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The effect of mother-baby yoga on mother's depression-anxiety-stress levels, perception of fragile baby, and maternal bonding: A randomized controlled trial

Tuba Koç Özkan [a,*], Zerrin Çiğdem [b], Emine Sarıkamış Kale [c], Yusuf Kale [d]

[a] Adıyaman University Faculty of Health Sciences, Midwifery Department, Altınşehir St. 02040 Adıyaman, Türkiye
[b] İstanbul Topkapı University Faculty of Health Sciences Nursing Department, Halide Edip Adıvar, Melikşah Sk. No:5, 34382 Şişli, İstanbul, Türkiye
[c] Hasan Kalyoncu University Faculty of Health Sciences Nursing Department, On Hasan Kalyoncu University Airport Road 8. km. Şahinbey, Gaziantep, Türkiye
[d] Medical Point Hospital, Batman, Türkiye

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ABSTRACT

Purpose: The study was conducted to examine the effects of mother–baby yoga applied to infants discharged from the Neonatal Intensive Care Unit (NICU) and their mothers on mothers' depression, anxiety, stress levels, perceptions of fragile infants, and mother–infant attachment.
Design and methods: This study was conducted as an interventional randomized controlled trial, with a mother–baby yoga group ($n = 20$) and a control group ($n = 20$). Mothers and infants were assigned to groups using the block randomization method.
Results: After ten sessions, mothers in the yoga group had significantly lower scores on the Depression, Anxiety, and Stress Scale and the Fragile Infant Perception Scale ($p < .05$), and higher scores on the Maternal Attachment Scale ($p < .05$), compared to the control group.
Conclusion: Mother–baby yoga effectively reduces maternal depression, anxiety, and stress levels, lowers perceptions of infant fragility, and improves maternal attachment in mothers of preterm infants.
Implications for Practice: Pediatric nurses should consider mother–baby yoga as a supportive practice in the post-discharge care of preterm infants to promote maternal mental well-being and strengthen early bonding
Clinical trial registration number:
Clinical Research Information Service, NCT06202937.

Introduction

According to the World Health Organization (WHO), babies born before completing 37 weeks of gestation are defined as preterm babies (World Health Organization, 2022). WHO reported that approximately 15 million preterm babies are born every year and the preterm birth rate varies between 5 % and 18 % (World Health Organization, 2021). According to the data of the General Directorate of Public Health of the Ministry of Health in Turkey, 26.2 % of babies were born very premature, 13.6 % were born small premature, and 18.7 % were born borderline prematüre in 2021 (Ministry of Health, Public Health General Directorate, 2021). Preterm birth is an important problem today with high morbidity and mortality rates and is the direct cause of 35 % of all neonatal deaths (WHO, 2022). In his study, Ritchie reported that 76 % of babies born at 25 weeks of gestation or weighing 750 g could be kept alive (Ritchie, 2002a, 2002b). In recent years, developments in perinatal and neonatal care, innovations in technology and medicine, and improved quality of care in the Neonatal Intensive Care Unit (NICU) have significantly reduced the mortality rates of preterm infants (Çavuşoğlu, 2019). In this context, following developmental care practices in the NICU, the need to support the development of infants and families can be maintained after discharge and during the first years of life (Spittle & Treyvaud, 2016).

Discharge from the NICU represents a highly stressful transition for families, particularly for mothers. In this process, mothers try to cope with many problems. The mother of a newborn who has been discharged from both preterm and intensive care has more difficulty in caring for the baby at home than the mother of a healthy newborn, and this may cause fear and feelings of inadequacy in the mother (Erdem, 2010). In a study comparing the parenting competencies of families with preterm infants at home with those of families with term infants, it was reported that parents with preterm infants were

* Corresponding author at: Adıyaman University Faculty of Health Sciences, Midwifery Department, Altınşehir St, 02040 Adıyaman, Türkiye.
E-mail address: tubakocozkan@gmail.com (T. Koç Özkan).

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less confident and preferred to watch as spectators rather than actively participating in the care of the infant (Ritchie, 2002a, 2002b).

A mother who gives birth before completing the gestational period and whose baby is hospitalized in the NICU may experience fear of losing her baby at home at any time after discharge (Yavaş-Çelik & Çiğdem, 2020). The mother may not touch her baby thinking that she will harm her baby, or she may delay this process and make it difficult for her to participate in the care of her baby. Such experiences may lead to difficulties in maternal–infant bonding and caregiving, potentially contributing to the development of Fragile Baby Syndrome (FBS), wherein mothers perceive their infants as highly vulnerable (Inandi et al., 2002). When the studies reporting that the perception of vulnerability occurs due to preterm birth are examined; Horwitz et al. (2015) determined that preterm birth was a risk factor in the perception of vulnerability in their study with mothers with preterm babies. In addition, it was explained that the perception of vulnerability can be prevented as a result of mothers receiving adequate social support and developing positive coping methods. Teti et al. (2005) also found that the support given to the mother during the mother and infant adjustment process increased her self-confidence, facilitated coping with the problems experienced in preterm infants and prevented the formation of the perception of vulnerability.

One of the negative effects of preterm birth on mother and baby is the mother-baby attachment problem. Henderson et al. (2016) found that mothers of preterm infants experience increased anxiety and fatigue, struggle to bond with their babies and have difficulties in the transition to motherhood. Preterm babies may be more restless than their term-born peers due to the neurobehavioral changes that occur; this may make it difficult for mothers to understand their babies' cues and bond with their babies, and may negatively affect the quality of the early mother-infant relationship. The signals sent by the baby to the mother for care and the mother's correct perception of these signals and meeting the needs of the baby lay the foundations of secure attachment between mother and baby (Bowlby, 1973). Tooten et al. (2012) reported that preterm infants responded less to their mothers' voices, were more hypotonic, less participatory, more passive and unresponsive than term infants; therefore, the cues given by the parents were less understood by the infants and they were more tense and difficult to calm. Schmücker et al. (2005) reported that mothers of preterm infants looked at and talked to their babies more, whereas mothers of term infants touched and smiled more. In a study conducted by Borghini et al. (2014) with a total of 80 families of 50 preterm and 30 term babies, it was reported that secure attachment occurred in 20 % of mothers of preterm babies and 53 % of mothers of term babies 6 months after birth, and that these rates were 30 % and 57 %, respectively, when the babies were 18 months old. The study also suggested that mothers with low-risk preterm infants had more difficult attachment than mothers with high-risk preterm infants.

Mothers are concerned about the life and future of their babies during and after their babies are hospitalized in the NICU and experience complex emotions such as fear, grief, powerlessness and guilt. All these emotions cause the preterm infant's parents, especially the mother, to experience depression and anxiety after birth and increase their stress levels. The depression, anxiety and stress experienced by the mother have a significant effect on her perception of her baby as fragile, her inability to touch her baby and the inability to ensure secure mother-infant attachment. In a study in which mothers of preterm and term babies were compared in terms of postpartum depression and psychological stress 6 weeks after birth, the frequency of stress and depression was found to be 29 % and 11 %, respectively, in mothers of preterm babies and 2 % and 0 % in mothers of term babies (Kukreja et al., 2012).

In a meta-analysis of 26 studies conducted with mothers of preterm infants, it was reported that 40 % of mothers had symptoms of postpartum depression in the early postpartum period (Vigod et al., 2010). In another study, it was reported that the risk of postpartum depression in mothers of preterm infants was 1.6 times higher than in mothers who gave birth at term (Drewett et al., 2004). In various studies, the birth of the baby earlier than expected in parents with preterm babies has been accepted as a trauma, and the problems experienced by the parents afterwards have been defined as Post-Traumatic Stress Disorder (PTSD) (Holditch-Davis et al., 2003). Carson et al. (2015) conducted a study in England between 2000 and 2002 to evaluate the parental distress levels of 18,495 mothers and 13,167 fathers whose babies were 9 months old; they found that the stress level of mothers with preterm babies was 2.1 times higher than mothers with term babies. In a study conducted by Pierrehumbert et al. (2003), it was found that mothers with preterm babies showed PTSD symptoms more than mothers with term babies even when their babies were 18 months old. In another study, it was reported that the stress levels of mothers with preterm babies did not decrease after birth and that they experienced high levels of stress in the 6–14 months after birth (Kersting et al., 2009).

After discharge from the NICU, it is important to maintain the development of infants at home and the support needs of families in the first months and years. According to a meta-analysis of 44 studies involving 5051 infants examining Early Intervention Developmental Programs (EIDP) applied to preterm infants in their post-discharge period, early developmental interventions make a difference on cognitive and motor functions of these infants in infancy and cognitive functions in preschool period. In addition, in the same meta-analysis, it was stated that most of the interventions focused on both the infant and the parent-infant relationship. It was shown that EIDP focusing on the parent-infant relationship was more effective on cognitive functions than programs focusing only on the infant or only on the parent (Orton et al., 2024).

Recently, it has been suggested that mother-baby yoga, which is one of the therapeutic support approaches focused on the mother-baby relationship, has a positive effect on mother-baby health (Arasappa et al., 2023; Rusnani et al., 2022).Yoga is a practice that aims at the unity of body-mind and has its roots in India 4000 years ago. Yoga is a mind–body practice that combines physical postures (asanas), breathing techniques (pranayama), and mindfulness or meditation. Numerous studies have shown that yoga can improve emotional regulation, reduce stress, anxiety, and depressive symptoms, and enhance overall physical health (Cramer et al., 2013; Pascoe et al., 2017). It has also been linked to reduced cortisol levels, improved sleep quality, enhanced autonomic nervous system balance, and increased body awareness. These general benefits make yoga a potentially effective intervention for supporting maternal well-being in the postpartum period (Kimoto et al., 2021; Pascoe et al., 2017; Streeter et al., 2012)It includes physical poses called asana, breath awareness exercises called pranayama and meditation. In addition to adult yoga practices, mother-baby yoga practices include special poses and movements for mothers in the postpartum period, yoga positions practiced by mother and baby together, positions and movements for babies, baby massage and mother-baby interaction (Bozgan, 2021).

Mother-baby yoga is an easy and relaxing practice in which basic yoga movements and postures are practiced with the baby. Throughout the yoga practice, mother and baby are together. While the mother is practicing her own body, her baby is either on her lap or nearby where she can look at, touch and smile at her. There are very few studies in the literature investigating the effectiveness of mother-baby yoga in preterm infants. In these studies, it has been emphasized that mother-baby yoga, which is practiced once a week for 60 min for six weeks, positively affects the motor development and mother-infant attachment of preterm infants, can support the development of sleep patterns by calming babies, different touches, movements and sounds can increase the emotional development of babies, and by facilitating digestion, it can help to eliminate digestive and intestinal problems such as constipation, gas pains and colic that may occur in the baby. It was concluded that mothers will have the opportunity to observe the development and reactions of their babies, reduce their anxiety levels, increase their health-related quality of life, provide both physical healing and

emotional support, and help mothers socialize (Rusnani et al., 2009; Russel, 2017; Leahy-Warren et al., 2020; Arasappa et al., 2023;). In a qualitative study conducted by Russel (2017) with 17 mothers with term babies who participated in mother-baby yoga classes, she reported that mother-baby yoga groups increased the mental well-being of mothers in terms of finding the opportunity to exercise with their babies and interacting with other mothers participating in the practice.

This study was conducted to examine the effects of mother-infant yoga applied to infants discharged from the NICU and their mothers on mothers' depression, anxiety, stress levels, perceptions of fragile infants and mother-infant attachment.

Methods

Type of research

This randomized controlled trial aimed to evaluate the impact of a mother–infant yoga program on maternal depression, anxiety, stress, perceptions of infant fragility, and mother–infant attachment among mothers of NICU-discharged preterm infants.

Population and sample of the study

The study was conducted between 2 August 2023 and 2 December 2023. The population consisted of 112 preterm infants and their mothers who were discharged from the NICU of a private hospital between April 2023 and May 2023. G*Power power analysis was used to determine the sample of the study. In the power analysis performed by considering the reference study, 96 % power (1-β), alpha value 0.05 and Cohen effect size coefficient d = 1.11 were calculated and a total of 40 preterm infants and their mothers were included in the study, with at least 20 preterm infants and mothers in each group. No participants dropped out of the study; thus, the attrition rate was 0 %. Participants were randomly assigned to either the mother–baby yoga group ($n = 20$) or the control group (n = 20) using a block randomization method with a block size of 4, generated through the online tool at https://www.sealedenvelope.com/simple-randomiser/v1/lists. The randomization list was prepared by an independent researcher not involved in data collection or intervention delivery, and group allocation was concealed until the intervention began (Fig. 1-CONSORT).

In the calculation made according to the MAS results of the study, the effect size of the research was calculated to be 4.836.

Inclusion criteria for infants were as follows: born before 37 weeks of gestational age, treated in the NICU, discharged at least 8 and at most 16 weeks ago, without any chronic disease or congenital defect, screened for developmental hip dysplasia and medically cleared by the attending physician to participate in yoga. For mothers; Turkish-speaking mothers who were older than 18 years of age, who did not have any physical discomfort that prevented practicing yoga, who voluntarily wanted to participate in the study, and who were approved by their physicians to practice yoga were included. The exclusion criteria were infants who had health problems during the study,

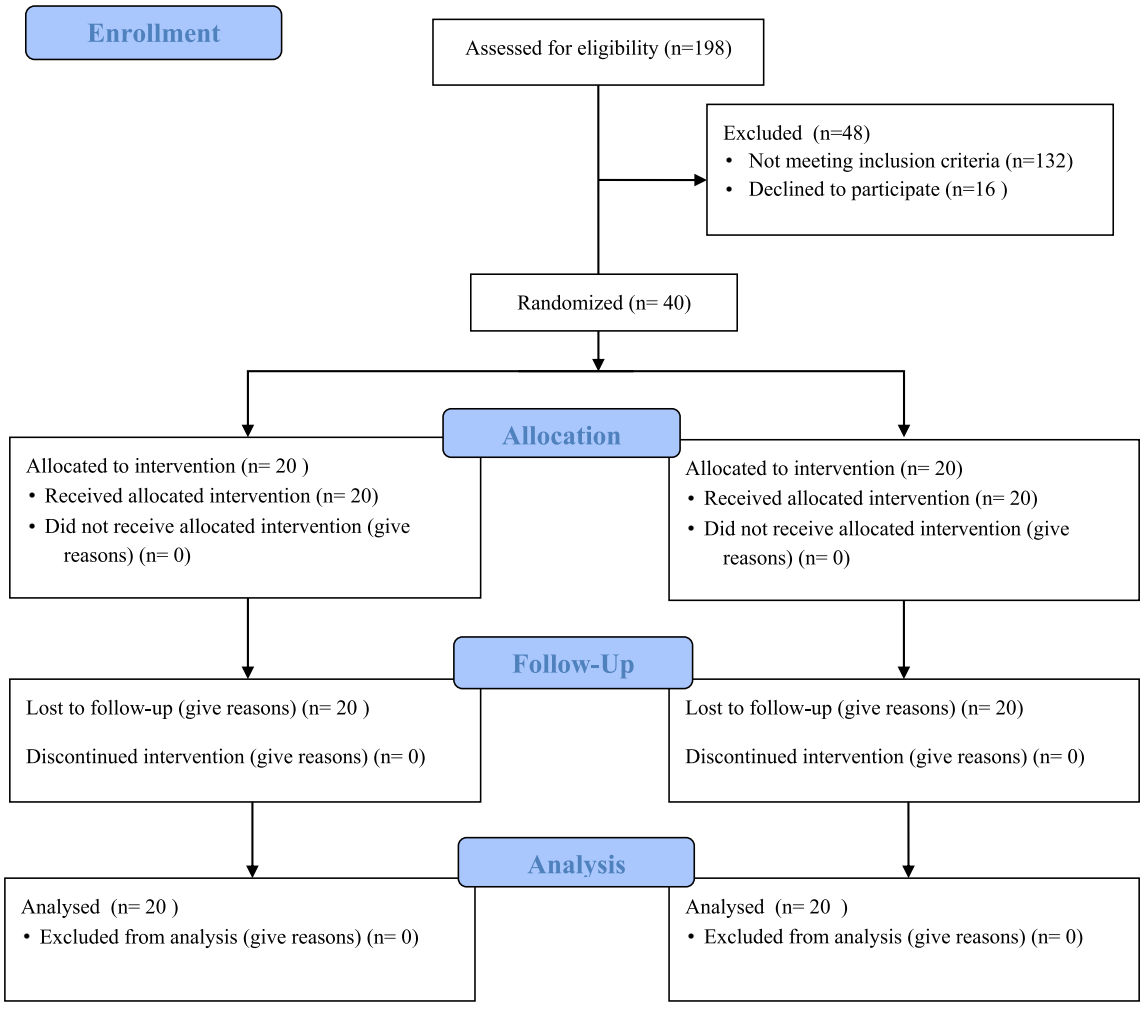

Fig. 1. CONSORT Diagram.

mothers and infants who did not complete the 10 lessons or who wanted to withdraw at any stage of the study.

Location and characteristics of the research

The NICU where the study was conducted is a private hospital with a total of 41 beds, providing level 2 service with 8 beds and level 3 service with 33 beds.

Data collection tools

The Descriptive Characteristics Form, the Fragile Infant Perception Scale (FIPS), the Maternal Attachment Scale (MAS) and the Depression, Anxiety, Stress Scale (DASS-21), which were developed in line with the suggestions and opinions of three expert pediatric nurses and a neonatologist, were used to collect the data.

Mother and Infant Diagnostic Characteristics Form: The form included information about the mother and infant and consisted of 15 questions.

Depression, Anxiety, Stress Scale (DASS-21): It is an assessment tool created by shortening the DASS-42 scale developed by Lovibond and Lovibond in 1995 to evaluate the depression, anxiety and stress levels of individuals. The scale has 3 sub-dimensions: depression, anxiety and stress. The scale, which has 7 items in each sub-dimension, consists of 21 items in total. Scale items are scored between 0 (never) and 3 (always). In scale scoring, sub-dimensions are summed within themselves. The scores that can be obtained from each sub-dimension vary between 0 and 21. The increase in the scores means that the individual experiences the emotional state evaluated by the relevant sub-dimension more. According to the scores obtained from DASS 21, the emotional state experienced by the individual is evaluated as “normal”, “mild”, “moderate”, “severe” and “very severe” for each of the three subgroups. The Turkish adaptation of the scale was conducted by Sarıçam (2018) (33). The Cronbach's a internal consistency reliability coefficient of the scale in the clinical sample was found to be $\alpha = 0.87$ for the depression subscale, $\alpha = 0.85$ for the anxiety subscale and $\alpha = 0.81$ for the stress subscale. Test-retest correlation coefficients in normal samples were calculated as $r = 0.68$ for the “depression” subscale, $r = 0.66$ for the “anxiety” subscale and $r = 0.61$ for the “stress” subscale. The long version of the Depression Anxiety Stress Scale-42 was used to examine the criterion validity of the scale. The correlation between the two scales was 0.89, indicating a strong criterion validity.

Fragile Infant Perception Scale (FIPS): The scale was developed by Kerruish et al. in 2005. The scale consists of 10 questions and is 5-point Likert type. The total score of the scale is 50. A score of 27 and above indicates that the mother's perception of vulnerability is high. It is not recommended to apply the scale in case of mother-infant separation for any reason. The mother and infant must be together for the application of the scale. In a study by Kerruish et al. (2005), the Cronbach's a reliability of the scale was found to be 0.70. The scale was adapted into Turkish by Yavaş Çelik and Çiğdem (2020) and the Cronbach's a reliability coefficient was found to be 0.84.

Maternal Attachment Scale (MAS): This scale was developed by Müller in 1994 to measure maternal affectionate attachment. Müller found the reliability coefficient of the scale to be 0.85 in mothers of newborns. The MAS was adapted to the Turkish population by Kavlak and Şirin in 2009 and the alpha reliability coefficient was found to be 0.77 in mothers of newborns. The MAS measures maternal feelings and behaviors. Since the MAS is a self-administered scale, mothers who can read and write and understand what they read can apply it. The MAS is a four-point Likert-type scale consisting of 26 items. The scale includes direct statements rated on a scale of 1–4 (never, sometimes, often, always). Scores between 26 and 104 are obtained from the scale. A higher score means higher maternal attachmen (Kavlak & Şirin, 2009).

Data collection

Before the start of the study, the families of the infants who met the inclusion criteria were informed about the study and a written consent form was completed. At the beginning of the study, nurse and physician daily observation form and Mother-Infant Descriptive Characteristics Form were completed with verbal information obtained from the mothers. The mothers in the yoga and control groups were administered FIPS, MAS and DASS-21 before the 1st and after the 10th lesson. Data were collected by the first researcher. Then, at this stage, randomization was performed by the third researcher.

Mother-baby yoga was practiced by second researcher with a mother-baby yoga practitioner certificate in three groups of 6, 7 and 8 mother-babies, 3 days a week for an average of 10 60-min classes. The yoga sessions was carried out in a private hospital training hall. In the group of six mother-babies, one mother left the group in the second lesson and this group was continued with 5 mother-babies. The lessons started with a general conversation between the researcher and the mothers about themselves and their babies, which lasted about 10 min, and information was exchanged about the changes they experienced in themselves and their babies. These conversations were followed by deep breathing, OM matra and warm-up movements. Then, after the first contact with the baby and breathing exercises together, massage was applied to the baby, followed by the application of yoga movements for mother and baby, and finally the class was completed with Shavasana-Final Rest (mother-baby side by side). Before each class, it was explained to the mothers that when there was an inappropriate change in the baby's physiological values, when the baby cried, when the baby needed care, the mother could interrupt the class and meet the baby's needs and rejoin the class when appropriate. When the baby fell asleep, she was informed that she could continue in the Shavasana-Last Rest pose (mother-baby side by side) until the end of the class. Mothers and infants in the control group did not receive any intervention and continued standard post-discharge care. A detailed sample session plan is presented in Appendix 1.

The sessions were delivered face-to-face in a designated training space and led by the first author, who completed a 200-h certified Mother–Baby Yoga training program at Alper Akbaş Yoga on June 30, 2021.

Data evaluation

The data obtained in the study were analyzed using SPSS for Windows 25.0 (SPSS Inc., USA). Statistical significance was accepted as $p < .05$. In the statistical analysis of the data, the descriptive characteristics of the participants in the yoga and control groups were shown separately, and whether there was a significant difference between the yoga and control groups in terms of these characteristics was investigated using *t*-test and chi-square test. Whether the data related to the DASS-21, FIPS and MAS used in the study showed normal distribution was analyzed separately for the yoga and control groups. Skewness and kurtosis values were used for normality analysis. If the skewness and kurtosis values were within the range of ± 2, it was decided that the data distributions were normal. Based on the findings of the normality analysis, parametric tests were used in the analyses using DASS-21, FIPS and MAS data. Independent sample t-test was used when the data of the yoga and control groups were compared, while the dependent sample t-test was used when the pre-test and post-test data of the experimental group or the control group were compared.

Ethical dimension of the research

Before starting the study, ethics committee permission was obtained from Hasan Kalyoncu University, Faculty of Health Sciences, Non-Interventional Research Ethics Committee ((date: 12.6.2023, no: 2023/64).). Written informed consent was obtained from the mothers included in the study. The study was conducted in accordance with the principles of the Declaration of Helsinki. The Clinical Trial Number is NCT06202937.

Results

Descriptive characteristics of preterm infants were similar across the yoga and control groups, no difference was found between the groups in terms of the variables examined ($p > .05$) and the groups were found to have a similar distribution (Table 1).

At baseline, both the yoga and control groups had high DASS-21 Depression scores, with no significant difference between them ($p > .05$). Following the intervention, the yoga group showed a significantly lower mean depression score compared to the control group ($p < .05$). Within-group analysis revealed a significant reduction in depression scores from pre- to post-intervention in the yoga group ($p < .05$), whereas no significant change was observed in the control group ($p > .05$) (Table 2).

At the first measurement, the yoga group had a significantly lower mean DASS-21 Anxiety score compared to the control group ($p < .05$). This difference persisted in the final measurement, with the yoga group continuing to show lower anxiety levels than the control group ($p < .05$). Within-group analysis revealed a significant reduction in anxiety scores from pre- to post-intervention in the yoga group ($p < .05$), while no significant change was observed in the control group ($p > .05$) (Table 2).

At baseline, the yoga group had significantly lower DASS-21 Stress scores than the control group ($p < .05$). This difference remained at the final measurement, with the yoga group continuing to report lower stress levels ($p < .05$). Within-group comparisons showed a significant decrease in stress scores from pre- to post-intervention in the yoga group ($p < .05$), whereas no significant change was found in the control group ($p > .05$) (Table 2).

In the FIPS assessment, scores of 27 and above indicate a high perception of infant vulnerability. At baseline, both the yoga and control groups had elevated FIPS scores, with no significant difference between them. Post-intervention results showed that the yoga group had significantly lower FIPS scores compared to the control group ($p < .05$). Within-group analysis revealed a significant reduction in FIPS scores in the yoga group from pre- to post-test ($p < .05$), whereas no significant change was observed in the control group ($p > .05$) (Table 3).

The MAS score ranges from 26 to 104, with higher scores indicating stronger maternal attachment. At baseline, the control group had significantly higher MAS scores than the yoga group ($p < .05$). However, this trend reversed in the post-intervention measurement, where the yoga group reported significantly higher scores ($p < .05$). Within-group comparisons revealed a significant increase in attachment scores in the yoga group from pre- to post-test ($p < .05$), while the control group showed a significant decrease over the same period ($p < .05$) (Table 4).

The ANCOVA analyses conducted for anxiety and stress levels have shown significant differences between groups even when the effect of baseline levels was controlled. For anxiety, the group effect was found to be significant ($F(1, 37) = 295.65$, $p < .001$), and the baseline anxiety level also contributed significantly to the model ($F(1, 37) = 6.51$, $p = .015$). Similarly, for stress levels, the group effect was significant ($F(1, 37) = 289.60$, $p < .001$), and the baseline stress level as a covariate was also influential ($F(1, 37) = 5.58$, $p = .024$). In both models, the explained variance was quite high (Adjusted $R^2 = 0.906$ for anxiety; Adjusted $R^2 = 0.908$ for stress), indicating a strong effect of the intervention (Table 5).

ANCOVA results revealed a significant main effect of group on post-intervention maternal attachment scores after adjusting for baseline scores ($F(1, 37) = 215.67$, $p < .001$). The covariate (MAS pretest score) was not statistically significant ($F(1, 37) = 2.95$, $p = .094$), indicating that the group effect was independent of initial attachment levels. The model accounted for 87.0 % of the variance (Adjusted $R^2 = 0.863$), reflecting a very strong intervention effect (Table 5).

Table 1
Comparison of descriptive characteristics of preterm infants in the yoga and control groups ($n = 40$).

Characteristics		Yoga (n = 20) Mean ± SD	Control (n = 20) Mean ± SD	t	*p*
Maternal Age		33.30 ± 6.81	29.65 ± 6.31	1.76	0.09
Gestational Age of Infant at Birth		30.75 ± 2.92	31.25 ± 2.99	0.54	0.60
Current Corrected Age of Infant (weeks)		11.35 ± 1.87	12.20 ± 2.28	1.29	0.21
Birth Weight of Infant (grams)		1661.25 ± 453.84	1640.50 ± 498.00	0.14	0.89
Current Weight of Infant (grams)		3234.50 ± 640.35	3170.50 ± 479.39	0.36	0.72
Duration of Infant's Treatment (days)		36.60 ± 19.46	39.95 ± 21.37	0.52	0.61
Characteristics	Group	n(%)	n(%)	X^2	*p*
Maternal Employment Status	Yes	3(15.0)	7(35.0)	2.13	0.14
	No	17(85.0)	13(65.0)		
Maternal Education Level	Primary School	7(35.0)	6(30.0)		
	High School	9(45.0)	10(50.0)		
	University +	4(20)	4(20.0)	0.13	0.94
Pregnancy	Planned	6(30.0)	9(45.0)	0.96	0.33
	Unplanned	14(70.0)	11(55.0)		
Birth Experience	First Birth	5(25.0)	5(25.0)	0.00	>0.999
	Not First Birth	15(75.0)	15(75.0)		
Mode of Delivery	Normal	3(15.0)	4(20.0)	0.17	0.68
	Cesarean	17(85.0)	16(80.0)		
Infant Gender	Female	11(55.0)	11(55.0)	0.00	>0.999
	Male	9(45.0)	9(45.0)		
Reason for Infant Hospitalization	Preterm	5(25.0)	5(25.0)		
	RDS	12(60.0)	10(50.0)		
	Transient/Tachypnea	1(5.0)	2(10.0)	0.72	0.87
	N. Pneumonia	2(10.0)	3(15.0)		
Previous Preterm Birth	Yes	4(20.0)	4(20.0)	0.00	>0.999
	No	16(80.0)	16(80.0)		

Table 2
Comparison of Depression, Anxiety, and Stress Scale Scores of Yoga and Control Groups.

		N	Yoga Group	Control Group	*t*	*p*	cohen's d
			Mean ± SD	Mean ± SD			
DASS-21 Depression	First Measurement	20	17.55 ± 1.05	17.35 ± 1.46	0.50	0.62	0.16
	Final Measurement	20	10.15 ± 1.18	18.05 ± 1.47	−18.74	0.001	5.93
	t		19.49	−1.85			
	p		0.001	0.08			
DASS-21 Anxiety	First Measurement	20	13.30 ± 1.26	14.50 ± 1.96	−2.30	0.03	0.73
	Final Measurement	20	8.00 ± 1.17	15.30 ± 1.38	−18.04	0.001	5.71
	t		20.18	−1.78			
	p		0.001	0.09			
DASS-21 Stress	First Measurement	20	15.00 ± 1.62	16.25 ± 1.37	−2.63	0.001	0.83
	Final Measurement	20	8.10 ± 1.29	16.00 ± 1.41	−18.43	0.001	5.85
	t		15.87	0.93			
	p		0.001	0.37			

Table 3
Comparison of the Mean Scores of the Yoga and Control Groups on the Fragile Infant Perception Scale.

		N	Yoga Group	Control Group	*t*	*p*	*cohen's d*
			Mean ± SD	Mean ± SD			
FIPS	First Measurement	20	31.05 ± 2.39	29.85 ± 2.23	1.64	0.11	0.52
	Final Measurement	20	25.95 ± 3.20	29.70 ± 3.21	−3.70	0.001	1.17
	t		7.91	0.25			
	p		0.001	0.81			

Discussion

The findings obtained in the study, which was carried out to examine the effect of mother-baby yoga on maternal depression-anxiety-stress, perception of fragile infant and maternal attachment in mothers and infants who had preterm delivery and were discharged, were discussed in line with the literature and with the results of similar studies.

When the distribution of the descriptive characteristics of preterm infants and their mothers according to their groups was examined, no statistically significant difference was found between these variables and the groups and the groups were homogeneously distributed (Table 1). Homogeneous distribution of the descriptive characteristics of the infants and mothers in the groups is important in terms of eliminating the confounding effect of the parameters examined in the mothers.

Mothers of preterm infants are at increased risk for multiple physiological and psychological challenges. Conditions that can be seen in mothers in the postnatal period with preterm birth can be listed as increased stress level, PTS, post natal depression, mental health problems including mood and anxiety disorders, decreased sleep quality, fatigue, difficulties in mother-infant attachment, decreased self-efficacy, increased perception of fragile baby, difficulty in understanding the baby's signs, decreased mother-infant interaction and relationship quality (Russell, 2017; Leahy-Warren Bozganet al., 2020, 2021; Russani et al., 2022).

In the study, DASS-21 scores at baseline showed high levels of depression, anxiety, and stress in both groups. Following the intervention, a marked reduction was observed in the yoga group, while levels in the control group remained elevated.

The observed decrease in depression among mothers in the yoga group suggests that mother–baby yoga may help alleviate postpartum depressive symptoms. This is significant considering the known impact of maternal depression on caregiving, bonding, and infant development.

Anxiety scores, although initially high in both groups, decreased substantially in the yoga group post-intervention. These results support the potential of yoga in reducing maternal hyperarousal and enhancing emotional regulation during the postpartum period.

The decline in maternal stress levels in the yoga group may reflect increased coping capacity and emotional resilience. Stress is a key barrier to maternal sensitivity, and its reduction may facilitate improved responsiveness to infant cues.

The shift in favor of the yoga group, despite higher initial scores in the control group, strengthens the case for yoga's effectiveness. These findings are consistent with previous research reporting similar benefits among mothers of low birth weight infants (Rusnani et al., 2022). In a study conducted by Rusnani et al. (2022) with mothers with low birth weight / preterm infants, they explained that mothers experienced moderate or severe depression, anxiety and stress and stated that anxiety levels were more prominent.

Bozgan (2021) examined the effects of internet-based mother-baby yoga on preterm infants and their mothers. She explained that both state and trait anxiety levels of the mothers in the intervention and control groups were similar at the beginning, but after six weeks of practice, the state anxiety level of the mothers in the yoga group decreased significantly compared to the control group. In the intragroup analysis, a statistically significant decrease was found in trait anxiety level. In addition, according to the findings obtained from the WHO Quality of Life Short Form Scale, mothers in the mother-baby yoga group showed a

Table 4
Comparison of Maternal Attachment Scale Mean Scores of Yoga and Control Groups.

		N	Yoga Group (SD)		Control Group		*t*	*p*	cohen's d
			$\overline{X}$	Ss	$\overline{X}$	Ss			
MAS	First Measurement	20	86.75	3.60	90.10	2.94	−3.23	0.003	1.02
	Final Measurement	20	100.40	2.06	86.60	3.47	15,29	0.000	4.84
	t		−17.52		3.97				
	p		0.001		0.001				

Table 5
ANCOVA Results for Post-Intervention anxiety scores, Stress Scores and FIBS scores (Controlling for Baseline).

Anxiety-Source	SS	df	MS	F	p
Covariate (Pretest Anxiety)	9.31	1	9.31	6.52	0.015
Group (Yoga vs. Control)	422.60	1	422.60	295.65	<0.001
Error	52.89	37	1.43		
Total	6024.00	40			
Corrected Total	595.10	39			
$R^2 = 0.911$ (Adjusted $R^2 = 0.906$)					
Stress-Source	SS	df	MS	F	p
Covariate (Pretest Stress)	9.14	1	9.14	5.58	0.024
Group (Yoga vs. Control)	474.77	1	474.77	289.60	<0.001
Error	60.66	37	1.64		
Total	6502.00	40			
Corrected Total	693.90	39			
$R^2 = 0.913$ (Adjusted $R^2 = 0.908$)					
MAS-Source	SS	df	MS	F	p
Covariate (MAS pretest)	22.879	1	22.879	2.952	0.094
Group (Yoga vs Control)	1671.249	1	1671.249	215.667	<0.001
Error	286.721	37	7.749		
Total	351,904.000	40			
Corrected Total	2214.000	39			
$R^2 = 0.870$, Adjusted $R^2 = 0.863$					

significant increase in all 4 sub-dimensions: physical, mental, social and environmental, while none of the quality of life sub-dimensions of the control group increased.

Arasappa et al. (2023) examined the feasibility and acceptability of mother-infant yoga specifically designed to strengthen mother-infant bonding with 14 mothers with severe mental illness admitted to the şMother Infant Psychiatric Unit of a national mental health center in India in a pilot study. They explained that the yoga practices selected for the mother-infant dyad included face-to-face interaction, gentle massage of the baby, gentle movement of the baby's limbs, and singing while holding the baby. At the end of the study, it was reported that the mother-infant yoga practice did not cause any negative effects and that the mothers stated that it was an appropriate, acceptable and useful intervention for them. We think that the results of this study will help health care workers to develop mother-baby yoga and different effective intervention strategies to address the psychological health problem among mothers of preterm infants.

Although anxiety, stress, and depression are often discussed together in the perinatal mental health literature, they are conceptually and clinically distinct constructs with potentially unique pathways of influence. Depression is typically associated with low mood, emotional detachment, and impaired motivation, which can negatively impact maternal responsiveness and bonding (Lutkiewicz et al., 2020; McManus & Poehlmann, 2012). In contrast, anxiety is characterized by heightened arousal and hypervigilance, which may increase maternal worry and the perception of infant fragility (Gordo et al., 2018). Stress, often resulting from environmental overload, may exacerbate both depressive and anxious symptoms and diminish maternal coping capacity (Shi & MacBeth, 2017). In the present study, reductions in all three emotional states were observed in the yoga group. However, the improvement in maternal attachment may be more closely linked to decreased depressive symptoms, while reduced anxiety may have contributed more strongly to the observed decline in perceived infant fragility. These differential pathways suggest that yoga may serve as a multifaceted intervention and highlight the need for future studies to employ mediation models to explore these potential indirect effects (Mahmoudi et al., 2020).

In addition to reductions in anxiety and stress, the yoga intervention led to a significant decrease in depressive symptoms, as measured by the DASS-21 depression subscale. This outcome is especially relevant given that maternal depression is consistently linked to difficulties in mother–infant bonding and reduced maternal sensitivity (Binda et al., 2019; Lutkiewicz et al., 2020). Postpartum depression may disrupt a mother's ability to interpret and respond to infant cues, contributing to increased perceptions of infant vulnerability or fragility (Lefkovics et al., 2018). Therefore, the improved maternal attachment scores observed in the yoga group may be partly attributed to decreased depressive symptoms. Yoga-based interventions that integrate relaxation, mindfulness, and breath awareness have been shown to reduce perinatal depressive symptoms and enhance maternal–infant connectedness (Munns et al., 2024; Oyarzabal et al., 2021). In this context, the parallel decrease in Fragile Infant Perception Scale (FIPS) scores in the yoga group may reflect an overall improvement in maternal confidence and emotional regulation. These findings suggest that yoga can serve as a multidimensional strategy for supporting both maternal mental health and relational outcomes.

The perception of a fragile infant is a condition in which the caregiver perceives the infant as inherently weak and consequently uses health care services disproportionately to the medical need. Preterm infants are one of the important groups at special risk for the development of fragile infant perception. In addition, maternal conditions such as postpartum depression, parental stress, and self-efficacy perception may also cause the perception of vulnerability. During the transition from NICU to home, mothers caring for fragile babies may experience fear, anxiety, loss, worry, insecurity and feelings of inadequacy about their ability to care for their babies' needs, along with relief that their babies are now well enough to be cared for at home. As a result of the development of the perception of vulnerability, the parent-child relationship is negatively affected. While overprotective behaviors are observed in parents, negative neurodevelopmental and behavioral problems in the infant are common as a result [9,29,32] (Karataş, 2023; Kerruish et al., 2005; Yavaş-Çelik & Çiğdem, 2020).

A score of 27 and above in the FIPS assessment indicates a high perception of fragility. In the study, it was concluded that the mothers in both groups perceived their babies as fragile according to the first measurement mean scores of the FIPS. According to the post-measurement FIPS mean scores, there was a significant decrease in the fragility perceptions of the mothers in the mother-infant yoga group and the difference was significant. In addition, it was found that the mean scores of the mother-infant yoga group also created a significant difference within the mother-infant yoga group. Karataş (2023) reported that the mean FIPS score of the mothers of infants with an average gestational age of 35.21 ± 2.67 weeks, who were hospitalized in the NICU for an average of 14.10 ± 11.32 days and discharged was 31.51 ± 5.53. In addition, in the same study, it was explained that there was a positive relationship between the perception of fragile infant and mother-infant attachment, and as the perception of fragile infant increased, mother-infant attachment decreased. In addition, it was suggested that the post-discharge fragile infant perception levels of mothers whose infants were hospitalized in the NICU should be evaluated and support should be provided to reduce mothers' perceptions of fragility (Karataş & Küçük Alemdar, 2024).

Preterm birth is a condition that causes a lot of difficulties for both the baby and his/her family, especially the mother. The combination of factors related to both the baby (unnatural atypical NICU environment, early and sometimes prolonged separation from parents, painful practices, etc.) and the mother (depression, anxiety, stress, PTS, etc.) cause significant difficulties in developing the desired level of mother-infant relationship and attachment in the early period. Given the critical importance of the relationship between mother and infant, it is of great importance to identify timely and effective interventions to improve infant and parental mental health and attachment, increase resilience,

reduce adversities as early as possible, improve outcomes and facilitate an optimal infant-parent relationship.

It is of great importance for mothers to overcome the difficulties they face after discharge from the NICU and to support the mother-infant relationship. Various relationship-based interventions can be used to support mothers and infants. These interventions should aim to reduce risk factors and support the sense of competence of the mother of a medically vulnerable infant. Currently, there are 11 basic intervention methods accepted for the factors affecting the mother-infant relationship in the NICU and after discharge from the NICU (Hoge et al., 2021). However, studies have indicated that infant massage, yoga and meditation may also be effective as complementary methods in the development of mother-infant attachment in the early period (Akarsu et al., 2017).

Sensitive, warm, positive and simultaneous mother-infant interaction supports the development of secure attachment. In mother-infant yoga practice, the mother's touching, massaging, talking, singing, singing a song/lullaby, facial expression and eye contact can be considered as the basic components of mother-infant interaction (Feijó et al., 2006).

A higher score on the MAS indicates better mother-infant attachment. In the study, when the mean scores of the first measurement were analyzed, it was found that the mean MAS score of the control group was higher and the difference between the two groups was statistically significant ($p < .05$). In the last measurement mean scores, it was observed that the mean MAS score of the mothers in the mother-baby yoga group increased and the mean score of the control group decreased, and the difference was found to be significant ($p < .05$). In the intragroup comparison, it was found that the last measurement value of the mean MBS score in the mother-baby yoga group was statistically significantly higher than the first measurement value ($p < .05$). In the control group, the last measurement value was statistically significantly lower than the first measurement value ($p < .05$). Although the mean MAS score was lower in the mother-infant yoga group in the first measurement, it increased in the last measurement, suggesting that this finding was in parallel with the findings of DASS 21 Anxiety, DASS 21 Stress and FIPS, and that mother-infant yoga practice had a positive effect on mother-infant attachment in mothers. Bozgan (2021) reported that as a result of 6-week internet-based mother-infant yoga training, mother-infant attachment showed a significant improvement in the mother-infant yoga group in both intergroup and intragroup comparisons, while no significant improvement was observed in the control group during the follow-up period. In the thesis study conducted by Russel (2017), the experiences of 17 mothers who participated in mother-infant yoga classes were qualitatively questioned. The mothers who participated in the study stated that mother-baby yoga groups increased their mental well-being due to the opportunity to exercise with their babies and to provide support by entering into a social relationship with other mothers in the group. In the study, it can be argued that the interaction of the mothers with each other and the instructor for about 10 min before each practice created an opportunity for them to share their experiences and learn different approaches and skills. In addition, it is thought that the mother's contact with the baby and baby massage, which are included in the mother-baby yoga practice, positively affect the mother-infant attachment by increasing the interaction.

As a result, mother-baby yoga can be applied as a complementary method to early support programs in routine follow-up of preterm and term babies and their mothers in order to protect and improve mother-baby health. Studies on the short- and long-term effects of mother-baby yoga on infants are recommended.

Limitations

Although variables such as maternal education and employment status were not included as covariates in the main analysis, there were no significant differences between groups in these characteristics ($p > .05$), suggesting a relatively balanced distribution. Maternal age was considered a potential covariate and may be explored in future studies. Nonetheless, the absence of other confounding variables such as perceived social support or mental health history represents a limitation of the present study.

Despite implementing a rigorous block randomization method and maintaining allocation concealment, slight baseline differences were detected between the intervention and control groups in measures such as anxiety, stress, and maternal attachment. These differences may have resulted from the relatively small sample size, which increases the chance of random variation. To address this issue, ANCOVA was performed to statistically control for baseline differences. Additionally, effect size calculations supported the conclusion that the observed group differences at posttest were not solely driven by pretest disparities.

Implications for practice

The findings of this study provide important implications for pediatric nursing practice. Mother–baby yoga appears to be a safe, feasible, and effective complementary intervention for improving the psychological well-being of mothers of preterm infants following discharge from the NICU. Pediatric nurses are in a unique position to recommend or facilitate mother–baby yoga programs as part of post-discharge support services. Integrating mother–baby yoga into follow-up care plans may help reduce maternal depression, anxiety, and stress levels, improve perceptions of infant vulnerability, and enhance mother–infant attachment. Nurses working in neonatal and pediatric settings can contribute to early intervention efforts by promoting accessible and low-cost practices such as yoga, ultimately supporting maternal mental health and fostering stronger early parent–infant relationships.

Conclusion

This randomized controlled trial demonstrated that mother–baby yoga significantly reduced depression, anxiety, and stress levels in mothers of preterm infants. Additionally, it lowered perceptions of infant fragility and enhanced maternal bonding. These results highlight the multifaceted benefits of mother–baby yoga as a supportive, holistic intervention that addresses both maternal mental health and early mother–infant relational outcomes. Further research is recommended to explore the long-term effects of such interventions and their integration into pediatric nursing care.

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CRediT authorship contribution statement

Tuba Koç Özkan: Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Zerrin Çiğdem:** Writing – review & editing, Visualization, Validation, Supervision, Conceptualization. **Emine Sarıkamış Kale:** Writing – review & editing, Supervision, Data curation, Conceptualization. **Yusuf Kale:** Writing – review & editing, Resources, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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N/A

Appendix 1. Mother–Baby Yoga Session Plan

Practice	Description	Duration (min)
Session Opening	Brief dialogue (reviewing previous session, assessing the mother's readiness). Comfortable and supported sitting posture. Mindful breathing and warming up.	7
OM Mantra	In a relaxed seated posture with the baby resting on the chest, the OM mantra is chanted 3 times while breathing calmly and deeply.	5
Breathing Practice	While maintaining eye contact with the baby, one hand is placed on the mother's heart and the other on the baby's chest. Deep breathing is repeated 3 times.	3
Baby Massage	Gentle massage applied to specific areas of the baby's body, with a different focus each session.	5
Mother–Baby Movement Sequences	Movements vary in each session and may include:- For Baby: Mini cobra, airplane, push/pull, clapping, twist walking, flying poses- For Mother: Chest and shoulder openers, spinal relaxation, hip and leg stretches- Mother–Baby Combined Poses: Gentle supported stretches and interaction-based postures	30
Shavasana – Final Relaxation	Mother and baby lie or sit side-by-side. This phase may include:- Sitting together- Breastfeeding- Walking- Lying down (baby may fall asleep)	10

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