



Breastfeeding duration and its relation to weight gain, eating behaviours and positive maternal feeding practices in infancy



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ABSTRACT

Research examining the relationship between breastfeeding and infant weight has generated conflicting results. Few studies account for significant covariates and many suffer methodological problems such as retrospective self-report. The current study aimed to investigate relationships between breastfeeding duration, infant weight and eating and positive maternal mealtime behaviours, whilst overcoming many of the limitations of previous research. Eighty-one women on low-risk maternity units gave informed consent and were visited at home at 1-week, 1-, 6- and 12-months postpartum. Infants included 45 males and 36 females (mean birth-weight 3.52 kg [SD 0.39]). Mothers and infants were weighed and measured and feeding information was recorded at each visit. Infant weight was converted to a standard deviation score (SDS), accounting for age and sex. Mothers reported infant eating behaviours at 12-months using the Children's Eating Behaviour Questionnaire and were observed feeding their infants solid food at home at 6- and 12-months. Partial correlations (covariates: maternal age, education, BMI, smoking during pregnancy, household income, infant birth weight SDS and age introduced to solid foods) revealed negative associations between breastfeeding duration and 1- to 6- and 1- to 12-month weight gain, and 6- and 12-month weight. Breastfeeding duration was also associated with a slower rate of infant eating and greater observed maternal vocalisations, appropriateness and sensitivity. Results support a dose-response relationship between breastfeeding and infant weight and suggest that breastfeeding may encourage the development of obesity-protective eating behaviours through learning to attend to internal hunger and satiety signals. Future research should investigate whether relationships between slowness in eating and weight extend to satiety responsiveness after infancy.

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1. Introduction

For the last 30 years, research has investigated whether breastfeeding protects against rapid weight gain, overweight and obesity. Findings have revealed that breastfed infants gain less weight during the neonatal period than formula-fed infants (Heinig, Nommsen, Peerson, Lonnerdal, & Dewey, 1993), and that infants who gain less weight during this period have a reduced risk of becoming obese later in life (Stettler, Zemel, Kumanyika, &

Stallings, 2002). Rapid weight gain in infancy is a risk factor for overweight/obesity in childhood and is associated with increased BMI and fat mass at 5- and 7- to 9-years (Sacco, de Castro, Euclides, Souza, & Rondo, 2013; Zhou et al., 2016). Although studies have also provided evidence for a dose-dependent protective effect of breastfeeding (Arenz, Ruckerl, Koletzko, & Von Kries, 2004; Hornell, Lagstrom, Lande, & Thorsdottir, 2013; Kramer, 1981; McCrory & Layte, 2012; Owen, Martin, Whincup, Smith, & Cook, 2005; Reynolds, Hennessy, & Polek, 2014; Skledar & Milosevic, 2015; Yan, Liu, Zhu, Huang, & Wang, 2014), there is considerable inconsistency in published findings.

Some studies claim the effect of breastfeeding on childhood obesity is small (Jiang & Foster, 2013; Umer et al., 2015) and others have found no effect at all (Davis et al., 2007; Martin et al., 2013; Novaes, Lamounier, Colosimo, Franceschini, & Priore, 2012; Oddy et al., 2004). It is possible that these null findings may have

Abbreviations: BMI, Body mass index; CEBQ, Child Eating Behaviour Questionnaire; EPDS, Edinburgh Postnatal Depression Scale; SDS, standard deviation score; SGA, small for gestational age.

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arisen due to a lack of control of covariates and a range of other methodological issues. There is wide variation between studies in the covariates accounted for; examples include infant birth weight, gender, gestational age, age introduced to solid food, maternal age, BMI, smoking status during pregnancy (and postnatally), maternal diabetes, postnatal depression, education and household income. Very few published studies account for all of these variables. [Smithers, Kramer, and Lynch \(2015\)](#) argue that poor measurement (or lack of adjustment) of such factors can result in biased effects of breastfeeding being reported from longitudinal cohort studies. The current study attempted to address such issues by measuring the most common covariates not controlled for in other studies. Extensive demographic information was obtained and, if related to breastfeeding or infant weight, controlled for in subsequent analyses.

Methodological problems in this area involve (but are not limited to) retrospective data collection, inconsistent definitions of breastfeeding (including exclusivity and duration), small sample sizes or the same data from larger samples being used several times, and maternal self-report of infant/child height and weight and breastfeeding history. [Michels et al. \(2007\)](#), who did not find an association between breastfeeding and overweight, obtained their sample from the Nurses' Health Study II (whose children comprise the Growing Up Today Study). The same environmental and genetic information has therefore contributed to more than one sample and has been studied numerous times ([Gillman et al., 2001, 2006](#)). Repeated use of the same cohort partially explains the occurrence of repeated findings both for and against the protective effect of breastfeeding on obesity. Furthermore, [Michels et al. \(2007\)](#) administered questionnaires to nurses' mothers asking if they breastfed their daughters and when breastfeeding stopped. Nurses' mothers were contacted when the nurses were aged between 37- and 44-years. The time elapsed since breastfeeding cessation suggests it is likely that mothers could not accurately recollect how they fed their infants and calls into question the accuracy of retrospective self-report. The current study attempted to improve such methodological issues by recruiting a new sample of participants and by avoiding the use of retrospective self-report of information.

Despite inconsistencies within the literature, the protective effect of breastfeeding is often demonstrated in large, methodologically rigorous studies. For example, a large, well-controlled study using multivariate analysis included 7798 children in Ireland and controlled for socio-demographic factors, child birth weight, gender, physical activity and parental BMI. Results demonstrated that children who had been breastfed for 13- to 25-weeks had a 38% reduction in the risk of being obese at 9-years-of-age, compared to those never breastfed ([McCrary & Layte, 2012](#)). Furthermore, breastfeeding for at least 26-weeks was associated with a 51% reduction in obesity risk at 9-years-of-age. These results also supported the dose-dependent effect of breastfeeding for durations greater than 4-weeks ([McCrary & Layte, 2012](#)). Furthermore, the protective effect of breastfeeding is also illustrated by a meta-analysis, which found that a longer duration of breastfeeding was associated with a reduced risk of becoming overweight ([Harder, Bergmann, Kallschnigg, & Plagemann, 2005](#)). However, as with individual studies, systematic reviews and meta-analyses may also suffer limitations with respect to the potential bias due to confounding ([Smithers et al., 2015](#)).

In addition to the effect of breastfeeding on weight, it is also related to the development of healthy eating behaviours, such as increased consumption of fruits and vegetables ([Kudlová & Schneidrová, 2012](#); [Mennella, Jagnow, & Beauchamp, 2001](#)). Breastfed infants are also found to be more responsive to satiety ([Brown & Lee, 2012](#)) and greater satiety responsiveness is related to

a lower risk of being overweight in childhood ([Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009](#)). Increased responsiveness to satiety may arise because breastfed infants may learn to better self-regulate their intake than formula-fed infants due to having more control over the size of the feed ([Birch & Fisher, 1998](#)) and the ever-changing fat content of the milk ([Jenness, 1979](#); [Nommsen, Lovelady, Heinig, Lönnerdal, & Dewey, 1991](#)).

Maternal sensitivity is associated with breastfeeding, infant weight gain and eating behaviours and is a potential candidate to explain the mechanism of the protective effects of breastfeeding on obesity. Breastfeeding mothers may be more sensitive and responsive to the hunger and satiety signals communicated by their infant and demonstrate less controlling feeding practices than formula-feeding mothers. [Shloim, Rudolf, Feltbower, Mohebati, and Hetherington \(2015\)](#) observed mealtime interactions between mothers and infants and found that breastfeeding mothers were more in tune with their infants' signals during feeding. Breastfeeding mothers also provided a more favourable feeding environment and fed their infants more responsively than mothers who fed solids or milk from a bottle ([Shloim et al., 2015](#)). More sensitive and less controlling behaviours during feeding allow infants to self-regulate their energy intake and learn to respond to internal hunger and satiety cues ([Brown & Lee, 2012](#); [Taveras et al., 2006](#)). However, much of the literature to date has relied on maternal report of feeding practices, with few prospective studies of breastfeeding outcomes examining observed sensitivity in solid feeding interactions.

A recent systematic review by [Bergmeier, Skouteris, and Hetherington \(2015\)](#) argued that much of the literature that has investigated relationships between maternal feeding practices and children's weight and eating behaviours has relied on unidirectional self-report methods. It is possible that such methods alone may be biased and capture intended, rather than actual, feeding behaviours ([Bergmeier, Skouteris, & Hetherington, 2015](#)). In support of this, [Bergmeier, Skouteris, Haycraft, Haines, and Hooley \(2015\)](#) found that maternal reported restriction was negatively associated with observed restriction during a mealtime observation, and reported pressure was only positively associated with observed pressure in mothers of girls, not boys. [Bergmeier, Skouteris, and Hetherington \(2015\)](#) argued that longitudinal observational methods should be employed that examine the bi-directional dimensions of parent-child mealtime interactions.

Results of previous literature emphasise the importance of investigating the relationships between breastfeeding duration, infant weight gain and eating behaviours and observed maternal feeding behaviours in one study. Currently, there is no longitudinal study published that investigates all of these factors together over the first year of life. The aim of this study was to investigate the relationship between observed maternal feeding behaviour, breastfeeding duration and infant weight and eating behaviours during the first 12-months of life, in a sample of healthy infants of uncomplicated pregnancy, controlling for necessary covariates. Extensive demographic information was collected, which measured the most common covariates not controlled for in other studies and, if related to breastfeeding or infant weight, these were controlled for in subsequent analyses. It was hypothesised that infants breastfed for longer durations would: (1) show slower weight gain throughout the first year; (2) weigh less at 12-months; (3) demonstrate more obesity-protective eating behaviours at 12-months; and (4) have mothers who were observed to be more sensitive during feeding, than infants breastfed for shorter durations.

2. Materials and methods

The study protocol received full ethical approval from

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