



Exploring the Effects of Mindfulness-Based Childbirth and Parenting on Infant Social-Emotional Development

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Abstract

Objective Maternal stress and depression in pregnancy and early parenting are associated with decreased maternal sensitivity and infant social-emotional development impairments. This randomized controlled trial explored if a Mindfulness-Based Childbirth and Parenting Program (MBCP) is more beneficial than a Lamaze program for infant's social-emotional development. Infant social-emotional development was also explored in the light of maternal psychological states.

Methods Pregnant women at risk of perinatal stress and depression were included and randomized to either MBCP or Lamaze. The Ages and Stages Questionnaire: Social-Emotional (ASQ:SE) regarding infant social-emotional development was filled out by the mothers ($n = 88$) 3 months postpartum. Data on mode of delivery, skin-to-skin care, and breastfeeding rates was collected from medical records and self-report questionnaires. The women also filled out self-report questionnaires: Perceived Stress Scale, Edinburgh Postpartum Depression Scale, Positive States of Mind, and Five Facets of Mindfulness Questionnaire, at baseline, postintervention, and 3 months postpartum.

Results There was a significant difference in score on the infants' social-emotional development, suggesting that infants in the MBCP-study arm showed better social-emotional development compared with infants in the Lamaze-study arm ($p = .049$ $d = .407$). At 3 months postpartum, 9% in the MBCP-arm compared with 29% in the Lamaze-arm ($p = .02$) scored above the EPDS cutoff 11/12. Furthermore, maternal positive states of mind at 3 months postpartum influenced the variance of ASQ:SE.

Conclusion The study shows positive effects of MBCP influencing the mother-infant dyad, suggesting that the increase in maternal psychological well-being supports positive infant social-emotional development.

Trial Registration NCT02441595

Keywords Mindfulness · MBCP · Maternal · Positive states of mind · Infant social-emotional development

For decades, it has been known that early mother-infant interaction plays a crucial role for child development. The sensitivity shown by the mother and her ability to read the infant's cues are essential, and the infants' relationship and attachment with their primary caregiver significantly shape development in childhood. This knowledge builds on early

studies and theories by Bowlby (1988), Ainsworth (1982), Winnicott (1966), and Stern (1971), and is also reinforced by more recent knowledge by, for example, Fonagy and Target (1997). Consequently, infants are vulnerable to depressive symptoms in their mother (Edhborg et al., 2003) and maternal distress can amount to risks for the health of the child—risks which can persist into late adolescence and adulthood (Murray et al., 2011; Netsi et al., 2018; Stein et al., 2014). In addition, exposure to maternal stress during pregnancy increases the risk for behavioral and mental health problems later in life (Van Den Bergh et al., 2017). It is therefore of great concern that mental health problems are increasing globally (WHO, 2018), as well as in Sweden (Folkhälsomyndigheten, 2017). Depression, stress, and anxiety are the major contributors to this increment (WHO, 2018). Furthermore, anxiety and depression are more common among

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women than men (Folkhälsomyndigheten, 2017). Thus, interventions that can mitigate stress and common mental disorders in mothers during pregnancy and early parenting are well-warranted (Stein et al., 2014). In search for such interventions, mindfulness-based programs may be a promising way forward.

In recent decades, there has been an exponential growth of research and implementation of mindfulness-based programs (Crane et al., 2017). The two most common programs, Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), show improvements in depressive symptoms, anxiety, stress, quality of life, and physical functioning (Goldberg et al., 2018; Khoury et al., 2013). Moreover, MBCT reduces the risk of relapse in recurrent major depressive disorder, being as effective as maintenance antidepressant medication (Piet & Hougaard, 2011). Underlying mechanisms are suggested to consist of enhanced positive emotional regulation strategies, higher self-compassion levels, decreased rumination, and decreased experiential avoidance (Chiesa et al., 2014). The practice of mindfulness is related to increased tolerance of negative emotions, more frequent experiences of positive emotions, and a stronger manifestation of these positive emotions (Bränström & Duncan, 2014).

An extension of mindfulness to parent–child relationships is described by Duncan et al. (2009) as mindful parenting. In their model, the practice of mindfulness promotes effective parenting behaviors such as correctly discerning the child's cues, the sense of parenting self-efficacy, the appreciation of the child's traits, and responsiveness to the child's needs and emotions. Interestingly, higher levels of mindfulness in pregnant women (as assessed in self-reports) have been associated with positive infant outcomes, including less negative affectivity and self-regulation problems (van Den Heuvel et al., 2015), and with more adaptive autonomic nervous system changes and better social-emotional development (Braeken et al., 2017). Higher levels of mindfulness in expectant parents also seem to buffer the effects of depression on prenatal bonding (Hicks et al., 2018). Moreover, higher levels of mindfulness and higher levels of self-compassion in parents are associated with higher levels of mindful parenting that, in turn, is associated with lower levels of parenting stress and more optimal parenting styles (Gouveia et al., 2016).

In the search for interventions that can promote mental health during the transition to parenthood, mindfulness-based interventions tailored to pregnant women or expectant couples are gaining interest. Most of these programs are based on MBSR or MBCT with similarities in design, having weekly group meetings and assignments with mindfulness practices at home in between meetings. The Mindfulness-Based Childbirth and Parenting Program (MBCP) (Bardacke, 2012) is one of these antenatal programs, which

has been shown to reduce perceived stress and depressive symptoms and promote positive affect and mindfulness (Lonnberg et al., 2019). A briefer version of this program, consisting of four sessions instead of the original nine, also shows improvements in measures of stress and depression (Warriner et al., 2018).

Dimidjian et al. (2016) have shown that MBCT can prevent depression relapse among pregnant women. Furthermore, a version of MBCT adapted for pregnant women with general anxiety disorder indicates clinically significant improvements in anxiety, depression, and self-compassion (Goodman et al., 2014). Regarding the antenatal program MindBabyBody, there are indications of improvements in psychological distress (Woolhouse et al., 2014). Furthermore, Townshend et al. (2018) found reduced perinatal depression, stress, and anxiety from a mindful parenting program for pregnant women at risk of psychological distress. Also, a program called Mindful Motherhood has been evaluated and indicates decreases in anxiety and negative affect (Vieten & Astin, 2008).

The change processes associated with a reduction in perinatal depression have been indicated to be mediated by increases in self-compassion and the capacity to observe and act with awareness (Townshend et al., 2018), as well as with the capacity for non-reactivity to inner experience, and non-judging of experience (Lonnberg et al., 2019). Moreover, participants value MBCP due to their experiences of having become more self-compassionate and patient through the program (Lonnberg et al., 2018). The systematic reviews of antenatal mindfulness-based interventions all indicate promising improvements in maternal stress, anxiety, and depression (Cavanagh et al., 2016; Dhillon et al., 2017; Matvienko-Sikar et al., 2016; Shi & MacBeth, 2017). However, to the best of our knowledge, there has not yet been any evaluation regarding the effects on infants' social-emotional development. Given how interlinked maternal mental health and infants' social-emotional development is, this is an area worth exploring.

The present study explored the effects of MBCP compared with an active control, a Lamaze birthing class, in a sample of women who had an increased risk of perinatal stress and depression. In earlier papers, we have reported the main outcomes of the overarching research project, which were changes over time in maternal stress and depressive symptoms (Lonnberg et al., 2019; Lönnerberg et al., 2020). In this present study, the aim was to explore differences between the two groups in infant social-emotional development at 3 months of age, as rated by the mothers. Specific research questions were (1) Does MBCP have an effect on mother-reported infant social-emotional development?; (2) Is the effect on infant social-emotional development of MBCP greater than that of Lamaze?; and (3) How do maternal levels of stress, depressive symptoms, positive affect and

mindfulness correlate with mother-reported infant social-emotional development?

Methods

Participants

Ethical approval was granted for the study by The Stockholm Regional Ethics Committee. All women in the study gave their informed consent to participate, and they were blinded to the study hypothesis. Statistical power was calculated based on perceived stress at postintervention (which was the main outcome in the overarching research project) and data from a pilot study by Duncan and Bardacke (2010). Participants were recruited during 2015 and 2016, from eight maternal health care clinics in Stockholm County. First-time pregnant women received a letter of invitation around gestational weeks 15–22. Interested women were assessed for eligibility through an online questionnaire. To target those at risk of perinatal depression, inclusion criteria were (a) high levels of perceived stress measured by scoring six points or more on the short version of the Perceived Stress Scale, with 4 items (Cohen et al., 1983); (b) a history of mental health concerns (answered by yes/no, and if yes, they were asked to describe what kind and when); (c) having experienced early life adversity measured by scoring six points or higher on three selected items from the Childhood Trauma Questionnaire (Bernstein et al., 2003), which has a 5-point scale ranging from 0 to 4; (d) no current psychotic symptoms or major depressive episode; (e) fluent in Swedish; (f) at least 18 years old; and (g) no previous experience of mindfulness meditation.

Figure 1 illustrates the flow of participants. In all, 856 women were invited to the study and 184 women showed interest. Of these, 103 met the inclusion criteria and agreed to participate; 52 were randomized to MBCP and 51 to Lamaze. The final analyzed sample was 88 mothers; 43 from the MBCP-arm and 46 from the Lamaze-arm.

The sociodemographic background of participants is presented in Table 1. There were no significant differences in these measures between the two groups. Moreover, there were no significant differences between participants lost to follow-up and those who completed the study in regard to sociodemographic background variables or scores on the baseline questionnaires (data not shown).

One participant felt that her anxiety increased during the group meetings in the MBCP course and she therefore decided to leave the study.

Four (9.3%) mothers in the MBCP-arm had participated in a Lamaze course (privately, outside the study). Two mothers in each arm (5%) had participated in antenatal yoga and

one in each arm (2%) had participated in a birth class called “Give birth without fear.”

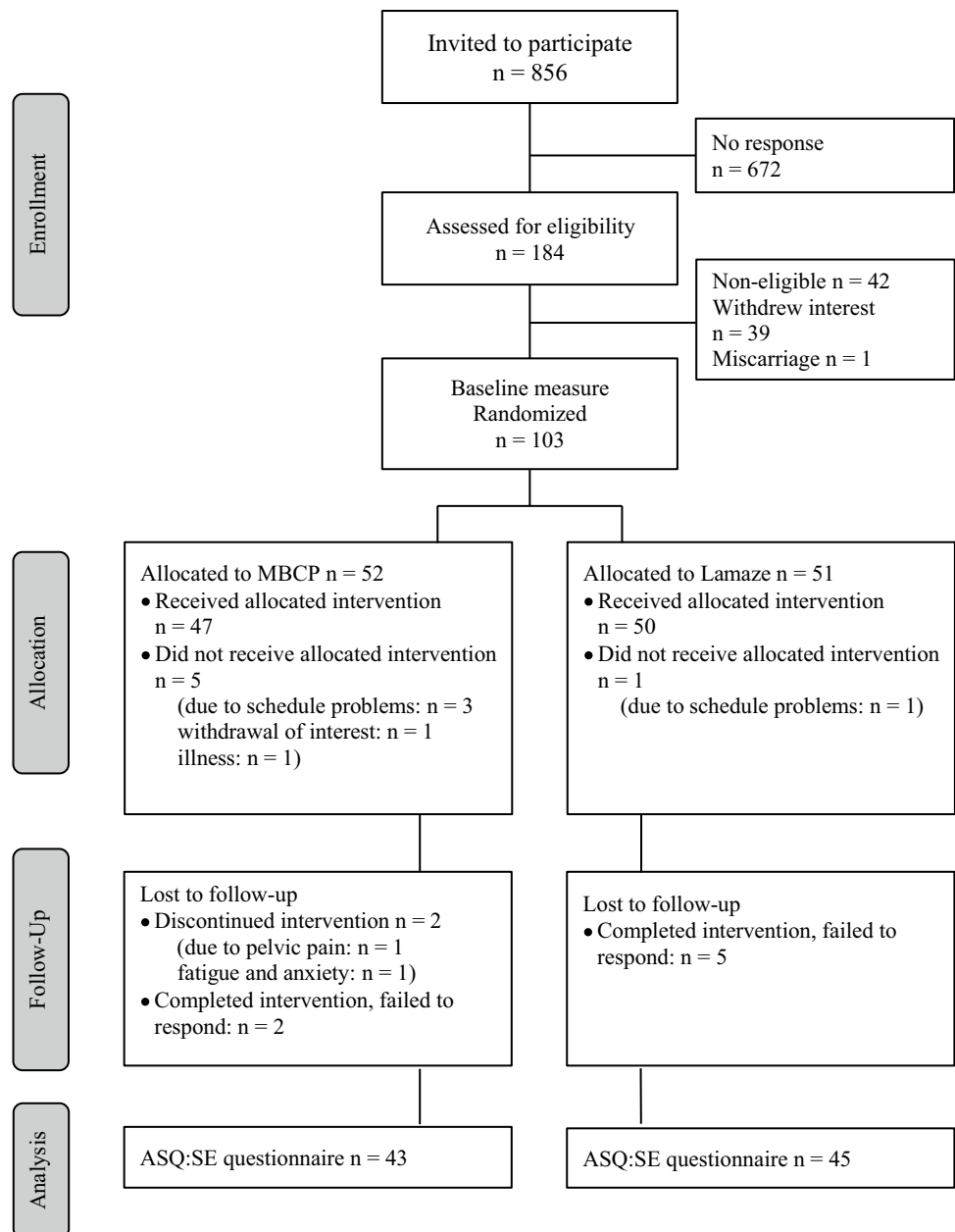
Procedures

When the baseline assessment was completed, the pregnant women were randomized by an administrator, external to the research team. A randomization sequence was generated in SPSS in blocks of ten to reduce the effects of time. Postintervention assessment was carried out 10 to 10 weeks later (still during pregnancy). Skin-to-skin care (SSC) meaning placing the newborn infant on the mother’s chest directly after birth, and breastfeeding during the first hours after birth, was tracked by the partner/support-person who filled out a questionnaire that they were asked to bring with them to the maternity ward. Data regarding mode of delivery and suckling behavior during the first hour, as well as breastfeeding status at discharge from the hospital, was collected from medical records. At 3 months post childbirth, mothers responded to the final questionnaire. At the three time points (baseline, postintervention, and 3 months post childbirth), maternal psychological outcomes were measured. The infant social-emotional development outcome was measured at the last time point, when the infants were 3 months of age.

Intervention Condition—MBCP The MBCP program developed by Bardacke (2012) was adapted to Swedish conditions, to take into account feasibility and differences in culture and health care systems. A shorter program made it more feasible for participants with busy schedules to attend and, if effective, these adaptations might increase cost-effectiveness in future implementation. Most of our groups numbered 8–14 persons, which is fewer than in the original program (usually including 24–30 participants), and time for group discussions was therefore shortened. Informative parts regarding childbirth could also be shortened, since expectant parents in Sweden have free access to maternity health care, including a program with visits to a midwife who provides support and information.

The majority (89%) of the pregnant women attended the classes with their partner. There were eight weekly sessions, each 2 h and 15 min long. Antenatal education was interwoven with a range of mindfulness practices. Participants were encouraged to practice informal meditation in daily life and formal meditations, supported with audio files, for 30 min per day in between sessions, and to pay mindful attention to their baby when feeling fetal movements. The gestational ages of the pregnant women were between 19 and 26 weeks at the start of the intervention and between 27 and 34 weeks at the end. A reunion meeting was held after childbirth. For an overview of the adapted program, see Table 2.

Fig. 1 Flowchart of the participants. Note: Medical records could not be obtained from one participant in MBCP and three participants in Lamaze. The skin-to-skin questionnaire was missing from 4 participants in MBCP and 2 participants in Lamaze



The intervention was delivered by three teachers who had at least 10 years of experience of mindfulness practice and were trained in MBCP by Bardacke (2019). To ensure fidelity to the intervention, teacher-meetings were held approximately every third month. The teachers were not blinded to the experimental hypothesis.

Active Control Condition—Lamaze Childbirth Program In order to control for possible effects of psychoeducation, preparation for childbirth, and peer support, we designed the study with an active control condition. The Lamaze program (Frisk, 2018) is widely available in Stockholm and appreciated by most expectant parents (Bergström et al.,

2011). The program teaches specific breathing and relaxation techniques. The Lamaze techniques affect physiological, cognitive, and psychological aspects: Physiologically, they carry an effect by improving the oxygen supply and reducing muscle tension, cognitively by focusing on breathing and relaxation, and psychologically by reducing fear and improving sense of control (Bergström et al., 2009; Rouhe et al., 2015). Relaxation and breathing techniques can contribute to the woman's ability to cope with pregnancy and childbirth pain, which makes the childbirth experience more positive and helps maternal adjustment (Rouhe et al., 2015).

The Lamaze program comprised three sessions, each 3 h long. The expectant fathers/co-parents participated as well.

Table 1 Sociodemographic background of participants

Variable	MBCP (n=43)	Lamaze (n=45)	Condition comparisons	df	p
Age, years mean (SD)	32 (3.77)	31 (3.71)	$t = -0.52$	86	0.404
Civil status	n (%)	n (%)	$FET = 1.103$	3	0.659
Single	3 (7.0%)	1 (2.2%)			
Co-living	27 (62.8%)	30 (66.7%)			
Married	13 (30.2%)	14 (31.1%)			
Nationality			$FET = 2.109$	2	0.435
Swedish	40 (93.0%)	40 (88.9%)			
European	2 (4.7%)	5 (11.1%)			
Non-European	1 (2.3%)	0 (0%)			
Education ^a			$X^2 = 1.811$	1	0.313
Elementary	0 (0%)	0 (0%)			
Secondary	7 (16.3%)	3 (7.0%)			
College	36 (83.7%)	40 (93.0%)			
Work hours ^a			$X^2 = 0.264$	1	0.641
Up to 40 h/week	28 (68.3%)	33 (73.3%)			
More than 40 h/week	13 (31.7%)	12 (26.7%)			
Household income/month ^a			$FET = 1.442$	4	0.810
<25,000 SEK	1 (2.4%)	0 (0%)			
25–40,000 SEK	10 (24.4%)	9 (20.0%)			
40–60,000 SEK	10 (24.4%)	13 (28.9%)			
>60,000 SEK	20 (48.8%)	23 (51.1%)			
Prescribed drug use			$FET = 2.032$	3	0.659
Non	32 (74.4%)	34 (75.6%)			
ADHD medication	0 (0%)	0 (0%)			
SSRI medication	3 (7.0%)	3 (6.7%)			
Sedatives	0 (0%)	2 (4.4%)			
Non-psychotropic	8 (18.6%)	6 (13.3%)			

^aData is missing for two persons

Note: MBCP Mindfulness-Based Childbirth and Parenting Program, FET Fisher's exact test

Table 2 Overview of the MBCP curriculum adapted for the present study

Session	Theme and practices
1	Introduction to mindfulness and introduction of the teacher and the participants. Practice: mindfully eating a raisin and body scan
2	Mind–body perspectives of childbirth regarding pain and fear, stress-hormones, and the role of oxytocin and endorphins. Practice: body scan
3	Coping with pain. Information about medical and non-medical analgesics. Practice: mindful yoga and pain-practice holding ice cubes and exploring how pain and time is experienced differently depending on how and where one pays attention
4	The role of the partner and how to best support a woman in labor. Practice: sitting meditation and pain-practice in couples supporting each other while holding one hand in ice water
5	The needs of a newborn and new parents, secure attachment, and child development. Practice: sitting meditation and reflection on one's own childhood and expectations of parenthood and gender roles
6	Mindful communication. Practice: sitting meditation, loving kindness meditation, and interpersonal mindful speaking and listening inquiry reflecting on fear and joy
7	Breastfeeding and the mind/body connection regarding prolactin, oxytocin, the let-down reflex, and stress/anxiety versus calmness. Practice: sitting meditation
8	Review of the course. Encouragement to continue practicing mindfulness, especially informal meditation with the baby after the birth. Practice: body scan
Reunion	Experiences of childbirth and early parenthood are shared and approached with kindness and curiosity. Practice: sitting meditation/ being with the baby

Information regarding breastfeeding and infants' eating and sleeping routines were also added to the program. The gestational ages of the pregnant women were between 24 and 31 weeks at the start of the intervention and between 27 and 34 weeks at the end. The three teachers were all experienced and trained in the Lamaze program. They were not blinded to the experimental hypothesis.

Adverse Events In the case of any adverse events during the antenatal courses, the course teachers were instructed to report them to the research team.

Contamination Across Groups At the 3-month follow-up, the mothers were asked if they had participated in any other parental course and, if so, what kind of course.

Measures

Ages and Stages Questionnaire: Social-Emotional The Ages and Stages Questionnaire: Social-Emotional (ASQ:SE) is a questionnaire designed to identify developmental problems in infants and children up to 5 years of age. It is filled out by the parents and focuses on the child's social and emotional behavior. For the 3–9-month-old infants, the following areas are included: self-regulation, communication, adaptive behavior, affect, and interactions with others. The questionnaire contains 24 items, where the parents rate the child's functioning, like: "Does your child smile at you and other family members?" and "Does your child stiffen and arch his back when picked up?" The parent indicates if their infant shows these behaviors "most of the time," "sometimes," or "never or rarely." Each item is also followed by a question on whether the behavior is of concern to the parent. The responses are given point values of 0, 5, or 10, and an additional 5-point score if the behavior is of concern. A high total score is indicative of problems with the social-emotional development of the infant. Squires et al. (2001) have suggested a cutoff score for being at risk at 45 points in total or 1.88 per item for the 3–9-month-age group. The ASQ:SE is widely used and has good reliability and validity: Test-retest reliability between parents' classifications has been shown to be 0.94 and the concurrent validity was measured by comparing the classifications of the children's scores on the ASQ:SE with scores from criterion measures. For this age group, concurrent validity was 0.93 (Squires et al. 2001, p. 417). In the current sample, the internal consistency for this scale was 0.42 (Cronbach's Alpha).

Perceived Stress Scale The full Perceived Stress Scale (PSS) consists of 14 items (the 4-item version was used to screen potential participants for eligibility) and measures frequency of stressful experiences during the past month (Cohen et al., 1983). Answers are given on a 5-point scale, ranging from

0 to 4 (from "never" to "very often"). The scores can range from 0 to 56, and higher scores indicate more perceived stress. The PSS has a validated Swedish translation (Eklund et al., 2014). In the current sample, the internal consistency was 0.91 (Cronbach's alpha).

Edinburgh Postnatal Depression Scale The Edinburgh Postnatal Depression Scale (EPDS) has ten items measuring the severity of depressive symptoms during the past week (Cox et al., 1987). A 4-point scale ranges from 0 to 3, with total scores ranging from 0 to 30. Higher scores indicate higher levels of depressive symptoms ($\alpha = 0.90$). A translated version of EPDS to Swedish has been validated for use during pregnancy (Rubertsson et al., 2011), as well as during the postpartum period, with a cutoff score set at 11/12 for detection of depressive symptoms (Wickberg & Hwang, 1996).

Positive States of Mind The Positive States of Mind (PSOM) consists of six items, and the scores range from 5 to 30, where high scores indicate high ability to experience positive states of mind. The six items have the following themes: focused attention, productivity, responsible caretaking, restful repose, sharing, and sensuous non-sexual pleasure (Adler et al., 1998; Horowitz et al., 1988). In the current sample, the internal consistency for this scale was 0.86 (Cronbach's alpha).

Five-Facet Mindfulness Questionnaire The Five-Facet Mindfulness Questionnaire (FFMQ) measures five elements of mindfulness: non-reactivity to inner experience, observing, acting with awareness, describing, and non-judging of inner experience (Baer et al., 2006). The Swedish version has 29 items (Lilja et al., 2011) that are rated on a 5-point Likert scale ranging from 1 ("never/almost never") to 5 ("always"), and with scores ranging from 29 to 145 ($\alpha = 0.90$).

Skin-to-Skin Care and Breastfeeding SSC and breastfeeding interact with maternal mental health (Yuksel et al., 2016), and infant development (Widström et al., 2011), play an important role for infant-mother attachment (Bystrova et al., 2009; Jonas et al., 2015; Tharner et al., 2012). Therefore, data was collected on these outcomes as well. The SSC questionnaire contained these questions: "Was the infant placed skin-to-skin with the mother immediately after birth?"; "If not, for what reason was the infant not placed skin-to-skin with its mother?"; and "How old was the infant when it was placed skin-to-skin with its mother the first time (hours and minutes)?" There were also questions regarding interruptions of SSC, and regarding whether the infant had started suckling before any interruptions occurred. Breastfeeding at discharge from hospital and at 3 months was divided into the following categories: (0) no breastfeeding—only formula;

(1) some breastfeeding but mostly formula; (2) 50/50 breastfeeding/formula; (3) predominantly breastfeeding; or (4) exclusive breastfeeding.

Data Analyses

All analyses were performed per protocol using SPSS version 25. Descriptive variables were analyzed with chi-square or Fisher's exact tests. Outcome data on interval scale levels are presented as means and standard deviations (SD). Student's *t*-test for independent samples was used for comparisons between groups for the ASQ:SE measure and baseline assessments of PSS, EPDS, PSOM, and FFMQ. Linear mixed models (LMM) were used to estimate change over time in the repeated assessments of PSS, EPDS, PSOM, and FFMQ. To estimate the effects of group difference on change in each outcome between baseline and assessments at postintervention and 3 months postpartum, models were adjusted for group, the interaction of group and time, and for baseline values of each outcome. Effect size was calculated using the Cohen *d* formula, where $d = t * \sqrt{(n1 + n2)/(n1 * n2)}$. Bivariate correlations were used to map how ASQ:SE correlated with maternal psychological outcomes. A forward regression analysis was conducted to study the impact of group allocation and the psychological outcomes (PSS, EPDS, PSOM, and FFMQ) on the total ASQ:SE score. Since the psychological outcomes were found to correlate with each other, a collinearity diagnostic test was performed.

Results

Mode of Birth, Skin-to-Skin Care, and Breastfeeding

A majority of the mothers had a normal vaginal mode of birth (62% in the MBCP-arm and 60% in the Lamaze-arm). Most newborns also immediately received SSC (77%_{MBCP}, 81%_{Lamaze}). Reasons for delayed SSC were that the infant had to be taken to a resuscitation table (23%_{MBCP}, 12%_{Lamaze}), the mode of birth was Caesarian Sect. (8%_{MBCP}, 12%_{Lamaze}), or the mother was bleeding or ill (2%_{MBCP}, 2%_{Lamaze}). No significant differences between the groups were found in mode of delivery, SSC, or suckling behavior at birth. There were no differences with respect to breastfeeding outcomes. At discharge from hospital, the rate of exclusive breastfeeding was 31 (76%) in the MBCP group and 28 (70%) in the Lamaze group, while the other mothers complemented breastfeeding with formula. When the infants were 3 months old, the two groups were also similar in regard to breastfeeding rates (Table 3). Since there were no between-group differences in these measures, they were not included in further analyses.

Infant Social-Emotional Development

The mean ASQ:SE score in the MBCP-arm was 20.67 (SD 17.16) or 0.86 per item, and 29.00 (SD 23.28) or 1.21 per item in the Lamaze-arm ($p = 0.049$, $d = 0.407$). Among subscales, there was a difference in the score on communication ($p = 0.006$, $d = 0.606$) (Table 4).

Table 3 Mode of delivery, skin-to-skin care, and breastfeeding

Variable	MBCP	Lamaze	Condition comparisons	<i>df</i>	<i>p</i>
Mode of delivery	<i>n</i> (%)	<i>n</i> (%)			
Vaginal non-instrumental	26 (61.9%)	25 (59.5%)	$X^2 = 0.21$	1	.50
Elective Caesarian section	5 (11.9%)	4 (9.5%)	$X^2 = 0.28$	1	.50
Caesarian section during labor	5 (11.9%)	7 (16.7%)	$X^2 = 2.61$	1	.38
Vacuum extraction	6 (14.3%)	6 (14.3%)	$X^2 = 0.29$	1	.62
Immediate skin-to-skin care at birth	30 (76.9%)	35 (81.4%)	$X^2 = 0.25$	1	.79
Suckling before any interruption	18 (47.4%)	18 (47.4%)	$X^2 = 3.14$	1	.24
Breastfeeding at discharge from hospital			$X^2 = 3.22$	1	.62
Exclusive	31 (75.6%)	28 (70.0%)			
50/50 breastfeeding/formula	10 (24.4%)	12 (30.0%)			
Breastfeeding at 3 months of age			$FET = 2.106$	5	.90
Exclusive	17 (40.5%)	23 (51%)			
Almost exclusive	12 (28.6)	11 (24.4%)			
Predominantly breastfeeding	4 (9.5%)	2 (4.4%)			
50/50 breastfeeding/formula	4 (9.5%)	5 (11.1%)			
Mostly formula	4 (9.5%)	3 (6.7%)			
Only formula	1 (2.4%)	1 (2.2%)			

Note: MBCP Mindfulness-Based Childbirth and Parenting Program

Mothers' Psychological Measures and the ASQ:SE Score

Maternal psychological outcomes have been reported previously (Lonnberg et al., 2019; Lönnberg et al., 2020). These outcomes are also presented here, since their correlation with ASQ:SE scores were explored. There were no differences in baseline measures between the two groups. At postintervention, the MBCP-arm had improved scores on PSOM, compared with the Lamaze-arm. At 3 months postpartum, the differences between the groups were no longer significant (Table 4). Furthermore, at baseline, 39.5% of the MBCP-mothers and 34.1% of the Lamaze-mothers scored above the EPDS cutoff indicating antenatal depressive symptoms. At postintervention, the corresponding numbers were 14.6%_{MBCP} and 24.4%_{Lamaze} (ns), and at 3 months postpartum, 9.3%_{MBCP} and 28.9%_{Lamaze} ($p=0.02$).

The postintervention measures of PSS and PSOM correlated with the ASQ:SE sum (PSS $r=0.309$, $p=0.004$;

PSOM, $r=-0.276$, $p=0.010$), whereas the EPDS or FFMQ scores did not. At 3 months post childbirth, ASQ:SE sum correlated significantly with all four measures (PSS $r=0.463$, $p<0.000$; EPDS $r=0.356$, $p=0.001$; FFMQ $r=-0.239$, $p=0.025$; and PSOM $r=-0.578$, $p<0.000$). The forward regression analysis showed that PSOM measured at 3 months postpartum explained 33% of the variance in ASQ:SE (Adj. $R^2=0.327$, $p<0.001$). None of the other self-reported measures contributed significantly to the variance in ASQ:SE (Table 5).

Discussion

Our aim was to explore the effects of MBCP during pregnancy on infant social-emotional development, assessed by the mother. We found a between-group difference in scores on the infant's social-emotional development, to the benefit

Table 4 Psychological measures at the three-points-in-time and ASQ:SE sum and subscales

Variable	MBCP (n=43) Mean (SD)	Lamaze (n=45) Mean (SD)	r^a	p	d
Baseline					
PSS	26.65 (7.75)	27.86 (8.02)	-.72	.476	.153
EPDS	9.95 (4.82)	11.05 (4.86)	-1.05	.296	.226
PSOM	19.16 (3.48)	19.07 (5.10)	.10	.920	.020
FFMQ	91.05 (10.66)	88.86 (13.28)	.84	.401	.181
			β^b	p	
Postintervention					
PSS	20.34 (6.40)	23.58 (6.44)	-1.87	.302	.708
EPDS	6.05 (4.41)	8.84 (4.83)	-1.50	.131	.603
PSOM	22.93 (3.72)	20.78 (4.04)	2.07	.037	.554
FFMQ	101.54 (13.15)	95.04 (11.72)	4.06	.123	.522
3 months postpartum					
PSS	20.63 (8.06)	23.40 (8.66)	-1.80	.430	.331
EPDS	6.26 (4.05)	8.82 (5.84)	-1.65	.193	.509
PSOM	20.00 (5.02)	19.02 (4.88)	1.09	.375	.200
FFMQ	98.56 (15.76)	93.93 (12.00)	2.69	.361	.330
			r^a	p	d
ASQ:SE sum	20.67 (17.16)	29.00 (23.28)	-1.99	.049	.407
Self-regulation	8.79 (9.05)	12.44 (11.95)	-1.61	.111	.344
Communication	.00 (.00)	1.11 (2.59)	-2.81	.006	.606
Adaptive functioning	5.42 (6.98)	8.11 (9.19)	-1.54	.127	.330
Affect	2.44 (3.51)	2.61 (3.53)	-.22	.822	.048
Interaction with people	1.05 (2.79)	1.56 (3.34)	-.77	.441	.166
General concerns and comments	2.57 (3.83)	3.17 (3.63)	-.75	.456	.161

^aTest of group mean differences using Student's t-test

^bEstimated effect of group difference on change in each outcome between baseline and assessments at postintervention and 3-month postpartum using linear mixed models with models adjusted for group, the interaction of group and time, and baseline values of each outcome

Note: *MBCP* Mindfulness-Based Childbirth and Parenting Program, *PSS* Perceived Stress Scale 14-items, *EPDS* Edinburgh Postpartum Depressive Scale, *PSOM* Positive States of Mind, *FFMQ* Five Facets of Mindfulness Questionnaire, *ASQ:SE* Ages and Stages Questionnaire: Social-Emotional

of MBCP. Specifically, it was the subscale related to dyadic communication that showed a significant effect, indicating that MBCP might help mothers better understand their infants' cues. Since this subscale had zero variance in the MBCP group and a low variance in the Lamaze group, it seems that mothers overall had very few issues regarding dyadic communication. Regarding the ASQ:SE, our Cronbach's alpha was 0.42. This is lower than the values submitted in the original study (Squires et al., 2001, p. 413), 0.69 and 0.67 for children aged 6 months and 12 months, respectively, which may be because the children in this study were younger (3 months old). Moreover, maternal stress, depressive symptoms, positive affect, and level of mindfulness correlated with the ASQ:SE score. The forward regression analysis showed that positive states of mind was the only variable to significantly explain the variance in ASQ:SE score.

The ASQ:SE result had a moderate effect size ($d=0.407$) (Cohen, 1992). As a comparison, in an RCT comparing parent-infant psychotherapy and treatment as usual, ASQ:SE effects obtained 6 months after treatment start showed a lower and non-significant effect size ($d=0.20$) (Salomonsson & Sandell, 2011). This was so, although mothers in psychotherapy had received more sessions than our MBCP group participants. However, the mothers in the psychotherapy study were clearly more depressed. Furthermore, maternal ASQ:SE and EPDS ratings are known to be associated (Salomonsson & Sled, 2010). Therefore, when assessing the efficacy of MBCP on the ASQ:SE and the EPDS, one needs to take into account the relatively low depression level in our sample. Our sample was selected to be at risk of perinatal depression, though not currently depressed, as the MBCP intervention was a strategy for prevention rather than treatment. In the light of a study by Sbrilli et al. (2020), of an antenatal mindfulness-based intervention, which points to greater improvements in maternal distress for pregnant women that were higher in anxiety and/or lower in mindfulness at baseline, it is likely that MBCP is more impactful for participants that start off with high levels of distress.

In line with our findings, maternal positive affect has been indicated to have a buffering effect on the relation of parenting stress to maternal sensitivity (Smith & Stephens, 2018). Smith and Stephens show that despite the presence of stress, mothers who rate high on positive affect behave more sensitively with their child. These authors' findings, as well as our results, fit well with Fredrickson's broaden-and-build theory of positive emotions (Fredrickson, 2001). This leads us to suggest that increased positive affect in mothers makes them more sensitive toward their infants, since the array of thoughts and actions that come to the mothers' mind is wider in such states. The opposite would be that with more stress coupled with less positive affect, the mother's sensitivity would be decreased, which could potentially lead to more problems with self-regulation and communication for the infant. Furthermore, Folkman and Moskowitz (2000) confirm the importance of positive affect, illuminating that it can co-occur with distress and serve as a restorative resource to support adaptive coping with stress.

The concept of mindful parenting also provides possible explanations for our findings regarding the difference in ASQ:SE scores between intervention and control group. This hypothesis is supported by a qualitative study of participants in MBCP (Lonnberg et al., 2018). That study illustrates how parents ascribe value to their practice of mindfulness, for example, experiencing that it increases their capacity for being more flexible and attuned to their baby, and to be more tolerant and patient, and to have a broader perspective when their baby is distressed. Indeed, this is a subjective perspective, but Duncan et al. (2015) have found associations between self-reported mindful parenting and observed mother-infant interactions. Accordingly, mothers who scored high on self-reported mindful parenting had more positive interactions with their children.

Finally, taking into account the mechanisms of fetal programming, it is also possible that the intervention effects regarding the decrease of maternal stress and depressive symptoms during pregnancy could have influenced the infants' social-emotional development (Stein et al., 2014;

Table 5 Impact of maternal positive states of mind on ASQ-score

Model	Unstandardized coefficients		Standardized coefficients	t	Sig	95.0% confidence interval for B	
	B	Std. error				Beta	Lower bound
1							
(Constant)	72.304	7.466		9.684	.000	57.462	87.147
PSOM score at 3 months	-2.440	.371	-.578	-6.571	.000	-3.178	-1.702

Dependent variable: ASQ_SUM

Note: PSOM Positive States of Mind, ASQ:SE Ages and Stages Questionnaire: Social-Emotional

Forward regression analysis showing the impact of PSOM score at 3 months on ASQ-score. The independent variables used for the regression were allocation to treatment or control, EPDS, PSOM, PSS, and FFMQ at 3 months and the dependent variable used was ASQ:SE score ($R^2=0.334$, adj. $R^2=0.327$)

Van Den Bergh et al., 2017). It is remarkable that the improvements in maternal psychological outcomes from pre- to postintervention remained largely stable 3 months postpartum, despite the significant changes associated with childbirth. This speaks to the value of providing this training during the antenatal period.

Limitations and Future Research

Most participants were highly educated and urban women of Swedish ethnicity, and therefore, we cannot generalize our findings to other populations. The treatment condition was confounded by the amount of time in the antenatal programs (18 versus 9 h) and the mothers could not be blinded to treatment condition. Moreover, infant social-emotional development was rated by the mothers. An external assessment would further have increased the validity of the findings. Furthermore, as this study is based on self-reported measures and the participants were asked to report on their own perceptions or impressions on several constructs, there is a risk that correlations among the constructs being measured may be due to response styles, social desirability, or priming effects which are independent of true correlations (Podsakoff et al., 2003).

Suggestions for future studies are to evaluate the effects of MBCP on infant social-emotional development by a third person (a researcher) instead of by mothers. It would also be of interest to evaluate the intervention effects on fathers'/ co-parents' psychological well-being, as well as on ratings of infant social-emotional development by the fathers/co-parents. Furthermore, mindfulness-based interventions do not suit everybody, and unpleasant experiences related to meditation have been reported (Britton, 2019). An important research question for future studies is therefore to find out more about “what suits whom” in order to better tailor interventions to suit different persons.

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Data Availability All data are available upon request.

Declarations

Conflict of Interest Gunilla Lönnberg and Maria Niemi are MBCP instructors. The other authors declare no competing interests.

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