

## **“An invisible map” - maternal perceptions of hunger, satiation and ‘enough’ in the context of baby led and traditional complementary feeding practices.**

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### **Abstract**

Mothers’ responsiveness to hunger and fullness cues has been implicated in the development of infant overweight, and baby led weaning (BLW) is argued to be one way to protect against overfeeding. Whilst studies have examined maternal perceptions of hunger, fullness and adequate intake to some degree in traditional weaning (TW) contexts, less is known about this in BLW. This study therefore aimed to understand and compare maternal perceptions of cues and intake in BLW and TW. Eleven mothers of infants (7-24m) participated in semi-structured interviews based on discussions of short videos featuring participants feeding their infants. Interviews were read and transcribed in full. Data were selected for coding which addressed mothers’ perceptions of infant hunger, fullness and sufficient consumption and subsequently subjected to template analysis. A sample of data was coded to produce an initial template which was applied to all interviews and revised in an iterative process to produce a final template for interpreting findings. Mothers in the study were adept at recognising fullness cues and gauging feeding state. Both groups perceived similar hunger cues although TW mothers reported a wider range of fullness cues. Both groups used numerous strategies for judging the adequacy of their babies’ intake. These included the use of infant cues, however perceived adequacy of intake was also influenced by factors such as infant tiredness and maternal worries about over and under-eating. Findings have implications for the development of responsive feeding interventions while also highlighting the utility of video elicited interviews for understanding feeding interactions.

### **Key words**

Weaning, complementary feeding, baby-led, feeding cues.

## 1

### Introduction

Responsive feeding incorporates the notion of prompt, predictable and appropriate responses to an infant while limiting controlling or intrusive behaviours (Ainsworth, 1989). Responsive feeding therefore requires mothers to both recognise and respond appropriately to infant feeding cues. Importantly, there is evidence that responsiveness during the complementary feeding (CF) period, when solid feeds are introduced, promotes positive feeding interactions and the development of healthy eating habits (Harbron & Booley, 2013). Furthermore, low responsiveness, particularly to fullness cues, appears to be a risk factor for infant overweight (de Lauzon-Guillain et al., 2012; Hurley, Cross, & Hughes, 2011).

It has been proposed that mothers using baby led weaning (BLW), (the use of whole foods and infant self-feeding from the outset of CF) feed more responsively, and exert less feeding control than those using traditional weaning (TW) (Brown, Jones & Rowan, 2017; Brown & Lee, 2011a). However, we know little about BLW mothers' perceptions of their feeding interactions and their infants' cues. Moreover, the question of how, and whether, such perceptions differ from those of TW mothers has not been investigated.

There is evidence that TW mothers can identify a range of feeding cues in infants of different ages (Hodges et al., 2008; Skinner et al., 1998). However, the interpretation of cues is not straight forward, with both infant characteristics (birthweight, temperament and sex) and maternal characteristics (body mass index, educational level and breast or formula feeding status) affecting maternal perceptions and responses (Gross et al., 2010; Shloim, Rudolf, Feltbower, & Hetherington, 2014, McNally et al., 2016). Despite this, relatively little is known about *how* mothers make sense of feeding cues and determine their responses to these. Price et al. (2012) analysed telephone discussions concerning obesity prevention between health professionals and 60 TW mothers of infants aged 0-6 months. Mothers reported two challenges to interpreting infant feeding state: contradictions between expected and observed behaviour (infants still appearing hungry after being fed) and the short duration of some breastfeeds which led some mothers to view these as inadequate and to offer additional formula feeds. Participants also reported the use of night feeds in the absence of infant hunger, to settle babies, especially when mothers were fatigued.

Bentley, Gavin, Black and Tedi (1999) also explored feeding practices and beliefs in interviews with 19 TW African American mothers aged 13-20 with infants between 0 and 24 months. Decisions about

early CF were found to be influenced by beliefs about hunger: small babies were perceived as needing to be 'fed up' while others were viewed as 'greedy' and 'needing' more food. Participants also reported that they viewed crying and night time waking as hunger cues. Meanwhile, the age of mothers in this study also shaped feeding responses, as mothers invariably relied on older generations for feeding advice. Thus, responses to perceived hunger were shaped by the high value placed on satiation, the need to keep infants settled, and inter-generational understandings of infant hunger and satiation.

Alongside studies examining perceptions of feeding cues in TW, three studies have explored how mothers decide what is *enough* food for their children. Johnson, Goodell, Williams, Power and Hughes (2015) interviewed 30 low income mothers of pre-school children preparing typical meals for their child in a laboratory setting to determine how they decided how much food to offer. Mothers reported their assessments of enough were shaped by the need to prevent children from becoming hungry again shortly after eating. They also reported that what was seen as 'enough' was influenced by whether children were perceived as 'good' or 'picky' eaters. For 'good eaters' judgements of enough were shaped by other eating that day and nutritional balance. For 'picky eaters', however, 'enough' was determined by what mothers believed their child would accept.

Interviews with 19 male and female mixed income caregivers of children aged between one and five years by Jacquier, Gatrell and Bingley (2016) similarly found that caregivers' anticipation of what children *would* eat, influenced the amount provided. Meanwhile, Spence, Hesketh, Crawford and Campbell's (2016) interviews with 26 mothers of two-year olds found that perceived 'poor' eating and child age (younger rather than older) caused concern about the sufficiency of intake thereby leading mothers to encourage greater intake.

Overall, evidence suggests that mothers and caregivers' interpretation of cues, feeding responses and perceptions of what is 'enough' are shaped by beliefs, experience, and child characteristics. However, findings to date regarding parental judgments of enough are limited to older children rather than infants, while those regarding perceptions of feeding cues have emerged from studies with largely low-income mothers and in TW, (rather than BLW) contexts. Therefore, it is unclear if such findings apply to different demographic groups or across different CF practices.

While no studies so far have examined perceptions of hunger, satiation and enough in the specific context of BLW, there is preliminary evidence from two self-report studies of different feeding responses (lower levels of maternal restriction and pressure to eat) in BLW compared with TW mothers (Brown, & Lee, 2011a; Brown & Lee 2015). Reasons for these findings are unclear: BLW mothers may be more attuned to their infants' signals or more disposed to following these than TW mothers. Alternatively, or additionally, BLW may be a more responsive approach because of the greater infant control it affords (Brown, Jones, & Rowan, 2017). If so, this raises questions as to how BLW mothers determine how much to offer, when to end meals and what is adequate intake. While a central tenet of BLW is trusting infant intake, higher prevalences of both underweight and overweight have been reported in BLW children (Townsend & Pitchford, 2012). Furthermore, BLW mothers have reported adapting their feeding approach where concerns about intake arise (Arden & Abbott, 2015) though little is known about factors influencing such adaptations. How BLW mothers interpret and act on their infants' satiation cues, and how this differs from TW mothers therefore merits attention. Developing knowledge in this area would enhance our understanding of current CF practices and, how mothers manage these. It may also have implications for professionals tasked with encouraging responsive feeding and may inform the development of feeding guidance and interventions. The aim of this study was therefore to understand how mothers using different feeding practices (BLW and TW) perceive, understand and respond to their infants' feeding cues. Furthermore, as previous investigations of maternal perceptions of feeding cues have largely been conducted distally from the interactions to which they apply, the current study specifically aimed to examine the dynamic 'online' assessments made by mothers during feeding, via their reflections on their infants' and their own behaviour during video recordings of TW and BLW interactions.

## **2**

### **Methods**

#### **2.1**

##### **Ethics**

Ethical approval for the study was given by the University of Leeds School of Psychology Research Ethics Committee reference number: 14-0116; date approved: 16-Jun-2014. Participants received information about the study and completed consent forms following discussions with the lead researcher.

## 2.2

### Participants

Mothers were eligible to take part if they had participated in a previous observational study of infant feeding cues (McNally et al., 2018). (Fathers had been invited to participate in this study, but only mothers were successfully recruited). Twenty mothers from the North of England were invited by email to participate in an interview study of CF choices and decisions made during infant feeding. Eleven mothers consented; five reported using BLW and six reported using TW. One of the BLW mothers reported some use of spoon feeding for example, to feed yoghurt. The remaining four BLW mothers reported using only independent feeding or use of loaded spoons for infants to self-feed. Of the TW mothers, one had commenced feeding using BLW but had abandoned it and adopted TW a few weeks into CF. The characteristics of BLW and TW mothers are shown in Table 1.

Participants received a £10 voucher for participation. Mean participant age was 33 years (SD 2.9) and mean infant age was 14.8 months (SD 3.8). Nine mothers had an undergraduate degree or higher. Mean age at which infants were introduced to solids was 23.4 weeks (SD 2.0). Four mothers (two from each group) were still breastfeeding at the time of the study. Mean breastfeeding duration was 29.4 weeks (SD 16.9). All others were from a white UK background.

	<b>BLW (n=5)</b>	<b>TW (n=6)</b>
<b>Mean maternal age (years)</b>	31.8 (SD 1.8)	34 (SD 3.4)
<b>Mean infant age (months)</b>	12.4 (SD 3.8)	16.8 (SD 2.6)
<b>Primiparous</b>	100%	50%
<b>Multiparous</b>	0%	50%
<b>Breastfeeding duration at interview (weeks)</b>	29.8 (SD 14.1)	29.1 (SD 0.3)
<b>Infant age at CF (weeks)</b>	22.8 (SD 2.0)	22.0 (SD 2.5)
<b>Educational level (degree equivalent or higher)</b>	80%	83%

**Table 1 – Maternal characteristics of participants (n=11) by feeding method**

## 2.3

### Data collection

Data were collected through video-elicited semi-structured interviews, in which the researcher and participant viewed and discussed a video of the mother feeding her infant a solid food meal at home. Videos had been filmed as part of a previous observational study of infant feeding cues (McNally et al., 2019). Mean video length was approximately 17 minutes and interviews took place an average of 13 weeks after filming. Mean interview length was approximately 52 minutes, equating to an average of 15 pages of interview transcripts per interviewee. Ten participants were interviewed in their own home and one was interviewed outside the home. Videos were paused at regular intervals and mothers were asked:

1. How they determined whether their baby was hungry or full
2. How they decided what was enough
3. How they decided when to end the meal.

Data were analysed using template analysis, a form of thematic analysis compatible with different ontologies and epistemologies. Our position was that of critical realism, which claims the independent existence of phenomena (such as feeding cues, maternal perceptions) and that our ability to know these is imperfect, but nonetheless capable of generating new knowledge. Template analysis was considered particularly suitable for the current study as it facilitates the comparison of data across groups (Waring and Wainwright, 2008). The method prioritises the early development of a coding template (based on a subset of data), to then guide, and be further developed by, application to the remainder of the dataset. Template format is flexible, and supports the hierarchical organisation of analytic outcomes, with similar codes drawn together to produce higher-order codes (Braun and Clarke, 2006; King, 2004).

The analysis progressed in stages. In stage one, a subset of interviews was randomly sampled (three BLW and three TW). These were read and re-read for familiarisation purposes. Consistent with the chosen methodology, data were first selected for further coding where these addressed the central interview questions. Selected data were then coded from the sample transcripts to develop a stage 1 template reflecting themes and sub-themes in participants' responses. The stage 1 template was then applied to all 11 interviews in a second

stage of coding. At this stage, interviews were scrutinised for the presence or absence of stage one themes and sub-themes and themes were refined, or new themes added, when new data were encountered or where codes could not easily be applied. This process of refinement and development gave rise to a stage two template. The analysis was repeated for the entire data set for a further two cycles using the stage two template; additions and revisions were made to the template at each stage. Coding and template development stopped after the initial template had been applied to the full data set three times; at this point no further significant themes or subthemes could be identified in the data.

## 2.4

### Template testing

Two interviews (one BLW interview and one TW) were randomly selected and coded by a second researcher using the final template. Cohen's Kappa indicated moderate agreement between coders,  $\kappa = .43$  (95% CI, .41 to .45),  $p < .001$  (Landis & Koch, 1997) for the coding of text relating to infant food choices.

## 3

### Results

#### 3.1

##### Reporting of feeding cues

The analytic plan for the study (template analysis) was pre-specified and themes and numbers of participants to which these apply are identified in (Tables 2 and 3). BLW and TW mothers reported noticing many similar hunger and satiation cues. Differences were observed, however, in the range of satiation cues reported by the two groups, with TW mothers reporting a wider and more extensive range of these than BLW mothers.

<b>Mothers using BLW (n = 5)</b>	<b>Mothers using TW (n = 6)</b>
Eagerness to eat	Eagerness to eat
Rapid eating	Rapid eating
Vocalisation	Vocalisation
Fractiousness/tantrum	Fractiousness/tantrum
Infant goes to get food him/herself	Infant goes to get food him/herself
Infant settled with food/absorbed in eating	Infant absorbed in eating
Continued eating	Tries to get into highchair
Agitation - food has run out	Will eat dessert if still hungry after main
Infant says “Yum yum”	Infant grabs the bowl
Infant tries to latch on	Needs night feeds/ more day time breastfeeds

**Table 2 – Hunger cues reported by BLW and TW mothers**

<b>Mothers using BLW (n = 5)</b>	<b>Mothers using TW (n = 6)</b>	
Drops/throws food	Drops/throws food	Fidgets, doesn't want to stay put
Stops eating	Stops eating	Back arching
Messes about with plate or food	Messes about with plate or food	Climbs out of high chair
Gives food	Gives food	Spits food out
Agitation/fussiness	Agitation/fussiness	Refuses food/closes mouth
Boredom	Boredom	Shakes head/turns away
Infant says 'all done'	Says 'all done'	Pushes food away
Not 'interested'	Not 'interested'	Feeding becomes a struggle
Slowed eating	Slowed eating	Will not even eat liked foods
Decreased intake	Decreased intake	Kicks self away from table
Infant doesn't seek food out	Infant doesn't seek food out	
Stops part way though eating	Stops part way though eating	

**Table 3 – Satiating Cues reported by BLW and TW mothers**



## 3.2

### Template themes

Three main themes were generated to capture maternal perceptions of infant hunger and satiation and how mothers determined when to end the meal. These were: ‘deciphering’, ‘enough’ and ‘strategies’, each with a number of sub-themes (Table 4). The majority of themes and sub-themes were shared, though some differences were observed between groups for both.

Mothers using BLW (n = 5)	Mothers using TW (n = 6)
<p><b>1. Deciphering (4)</b></p> <ul style="list-style-type: none"> <li>- Difficulty and guesswork (3)</li> <li>- Infant attributes – age, temperament, appetite (2)</li> <li>- Food preferences (1)</li> <li>- Continued eating (3)</li> <li>- Infant state – boredom (2)</li> <li>- Ambiguity/ need for certainty (1)</li> </ul>	<p><b>1. Deciphering (5)</b></p> <ul style="list-style-type: none"> <li>- Difficulty and guesswork (5)</li> <li>- Infant attributes – age (2)</li> <li>- Food preferences (1)</li> <li>- Continued eating (1)</li> <li>- Infant state – boredom/tiredness/ hunger (3)</li> <li>- Ambiguity/need for certainty (1)</li> </ul>
<p><b>2. Enough (3)</b></p> <ul style="list-style-type: none"> <li>- Offering enough (3)</li> <li>- Enough as sufficient (1)</li> <li>- Enough as not too much (2)</li> <li>- Infant decides enough (2)</li> <li>- Enough from a distance (1)</li> </ul>	<p><b>2. Enough (6)</b></p> <ul style="list-style-type: none"> <li>- Enough as sufficient (6)</li> <li>- Enough as not too much (1)</li> <li>- Infant decides enough (2)</li> <li>- Enough from a distance (3)</li> </ul>
<p><b>3. Strategies (5)</b></p> <ul style="list-style-type: none"> <li>- Gauging enough (5) <ul style="list-style-type: none"> <li>- Infant reading (3)</li> <li>- Time and routine (3)</li> </ul> </li> <li>- Overview (4)</li> <li>- Portions and measures (2)</li> <li>- Ensuring enough (1)</li> </ul>	<p><b>3. Strategies (6)</b></p> <ul style="list-style-type: none"> <li>- Gauging enough (5) <ul style="list-style-type: none"> <li>- Infant reading (2)</li> <li>- Time and routine (4)</li> </ul> </li> <li>- Portions and measures (3)</li> <li>- Ensuring enough (4)</li> </ul>

**Table 4 – Final Template – Themes and sub-themes for how mothers identify hunger, satiation and enough in TW and BLW and numbers of participants contributing to each theme (in brackets)**

### 3.2.1

#### Theme 1 Deciphering

Mothers from both groups reported numerous feeding cues exhibited by their infants as well as some difficulty in interpreting both hunger and satiation: *“It’s all guesswork”* (Katie, BLW); *“It’s just guesswork [...] I can’t ask him how hungry he is”* (Maggie, TW); *“I think you guess more at that age*

[...] *it wasn't an exact science*" (Christina, TW). This point reflected a common experience for both BLW and TW mothers, i.e. the specific difficulty of interpreting younger infants' cues: *"You always had to look a little bit harder I think to get her signals"* (Katie, BLW); *"At the time he couldn't (communicate hunger clearly). Well if he could, he was doing it very invisibly"* (Christina, TW); *"Early it was quite difficult to know if they were full or not"* (Emily, TW). In contrast, two mothers reported finding it easier to understand cues as their babies got older. This arose partly from mothers' developing familiarity with their infant, *"And then you just get to know what they're wanting"* (Keira, TW) and because of their developing communication skills: *"It's probably become a bit clearer now that he'll eat and then he'll say I'm done"* (Maggie, TW).

While infant age featured in several accounts, other infant characteristics influenced the clarity of cues and ease in interpreting these. Individual eating or temperament traits appeared in the accounts of two BLW mothers. One participant found her baby's hunger hard to gauge because she showed little interest in eating: *"I'm constantly trying to tell myself she'll eat if she's hungry"* (Rebecca, BLW) while another encountered difficulty in gauging her daughter's satiation because of the baby's avid appetite: *"Because she loves it so much, (she) would quite happily just eat until she pops"* (Katie, BLW). In both cases mothers were attuned to their individual babies' eating traits, though working with these presented challenges. While expert advice suggests that babies will express hunger through appetite, such examples demonstrate that in mothers' experience, infants may not follow the "rules" and that appetite regulation may not be obvious or equally apparent in all infants. Meanwhile, Katie identified her daughter's perceived placidity as a younger baby meant there were few cues from which to be 'baby led' so she had to play a more active role in prompting the infant: *"I don't know whether that's her temperament [...] but she was much more passive about, it was me saying - oh do you want to try some more?"* (Katie, BLW).

Beyond infant characteristics, mothers from both groups reported that infant behaviour also complicated interpretations of feeding state. A key issue was assessing satiation when infants ate beyond the expected point. This was even reported by the mother who viewed her baby as a poor eater: *"You just don't know if she's hungry or not. She'll eat something else if you put it in front of her"* (Rebecca, BLW). Importantly, this experience contradicted expectations regarding infant self-regulation: *"They say they'll stop eating when they're not hungry [...] well she doesn't"* (Rebecca, BLW). Other mothers experienced similar difficulty in responding to eating beyond expected satiation: *"If left to her own devices she would carry on eating, even though she's kind of done, [...] the messages get really mixed"* (Emily, TW). One participant reported that food preferences influenced her

daughter's continued eating: *"She would quite happily demolish a whole banana [...] no matter how full she is"* (Eleanor, BLW). For another though, the impact of food preferences increased the difficulty of assessing hunger and satiation: *"She has preferences for different foods and she can ask for different foods, now it gets slightly more muddled"* (Emily, TW). Such comments again demonstrate challenges faced by mothers in assessing infant hunger, in this case in situations where palatability and variety might promote overeating. Meanwhile, Eleanor's comment comparing her infant's behaviour at the time of the video and more recently, highlights again the changing landscape of feeding cues with increasing infant age.

Infant state also complicated assessments of hunger where mothers had to differentiate between two explanations for infant behaviour, e.g. hunger versus tiredness: *"Either he's starving or he's tired. What, what shall we do first?"* (Christina, TW); *"Yeah, either hungry or tired"* (Keira, TW). Within the meal itself, several mothers also reported difficulty differentiating between boredom and satiation: *"She sort of gets bored halfway through 'cos she still fidgets [...] and it's like, I don't know whether that's where she's starting to (get full)"* (Suzie, TW); *"I tried to work out whether he was full or whether he was just bored"* (Maggie, TW). This was largely a concern for TW mothers though one BLW mother similarly perceived boredom as affecting her infant's eating behaviour: *"She gets bored of foods quite easily but if you put something new in front of her she'll try that"* (Rebecca, BLW). Importantly, two mothers also expressed the view that boredom could compromise consumption should infants get bored before having consumed 'enough': *"It's sort of that anxiety that he'll get bored before he's finished eating, [...] then we'll end up in a bit of a cycle of him not eating much at meals"* (Maggie, TW); *"It wouldn't be very long before he'd be throwing the toy or doing something other than letting me feed him, 'cause he'd be bored"* (Christina, TW). In contrast, one BLW mother equated boredom with satiation, rather than seeing them as separate states: *"If he's hungry, it doesn't [...] touch the sides and nothing goes on the floor until the very end and he's bored"* (Laura, BLW). Thus, interpretations of boredom played a key role in perceptions of hunger with this being understood in very different terms: either as a risk to consumption or an indication that the infant had consumed enough. The precise reason why two mothers regarded loss of interest in feeding as boredom, while another interpreted boredom as satiation is unclear but this may relate to expectations of consumption i.e. boredom may not have been recognised as satiation if observed before infants had consumed what mothers considered to be "sufficient".

Finally, regarding infant state, for one mother, infant health was a factor in interpreting eating behaviour: *"She's had periods of illness where she's been poorly [...] and her appetite's obviously not*

*there*" (Emily, TW). In this case, awareness that the infant was ill appeared to make cues easier to interpret as poor appetite could be attributed to illness. This led to lower expectations about intake and impacted on the mother's response even where this induced some anxiety: *"I might worry internally but I try not to make it an issue at the table"* (Emily, TW). Like the issue of boredom, this highlights the importance of 'explainability' in shaping maternal responses to cues. Mothers are likely to respond more readily to behaviours that match expectations than those which do not.

In discussing the challenges of deciphering cues, two mothers expressed a desire for a 'definitive' signal for when to stop feeding: *"I tend to keep feeding her until she stops putting things in her mouth! But [...] it would be useful if she could tell me she's finished so I want to teach her the 'finished' sign"* (Lily, BLW); *"It's trying to find that definite 'I've had enough'"* (Suzie, TW). Suzie also commented that even seemingly 'clear' signals could involve ambiguity: *"If she has a box of raisins and she eats them she says 'they're all done, [...]', but I don't know whether she's saying when things are empty or when she's full"* (Suzie, TW). Thus, a key issue for these mothers was trying to minimise ambiguity in reading their infants' cues and knowing when to stop feeding.

### 3.2.2

#### Theme 2 - What is enough?

Discussions about feeding cues and responses often centred on ideas of 'enough'. This was conceptualised in three different ways: i) how much to offer infants; ii) enough as 'sufficient'; and iii) enough as 'not too much'. BLW mothers expressed concern about offering the right amount and, in doing so, emphasised choice as well as quantity. In particular, BLW mothers were concerned that infants should not feel overwhelmed by what was provided: *"It's not an overwhelming choice"* (Laura, BLW); *"Just one or two pieces maybe"* (Katie, BLW); *"Not [...] too much [...] because you don't want to outface (overface) them"* (Lily, BLW).

In contrast to BLW mothers' focus on how much to offer, TW mothers tended to focus on infants consuming 'enough'. Here 'enough' was expressed as a 'straight forward' notion without further elaboration: *"Just making sure she eats enough"* (Suzie, TW) or was talked about in terms of a 'good' amount: *"Wanting them to have a good meal"* (Keira, TW); *"I'd rather he ate a good (amount)"* (Maggie, TW). This idea also appeared in the account of one BLW mother though here the emphasis was on the infant consuming 'enough' in a main meal rather than from snacks: *"I'd rather see her [...]"*

*eat a decent amount at lunchtime*" (Rebecca, BLW). Thus, the nature of the eating episode was a factor in this mother's assessment of 'enough'.

Nutritional needs also featured in mothers' consideration of what was 'enough'. *"Making sure she eats enough of everything [...] the right balance of nutrients"* (Suzie, TW); *"You don't know whether she's getting [...] enough of the stuff [...] that is nutritionally, you know, the right stuff"* (Rebecca, BLW). Another mother's view of 'enough' meanwhile involved the infant's energy needs: *"I'd much rather he felt full at the end of the meal and then had [...] enough energy"* (Maggie, TW). This participant also emphasised the need to keep her infant's hunger at bay: *"And didn't get whingey an hour later"* (Maggie, TW). Another TW mother similarly commented that her baby would *"be hungrier in between meals later if he didn't eat all"* of what was offered (Christina, TW). Thus 'enough' was equated with eating everything.

Ideas about 'enough' were also shaped by 'external' pressures. One mother wanted to stop breastfeeding to return to work and so 'enough' meant filling the baby with solids to reduce the demand for breastfeeds: *"You kind of want them to eat the solids [...] you need to stop breastfeeding, you think [...] if they eat this they won't want that"* (Jess, TW). Another mother meanwhile judged 'enough' in relation to stopping night feeds: *"If they eat enough during the day they won't wake up as much at night [...] everyone was telling me he should not be feeding at night anymore"* (Maggie, TW). Again, this difference between observed and expected behaviour caused concern, particularly as it contradicted 'expert' advice: *"Health visitors [...] telling me that I was making a rod for my own back by feeding him at night [...] which wasn't true"* (TW).

Concerns about sufficiency of intake were largely expressed by TW mothers. However, this also applied to the BLW mother who perceived her baby to be a poor eater: *"Because she doesn't tend to eat that much [...] you're [...] anxious really about is she going to get enough"* (Rebecca, BLW). For another BLW mother, concerns about intake waxed and waned with her infant's developing eating habits. On commencing CF she worried her baby was not eating enough: *"I used to think, oh my God, he's not eating anything! Because it looked like [...] he didn't really swallow much"* (Laura, BLW). This worry re-emerged at a later stage when her baby cut down his intake of milk: *"It's now that I worry more that he's not eating enough"* (Laura, BLW).

For some mothers the idea of 'enough' meant sufficient but not 'too much': *"She'll eat the whole yogurt and then I don't give her anything else, [...] it's like us [...], you could eat more cake but you only have one slice!"* (Suzie, TW); *"I usually only get out enough, I would never get out too much"* (Eleanor, BLW). Here both portion size and food type appeared to influence judgements of 'enough' as both comments related to dessert foods. Within this, these mothers showed an awareness that palatability, rather than hunger, may affect consumption and so imposed external control over intake rather than relying on self-regulation by the infant.

Most mothers did not comment on over-consumption in main/savoury courses. However, one BLW mother stressed the importance of her infant not consuming too much, regardless of food type, based on comparisons between her baby and other babies: *"She's bigger than her friends [...] she enjoys her food an awful lot"* (Katie, BLW). This led to the introduction of portion controls to prevent over eating. Despite being baby-led therefore, this mother again did not rely purely on infant self-regulation to guide her feeding but also attended to infant weight gain, and comparable norms.

Altogether, ideas about what constituted enough, and when to end meals, were shaped by numerous concerns. Mothers from both groups, however, also emphasised infant autonomy in determining what was enough: *"You've got to trust their instincts [...] they'll stop eating when they're full"* (Laura, BLW); *"He's had enough [...] you just have to remind yourself that it's fine"* (Maggie, TW); *"They will decide when they've finished [...] let's just leave it at that"* (Katie, BLW). Within this, mothers appeared to need to 'remind' themselves of the idea of infant self-regulation, although this did not always seem an easy thing to do. Some TW mothers, however, reported finding it easier to accept infant autonomy to determine 'enough' as infants started to self-feed: *"Once [...] she was feeding herself [...] I'd kind of just let her carry on and then when she stopped eating she'd stopped"* (Emily, TW); *"With finger food (self-feeding), I don't think you seem as bothered. If they've left it [...] you think, well fair enough"* (Christina, TW). Thus, increasing feeding independence appeared to be associated with greater maternal acceptance of infant autonomy in determining intake for these mothers.

A final subtheme regarding perceptions of enough was how these differed proximally at the time of feeding and distally on observing the video. This was particularly true for TW mothers. One mother commented that she had been worried about her infant's intake when the meal was filmed but recognised her as well-nourished on the video commenting that she had been *"panicking' at the time"* that the child was not eating enough but now noted on the video her daughter's *"little chunky arms"*

(Keira, TW). Two other TW mothers spontaneously reflected on their own behaviour when watching the video: *“When I was spoon feeding her the yoghurt, I gave her the last mouthful and [...] looking back at the video, I don’t think she needed it* (Emily, TW); *“Why am I giving him more blueberries? [...] he’s telling me really clearly (he’s had enough)* (Maggie, TW). For the most part, BLW mothers did not comment on themselves or their infants’ intake on the video. However, Rebecca (BLW), who had concerns about her baby’s eating, commented that her daughter ate more on the video than she had perceived at the time: *“I didn’t realise how much she’d actually eaten until watching this again [...] I always thought she ate a heck of a lot less”*. Importantly then, observing themselves and their infants on the video seemed to give some mothers a different perspective on their own behaviour and that of their infants.

### 3.2.3

#### Theme 3 - Strategies

While mothers experienced uncertainty in assessing their infants’ satiation and determining what was enough, their accounts revealed the use of active strategies to ‘read’ the infant. For example, monitoring infant responses to continued offers of food to determine when to end meals: *“It was a bit of trial and error thing so usually it was giving her a couple of pieces and then just seeing how she got on”* (Katie, BLW); *“She’s eaten the pepper [...] I’ll just replace it with another piece”* (Lily, BLW); *“I just keep offering her things until, and she makes it quite clear she doesn’t want it”* (Suzie, TW). For one TW mother, observation of her baby’s response to the offer of dessert also helped her gauge satiation: *“He doesn’t eat yoghurt unless he really wants it, it’s not like [...] a favourite, so actually it’s quite a good way to tell if he’s had enough”* (Maggie, TW).

Allowing more time was another strategy used by both groups to determine when to end meals: *“I just give her a few more minutes and see what she does”* (Suzie, TW); *“Just leave her and see if she eats anymore on her own”* (Rebecca, BLW); *“You’re all done, you haven’t eaten anything in ages”* (Katie, BLW). Meanwhile, time of day and the infant’s usual routine were a means of assessing hunger for two TW mothers: *“It was always quite scheduled wasn’t it? You’d have a little snack didn’t you about 10 o’clock and dinner at 12”* (Keira, TW); *“Normally you have a meal at this time, normally you fill your nappy at this time”* (Christina, TW). However, while routine aided interpretations of infant behaviour, for the latter participant this again involved uncertainty: *“You’re following an [...] invisible map really”* (Christina, TW).

Some mothers' accounts emphasised the importance of gaining an overview of their babies' intake. This was particularly true of BLW mothers. One participant reported gauging intake by monitoring how much food was left or discarded during individual meals: *"And gets dropped, [...] I used to like clear up and put it in the bin and you think, oh gosh, he's not had anything"* (Laura, BLW). BLW mothers also reported assessing intake through general signs of the infant being well nourished or by trying to assess intake over several days: *"It's knowing the signs, [...] he's putting on weight, he's sleeping through, his nappies are full [...] it's just reading the signs"* (Laura, BLW); *"If you work it out over the week, you know, that they've eaten sufficient of everything to get what they need"* (Rebecca, BLW); *"It's trying to just get a coherent picture across everywhere"* (Katie, BLW).

Both BLW and TW mothers also relied on specific visual cues to assess intake. Here attention to portion size was used to assess appropriate amounts of different foods by two mothers: *"They say a portion for children is kind of the size of their fist, so, I try to kind of stick with that"* (Eleanor, BLW); *"I'd go with what they'd say was a portion, if it all went then that was it"* (Suzie, TW). TW mothers also reported using food containers to gauge what was enough: *"I used to do the pouches so I used to just base it on 'well you've eaten a whole one of those, that's what you should be eating"* (Suzie, TW); *"It was just the size of the bowl, I think I was just filling the bowl"* (Emily, TW). However, this mother also noted that relying on bowl size led to inappropriate expectations: *"It was probably way too much [...] I remember thinking, oh yes, she's not eating what's in front of her"* (Emily, TW). Another TW mother found that using container size to gauge the appropriate amount created a sense of pressure that the infant should finish what was offered: *"When it's like the pureed mixtures, in the bowls, in the yoghurts pots, you're a bit more, 'Come on you've got finish it, I've opened it"* (Christina, TW). One BLW mother reported a similar experience in relation to yoghurt pots: *"He loves yoghurt but he'll still stop half way through a yoghurt pot and [...] the instinct is to go, oh just finish it!"* (Laura, BLW).

While both groups of mothers reported using strategies to assess sufficiency of intake, their comments also referred to strategies to *ensure* that infants ate the right amount. Participants who viewed 'boredom' as threatening consumption reported combatting this by distracting infants or cajoling them into eating more: *"He'd get bored and I'd think something else might like entice him to have some more"* (Maggie, TW); *"I put a toy on the highchair for him to distract him [...] so I could carry on feeding him"* (Christina, TW). Meanwhile, another participant provided the solid part of the meal before breastfeeding to maximise intake of solid food: *"Give her dinner before you breastfeed so that you're trying to fill them on food"* (Jess TW). For this mother then, intake of solids was prioritised over that of milk.



Concerns about intake and strategies to ensure infants ate enough were generally reported by TW mothers. However, one BLW mother also reported leaving her baby to continue eating while she cleaned up from the meal to encourage intake: *“I [...] leave her and see if she eats anymore [...] because she often does better eating when she’s on her own”* (Rebecca, BLW). In contrast to TW mothers’ strategies to encourage intake, though, this mother’s approach did not involve ‘active’ encouragement or cajoling, rather, the infant was still allowed to determine her own intake.

Despite aligning themselves with the principle of infant led intake, two BLW mothers also reported using strategies to ensure that infants did not over-eat. For one mother, limiting what was on view was a means of preventing battles where the infant wanted more than the mother thought appropriate: *“She will kind of put up a little bit of a fight, but [...] I’d always pull off how much I think is an appropriate portion size for her [...] then it’s easier for me to say, look, it’s all gone”* (Eleanor, BLW). Another BLW mother introduced portion controls and tried to keep her infant away from snacks: *“Ella doesn’t get snacks, we have them but she doesn’t get them”* (Katie, BLW).

## 4

### Discussion

The aim of this analysis was to explore maternal perceptions of hunger, satiation and ‘enough’ in BLW and TW feeding interactions, as well as factors shaping responses to these. Three key themes were generated regarding mothers’ interpretations of cues, their understandings of ‘enough’ and strategies used to assess and manage aspects of their infant’s behaviour. This discussion will focus on findings regarding similarities and differences between TW and BLW mothers’ reports of feeding cues, sense-making and expectations during mealtimes, and feeding priorities and their impact on the negotiation of control.

#### 4.1

##### BLW and TW mothers’ perceptions

Mothers from both groups identified many common feeding cues; however, mothers from both groups also reported encountering difficulties in making sense of cues during feeding. Both groups also expressed a desire for certainty in judging when to end meals. Such findings are novel in relation to CF. They are also somewhat unexpected, given reports that, compared to TW mothers, BLW mothers have greater feeding confidence and lower concerns about filling infants up (Brown & Lee, 2011b).

A key difference was observed between the two groups in mothers' reporting of satiation cues, with TW mothers identifying a wider range of these than their BLW counterparts. Importantly, the additional satiation cues identified by TW mothers tended to be 'late' or 'negative cues', as described by Hodges et al. (2013) i.e. more overt cues which appear later in the development of satiation and/or which involve greater distress e.g. back arching, the infant pushing themselves away from the table etc.

Despite the greater reference to more overt satiation cues by TW mothers, they reported a similar range of 'early' satiation cues to BLW mothers thereby suggesting that TW participants were familiar with these but tended to feed until they observed more prominent cues. This is consistent with reports that TW mothers worry more about intake than BLW mothers and are more controlling in their feeding practices (Brown & Lee, 2011b). It is also consistent with the greater emphasis placed by TW participants in the current analysis on ensuring their infants were full. However, the responses of two TW mothers to watching the feeding videos indicated that they did not recognise their infants' satiation cues at the time of feeding, rather than noticing them and choosing not to respond. There were also differences in the interpretation of boredom between two TW mothers and a BLW mother with the former interpreting loss of interest in the meal as boredom, and the latter as satiation. Importantly both TW mothers' response to this was to try to encourage intake rather than pausing in feeding or terminating the meal. This is important as, while infants may conceivably start to become bored while eating, it is unlikely that this would lead to them consuming significantly less than they require, particularly on a regular basis.

The lower reporting of more overt satiation cues by BLW mothers, may have arisen from BLW infants having fewer opportunities to show such cues because of the autonomous and less dyadic nature of their feeding. If a baby is offered food their behaviour is reactive to the offering, however, in BLW they can refuse a food or stop eating without needing to signal this to the mother. Nonetheless, there is some evidence from the present analysis that some TW mothers were less responsive to satiation cues than BLW mothers.

## 4.2

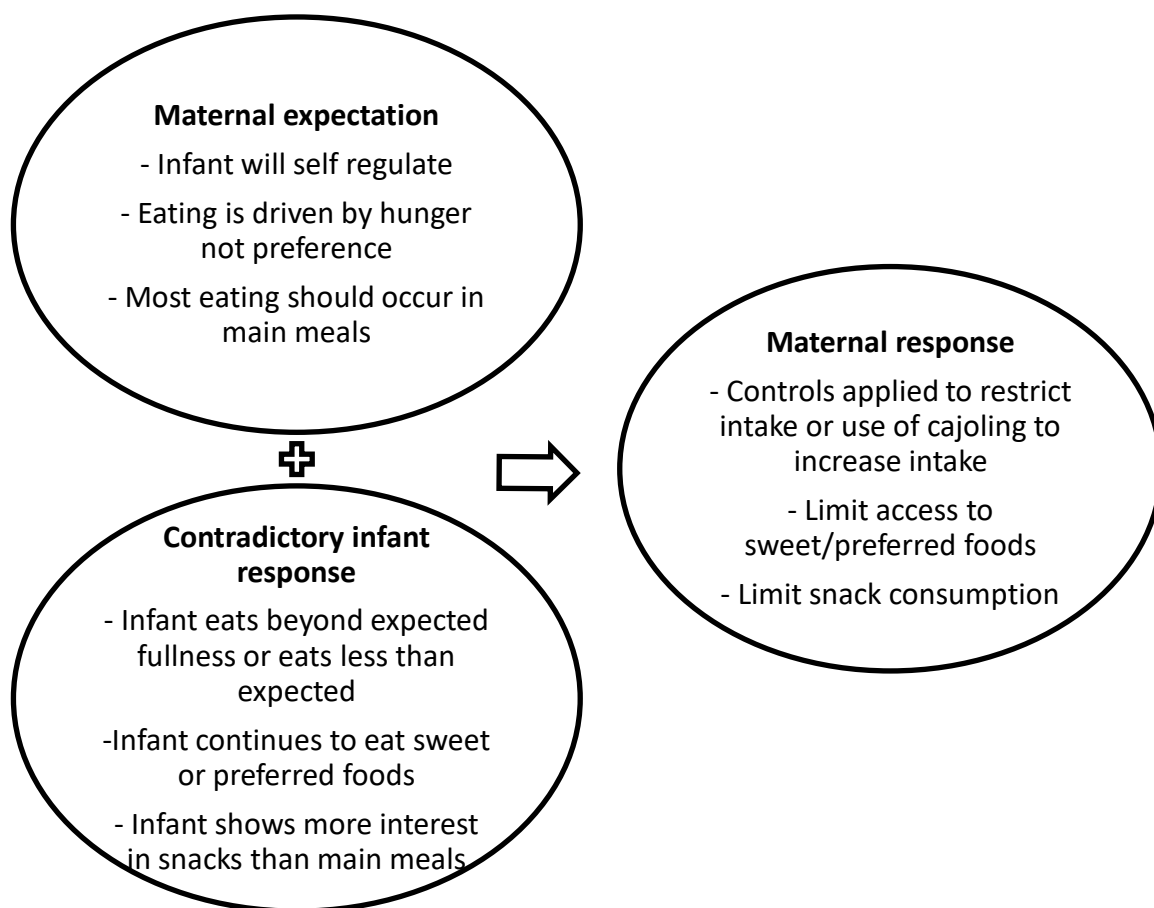
### Sense making and expectations

Mothers from both groups identified a desire to make sense of their infants' behaviour, particularly in relation to *knowing*, rather than *assessing* when to terminate feeding. For one mother, this need to

*know* involved trying to teach her daughter the 'finished' sign. This is consistent with recent research indicating that a signing intervention significantly increased parental feeding responsiveness and would therefore be of likely interest to many parents (Paul et al., 2019).

For the most part though, mothers in the current study drew on a wide range of information to decipher their babies' behaviour. For both groups, decisions about ending meals were reached cumulatively, over time, and through the 'active testing' of satiation. This is a novel finding which reflects the utility of video elicited interviewing for accessing detailed maternal accounts of their feeding interactions; mothers were able observe their own behaviour and to explain this directly, rather than having to rely on recall.

The importance of mothers' expectations was also observed in their perceptions of their infants' behaviour. For one BLW mother, the expectation that her daughter's intake would be routinely poor appeared to interfere with her assessment of intake at the time of feeding, though on watching the video, she observed that her infant had eaten much more than she had thought. This highlights the impact that anxiety can have on feeding perceptions and interactions. Such anxiety was also evident in other mothers' accounts when infant behaviour did not meet feeding expectations e.g. infants continued to eat despite expectations that they would be full. This is consistent with Price et al.'s (2012) finding that the observation of continued hunger cues following breastfeeding caused mothers difficulty in interpreting feeding state. In the current analysis, contradictions between observed and expected behaviour caused concern for mothers from both groups, particularly where behaviour contradicted 'expert' advice from health visitors, expectations about infant self-regulation and ideas about appropriate infant intake. In such instances, mothers from both groups employed a number of feeding interventions, for example, restricting access to snacks in response to infants perceived to overeat (Figure 1). This highlights the variability in infant feeding behaviour with important implications for professionals supporting mothers' CF.



**Figure 1- Maternal responses to unexpected infant feeding behaviour**

#### Feeding priorities, feeding responses and control

TW mothers' comments indicated that different priorities shaped judgements of what was enough between them and BLW and mothers. Consistent with Johnson et al. (2015), TW mothers' concerns were about meeting energy and nutritional needs and infants staying full for sufficiently long. BLW mothers however, placed more emphasis on monitoring intake and getting an overall sense that the infant was consuming enough. This is likely to arise from the lower control mothers have over infant intake in BLW and is consistent with reports from Arden and Abbott (2015) of BLW mothers expressing a need to monitor consumption, especially early in CF. Importantly it also provides evidence that while BLW mothers were more led by their infants' appetites, they were nonetheless appropriately vigilant for signs of adequate nutrition.

Maternal feeding priorities were also shaped for some TW mothers by a wish to decrease night feeds or a need to reduce breastfeeds to return to work. The former point is consistent with findings from

Bentley et al. (1999) and Price et al. (2012). This highlights the fact that night waking is often interpreted as a sign of hunger, as well as sleep being a shared priority for mothers of young infants. Importantly, it also highlights potential barriers to responsive feeding, as such issues were cited as reasons for mothers trying to ensure infants were as full as possible.

Three TW mothers reported feeling less need to control intake once infants were self-feeding. This is interesting as it suggests independent infant feeding may engender a more relaxed feeding situation than TW. However, it may be that these mothers felt more able to trust their infants' consumption by the time they were self-feeding, in which case infant age and maturity may have influenced the negotiation of control. Interestingly, this is consistent with reports of BLW mothers' increasing confidence in their infants' self-feeding ability with increasing age (Cameron, Heath & Taylor, 2012).

Notwithstanding indications of greater feeding control by TW mothers in this analysis, there were signs of BLW mothers also using strategies to encourage or discourage consumption. Such strategies tended to differ from those of TW mothers in terms of being less directive, e.g. leaving the infant to eat for longer while the mother cleared up or restricting what food was visible to the infant. One BLW mother however, intervened more directly by controlling portion sizes and access to snacks. Thus, BLW mothers were not entirely led by their infants' appetites. This is consistent with previous findings that BLW mothers may adapt the approach where concerns arise regarding sufficiency of intake (Arden & Abbott, 2015; Cameron et al., 2012). It also demonstrates that, while BLW affords fewer opportunities for maternal control than TW, BLW mothers ultimately retain control over how much, how often and what kind of food they offer. Furthermore, it highlights the fact that BLW mothers, like TW mothers, experience concerns about intake *and* that concerns can relate to over as well as under-consumption. In this case, BLW may be seen as a guide to intake rather than a specific, rigid approach. As least as far as self-report data can illustrate, BLW principles appear to encourage trust in the infant and flexibility by the caregiver to accept variability and to adapt to situations as needed. However, study findings indicate this may be more challenging for mothers where infant behaviour differs from their feeding expectations. Furthermore, the less directive nature of BLW combined with individual variability in infant feeding behaviour may be factors in reports of greater prevalence of over and underweight in BLW infants (Townsend & Pitchford, 2012).

### 4.3

#### Evaluation

The present analysis has a number of limitations. In the first instance, it is important to note that qualitative data are co-produced in a given context and shaped by the interests of the researcher and participants. Furthermore, coding using the template developed for the study achieved only a moderate level of inter-rater agreement. In addition, the video elicited nature of the interviews may have caused mothers some discomfort in commenting on their own behaviour, potentially inhibiting discussions to some degree. Despite this, mothers did not indicate that they were uncomfortable discussing the video content.

Other potential limitations to the study lie in the nature of the sample (a small group of participants from a relatively homogeneous demographic background). However, the similar backgrounds of TW and BLW mothers here may also be considered a strength; previous research with BLW and TW mothers has tended to involve groups with different demographic characteristics thereby potentially confounding comparisons between them. Moreover, this is the only known analysis involving the direct comparison of TW and BLW mothers' accounts of their feeding perceptions and responses. As such, it provides a fuller understanding of mothers' perceptions of, and responses to, feeding cues across different CF approaches, with implications for the development of feeding interventions which are likely to be seen as relevant by both groups of mothers.

Notwithstanding the potential of video elicited interviews to inhibit maternal responses, their use appeared to facilitate reflection on implicit feeding decisions by enabling mothers to observe, consider and account for these directly. The method has been used previously to explore interactions between health professionals and patients (Gao, Burke, Somkin, & Pasick, 2009; Henry & Fetters, 2012). However, its use in relation to feeding interactions is new. Importantly, in this study it proved to be highly productive for generating insights into feeding approach, attitudes, feeding responsiveness and the challenges of infant led feeding across different CF methods. Moreover, findings suggest that observing their own feeding practices distally on video may help mothers develop greater insight into their own behaviours and their infants' responses. Video observations may therefore have a role to play in future research in the area and may also have a role in the delivery of responsive feeding interventions.

## 5

### **Conclusion**

Findings from this analysis provide some support for reports of BLW as a more responsive feeding approach than TW in relation to infant satiation. They indicate that TW mothers, while recognising infant cues, may have been less inclined to follow these. There were also indications of satiation cues being missed or misinterpreted by some TW mothers. Meanwhile, findings suggest that some BLW mothers were not entirely 'infant led' in their feeding practices but that they intervened to encourage or restrict intake and were particularly able to exert control over the latter.

These suggest that mothers may benefit from advice regarding responses to infant behaviour which differs from expectations, particularly where there are concerns about infant self-regulation. Similarly, it may be productive for health professionals to encourage an awareness that infant 'boredom' may represent developing satiation and to encourage mothers to pause in feeding in response to perceived boredom to allow infants to indicate if they are still hungry, rather than responding by encouraging further intake. In particular, findings suggest that mothers may benefit from practical advice about managing sleep in older infants without resorting to feeding and timescales for gradually reducing breastfeeding where mothers are returning to work. Support in these areas may assist mothers in feeding more responsively.

## **Conflicts of Interest**

None declared by Janet McNally, Siobhan Hugh-Jones or Marion Hetherington

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## **Author contributions**

Janet McNally conducted the study with support from Marion Hetherington and Siobhan Hugh-Jones. Janet McNally drafted the research report with contributions from Marion Hetherington and Siobhan Hugh-Jones. All authors reviewed and approved the final report.

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