Original Article

Association between maternal depressive symptoms in the early post-natal period and responsiveness in feeding at child age 2 years

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Abstract

Maternal depression is a known risk factor for poor outcomes for children. Pathways to these poor outcomes relate to reduced maternal responsiveness or sensitivity to the child. Impaired responsiveness potentially impacts the feeding relationship and thus may be a risk factor for inappropriate feeding practices. The aim of this study was to examine the longitudinal relationships between self-reported maternal post-natal depressive symptoms at child age 4 months and feeding practices at child age 2 years in a community sample. Participants were Australian first-time mothers allocated to the control group of the NOURISH randomized controlled trial when infants were 4 months old. Complete data from 211 mothers (of 346 allocated) followed up when their children were 2 years of age (51% girls) were available for analysis. The relationship between Edinburgh Postnatal Depression Scale (EPDS) score (child age 4 months) and child feeding practices (child age 2 years) was tested using hierarchical linear regression analysis adjusted for maternal and child characteristics. Higher EPDS score was associated with less responsive feeding practices at child age 2 years: greater pressure [$\beta = 0.18$, 95% confidence interval (CI): 0.04–0.32, $P = 0.01$], restriction ($\beta = 0.14$, 95% CI: 0.001–0.28, $P = 0.05$), instrumental ($\beta = 0.14$, 95% CI: 0.005–0.27, $P = 0.04$) and emotional ($\beta = 0.15$, 95% CI: 0.01–0.29, $P = 0.03$) feeding practices (ΔR^2 values: 0.02–0.03, $P < 0.05$). This study provides evidence for the proposed link between maternal post-natal depressive symptoms and lower responsiveness in child feeding. These findings suggest that the provision of support to mothers experiencing some levels of depressive symptomatology in the early post-natal period may improve responsiveness in the child feeding relationship.

Keywords: maternal responsiveness, feeding practices, responsive feeding, post-natal depression, Edinburgh Postnatal Depression Scale.

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Introduction

Maternal post-natal depression has been shown to have moderate-to-large effects on maternal–infant interactions during the first year of life (Beck 1996) and has been associated with poorer cognitive, emotional and behavioural outcomes in children (Murray *et al.* 1996; Beardseele *et al.* 1998; Martins & Gaffan

2000). Mothers experiencing symptoms of depression tend to be less sensitive or responsive to their infant and show impaired performance in a variety of caregiving activities (Field 2010). Thus, reduced maternal responsiveness is a potential mediator of the established associations between maternal post-natal depression and poor child outcomes. Developing an appropriate level of responsiveness in feeding may be

particularly difficult for mothers with post-natal depression. Although post-natal depression has been associated with infant growth faltering (O'Brien *et al.* 2004; Wright *et al.* 2006), especially in low-income countries (Patel *et al.* 2004), the potential role of post-natal depression in contributing to children's obesity risk has also been considered. To date, evidence for such an association is mixed (Grote *et al.* 2010; McPhie *et al.* 2012; Milgrom *et al.* 2012). A recent review found that of the five studies identified (one cross sectional and four longitudinal), three (the cross-sectional study and two longitudinal studies) reported a positive relationship between maternal depressive symptoms and childhood obesity (Milgrom *et al.* 2012).

The global increase in childhood obesity has directed attention to not only what, but also how parents feed their children. Feeding is a bidirectional relationship where infants provide feeding-related cues and caregivers are required to respond appropriately (Satter 1990; DiSantis *et al.* 2011). While infants appear to be born with an ability to self-regulate their food intake (Birch & Deyser 1986), non-responsive feeding practices such as feeding a child when they are not hungry may diminish a child's ability to regulate their intake, and have been implicated in excess energy intake and weight gain leading to the development of overweight and obesity (Scaglioni *et al.* 2008; DiSantis *et al.* 2011). Non-responsive feeding practices represent a potential mechanism (mediator) through which an association between maternal post-natal depression and increased child obesity risk is realised.

Hurley *et al.* (2008) investigated the cross-sectional relationship between maternal mental health (stress, depression and anxiety) and feeding responsiveness. The study population ($n = 702$) included infants aged 0–13 months old and was drawn from the Maryland

Infant Feeding Study, which is nested within the Women, Infants and Children programme. A 25-item questionnaire was used to assess five hypothesised feeding styles: responsive, forceful, restrictive, indulgent and uninvolved. In keeping with the notion that infant feeding is bidirectional, the role of infant temperament was also considered. Maternal self-reported depression symptomatology was significantly associated with forceful, indulgent and uninvolved feeding styles, which the authors considered non-responsive practices.

In a small ($n = 87$) longitudinal study, Farrow & Blissett (2005) examined the relationship between maternal psychological distress (measured via the Brief Symptom Inventory; Derogatis & Melisaratos 1993) and self-reported use of two 'controlling' (non-responsive) feeding practices – pressure to eat and restriction (Birch *et al.* 2001) at child age 1 year. Both maternal anxiety and general psychological dysfunction (but *not* depression) during pregnancy and at child age 6 months were associated with greater restriction at child age 1 year. Conversely, no associations with pressure to eat were observed, which may reflect on the small sample size and potentially low power of the study (Farrow & Blissett 2005). Further research to replicate and extend these findings is required to improve our understanding of how variations in the level of post-natal depressive symptoms impact on mothers' responsiveness in child feeding.

The current paper reports a secondary analysis of longitudinal, self-report questionnaire data from a community sample of Australian first-time mothers. The aim was to investigate whether level of post-natal depressive symptomatology (baseline: child age 4 months) predicts the use of non-responsive feeding practices when children are 2 years of age, after adjusting for key covariates (measured at baseline) including both maternal characteristics [age, body

Key messages

- Maternal post-natal depressive symptomatology at child age 4 months was associated with less responsive feeding practices at child age 2 years.
- Depressive symptoms in the post-natal period may lead to lower responsiveness in child feeding.
- Support to mothers experiencing depressive symptomatology in the early post-natal may improve responsiveness in child feeding.

mass index (BMI), education level and breastfeeding status] and infant characteristics (gender, temperament and BMI *z*-score).

Materials and methods

Study design and participants

Data were collected prospectively from mothers allocated to the control group of the NOURISH randomized controlled trial ($n = 346$) (Daniels *et al.* 2009). Of the 277 control group mothers who provided some data at follow-up (child age 2 years), 211 had complete data and were included in the present study. Recruitment into the NOURISH trial occurred in two Australian cities during 2008 and 2009. Eligible adult (≥ 18 years old) first-time mothers who had delivered a healthy term infant (>35 weeks gestation, >2500 g) were approached while still in hospital and invited to provide details for later contact regarding enrolment in the study. Mothers agreeing to re-contact provided demographic data and information about health and lifestyle variables. These mothers were re-contacted when infants were aged approximately 4 months old, to formally enrol in NOURISH, a primary prevention intervention for childhood obesity that commenced early in infancy (Australian and New Zealand Clinical Trials Registry Number 12608000056392). Mothers allocated to the control group had access to 'usual care' only. The protocol, recruitment and outcomes have been reported elsewhere (Daniels *et al.* 2009, 2012, 2013).

Data were collected at first contact (birth), baseline [infant mean age = 4.3, standard deviation (SD) = 1.0 months] and follow-up (mean age = 24.1, SD = 0.7 months) (Daniels *et al.* 2013). Allocated mothers were on average 2–3 years older than non-consenters and non-contacts ($M = 30$, SD = 5 vs. $M = 27$, SD = 6 years) and more had a university degree (58% vs. 33%), and were married or cohabiting (95% vs. 88%). At child age 2 years, 78% of participants were still active in the study, and baseline characteristics of non-completers did not vary by treatment (data not shown). Across both control and intervention groups mothers who had discontinued participation in the study at this time point were younger ($M = 28$, SD = 6

Table 1. Characteristics of first-time mother–child dyads ($N = 211$)*

Variable	M (SD); % (<i>n</i>)
Maternal characteristics	
Age at delivery (years)	30 (5)
University education (yes)	65 (138)
BMI (kg m^{-2}) at 4 months post-natal [†]	26.2 (5.6)
EPDS score at 4 months post-natal	4.2 (3.2)
Child characteristics	
Age (months)	24 (1)
Gender (male)	48 (102)
Infant temperament score at 4 months [‡]	2.5 (0.6)
BMI for age <i>z</i> -score at 4 months [§]	−0.21 (1.00)
Feeding mode at 4 months (any breastfeeding) [¶]	77 (195)

BMI, body mass index; EPDS, Edinburgh Postnatal Depression Scale (Cox *et al.* 1987) (maximum possible score = 30); SD, standard deviation. *Participants in this study were from the control condition of the NOURISH randomised controlled trial (Daniels *et al.* 2009). Of the 277/346 control group mothers who provided some data at follow-up (child age 2 years), 211 had complete data and were included in the present study. [†]BMI calculated from measured height and weight data. [‡]Temperament measured on a 6-point scale (1–6) with a higher mean score indicating a more difficult temperament (Sanson *et al.* 1987). [§]BMI *z*-score (World Health Organization 2006) calculated from length and weight data collected at infant age 4 (SD = 1) months. [¶]Feeding mode at infant age 4 (SD = 1) months dichotomised as any breastfeeding (exclusive/fully/combination with formula) vs. exclusive formula feeding.

vs. $M = 31$, SD = 5 years), fewer had a university degree (40% vs. 63%) and score on the EPDS at baseline was higher ($M = 5.66$, SD = 4.64 vs. $M = 4.41$, SD = 3.58) compared with those who completed, P -values < 0.05 . Characteristics of participants included in the final analysis are presented in Table 1.

Measures

Outcomes

Self-reported feeding practices were collected at child age 2 years via widely used and previously validated questionnaires. The *Child Feeding Questionnaire* (CFQ; Birch *et al.* 2001) assesses parents' attitudes and practices related to feeding children aged 2–11 years. Three subscales that specifically measure non-responsive (termed 'controlling') feeding practices were selected for the present study: pressure to eat (four items; e.g. *If my child says 'I am not hungry' I try to get her to eat anyway*), restriction (eight items; e.g. *I*

have to be sure my child does not eat too many sweets) and monitoring (three items; e.g. *How much do you keep track of the snack foods that your child eats?*). Four subscales from the *Parental Feeding Style Questionnaire* (PFSQ; Wardle *et al.* 2002) that assess non-responsive feeding practices were also used: emotional feeding (five items; e.g. *I give my child something to eat to make him feel better when he is upset*), instrumental feeding (four items; e.g. *I reward my child with something to eat when she is well behaved*), encouragement to eat (eight items; e.g. *I praise my child if she eats what I give her*) and control [10 items; e.g. *I let my child decide when s/he would like to have her meal* (reverse scored)]. Items from all of the subscales were rated on a 5-point Likert-style scale. Mean scores for each subscale were computed, with five items from the control scale of the PFSQ being reverse scored. Higher mean scores represented higher levels of the feeding practices. Internal reliability estimates of the seven subscales as used in the present sample were good (Cronbach's α : 0.72–0.93).

Predictor

Maternal depressive symptoms at child age 4 months were assessed using the Edinburgh Post-natal Depression Scale (EPDS; Cox *et al.* 1987). The EPDS contains 10 items each scored from 0 to 3. Scores are calculated as the sum of all responses, giving a minimum of 0 and maximum total score of 30. A score of 13 or more is considered indicative of psychological distress (Cox *et al.* 1987; Matthey *et al.* 2006). Five mothers in the present sample scored 13 or more on the EPDS and were excluded from analyses, as the purpose of the study was to investigate associations in a community sample of mothers with no psychiatric history and whose score on the EPDS was not indicative of psychological distress. Inclusion of these mothers in the analyses made no substantive difference to the results (data not shown).

Covariates

Maternal and infant characteristics collected at birth included maternal age, education and infant gender.

At child age 4 months maternal and child anthropometrics, breast feeding status and infant temperament were assessed. Weight and height/length were measured by trained study staff using standard procedures at local child health clinics. Infant weight and length data were used to compute BMI for age z-score using the World Health Organization (WHO) ANTHRO software program version 3.0.1 and macros (World Health Organization 2006). At 4 months of age, breastfeeding status was dichotomised as any breastfeeding [i.e. exclusive or fully breastfeeding or combination feeding (formula/breast)] vs. no breastfeeding (formula feeding only). Infant temperament was assessed using a maternal self-report measure that has been validated with a representative sample of Australian infants ($n = 2443$) (Sanson *et al.* 1987). The questionnaire has 12 items measured on a 6-point scale from 'almost never' (1) to 'almost always' (6). A higher mean score is indicative of temperamental difficulty (i.e. low cooperation, low approach and high irritability). The internal reliability in the present sample was good (Cronbach's $\alpha = 0.74$).

Data analysis

Pearson's correlations were conducted between the seven feeding practice subscales. Hierarchical multivariable linear regression analyses were conducted to examine the combined and unique influence of the independent variable (maternal EPDS score entered in Block 2) and the identified covariates (listed above; entered in Block 1) on each of the feeding practice subscales. There was no multicollinearity between variables in the regression models. Influential data points (multivariate outliers) were checked using Cook's distance, with all values well below the recommended maximum of 1. The analyses were performed in IBM SPSS version 19 IBM Corp, Armonk, NY, USA.

Results

Scores on the seven feeding practice subscales from the CFQ (Birch *et al.* 2001) and PFSQ (Wardle *et al.* 2002) are listed in Table 2 along with Pearson's correlation between the feeding practices. Moderate-to-

Table 2. Reliability estimates, means (SD) and inter-correlations (*r*) of feeding practice subscales reported by first-time mothers at child age 2 years (*N* = 211)

	Cronbach's α	M (SD)	Correlation (<i>r</i>)						
			1	2	3	4	5	6	7
1 Pressure to eat (4 items) [†]	0.72	2.23 (0.93)	1	0.28**	-0.03	0.30**	0.29**	0.08	0.02
2 Restriction (8 items) [†]	0.73	2.98 (0.74)		1	0.25**	0.33**	0.39**	-0.03	-0.01
3 Monitoring (3 items) [†]	0.93	4.27 (0.91)			1	-0.09	-0.18*	0.12	0.23**
4 Emotional feeding (5 items) [‡]	0.79	1.53 (0.53)				1	0.58**	-0.04	-0.25**
5 Instrumental feeding (4 items) [‡]	0.74	1.57 (0.53)					1	0.09	-0.25**
6 Encouragement to eat (8 items) [‡]	0.74	4.04 (0.48)						1	0.29**
7 Control (10 items) [‡]	0.74	3.94 (0.42)							1

SD, standard deviation. * $P \leq 0.05$, ** $P \leq 0.01$ (two tailed). [†]Child Feeding Questionnaire (Birch *et al.* 2001) response options: pressure and restriction: 1 = disagree to 5 = agree; monitoring 1 = never to 5 = always. [‡]Parental Feeding Style Questionnaire (Wardle *et al.* 2002) response options: 1 = never to 5 = always.

strong relationships were noted between a number of the practices, including restriction and instrumental feeding ($r = 0.39$, $P < 0.001$) and emotional and instrumental feeding ($r = 0.58$, $P < 0.001$).

The hierarchical regression models (Table 3) indicated that between 7% and 16% of the variance in each of the feeding practices was explained by the combination of maternal and child covariates and maternal EPDS score, R^2 values: 0.07–0.16, P -values: 0.08 to <0.001 . Adjusting for key maternal and child covariates, a higher EPDS score was significantly associated with more pressure to eat ($\beta = 0.18$, $P = 0.01$), restriction ($\beta = 0.14$, $P = 0.05$), instrumental feeding ($\beta = 0.14$, $P = 0.04$) and emotional feeding ($\beta = 0.15$, $P = 0.03$) practices. However, in all cases ΔR^2 values were small: 0.02–0.03, $P < 0.05$. Maternal BMI was negatively associated with pressure ($\beta = -0.17$, $P < 0.05$), restriction ($\beta = -0.19$, $P < 0.01$), monitoring ($\beta = -0.16$, $P < 0.05$), encouragement ($\beta = -0.15$, $P < 0.05$) and control ($\beta = -0.15$, $P < 0.05$). Maternal age was negatively associated with restriction ($\beta = -0.15$, $P < 0.05$) and instrumental feeding ($\beta = -0.30$, $P < 0.01$). Infant temperament was positively associated with emotional feeding ($\beta = 0.21$, $P < 0.01$) and negatively associated with control ($\beta = -0.20$, $P < 0.01$).

Discussion

The present study investigated longitudinal relationships between mothers' level of depressive symptoms

assessed when their infants were approximately 4 months old and self-reported feeding practices measured using subscales from validated questionnaires when children were 2 years old. Adjusting for child and mother characteristics, mothers' scores on the EPDS were positively correlated with four of the seven assessed feeding practices: greater pressure to eat, restriction, instrumental feeding and emotional feeding. Most of these practices represent situations where the child is fed regardless of hunger or satiety. Pressure feeding explicitly ignores child cues of satiety, restriction involves overtly limiting access to certain foods while paradoxically using (liked) foods as rewards, instrumental feeding involves using food as a reward and emotional feeding refers to managing child mood with food. Practices such as these are postulated to undermine child self-regulation of intake and have been associated with obesogenic eating behaviours and increased risk of overweight (Birch *et al.* 2001, 2003; Wardle *et al.* 2002).

Despite the four significant associations observed, EPDS scores accounted for no more than 3% of the unique variance explained in any of the feeding practices. Small effect sizes were also reported in the study by Hurley *et al.* (2008). The single exception reported by Hurley *et al.* was for uninvolved feeding style, which exhibited a substantial increase in odds for those with high levels of psychological distress. This factor, however, was evaluated with the two items: 'Do you know what infant is eating?' and 'Do you know when infant is eating?'. For a carer to be

Table 3. Relationship between maternal and child factors and maternal-reported child feeding practices at child age 2 years (N = 211)

Predictor	Child feeding practices				
	Child Feeding Questionnaire ²		Parental Feeding Style Questionnaire ³		
	Pressure	Restriction	Monitoring	Emotional	Instrumental
	Standardised regression coefficient (β)				
Block 1	$\Delta R^2 = 0.08$, $P = 0.02$	$\Delta R^2 = 0.08$, $P = 0.017$	$\Delta R^2 = 0.06$, $P = 0.06$	$\Delta R^2 = 0.07$, $P = 0.03$	$\Delta R^2 = 0.14$, $P < 0.001$
Maternal age at delivery (years)	-0.01	-0.14*	-0.04	-0.07	-0.30**
University education (no vs. yes)	-0.10	-0.11	0.05	-0.01	0.12
Maternal BMI at 4 months	-0.17*	-0.19**	-0.16*	0.02	-0.02
Infant gender (male)	-0.08	0.05	-0.12	0.08	0.06
Infant temperament at 4 months ⁸	0.06	0.08	-0.10	0.21**	0.12
Infant BMI z-score at 4 months ⁹	-0.12	-0.004	0.11	-0.05	-0.09
Feeding mode at 4 months (any breastfeeding) ^{††}	0.03	0.039	-0.11	-0.001	0.11
Block 2	$\Delta R^2 = 0.03$, $P = 0.01$	$\Delta R^2 = 0.02$, $P = 0.05$	$\Delta R^2 = 0.002$, $P = 0.51$	$\Delta R^2 = 0.02$, $P = 0.03$	$\Delta R^2 = 0.02$, $P = 0.04$
EPDS at 4 months	0.18**	0.14*	0.05	0.15*	0.14*
Final model	$R^2 = 0.11$ ($R^2_{Adj} = 0.07$), $P = 0.003$	$R^2 = 0.10$ ($R^2_{Adj} = 0.06$), $P = 0.008$	$R^2 = 0.07$ ($R^2_{Adj} = 0.03$), $P = 0.08$	$R^2 = 0.09$ ($R^2_{Adj} = 0.06$), $P = 0.01$	$R^2 = 0.16$ ($R^2_{Adj} = 0.13$), $P < 0.001$
				$R^2 = 0.11$ ($R^2_{Adj} = 0.08$), $P = 0.002$	$R^2 = 0.08$ ($R^2_{Adj} = 0.05$), $P = 0.02$

BMI, body mass index; EPDS, Edinburgh Postnatal Depression Scale (Cox *et al.* 1987). * $P \leq 0.05$; ** $P \leq 0.01$. All values given as per final regression model. [†]Child Feeding Questionnaire (Birch *et al.* 2001) response options: pressure and restriction: 1 = *disagree to 5 = agree*; monitoring: 1 = *never to 5 = always*. ²Parental Feeding Style Questionnaire (Wardle *et al.* 2002) response options: 1 = *never to 5 = always*. ⁸Temperament measured on a 6-point scale (1–6) with a higher mean score indicating a more difficult temperament (Sanson *et al.* 1987). ⁹BMI z-score (World Health Organization 2006) calculated from length and weight data collected at infant age 4 (SD = 1) months. ^{††}Feeding mode at infant age 4 (SD = 1) months dichotomised as any breastfeeding (exclusive/fully/combination with formula) vs. exclusive formula feeding.

unaware of what and when an infant is eating may suggest substantial impairment in the caregiving role, with low scores potentially corresponding with significant dysfunction within the family unit, rather than a feeding practice *per se*.

There are a number of alternative explanations for the small associations observed between level of post-natal depressive symptoms and feeding practices in our sample. Firstly, mothers with previous psychiatric disorders or with high levels of psychological distress (Kessler 10 score >30) (Kessler *et al.* 2002) identified at maternity or pre-enrolment were not eligible to participate in the NOURISH trial (Daniels *et al.* 2012). Furthermore, mothers in the present sample who scored 13 or more on the EPDS were excluded from analyses. Comparing feeding practices of clinically depressed vs. non-depressed mothers may reveal stronger associations with feeding practices. Secondly, change in depressive symptoms on the EPDS over the period of the study was unknown. Current level of depressive symptoms at child age 2 years may have mediated the relationship between EPDS at 4 months and feeding practices when children are 2 years of age. As such, the longitudinal analysis may underestimate short-term impacts of maternal post-natal depression on feeding practices.

Overall, the direction of the relationships between EPDS score and non-responsive feeding practices shown in the present study are in accord with the well-documented impact of post-natal depression upon many aspects of general daily functioning (Fleishman & Zuvekas 2007), and parental role functioning in particular (Harvey *et al.* 2011). Even in our community sample of first-time mothers, a higher score on the EPDS at 4 months post-partum predicted less responsiveness in feeding when their children were 2 years old. Based on our analyses in which EPDS score was used as a continuous variable to indicate level of depressive symptoms, we predict that the impact of higher levels of post-natal depression (e.g. EPDS score ≥ 13) on feeding practices may be stronger than those observed in our sample. In sum, the present results speak to the potential unfavourable longer term influence of depressive symptoms in the post-natal period on feeding practices (Farrow & Blissett 2005; Hurley *et al.* 2008).

A number of other key maternal and child variables were associated with feeding practices in the multivariable analyses. Maternal BMI was associated with lower levels of responsive feeding on five subscales. Older mothers reported higher levels of restriction and instrumental feeding. A more difficult infant temperament was associated with higher emotional and instrumental feeding practices and lower control practices at 2 years. The latter finding is consistent with evidence suggesting that infant temperament is a risk factor for childhood obesity: difficult infant temperament has been associated with a more obesogenic diet at 18 months (Vollrath *et al.* 2011), less responsive feeding practices at 1 and 2 years of age (Blissett & Farrow 2007) and increased obesity risk at age 6 years (Faith & Hittner 2010). Additionally, in the study by Hurley *et al.* (2008) depression symptomatology was associated with maternal perceptions of infant temperament, and mothers who rated their infant's temperament as difficult had low scores on responsive feeding style. Similar results were obtained in a previous study by our group (McMeekin *et al.* 2013) reporting cross-sectional data from the NOURISH control group. A more difficult infant temperament at 4 months was associated with poorer awareness of infant feeding cues, greater concern about the infant becoming overweight or underweight, and higher use of food to calm the infant. An acknowledged limitation of both studies (Hurley *et al.* 2008; McMeekin *et al.* 2013) was the cross-sectional design, which precluded investigation of the longer term impact of maternal and child factors in the early post-natal period on feeding practices.

Strengths and limitations

Interpretation and generalisation of the present findings should take account of a number of factors. The NOURISH sample consisted of mothers who were more educated, older and more likely to be in a relationship than mothers who did not consent or could not be re-contacted at the second stage of recruitment. Similar biases were noted in terms of mothers who remained in the trial at the follow-up assessment when the children were 2 years old. These selection and retention biases limit the generalisability of the

present results to primiparous, older, well-educated, married/cohabiting mothers without past psychiatric history and with lower EPDS score 4 months post-partum. Another limitation was that mothers did not complete the EPDS again at child age 2 years. All measures (except anthropometry) were self-reported by the mothers; therefore, it is possible that level of depressive symptoms may have biased mothers' perceptions of their infants' temperament and their own feeding practices. It was also not possible to control for feeding practices at 4 months of age due to the lack of validated measures of responsive feeding at this age. Finally, the potential for fathers or other carers to have a moderating effect on the relationship between mothers' level of post-natal depressive symptoms and non-responsive feeding practices was not examined. It may be that a good support network can attenuate the potentially negative impacts of maternal post-natal depressive symptoms.

Implications for research and practice

The results of the present study do not support the position that post-natal depression symptomatology is a *strong* predictor of feeding practices in a community sample of mothers. However, at a group level depressive symptoms in the early post-natal period did have *small* long-term associations with a number of feeding practices when children were aged 2 years. Thus, we recommend that post-natal depression or psychological distress is routinely considered in the investigation of early feeding practices.

The present study adds to the literature on the links between maternal mental health and feeding practices and raises the question of whether post-natal depression should be a topic that is included in child nutrition education programmes – either within universal programmes (i.e. focus is *not* mental health, but it is discussed) or targeted programmes (i.e. focus is mental health, but feeding is discussed). For example, the developers of the 'What were we thinking?' psychoeducational intervention to prevent post-partum mental disorders in first-time mothers, recommended focussing on maternal and infant health rather than maternal depression and positioning post-natal depression as a matter for families, rather than

individual women (Rowe & Fisher 2010). Concerns about children's eating in the first 2 years of life are reported by 20–30% of mothers (Chan *et al.* 2010) and are a common reason for seeking child health and paediatric services (Danby *et al.* 2009; Östberg & Hagelin 2011). Thus, interventions with a focus on managing early life feeding may be an acceptable and useful platform to deliver anticipatory guidance regarding responsive parenting practices to new mothers at risk of or experiencing post-natal depression.

Conclusion

The purpose of this study was to investigate whether levels of post-natal depressive symptoms 4 months after delivery were associated with non-responsive feeding practices when the child was 2 years old. Significant positive associations were found between EPDS score and pressure, restriction, instrumental and emotional feeding after adjusting for maternal and child covariates. However, effects were small and the generalisability of findings is limited by the study sample comprising only first-time mothers, many of whom were well educated, older and married/cohabiting. Nevertheless, these findings emphasise the importance of providing support to mothers experiencing depressive symptomatology in the early post-natal period in order to promote responsiveness in the context of child feeding. Longitudinal research in mothers experiencing higher, clinical levels of post-natal depression is warranted to extend these findings. Similarly, the generalisability of future research findings will be enhanced by broadening the socio-demographic profile of participants.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

KMM conducted the statistical analyses and led the writing of the manuscript; LAD led the design, successful funding application, and overall implementation of the NOURISH RCT; JLW, EJ and JMN conceived the present secondary analysis paper. All authors contributed to interpretation of results and preparation of the manuscript.

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