

Rumination in dysphoric mothers negatively affects mother–infant interactions

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Background: Postnatal maternal depressive symptoms are consistently associated with reduced quality of mother–infant interaction. However, there is little research examining the role of maternal cognitive factors (e.g. rumination) in the relationship between depressive symptoms and mother–infant interaction quality. This study investigated the hypotheses that: dysphoric mothers would demonstrate less sensitive behaviour towards their infants compared with nondysphoric mothers; mothers induced to ruminate would be less sensitive towards infants; rumination would moderate the relationship between maternal depressive symptoms and maternal sensitivity and the impact of the rumination induction would increase following a stressor (still face) task. **Method:** Mothers ($N = 79$; 39 dysphoric and 40 nondysphoric) and their infants were randomised to either a rumination induction or a control condition. Maternal sensitivity in mother–infant interactions was assessed before and after the induction using the CARE Index. In the second interaction task, mothers also completed the still-face procedure as a stressor. **Results:** Extending previous research, mixed measures ANOVAs demonstrated that dysphoric mothers had reduced quality of interaction with their infant compared with nondysphoric mothers and that mothers in the rumination condition exhibited reduced sensitivity towards their infants relative to mothers in the control condition. Further, maternal sensitivity worsened further after the still-face procedure in the rumination condition, but not in the control condition. **Conclusions:** This study suggests that the repetitive, internal focus of a ruminative state is causally implicated in mother–infant interaction quality, regardless of the level of depressive symptoms. This research extends understanding of specific mechanisms involved in the quality of the mother–infant relationship. **Keywords:** Rumination; maternal sensitivity; postnatal depression; dyadic sensitivity; mother–infant relationship.

Introduction

There is considerable evidence demonstrating that postnatal depression (PND) is associated with negative child outcomes, and this relationship appears to be partly mediated by disturbances in the mother–infant relationship (Grace, Evindar, & Stewart, 2003). Although there is a strong research base demonstrating that there are specific behavioural mechanisms associated with PND and the disruption in the mother–infant relationship (e.g. capacity to provide adequate responsiveness and stimulation; Stein et al., 2010), there is as yet little research investigating maternal cognitive processes in depression that may influence maternal sensitivity to the infant.

Postnatal depression and maternal sensitivity

Research has demonstrated that low maternal mood is associated with poorer maternal sensitivity (for review, see Field, 2010). Meta-analyses of studies using observational methods have found that mothers with PND exhibit less engagement and sensitive attunement, reduced positive responsiveness and greater negative responsiveness to their infant (e.g. Beck, 1995). Research has also demonstrated that depressed mothers may display controlling or unresponsive and withdrawn behaviours when interacting

with their infants, thus demonstrating reduced sensitivity (Malphurs, Raag, Field, Pickens, & Pelaez-Nogueras, 1996). However, it is unclear what mechanisms might drive poor maternal sensitivity in mothers. We propose that cognitive mechanisms, such as rumination, may have an important impact on maternal behaviours towards her infant.

Rumination and maternal sensitivity

In the general depression literature, there is strong evidence linking rumination, broadly defined as a repetitive, prolonged, recurrent thoughts about one's self-one's concerns and one's experiences (Harvey, Watkins, Mansell, & Shafran, 2004) to the onset and maintenance of depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Rumination has been hypothesised to reduce unbiased sensitivity to information in the environment (Stein, Lehtonen, Harvey, Nicol-Harper, & Craske, 2008; Watkins, 2008). We, therefore, proposed that rumination, by virtue of its internal, self-focused nature (Nolen-Hoeksema & Morrow, 1991), and its role as a passive, avoidant, emotion regulation strategy (Moulds, Kandris, Starr, & Wong, 2007), would reduce sensitive maternal responding to the infant.

Recent studies have provided preliminary evidence that ruminative thinking has an impact on factors associated with healthy mother–infant functioning including maternal depressive symptoms (Barnum, Woody, & Gibb, 2013), self-reported maternal

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responsiveness (Tester-Jones, O'Mahen, Watkins, & Karl, 2015) and interpersonal functioning (O'Mahen, Flynn, & Nolen-Hoeksema, 2010). In an experimental study, Stein et al. (2012) found that a rumination induction reduced the responsiveness and maternal vocalisation of mothers with generalised anxiety disorder to their infants, relative to those who received a control induction. In mothers with depression, a similar (nonsignificant) trend was observed. These results support the idea that repetitive thought processes such as rumination and worry play a role in mother–infant interaction, although it is as yet clear how important rumination is to the mother–infant interaction in depressed mothers.

To date, most studies of rumination have used Nolen-Hoeksema's (1991) definition of rumination (focusing attention on the symptoms of one's distress and on the possible causes and consequences of that distress) and have, therefore, used inductions that asked participants to focus on thoughts about sad mood and its implications. There are three potential difficulties with this approach. First, it does not take idiographic concerns into account, thereby limiting the relevance of the manipulation to the individual and its external validity; second, the experimental induction associated with this method is voluntary and deliberate and is often relatively weak and short-lived (Huffziger et al., 2013); third, it assumes that rumination is detrimental only in the presence of negative (i.e. depressed) mood, instead of being problematic in its own right. Together, these issues may have been particularly limiting when attempting to assess maternal sensitivity to infants via observational assessment. Whereas many experimental paradigms using rumination assess dependent variables via self-report or implicit measures, observational assessment of play and interactions with the infant are potentially more naturally distracting, thereby requiring a more powerful and realistic rumination induction.

Recent work using a control theory approach, which views rumination as a repetitive thinking process that begins when a goal discrepancy occurs and persists until the goal is either resolved or abandoned (Martin, Tesser, & McIntosh, 1993; Watkins, 2008), has demonstrated that by using inductions that ask individuals to think about unmet personally relevant goals, the induction captures the persistent nature of rumination and produces a more powerful, long-lasting and ecologically valid effect (Roberts, Watkins, & Wills, 2013). Importantly, by focusing on unresolved problems, the control theory task does not require dysphoric mood to be effective. Therefore, a control theory task, by nature of its highly self-relevant content, may produce a ruminative effect that is both powerful and long-lasting enough to demonstrate an effect during an observational task.

We propose that this view of rumination as a persistent, recursive, self-focused attention (Papageorgiou &

Wells, 2004) that is prompted by problems in goal achievement (Martin & Tesser, 1996) may be particularly relevant in the postnatal period, where mothers are faced with managing competing goals (e.g. between old and new motherhood goals), and motherhood goals, in particular, may be perceived to have high personal relevance, but infants often provide ambiguous feedback (e.g. crying, fussing, failing to engage in activities, such as breastfeeding, sleeping all night, adapting to a routine). This ambiguous feedback could make it more difficult for a mother to evaluate her goal progress. Although a control theory account posits that rumination may initially serve to solve problems, the repetitive, abstract and inwardly focused nature of rumination ultimately interferes with effective problems-solving and crucially may prove detrimental to sensitive parenting (Donaldson, Lam, & Mathews, 2007; Stein et al., 2010). Further, given previous research demonstrating that rumination exacerbates and prolongs stressful events (Jose & Lim, 2015; Moberly & Watkins, 2008), and that difficulties in the mother–infant relationship emerge during stressful or challenging contexts (Ginsburg, Grover, Cord, & Ialongo, 2006), we expected that mothers induced to ruminate would show further decreases in sensitivity following a stressful mother–infant interaction.

The present study

This study proposed that dysphoric mothers would demonstrate less sensitive behaviour towards their infants compared with nondysphoric mothers. We hypothesised that mothers induced to ruminate by thinking and focussing on a goal-based problem would be less attentive and sensitive to their infants than mothers who were induced to think about a goal-based problem they had resolved (rumination control). Consistent with previous research that has demonstrated that dysphoria moderates the effects of rumination on outcomes, we predicted that the effects of rumination would be stronger in dysphoric rather than nondysphoric mothers. Further, we expected that the quality of mother–infant interactions would reduce following the introduction of the still-face procedure (Weinberg & Tronick, 1994) and that this reduction would be greatest in mothers who had higher dysphoric symptoms and were induced to ruminate.

We expected that maternal rumination manipulated in the laboratory would exert an influence on maternal attention and behaviour towards the infant, rather than directly affecting infant behaviour. We, therefore, coded interactions using the CARE Index sensitivity scale. Sensitive responding in the mother is suggested to be a core concept in the assessment of early mother–infant interactions (Stern & Bruschweiler-Stern, 1998). It is argued that sensitivity in the mother integrates experiences and emotions that have an important role in later infant development in areas including self-valuation,

communication, cooperation and reciprocity (Marone, 2001).

Method

Design

A 2 (dysphoric group vs. nondysphoric group) \times 2 (rumination condition vs. control condition) \times 3 (Time 1: baseline, Time 2: post rumination task, Time 3: post infant stressor task) mixed measures design was used. Dysphoric and nondysphoric mothers were randomised to rumination versus control conditions to create four cells: dysphoric, rumination; nondysphoric, rumination; dysphoric, control; nondysphoric, control. Dependent variables were scores for maternal sensitivity as assessed using the CARE Index.

Participants

Seventy-nine mother–infant dyads were recruited through community health: visitors, GP surgeries, mother and baby groups and children's centres based in the South West of England. Women were invited to participate if they had an infant aged 3–12 months, were 18 years or older, could speak English, had no current experience of psychosis and met the criteria for either the nondysphoric group (scoring below 10 on the Beck Depression Inventory, BDI-II) or the dysphoric group (scoring above 14 on the BDI). The study was approved by the University of Exeter, Department of Psychology ethics committee, the South West Research National Health Service Research Ethics Committee, Devon Primary Care Trust and Torbay Primary Care Trust. All participants gave informed signed consent.

Measures and materials

Dysphoric symptoms. Dysphoric symptoms were assessed using the 21-item Beck Depression Inventory-II (BDI-II). Reported sensitivity (ranging from 43% to 82%), specificity (89%) and positive predictive values (50%) of the BDI-II in perinatal populations are good (e.g. Gaynes et al., 2005). Responses ranged from 0 (e.g. 'I do not feel like a failure') to 3 (e.g. 'I feel I am a total failure as a person'). Item scores are summed for a total score. Higher scores indicate more severe depressive symptoms. The BDI-II has high internal consistency and good test–retest reliability (Sprinkle et al., 2002). Cronbach's alpha in our sample was .94.

Rumination induction. A rumination task adapted from Roberts et al. (2013), which has previously been demonstrated to successfully induce rumination, was used to induce either rumination or a control, 'nonrumination' condition. Participants in the rumination condition were asked to identify unresolved, self-relevant problems; participants in the control condition were asked to identify resolved, self-relevant problems. Participants were given examples of topics on a sheet of paper (e.g. an aspect of parenting you're concerned you're not managing well and it is worrying you) or were invited to choose their own. A 10-min focus period followed, during which participants worked through a pre-recorded script which prompted them to focus on the concern identified. Examples of prompts included 'Focus on how this problem/difficulty bothers and troubles you' and 'Think about how this problem/difficulty is still unresolved'. The control condition asked participants to spend the same period of time thinking about a concern that had previously troubled them but that had since been resolved (e.g. an aspect of parenting that you previously felt you did not manage well, but that you now manage as well as other people). Prompts in the control condition included 'Think

about how this problem/difficulty is now resolved'. Because rumination is initiated when there is a goal discrepancy and persists until the goal is either resolved or abandoned, it is expected that this control condition would not elicit a ruminative response.

Mother–infant interaction quality. Mother–infant interaction behaviour during free play was scored from videotapes using the Child–Adult Relationship Experimental Index (CARE Index; Crittenden, 2004). The CARE Index is derived from the Dynamic-Maturational Model of Attachment and Adaptation (DMM; Crittenden, 2006), which is an attachment-based approach to formulation of behavioural disorder. Mothers were filmed for 5 min both prior to and post rumination induction either in their own home or at the University of Exeter in a quiet room in the Mood Disorders Centre with minimal noise disruption. Age appropriate toys, a blanket, a bouncer and a high chair were supplied. Mothers were asked to play normally with their infant as if they were at home and asked to try to ignore the cameras as much as possible.

Videos were scored by two coders (blind to study conditions, variables and hypotheses) who were trained to reliability. A third coder, trained by course providers from the Family Relations Institute and certified as reliable, scored 31 (15%) of the video interactions selected randomly in order to assess intercoder reliability. Interrater agreement was strong, $k = .88$.

Seven aspects of behaviour (facial expression, verbal expression, position, affection, turn-taking, control and choice of activity) were evaluated on the sensitivity scale using the CARE Index manual (Crittenden, 2004). The coder was trained to score each aspect of behaviour from the perspective of the other participant in the dyad (e.g. the mother's behaviour was viewed and scored from the perspective of the infant). For each of these seven aspects of behaviour, two points were allocated to denote whether the behaviour was sensitive, controlling or unresponsive. The two points can be allocated in a number of different combinations (e.g. for facial expression the coder could score 0 sensitive, 2 unresponsive if, e.g., the facial expression is fixed, blank and does not respond contingently to the infants expressions or emotions. Alternatively, the coder could score 1 sensitive, 1 controlling and 0 unresponsive if the behaviour had aspects that were both sensitive and controlling; for example, the mother responded with facial expressions that were appropriate and contingent with the infants emotions and action, but on occasion displayed a fixed, smiling face). A total of 14 points can be allocated for the parent. Higher sensitivity scores denote a more sensitive interaction. Mother–infant dyads are classified as highly sensitive (scores 11–14), adequately sensitive (scores 7–10), requiring intervention (scores 5–6) or at risk (scores 0–4). The CARE index has been validated for use with families from different social classes and cultural backgrounds (Leventhal, Jacobsen, Miller, & Quintana, 2004) and is a reliable and valid scoring system for children from birth to 15 months (Crittenden, 2004).

Infant stressor task. The normal flow of interaction between the mother and the infant was disrupted using an adaptation of the still-face procedure (Weinberg & Tronick, 1994). During the second free play task (post induction), when indicated to do so by a knock on the door, the mother was instructed to face their infant, freeze their face in a blank expression and stop talking to or playing with the infant, withholding all responses and interaction for a period of 30 s. The researcher informed participants when to resume play with a second knock on the door.

Manipulation check. A visual analogue scale (VAS) was used to assess levels of analytical thinking during the rumination or control induction (Roberts et al., 2013). Analytical thinking has been proposed as a core feature of

negative rumination (see Watkins, 2008). Participants were asked to indicate what proportion of their thoughts were concerned with trying to explain, understand or make sense of things during the induction task from 0% (none of their thoughts) to 100% (all of their thoughts). Thus, a higher score on the VAS indicated a greater level of analytical thinking.

Procedure

Women were approached by the experimenter in community children and family centres and were also recruited via Health Visitors, GP surgeries and family support workers. Interested women were contacted via telephone, gave initial verbal consent and completed the BDI-II to assess eligibility.

Eligible women were asked to complete a face-to-face session with their infant. Informed written consent was obtained. Participants completed the baseline questions and were asked to engage in the mother–infant observational task using the CARE Index procedure with their infant.

Participants then completed the rumination induction or control condition. Following the rumination induction, the mother was asked to complete a brief manipulation check and a second 5-min assessment of mother–infant interaction quality. Half way through the second 5-min interaction, participants performed the still-face paradigm for 30 s.

Participants then completed a distraction task to return their mood to baseline (Morrow & Nolen-Hoeksema, 1990) in which they focused on nonself-relevant images for 8 min (e.g. 'think about a fan slowly rotating back and forth'). Participants were then debriefed. Before leaving, all mothers spent 5 min positively interacting with their infant and were provided with a debrief leaflet that included local and national mental health and parenting support phone numbers.

Statistical analysis

The data were analysed in IBM SPSS Statistics for Windows, Version 19.0. (Released 2010; IBM Corp., Armonk, NY) with mixed measures (repeated between subjects) ANOVAs and *t*-tests for the maternal sensitivity scale. A 2 (rumination vs. control) \times 2 (dysphoric vs. no-dysphoric) between subjects ANOVA was conducted to test the manipulation. Data were initially checked for accuracy, missing data, outliers and normality. Scores for maternal sensitivity demonstrated a normal distribution at baseline (time 1; T1), post induction (time 2; T2) and post still-face situation (time 3; T3), and no outliers were found. One participant was not happy to complete the still-face situation due to infant distress resulting in missing scores for this participant at T3.

Results

Demographics

The mean age of mothers was 32.2 ($SD = 4.4$), and the mean age of infant was 7.2 months ($SD = 2.9$). Age of infant ranged from 3 to 12 months. Mean age of infant in the nondysphoric group was 6.91 months ($SD = 2.94$), and in the dysphoric group was 7.53 months ($SD = 2.92$). BDI-II scores ranged from 0 to 47 ($M = 13.84$, $SD = 10.78$; see Table 1). Based on recommended cut-off scores for the BDI-II, 25.6% ($N = 10$) of the dysphoric group reported mild depression, 51.3% ($N = 20$) moderate

and 23.1% ($N = 9$) severe depressive symptoms. The majority of mothers were British (95%, $N = 69$) and had received a university higher education degree or postgraduate qualification (75%, $N = 50$).

Manipulation check

Analytical thinking. A two-way between subjects ANOVA was conducted to compare the effect of induction condition (rumination vs. control) and group (dysphoric vs. nondysphoric) on participants' analytical thinking. There was a significant effect of induction type, $F(1, 78) = 4.08$, $p = .04$, $\eta_p^2 = .05$. Analytical thinking was significantly higher in the rumination induction condition ($M = 58.05$, $SD = 26.49$) than in the control condition ($M = 46.83$, $SD = 24.20$), confirming the effectiveness of the induction and suggesting that the mothers in the rumination condition were more likely to be focussed on trying to explain, understand or make sense of things. There was no effect of group, $F(1, 78) = 1.86$, $p = .18$, $\eta_p^2 = .03$, nor was there a significant two-way interaction between group and induction condition, $F(1, 78) = 0.75$, $p = .39$, $\eta_p^2 = .01$.

Observational mother–infant interactions

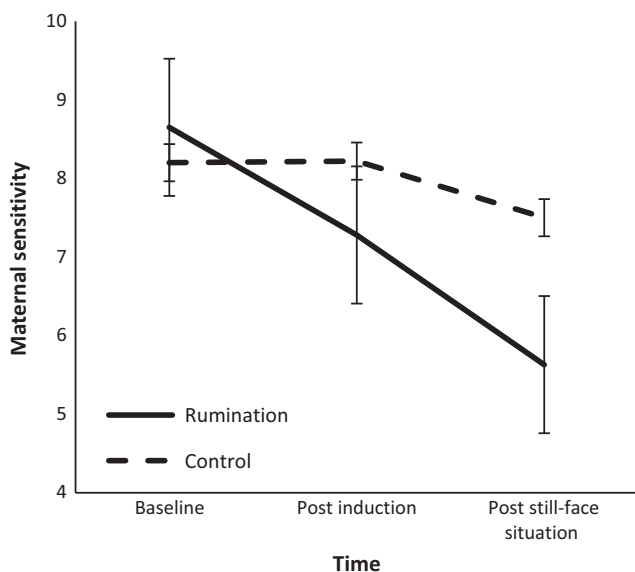
Effects of ruminative thinking on maternal sensitivity. A 2 (group: dysphoric vs. nondysphoric) \times 2 (induction condition: rumination vs. control) \times 3 (time: T1 baseline, T2 post induction, T3 post still-face) mixed ANOVA was used to analyse ratings of maternal sensitivity. There was a significant main effect of group, $F(1, 74) = 19.60$, $p < .001$, $\eta_p^2 = .21$. Dysphoric mothers had lower overall sensitivity ($M = 6.29$, $SD = 2.75$) compared with nondysphoric mothers ($M = 8.77$, $SD = 2.08$). There was a main effect of time, $F(2, 148) = 12.63$, $p < .001$, $\eta_p^2 = .15$, indicating that maternal sensitivity decreased across time. Post hoc analyses demonstrated that there were significant decreases in sensitivity between (a) T1 and T2, $t(78) = -1.98$, $p = .05$, 95% CI $(-1.44, 0.00)$, $d = 0.45$; (b) T1 and T3, $t(77) = -4.24$, $p < .001$, 95% CI $(-2.70, -0.97)$, $d = 0.97$; and (c) T2 and T3, $t(77) = -3.47$, $p = .001$, 95% CI $(-1.86, -0.50)$, $d = 0.79$. There was no main effect of induction condition, $F(1, 74) = 2.33$, $p = .13$, $\eta_p^2 = .03$.

The main effect of time was qualified by a significant two-way time by induction condition interaction on maternal sensitivity, $F(1, 74) = 4.08$, $p = .01$, $\eta_p^2 = .06$. To examine this interaction, we conducted 2 one-way repeated-measures ANOVAs of time within each induction condition. There was a significant effect of time in the rumination condition, $F(2, 74) = 17.48$, $p < .001$, $\eta_p^2 = .32$, reflecting a decrease in sensitivity, but not in the nonrumination resolved goal condition, $F(2, 78) = 1.19$, $p = .31$, $\eta_p^2 = .03$. We conducted *t*-tests using change scores to further explicate where significant change occurred within the rumination condition (Figure 1). A significant decrease was observed in maternal

Table 1 Means (*SD*) and significance tests for comparison of dysphoric and nondysphoric participants on demographic and key study variables

Measure	Dysphoric	Nondysphoric	F/χ^2 (<i>df</i>)	<i>p</i>
Mother age (years)	32.02 (5.56)	32.50 (3.30)	0.20 (1, 73)	.66
Infant age (months)	7.53 (2.92)	6.91 (2.84)	0.81 (1, 71)	.37
BDI-II	24.21 (7.38)	5.15 (3.16)	214.86 (1, 78)	>.001
Manipulation check				
Control	48.26 (25.27)	45.40 (23.65)	2.28 (1, 39)	.72
Rumination	64.78 (26.24)	52.00 (25.87)	0.14 (1, 37)	.14
Education (highest qualification)				
GCSE	5 (12.8%)	4 (10%)	19.27 (5)	.002
A/O level	7 (17.9%)	0 (0%)		
Undergraduate degree	11 (28.2%)	18 (45%)		
Postgraduate qualification	3 (7.7%)	17 (42.5%)		
GNVQ	3 (7.7%)	0 (0%)		
Other	1 (2.6%)	1 (2.5%)		
None	0 (0%)	0 (0%)		
Ethnicity				
White	37 (92.5%)	30 (76.9%)	2.26 (3)	.52
Asian	1 (2.5%)	0 (0%)		
Black	1 (2.5%)	2 (2.6%)		
Oriental	0 (0%)	0 (0%)		
Mixed or other ethnic group	1 (2.5%)	4 (7.7%)		

BDI-II, Beck Depression Inventory-II.

**Figure 1** Estimated marginal means and standard errors for maternal sensitivity in the rumination and control conditions across time points

sensitivity between T1 and T2, $t(37) = -2.84$, $p = .007$, 95% CI $(-2.34, -0.39)$, $d = 0.93$ ($M = -1.36$, $SD = 2.96$). Maternal sensitivity further decreased significantly between T2 and T3, $t(37) = -3.75$, $p = .001$, 95% CI $(-2.60, -0.76)$, $d = 1.23$ ($M = -1.65$, $SD = 2.72$). We also conducted tests of simple main effects comparing induction type at each time point. Significant differences were found at T2, $F(1, 78) = 25.91$, $p = .04$, $\eta_p^2 = .01$ and T3, $F(1, 78) = 155.07$, $p = .006$, $\eta_p^2 = .07$, but not at T1, $F(1, 78) = 10.67$, $p = .08$, $\eta_p^2 = .01$ (Table 2).

There was no significant two-way time by group interaction, $F(2, 148) = 0.58$, $p = .56$, $\eta_p^2 = .01$, nor was there a three-way time by group by induction

Table 2 Means (*SDs*) of maternal sensitivity scale by group and condition for each time point

	Dysphoric		Nondysphoric	
	Rumination	Control	Rumination	Control
Sensitivity				
T1	7.11 (3.55)	6.85 (4.37)	10.05 (2.93)	9.55 (2.37)
T2	6.28 (2.63)	6.70 (3.90)	8.20 (2.84)	9.75 (2.40)
T3	4.61 (2.43)	6.45 (3.52)	6.55 (3.50)	8.55 (3.30)

T, time.

condition interaction, $F(2, 148) = 0.44$, $p = .64$, $\eta_p^2 = .01$.

Discussion

This study demonstrated that a rumination induction resulted in significant changes in mother–infant interactions compared with a control condition. We provide novel evidence that rumination causally impairs maternal sensitivity. This study also demonstrates that a robust ecologically valid, self-relevant experimental analogue to rumination that does not depend on instructed focus on particular content impacts on maternal sensitivity. Importantly, when using a control theory, self-relevant rumination induction, the effect of rumination on maternal sensitivity was not moderated by dysphoria. Rather, all mothers, regardless of level of depressive symptoms, who were induced to ruminate demonstrated reduced maternal sensitivity to their infant. Mothers induced to ruminate had further reductions in sensitivity following a stressful task with their infant.

These results provide novel evidence that maternal rumination affects maternal sensitivity to infants, both during regular and stressful mother–infant

interactions. That these effects were present regardless of the level of maternal depressive symptoms suggests that rumination may be a key target in preventative and treatment interventions aimed at improving the mother–infant relationship. The results of this study are in contrast to previous studies which have found a negative effect of rumination on parenting related behaviours only in the context of low (O'Mahen, Boyd, & Gashe, 2015) or anxious mood (Stein et al., 2012). We suggest that the difference in the findings from this study are due to the type of induction we used; namely, a self-relevant task that focused on difficulties meeting an important goal. These results provide support for a control theory account of the impact of rumination on maternal sensitivity and are consistent with robust findings across the psychological literature that using self-relevant experimental inductions increases both the ecological validity and power of manipulations.

In those mothers induced to ruminate, sensitivity to their infant continued to worsen following the still-face procedure. These results replicate previous evidence demonstrating that difficulties in mother–infant interactions often emerge in more stressful contexts, but also indicate that maternal factors, such as rumination, affect this process (Ginsburg et al., 2006). They are also consistent with the idea that rumination serves as a maladaptive and unhelpful emotion regulation function (Nolen-Hoeksema et al., 2008); mothers who ruminate may find it difficult to manage and recover from stressful interactions with their infants.

It is of particular interest that when taking a goal-based approach to rumination, we observe an effect of rumination on sensitivity that is not specific to mothers with dysphoric symptoms, but that can be generalised to all mothers, regardless of mood valence. These findings suggest a vulnerability to the effects of a ruminative response style before clinical presentation. This highlights the extent to which rumination may affect parenting, in general, and supports the notion that the impact of a ruminative response style may go beyond clinical implications, and instead have implications for parenting in a much wider context. This may be particularly relevant when considering the mother–infant relationship. Mother–infant interactions can be negatively affected by depressive symptoms, but the present findings suggest that the effects of rumination may extend after a depressive episode. Rumination may be a habitual response (Watkins & Nolen-Hoeksema, 2014). If rumination endures beyond the depressive episode, we may expect to see more longitudinal effects on the mother–infant relationship, as has been observed in the maternal depression literature (e.g. Moehler, Brunner, Wiebel, Reck, & Resch, 2006). Future longitudinal studies may focus on a ruminative response style

over time and following remission of depression, and parenting and attachment interventions could consider a focus on rumination.

Limitations

This study used a sample of dysphoric mothers, rather than mothers who had a clinical diagnosis of PND. It is possible that stronger effects of rumination might emerge in clinically depressed versus symptomatic mothers. However, we note that depression scores in the current sample ranged from mild to very severe depression, and that the mean depression score was indicative of moderate depression. Further, previous research has demonstrated the robust nature of rumination effects across both clinically diagnosed and dysphoric samples (e.g. Lyubomirsky & Nolen-Hoeksema, 1995). There were also significant differences in level of education between groups. Both age of infant and level of education were controlled for in post hoc analyses, with the effects of rumination on sensitivity remaining. However, future studies should endeavour to ensure groups are well matched with regard to level of education.

In order to reduce the burden of participation, each participant could take part either in their own home or at the university. This may have impacted on the level of control the experimenter had over external conditions. However, we conducted sub-analyses to check whether patterns of outcomes differed significantly between those who completed the task at home or in the laboratory and did not find any differences.

Due to a technical error and subsequent loss of data, we were not able to analyse current mood post rumination induction. However, previous research in this area has been criticised for relying primarily on a post-mood rumination induction because it is unclear whether subsequent outcomes are due to changes in mood associated with rumination or due to changes in actual ruminative behaviour. This study directly assessed analytical thinking and showed that individuals in the rumination condition reported more analytic and evaluative thinking than individuals in the control condition, thus demonstrating increases in styles of thinking that are characteristic of and synonymous with rumination (e.g. Watkins & Teasdale, 2001).

We also acknowledge that the age range of the infants in this sample was broad, spanning 3–12 months, and it is possible that infants of different ages may respond differently to their mothers. Although we recognise that this is a limitation, we allowed this variation in infant age for two reasons: first, we were primarily interested in investigating the impact of maternal cognitions on maternal sensitivity to the infant, and felt this would be less susceptible to infant age than other observational codes of the mother–infant interaction;

second, a wider infant age range allowed for a larger sample size within the time constraints of the data collection period. Furthermore, post hoc analyses confirm that the effects of rumination on maternal sensitivity remained after controlling for infant age. Future research may examine whether the effects of rumination on maternal sensitivity vary by infant age.

The second and third interaction periods were for a total of 5 min, rather than for 5 min each, with the post rumination period being shorter (2.5 min) than the baseline period (5 min) in order to reduce testing time burden. However, this would not have an impact on scoring; the CARE Index manual and training states that scores can be derived from a very brief interaction period that is as short as 2 min, thus a total of 5 min for both pre and post still face was enough time to appropriately score the behaviours observed.

Finally, it is recognised that although the experimental design employed in this study allows us to conclude that induced rumination is causally linked to maternal sensitivity in the Still Face Paradigm, it does not address whether depressed mothers who ruminate more exhibit less sensitive behaviours in naturalistic interactions with their infants. Future research may, therefore, consider examining these effects in a more naturalistic setting.

Conclusions

In sum, the findings from this research suggest that rumination causally reduces maternal sensitivity to infants. These findings suggest a novel framework for beginning to understand maternal cognitive processes that may impact the mother–infant relationship in two ways. First, this study builds on our

understanding about how specific cognitive processes such as rumination are causally implicated the mother's ability to sensitively respond to her infant, suggesting that negative effects on mother–infant interaction quality may be driven by ruminative thinking. Second, these findings demonstrate the utility of rumination induction procedures that are informed by control theory. Clinically, the results of this study highlight the potential importance of targeting the role of ruminative thinking in parenting programmes aimed at improving mother–infant interaction and maternal sensitive responding, not just in mothers who are already experiencing low mood or that have been diagnosed with depression.

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Key points

- Postnatal maternal depressive symptoms are associated with reduced quality of mother–infant interaction.
- Little research has examined the role of rumination in the relationship between depressive symptoms and mother–infant interaction quality.
- Mother–infant interactions were assessed before and after a rumination or control induction.
- The repetitive, internal focus of a ruminative state was causally implicated in quality of interaction and maternal sensitive behaviours.

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