachment of Primiparous Women: A Randomized Controlled Study

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Abstract
The use of art therapy methods such as mandala is becoming increasingly popular in mother-infant health education and counseling. The aim of the study was to evaluate the effect of a mandala and technology-based breastfeeding program on women's breastfeeding self-efficacy and attachment between mother and infant. This randomized controlled, single-blind, and parallel-group trial design was conducted in foundation university hospital. The study was completed by 66 women and their infants (intervention group: $n=33$; control group: $n=33$). The women who are at the 32–37th gestational week in the intervention group participated in the mandala and technology-based breastfeeding (including Zoom and WhatsApp platforms) program. They received three education module via WhatsApp. Women in control group received routine care. The Maternal Attachment scale and Breastfeeding Self-efficacy Scale were applied in the first week and second month postpartum. Growth follow-ups of the infants were evaluated in the first week, first month and second month postpartum. The registration number of this study on ClinicalTrials.gov is NCT05199298. In the second month postpartum, it was determined that the women in the intervention group had higher Breastfeeding Self-efficacy and Maternal Attachment scale scores compared to the control group ($p<0.05$). Also, the rates of breastfeeding in the intervention group were higher than in the control group. Mandala and technology-based breastfeeding program increased women's breastfeeding self-efficacy and maternal attachment. Health care professionals should make use of technology-based educations to give holistic care in maternal and infant health.

Keywords Art therapy · Breastfeeding · Maternal-infant attachment · WhatsApp

Introduction

Breastfeeding is one of the most important indicators of maternal and infant health. Therefore, it is important to know the factors that will affect breastfeeding. One of the factors affecting breastfeeding is the anxiety experienced by mothers during gestation and the postpartum period [1]. It has been reported that anxiety is high in pregnant women, especially in the first and third trimesters, and anxiety related to breastfeeding and infant care is experienced in the postpartum period [2]. Anxiety experienced by the mother affects the health of the infant as well. As anxiety increases, mother-infant attachment and infant development are also affected, depending on the intention to breastfeed and the continuity of breastfeeding [3]. While the anxiety experienced by mothers affects breastfeeding, mother-infant attachment, and infant care, the low self-confidence of mothers and insufficient support in breastfeeding and infant care cause the anxiety level to increase. It has been reported that anxiety and self-efficacy were lower in primiparous mothers, especially those with a lack of experience, compared with multiparous mothers [4]. In the study of Sarı and Altay (2021), it was reported that the education, counseling, and support services provided to primipar women about

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infant care increased breastfeeding rates (88.6%) compared to the pre-program (80%), and also increased women's self-efficacy. For this reason, interventions that reduce anxiety, support mothers' self-efficacy, and provide information support are essential in increasing breastfeeding rates and thus improving maternal and infant health [4].

However, technology-based health education has started to replace the health training given face-to-face, one-on-one or in groups in the past, with the help of the widespread use of the internet in recent years. Thanks to technology-based applications, mindfulness-based art therapies can be used that reduce symptoms such as anxiety and depression, which are factors that affect the mother's self-efficacy, breastfeeding, and mother-infant attachment negatively [5]. The literature on the subject recommends mindfulness-based interventions to reduce anxiety, and depression in childbirth classes and emphasizes that these are effective in terms of improving mother-infant attachment, breastfeeding, and self-efficacy [6, 7]. Mindfulness-based arts interventions can enable mothers to focus on the moment, enable them to develop positive emotions and increase their self-confidence [8]. In this sense, different methods such as painting therapies, mandala painting and imagination are included within the scope of mindfulness-based arts interventions. Studies show that painting therapy for fear of childbirth is used within the scope of mindfulness-based programs that reduce anxiety and depression in mothers and to support birth self-efficacy [9, 10]. The nature of mandalas, which provides integration between mind and body and where abstract thought turns into pictorial images, is very compatible with mindfulness [11]. For this reason, it is recommended that artistic activities such as mandala be applied with the principles of mindfulness.

Any program for breastfeeding and mother-infant attachment integrated with artistic activities such as mindfulness-based mandala, prepared with technological-based applications, could not be found in the literature. There has been no study with primiparous women using such interventions, especially from the prenatal period to the postnatal period. Therefore, this study was conducted to determine the effect of the breastfeeding program based on technology-based mandala activity on breastfeeding self-efficacy, state anxiety levels, and postpartum mother-infant attachment in primiparous women. In addition to mindfulness-based mandala drawing and painting method, which reduces mothers' anxiety, creates breastfeeding intention, and reinforces positive emotions while imagining their infant, was used in this study. Thanks to the technology-based nature of this study, it is thought that it will lead to the development of new programs in this field, as it provides trainings such as breastfeeding and mother-infant attachment, as well as an enjoyable activity that fosters the creativity of the mothers. Moreover, since it is a program that covers the antenatal and postnatal periods, it is thought that it will also improve the health of the mother and infant, in terms of considering maternal and infant health holistically.

The hypotheses of the study are as follows:

H0a: Maternal attachment level in the intervention group was not different from the mothers in the control group.

H0b: Breastfeeding self-efficacy perception level of women in the intervention group was not different from the women in the control group.

H0c: Breastfeeding rate, weight for age, height for age, head circumference for age were not different from the babies in the control group in the first 2 months of infants of women in the intervention group who received a mandala activity-based breastfeeding program.

H0d: The state anxiety levels of the women in the intervention group was not different from the women in the control group.

Methods

Design

The study has a randomized, single-blind, and parallel-group trial design. It was carried out to determine the effect of the breastfeeding program based on technology-based mandala activity on breastfeeding self-efficacy, state anxiety levels, and postpartum mother-infant attachment for primiparous mothers. This study was reported according to the CONSORT checklist and the registration number of this study on ClinicalTrials.gov is NCT05199298.

Participants

The research was carried out on primiparous pregnant women who were followed up in the Obstetrics and Gynecology outpatient clinic of a foundation university hospital between January 1 and May 2022. The inclusion criteria were determined as follows: (a) being primiparous (b) being between 32 and 37 weeks of gestation (c) being over 18 years old (d) having internet access at home or at work (e) speaking Turkish and d) agreeing to participate in the research. In addition, babies born between 37 and 42 weeks of gestation and weighing 2500 to 4000 g without any health problems were included in the study. The study exclusion criteria were as follows: mothers who: (a) had a high-risky pregnancy (b) gave birth before 36 weeks of gestation (c) did not have Internet access.

The sample of the study was determined with G*Power version 3.1.9.7 software based on a similar study [4]. The sample size was calculated with an 80% confidence interval

and ±5% margin of error and was determined to be a total of 60 primiparous women (30 for each group). The 10% loss rate in a previous randomized controlled trial [3] was taken into account. At the time of the study, 72 primiparous pregnant women were reached. Pregnant women were divided into 4 strata groups by stratified sampling method on the basis of mothers' age (19–28; 29–37 years old) and educational status (high school and university). The study was completed with 66 people since two of the pregnant women did not use the internet, two of them had risky pregnancies, and the other two decided to continue their health follow-ups in another health center. There were no participants who left the research during the program. The flow chart of the study according to CONSORT guidelines is shown in Fig. 1.

Randomization

Participants were then assigned to the groups using the www.randomizer.org site from the pregnant pool created. Apart from the researchers, an academician nurse, who was well-equipped in the research, and followed the health of the pregnant women in the NST unit of the hospital, assigned the participants by randomization. At the beginning of the study, the nurse handed the assignment sequence in a sealed opaque envelope to the active researcher who would conduct the research. The nurse briefed the pregnant women without giving details about the research and informed them that a training program would be implemented for the participants. The demographic characteristics form and the first questionnaires were sent to the participants by the nurse working in the NST unit. Participants and researchers did not know who was in which group until the study started. In addition to participant blinding, statistics and reporting blinding were also used to reduce bias in the study.

Theoretical Framework

The theoretical and methodological framework, of the study was prepared on the basis of Watson's Theory of Human Care. According to Watson, health is the harmony of body, mind and spirit. The theory has four basic concepts (caritas processes, transpersonal caring relationship, caring occasion/caring moment and caritas consciousness). The theory emphasizes a holistic support by bringing together the concepts of mind-body-spirit [12]. The applications and measurement tools of the research based on Watsons' theory are presented in supplementary file-Table 1.

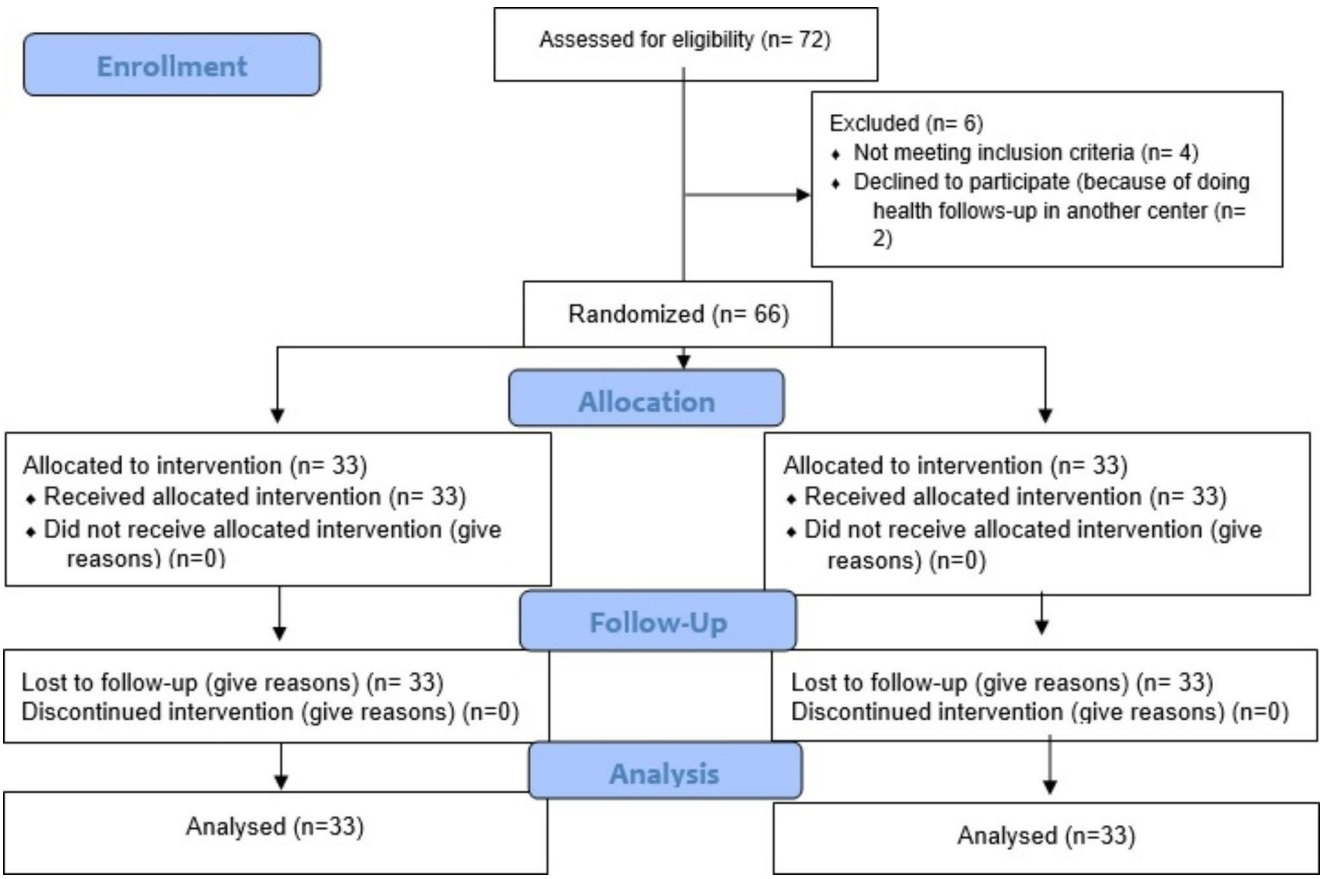

Fig. 1 Flow diagram of the study

Data Collection

Mother-infant attachment and breastfeeding self-efficacy scores were the primary outcomes of this study. The secondary outcomes of the study were women's anxiety levels, breastfeeding rates, and infants' weight and head circumference measurements. The data collection times according to the primary and secondary outcomes of the study, the interventions used in the study and their characteristics are detailed in Table 1.

After NST follow-up, the Descriptive Characteristics Form, the Maternal Attachment Scale, and Spielberger State-Trait Anxiety Scale were applied to the pregnant women who wanted to participate. All the forms in the research were applied in the form of an online questionnaire. An online questionnaire was preferred to collect data in a short time and in a healthy environment due to the physiology of pregnancy and COVID-19. All of the scales were prepared in Google forms and the link was sent to the participants. The flow chart of the research is shown in Fig. 1.

Descriptive Characteristics Form

The researchers prepared the form, using the literature in order to determine the sociodemographic characteristics of the parents and the obstetric characteristics of the mothers, and their training needs regarding breastfeeding. A total of 8 questions were included in the form which was sent to WhatsApp accounts as an online form.

Spielberger state-trait anxiety scale (STAI)

It was developed in 1970 by Spielberger, Gorsuch, and Lushene. It consists of two subscales, state, and trait anxiety. Emotions and behaviors expressed in the items of the State Anxiety Sub-Scale are indicated by choosing one of the options '0 = not at all/almost never/; 1 = a little/sometimes; 2 = quite a lot/often; and 3 = a lot/almost always' according to the severity of such experiences. The total score obtained from the scale ranges from 20 to 80. A high score refers to high anxiety while a low one indicates low anxiety. High scores from each subscale indicate a high level of anxiety. Oner and Le Compte performed the Turkish adaptation [13]. The Cronbach's α internal consistency ratio of the scale is 0.96 for the State Anxiety Sub-scale.

Maternal Attachment Scale

The Maternal Attachment Scale (MAS), developed by Müller in 1994. The validity and reliability study in Turkey was

Table 1 The interventions used in the study

Pregnancy Week	Training Modules and Interventions	Contents of Training and Interventions
34th week	**The First Module**	- Importance of Breastfeeding -The Importance of Intention and Desire for Prenatal Breastfeeding -Content of Breast Milk
	Information About Mandala and Breathing exercise	Brief information about the philosophy of the mandala and what it is. A short breathing exercise video prepared by the researchers was sent to the participants. Participants did breathing exercises before each mandala practices.
	Wish/Intention Mandala Drawing-Coloring	A simple mandala drawing is made. The instruction "Make a wish when you think of your baby" is given. When the pregnant woman imagines her baby, she is asked to color the mandala with her favorite colors for her wish. Then he is asked to write down his feelings and thoughts while painting the mandala. It is stated that he can write words that describe his baby while drawing a mandala. He is asked to name the mandala in its final form. For example, naming the mandala "My baby and peace" or "My baby and love". He is asked to hang the mandala in his room or a favorite place. **Sample Mandala drawing was recorded as a video by the researcher and sent to the pregnant women. Materials needed: Colored crayons, colored markers, desired size paper or notebook
35th week	**The Second Module**	- Breastfeeding Technique, positions -Frequently asked questions and answers about Breastfeeding-Baby Nutrition
	Stress reducing mandala.	Pregnant women are shown a mandala drawing-painting activity that they will simply draw when they feel stressed. It is based on relaxing by drawing spirals from the outside to the center of a large circle and then completing the mandala with the desired shape and/or words. Pregnant women will be able to reduce their stress through the spirals they draw. After reducing their stress, they will accept and release the internal negative energy by tearing it or dissolving it in water. **The mandala drawing was recorded as a video by the researcher and sent to the pregnant women. Materials needed: Colored crayons, colored and white mandala drawing papers
36th week	**The Third Module**	Trainings on mother-infant attachment in the prenatal and postnatal period -Mother talking to her baby, following her movements - Breastfeeding in the postpartum period, the importance of skin-to-skin contact -What to do to support baby development by month -Frequently asked questions and answers about Mother-Infant Attachment
37th week	Structured mandala	A ready-made mandala template will be sent to mothers and asked to paint (via whatsapp application).

done by Kavlak and Şirin (2009). It is a 4-point Likert-type scale consisting of 26 items, where each item varies between "always" and "never". While the lowest score that can be obtained on the scale is 26, the highest is 104. The higher the score, the higher the maternal attachment. The internal consistency (Cronbach's alpha) coefficient of the scale was 0.85 and 0.82 for mothers with 4-month-old infants [14].

Infant and Breastfeeding Follow-Up Form

It has been prepared in two parts to determine the growth parameters and nutritional status of babies. The infants' gender, date of birth, birth weight, head circumference and percentiles are included in the first part. In the second part, there were two questions in which data such as breastfeeding status and the use of other foods were evaluated in three postpartum follow-ups (1st week, 1st month, and 2nd month after birth).

Postpartum Breastfeeding Self-Efficacy Scale

The Breastfeeding Self-Efficacy Scale (short form) was created by Dennis in 2003. The 5-point Likert-type scale consisted of 14 items assessing breastfeeding self-efficacy. Scale items are evaluated by grading from "1 = not at all confident" to "5 = very confident". The lowest score that can be obtained from the scale is 14, while the highest is 70. A higher score means higher breastfeeding self-efficacy. Tokat, Okumuş, and Dennis (2010) conducted a Turkish reliability and validity study for the short version of the scale and found the Cronbach's alpha value of 0.86 [15].

Intervention

The research was implemented in two stages: (a) creating a mandala-based breastfeeding program; (b) implementation of the mandala-based breastfeeding program.

Creating a Mandala and Technology-Based Breastfeeding Program

The trainings, the contents of which were prepared by both researchers, consist of three modules. In the first module, a training module was prepared that includes the importance of breastfeeding, the intention and willingness to breastfeed, and its benefits in terms of maternal and infant health. Mandala drawings were videotaped by the first researcher and presented to the expert opinion of three academicians who are experts in their fields. Mandala videos were sent to the mothers' WhatsApp accounts and they were asked to watch and draw them. The second training module covers topics such as breastfeeding positions, continuity of breast milk, and mother-infant communication through breastfeeding. This module is reinforced with the "stress-reducing mandala". The third training module focuses on the importance of developing mother-infant communication before and after birth and includes relevant training. A ready-made mandala template was sent to the mothers, and they were asked to paint it. In addition, they were informed that they can add to the mandala shapes as they wish.

The training contents were finalized in line with expert opinions. The training contents were prepared as an audio narration video in the form of an MS Powerpoint presentation and sent to the WhatsApp accounts of the pregnant women as a separate module every week. Mothers had the chance to watch videos before and after birth whenever and wherever they wanted. Training videos are prepared via Zoom. The interventions applied in the study and their detailed explanations are given in Table 1.

Implementation of the Mandala-Based Breastfeeding Program

Non-stress test was performed on pregnant women at 32–33 weeks of gestation. The nurse working in this unit was informed about the details of the research. The nurse gave brief information about the research to the pregnant women who came to the NST and performed the randomization process. Considering the COVID-19 pandemic conditions, the forms to be filled by pregnant women (such as the Descriptive Characteristics Form, and Spielberger State-Trait Anxiety Scale) were prepared in the form of Google Forms and sent to the WhatsApp accounts of the participants.

Intervention Group

Relevant training and mandala videos for each week were sent to the mothers' WhatsApp accounts. After watching the videos, the questions of the mothers, if any, were answered by the researcher. Mandala videos supporting each module were sent to mothers and they were asked to do drawing-painting activities. After each module, feedback was received from mothers via phone call and/or WhatsApp.

The mothers reported to the researcher that they gave birth. The mothers in the study group were called 24 h after birth and asked if they had any problems with breastfeeding. Breastfeeding and Infant Follow-Up form, Maternal Attachment Scale, and Postpartum Breastfeeding Self-Efficacy Scale were sent to mothers as Google Forms in the first week after birth. For the mothers in the study group, follow-up and counseling were provided by telephone until the second month after birth. The mothers informed the researcher when they came to the hospital in the 1st week, 1st month, and 2nd month for follow-up. The researcher carried out the

measurements of the infants' height, weight, and head circumference until the second month after birth, together with the responsible nurse in the hospital. The final tests of the scales (Breastfeeding and Infant Follow-Up form, Maternal Attachment Scale, Postpartum Breastfeeding Self-Efficacy Scale, Spielberger State-Trait Anxiety Scale) were administered in the 2nd month after birth.

Control Group

The pregnant women in the control group were subject to the standard practices of the hospital. The mothers were called by phone 24 h after the birth. The mothers were called by phone 24 h after birth and asked if they had any problems with breastfeeding. Mothers who had problems with breastfeeding were directed to the hospital. The mothers were asked to inform the researcher when they came for follow-up in the first week, first month, and second month after delivery. The pre-test and post-test applications of the scales were sent to the social media accounts of the mothers as an online form.

Data Analysis

Research data were evaluated with SPSS 20.0 software. A non-research instructor entered the data to SPSS software by coding them as A and B. The statistician performed the statistical analyzes with coding and the research report was written in coded form. The conformity of the variables to the normal distribution was examined by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). In the comparison between the groups, the t test was used in independent groups for normally distributed 2-parameter ordinal data, and the Mann Whitney U Test was used for non-normally distributed data. Chi-square test was used to compare nominal data between groups. The z-scores of the infants' height, weight and head circumference measurements were calculated using the World Health Organization's Anthro Survey Analyzer.

Ethical Considerations

The research started after obtaining the necessary written permissions from the institution and the ethics committee (2021.10.13/109), and the written consent of the pregnant women. After the study was completed, the training and mandala modules were sent to the WhatsApp accounts of the mothers in the control group and their questions, if any, were answered.

Results

Descriptive Characteristics

The mean age of the women in the intervention group was 28.66 ± 0.68 years, and 54.5% of them held a university degree. Although not stated in the table, all of the mothers in both groups stated that they needed information about breastfeeding and mother-infant bonding, and that the pregnancies were planned (Table 2).

State Anxiety Scale Scores, Postnatal Breastfeeding Self-efficacy Scale Scores, and Maternal Attachment in Primiparous Women

It was determined that the state anxiety scale mean score (45.66 ± 0.93) in the intervention group was lower than the mean score of the control group, and there was a significant difference between the two groups. ($U = 271.000$, $p < 0.05$) (Table 2). While the mean score of the Postnatal Breastfeeding Self-Efficacy Scale administered in the postnatal first week after birth was similar in both groups ($t = 0.54$, $p > 0.05$), the mean score of the scale in the postnatal second month was found to be higher in the intervention group than in the control group ($U = 158.500$, $p < 0.05$) (Table 3). Similarly, in the postnatal period, it was determined that the mean score of the maternal attachment scale was higher in the intervention group than in the control group ($U = 399.500$, $p < 0.05$) (Table 3).

Nutritional Status of Infants

In the first postnatal week, first and third postnatal month, the number of exclusively breastfed infants in the intervention group (81.8%; 66.7%;87.8% respectively) were higher compared to the control group (51.5; 42.4; 42.4 respectively). The rate of mixed type feeding (breastmilk and formula) given to the infants was much lower in the intervention group (18.2% in the first week and 12.2% in the second month) compared to the control group (48.5% in the first week and 36.4% in the second month) (Table 4).

Growth Characteristics of Infants

In the first postnatal week, the intervention group body weight, height and head circumference *z* score (-0.40 ± 0.153; -0.78 ± 0.338; -0.30 ± 0.217) was higher than the control group ($-0,58 \pm 0.137$; -0.95 ± 0.199; -0.66 ± 0.187), but the difference was not statistically significant ($p > 0.05$). In the second month, the body weight and head circumference z scores average ($0,55 \pm 0.146$;-2.59 ± 1.50) for control group

Table 2 Descriptive characteristics of participants

	Intervention Group (n = 33)		Control Group (n = 33)		Test	
Characteristics	(M ± SD)	Min-Max	(M ± SD)	Min-Max	U, t	*p*
Mother's age (years)	28.66 ± 0.68	21–37	28.36 ± 0.72	19–36	U = 538.500	0.93
Father's age (years)	30.15 ± 0.64	23–36	30.33 ± 0.47	24–36	t = 64	0.82
marriage duration (months)	30.42 ± 16.96	9–84	29.48 ± 16.65	9–96	U = 522.500	0.77
	n	%	n	%	$\chi 2$	*p*
Baby's Gender						
Boy	18	54.5	15	45.5		
Girl	15	45.5	18	54.5	0.54	0.46
Mother's education						
University	18	54.5	19	57.6	0.07	0.96
High school	15	45.5	14	42.4		
Father's education						
University	20	60.6	18	54.5	1.49	0.47
High school	9	27.3	13	39.4		
Elementary school	4	12.1	2	6.1		
Family income						
Expenses more than income	8	24.2	5	15.2	20.9	0.46
Income is equal to expenses	17	51.5	19	57.6		
Income more than expenses	8	24.2	9	27.3		

Table 3 Comparison of State Anxiety Scale, Postnatal Breastfeeding Self-efficacy Scale and Maternal Attachment Scale scores for women in the intervention and control group

Intervention Group			Control Group			
State Anxiety Scale	(M ± SD)	Min-Max	(M ± SD)	Min-Max	Test	*P*
Pre-program*	44.72 ± 1.32	34–79	50.33 ± 2.05	37–80	U = 391.000	0.04
Post-Program	45.66 ± 0.93	36–55	55.84 ± 2.08	37–80	U = 271.000	0.00
Postnatal Breastfeeding Self-efficacy						
Postnatal First week	52.06 ± 1.82	33–69	51.57 ± 1.70	33–67	t = 0.54	0.58
Second month	64.21 ± 0.91	48–70	50.24 ± 2.07	29–70	U = 158.500	0.00
Maternal Attachment						
Postnatal First week	101,61 ± 0.50	91–104	99.75 ± 0.82	91–104	U = 469.500	0.32
Second month	103.58 ± 0.12	102–104	102.01 ± 0.16	101–104	U = 399.500	0.03

*Pre-program = 32-33rd week, post-program = postnatal second month

infants was significantly ($p = 0.00$; $p = 0.04$) lower than the intervention group (0.67 ± 0.132; 0.59 ± 0.23) (Table 5).

Discussion

A mandala-based technology-based breastfeeding program was applied to primiparous pregnant women in this study. In the second month after birth, it was determined that while the self-efficacy levels of the mothers in the intervention group were higher than those in the control group, their state anxiety levels were lower ($p < 0.05$). A study evaluating the effectiveness of a computer-based breastfeeding program reported that at the sixth week and third month after delivery breastfeeding self-efficacy of mothers in the intervention group who received training was higher than the control group [16]. We could not find any study evaluating art therapy or mandala-based technology-based breastfeeding program in the literature. In the literature, there are studies that evaluate only technology-based breastfeeding education [5] or mindfulness-based studies that evaluate the psychosocial well-being of pregnant women [17, 18]. We conclude that supporting the psychological well-being of pregnant women and implementing technology-based breastfeeding programs will increase their breastfeeding self-efficacy and breastfeeding rates.

Mother-infant attachment is among the indicators of healthy communication and development and should be supported by appropriate interventions. We concluded that mandala intervention (intention/wish, stress and structured mandala application) and the training program provided to strengthen attachment significantly increase maternal attachment. Similarly, we found that nursing interventions in randomized controlled studies that started during pregnancy [19, 20], or the postpartum period significantly increased the level of mother-infant attachment in the intervention group

Table 4 Distribution of infants nutritional status in the intervention and control groups

Postnatal First week					First month				Second month			
	Intervention Group		Control Group		Intervention Group		Control Group		Intervention Group		Control Group	
	n	%	n	%	n	%	n	%	n	%	n	%
Exclusively breastfed	27	81.8	17	51.5	22	66.7	14	42.4	29	87.8	14	42.4
Breastmilk and formula	6	18.2	16	48.5	6	18.2	12	27.3	4	12.2	12	36.4
Formula	-		-		5	15.2	7	30.3	-	-	7	21.2

compared to the control group [21]. The results of the study are similar to the results of many randomized controlled trials regarding the development of mother-infant attachment, especially the process of getting to know the infants of primiparous women and emphasizing the points to consider in communication. In our study, in addition to the education that strengthens mother-infant attachment, enabling women to focus on the moment by imagining their infants in mandala studies strengthened mothers' love and interest for their infants at the level of emotion and thought. In this regard, it is believed that the effectiveness of the technology-based education program has increased.

In the study, the rate of exclusive breastfeeding in the second month after birth in the intervention group that received mandala-based breastfeeding training was 87.8%, while this rate was 42.4% in the control group. Similar to our study, the rate of exclusive breastfeeding in the postpartum third month was 88% in a study in which a technology-based care program was applied in the antenatal and postnatal period [4]. The target of exclusive breastfeeding for the first six months worldwide is 70% [22]. It is of great importance that technology-based programs such as mandala, which increase the psychological well-being of pregnant women, and which are applied in the antenatal and post-antenatal periods, become widespread to reach this rate.

Nutritional status of infants, healthy attachment and communication between mother and infant are important factors for the growth of the infants. For this reason, it is thought that education programs that address these factors will affect the growth of infants. In our study, it was determined that the anthropometric measurement (weight and head circumference) z-scores of the infants in the intervention group were higher than the control groups. In the study of Sarı and Altay, as a result of the web-based care program, it was determined that the weight and head circumference z scores of the infants in the intervention group at the postnatal third month were higher than the control group [4]. The finding that infants of women in the technology-based education group had better anthropometric z-scores is similar to our study. It has been reported in the literature that growth parameters were better in breastfed infants compared to those who received only breast milk and those who received formula. In our study, the fact that the infants in the intervention group had higher z scores for weight and head circumference than the control group may be related to the high rate of breastfeeding in this group.

It is thought that especially the programs in which technological-based artistic activities are integrated will be effective in improving maternal and infant health with a holistic perspective.

Table 5 Comparison of the body weight, height and head circumference *z* scores in intervention and control group infants

Z score	Intervention Group		Control Group			
Body weight	(M ± SD)	Min-Max	(M ± SD)	Min-Max	Test	*P*
First week	-0.40 ± 0.153	-1.86–1.79	-0,58 ± 0.137	-1,91–0.97	t = 0.88	0.37
Second month	0.67 ± 0.132	-1.54–1.96	-0,55 ± 0.146	-2.48–0.95	U = 135.500	0.00
Height						
First week	-0.78 ± 0.338	-9.77–1.64	-0.95 ± 0.199	-3.21–0.99	U = 457.00	0.26
Second month	-0.69 ± 0.221	-3.22–1.43	-1.11 ± 0.214	-4,22–1.92	U = 443.00	0.19
Head circumference						
First week	-0.30 ± 0.217	-2.59–4.67	-0.66 ± 0.187	0.08 ± 0.14	U = 453.500	0.23
Second month	0.59 ± 0.230	-2.28–3.91	-2.59 ± 1.50	-1.82–1.44	U = 392.000	0.04

Limitations of the Study

The study has some limitations, one of which is that the results of the study cannot be generalized. The study has some limitations, one of which is that the results of the study cannot be generalized. The fact that this study was conducted in a foundation university hospital is one of the reasons why the results of the study cannot be generalized. The fact that this is the first study to integrate technology-based mandala activity with the educational program and to apply an innovative educational program in this study is another reason why the study results are not generalizable. Further studies are needed to develop and evaluate the effectiveness of mandala-based breastfeeding programs. Double blinding was not possible due to the nature of the study. As this study was conducted during the COVID-19 pandemic, the acceptability and adoption of the program by pregnant women has increased. However, there is a need to compare the effectiveness of technology-based applications with that of standard training.

Conclusion

As a result of the technology-based program in the study, it was determined that while the state anxiety level of the mothers in the intervention group was lower than the control group, their breastfeeding self-efficacy was higher. Furthermore, it was determined that the rate of breastfeeding of infants in the intervention group was higher in all three postnatal follow-ups. Anthropometric z-scores of the infants in the intervention group were better than the control group. We determined that the mother-infant attachment scores of the mothers in the intervention group were better than the control group.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10916-023-01942-3.

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Author Contribution Study conceptualization: CSO; Investigation: CSO, KD; Data collection: CSO, KD; Statistical analysis: CSO; Initial draft preparation: CSO, KD; Review and editing: CSO All authors read and approved submission of the final article. Correspondence: Cigdem SARI OZTURK, Gazi University, Faculty of Nursing, Pediatric Nursing Department, Ankara, Turkey

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Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of Interest The authors have no relevant financial or non-financial conflicts of interest to disclose.

Ethical Approval The study was reviewed and approved by the university Institutional Review Board. The registration number of this study on ClinicalTrials.gov is **NCT05199298.**

Informed Consent Informed consent was obtained from all individual participants included in the study.

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