



Maternal mindfulness during pregnancy and infant socio-emotional development and temperament: The mediating role of maternal anxiety



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ARTICLE INFO

Article history:

Received 7 October 2014

Accepted 9 December 2014

Keywords:

Foetal programming
Maternal mindfulness
Maternal anxiety
Self-regulation
Temperament

ABSTRACT

Background: Accumulating evidence shows that maternal anxiety during pregnancy adversely affects child outcomes. The positive effects of maternal psychosocial factors during pregnancy on child outcomes are not yet studied. This prospective study addresses the association between maternal mindfulness during pregnancy and socio-emotional development and temperament in 10 months-old infants. We also investigated whether this association was mediated by maternal anxiety.

Method: Mothers ($N = 90$) provided information about mindfulness and anxiety at the beginning of the second trimester of pregnancy. Infant socio-emotional development (Ages and Stages Questionnaire: Social Emotional; ASQ:SE) and temperament (Infant Behaviour Questionnaire—Revised; IBQ-R) were assessed at age 10 months.

Results: Higher maternal mindfulness during pregnancy was associated with less infant self-regulation problems and less infant negative affectivity. Mediation analysis showed that maternal anxiety mediated the association between infant self-regulation problems and maternal mindfulness.

Conclusion: These results suggest that maternal mindfulness during pregnancy may have positive effects on infant development. This association may be mediated by reduced anxiety symptoms in pregnant women who score high on mindfulness. Additional replication studies are needed using objective measures of infant behavioural/emotional outcomes and mindfulness of the mother during child development.

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1. Introduction

Accumulating evidence shows that maternal anxiety during pregnancy is linked to adverse birth outcomes and alterations in early socio-emotional, behavioural, and (neuro)cognitive development and even mental health problems in adolescence and early adulthood [1–3]. The Developmental Origins of Behaviour Health and Disease (DOBHAD) hypothesis studies short- and long-term effects of an individual's experience during the perinatal period on subsequent phenotypic variations in health and disease [1]. The magnitude of these effects is clinically relevant, since the attributable risk of childhood emotional and behavioural problems caused by prenatal anxiety is estimated to be about 10–15% [4]. Considering these substantial negative

consequences of prenatal exposure to maternal anxiety [4], anxious women and their infants may benefit from factors promoting maternal wellbeing during pregnancy. Unfortunately, emotional care seems to be an often neglected part of obstetric medicine [4]. Research examining factors promoting pregnant women's emotional wellbeing is therefore highly needed.

Only few studies have examined the effect of such promoting factors during pregnancy in relation to pregnancy and child outcomes. An example of such a factor is partner support during pregnancy. Stapleton et al. [5], for instance, found that mothers experiencing higher levels of partner support during pregnancy reported less emotional distress postpartum and less infant distress to novelty. Several studies also observed associations of higher partner support with higher levels of maternal–foetal attachment (for a review, see [6]). In addition, Pluess et al. [7] studied the impact of positive and negative life events during pregnancy on maternal stress hormone levels (i.e. cortisol) and found that positive life events predicted lower maternal cortisol levels, whereas negative life events were unrelated to maternal cortisol level. Elevated levels of maternal cortisol early in gestation are associated with adverse infant outcomes, such as slower development rate of the infant [8]. The above suggests that positive factors during pregnancy, like negative factors, are also likely to influence maternal and infant developmental outcomes.

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The present study addresses the possible positive impact of maternal mindfulness during pregnancy on the offspring, as being mindful has been associated with many factors of psychological health, including increased life satisfaction, optimism and feelings of competence (for a review, see [9]). Kohls et al. [10] present a two-component model of mindfulness consisting of: (a) self-regulation of attention (i.e. the capability to focus one's thoughts and feelings at the present moment) and (b) specific state of mind (i.e. the capability of preserving a non-judgemental state of mind regarding their own experience). Being mindful has been associated with better emotion-regulation [11] and better work–family balance [12]. Moreover, several studies found that mindfulness-based interventions significantly reduced anxiety symptoms in women during pregnancy (e.g. [13,14]). Considering these desirable outcomes, mindfulness seems to be a useful skill, associated with many advantages for pregnant women. Recently, van den Heuvel et al. [15] showed that infants prenatally exposed to higher maternal mindfulness devote less in-depth processing of irrelevant, frequently occurring sounds as measured with event-related brain potentials. While this study suggests that the advantages of mindfulness for the mother translate into advantages for the developing child in terms of auditory attention, little is known about other key aspects of child development.

An important prerequisite for later healthy psychological functioning is appropriate socio-emotional development of the child, since research indicates that early emerging socio-emotional problems often persist into childhood and preadolescence [16]. In addition, infant temperament is also highly relevant for subsequent healthy psychological functioning, as several studies identified continuities between infant and toddler “difficult” temperament and later psychosocial problems in late childhood [17]. Socio-emotional development and temperament are two closely related constructs [18]. Self-regulation, for instance, is in some theories seen as a dimension of temperament (i.e. [18]) but in other theories as a dimension of socio-emotional functioning [19]. Since we use the theory underlying the ‘Ages and Stages Questionnaire: Social-Emotional’, self-regulation is viewed as part of socio-emotional development in the current study. Research has shown that maternal anxiety during pregnancy is associated with both infant socio-emotional problems, e.g. deficits in emotion regulation [20], sleep problems in infancy [21] and excessive infant crying [22], and “difficult” infant temperament (e.g. [23–26]). To the best of our knowledge, no previous study investigated the influence of dispositional mindfulness of the mother during pregnancy on infant socio-emotional development and temperament.

In the current study, we examine whether maternal mindfulness during pregnancy is positively associated with infant social-emotional functioning and temperament at age 10 months. Maternal anxiety and negative affect are associated with adverse outcomes in children [1] and these psychological factors are inversely related to mindfulness [9]. We therefore examined whether the association between maternal mindfulness during pregnancy and child outcomes is mediated by maternal anxiety. Furthermore, we explored whether sex of the child moderates this association, as several studies have found different effects of exposure to prenatal maternal stress for boys versus girls (e.g. [24,27]). To this aim, the current study examined the following two hypotheses: (a) maternal mindfulness during pregnancy is negatively associated with social-emotional problems and “difficult” temperament (hypothesis 1); (b) anxiety during pregnancy mediates the association between maternal mindfulness and socio-emotional problems (hypothesis 2.1) and temperament characteristics (hypothesis 2.2).

2. Method

2.1. Study design and participants

Data were collected as part of the Prenatal Early Life Stress project, an ongoing prospective cohort study following pregnant women and their offspring from the beginning of pregnancy onwards. All

participating parents provided written informed consent. The Medical Ethical Committee of the St. Elisabeth hospital, Tilburg, The Netherlands, approved the study.

Participants were recruited in the 15th week ($N = 178$) and between the 16th and 22nd week of pregnancy ($N = 12$) from a general hospital and four midwife practices in Tilburg, The Netherlands. For the purpose of the current study, we analyzed data of those mother–infant dyads for whom information on maternal mindfulness and anxiety at 20.5 weeks of gestation ($SD = 1.7$) and on infant social-emotional development and infant temperament at 10 months after delivery ($M_{age} = 9.7$ months ($SD = 1.3$)) was available. Mothers provided this information via postal or digital questionnaires.

The final sample consisted of 90 mother–infant dyads. From the total sample of 190 mother–infant dyads, one mother had a miscarriage and one infant passed away after birth, excluding two mother–infant dyads. Furthermore, we excluded dyads with extreme low birth weight of the infant (<2500 g; $N = 16$) because behavioural and emotional problems might be associated with low birth weight [28]. Additionally, 82 mother–infant dyads were excluded due to missing data on maternal anxiety and mindfulness during pregnancy and/or infant outcome (Table 1).

2.2. Questionnaires

2.2.1. Maternal mindfulness

Maternal mindfulness was assessed using a Dutch translation of the Freiburg Mindfulness Inventory–Short Form [29]. Mothers rated 14 items (e.g., “I am open to the experience of the moment” and “I observe my mistakes and difficulties without judging myself”) on a four point Likert scale (1 = rarely to 4 = almost always). A higher score on the FMI-s reflected higher levels of mindfulness. The FMI-s has good internal consistency (Cronbach's $\alpha = .86$; [29]).

2.2.2. Maternal anxiety

Maternal anxiety during pregnancy was assessed with the anxiety subscale of the Symptom Checklist-90 (SCL-90; 30). This subscale of the SCL-90 mainly measures somatic anxiety symptoms (e.g., vegetative arousal) instead of merely psychological anxiety symptoms (e.g., anxious thoughts). Participants rated the scale, which consists of 10 items, on a five point Likert scale (1 = not at all, 2 = somewhat, 3 = quite, 4 = quite a lot and 5 = extremely). A higher score indicates a higher level

Table 1
Characteristics of the participating mother–infant dyad sample.

Infants ($N = 90$)	N	%	M (SD)
Sex			
Girl	44	48.9	
Boy	46	51.1	
Birth weight (grams)			3495.25 (487.26)
Gestational age at birth (weeks)			39.98 (1.26)
Self-Regulation (ASQ;SE 12)	90		4.94 (6.02)
Negative Affectivity (IBQ-r)	90		37.01 (10.79)
Mothers ($N = 90$)	N	%	M (SD)
Age (years)	90		32.13 (3.61)
FMI sum (prenatal)	90		40.06 (6.50)
SCL-90 sum (prenatal)	90		13.48 (3.87)
SCL-90 sum (postnatal)	90		13.27 (4.98)
Education			
Low/Medium	31	34.4	
High	59	65.6	
Smoking (during pregnancy)	0	0	
Alcoholic intake (during pregnancy)	6	6.7	
Beer	2	2.2	
Wine	4	4.4	
Liquor	1	1.1	

Note ASQ;SE = Ages and Stages Questionnaire: Social Emotional; IBQ-r = Infant Behaviour Questionnaire–revised; FMI = Freiburg Mindfulness Inventory; SCL-90 = anxiety subscale of the Symptom Checklist.

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