



Responsive complementary feeding in rural Bangladesh

Anna C Moore^{a,*}, Sadika Akhter^b, Frances E Aboud^c

^aICDDR, B: Centre for Health and Population Research, Dhaka, Bangladesh

^bPlan International, Bangladesh

^cMcGill University, Montreal, Canada

Abstract

It is now widely recognized that malnutrition can partly be attributed to caregiver–child interaction during feeding episodes. Current conceptual frameworks emphasize the importance of responsiveness (including active and social behaviour), psychomotor abilities of the child to self-feed, and a non-distracting feeding environment. The present observational study had three main objectives: (1) to define operationally key terms such as responsive and active feeding and observe their frequency in a rural Bangladesh sample; (2) to examine whether self-feeding, responsive and active behaviours of the mother and child varied with child's age and amounts eaten; and (3) to determine associations between mother and child behaviours. Fifty-four mother–child pairs were observed during one feeding episode and behaviours were coded for 5 categories, namely self-feeding, responsive, active, social and distracting behaviours. Children were between 8 and 24 months of age. Results indicated that the five behaviours could be observed and reliably coded. Two-thirds of mothers had an active feeding style but only a third were responsive; the two styles did not overlap. With older children, mothers encouraged more eating and more self-feeding, but children did not feed themselves more; instead older children were more negatively responsive (refusing offered food). Positively responsive mothers tended to have active children who explicitly signaled their desire for food or water, and who ate more mouthfuls of food. Positively active mothers adopted different strategies to encourage eating, such as verbally directing the child to eat, focusing, and temporarily diverting. These mothers tended to have children who were negatively responsive and refused food. Children accepted on average 5.31 mouthfuls of food and rejected 2.13. Mothers who used intrusively active strategies (e.g. force feeding) tended to have children who were both positively and negatively responsive, thus partially reinforcing her forceful behaviour. Thus, the responsive feeding framework, once operationalized, has the potential to identify specific behaviours that support or impede mother–child interaction during complementary feeding.

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Keywords: Responsive feeding; Feeding practices; Malnutrition; Child development; Bangladesh

Introduction

UNICEF (2004) estimates that 48% of children under 5 years of age living in Bangladesh are

malnourished. Many other countries in South Asia, sub-Saharan Africa and Latin America grapple with a similar problem of malnutrition, which has long-term effects on physical and mental health. Children are particularly vulnerable from the age of 6 months, when they begin to require foods additional to breast milk. However, malnutrition is no longer

*Corresponding author. Tel.: +88028811751.

E-mail address: anna@icddr.org (A.C. Moore).

considered simply to be a question of a shortage of good quality food. Even among poor families some children have better nutritional status than others; this is increasingly being attributed to responsive feeding practices of the mother (Engle, 1998; Pryer, Rogers, & Rahman, 2004). A conceptual framework outlined by Engle, Bentley, and Peltó (2000) proposes three critical components of a responsive feeding style, namely being sensitive to the child's psychomotor abilities for self-feeding, being responsive and active, and providing a supervised, non-distracting environment. The present study used the responsive feeding framework to examine data collected from rural Bangladesh, with a view to identifying problem feeding practices that could contribute to poor nutritional status (Dewey, 2003).

Responsive feeding practices incorporate the components of caregiving that are known to promote physical, mental, and social development more generally (Engle et al., 2000). They include being sensitive and responsive to the child's signals, and providing a stimulating but structured environment within which the child can actively participate in his/her own development. Within a complementary feeding context, these practices call for a delicate balance between being responsive and active. For example, the mother will need to observe that her child can use the finger pincer motion to pick up solid food at 9 months, and respond to this ability by presenting food to be picked up. Likewise, the mother needs to respond to cues of satiety/disinterest but also prevent anticipated refusals with active strategies.

Attempts to operationalize and observe these feeding practices have met with mixed success. Peltó, Levitt, and Thairu (2003) applied the responsive feeding framework retrospectively to data from a number of international studies. Behavioural categories related to self-feeding and to characteristics of the environment (e.g., schedule, supervision, utensils, distractions) could be clearly observed and described, but responsiveness was typically not. In a recent study, responsive feeding in Viet Nam was operationalized as physically "facilitating feeding or directly helping the child" and positive verbalization (Ha et al., 2002). This description combines three arguably distinct behavioural categories, namely responsive, active and social behaviours. Because specific behaviours of the child were not described, other than to accept or reject offered food, there was no

way to know if the mother was being responsive or simply performing what had been identified a priori as a good practice.

The current literature on sensitive and responsive caregiving (De Wolff & van Ijzendoorn, 1997; Isabella, 1993; NICHD, 1997) empirically distinguishes *responsiveness*, in which the mother interprets and responds to child signals, from *active* behaviours, in which the mother focuses, stimulates and encourages the child to act. We therefore applied these definitions to the feeding context, coding behaviours as responsive or active in a positive (supportive) manner or in a negative (aversive, counter to feeding) manner. We also observed child responsive and active behaviours independently of the mother's in recognition of the fact that the child should have a place in the framework (Engle et al., 2000). *Social* interaction in the feeding context might be defined as verbal or gestural interaction concerning non-food topics. Once operationalized in a manner that allows them to be reliably observed, the categories of "active and responsive" feeding behaviours can be used to describe and improve complementary feeding.

The aim of the current study, then, was to elaborate on the responsive feeding conceptual framework by applying it to observations of complementary feeding episodes in a rural area of Bangladesh. First, we created operational definitions to distinguish among responsive, active and social behaviours, and hypothesized that they may be empirically distinct as well (De Wolff & van Ijzendoorn, 1997). Second, we hypothesized that the mothers' responsive feeding would correlate with her child's age and number of mouthfuls eaten (Engle et al., 2000) and with her education or assets (Guldan et al., 1993); no hypotheses were formulated concerning associations with the child's gender or weight for age. Using similar codes for the child's behaviour, we examined them in relation to age, gender, the number of mouthfuls eaten, and weight for age. Finally the association between caregiver and child behaviour was examined. While the number of mouthfuls accepted or rejected by a child (Ha et al., 2002) may be important in the short term, we also took the longer-term perspective that self-feeding and an active interest in food reflect the development of good eating habits. It was hypothesized that these child-eating behaviours would be associated with responsive caregiver feeding.

Method

Setting, design, and overview

The study was conducted in Gazipur, a rural area of Bangladesh. It was primarily a cross-sectional observational study of mother–child interaction during a feeding episode, complemented with a short interview of mothers beforehand concerning their experiences feeding their child. Before conducting the study, we ran a focus group of more articulate mothers of similarly aged children in order to find out about child-feeding problems, such as refusals, and how they handled such problems. This helped in understanding the intentions behind certain behaviours.

Participants

The participants were a convenience sample of 54 caregiver–child pairs. Children were recruited from five villages where a parenting program for mothers of children under 3 years of age was to be implemented. Children between 8 and 24 months were selected because they would have the motor skills to sit and participate in their feeding. Forty-six caregivers were mothers; the others were aunts or grandmothers.

Procedure and measures

Caregiver interview

A caregiver interview was first administered by trained local young women and consisted of a series of closed and open questions. Demographic and economic questions included the age, education and occupation of the parents, whether the family owned land for production and the number of household assets, scored out of 11 possible items (e.g. table, bed, clock, bicycle, radio). The number of assets is a commonly used measure of socio-economic status in Bangladesh. Feeding practice questions included current breastfeeding, the age at which the child started complementary foods, and foods first introduced. An open-ended question was used to explore problems: “Does your child have any problems eating solid foods?” If the answer was “yes” we asked for an elaboration, and then “How do you try to solve this?” The child’s weight was taken on a Uniscale and translated into weight-for-age *z* score using the Center for Disease Control and Prevention tables (CDC 2000).

Observation of feeding episode

The research assistant returned to the home at a time suggested by the mother to watch the child eating a daytime meal. The observer sat to one side and recorded all behaviours she saw related to caregiver and child during the feeding episode, organized according to who was the actor, to whom or in whose presence the behaviour was enacted, and exactly what was said or done. Observers were trained to record verbal and non-verbal behaviours, and note the time every 5 minutes. The duration of the feeding episode, where the feeding took place, who fed the child and what the child was given to eat was also recorded. A maximum time of 1 hour was set although most lasted between 5 and 20 minutes. The transcripts were translated into English and coded by the principal investigator.

A coding system was devised which consisted of 5 behavioural categories: (1) self-feeding, (2) responsiveness, (3) active feeding, (4) social behaviour and (5) distraction. The behaviours of both mother and child were coded in which the unit of behaviour was the smallest meaningful action or utterance. In most cases each category had a positive and negative classification: positive meaning that it promoted feeding, and negative that it was aversive, intrusive or interrupted feeding. The codes are mutually exclusive except for self-feeding which could be a response to the partner’s cue or actively initiated on its own. Because of the importance given to the development of self-feeding behaviours, we coded this first (with a subcode of Responsive or Active); if the behaviour did not reflect self-feeding, then it was coded as one of the other four. See Appendix A for the codes and behavioural examples.

The first code, self-feeding, is done by the child, but the mother can behave in a manner to initiate it (positive self-feeding) or to discourage it (negative self-feeding). Likewise, the child can pick up food or hold a cup (positive self-feeding) or not take the cup offered by the mother (negative self-feed). On the basis of De Wolff and van Ijzendoorn (1997), we operationalized responsiveness as behaviour that is in direct response to the behavioural, gestural or verbal cue of the feeding partner (mother or child), i.e. synchronous. Responsive behaviour on the part of the mother is child-driven; it should be in line with the child’s cue, not counter to it. A positive responsive behaviour promotes feeding in response to a partner cue; whereas a negative responsive

behaviour interrupts feeding in response to a cue. Active feeding was operationalized as behaviour that encourages the child to eat or the mother to feed, either indirectly through words or directly through forcing food into the child's mouth. Active strategies on the part of the mother may follow a child refusal but are not in line with a child's cues and are mother-driven. We coded active behaviours as negative if they were clearly aversive, intrusive, or threatening. The first three codes concerned food and feeding/eating. Social behaviours took place between the feeding partners but concerned non-food topics. Distraction was coded when a behaviour of the mother or child was directed toward a non-feeding partner or event, such as the mother having a conversation with another adult which interrupts feeding. If the mother used diversion as a strategy to encourage intake then it was coded as active. Finally, offering food to the child by simply bringing food to the child's mouth was coded as Mother Offers Food, rather than as active, because it was not a special strategy to encourage feeding. If food was offered while the mother said, "Eat food, it's tasty" this would be Active-positive; if food was offered in response to a child's signal for more, it was coded as Responsive-positive. The unit of analysis was the individual. Consequently, each mother and child received a behavioural category score reflecting the frequency with which they exhibited that behaviour. The coders also made a binary judgment about whether the feeding session ended prematurely or not, based on factors such as definite signals of child hunger, a single refusal or few mouthfuls consumed (100% agreement) and who ended the session, mother or child (93% agreement). Judgements about who terminated the feeding episode were based on the last two mouthfuls of food. If the child refused the last two mouthfuls then the episode was considered to be child terminated. If the child accepted at least one of these mouthfuls, the episode was considered to be ended by the mother. Children who self-fed were judged to terminate feeding themselves. Twenty-eight (52%) of the transcripts were coded independently by the third author. The mean correlation was $r = 0.91$ (range .73 distraction to .99 child self-feeding positive). Thus, it appears to be feasible to define operationally, observe, and code with some reliability the behavioural categories and their subtypes.

Method of analysis

Frequency counts of each behavioural variable were subjected to descriptive analysis. Because the variables were strongly skewed with a limited range, they were subjected to a square root transformation for correlational analyses, and converted to binary data for Chi square analyses. If the person was observed to behave that way at least two times, it was scored as present; otherwise not. A behaviour that occurred only once might reveal the ability to act responsively or actively but it could hardly be called a caregiver "style". Gender differences were examined; because differences occurred on weight but not any of the behaviour variables, boys' and girls' data were combined for analyses.

The first hypothesis concerning the co-occurrence of mothers' responsive, active and social behaviours was evaluated with Chi square tests and an alpha coefficient. The second hypothesis concerned associations between mother and child behavioural codes and continuous variables related to demographic, economic and nutritional variables. For this, square root transformed behavioural frequencies were correlated with mother's education, family assets, child's age, number of mouthfuls eaten and weight for age. Finally, the third hypothesis concerning mother and child behavioural associations was examined with Chi square analyses using Fishers exact test where necessary, on the whole sample and the two older age groups separately. The significance level was set at $p < .05$.

Results

Descriptive statistics are first presented for demographic and economic characteristics, the mothers' interview data on feeding practices, and children's nutritional status, followed by descriptive frequencies of the feeding behaviours. Finally, analyses related to the hypotheses are presented.

Demographic and economic characteristics

See Table 1 for a summary of family variables. Children were on average 16.8 months: 8 were 8–11.9 months, 23 were 12–17.9 months, and 23 were 18–24 months. Parents averaged 6 years of schooling; 27.8% had received no education at all. On the assets scale, a measure of economic status, the mean score was 7.67 out of 11; 33% owned their

own land for production. The vast majority of the mothers were housewives (94%); all the fathers were employed, the largest groups as wage labourers (38.9%), merchants (20.4%) and farmers (18.5%). Eighty-three per cent of the sample were Muslim; 17% were Hindu.

Nutritional status and mothers' reports of feeding

The majority of the children were underweight (see Table 1). Forty-six per cent were moderately or severely underweight ($z < -2$) and 37% were mildly underweight ($-2 \leq z < -1$). This is consistent with current rates of malnutrition in Bangladesh. Mothers reported that 96% of their children continued to have breast milk; all of the children, except one, were breastfed in the past. The mean age to be given solids was 6.8 months, most were given solid foods between 5–6 months but a small number of children were started at 12–14 months. Solid foods first introduced into the child's diet included:

Table 1
Socio-demographic variables

Variable	Mean	SD
Mother age	24.3	5.3
Father age	32.5	5.8
Child age	16.8	4.3
Mother education	5.8	4.2
Father education	6.0	4.8
Assets	7.7	2.9
Household size	5.2	1.6
Siblings	1.0	1.1
Weight for age	-1.87	1.08
Boys	-1.46	1.28
Girls	-2.12	.86

Table 2
Mothers' strategies to overcome poor child appetite both reported ($n = 34$) and observed ($n = 54$)

Strategies reported	<i>N</i>	%	Strategies observed	<i>N</i>	%
Diversion	12	22.22	Verbal direction	23	42.59
Follow child with food	7	20.54	Focus attention	21	38.89
Force feed	5	17.71	Question	16	29.63
Doctor/vitamins	4	11.76	Divert momentarily	9	16.67
Beat	2	5.88	Talk about food	8	14.81
Pause from feeding	2	5.88	Model	3	5.56
Threaten harm	1	2.94	Increase food variety	2	3.70
Increase selection of foods	1	2.94	Praise	1	1.85
Wait for child to open mouth	1	2.94			
No solution offered	11	22.22			

61% kitchuri (a combination of rice, lentils, oil and sometimes egg, vegetable or meat), 53% fruit, 43% rice and 28% eggs; vegetables were not mentioned. Thirty-three per cent of mothers reported that their children showed a generally positive response to the introduction of solid food, 19% were generally negative and the remaining children liked some foods but not others.

Thirty-four mothers reported that their children had difficulties in the feeding situation, primarily the child's lack of interest in eating. One third were unable to generate any solutions to their problem; two thirds generated at least one solution, summarised in Table 2 (along with observed strategies reported later). Most of the solutions concerned strategies to overcome child reluctance or disinterest in the feeding context, so we could expect to observe these during the feeding episode. Several of these would be considered aversive to the child including beating, threatening to beat and force-feeding. Two common strategies reported by mothers were to divert the child momentarily and to follow the child around with a plate of food, waiting until the child would take a mouthful. There was a significant association between whether or not the mother reported problems and child refusal of offered food during the observed meal, $\chi^2 = 9.8$, $p = .002$; 85% of mothers reporting problems encountered at least one refusal, whereas only 45% of mothers who did not report problems encountered a refusal.

Descriptive analysis of observed feeding behaviour

A limited range of foods was offered to the children during the observed feeding: 42 were given rice, 12 were given fruit and 10 were given dal; only

Table 3
Mean (SD), range and frequency showing 2+ behaviours for each category

Behavioural categories	Mother				Child			
	Descriptive		Frequency		Descriptive		Frequency	
	<i>M</i> (SD)	Range	<i>N</i>	%	<i>M</i> (SD)	Range	<i>N</i>	%
Self-feed								
Positive	.44 (0.7)	0–2	6	11.1	3.02 (3.5)	0–14	29	53.7
Negative	.20 (0.5)	0–2	2	3.7	.43 (0.9)	0–4	5	9.3
Responsive								
Positive	1.37 (1.5)	0–7	19	35.2	3.96 (2.9)	0–11	42	77.8
Negative	.19 (0.4)	0–1	0	0	3.11 (3.1)	0–14	31	57.4
Active								
Positive	2.57 (2.6)	0–14	34	63.0	1.72 (1.8)	0–7	23	42.6
Negative	.98 (1.7)	0–11	13	24.1	0	0	0	0
Social	.93 (1.0)	0–4	14	25.9	.94 (1.1)	0–5	11	20.4
Distraction	0	0	0	0	1.50 (2.4)	0–15	19	35.2
Mother offers food	5.19 (3.8)	0–16	46	85.2	NA			
Mouthfuls accepted	NA				5.31 (2.7)	1–12	51	94.4
Mouthfuls refused	NA				2.13 (2.5)	0–12	23	42.6

NA = behavioural code not applicable to this feeding partner.

4 were given egg, and one vegetables. Half of the children were fed in a room and half outside on the verandah or yard; a third were fed in two or three locations.

Means, standard deviations, ranges, and frequencies for each observed behavioural code are presented in Table 3. Frequencies refer to the number of mothers and children who were observed performing a particular behaviour on at least two occasions. Examination of the table shows that few engaged in behaviours to either promote or restrict self-feeding, such as giving the child his/her own plate or saying “No” when the child attempted to pick up food. A third of mothers showed positive responsive behaviours such as bringing water when a child asked; two thirds showed two or more positive active behaviours, such as encouraging the child to eat after a refusal. One in four provided some social interaction unrelated to food such as talking about a family member or smiling and making eye contact. One quarter of the mothers showed some negative active behaviours such as threatening, hurrying the child or force-feeding (the last demonstrated by 18.5% on at least one occasion). Most of the mothers’ feeding behaviour entailed simply putting food into the child’s mouth (coded as Mother Offers Food).

Overall children tended to be more behaviourally active in the feeding situation than their mothers. Half showed positive self-feeding, almost all being active rather than responsive. Despite this expressed interest in and ability to self-feed, very few children ate most of their meal on their own: 14 (26%) had 3 or more mouthfuls by themselves and only 9 (16%) had 5 or more. Most children showed positive responsive behaviours, such as eating food when it was offered, while also being negatively responsive by refusing food, regurgitating the rice that was put into their mouth or leaving the feeding situation. Some 42.6% showed positive active behaviour such as asking and reaching for food, and 20% of children engaged in social (non-food related) interaction with the mother during the feeding episode. One in three was distracted by toys or people other than the feeder.

Thirty seven (almost 70%) of the feeding episodes were judged to end prematurely, with the child still showing an interest in eating, or a single refusal often with few mouthfuls. This is consistent with the mean of 5.31 accepted mouthfuls (“bites”) of food ingested by the child. The mother ended the feeding episode in 54% of cases. There was no significant association between whether the meal ended prematurely and who ended it (i.e. mother or child).

Associations among responsive feeding behavioural components

The behavioural categories were operationally defined, observed and coded as distinct behaviours. This allowed us to examine whether they co-occurred in the same individual. Are responsive mothers more likely to be active, and are both of these positive practices associated with social interaction? If so, then a single “responsive feeding” category might be warranted. Results of Chi square analyses showed that there were no significant associations between responsive, active and social categories, either positive or negative, $\chi^2 = .08-3.21$, $p = \text{ns}$. When self-feeding behaviours were double coded as responsive or active, and added to the main responsive and active categories, Chi squares were still not significant. Likewise, the alpha coefficient for a combination of responsive, active, and social behaviours was only .37. This suggests that responsive, active, and social behaviours, as defined here, can be considered distinct components of caregiver feeding style. Mothers who had an active style, in the sense of manifesting encouraging behaviours on two or more occasions, were not necessarily also responsive or socially interactive. Not surprisingly, the behavioural codes were also unrelated among children.

Correlations between behavioural frequencies and demographic, economic and nutritional variables

As mentioned before, there were no gender differences in behavioural variables. Boys had significantly higher weight-for-age than girls, $t = 2.29$, $p = 0.03$, and those with better-educated fathers had higher weight-for-age, $r = .35$, $p = .009$. But there was no relation between weight-for-age and any of the behavioural variables. There were also no significant correlations between mother education and any of the behavioural variables. Mothers with more family assets were less likely to encourage self-feeding, $r = -.30$, $p < .05$, and more likely to simply offer food, $r = +.29$, $p < .05$. As these were the only significant associations, observational data were not analysed separately according to assets, child gender or nutritional status.

However, there were interesting relations between children’s age and the behavioural variables. These can be seen in Table 4, while means for the three age groups are presented in Table 5. Older children received more mother overtures toward self-feeding,

Table 4
Correlations of age and mouthfuls eaten with mother and child behavioural frequencies

Behaviour codes	With child’s age		With mouthfuls eaten	
	Mother	Child	Mother	Child
Self-feeding positive	.35**	.23	.22	.45**
Responsive positive	.22	-.32*	.33*	.29*
Responsive negative	—	.27*	—	-.06
Active positive	.30*	.08	.23	.37**
Active negative	.14	—	.17	—
Social	.27*	.07	.11	.33*
Mother offers food	-.11	—	.26	—
Mouthfuls eaten	—	-.13	—	—
Mouthfuls refused	—	.16	—	.05

Note: Variables with very low frequencies where the positive skew could not be reduced were omitted, namely Negative Self-Feeding, Mothers’ Responsive Negative, and Child’s Active Negative.

* $p < .05$, ** $p < .01$.

though on average still less than one, more positively active behaviours and more social interaction. Older children, however, did not self-feed more; they were less positively responsive and more negatively responsive.

Correlations between the number of mouthfuls accepted by children and behavioural codes (see Table 4) showed that children of positively responsive mothers ate more mouthfuls. Many child behaviours were correlated with eating more mouthfuls, namely self-feeding, positively responsive, positively active, and social. Multiple regression analyses were conducted to determine which behaviours were most closely associated with mouthfuls; it controlled first for age before entering four of the top behaviours. Child behaviours predicted 57% ($p < .0001$) of the variance in mouthfuls accepted, with self-feeding (std beta = .69, $t = 5.8$, $p < .0001$) and positively responsive behaviours significant (std beta = .57, $t = 4.9$, $p < .0001$). Maternal behaviour predicted 33% ($p = .003$) of the variance in mouthfuls, with encouragement of self-feeding (std beta = .30, $t = 2.3$, $p = .01$) and positively responsive behaviours significant (std beta = .35, $t = 2.9$, $p = .005$).

Associations between mother and child feeding behaviours

Children’s responsive and active, but not self-feeding, behaviours were associated with the

Table 5
Mean (SD) frequencies of mother and child behaviours for 3 child age groups

Behavioural categories	Mothers' behaviour			Children's behaviour		
	8–11.9	12–17.9	18–24	8–11.9	12–17.9	18–24
Self-feed positive	0.0 (0)	.39 (.7)	.65 (.8)	1.00 (1.9)	3.04 (3.9)	3.70 (3.4)
Self-feed negative	.13 (0.4)	.22 (0.5)	.22 (.5)	.13 (0.3)	.43 (.8)	.52 (1.1)
Responsive positive	1.13 (1.4)	1.09 (1.0)	1.74 (1.9)	6.50 (2.7)	3.87 (2.3)	3.17 (3.2)
Responsive negative	.38 (0.5)	.13 (.34)	.17 (0.4)	1.75 (3.1)	2.87 (2.5)	3.83 (3.6)
Active positive	1.63 (1.4)	2.17 (2.0)	3.30 (3.3)	1.75 (2.1)	1.43 (1.3)	2.00 (2.1)
Active negative	.63 (0.7)	1.00 (1.2)	1.09 (2.3)	—	—	—
Social	.25 (0.5)	.91 (1.0)	1.17 (1.1)	.63 (1.1)	1.35 (1.3)	.65 (0.8)
Distraction	—	—	—	.88 (0.8)	2.09 (1.2)	1.13 (1.7)
Mother offers food	6.38 (3.6)	5.13 (3.4)	4.82 (4.3)	—	—	—
Mouthfuls accepted	—	—	—	5.57 (2.9)	5.74 (2.6)	4.74 (2.7)
Mouthfuls refused	—	—	—	1.13 (1.4)	2.09 (2.2)	2.52 (2.9)

Samples sizes: $n = 8$ for 8–11.9 mo., $n = 23$ for 12–17.9 mo., $n = 23$ for 18–24 mo. Bold numbers mean a significant age difference according to correlation analyses.

Table 6
Chi square associations between mother and child behaviours

Child categories	Mother behavioural categories		
	Responsive pos	Active pos	Active neg
Self-feeding pos	0.01	0.51	1.60
Responsive pos	0.70	0.09	4.49*
Responsive neg	0.40	9.79**	8.53*
Active pos	8.00*	0.08	0.09
Social	0.64	2.11	3.45

* $p < .05$ for 18–24 month olds only.

** $p < .01$ for 12–17.9 and 18–24 month olds.

mothers' behaviour, particularly children of 18–24 months. While the specific causes of these combinations cannot be determined, we attempt to provide likely avenues of mutual influence. We were particularly interested in mothers who displayed responsive and active behaviours. Encouragement of self-feeding behaviour on the part of the mother was not associated with child behaviors.

Mothers who were positively responsive tended to have older children who were positively active (see Table 6). These mothers showed a synchrony that maintained interest and continuity in feeding. Undoubtedly mothers had more opportunities to be responsive if the child explicitly pointed or stated the word “water” or “rice”. The following excerpt is of a 21-month-old who actively shows an interest in

the meal and the mother responds in line with his signals:

Mo–Ch: Says “Will you eat rice?” (active pos)
 Ch–Mo: Says yes by nodding head (responsive pos)
 Ch–Mo: Says “rice” (active pos)
 Mo–Ch: Gave food (responsive pos)
 Ch: Put some into his mouth by spoon (self feeding pos)
 Ch–Mo: Says “hot”! (active pos)
 Mo–Ch: Blow on foods (responsive pos)
 Ch–Mo: Wants water by saying “water, water” (active pos)
 Mo–Ch: Gives the child water (responsive pos)
 [#20 21-month-old weighing 10.2 kg]

Although overall the children of responsive mothers ate more mouthfuls of food, they themselves did not show more responsive, self-feeding or social behaviour.

Mothers who were positively active were more likely to have children who were negatively responsive, that is to refuse her offerings of food. The association was significant for both 12–17.9 month olds and 18–24 month olds. In the following excerpt the mother tried to encourage and divert a reluctant child:

Mo–Ch: offers rice (offers food)
 Ch–Mo: turns his face and cries (responsive neg)

Mo-Ch: asks, "Will you drink water?" (active pos)
 Ch-Mo: cries (responsive negative)
 Mo-Ch: offers water (offers food)
 Ch-Mo: drinks water (responsive pos)
 Mo-Ch: again offers rice (offers food)
 Ch-Mo: turns his face (responsive neg)
 Mo-Ch: shows him a bird outside (active pos)
 Mo-Ch: then offers rice (offers food)
 Ch-Mo: eats rice (responsive pos)
 Mo-Ch: offers rice (offers food)
 Ch-Mo: says "no" (responsive neg)
 Mo-Ch: gives him a toy to play with (active pos)
 [#49 12-month-old weighing 8.8 kg]

The following is an excerpt where the mother is positively active at the start of the feeding episode before the refusals (perhaps in anticipation of refusals from prior experience) but she is not responsive in acknowledging his disinterest. The child shows mostly negative responsive behaviour until the mother leaves, at which time he feeds himself.

Mo-Ch: asks "Will you eat rice?" (active pos)
 Mo-Ch: says "My son is eating rice" (active pos)
 Mo-Ch: then she offers rice (offers food)
 Ch-Mo: goes away from his mother (responsive neg)
 Mo-Ch: calls child "Come to me and eat rice" (active pos)
 Ch-Mo: doesn't come to his mother (responsive neg)
 Mo-Ch: fetches the child by holding his hand (active pos)
 Mo-Ch: tries to give food into his mouth by force (active neg)
 Ch-Mo: not opening his mouth (responsive neg)
 Mo-Ch: says "If you eat quickly I will clap for you" (active pos)
 Ch-Mo: claps by himself (responsive pos)
 Ch-Mo: sticks out his tongue (responsive neg)
 Mo-Ch: offers rice by spoon (offers food)
 Ch-Mo: crying (responsive neg)
 Mo-Ch: goes to another room, leaving child (responsive neg)
 [#47 18-month-old weighing 11.4 kg]

Most mothers became active when the child countered their feeding overtures by leaving or refusing. When interviewed 34 mothers said they had experienced difficulties feeding their child; the most common solutions were diversions, following

the child around with food, and force-feeding. However, when the observed positive active strategies were categorized (see Table 2), the most common were verbally to direct the child saying "eat, eat", to focus which usually involved bringing the child back to the feeding situation after she/he had left it, to question and to divert by drawing the child's attention to an interesting animal. Other strategies such as talking about food, modeling, increasing the variety of food, and praising the child occurred infrequently. As seen in the excerpts above, the mothers' active attempts were sometimes poorly timed, inappropriate or insensitive, and therefore may have been experienced by the child as controlling or manipulative. They did not correlate significantly with the number of mouthfuls of food eaten by the child.

Finally, mothers who were negatively active had older children who tended to be negatively responsive and positively responsive. Forcing the child to eat, physically or with threats, tended to be used with children who refused to eat, though the intrusive strategies may also have provoked older children to refuse. Yet, the threatening strategies were also seen to be successful in the sense of getting the child to attend and respond to her. This would serve to reinforce the mother's belief that threats and force-feeding are effective as a last resort. However, this mother behaviour was not significantly correlated with the total number of mouthfuls accepted by the child. The following two excerpts illustrate mothers who used negative active strategies to encourage their children to eat.

Mo-Ch: offers food to child by saying "take, take food" (active pos)
 Ch-Mo: eats the food (responsive pos)
 Ch-Mo: shuts his mouth tight (responsive neg)
 Mo-Ch: gives food into his mouth by pushing the spoon (active neg)
 Ch-Mo: eats the food (responsive pos)
 Mo-Ch: offers food (offers food)
 Ch-Mo: eats food (responsive pos)
 Ch: is about to cry (responsive neg)
 Mo-Ch: again gives food into mouth by pushing spoon (active neg)
 Ch-Mo: eating (responsive pos)
 Mo-Ch: calls his name lovingly (social)
 Ch: says "father" (social)
 Mo-Ch: offers food to his mouth
 Ch-Mo: turns his face and starts to cry (responsive neg)

Mo: says to herself he will not eat any more and stops feeding
 [#46 10-month-old 9.9 kg]

Mo–Ch: offers rice into her mouth (offers food)

Ch–Mo: spits out rice (responsive neg)

Ch–Mo: says “I will not eat anymore” (responsive neg)

Mo–Ch: asks “Why?” (responsive pos)

Ch–Mo: moving away from her mother (responsive neg)

Mo–Ch: says “I will give your rice to the chickens” (active neg)

Ch–Mo: took rice into her mouth (responsive pos)

Ch–Mo: spits out rice (responsive neg)

[#35 23-month-old 10.4 kg]

Discussion

The findings contribute to a growing interest in and awareness of the role of responsive feeding by building on the current framework offered by Engle et al. (2000) and Dewey (2003). By operationalizing and examining maternal and child behaviours during complementary feeding, we elaborated the framework in a way that makes it useful for research on malnutrition and for guidelines to improve child feeding in areas where malnutrition is high. The findings point out that malnutrition may be due as much to problematic mother–child interaction as to a shortage of high-quality foods.

The findings are discussed as they pertain to questions concerning the distinctiveness of responsive feeding components, the role of the child, and supportive and problematic caregiver practices.

Caregiver responsive feeding behaviours

We found no association among the different components of caregiver responsive feeding behaviours. In addition to encouragement of self-feeding according to the child’s psychomotor abilities, we found three distinct behavioural categories, namely responsive, active, and social. Mothers who evidenced a responsive style, in the sense of responding synchronously to the child’s signals on two or more occasions, did not necessarily display active or social behaviours. A lack of coherence was also reported among “active” feeding behaviours of Nicaraguan mothers where the alpha coefficient was very low (Engle & Zeitlin, 1996). Consequently

it will be important in future research to observe and code these behaviours separately in order to determine if they are associated with different feeding and nutritional outcomes, as they were here.

Based on the social development literature, responsive, active and social behaviours were defined in a way that allowed them to be observed and coded separately. The definitional criterion distinguishing responsive from active was whether the mother’s behaviour was synchronized with the preceding child behaviour (in the former) or whether it was driven by the mother’s agenda (in the latter). Because responsiveness has been positively related to other aspects of child development, such as language and attachment, it is important to keep the definitions consistent across different domains of care.

The three major styles of feeding proposed by Engle et al. (2000) can be identified using our coding scheme. A controlling feeding style would be evidenced by a mother with low self-feeding input, low responsiveness, and high active input, including negative active. Laissez-faire feeding style would be evidenced by a mother whose profile was low frequencies on all categories. A responsive style would be reflected in a high frequency of positive responsive behaviours. From our data, it would be premature to infer that all these mothers have a controlling style, as there seem to be individual differences, not tied to mother’s education, assets, or child’s gender. The behavioural categories may need further refining with concrete examples in other cultural settings in order to maintain conceptual clarity and coding reliability.

The role of the child in the feeding framework

Our findings clearly point to the need to incorporate child behaviours in the framework. This is important not only in recognition that children’s age and behaviours directly and indirectly influence the mother’s behaviours, but also because the goal is child growth and development.

The findings that bear most directly on this issue concern behaviours correlated with the child’s age. Mothers were not more responsive with older children, but they did encourage more self-feeding, encourage more acceptance of the food they offered, and socialize more. Still, encouragement of self-feeding occurred on average less than once per episode even in the oldest group. Contrary to the expected developmental pattern (Engle et al., 2000),

children did not show significant increases in self-feeding with age—there was some self-feeding after 1 year but not much variation between 12 and 24 months, and only 9 mostly fed themselves. Mothers in Bangladesh expect that children are incapable of feeding themselves before 2 years of age; they also feel that they communicate love for their child by feeding. Consequently, progress in responsive feeding will need to combine expressions of maternal love with a more active role for the child.

Older children were less positively responsive and more negatively responsive to their mothers. These behaviours might be part of the child's age-appropriate bid for control over the pace of feeding. Older children were likely to respond negatively to an active encouragement from their mother, such as child #47 (see previously) whose mother said, "If you eat quickly, I will clap for you." He responds by clapping for himself, then sticking out his tongue. When she leaves, he self-feeds.

Many of these child behaviours are important for nutritional reasons in that they were consistently related to the number of mouthfuls of food eaten. Children ate more mouthfuls if they fed themselves, showed an active interest in food, were positively responsive, and social. Of the mother behaviours, positive responsiveness was associated with the child's intake. Simply offering food without responsiveness was not successful.

The child's gender and weight did not correlate with feeding behaviours in our sample. Although boys weighed more than girls, we did not see more responsive feeding behaviours directed toward boys or toward well nourished children, nor did we see more active encouragement of under-weight children. A longitudinal study would need to be conducted to determine how behaviours, mouthfuls eaten, and weight influence each other.

Supportive and problematic feeding practices

The most supportive feeding style noted in our observations concerned positively responsive behaviours of the mother, which were associated with active behaviours of her child and the number of mouthfuls of food eaten. Responsive behaviours did not occur frequently, averaging slightly over one per mother, and only one third of the mothers displayed them on two or more occasions. Child active behaviours occurred at a slightly higher rate. Nonetheless, the link between the two indicates a mutually supportive feeding repertoire: a mother

who responds to explicit signals reinforces the child's use of such signals, and a child who is active provides clear signals consistent with the mother's feeding agenda. This provides some support for the responsive feeding framework and the theory underlying social-emotional, cognitive and language development. It also suggests that responsive feeding and encouragement of age-appropriate self-feeding should be the main goals of nutrition interventions.

Active positive behaviours of the mother were common, but unfortunately not associated with either positively responsive or self-feeding behaviours of the child, and not with taking more mouthfuls of food. Instead, encouragement from the mother was associated with negatively responsive behaviours of the child, i.e., refusals or avoiding. This implies that mothers used encouraging strategies to overcome actual or anticipated rejection of her food offerings, but that they did not typically meet with success. On the surface, the commonly used strategies appear reasonable: verbal direction, focusing attention, questioning and diversion. However, the transcripts showed attempts that were hurried, inflexible and non-engaging—tactics insufficient to arouse interest in eating. Verbal directives, such as "eat, eat" and bringing a wandering child back to the meal may force compliance but not overcome reluctance or a negative attitude (Dewey, 2003). Diversions usually consisted of drawing the child's attention to an interesting animal and then slipping food in when the child's defences were down. Again, this strategy might succeed in the short term if it served to put the child in a happy mood, but most children would learn quickly that the purpose was not to please but to feed. Interventions aimed at caregiver feeding practices could modify these active strategies so that they serve to increase the child's interest in food and willingness to accept it. For example, diversion strategies that turn food imaginatively into an object of interest (e.g. plane or fish) leave children feeling happy that they opened their mouths rather than resentful or resistant.

Mothers who used negative active behaviours such as threats and force-feeding were also not successful in getting more mouthfuls accepted. Instead they were associated in older children (18–24 months) with rejection. Perhaps as a consequence of repeated refusals, the mother resorted to intrusive feeding; or a mother who was too controlling and pushed the child too quickly

might provoke refusal and regurgitation. Most researchers have recognized negatively active strategies as detrimental to good feeding (Guldan et al., 1993; Ha et al., 2002). However, these intrusive strategies were sometimes associated with a positive response from a child who opened his or her mouth. This would serve to reinforce the mother's behaviour; if her force-feeding successfully put food into the child's mouth, she would likely repeat it under similar circumstances. For most mothers the alternative was to give up and end the feeding episode prematurely. They lacked the flexible problem-solving skills to re-engage their children when feeding became difficult.

Neither the framework nor the mothers in our sample seemed to incorporate a longer-term perspective on feeding. Both viewed the feeding episode as an occasion to provide immediate nutrition. Although this is important in malnourished children, long-term development of feeding skills and a healthy appetite should not be sacrificed. Too great an emphasis on immediate compliance (Kochanska, Coy, & Murray, 2001), by encouraging the passive acceptance of offered food, can interfere with active participation in feeding and internalization of feeding skills, such as those comprising the categories of active, social, and self-feeding. For the most part, our sample of children showed ambivalence—both interest and disinterest in feeding. Their interest is reflected in the frequencies of positive behavioural categories such as self-feeding and active positive. However, over half showed explicit disinterest by refusing or leaving. We attribute this disinterest to several potential factors, which could be usefully studied in similar contexts. (1) They might have had intestinal infections that created discomfort and dampened their appetite. (2) They might have been too inactive during the day, sitting with the women and older folk at home without play materials. (3) Their diet was unvaried and

repetitive, consisting of little more than rice three times a day even though older children and adults often ate vegetables, fruit, and fish in addition to rice. (4) They were passive responsive eaters and so gained no social, emotional, or sensory satisfaction from mastering feeding skills.

There are of course certain limitations that constrain the conclusions to be drawn from this study. It is well known that a cross-sectional design does not allow conclusions to be drawn about the direction of relations between mother and child. A greater sample size might have produced a better spread of data, permitting greater use of multivariate tests. Finally, the use of a more formalized observation technique, for example video, would be beneficial to minimize the potential for 'missed' data. Simply observing the mother might have altered her behaviour in ways that she felt were more desirable. However, there was a close match between our observations of the feeding situation and the problems and solutions mothers described in the interview, conducted prior to the observations. Despite these limitations, the findings identify specific caregiver behaviours that contribute to poor mother-child interaction in the complementary feeding context. These behaviours fit within current theories of child development, and more specifically the responsive feeding framework, and are amenable to targeted change.

Acknowledgements

This research study was funded by Plan Bangladesh, grant number 2003-029. ICDDR, B acknowledges with gratitude the commitment of Plan Bangladesh to the Centre's research efforts. We are also grateful to our research assistants and to the mothers and children who participated in the study.

Appendix A. Behavioural feeding codes

Mother	Child
<p>1. Self-Feeding: Directed toward or indicative of child putting food into own mouth</p> <p>Positive behavior Allows, promotes self-feeding, e.g. gives child food to eat herself, verbally encourages or praises</p> <p>Negative behaviour Discourages, disallows, interrupts, e.g. “no”; pushes child’s hand away, tells the child that mother will feed</p>	<p>Positive behavior Self-feeding attempt, e.g. holds utensils/cup, puts food into mouth</p> <p>Negative behaviour: Rejects self-feeding, e.g. says “no” or throws food that she was given</p>
<p>2. Responsive Feeding sensitive, synchrony, responds in accordance with other’s cue</p> <p>Positive behaviour Synchronous response promotes continued feeding, e.g. interprets child feeding cues, responds to child’s needs.</p> <p>Negative behaviour Synchronous response interrupts feeding, e.g. responds to child’s reluctance cues by ending feeding episode prematurely.</p>	<p>Positive behaviour e.g. accepts food when it is offered</p> <p>Negative behaviour Responds to mother’s cue by interrupting feeding, e.g. walks away, refusal</p>
<p>3. Active Feeding: encourages, keeps interested</p> <p>Positive behaviour (see detailed codes below) mother-initiated attempt to arouse child’s interest, e.g. talks about food, models, food games, verbal encouragement, distraction if intent is to feed, refocusing attention such as taking on knee.</p> <p>Negative behaviour Aversive, intrusive attempts to direct feeding, e.g. force-feed, holds child’s head, threats, shakes child</p>	<p>Positive behaviour Child-initiated attempt to get food, e.g. looks at food, says food words, requests food/drink, touches food, opens mouth, cries for food.</p> <p>Negative behaviour Shows disinterest, discouragement</p>
<p>4. Social Behaviour toward feeding partner only but not directly related to feeding e.g. talking (but not about food), touching, smiling, looking, laughing.</p>	<p>e.g. talking (but not about food), touching, smiling, looking, laughing, cries but not in response to food.</p>
<p>5. Distracting feeding situation</p> <p>Distraction Encourages attention away from feeding, e.g. by talking to someone other than child</p>	<p>Distraction Child is distracted from eating, child can be active party or reactive (include social interaction directed towards non-feeder)</p>
<p>6. Extra codes concerned with feeding behaviour</p> <p>Mother offers food Mother offers or gives food without any special responsive or encouraging strategy</p>	<p>Child stops feeding e.g. Child breaks or pauses from feeding situation. Not a specific refusal and no evidence of environmental distractors</p>

Note: Self-feeding codes may overlap with Responsive or Active. Consequently, Self-feeding could be double-coded or given priority.

Additional information

1. Who terminated feeding— ?

Look at the last two mouthfuls of food (exclude water).

If child refused 2 consecutive mouthfuls offered—child terminated.

If child accepted at least one of these mouthfuls—mother terminated.

If child is self feeding and independently stops eating—child terminated.

If child says “I don’t want anymore food”—child terminated.

2. Does the feeding episode end prematurely?

(Relevant factors include: definite signs of child hunger such as continued eating, a single refusal with little mother encouragement, few mouthfuls consumed.)

Additional codes for mother active positive

Verbal directions (e.g. “eat, eat”).

Talks about food, labels food (e.g. “this is rice, rice is nice”).

Asks the child a question about food.

Diverts momentarily (e.g. “Look at the ants”).

Focuses the child’s attention (e.g. Puts child on lap, Brings child back to feeding place).

Modelling (e.g. shows child how to eat, swallow).

Makes a positive statement about the child during eating (“You are so good”).

Variety (e.g. brings a different type of food).

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