



## The relationship between maternal feeding beliefs and practices and perceptions of infant eating behaviours at 4 months



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### ARTICLE INFO

#### Article history:

Received 14 January 2016

Received in revised form

26 April 2016

Accepted 26 April 2016

Available online 28 April 2016

#### Keywords:

Infant

Eating behaviour

Feeding beliefs and practices

### ABSTRACT

Parental feeding practices and children's eating behaviours are inter-related and both have been implicated in the development of childhood obesity. However, research on the parent-child feeding relationship during the first few months of life is limited. The aim of this study was to examine the cross-sectional relationship between maternal feeding beliefs and practices and infant eating behaviours in a community sample. Mothers (N = 413) of 4 month old infants recruited during pregnancy for the *New Beginnings: Healthy Mothers and Babies* study self-reported feeding beliefs/practices and eating behaviours of their infants on established tools. Data on a comprehensive range of maternal and infant characteristics were also collected. Multivariable regression models were used to assess the associations between five feeding beliefs and practices and four eating behaviours, adjusting for key maternal and infant covariates. Mothers concerned about their infant becoming underweight rated the infant higher on satiety responsiveness and lower on enjoyment of food. Higher awareness of infant feeding cues was associated with higher infant enjoyment of food. Mothers concerned about their infant becoming overweight and those who used food to calm their baby rated the infant as higher on food responsiveness. Feeding to a schedule (vs on demand) was not associated with any of the infant eating behaviours. A relationship between maternal feeding beliefs and practices and infant eating behaviours is apparent early in life, therefore longitudinal investigation to establish the directions of this relationship is warranted.

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Eating behaviours such as a high responsiveness to food cues and a low responsiveness to cues of satiety are positively associated with a higher weight status in both child and adult populations (French, Epstein, Jeffery, Blundell, & Wardle, 2012). Eating behaviours in children have become an important component of the research agenda for preventing childhood obesity in an obesogenic food environment (Birch & Fisher, 1998; Carnell & Wardle, 2008; Sleddens, Kremers, & Thijs, 2008; Webber, Hill, Saxton, van Jaarsveld, & Wardle, 2008). Associations between children's eating behaviours and parental feeding practices (Birch & Fisher, 1998; Carnell, Benson, Driggin, & Kolbe, 2014; Fisher & Birch, 1999a) has led to several early intervention trials that have attempted to modify child eating behaviours through the

promotion of 'protective' feeding practices (Campbell et al., 2013; Daniels, Mallan, Battistutta et al., 2014, Daniels, Mallan, Nicholson et al., 2015; Wen et al., 2015). 'Protective' feeding practices (Daniels et al., 2015) are responsive to the child's internal cues of hunger and satiety and exclude 'non-responsive' practices such as pressure, emotional feeding or using food as a reward because these practices undermine children's capacity to self-regulate their intake (DiSantis, Hodges, Johnson, & Fisher, 2011). To date there has been limited research into eating behaviours during infancy, and whether these are associated with specific feeding practices or beliefs. In contrast, the long term implications of rate of growth during infancy have been highlighted in a number of systematic reviews which concluded that rapid weight gain during infancy is associated with increased obesity risk and chronic disease in later life (Baird et al., 2005; Fisher et al., 2006; Monteiro & Victora, 2005; Ong & Loos, 2006).

Infant eating behaviours, like child and adult eating behaviours, appear to be associated with weight status. Two longitudinal

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studies (Agras, Kraemer, Berkowitz, & Hammer, 1990; Agras, Kraemer, Berkowitz, Korner, & Hammer, 1987) identified a vigorous milk feeding style (short resting periods and long bursts of fast, high pressure sucking) at 2 and 4 weeks of age to be associated with a higher body mass index (BMI) at ages 1, 2 and 3 years old. The Baby Eating Behaviour Questionnaire (BEBQ) (Llewellyn, van Jaarsveld, Johnson, Carnell, & Wardle, 2011) was developed based on the Children's Eating Behaviour Questionnaire (CEBQ); (Wardle, Guthrie, Sanderson, & Rapoport, 2001), a widely used and well validated tool that has facilitated research in large samples of children across the world. The BEBQ (Llewellyn et al., 2011; Wardle et al., 2001) has allowed for a more nuanced measurement of individual eating behaviours during the predominantly milk feeding period of infancy. Higher general appetite (assessed using a single item) and enjoyment of food at 3 months of age were prospectively associated with higher and faster weight gains over a 6–12 months period, whereas greater satiety responsiveness and slower eating were associated with lower and slower weight gains over this period.

Whilst the evidence to date clearly supports the influence of genetics in the expression of eating behaviours in infancy (Llewellyn, van Jaarsveld, Plomin, Fisher, & Wardle, 2012; van Jaarsveld, Boniface, Llewellyn, & Wardle, 2014), modifiable environmental factors, including parent feeding beliefs and practices are also implicated in the development of eating behaviours (DiSantis et al., 2011; French et al., 2012) and indirectly weight status (Carnell et al., 2014; Fisher & Birch, 1999a, 1999b; Rodgers et al., 2013; Webber, Cooke, Hill, & Wardle, 2010). Cross-sectional studies of associations between maternal feeding practices and eating behaviours of children aged 3–5 years have shown that restriction (e.g., in terms of type and amount), instrumental (e.g., using food as a reward) and emotional feeding (e.g., to comfort) are associated with greater food responsiveness (Carnell et al., 2014; Webber et al., 2010) whereas pressure to eat is associated with greater satiety responsiveness (Carnell et al., 2014; Webber et al., 2010), lower enjoyment of food, fussier eating and slower food consumption (Webber et al., 2010). A longitudinal study (Rodgers et al., 2013) further supports these results, finding that a range of feeding practices such as restriction, emotional feeding and pressure at age 2 years were prospectively associated with problematic eating behaviours including overeating and emotional eating 12 months later.

Research on maternal feeding practices during the period of infancy has typically focussed on growth, rather than eating behaviours, as the 'outcome'. It is well established that feeding mode (i.e., breastfed or formula fed) influences growth (Butte, Wong, Hopkinson, Smith, & Ellis, 2000; Dewey, 1998; Dewey, Heinig, Nommsen, Peerson, & Lönnerdal, 1993; Tull Dahl, Pettersson, Andersson, & Hulthén, 1999) and emerging cross-sectional evidence has shown differences in infant eating behaviours according to whether infants were breastfed, mixed fed (combination of breast milk and formula) or formula fed (Llewellyn et al., 2011; Mallan, Daniels, & de Jersey, 2014). In addition to feeding mode, other maternal feeding practices may also influence infants' eating behaviours and growth. However, the majority of studies have utilised a cross-sectional design and only considered infant weight rather than eating behaviours. In an Australian cross sectional study ( $n = 612$ ) feeding on a schedule was related to rapid infant weight gain ( $>0.67$  weight-for-age Z score (WAZ score) from birth to 4–7 months old) (Mihirshahi, Battistutta, Magarey, & Daniels, 2011). Lower maternal awareness of infant hunger and satiety cues predicted greater weight gain from 6 to 12 months (Worobey, Islas Lopez, & Hoffman, 2009). A prospective study showed that when maternal control in feeding was low to moderate, infants were able to self-regulate their weight in the first year of life, but when

maternal control was high, weight gain in the first year of life was consistently high (Farrow & Blissett, 2006). These results suggest that the ability of infants to self-regulate their intake and subsequently weight status requires appropriate maternal response to hunger and satiety cues.

In contrast to the substantive amount of research on the relationship between parental feeding practices and child eating behaviours in older children, there has been limited research on this relationship in the first few months of life. To our knowledge the relationships between BEBQ factors and maternal feeding beliefs and practices (excluding feeding mode) have not yet been examined. The aim of the present study was to investigate the associations between maternal-reported feeding beliefs and practices and maternal-reported infant eating behaviours (satiety responsiveness, slowness eating, enjoyment of food and food responsiveness) during the predominantly milk feeding period. A multivariable approach was taken to account for potential covariance between feeding practices and to adjust for key maternal and infant covariates.

## 1. Methods

### 1.1. Study design and participants

The results reported in this paper utilised data collected by self-administered questionnaire at approximately four months postpartum from participants enrolled in the observational *New Beginnings: Healthy Mothers and Babies* study. Study recruitment has been described previously (de Jersey, Nicholson, Callaway, & Daniels, 2013). Briefly, all eligible women receiving antenatal care at the Royal Brisbane and Women's Hospital (RBWH) were approached via mailed registration packages or face to face in the antenatal clinic between August 2010 and January 2011. Eligible participants needed to be  $\geq 18$  years of age, have no pre-existing type 1 or 2 diabetes and have sufficient language skills to complete the questionnaires in English. Six hundred and sixty-four women consented to participate and provided some baseline data (response rate: 63%). In terms of age, marital status, ethnicity, parity and anthropometric characteristics the participants were broadly representative of the Queensland obstetric population (Health Statistics Centre, 2011).

Data used in this analysis were based on self-administered questionnaires completed at 16 weeks gestation (demographic data and pre-pregnancy weight) and 4 months postpartum (maternal-reported wellbeing, feeding practices and beliefs, baby eating behaviours and infant growth). Maternal height was measured at first contact (16 weeks gestation) and infant birth weight and sex were collected from hospital records.

Of the 664 women who provided some data at baseline, demographic data from 551 participants were available to assess retention bias (585 participants returned the baseline questionnaire however those who actively withdrew from the study ( $n = 22$ ) or suffered an adverse outcome/early delivery ( $n = 12$ ) were removed). Complete data on the variables considered in the present study were available from 413 participants. Women included in the study were slightly older ( $M$  age =  $30 \pm SD = 5$  vs  $29 \pm 5$ ,  $p = 0.037$ ), more likely to have a university degree (49% vs 38%,  $p = 0.022$ ), more likely to be overweight prior to pregnancy (34% vs 18%,  $p < 0.001$ ), more likely to be born in Australia (non-significant trend: 72% vs 63%,  $p = 0.051$ ) and more likely to be married or in a *de facto* relationship (non-significant trend: 96% vs 92%,  $p = 0.088$ ) than those excluded due to missing data or loss to follow-up ( $n = 138$ ). There were no significant differences in terms of parity ( $p = 0.42$ ), or infant gender ( $p = 0.69$ ).

Ethical approval was obtained from the RBWH (HREC/10/QRBW/

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