Appetite 108 (2017) 74–82

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Looking for cues – infant communication of hunger and satiation during milk feeding

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ARTICLE INFO

Article history:
Received 18 April 2016
Received in revised form
8 September 2016
Accepted 16 September 2016
Available online 17 September 2016

Keywords:
Breastfeeding
Formula feeding
Responsive feeding
Obesity hunger
Satiety
Mealtime interactions

ABSTRACT

It is known that duration of breastfeeding and responsive feeding are associated with decreased risk of obesity. It is however, not clear whether breastfed infants signal more to mothers to facilitate responsive feeding, compared to formula fed, nor what communication cues are important during the feeding interaction. The present study aimed to explore feeding cues in milk-fed infants and to examine if such cues vary by mode of feeding. Twenty-seven mothers and infants were filmed while breastfeeding or formula feeding. Infants' age ranged from 3 to 22 weeks. Feeding cues were identified using a validated list of communication cues (NCAST). The frequency of each cue during the beginning, middle, and end of the meal was recorded. There were 22 feeding cues identified during the feeds, with significantly more frequent disengagement cues expressed than engagement cues. Significantly more frequent feeding cues were observed at the beginning than at the end of the meal showing that cue frequency changes with satiation. Breastfeeding infants exhibited more engagement and disengagement cues than formula fed infants. Supporting mothers to identify engagement and disengagement cues during a milk feed may promote more responsive feeding-strategies that can be acquired by mothers using different modes of feeding.

1. Introduction

The World Health Organization (WHO) suggests that mothers should breastfeed exclusively for the first six months of life, to continue to breastfeed beyond this time and to introduce appropriate complementary feeding (WHO, 2002). Breastfeeding confers many benefits to mother and baby, from improved gut microbiota and immune function in infants (Fisk et al., 2011; Chong, 2015) to protection from development of overweight and obesity in baby and mothers (Grube, Von Der Lippe, Schlaud, & Brettschneider, 2015; Weng, Redsell, Swift, Yang, & Glalazebrook, 2012). Explanations for the beneficial effects of breastfeeding against developing overweight can be grouped into biological or behavioural accounts. Among biological account, metabolic differences attributed to the different protein content of milks (Horta, Gigante, Lima, Barros, & Victora, 2013) indicates that insulin response and adipose tissue deposition could be lower in breastfed relative to formula-fed infants. Similarly, the hormone content of breastmilk may facilitate energy regulation and reduce fat deposition in breastfed babies (Savino, Liguori, Sorrenti, Fissore, & Oggero, 2011). Behavioural explanations focus on the ability of breastfed babies to recognise satiety (Dietz, 2001) and to self-regulate on the basis of greater satiety responsiveness (Li, Fein, & Grummer-Strawn, 2010; Ong, Emmett, Noble, Ness, & Dunger, 2006). These behavioural explanations are partly related to the control of the feed resting with the infant rather than the mother. Since breastfed babies can determine when, how long and how much is consumed during a feed they may be better placed to communicate satiety cues to their mothers, who may in turn be receptive to these cues.

Thus, Singhal et al. (2010) suggest that appetite entrainment differs between breastfed and formula-fed babies because of differences in the locus of control in the feed. That is, breastfed babies have more control over the feed than formula-fed babies. It is suggested that self-regulation may be facilitated more by breastfeeding compared to formula feeding. Brown and Lee (2011) explored maternal control in a sample of ~500 mothers who either breastfed or formula-fed their babies using a modified version of the Child Feeding Questionnaire (CFQ; Birch et al., 2001).

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http://dx.doi.org/10.1016/j.appet.2016.09.020
0195-6663/

Mothers who breastfed for at least 6 months reported less controlling feeding behaviours, as measured by "lower levels of feeding according to a schedule" compared to mothers who formula-fed. In a later study, breastfeeding was associated with a less controlling feeding style in a sample of 390 mothers and infants aged 0–6 months (Brown and Lee, 2012). Similarly, Blissett and Farrow (2007) found that duration of breastfeeding during the first year of life was related to controlling feeding practices, with lower duration predicting higher control. Furthermore, parental control recorded at 1 year was stable at 2 years suggesting the durability of parental control. In summary, mode of feeding might direct children's eating more towards external factors (likely controlled by the mother e.g. time of feeding, volume of feed) or more towards internal factors (experienced by the child such as internal cues of hunger and satiety). Thus, breastfed babies, who are assumed to have more control of the meal, are predicted to eat more in response to internal signals such as hunger and less to external factors such as time or volume offered.

Caregivers who recognise and respond to their babies' behavioural cues are said to be responsive feeders (Hurley, Cross, & Hughes, 2011) and this is seen in both breast and formula feeding. Responsive feeding reflects communication between an infant and its mother. The infant communicates hunger, appetite and satiation and in turn the mother makes an appropriate response. Responsive feeding has the following elements: (1) Identification of the feeding cue; (2) Interpretation of the cue e.g. deciding what the cue means such as hunger or satiety and (3) Responding to this by either continuing to offer food or pausing/stopping (Black and Aboud, 2011; Engle, Bentley, & Pelto, 2000). To feed responsively the caregiver must first identify the feeding cues which are communicated by the infant and decide if these indicate hunger or satiation. In early life, when infants are only milk fed, such feeding cues are addressed as drinking cues. . Research by McNally et al. (2015) noted that parents struggle to interpret drinking cues. This is especially the case when the baby is very young. Thus, in order for parents to feed in a responsive way it is necessary to identify and respond to these cues from a very young age.

Assuming that infants are able to self-regulate and communicate hunger, appetite and satiation during a feed (Li, Scanlon, May, Rose, & Birch, 2014; Oddy, 2012), then unresponsive feeding at any one of these three stages could result in under- or over-feeding, and hence in the long term, underweight or overweight infants.

In support of this contention, Worobey, Lopez, and Hoffman (2009) noted that mothers' lower sensitivity to infant's feeding cues at 6 months was positively associated with infants' higher weight gain at 12 months. Brown and Lee (2011) demonstrated that lower levels of responsiveness to a child's needs were positively associated with higher child weight gain at the age of 2 years. In older children, such behaviours were also positively associated with higher body weight (Hurley et al., 2011; Ventura and Birch, 2008). Finally, a recent systematic review suggested that less responsive and more uninvolved parenting styles are linked to a higher child weight between 4 and 12 years (Shloim, Edelson, Martin, & Hetherington, 2015).

Responsive feeding is influenced by both maternal and infant characteristics (McNally et al., 2015). Gross et al. (2010) observed that obese mothers who breastfed for longer than other obese mothers, perceived hand sucking as a hunger cue and were therefore more aware of their infant's engagement cues. Overfeeding possibly results from missed cues, using feeding to soothe and/or responding to difficult temperaments (Stifter, Anzman-Frasca, Birch, & Voegtline, 2011). Whatever the underlying reason for this, unresponsive feeding is associated with heavier infants (Disantis et al., 2013). As caregiver and child are mutually influencing each other over time during a feed, through the consistency, meaning and appropriate interpretation of each other's behaviours, the study of responsive feeding might benefit from investigating different influences (e.g. infant's gender, maternal socio-economic status), longitudinally, and systematically (e.g. filmed observations) so that communication dynamics can be recorded and then coded.

Disantis, Hodges, Johnson, and Fisher (2011) noted that research exploring responsive feeding has tended to focus on pre-school children (Birch et al., 2001; Hughes, Power, Fisher, Mueller, & Nicklas, 2005; Hurley et al., 2011) and less on infancy. However, it is in infancy that these important meal interactions begin and therefore should be observed and understood.

Therefore, the present study examined infant communication cues during milk feeding. A feed was filmed, and the cues that were displayed by infants were systematically recorded. In particular, cues which indicated interest in eating, approach behaviours and hunger were clustered within a category "engagement". Cues which indicated disinterest in eating, avoidance behaviours and fullness were clustered within a category "disengagement". The assumption was made that engagement during a meal reflects the underlying state of hunger, and that disengagement cues reflect the onset of satiation and satiety. Since self-regulation of milk intake by infants varies by mode of feeding (Li et al., 2010), it was hypothesized that frequency of engagement and disengagement feeding cues would vary with mode of feeding. It was also hypothesized that engagement cues would be observed more frequently early in the meal and disengagement cues would be seen more frequently at the end of a meal.

2. Methods

2.1. Participants

156 women in Israel (N = 67) and the United Kingdom (N = 89) took part in a study examining eating behaviours during pregnancy (Shloim, Rudolf, Feltbower & Hetherington, 2014). Of this number, 73 women participated in the follow-up study [N = 42; from Israel (59%); N = 31; from the UK (41%)] exploring eating behaviours and infant feeding choices until two years postpartum (Shloim et al., 2014). From those who agreed to the follow-up study, 41 women agreed to take part in an in-depth study characterising mother-infant mealtime interactions (Shloim, Hetherington, Rudolf & Feltbower, 2015). Thus, the present study was a secondary analysis of existing data.

2.2. Procedure

The researcher (NS) contacted the participants and agreed on a time to arrive at the mothers' homes to film a meal interaction. Mothers were asked to feed their infants "as normal" as possible and to ignore the presence of the researcher (see Shloim, Hetherington, et al., 2015 for more detail). In the first follow-up (2–6 months postpartum), a total of 41 films were recorded in which mothers breastfed (N = 13; 32%), formula fed (N = 14; 34%) or provided solids (e.g. purees N = 14; 34%). As the purpose of the current study was to explore communication cues during milk feeding only, films where mothers offered solids were not included in the present analysis. Breastfeeding was defined as feeding directly from the breast compared to formula feeding which was defined as feeding from a bottle. None of the mothers bottle-fed breast milk for this meal. Starting time of a feed was defined for breastfeeding as the time the nipple reached the mouth. For formula feeding, the time the bottle entered the mouth was defined as the beginning of the feed.