

# Effect of a mindfulness-based pilot intervention on maternal-fetal bonding

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**Abstract:** This pilot study explored the effects of a two-week mindfulness-based intervention designed to enhance maternal-fetal bonding among pregnant women. Participants who listened to their baby's heartbeat every day for two weeks and received four texts per week with mindfulness-based activities to do from home reported a significant increase in reported maternal-fetal attachment scores across the study period. Enhancing maternal-fetal bonding through this low-cost intervention has the potential for reducing adverse birth outcomes.

**Keywords:** pregnancy, mindfulness, intervention, attachment, bonding, MFAS

## Introduction

Maternal-fetal bonding refers to the affectionate feelings and perceptions a mother develops for her fetus during pregnancy<sup>1</sup> and includes behavioral acts during pregnancy that demonstrate care and commitment to the fetus.<sup>2</sup> Maternal-fetal bonding lays the foundation for post-birth mother-infant bonding and early caregiving, including maternal sensitivity, nurturing behaviors, and infant attachment security,<sup>3,4</sup> which are necessary for infants to reach their developmental potential.<sup>5,6</sup>

Maternal-fetal bonding is also critical for healthy fetal development because it is associated with healthier maternal behaviors during pregnancy.<sup>7</sup> For example, women with high levels of prenatal bonding are more likely to stop or reduce smoking cigarettes, alcohol, and illicit drug use.<sup>7,8</sup> Fortunately, maternal-fetal bonding appears to be modifiable; prior research indicates ultrasounds can increase prenatal attachment and improve maternal health behaviors during pregnancy.<sup>9</sup> Yet the high costs (eg, equipment, medical personnel, patient time off of work, transportation, etc.) may be prohibitive for the women who would benefit most from intervention.

## Methods

The data for this project, Babies and Moms connected by Love, Openness, and Opportunity (BLOOM) come from a larger study following 177 pregnant girls and women (ages 15–40) from two prenatal clinics serving high proportions of Medicaid patients. The Oklahoma State University Institutional Review Board approved the study protocol before data collection began. Participants provided written informed consent for the overall study at the time of enrollment; participants in BLOOM electronically reviewed and signed additional informed consent forms before participating in the additional BLOOM intervention. Participants completed online surveys about their pregnancy, including prenatal

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bonding and sociodemographic information. All women enrolled in the larger study were invited to participate in BLOOM if they were still pregnant, in their second trimester, and were planning to take the baby home from the hospital. The sample for the present study consists of 34 pregnant girls and women (15–40 years of age) in their second trimester who volunteered for the BLOOM intervention.

The study was conducted in 2018. Participants were randomly assigned to a control group ( $n=9$ ) or to one of three intervention groups that received either (1) fetal Doppler heartrate monitors ( $n=8$ ); (2) four texts per week with mindfulness tasks designed to enhance feelings of maternal attachment ( $n=11$ ); or (3) both Doppler monitors and mindfulness exercises ( $n=6$ ). The groups did not significantly differ by sociodemographic, health, or pregnancy characteristics. The participants who received fetal Doppler monitors were trained on appropriate use and instructed to listen to their baby's heartbeat for at least 1 min per day over the two-week period. We examined compliance with the protocol by asking participants during the follow-up how many times per day that actually used the Doppler during the study period. On average, participants with the Dopplers reported using the monitors 1.5 times per day.

The mindfulness exercises were sent via text messages with instructions for the specific exercise assigned that day. All participants in the mindfulness groups received the same text message. Text messages were sent at the same time of day for all groups (mid-evening). Women were asked to “take a few moments alone and complete the following task”, which were different and included: deep breathing, meditation, prenatal massage, responding to kicks, nursery rhymes, telling the baby about a cherished person in their life, planning an activity with the baby, and reading a story to the baby.

All participants completed the Maternal-Fetal Attachment Scale (MFAS)<sup>10</sup> prior to and immediately following the intervention. The MFAS is a 23-item scale measuring maternal interaction and feelings toward the fetus.<sup>10</sup> For example, participants were asked whether they think or do the following things: talk to their baby, refer to the baby by a nickname, decided on a name, wonder what the baby thinks and feels inside me, gave up doing certain things because they want to help their baby. Responses to the questions ranged from “definitely yes (1) to uncertain (3) to definitely no (5)”. We reverse coded one item, “I feel my body is ugly.” The potential

MFAS score range is between 23 and 115. Cronbach's alpha for our sample is 0.87.

A change score analysis was conducted on participants' pre- and post-test MFAS scores to determine the effect of the intervention. We first calculated the change score by subtracting the pre-MFAS score from the post-MFAS score. To compare differences in pre- and post-test MFAS scores we used one-way analysis of variance. A one-way analysis of covariance was used to estimate the association between the intervention groups and MFAS change score, controlling for the pre-MFAS score.

## Results

Table 1 presents pre- and post-test results for each group. The average pre-MFAS score was 93.86 ( $SD=9.14$ ). The intervention groups did not differ significantly from each other on pre-MFAS scores. For the post-MFAS scores, the average score was 94.67 ( $SD=9.57$ ), and all intervention groups reported higher levels of post-MFAS relative to the control group, but the difference was not statistically significant. Comparing change scores before and after the two-week period, the control group was the only one to report a decrease in feelings of maternal-fetal bonding ( $\Delta S = -1.78$ ). Using the change score as the outcome variable, we fit an ANCOVA model to determine if changes in MFAS scores between baseline and time 2 were significant. After adjusting for baseline MFAS, women in the Doppler + Mindfulness group had significantly higher levels of MFAS, with  $F(1, 28) = 5.39$ ,  $p < 0.05$ . Controlling for baseline scores, results indicate a significant increase in MFAS scores for the Doppler + Mindfulness group ( $\Delta S = 4.83$ ,  $p < 0.05$ , Cohen's  $d = 0.59$ ). The other three groups all reported an increase in scores post-intervention, but their change scores did not differ significantly from the control group.

## Discussion

Although maternal-fetal bonding typically increases throughout pregnancy, there is considerable variation among pregnant women.<sup>1</sup> Our findings suggest that mindfulness skill-building in combination with the use of inexpensive fetal Doppler monitors at home by pregnant women quickly achieves an increase in maternal feelings of bonding. Future research is needed to determine whether the increase in maternal-fetal bonding scores due to the BLOOM intervention is associated with subsequent improvements in maternal health behaviors during pregnancy.

**Table I** BLOOM intervention pilot results (N=34)

	Condition									
	Control (n=9)		Doppler only (n=8)		Doppler+ Mindfulness (n=6)		Mindfulness only (n=11)		Total (n=34)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Pre-MFAS	90.40	11.32	94.88	8.46	93.00	6.10	96.73	8.81	93.86	9.14
Post-MFAS	88.22	11.46	96.57	7.21	97.83	9.83	97.00	7.51	94.67	9.57
Difference MFAS	-1.78	7.31	2.57	5.50	4.83	6.68	0.27	5.90	1.03	6.52
Change Score Analysis <sup>a</sup>										
$\beta$			0.34		0.44*		0.28			
Adj. $R^2$									0.15	
Analysis of covariance										
	Sum of squares				df		Mean square		F	p
Model	353.13				4		88.28		2.45	0.069
Control	111.55				1		111.55		3.10	0.089
Doppler only	194.14				1		194.14		5.39	0.028
Doppler + Mindfulness	65.62				1		65.62		1.82	0.188
Mindfulness only	172.44				1		172.44		4.79	0.037
Error	1007.84				28		35.99			
Total	1360.97				32		42.53			

**Notes:** <sup>a</sup>Change score analysis of difference in MFAS between time 1 and time 2 controlling for baseline MFAS. \* $p < 0.05$ .

**Abbreviations:** BLOOM, Babies and Moms connected by Love, Openness, and Opportunity; MFAS, Maternal-Fetal Attachment Scale.

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## Disclosure

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