Synchrony, co-eating and communication during complementary feeding in early infancy

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Abstract

The transition from milk to complementary food is a crucial but difficult process, requiring considerable adult sensitivity. We know little about the relationship between maternal feeding behaviours and infant willingness to eat at the onset of complementary feeding (CF), and we know even less about how these patterns might vary across cultures. Thirty-seven dyads (15 from the UK and 22 from Italy) took part in a longitudinal study, during which mealtimes were video-recorded one week after the onset of CF (Time 1) and at 7 months of infant age (Time 2). The first five minutes of mealtimes were coded for maternal feeding behaviours, for infant willingness to eat and for synchrony in feeding. Maternal vocal communications (MVCs) and attention directing acts (ADAs) during the whole mealtime were also coded. Infant willingness to eat was significantly related to synchrony and co-eating, suggesting the importance of sensitivity and empathy during feeding as in other parent-infant interactions. The frequency of maternal ADAs varied between nationalities, and, contrary to current advice, did not relate negatively to infant willingness to eat. These patterns and variations suggest the need to consider CF as a contextually variable and sensitive foundation for feeding relationships.

Introduction

The feeding relationship can be a complex process beginning with the onset of breast or formula feeding and developing with the introduction of complementary food. When milk is no longer sufficient to meet the nutritional requirements of the infant, complementary foods are necessary to fill the gap in energy, iron and other essential nutrients (European Food Safety Authority [EFSA], 2009). This transition from breast or formula feeding to complementary feeding (CF) can be a delicate one for both mother and infant, with the changes in situation as well as the structure of actions demanding that they learn to interact with each other in a different way: for instance, during milk feeding the infant is in the mother's arms, while during CF the infant is generally separate from the mother's body, and sensitivity to each other's intentions becomes more challenging.

In the literature, there are only a few studies exploring developmental changes in eating behaviours during the CF period (e.g., Negayama, 1993; Van Dijk, Hunnis, & Van Geert, 2012). Indeed, most research mainly focuses on studying caregivers' feeding behaviours during breastfeeding or, somewhat later, in children aged over two years (Blissett, 2011; Young & Drewett, 2000); the early stage of CF has largely been neglected. However, there are indicators that the CF period is of great importance as it is in this phase that the child builds the foundations for later eating habits (Harris, 1993; Van Dijk et al., 2012) with infant experiences during this time possibly impacting on later food preferences (Hetherington, Cecil, Jackson, & Schwartz, 2011). CF is a complex dynamic and interactive system (Van Geert, 1994), which consists of varying elements (infant, caregiver, food and feeding context) all interacting on a moment-to-moment basis. The skills that infants develop at the CF stage facilitate the transition from a predominantly caregiver-regulated feeding to a more independent, self-regulated pattern that is typically established at the end of the first year (Silberstein et al., 2009). The transition is deeply embedded within the mother-infant

relationship (Chatoor & Ganiban, 2004) with the way in which caregivers provide bite sized food to the infant being potentially crucial for the gradual emergence of patterns and behavioural practices in CF (Van Dijk et al., 2012). Thus, exploring the emergence of interactive patterns and practices in the early weeks of CF seems crucial. Whilst there is a growing body of literature investigating clinical feeding problems (Chatoor, 2002; Manikam & Perman, 2000; Nicholls, Chater, & Lask, 2000) less is known about the predictors of the broad range of problems experienced in non-clinical community samples, particularly in infancy (Powell, Farrow, & Mayer, 2011). Increased understanding of possible risk factors during this sensitive period before the onset of feeding problems provides opportunities for immediate prevention and intervention (Powell et al., 2011).

Feeding practices, cultural differences and the dearth of observational data

How parents feed their infants can vary enormously between individuals and between cultures. The term "feeding practices" is generally used to refer to parental behaviours displayed during mealtimes particularly to specific techniques and behaviours used to facilitate or limit ingestion of food, for example, restricting the child's access to food or encouraging or forcing the child to eat (Blisett, 2011). Parental pressure to eat has been associated with a wide range of undesirable child eating habits (Hetherington et al., 2011) and negatively associated with the consumption of fruits and vegetables in young children (Fisher & Birch, 2002).

Differences in parental feeding behaviour may be due to cultural variations in attitudes (Dettwyler, 1989; Hughes, Power, Fisher, Mueller, & Nicklas, 2005); Hispanic parents, for instance, are found to exercise more control over feeding than African-American parents (Hughes et al., 2006). Differences may also be due to experiences (Swenson, 1984) and competence (Zeitlin, Ghassemi, & Mansour, 1990). Most research has relied on self-report questionnaires given to parents, a method with obvious limits in the scope of interpretation.

Observational studies of feeding practices within or across cultures are rare, particularly in the early weeks of CF.

Nonetheless, there is no dearth of recommendations about *how* to feed infants: the World Health Organization (WHO, 2003) recommends encouraging children to eat without coaxing, forcing, interacting or talking to children during feeding and minimising the use of distractions when children lose interest. Similar advice is also given by the Department of Health (DoH) in the UK (2011), which recommends that infants should not be forced to eat or to rush, as feeding requires time. DoH advice also states that infants should eat while seated upright in a high chair. Although such advice should - and sometimes does - vary across cultures (for example, paediatricians in Italy are advised to be culturally sensitive in their advice, Ministero della salute, 2010), the general advice for parents in Western countries is to sit directly in front of the infant, preferably seated upright in a high chair, offer the spoon and wait for the infant's mouth to open before attempting to feed, to respect the infant's timing and desires in accepting food, to avoid distracting the infant with toys during feeding, and to avoid coaxing and pressurising infants to eat (Chatoor et al., 1997; Satter, 2000).

Although the general use of self-report questionnaires in studying feeding behaviour has some advantages (viz., it allows the study of large samples), the relative lack of observational studies has the consequence that actual practices of feeding and eating and particularly the way in which these practices emerge, is still largely unknown. A descriptive understanding of these processes in non-clinical mother-infant dyads is crucial not only for identifying the development of risky interactions in the pathways to independent eating by infants (Van Dijk et al., 2012) but also for either supporting or challenging the prescriptive recommendations boldly made by various governmental and other advisory bodies about how mothers *should* introduce CF and how they *should* feed their infants. These are often presented as a-cultural

and universal absolutes. Cross-cultural observational studies of actual feeding behaviour in the early weeks of CF are therefore urgently needed.

Synchrony and co-eating

Synchrony and empathy are two factors which appear to be crucial, even if they manifest differently, in all cultures, particularly in nonverbal exchanges. Synchrony between participants reveals mutual sensitivity and has been argued to constitute the key process coordinating sensory, hormonal and physiological exchanges and promoting mutually rewarding interactions (Reyna & Pickler, 2009). Variously operationalised, synchrony is sometimes seen as the matching of behaviours, affective states and biological rhythms allowing dyads to function as single units (Feldman, 2007a); it has sometimes been seen as consisting of three necessary components: maintained engagement (e.g., in mutual attention), temporal coordination (e.g., of rhythm or pacing) and contingency (e.g., between events in the dyad) (Harrist & Waugh, 2002). From as early as 3 months of age, synchrony is evident in social exchanges (Feldman, 2007b). It shows a complex, possibly bi-directional, interplay with infant health (prematurity and low vagal tone, Feldman & Eidelman, 2007) and predicts the emergence of symbolic complexity and self-control (Feldman, 2007; Feldman, Greenbaum, & Yirmiya, 1999). Asynchrony can be present in feeding, with infant and mother out of rhythm in terms of sensitivity to signals (Satter, 1986). Although there has been some study of mother-infant synchrony in relation to milk feeding (de Graag, Cox, Hasselman, Jansen, & de Weerth, 2012; Isabella, Belsky, & Von Eye, 1989) very little is known about mother-infant feeding synchrony at the early stages of CF, even though maternal sensitivity in dyadic interactions in general may be important for feeding interactions too (Britton, Britton, & Gronwaldt, 2006). The role of synchrony in contributing to the successful transition to complementary foods remains speculative.

Empathy, widely accepted as important in any social exchanges, may also play a crucial role in feeding. Particularly in the early months, maternal empathy may reveal itself in behaviours such as co-eating - that is, in mothers opening their own mouths while their infants are attempting to eat (Toyama, 2013). Japanese mothers, more so than Scottish mothers, have been shown to co-eat when offering complementary food to their infants (Negayama, 2000), a cultural difference that might indicate differences in empathetic behaviour generally, or that may be particular to feeding. However, with only one study so far, conclusions are hard to draw. Co-eating may well be important in CF, successfully showing infants how and when to open their mouths; and it may be differentially present even within Europe. However, there is no evidence so far to show that this may be the case or indeed that maternal co-eating is related to infant willingness to eat.

The current study

This study aimed to observe variations and patterns of maternal feeding practices and their relation to infant willingness to eat (which can be taken to be the key indicator of the successful introduction of CF, see Cooke, McCrann, & Higgins, 2013) in the early weeks of the introduction of complementary food. We hypothesised that infant willingness to eat would be related to: (i) maternal feeding behaviours which do not show pressure or force, such as *more waiting* and *less pushing* (Hypothesis one), (ii) maternal feeding behaviours showing more empathy (as in more maternal *co-eating* and *more maternal vocal communication*) (Hypothesis two), (iii) greater mother-infant synchrony (synchrony between approaching spoonfuls and infant readiness to eat) (Hypothesis three), and (iv) lower incidence of maternal use of distractions (i.e., acts directing the infant's attention to other objects or locations, sometimes used by parents as a coaxing strategy) (Hypothesis four).

We studied mother-infant dyads from two European countries - Italy and the UK - a choice influenced by recognition of the very different attitudes towards food and feeding

within Europe and the need to explore such differences further (Wright, Nancarrow, & Kwok, 2001). Given the greater social embeddedness often reported in Italian mealtimes (e.g., Ochs & Shohet, 2006) we hypothesised that Italian mothers would show higher frequencies of conversational acts (vocal communications generally) and higher frequencies of acts directing attention to other objects and locations during feeding when compared to British mothers (Hypothesis five). The decision to conduct a longitudinal study was mainly due to the developmental changes that occur during infancy. Because of developmental changes between 6 and 7 months in better swallowing and better enclosing of spoon with mouth (Engle, Bentley, & Pelto, 2000), we observed feeding interactions at two distinct times: the onset of CF (one week after the first introduction of complementary food) and when the infants were 7 months old. We hypothesised that feeding would become more fluent between these two times - with an increase in synchrony between mother and infant at Time 2 (Hypothesis six). We also investigated possible changes between Time 1 and Time 2 in maternal waiting, pushing, vocal communications and attention-directing but made no firm hypotheses.

Method

Design

This study explored mother-infant interactions during CF in two European communities, Portsmouth, UK, and Rome, Italy. The study was part of a larger investigation which involved British and Italian mothers and their infants aged between 14 and 31 weeks. This study aimed to explore the introduction of complementary food to infants, and took place between February 2011 and March 2012. For the purpose of this study the mealtimes were video-recorded at the participants' family homes at Time 1 (one week after the introduction of complementary food) and at Time 2 (when the infants reached 7 months of age).

Participants

British and Italian mothers of infants aged between 3 and 4 months were recruited through advertisements in health centres and Universities in Portsmouth and Rome. Inclusion criteria required infants who had not yet started the introduction of complementary food.

Forty-six mother-infant dyads originally took part in the study (23 from the UK and 23 from Italy); 8 dyads were excluded from the present analyses as infants were not exclusively spoon fed, and 1 dyad was further excluded from the British group as the mother was originally from South America. This left 15 British and 22 Italian dyads in the study. All 37 mothers and their infants participated in the visits at both Times 1 and 2. All mothers and infants were Caucasian.

The sample was well matched in terms of infant gender, mother's age and education, and family social status[1]. None of the infants were known to have disabilities or illnesses at the time of the study; moreover, none of the infants had a birth weight lower than 2.5 kg nor were any below the 10th percentile for weight (see WHO, 2004) at Times 1 or 2. At the onset of CF, 14 infants (2 British and 12 Italian) were exclusively breast fed; 20 infants (9 British and 11 Italian) were introduced to complementary food before 5 months and 17 infants (6 British and 11 Italian) after 5 months. The present study was conducted according to guidelines laid down in the Declaration of Helsinki, with written informed consent obtained from a parent for each child before any assessment or data collection. All procedures involving mothers and infants in this study were approved by the Research Ethics Committee at the University of Portsmouth, UK. Table 1 shows participants' characteristics.

TABLE 1 ABOUT HERE

[1] The Barratt Simplified Measure of Social Status (BSMSS, Barratt, 2006) was used to provide further depth to the demographic information. The BSMSS takes into consideration parents' education and occupation; the scores range from 8 to 66 (higher scores indicate that parents have a high level of education and a professional position of high responsibility).

Procedure

At the start of the first visit mothers completed an Informed Consent Form and a Demographics Questionnaire, which included questions about the mother's age and education, and the infant's health. Mothers were informed about the purpose of the research and about any confidentiality issues. Mothers were also informed that they could change their decision to participate at any time. The only instruction given to mothers prior to video-taping the mealtimes at Times 1 and 2 was: "Behave as you normally do when feeding your baby".

Video-recordings took place in one room, generally the kitchen or the living room, wherever the infant was typically fed. The infant was mainly in a high chair, but occasionally on the mother's lap. If the infant was being fed while seated in a high chair, the camera was positioned at the side (enabling a profile view of both mother and infant), and if the infant was on the mother's lap the camera was positioned in front of them. Prior to Time 1, the first author, who collected the data in both countries, had already met and spent some time with both mother and infant and she was thus not likely to cause any distress during the mealtimes; furthermore, she was always positioned behind the camera during the video-recording. If mothers believed that the infant was not feeling well on the day of the visit, they had been asked to contact the first author by phone to arrange a new appointment; however, this did not happen on any occasion. At each visit the weight (recorded in Kg) and the length (recorded in cm) of the infants were measured using the "First years baby scale" and the "Seca baby mat".

Coding

The feeding sessions at Time 1 and Time 2 were coded in three ways (details in Table 2):

i) *Micro-analysis of behaviours in the first five minutes*[2] of feeding using a video analysis package (Interact, v. 9, 2011, Germany): maternal *Waiting*, *Pushing*, *Co-eating*, and mother-infant feeding *Synchrony* (temporal coordination between approach of spoon and opening of mouth) (see Figure 1).

ii) *Infant willingness to eat in the first five minutes:* infant response to each offered spoonful in the first five minutes was coded as *Willingly Eaten*, *Reluctantly Eaten*, or *Refused*.

iii) *Maternal communications during the whole meal:* maternal behaviour directed toward the infant which consisted of *Maternal Vocal Communications* (*MVCs*) and broken down into *MVC praise* and *MVC sounds*, and *Attention Directing Acts* (*ADA*s) towards objects or locations were coded for the duration of the meals[3].

TABLE 2 ABOUT HERE

FIGURE 1 ABOUT HERE

Reliability

A second observer blind to the interests of the study coded all the above measures for 20% of the data at both Times 1 and 2. Reliability of coding using Cohen's *kappa* was high on all measures (between .80 and .90).

Data analysis

Pearson's correlations were conducted to examine the relationships between the various maternal behaviours (i.e., *Waiting*, *Co-eating*, *Synchrony*, *MVCs)* and *Food Willingly Eaten (FWE)* by the infant.

Pushing and *ADAs* were treated as discrete variables as in both cases the incidence of the behaviour was relatively infrequent with at least half the mothers not showing the behaviour

[2] Because duration of meals varied between infants, in the interests of a consistent comparison, only the first 5 minutes of feeding were coded in this way.

[3] For analyses, MVC praise and MVC sounds were combined to form one MVC variable as at Time 1 MVC praise and MVC sounds were significantly positively correlated ($r = .53$, $p = <.001$) and the same was the case at Time 2 ($r = .31$, $p = <.05$).

at all. For *Pushing* we used the criterion of < or =/> 2 to divide mothers into those who *pushed* and those who *did not push* the food into their infant's mouth. For *ADAs* we used a simple yes/no criterion to divide the mothers into those who did and those who did not use *ADAs*. For these two variables we used *t*-tests[4] to examine their effect on *FWE*.

Two-way mixed factorial ANOVAs were conducted with *Waiting*, *Co-eating*, *Synchrony*, and *MVCs* as dependent variables, *Time* (Time 1, Time 2) as a within-subjects variable and *Nationality* (British, Italian) as an independent factor.

Chi-square tests were used to examine the associations between *Time* and *Nationality* and *Pushing* and *ADAs*.

Results

Maternal Behaviours, Synchrony and Infant Willingness to Eat: Setting the Scene

We predicted that infant willingness to eat would be positively related to *more waiting* and *less pushing* (Hypothesis one), positively related to maternal feeding behaviours showing empathy (*maternal co-eating* and *maternal vocal communications*) (Hypothesis two), positively related to mother-infant *synchrony* (synchrony between approaching spoonfuls and infant mouth opening; Hypothesis three) and negatively related to maternal use of distractions (*acts directing the infant's attention to other objects or locations*; Hypothesis four).

Most of these behaviours were prevalent (using a criterion of at least two occurrences) in the majority of the sample. *FWE*: At Time 1, 95% of the infants and at Time 2 all the infants, willingly ate food. *Waiting*: Most of the mothers waited for their infant to accept the food (95% at Times 1 and 2). *Pushing:* Overall, less than half the mothers showed pushing (32% at Time 1 and 19% at Time 2). *Co-eating:* Most of the mothers showed co-eating (89% at Time 1 and 92% at Time 2). *MVCs*: Most of the mothers vocally interacted with their infants at least twice (92% at Time 1 and 95% at Time 2). *Synchrony*: Most of the dyads at Time 1

[4] See de Winter (2013) for information about the use of *t* tests with small sample sizes.

(87%) and all of the dyads at Time 2 were in synchrony during feeding. *ADAs:* Around half of the mothers used *ADAs* (60% at Time 1 and 49% at Time 2).

Maternal Behaviours, Synchrony and Infant Willingness to Eat: Addressing our Hypotheses

Table 3 shows Pearson's correlations between the continuous variables *FWE*, *Waiting*, *Co-eating*, *MVCs* and *Synchrony* at both Times.

TABLE 3 ABOUT HERE

Contrary to Hypothesis one, there was no significant relationship between *FWE* at Time 1 and *Waiting* at Time 1 nor between *FWE* at Time 2 and *Waiting* at Time 2. Interestingly, there was a significant positive correlation between *FWE* at Time 1 and *Waiting* at Time 2, that is, earlier willingness to eat related to increased maternal waiting at Time 2.

Hypothesis two was partially supported. *FWE* at Time 1 and *Co-eating* at Time 1 were significantly positively correlated but they were not related at Time 2. There was a notable lack of correlation between *FWE* and *MVCs* at both Times.

In support of Hypothesis three, there were significant correlations between *FWE* at Time 1 and *Synchrony* at Time 1 and *FWE* at Time 2 and *Synchrony* at Time 2. *Synchrony* at Time 1 was also strongly correlated with *FWE* at Time 2, but conversely, *Synchrony* at Time 2 was not related to *FWE* at Time 1. If there was a direction of influence, therefore, it was likely to be in the direction of earlier synchrony influencing later willingness to eat rather than the other way round.

FIGURE 2 ABOUT HERE

As *Pushing* and *ADAs* were coded as discrete variables they were not included in the correlations. Instead they were used as independent variables in *t*-tests with *FWE* as the dependent variable.

As predicted by Hypothesis one, at Time 1, *non-pushed* infants showed higher *FWE*[5] (M = 18.32, SD = 6.37) than *pushed* infants (M = 4.67, SD = 2.96) ($t(35) = -8.90$, $p = <.001$); similarly, at Time 2 *non-pushed* infants ate food more willingly (M = 24.20, SD = 8.33) than *pushed* infants (M = 10.86, SD = 10.59) ($t(35) = -3.63$, $p = .001$). Contrary to Hypothesis four, *ADAs* did not relate to food willingly eaten by infants.

Nationality and Time: Setting the Scene

We hypothesised that Italian mothers would show higher frequencies of *MVCs* and higher frequencies of *ADA*s than British mothers (Hypothesis five). Further, we predicted that feeding would become more fluent between Time 1 and Time 2, with an increase in *Synchrony* between mother and infant at Time 2 compared to Time 1 (Hypothesis six). We also investigated possible changes between Time 1 and Time 2 in *Waiting*, *MVCs*, *Co-eating*, *ADAs* and *Pushing* but made no firm hypotheses. Table 4 shows the descriptive statistics for maternal behaviours and synchrony as a function of *Nationality* and *Time*.

TABLE 4 ABOUT HERE

Nationality and Time: Addressing our Hypotheses

To investigate Hypotheses five and six, a series of two-way mixed factorial ANOVAs were conducted with *Time* and *Nationality* as the independent variables and *Synchrony, Waiting, Co-eating* and *MVCs* as the dependent variables. No significant results were found for *MVCs* so no support was found for this part of Hypothesis five. There was a significant main effect of *Time* for *Synchrony*. There was greater *Synchrony* at Time 2 than at Time 1 thus supporting Hypothesis six. There was a significant main effect of *Nationality* for *Co-eating*, Italian mothers showed more co-eating than British mothers. There was a significant interaction between *Time* and *Nationality* for *Synchrony*: in British dyads *Synchrony*

[5] There was a necessary overlap between the occurrence of pushing and coding of food willingly eaten (FWE): if a spoonful involved pushing, the infant's response would have not been coded as willingly eaten. However, the converse did not need to be true, even in the absence of pushing infants might not have eaten the food willingly.

increased with time, but this was not the case for Italian dyads. However, it should be noted that, at Time 1, the Italian dyads showed higher synchrony than the British dyads. A significant interaction effect was also found for *Waiting*: British mothers decreased *Waiting* from Time 1 to Time 2, but Italian mothers increased *Waiting* from Time 1 to Time 2.

Chi-squared tests were performed for *ADAs* as a function of *Nationality* and *Time*. In partial support of Hypothesis five, a significant association was found between *ADAs* and *Nationality*, with Italian mothers showing more use of *ADAs* than British mothers; however, this association was significant only at Time 2. There was an overall significant association between *ADAs* and *Time* with a significant drop in *ADAs* between Time 1 and Time 2; there was a drop for the British mothers, but an increase for the Italian mothers.

Chi squared tests showed a significant association between *Pushing* and *Time* with a significant drop between Time 1 and Time 2, especially for the British group. There was no significant association between *Pushing* and *Nationality* at Time 1, but there was a significant association at Time 2, with 32% of Italian mothers and no British mothers pushing at Time 2.

Discussion

The present study was the first to look at maternal behaviours and synchrony during feeding at the onset of CF and when infants were 7 months old and was the first to explore these factors for two nationalities. There were significant relationships between infant willingness to eat and some feeding patterns and significant variations in patterns between nationalities and over time. The early complementary feeding situation seems a sensitive and contextually varying platform for parent-infant interactions.

Synchrony in the CF situation surfaced as a crucial variable. It increased between the first week of CF and 7 months of age as we predicted, suggesting the early development of relational rhythms (Reyna & Pickler, 2009). Most importantly, in support of the relevance of synchrony as a significant variable in the measurement of feeding behaviour, there were

significant correlations between mother-infant synchrony and infant willingness to eat at both Time 1 and Time 2, supporting our predictions. It could be argued that synchrony is the illusory result of willingness to eat, that is, that the hungry infant already well-adapted to eating complementary foods creates the appearance of fluent and synchronous feeding. A parallel argument was made in discussions of turn-taking in proto-conversation (Kaye & Fogel, 1980; Schaffer, 1984); it was suggested that maternal scaffolding created the illusion of infant turn-taking. That argument was dismissed by perturbation studies manipulating the mother's input (Cohn & Tronick, 1987; Murray & Trevarthen, 1985). In the present case, however, evidence for arguing that the direction of influence is from synchrony to willingness to eat rather than the other way round is a temporal one: early synchrony (at Time 1) related to later willingness to eat (at Time 2), but early willingness to eat did not relate to later synchrony. A synchronous and therefore positive feeding relationship, it would seem, is indeed crucial for good infant nutrition (Satter, 1986). Inconsistent synchrony may be a marker of potential infant feeding difficulties; therefore, the investigation of mother-infant synchronous feeding patterns may be essential for early intervention in infant feeding practices (Toyama, 2014). Given the recent recognition of the pervasiveness and importance of parent-infant synchrony for the emergence of self-regulatory as well as complex cognitive skills in infants (Feldman, 2007; Feldman et al., 1999) the present results indicate a need for more extensive investigation of synchrony as a factor in typical as well as high risk feeding interactions.

Co-eating, seen as empathic behaviour by the mother (Negayama, 1993), did not differ between Time 1 and Time 2 in this study, portraying a slightly different picture from Negayama's (1993) study where maternal co-eating increased in the second semester of infant life. Co-eating, like synchrony, was positively related to infant willingness to eat; however, this was the case only at Time 1. It is possible that co-eating may play a practical

role in the process of CF, helping to encourage willing eating immediately after the onset of CF. However, given the lack of any relation over time between co-eating and food willingly eaten by infants, it is unclear whether co-eating is in fact led by anxiety about poor eating and is thus an attempt to make the infant eat.

Contrary to our predictions, maternal waiting did not relate to infant willingness to eat either at Time 1 or at Time 2. However, earlier willingness to eat (FWE at Time 1) was significantly correlated with later waiting (at Time 2). This suggests that waiting may have increased over time for some mothers as a result of gaining confidence in infant willingness to eat. As we predicted, pushing was a negative predictor of food willingly eaten at both Times. Although we cannot argue for the direction of effects on the basis of these results (one could as easily argue that pushing was the result of unwillingness to eat as that unwillingness to eat resulted from prior pushing) the negative correlation between pushing and synchrony is highly suggestive. At both Times, mothers who pushed had a lower percentage of synchronous spoonfuls than "non-pushing" mothers; by extension from the finding that early synchrony was associated with later willingness to eat but not the other way round, it is possible to speculate that pushing too may be a stylistic feature of feeding rather than a result of unwillingness to eat. To test this speculation one would need a greater number of mothers who exhibit 'pushing' studied over a longer period of time (the number of such mothers in the present study were relatively low at this stage of CF, 12 at Time 1 and 7 at Time 2). That said, these findings are consistent with those of Orrell-Valente and colleagues (2007), who found that pressure to eat was associated with food refusal, and in line with the advice given by the WHO, which recommends feeding infants slowly and patiently and encouraging them to eat without forcing (WHO, 2003). Indeed, if infants feel negative emotions, such as frustration and distress from unwanted pressure to eat, infant feeding problems such as Rumination and Infantile Anorexia or failure to thrive may result (Ammaniti, Ambruzzi,

Lucarelli, Cimino, & D'Olimpio, 2004; Chatoor, 2002; Kreisler, 2012). Our study, therefore, presents partial support for the claim that less pressure in feeding practices might be helpful for infant eating even at the earliest stages of CF.

Contrary to our prediction and more importantly, contrary to current advice and assumptions from official sources (Satter, 2000; WHO, 2003) about the disruptive nature of distractions, in our study maternal attempts to direct infant attention to external objects or locations while feeding did not bear any relation at all to infant willingness to eat. Combined with the finding that there was a significant nationality difference in the use of distractions (greater among Italian mothers) the assumption that it is important to have an exclusive focus on food during feeding cannot be sustained and we do not support the rather negative view of distractions currently assumed. This finding underlines the importance of recognising dyadic and cultural differences in feeding practices; the advice against the use of distractions during feeding tends to originate from Western European or Anglo-American sources and may not sufficiently recognise contextual differences in their impact. Cultural differences in the extent to which eating is a more social and sociable activity (as is often argued to be the case in Mediterranean cultures) could explain why feeding infants may involve lots of other communications including attempts to entertain them by waving toys at them and so on, rather than single-mindedly focussing on the feeding. Advice from professionals about how to feed infants cannot, therefore, be given independently of the larger cultural attitudes and habits.

Additionally, the current study found that there were differences between nationalities in co-eating, with Italian mothers showing significantly higher incidence of co-eating than the British mothers. This could be interpreted along the same dimension as maternal personal 'involvement' in the infant's eating, and is in line with previous findings that Japanese

mothers (with greater proximal attachment relationships to infants) show higher incidence of co-eating than Scottish mothers (Negayama, 2000).

In conclusion, the present findings suggest that maternal feeding behaviour varies enormously and subtly, and bears a strong relationship with infant willingness to eat. The introduction of complementary food is a crucial time for establishing a desire to eat and a good feeding relationship with the caregiver. Synchrony seems to positively affect infant willingness to eat, while pushing is negatively associated with infant willingness to eat. Other maternal feeding behaviours, however, such as the use of external distractions or vocal communication during feeding, do not seem to be linked to infant willingness to eat; they may be culturally variable practices which deserve further exploration with sensitive attention to contexts and cultural patterns of sociability at mealtimes. In contrast to the general advice discouraging the use of distractions during meals for the reasons that infants may lose interest in food (Dewey, 2001) and develop feeding problems (Chatoor et al., 1997; Kreisler, 2012), our findings suggest that mothers might be better off using distractions in their own way. Empowering mothers in their interactions with their infants by encouraging spontaneous tendencies rather than prescribing against particular behaviours may be valuable in establishing synchrony and successful relationships, especially in immigrants and with the mixing of cultural practices (Gratier, 2003).

Although it is arguable that the findings of this study are limited by the relatively small sample size (37 dyads), it should be noted that previous research investigating infant feeding practices and feeding interactions in typically developing mother-infant dyads using video observations, has generally included 20 or fewer participants (e.g., Barratt, Negayama, & Minami, 1993; Van Dijk et al., 2012; Toyama, 2013). Despite the modest sample size, this study highlights the importance of investigating the process of CF as an early foundation for children's eating habits and attitudes. The process and dynamics of CF using naturalistic

observation in typical mother-infant dyads provides evidence of the development of early relational patterns and interactions during feeding.

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Table 1.

Participants' Characteristics

Demographic variables	**Entire sample**	**British**	**Italian**	**Statistical analyses**		
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*df*	*t*	*p*
Mother's age (years)	31.73 (4.50)	31.07 (5.22)	32.18 (4.01)	35	-.74	.47
Mother's education (years)	15.24 (2.71)	15.60 (1.06)	15.00 (3.42)	26	.77	.45
Family social status (BSMSS score)	49.42 (10.56)	48.63 (12.70)	49.95 (9.11)	35	-.37	.71
Infant's age (weeks)						
Time 1	21.68 (2.56)	21.47 (2.39)	21.82 (2.72)	35	-.41	.69
Time 2	30.16 (.37)	30.27 (.46)	30.10 (.29)	22	1.31	.20
Infant BMI						
Time 1	17.48 (1.73)	17.91 (1.92)	17.18 (1.57)	35	1.25	.22
Time 2	18.19 (1.50)	18.52 (1.31)	18.00 (1.61)	35	1.11	.28
	n	*n*	*n*	*df*	X^2	*p*
Mother's marital status						
Married/living with partner	36	15	21	1	.70	.40
Single/divorced	1	0	1			
Infant's birth order						
First	23	7	16	1	2.58	.11
Subsequent	14	8	6			
Infant gender						
Female	20	8	12	1	.01	.94
Male	17	7	10			

Table 2.

Coding Scheme for Maternal Feeding Behaviour, Synchrony and Infant Willingness to Eat in First Five Minutes of Feeding∗ and Maternal Verbal Communications (MVCs) and Attention Directing Acts (ADAs) during the Whole Meal

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Waiting: coded when the mother waited (from 1 to 123 seconds) for the infant's response, with the spoon within 30 cm** of the infant's mouth. The spoon does not touch the infant's lips.

Pushing: coded if the mother pushed the spoon against the lips to urge the infant to open the mouth or if she pushed the spoon into the infant's mouth.

Co-eating: coded when the mother opened her mouth during the approach of the spoon or while the infant was opening the mouth. Slight movements of the mother's mouth (e.g., yawn or talking) were excluded

Synchrony: the absence of temporal overlap (less than 0.2 seconds) or temporal gap (greater than 0.2 seconds) between the arrival of the spoonful at the infant's mouth, and the infant's volitional opening of the mouth. For this measure only 'direct' spoonfuls were used. A direct spoonful involved any spoonful of food taken from the bowl which touched the infant's mouth; thus, some direct spoonfuls may have never resulted in the infant's mouth opening at all (if the infant kept the mouth shut and refused to eat) and would have been coded as asynchronous. The selection of 0.2 seconds as the criterion was the modal cut-off point derived from initial impressionistic judgements by two observers.

Food Willingly Eaten (FWE): the infant opened the mouth voluntarily when the food was coming and did not turn the head or close the mouth to avoid the spoonful; the infant did not show any signs of food refusal and appeared keen to eat the food.

Food Reluctantly Eaten: the infant did not open the mouth spontaneously and/or turned the head to avoid the spoonful; the infant did not appear keen to eat the food and showed signs of food refusal.

Food Refused: the infant closed the mouth and kept it closed until the mother retracted the spoonful.

Maternal Vocal Communications (MVCs) included *praise* for successful eating (e.g. "well done", "good boy/girl") and *sounds* (i.e. "yum", "hum hum", "ah ah").

Attention Directing Acts towards objects or locations (ADAs) included shaking or rattling a toy, and pointing to a location (e.g. "look there!").

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*Coding was done for all spoonfuls uninterrupted by chance events and excluding any spoonfuls not direct from the bowl to the infant's mouth (such as cleaning the infant's mouth and offering the food again).
**Distance was measured using Dartfish Software (v. ProSuite, 2006, Switzerland).

Table 3.

Pearson's Correlations between Waiting, Co-eating, Maternal Vocal Communications (MVCs), Mother-Infant Synchrony, and Food Willingly Eaten (FWE) at Time 1 and Time 2

	Time 1					**Time 2**				
	Waiting	*Co-eating*	*MVCs*	*Synchrony*	*FWE*	*Waiting*	*Co-eating*	*MVCs*	*Synchrony*	*FWE*
Time 1										
Waiting	/	-.08	-.44**	-.55***	.11	.24	-.13	-.13	-.27	-.05
Co-eating		/	.29	.31	.33*	.38*	.54**	-.26	-.16	.27
MVCs			/	.25	.21	.02	.12	.28	.01	.06
Synchrony				/	.50**	.14	.30	-.21	.44**	.59***
FWE					/	.40*	.09	-.25	.22	.58***
Time 2										
Waiting						/	-.02	-.13	-.39*	.15
Co-eating							/	.12	-.10	.26
MVCs								/	-.17	-.20
Synchrony									/	.57***
FWE										/

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

Table 4.

Maternal Behaviours and Synchrony as a Function of Nationality and Time

	Nationality	**Time 1**	**Time 2**		**Statistical analyses**			
		M (SD)	*M (SD)*		*df*	*F*	*η²partial*	*p*
Waiting								
	British	12.73 (5.16)	5.67 (4.13)	Time	1, 35	1.91	.05	.17
	Italian	10.91 (7.98)	14.05 (9.45)	Nationality	1, 35	2.62	.07	.12
	Entire Sample	11.65 (6.95)	10.65 (8.73)	Time x Nationality***	1, 35	12.89	.27	.001
Co-eating	British	5.93 (6.61)	11.07 (7.32)	Time	1, 35	2.73	.07	.11
	Italian	16.05 (11.08)	16.59 (12.45)	Nationality**	1, 35	7.13	.17	.01
	Entire Sample	11.95 (10.67)	14.35 (10.90)	Time x Nationality	1, 35	1.78	.05	.19
MVCs	British	18.87 (15.06)	31.33 (25.92)	Time	1, 35	1.32	.04	.26
	Italian	29.09 (25.75)	26.95 (21.65)	Nationality	1, 35	.23	.01	.64
	Entire Sample	24.95 (22.39)	28.73 (23.22)	Time x Nationality	1, 35	2.64	.07	.11
Synchrony	British	16.00 (14.35)	36.67 (18.69)	Time**	1, 35	7.38	.17	.01
	Italian	31.86 (28.81)	31.73 (22.71)	Nationality	1, 35	1.01	.03	.32
	Entire Sample	25.43 (25.03)	33.73 (21.04)	Time x Nationality**	1, 35	7.58	.18	.01
ADAs		%	%		*df*	X^2	*N*	*p*
	British	53.30	13.30	Time*	1	4.88	37	.03
	Italian	63.60	72.70	Nationality (Time 1)	1	.39	37	.53
	Entire Sample	59.50	48.60	Nationality (Time 2)***	1	12.59	37	<.001
Pushing	British	26.70	.00	Time***	1	11.19	37	.001
	Italian	36.40	31.80	Nationality (Time 1)	1	.38	37	.54
	Entire Sample	32.40	18.90	Nationality (Time 2)*	1	5.89	37	.02

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

A B C D

Figure 1. Example of maternal co-eating and synchrony between spoon approach and infant mouth opening (A: mother spooning food from bowl, infant gaze to spoon and food; B: mother lifting spoon out, opens own mouth, infant gaze on spoon; C: mother brings spoon closer, still co-eating, infant opens mouth, his gaze to spoon, D: spoon at infant's mouth, mother still co-eating, infant accepting food).

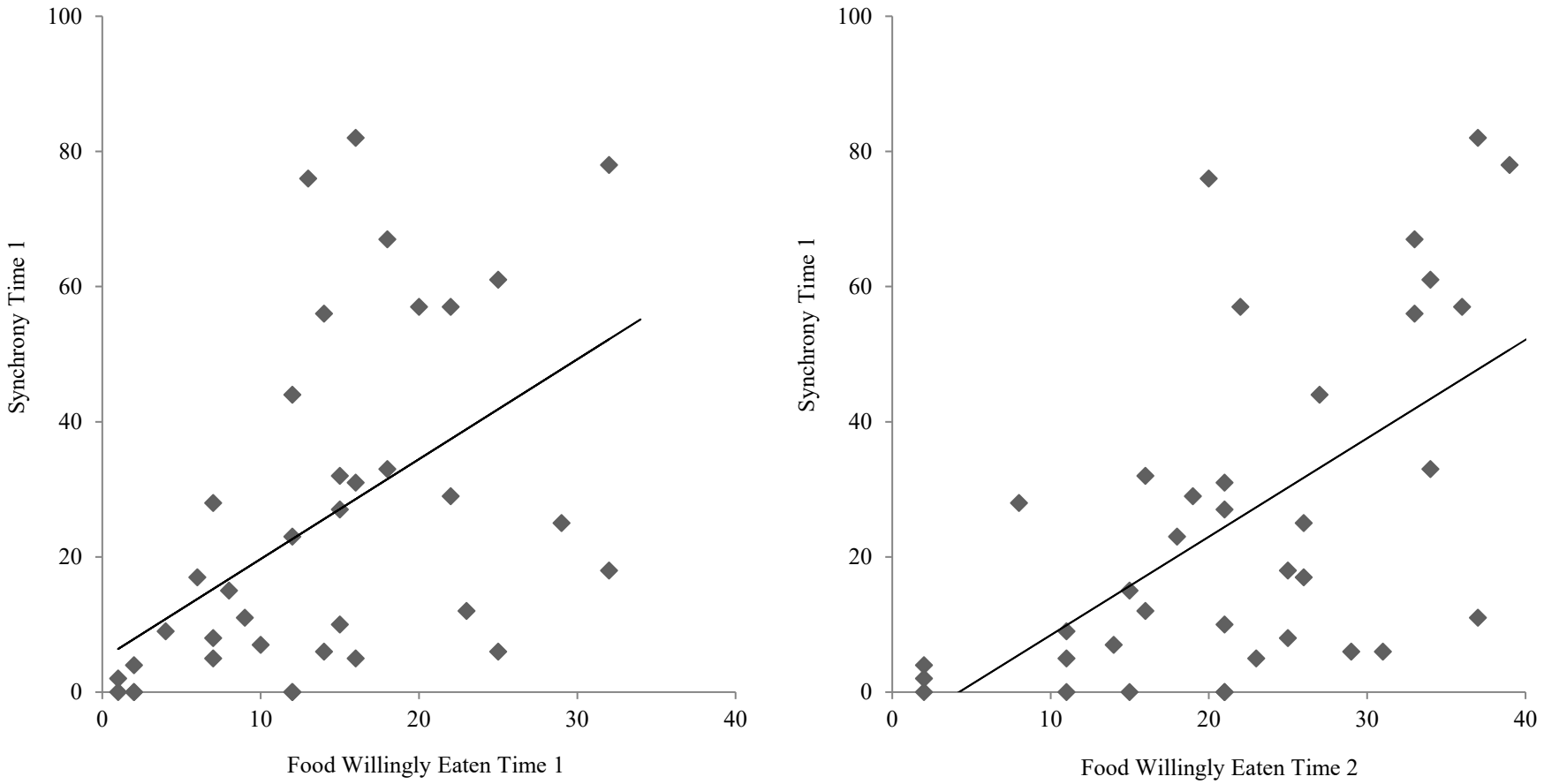

Figure 2. Relationship between Synchrony at Time 1 and Food Willingly Eaten at Time 1 and Time 2 (N = 37).