



RESEARCH PAPER

Maternal control of child-feeding during breast and formula feeding in the first 6 months post-partum

A. Brown, P. Raynor & M. Lee

School of Human and Health Sciences, Swansea University, Swansea, UK

Keywords

breastfeeding, child-feeding questionnaire, encouragement to feed, formula feeding, maternal control, restriction.

Correspondence

A. Brown, School of Human and Health Sciences, Swansea University, Swansea, SA2 8PP, UK.

Tel.: +44 (0) 1792 295687

Fax: +44 (0) 1792 518640

E-mail: a.e.brown@swansea.ac.uk

doi:10.1111/j.1365-277X.2010.01145.x

Abstract

Background: Mothers who breastfeed use lower levels of control over later child diet. The baby-led nature of breastfeeding may encourage this low control to develop. Alternatively maternal desire for control may drive breastfeeding duration. The present study explored whether differences in maternal control are present during milk feeding and whether these stem from or drive breastfeeding duration.

Methods: Five hundred and two mothers with an infant aged 6–12 months completed a modified retrospective version of the child-feeding questionnaire adapted to reflect milk feeding during the first 6 months post-partum. Participants were recruited from mother and baby groups and online parenting forums. Mothers recalled their use of encouraging intake and scheduling feeds in relation to their infant's intake of milk. Attitudes towards breastfeeding were also measured, including views that breastfeeding is inconvenient, difficult and that formula-fed infants were more content.

Results: Compared to mothers who formula-fed or ceased breastfeeding within 1 week, mothers who breastfed for at least 6 months recalled a lower use of scheduling and encouraging milk feeds. Mothers who initiated breastfeeding but ceased within 1 week reported lower control compared to exclusive formula feeders. A high level of scheduling feeds was associated with considering that breastfeeding was inconvenient and a greater perceived infant size, whereas encouraging feeds was associated with considering that breastfeeding was difficult, low maternal confidence and a smaller perceived infant size.

Conclusions: Maternal desire for control may drive breastfeeding duration. A controlling maternal feeding style may therefore be dispositional and present much earlier than current studies suggest.

Introduction

Numerous studies have evaluated the association between maternal control of child-feeding practices, childhood weight and eating style in children over the age of 12 months (Ventura & Birch, 2008). Restricting the intake of palatable foods may increase a child's consumption of these foods when allowed free access (Lee *et al.*, 2001), which can result in a higher body mass index (BMI) (Fisher & Birch, 2002). Pressure to eat, on the other hand, may be associated with a decreased intake of

nutrient dense foods (Fisher *et al.*, 2000) and increased pickiness (Galloway *et al.*, 2003) and thus a lower BMI (Brann & Skinner, 2005).

Recent studies performed in both US and UK populations have revealed an association between breastfeeding during the first year and lower levels of maternal control in the second year and beyond, when the child is fed a solid diet (Fisher *et al.*, 2000; Taveras *et al.*, 2004; Farrow & Blissett, 2006, 2008; Blissett & Farrow, 2007). The reasons for this relationship, however, remain unclear. One explanation could be the differing nature of breast and

formula feeding. Although it is possible for the mother to attempt to control a breastfed infant's feeding pattern and intake of milk, breastfeeding typically needs to be infant led to establish milk supply (Daley & Hartmann, 1995). Restricting feeds can signal that the milk is not needed, and supply will drop (Dewey & Lonnerdal, 1986). Breastfeeding also has greater potential to be predominantly controlled by the infant because the frequency, energy density and duration of feeds will naturally vary over the course of the day if the infant is allowed to feed on demand (Dewey *et al.*, 1991). Conversely, formula feeds are likely to be prepared using a similar volume and energy density of milk each time. Moreover, unlike bottle feeding, there is no visual cue with respect to the amount of milk consumed during breastfeeding and it is more difficult (although not impossible) to encourage a breastfed infant to continue feeding when satiated (Wright *et al.*, 1980). Taveras *et al.* (2004) therefore suggested that breastfeeding may promote a permissive child-feeding style, because breastfeeding mothers may learn to allow their infant to self-regulate their own intake of milk, possibly adopting a long-term feeding style that is low in control. Certainly, control behaviours in later infancy have been shown to be stable once developed (Blissett & Farrow, 2007).

However, it has also been suggested that maternal individual differences may drive both breastfeeding duration and later use of control (Farrow & Blissett, 2006). The reasons for using formula or only breastfeeding for a short duration of time are multiple (Thulier & Mercer, 2009). Alongside factors such as physical difficulties (Scott *et al.*, 2006), pain (Gatrell, 2007) and embarrassment (McFadden & Toole, 2006), beliefs about the baby-led nature of breastfeeding have been associated with formula use. Many view breastfeeding as inconvenient, time consuming and consider that formula-fed infants are more content (Arora *et al.*, 2000; Dykes *et al.*, 2003; Wright & Weaver, 2007). Others struggle with being unable to see the amount consumed and consider that their milk supply is poor (Ingram *et al.*, 2002; Li *et al.*, 2008). Formula feeding, however, alleviates both these concerns.

It is possible that maternal beliefs about the infant-led nature of breastfeeding dictate breastfeeding duration. Mothers who want to be in control of their baby's feeding pattern choose to formula feed from birth or to only breastfeed for a short duration of time. Subsequently, when feeding their child a solid diet, these mothers may continue to use a feeding style that is high in control. Rather than experience of breastfeeding dictating level of control, maternal disposition may drive both breastfeeding duration and later maternal feeding style. The present study aimed to explore feeding style during early infancy

when milk is the primary source of nutrition, alongside attitudes and beliefs that may potentially influence its use. The hypothesis was tested that mothers who breastfed during the first 6 months post-partum would recall using lower levels of control during milk feeding than mothers who formula fed. This not only may emerge as a consequence of feeding method, but also be related to attitudes underlying the infant-led nature of breastfeeding.

Materials and methods

Participants

All participants provided their informed consent before inclusion in the study. All aspects of this study were performed in accordance with the ethical standards set out in the 1964 Declaration of Helsinki. Approval for the study was granted by the Swansea University Department of Psychology Research Ethics Committee. Five hundred and two mothers whose child was aged between 6 and 12 months [mean (SD) age 7.85 (1.45) months completed the questionnaire]. Participants were recruited from day care centres, post-natal groups, mother and baby groups and community centres. In addition, 20% of the participants were recruited through online parenting forums based in the UK. Groups were located in areas with varying degrees of social deprivation. No significant difference was seen in mean age, years in education or breastfeeding duration between mothers who participated online or through the different groups.

Participants provided details about their age, level of education and gave measures of socioeconomic status. The mean (SD) age of the respondents at childbirth was 28.6 (4.83) years (range 17–44 years) and the mean (SD) number of years in education was 13.9 (2.02) years. Occupations were coded according to the National Statistics Socio-Economic Classification self-coded method (NS-SEC, 2005). A wide range of respondents in terms of socioeconomic status took part.

Participants provided infant birth weight and gestational age at birth. Infants were excluded from the analysis if they had a low birth weight (<2500 g) or were born prematurely (<37 weeks) (World Health Organization, 1992). In addition, participants provided a measure of perceived size of their infant through the item 'As your baby was growing was she/he' [Very small for age; Small for age; Average size for age; Large for age; Very large for age].

Participants indicated whether they initiated breastfeeding at birth, for how long they breast-fed and any use of supplementary formula. Any mother who reported breastfeeding but gave formula milk more than once a day during the period that they were breastfeeding was excluded ($n = 9$).

Adapted child-feeding questionnaire

Participants recalled their feeding practices when giving their infant milk feeds during the first 6 months post-partum. A self-report questionnaire was used based on previous work in the area that examined maternal control over later childhood diet. The questionnaire was based on the child-feeding questionnaire (CFQ) designed and validated by Birch *et al.* (2001). The CFQ evaluates parental beliefs, attitudes and practices towards the children's diet and was designed to be used with parents whose children are consuming solid foods, with a suggested age range of approximately 2–11 years. The CFQ aims to assess the level of primary carer involvement and control over the child's diet and targets behaviours, including perceived responsibility, concerns about child weight, restriction, pressure to eat and monitoring feeds alongside perceptions of both parental and child weight.

Because no validated questionnaire exists for use with parents with milk-fed infants, it was decided to modify the items of the CFQ in the context of milk feeds (Appendix 1). Questions relevant to milk feeding were selected and reworded to apply specifically to milk feeding and retrospective behaviour. Items relating to the dimensions of perceived responsibility, concern about child weight, restriction, pressure to eat and monitoring were selected as relevant to milk feeding. Any individual items not relevant to milk feeding were omitted. Response options were as the original CFQ (agree, slightly agree, neither agree nor disagree, slightly disagree and disagree). For example, the question 'How much do you keep track of the food your child eats?' became 'How much did you keep track of the amount your baby drank?'

Attitudes questionnaire

Participants rated a series of statements to indicate their attitudes towards breastfeeding. Responses were given via a five-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree). Items were based on established influences upon breastfeeding duration (Thulier & Mercer, 2009). Items targeted beliefs such as breastfeeding is difficult, inconvenient and embarrassing. Measures of confidence were also taken.

Statistical analysis

Data were tested for normal distribution. A factor analysis was carried out using SPSS, version 13 (SPSS UK Ltd, Feltham, UK) for the adapted CFQ and attitudes questionnaire. Factor analysis establishes whether one or more factors underlie a large number of variables, grouping

such items together. This allowed items from the questionnaires to be grouped together into statistically similar factors, instead of deciding manually which factors should be grouped together. This increased the validity of the measures. To perform the data analyses, principal component analysis was used, subject to varimax rotation. Factors with eigenvalues over one were retained. A threshold of 0.5 was used to determine which variables should be retained, reducing the number of items from 16 to 13. The factor scores computed were saved as regression scores and used for the data analysis as recommended by Tabachnik & Fidell (2006). Cronbach's alpha was computed for each factor to examine internal consistency of the factors produced. This was high for each factor (typically 0.7–0.8; Tables 1, 3 and 4). Multivariate analysis of variance was applied to compare maternal use of control for three feeding groups (formula-fed from birth, breast-fed for 1 week or less and breast-fed for 6 months or more). Maternal age and level of education were controlled for throughout the analyses. Bonferroni tests were used to identify which groups were significantly different from each other. Spearman's rho correlation coefficient was calculated to examine relationships between maternal use of control and maternal attitudes towards breastfeeding, confidence, infant birth weight and perceived size of infant.

Results

An exploratory factor analysis was conducted to establish the factor structure of the adapted CFQ (Table 1). The first four factors of the rotated component matrix explained 53.5% of the variance. The first, labelled 'scheduling feeds', accounted for 28.9% of the variance and was weighted on four items that described scheduling and stretching out the time between feeds. The second factor accounted for 9.3% of the variance and was based on five items assessing encouragement for higher milk consumption alongside anxieties that the infant was underweight. This was labelled 'encouraging feeds'. A third factor labelled 'using milk for comfort' was based on two items relating to feeding in response to infant behaviour aiming to comfort or calm behaviour. This factor accounted for 8.7% of the variance. Finally, accounting for 6.6% of the variance, the fourth and final factor with an eigenvalue greater than 1, labelled 'perceived responsibility', encompassed two items relating to feeling responsible for feeding the child. Two confirmatory factor analyses were conducted on random subsets of the data that resulted in similar factor structures. Therefore, the factors extracted by using the entire sample were used. Factor scores for the four dimensions were created using the regression method.

Table 1 Factor analysis of the modified child-feeding questionnaire with regard to milk feeding

| Item | Scheduling feeds | Encouraging feeds | Using milk for comfort | Perceived responsibility |
|---|------------------|-------------------|------------------------|--------------------------|
| When your baby was at home how often were you responsible for feeding her? | 0.036 | -0.106 | 0.475 | 0.575 |
| How often were you responsible for deciding how much your baby drank? | -0.042 | 0.087 | -0.142 | 0.775 |
| How concerned were you about your baby becoming over weight? | 0.555 | 0.021 | -0.137 | -0.152 |
| If I did not guide my baby's feeding she would feed too much | 0.784 | 0.108 | -0.051 | -0.042 |
| I tried to stretch out my baby's feeds so I was feeding him/her less often | 0.726 | 0.131 | -0.186 | 0.152 |
| I limited my baby's feeding | 0.739 | 0.240 | -0.062 | -0.076 |
| How concerned were you about your baby becoming under weight? | -0.154 | 0.690 | -0.128 | -0.068 |
| If my baby did not want to feed when I thought he/she should I tried to get her to feed anyway | 0.240 | 0.641 | -0.014 | 0.144 |
| I had to be especially careful to make sure my baby drank enough | 0.224 | 0.698 | -0.207 | -0.042 |
| If I did not guide or regulate my baby's intake of milk he/she would drink less than she should | 0.208 | 0.804 | -0.064 | 0.005 |
| I thought my baby should always finish the bottle or breastfeed for a certain length of time | 0.385 | 0.500 | -0.128 | 0.043 |
| I offered milk to my baby as a comfort | -0.232 | -0.088 | 0.744 | 0.198 |
| I offered milk to my baby to calm her behaviour (if she wasn't hungry) | -0.129 | -0.001 | 0.849 | 0.072 |
| % of variance | 28.877 | 9.330 | 8.714 | 6.621 |
| Cronbach's alpha | 0.72 | 0.75 | 0.77 | 0.51 |

Bold values signifies items which load highly on each factor.

Table 2 Results of the multivariate analysis of covariance showing differences in reported use of scheduling and encouraging feeds by duration of breastfeeding

| Control | Mean (SEM) | Formula | Breastfed ≤7 days | Breastfed ≥6 months | Significance |
|---------------------------------------|----------------|------------------|-------------------|---------------------|---------------------------------|
| Limit feeds (n = 496) | Factor score | 0.75*, † (0.122) | 0.45† (0.075) | -0.32 (0.053) | $F_{4,492} = 23.36, P < 0.001$ |
| | Computed score | 2.57 | 2.38 | 1.48 | |
| Encourage feeds (n = 496) | Factor score | 0.51*, † (0.122) | 0.13† (0.075) | -0.30 (0.053) | $F_{4,492} = 16.93, P < 0.001$ |
| | Computed score | 3.293 | 2.881 | 0.769 | |
| Milk for comfort (n = 496) | Factor score | -0.59† (0.112) | -0.60† (0.069) | 0.60 (0.049) | $F_{4,492} = 124.07, P < 0.001$ |
| | Computed score | 1.71 | 2.10 | 3.93 | |
| Perceived responsibility (n = 492) | Factor score | -0.29 (0.136) | 0.05 (0.084) | -0.01 (0.059) | $F_{4,492} = 2.40, P > 0.05$ |
| | Computed score | 3.95 | 4.23 | 3.92 | |

Bonferroni's test: * $P < 0.05$ compared to breastfed (BF) ≤7 days.

† $P < 0.05$ compared to BF ≥6 months.

The mean factor scores (Z-scores) and the computed scores for use of control for each group are shown. The computed scores were used for ease of comparison and are based on the mean score (as per Likert scale response 1–5) for each of the items that clustered on each factor.

Because the main aim of the present study was to examine maternal control during milk feeding, only the two behaviours of scheduling and encouraging feeds are further reported. These two variables were not significantly associated with each other (Pearson's $r = 0.014, P > 0.05$).

Breastfeeding duration and feeding style

Levels of scheduling and encouraging feeds were compared for mothers who formula fed from birth ($n = 57$),

mothers who breastfed for 7 days or less ($n = 148$) and mothers who breastfed for at least 6 months ($n = 297$). The aim was to determine whether mothers who initiated breastfeeding, even for a short duration of time, differed in their feeding style compared to mothers who formula fed from birth or mothers who breastfed for an extended period.

A multivariate analysis of covariance indicated that scheduling and encouraging feeds significantly differed according to the duration of breastfeeding (Table 2). Bonferroni's test confirmed that mothers who breast-fed

Table 3 Factor analysis of items exploring attitudes towards breastfeeding

| | Difficult | Inconvenient | Formula-fed babies more content | Health |
|---|--------------|--------------|---------------------------------|--------------|
| Breastfeeding is painful | 0.516 | 0.265 | 0.103 | |
| If you formula feed other people can feed the baby | 0.558 | | 0.138 | -0.174 |
| Lots of mums can't breastfeed | 0.771 | | | |
| Breastfeeding is difficult | 0.652 | 0.185 | | |
| You can't see how much an baby is drinking with breastfeeding | 0.605 | 0.183 | 0.294 | -0.141 |
| Lots of mums don't have enough milk | 0.732 | 0.178 | | |
| Breastfeeding is exhausting | 0.660 | 0.196 | 0.117 | |
| Breastfeeding takes too much time | 0.550 | 0.294 | 0.256 | |
| Breastfed babies do not put on enough weight | 0.551 | 0.341 | 0.156 | -0.124 |
| Breastfeeding is too much hassle | 0.352 | 0.405 | 0.152 | -0.165 |
| You have to do all the feeds if you breastfeed | | 0.638 | 0.167 | |
| You can't go back to work if you breastfeed | 0.117 | 0.693 | | -0.136 |
| You can't have a social life if you breastfeed | 0.104 | 0.731 | 0.182 | -0.126 |
| Only you can soothe the baby if you breastfeed | | 0.642 | 0.210 | |
| You are stuck in the house if you breastfeed | 0.191 | 0.515 | 0.331 | -0.218 |
| Breastfeeding is too much responsibility | 0.281 | 0.503 | 0.211 | -0.120 |
| Formula-fed babies are more content | 0.397 | 0.267 | 0.538 | -0.110 |
| Formula-fed babies sleep better | 0.300 | 0.231 | 0.698 | |
| You have more of a routine if you formula feed | 0.275 | 0.175 | 0.690 | -0.113 |
| Breastfed babies feed more often | | 0.152 | 0.527 | 0.114 |
| Breastfeeding is best for babies health | | -0.187 | | 0.771 |
| Breastfeeding is best for mothers health | -0.339 | -0.275 | | 0.636 |
| Health professionals should encourage breastfeeding | -0.151 | -0.138 | | 0.603 |
| % of variance | 34.32 | 10.37 | 5.75 | 3.49 |
| Cronbach's alpha | 0.808 | 0.576 | 0.791 | 0.826 |

Bold values signifies items which load highly on each factor.

Table 4 Factor analysis of items exploring confidence towards milk feeding

| Item | Confidence |
|--|------------|
| I felt informed in my decision on how to feed my baby | 0.619 |
| I felt I received enough advice from health professionals on how to feed my baby | 0.713 |
| I experienced a lot of problems feeding my baby | 0.598 |
| I received enough professional help with any problems I had feeding my baby | 0.744 |
| I felt confident in feeding my baby | 0.778 |
| Cronbach's alpha | 0.719 |

for 6 months or more scheduled and encouraged milk feeds significantly less frequently than formula-feeders or mothers who initiated breastfeeding but ceased within 1 week ($P < 0.001$ in both cases). Moreover, mothers who breastfed for 7 days or less reported limiting ($P < 0.05$) and encouraging ($P < 0.001$) feeds significantly less than mothers who formula fed from birth. Table 2 shows both the mean factor scores (Z -scores) and computed scores for use of control for each group. The computed scores were used for ease of comparison and are based on the mean score (as derived from the likert scale response 1–5) for each of the items that clustered

on each factor. All relationships were independent of maternal age and education and infant age.

Attitudes towards breastfeeding and maternal control

Participants responded to a series of statements regarding beliefs underlying the infant-led nature of breastfeeding. Again, exploratory factor analysis was conducted to establish factor structure (Table 3). The first four factors of the rotated component matrix explained 53.9% of the variance. The first accounted for 34.3% of the variance and was weighted on 10 items that described breastfeeding as a difficult experience. This factor was labelled 'breastfeeding as difficult'. A second factor, labelled 'breastfeeding as inconvenient', was based on viewing breastfeeding as interfering with maternal lifestyle and placing greater responsibility on the mother than formula feeding would. This factor accounted for 10.4% of the variance. Accounting for 5.8% of the variance, the factor 'formula-fed infants are more content' was produced. This described the beliefs that formula-fed infants were easier to settle and slept for longer. Finally, accounting for 3.5% of the variance, the factor 'breastfeeding as healthier' was produced. Two confirmatory factor analyses were conducted on random subsets of the data, resulting in similar factor

structures. The factors extracted from the entire sample were therefore used. Factor scores for the four dimensions were created using the regression method.

Mothers also responded to five questions with regard to their confidence about milk feeding (Table 4). An exploratory factor analysis retained only one component and therefore the solution could not be rotated. This factor explained 48.2% of the variance and contained the five items posed. Items in this factor included beliefs such as feeling informed, receiving help and whether problems were encountered. The factor was labelled as 'confidence'.

Spearman's rho correlations were used to examine the association between maternal attitudes and use of control. Maternal attitudes were associated with both scheduling and encouraging feeds (although weakly in some cases). Scheduling feeds was positively associated with believing breastfeeding to be inconvenient (Spearman's $\rho = 0.247$, $P < 0.001$) and that formula-fed infants were more content (Spearman's $\rho = 0.152$, $P < 0.01$). Encouraging feeds was associated with the beliefs that breastfeeding was difficult (Spearman's $\rho = 0.224$, $P < 0.001$) and that formula-fed infants were more content (Spearman's $\rho = 0.126$, $P < 0.05$). Moreover, maternal confidence was inversely associated with degree of encouraging feeds (Spearman's $\rho = -0.117$, $P < 0.05$). Mothers who reported lower levels of confidence in feeding their infant were significantly more likely to report encouraging feeds.

Association of infant weight with measures of control and beliefs about breastfeeding

A greater level of scheduling feeds was associated with a higher birth weight (Spearman's $\rho = 0.110$, $P < 0.001$), longer gestation (Spearman's $\rho = 0.082$, $P < 0.05$) and a greater perceived size (Spearman's $\rho = 0.313$, $P < 0.001$). By contrast, a high level of encouraging feeds was negatively associated with birth weight (Spearman's $\rho = -0.257$, $P < 0.001$) and perceived size (Spearman's $\rho = -0.421$, $P < 0.001$).

Which variables predict maternal use of control?

Both scheduling and encouraging feeds were associated with breastfeeding duration, attitudes towards breastfeeding, maternal confidence and infant weight characteristics. To establish which of these variables independently explained the greatest proportions of the variance (and as a number of correlations were weak), linear regression analysis using the enter method with either scheduling or encouraging feeds as the outcome measure was performed. For scheduling feeds, the model explained 23.7% of the variance ($F_{6,303} = 16.71$, $P < 0.001$) retaining four items (Table 5). Mothers who perceived their infants to

Table 5 Results of a multiple linear regression analysis showing the unstandardised and standardised regression coefficients for variables associated with maternal use of scheduling and encouraging feeds

| Behaviour | Variable | B | SE B | β |
|-------------------|----------------------------|--------|--------|----------|
| Scheduling feeds | Perceived size of baby | 0.345 | 0.0434 | 0.410* |
| | Breastfeeding as difficult | 0.295 | 0.052 | 0.292* |
| | Formula fed more content | 0.134 | 0.0452 | 0.133* |
| | Birth weight | 0.370 | 0.126 | 0.174** |
| Encouraging feeds | Perceived size | -0.475 | 0.043 | -0.514* |
| | Breastfeeding as difficult | 0.372 | 0.049 | 0.335* |
| | Formula fed more content | 0.187 | 0.048 | 0.168* |
| | Confidence | -0.140 | 0.049 | -0.125** |
| | Birth weight | -0.267 | 0.120 | -0.113** |

*Spearman's $\rho = <0.01$.

** <0.05 .

be larger than average had strong beliefs that breastfeeding was inconvenient and that formula-fed infants were more content, and mothers who had infants of a higher birth weight were more likely to report scheduling feeds. For encouraging feeds, the model explained 46.9% of the variance ($F_{7,291} = 37.70$, $P < 0.001$) retaining five items (Table 5). Mothers who perceived their infants to be smaller than average had strong beliefs that breastfeeding was difficult or that formula-fed infants were more content and were low in confidence, and mothers who had an infant with a lower birth weight were more likely to report encouraging feeds.

Discussion

The present study aimed to establish whether differences in maternal control of infant-feeding could be identified in the early post-partum period (between birth and 6 months), whether these were associated with breastfeeding duration, and to establish possible influences on maternal control. The results suggested that maternal behaviour patterns indicative of control are evident in early infancy when milk is the primary source of nutrition. The modified CFQ used in the context of early infant feeding confirmed the use of control strategies such as scheduling or encouraging feeds during milk feeding. High levels of reported maternal control for both these factors were related to shorter breastfeeding duration. Moreover, the level of maternal control was associated with attitudes and beliefs about the infant-led nature of breastfeeding.

The existence of a controlling maternal child-feeding style when children are 12 months or older is well documented (Birch & Fisher, 2000; Fisher & Birch, 2002; Johnson, 2000). By employing a modified version of the CFQ modified for early infant feeding, the results of the present study extended the previous literature by demonstrating that a controlling child-feeding style is

measurable in the first 6 months post-birth, before weaning occurs. The emergence of maternal control in earlier in infancy than previously shown is an important finding because several studies have suggested that, once established, parental child-feeding practices are stable (Blissett & Farrow, 2007).

Several studies have demonstrated that mothers who have breastfed their infants are less likely to use restrictive or pressurising child-feeding practices after weaning than mothers who used formula (Fisher *et al.*, 2000; Taveras *et al.*, 2004; Farrow & Blissett, 2006, 2008; Blissett & Farrow, 2007). In the present study, mothers who breastfed during the first 6 months post-partum recalled using lower levels of control during milk-feeds compared to mothers who had formula-fed from birth. Breastfeeding presents few opportunities for the mother to actively manipulate milk intake. To establish milk supply, infants need to be fed on infant demand, often in a frequent irregular pattern, and the amount of milk consumed is not visual (Daley & Hartmann, 1995; Riordan *et al.*, 2005). Thus, one explanation for why breastfeeding mothers report lower levels of controlling child-feeding practices is that they learn through experience to allow the infant to take control of feeding. However, control in women who initiated breastfeeding at birth but switched to formula-feeding by the seventh day post-partum was also examined. This group of women reported significantly lower levels of both scheduling and encouraging feeds than mothers who formula fed from birth but reported higher levels of these control factors than women who breastfed for at least 26 weeks. There are two ways in which to interpret this finding. First, perhaps even a short exposure to breastfeeding goes some way towards promoting a less controlling feeding style. However, this appears unlikely because the majority of the women ceased breastfeeding within 72 h post-partum, before the supply of breast milk had begun. Alternatively, initiation and duration of breastfeeding may be influenced by maternal attitudes towards breastfeeding and a general desire for control over feeding. If mothers view breastfeeding to be infant-led and, for whatever reason, are uncomfortable with this approach, perhaps this affects breastfeeding duration. Perhaps maternal differences or a desire for control encourage mothers to breast or formula feed (Farrow & Blissett, 2006).

In an attempt to understand how maternal control is associated with early infant feeding, attitudes about infant feeding, maternal confidence and their relationship with maternal control were examined. It was recognised that, as a result of the retrospective design of the present study, causality is impossible to determine. However, certain patterns in the findings raise speculative conclusions as to how breastfeeding duration, control, attitudes and experience may be inter-related. It is assumed with caution that

scheduling and encouraging feeds are the outcome variables. First, it appears that scheduling and encouraging feeds are two separate behaviours. No significant association was seen between the two behaviours. Moreover, a different pattern of attitudes and experiences were related to each behaviour. Encouraging feeds was associated with the belief that breastfeeding is difficult and low levels of maternal confidence. Mothers who perceived their infant to be smaller than average or whose infant was a lower birth weight were also more likely to encourage feeds. This suggests that encouraging feeds may be a reaction to anxieties that the infant is not consuming enough milk and growing well. In later childhood, mothers whose child is underweight are more likely to pressurise them to eat (Brann & Skinner, 2005). It appears that this relationship may be present during milk feeding, or indeed from birth. Breastfeeding, however, is incompatible with trying to encourage the infant to consume more milk and the amount consumed cannot easily be measured. Formula-fed infants on the other hand can be persuaded to take greater amounts of milk with amount consumed easily tracked (Wiessinger, 1998). Maternal anxieties may therefore drive both control level and breastfeeding duration.

Scheduling feeds described the behaviour of stretching out the time between feeds and feeding to a maternal led routine. It was associated with the beliefs that breastfeeding was inconvenient and that formula-fed infants were more content. It appears that mothers who desire a feeding style that is strict and predictable may therefore choose to formula feed because formula feeding allows this manipulation. Alternatively, they may attempt to breastfeed but struggle because scheduling or stretching out the time between feeds can interfere with milk supply (Daley & Hartmann, 1995). Scheduling feeds was also associated with measures of infant size. Mothers who had a larger infant at birth and perceived their infant to be larger were significantly more likely to schedule feeds. One possible explanation for this relationship is that, even at this early stage, mothers perceive their infant to be larger than average and aim to try and reduce milk intake. Alternatively, because a great deal of emphasis is placed on weight gain as a positive indicator of health in early infancy (Haslam *et al.*, 2009), another plausible explanation could be that perhaps a larger infant ignites greater confidence in a mother to be able to schedule feeds.

The associations of maternal control, infant size and breastfeeding duration are of great interest because they potentially have long-term consequences. In the immediate term, high levels of maternal control appear to be associated with a short duration of breastfeeding. However, because maternal control, once developed, has been shown to be stable, it is possible that these early patterns of feeding may have long-term consequences. In

particular, if encouraging the infant to feed (perhaps using formula milk) increases weight gain, this negative behaviour could be reinforced. A longitudinal study is needed to track the development of maternal control. Furthermore, Farrow & Blissett (2006) found that high level of control during the second 6 months post-partum had negative consequences for infant weight. Infants who were smaller at 6 months, remained small, whereas larger infants continued to gain weight more rapidly. Mothers with lower levels of control, however, had infants who balanced their weight gain, so that smaller infants gained greater amounts of weight by twelve months, whereas larger infants slowed in their weight gain. Maternal control during the first year post-partum is therefore potentially of consequence to child growth and weight.

These observed associations between maternal control and attitudes towards breastfeeding fit well with the literature examining the reasons why women choose not to breastfeed. Many studies report that mothers choose formula milk because it is viewed as more convenient and less time consuming, and that formula-fed infants are more content (Thulier & Mercer, 2009). In short, it allows mothers to track and control their infants' feeding pattern much more easily than if they were breastfeeding. Moreover, a number of studies report that even prenatally mothers hold beliefs that breastfeeding is difficult, and have concerns about the breastfed infant's feeding pattern or have high concerns about milk intake (Arora *et al.*, 2000; Scott *et al.*, 2006). It is therefore possible that maternal desire for a method of feeding that is high in control encourages women to formula feed from birth or to breastfeed for only a short duration of time. Maternal control, rather than developing as a consequence of experience of breast or formula feeding, may in fact drive breastfeeding duration.

There are a number of limitations to the present study that could be addressed in future research. First, mothers completed the modified CFQ in retrospect, recollecting the experience of feeding their only (or youngest) child from birth to 6 months. Current child-feeding practices could have influenced responses to the CFQ, or the accuracy of information recalled from memory could be questioned (Pieters *et al.*, 2006). However, first, the age of the child on the completion of the questionnaire was not associated with the responses. Second, a number of other studies recalling health behaviour over much greater periods of time have relied on retrospective reports including memories of diet as a child (Brunstrom *et al.*, 2005) and other health behaviours (Dube *et al.*, 2001; Kollins *et al.*, 2005). A prospective longitudinal study is clearly needed.

Second, although the sample was large and included a wide maternal age range and variety with respect to socioeconomic status, participants were self-selecting and

a higher proportion of participants breastfed for an extended period compared to the national average (Bolling *et al.*, 2007). However, when a sub-section of the data set was used to construct a representative sample of expected breastfeeding duration as per the Infant Feeding Survey (2007), the main effects of scheduling and encouraging feeds and breastfeeding duration remained unchanged. Data from the whole sample were therefore used. Further research should, however, target a wider population-based sample.

Third, the data would benefit from more sophisticated statistical analysis, such as structural equation modelling. This would enable the relative importance of both the direct and mediated causal pathways to be examined, thus further exploring the potential contribution of both experience of infant feeding and maternal attitudes upon the development of maternal feeding style.

Putting such limitations aside, the present study provides insight into how maternal control over child-feeding may be present earlier than has previously been considered. Maternal use of child-feeding strategies, such as scheduling and encouraging feeds, were evident before 6 months. The relationship between breastfeeding duration and feeding style may therefore largely be a consequence of maternal attitudes or anxieties surrounding the infant-led nature of breastfeeding rather than actual feeding experience. Further analysis is needed to substantiate this idea.

Conflict of interests, sources of funding and authorship

The authors declare that they have no conflicts of interest. Amy Brown is supported by a PhD Studentship from the Economic and Social Research Council, UK. All authors critically reviewed the manuscript and approved the final version submitted for publication. AB and MD developed the conception and design of the study. AB collected the data. AB and MB oversaw data analysis. AB and MD wrote the initial manuscript. AB, PR and MD reviewed manuscript content and have approved final version submitted for publication.

References

- Arora, S., McJunkin, C., Wehrer, J. & Kuhn, P. (2000) Major factors influencing breastfeeding rates: mother's perception of fathers attitude and milk supply. *Pediatrics* **106**, 67–72.
- Birch, L. & Fisher, J. (2000) Mothers' child – feeding practices influences daughters eating and weight. *Am. J. Clin. Nutr.* **71**, 1054–1061.
- Birch, L.L., Fisher, J.O., Grimm-Thomas, K., Markey, C.N., Sawyer, R. & Johnson, S.L. (2001) Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of paren-

- tal attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite* **36**, 201–210.
- Blissett, J. & Farrow, C. (2007) Predictors of maternal control of feeding at 1 and 2 years of age. *Int. J. Obes.* **31**, 1520–1526.
- Bolling, K, Grant, C, Hamlyn, B & Thornton, A. (2007) *Infant Feeding Survey 2005*. London: The Information Centre.
- Brann, L.S. & Skinner, J.D. (2005) More controlling child-feeding practices are found among parents of boys with an average body mass index compared with parents of boys with a high body mass index. *J. Am. Diet. Assoc.* **105**, 1411–1416.
- Brunstrom, J., Mitchell, G. & Baguley, T. (2005) Potential early life predictors of dietary behaviour in adulthood: a retrospective study. *Int. J. Obes.* **29**, 463–474.
- Daley, S.E. & Hartmann, P.E. (1995) Infant demand and milk supply. Part 1: infant demand and milk production in lactating women. *J. Hum. Lact.* **11**, 21–26.
- Dewey, K. & Lonnerdal, B. (1986) Infant self-regulation of breast milk intake. *Acta Paediatrica* **75**, 893–898.
- Dewey, K., Heinig, M., Nommsen, L. & Lonnerdal, B. (1991) Adequacy of energy intake among breast fed infants in the DARLING study: relationships to growth velocity, morbidity and activity level. Research on Lactation, Infant Nutrition and Growth. *J. Pediatr.* **199**, 538–547.
- Dube, S., Anda, R., Felitti, V., Croft, J., Edwards, V. & Giles, W. (2001). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults – the adverse childhood experiences (ACE) study. *Am. J. Prev. Med.* **14**, 245–258.
- Dykes, F., Moran, V.H., Burt, S. & Edwards, J. (2003) Adolescent mothers and breastfeeding. Experiences and support needs – An exploratory study. *J. Hum. Lact.* **19**, 391–401.
- Farrow, C. & Blissett, J. (2006) Does maternal control during feeding moderate early weight gain? *Pediatrics* **118**, 293–298.
- Farrow, C. & Blissett, J. (2008) Controlling feeding practices: cause or consequence of early child weight? *Pediatrics* **121**, e164–e169.
- Fisher, J. & Birch, L. (2002) Eating in the absence of hunger and overweight in girls from 5 to 7 years of age. *Am. J. Clin. Nutr.* **76**, 226–231.
- Fisher, J., Birch, L., Smiciklas – Wright, H. & Piccano, M. (2000) Breastfeeding through the first year predicts maternal control in feeding and subsequent toddler energy intakes. *J. Am. Diet. Assoc.* **100**, 641–646.
- Galloway, A., Lee, Y. & Birch, L. (2003) Predictors and consequences of food neophobia and pickiness in young girls. *J. Am. Diet. Assoc.* **103**, 692–698.
- Gatrell, C.J. (2007) Secrets and lies: breastfeeding and professional paid work. *Soc. Sci. Med.* **65**, 393–404.
- Haslam, D., Sattar, N. & Lean, M. (2009) Obesity – time to wake up. *BMJ* **333**, 640–642.
- Ingram, J., Johnson, D. & Greenwood, R. (2002) Breastfeeding in Bristol: teaching good positioning, and support from fathers and families. *Midwifery* **18**, 87–101.
- Johnson, S. (2000) Improving preschoolers self regulation of energy intake. *Paediatrics* **106**, 1429–1435.
- Kollins, S.H., McClernon, J.F. & Fuemmeler, B.F. (2005) Association between smoking and attention-deficit/hyperactivity disorder symptoms in a population-based sample of young adults. *Arch. Gen. Psychiatry* **62**, 1142–1147.
- Lee, Y., Mitchell, D., Smiciklas – Wright, H. & Birch, L. (2001) Diet quality, nutrient intake, weight status and feeding environment of girls meeting or exceeding recommendations for total dietary fat of the American Academy of Paediatrics. *Paediatrics* **107**, e95.
- Li, R., Fein, S.B., Chen, J. & Grummer-Strawn, L.M. (2008) Why mothers stop breastfeeding: mothers' self reported reasons for stopping during the first year. *Pediatrics* **122**, 69–76.
- McFadden, A. & Toole, G. (2006) Exploring womens views of breast feeding: a focus group study within an area with high levels of socio-economic deprivation. *Matern. Child Nutr.* **2**, 156–168.
- NS – SEC. (2005) Office of National Statistics 2005.
- Pieters, R., Baumgartner, H. & Bagozzi, R. (2006) Biased memory for prior decision making: evidence from a longitudinal field study. *Organ. Behav. Hum. Dec. Proc.* **99**, 34–48.
- Riordan, J., Gill – Hopple, K. & Angeron, J. (2005) Indicators of effective breastfeeding and estimates of breast milk intake. *J. Hum. Lact.* **21**, 406–412.
- Scott, J.A., Binns, C.W., Oddy, W.H. & Graham, K.I. (2006) Predictors of breastfeeding duration: evidence from a cohort study. *Pediatrics* **117**, 646–655.
- Tabachnik, B.G. & Fidell, L.S. (2006) *Using Multivariate Statistics*, 5th edn. Harlow: Pearson Education 2006.
- Taveras, E., Scanlon, K., Birch, L., Rifas-Shiman, S., Rich-Edwards, J. & Gillman, M. (2004) Association of breastfeeding with maternal control of infant feeding at age 1 year. *Paediatrics* **114**, 577–583.
- Thulier, D. & Mercer, J. (2009) Variables associated with breastfeeding duration. *J. Obstet. Gynecol. Neonatal Nurs.* **38**, 259–268.
- Ventura, A.K. & Birch, L.L. (2008) Does parenting affect children's eating and weight status? *Int. J. Behav. Nutr. Phys. Act.* **5**, e15.
- Wießinger, D. (1998) A breastfeeding tool using a sandwich analogy for latch on. *J. Hum. Lact.* **14**, 51–56.
- World Health Organization. (1992) *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*. Geneva: World Health Organization.
- Wright, C.M. & Weaver, L. (2007) Image or reality: why do infant size and growth matter to parents? *Arch. Dis. Child.* **92**, 98–100.
- Wright, P., Fawcett, J. & Crow, R. (1980) The development of differences in the feeding behaviour of bottle and breast fed human infants from birth to two months. *Behav. Process.* **5**, 1–20.

Appendix 1 Adapted child-feeding questionnaire

| Child-feeding questionnaire (CFQ) factor | CFQ question | Adapted question and/or additional questions | Response options |
|--|---|---|---|
| Perceived responsibility | When your child is at home how often are you responsible for feeding her? How often are you responsible for deciding what your child's portion sizes are? | When your baby was at home how often you were responsible for feeding her? How often you were responsible for deciding how much your baby drank? | 1. Never 2. Seldom 3. Half of the time 4. Most of the time 5. Always |
| Concern about child weight | How concerned are you about your child being over weight? | How concerned were you about your baby becoming over weight? How concerned were you about your baby becoming under weight? | 1. Unconcerned 2. A little concerned 3. Concerned 4. Fairly concerned 5. Very concerned |
| Monitoring | How much do you keep track of the food your child eats (three questions in original cfq targeting sweet, snack and high fat food) | I kept track of the amount my baby drank I thought my baby should always finish the bottle or breastfeed for a certain length of time I let my baby take control of how much milk he/she drank | 1. Disagree 2. Slightly disagree 3. Neutral 4. Slightly agree 5. Agree |
| Reward (subset of restriction) | I offer sweets to my child as a reward for good behaviour | I offered milk to my baby as a comfort I offered milk to my baby to calm her behaviour (if she wasn't hungry) | 1. Disagree 2. Slightly disagree 3. Neutral 4. Slightly agree 5. Agree |
| Restriction | If I did not guide or regulate my child's eating she would eat too much (junk food or favourite food) I have to be sure that my child does not eat too much (sweets, high fat or favourite foods) | If I did not guide my baby's feeding she would feed too much I limited my baby's feeding I tried to stretch out my baby's feeds so I was feeding him/her less often I fed my baby whenever he/she wanted feeding (reverse scored) | 1. Disagree 2. Slightly disagree 3. Neutral 4. Slightly agree 5. Agree |
| Pressure to eat | I have to be especially careful my child eats enough If my child says 'I'm not hungry I try to get her to eat anyway' If I did not guide or regulate my child's eating she would eat less than she should | I had to be especially careful to make sure my baby drank enough If my baby did not want to feed when I thought he/she should I tried to get her to feed anyway If I did not guide or regulate my baby's intake of milk he/she would drink less than she should | 1. Disagree 2. Slightly disagree 3. Neutral 4. Slightly agree 5. Agree |