Caregiver Feeding Behaviors and Their Relation to Growth and Dietary Diversity in Rural Bangladesh: An ancillary study of women and children participating in the JiVitA-4 complementary food supplementation trial

by

Zaynah Tahmina Chowdhury, MPH

A dissertation submitted to Johns Hopkins University in conformity with the requirements for the degree of Doctor of Philosophy

Baltimore, Maryland
August 2016

© 2016 Zaynah T. Chowdhury
All Rights Reserved
Abstract

Background: Variations in child growth are explained by a myriad of factors including nutrition, hygiene and other environmental determinants. Feeding behaviors (responsive and non-responsive) are known to influence the development of eating behaviors and subsequent nutritional status. Limited knowledge exists about how responsive and non-responsive feeding behaviors in rural Bangladesh may influence child dietary intake and growth.

Objective: This dissertation research aims to characterize young child feeding in rural northwestern Bangladesh, and assess the relationship between caregiver feeding behaviors and diet and growth at 24 months.

Methods: In-depth interviews (n=30), focus group discussions (n=5) and in-home observations (n=10) were conducted to qualitatively assess caregiver feeding behaviors in Gaibandha, Bangladesh. Quantitative data were collected on 4846 mother-child dyads enrolled in a complementary food supplementation trial. Anthropometry (weight, length) and child diet (24-h recall) were collected. A context-specific 11-item feeding behaviors module was developed; factor analysis revealed 2 theoretically derived constructs of feeding: responsive (5 items) and forceful (6 items). Each was dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive [70%], low forceful [66%]). Dietary diversity score (DDS; range 0-7) was derived using the diet recall data and was used to define minimum dietary diversity (MDD; score of 4 or more). Relations were examined using multivariate linear/logistic regression models, adjusting for confounders, intervention status, and study design.
**Results:** In a setting with high undernutrition, caregivers fed their children in a way that they thought would increase intake. Two theoretically derived feeding constructs emerged in this population: responsive and forceful. Responsive feeding was positively associated with DDS ($\beta$: 0.11, 95% CI: 0.03, 0.19). No significant relations were seen with MDD or growth outcomes ($p>0.05$). Conversely, forceful feeding was negatively associated with WAZ ($\beta$: -0.16, 95% CI: -0.22, -0.11), WLZ ($\beta$: -0.20, 95% CI: -0.25, -0.14), and DDS ($\beta$: -0.13, 95% CI: -0.21, -0.05) and positively with underweight (OR: 1.38, 95% CI: 1.22, 1.56), wasting (OR: 1.55, 95% CI: 1.33), 1.81, and meeting MDD (OR: 0.78, 95% CI: 0.68, 0.88). No relationship was seen with LAZ or stunting ($p>0.05$).

**Conclusions:** Caregivers in this setting fed in a way they thought would increase intake, fueled by the concern that their child is not eating enough. Findings suggest that even in the context of high undernutrition, non-responsive feeding behaviors (especially forceful) are associated with poor growth and dietary diversity among young children. Future longitudinal research is needed to better understand causality and test the efficacy of responsive feeding interventions on the promotion of child growth and diet.

**DISSERTATION COMMITTEE**

**ADVISOR:**
Parul Christian, MPH, DrPH
Professor, International Health

Kristen Hurley, MPH, PhD
Assistant Professor, International Health

Donna Strobino, PhD
Professor, Population, Family, and Reproductive Health

Sara Benjamin Neelon, PhD
Associate Professor, Health, Behavior and Society
Acknowledgements

I would first and foremost like to thank my wonderful advisor, Dr. Parul Christian. I could not have gotten through this program without her steadfast guidance. Parul has instilled in me and in all her students a higher standard of work, and has always been a model of intelligence, insight, work ethic and academic rigor. Under her guidance I have been challenged to think critically and write competitively, skills that I will always attribute to her. Most notably, my time in the field was enriched by her encouragement to constantly take in as much as I possibly can, to make use of every opportunity to try new things and learn about everything, even if it was not directly related to my work out there. She also made sure I did everything related to my dissertation myself, from submitting IRB documentation to overseeing every aspect of my data collection and working closely with my data collectors. I greatly appreciate her patience and dedication to seeing me through this process, especially through these final stages.

In addition, I would like to thank Dr. Kristen Hurley, who has acted almost as a second advisor to me for the past few years. Working with her, I’ve developed an excitement and passion about feeding behaviors that I never knew I could have! She has always left her door open to me, and has always been available to help me interpret and write and practice and exchange ideas. Even during her field visit to Gaibandha we worked long, productive days but it didn’t feel like it at all because I was learning so much. I would like to thank her for providing opportunities for me to learn and for always being understanding and encouraging during the rough patches of this grueling process.

I would like to extend my appreciation to my committee members, Drs. Donna Strobino and Sara Benjamin Neelon, for their time, input and contributions towards this endeavor. Our Human Nutrition faculty has helped me along every step of the way, providing encouragement and praise and answers to my questions whenever I needed.
them. Working with them both as a student and a teaching assistant has laid the foundation of my nutrition knowledge. I would like to especially thank Dr. Laura Caulfield for guiding me in our very close-knit Proposal Development class. Her criticisms were always constructive and coupled with encouragement, which was a great basis for my first foray into setting up my dissertation research. My colleagues past and present have been invaluable; thank you to Megan Henry, Yunhee Kang, Sun Eun Lee, and Lenis Chen for welcoming me into this program and providing guidance whenever I needed it; and for Marie Spiker, Vanessa Oddo, and Julie Ruel-Bergeron for your companionship and for being there to commiserate with me. A special thank you to Rebecca Campbell, my PhD partner-in-crime. I have greatly enjoyed having a buddy to go through every step of this process with, including being next-door neighbors out in the field and traveling far and wide to disseminate our findings together!

A huge thank you to my JiVitA family for making my field experience the absolute greatest experience it possibly could have been. Thanks to my colleagues at the faculty house, Kelsey Zeller, Neelu Singh, Jenn Masters, Rebecca Campbell and Saijuddin Shaikh for keeping me mentally intact during my time in Gaibandha. Particularly Saijuddin for being the ever-present voice of reason, always there with a solution for my problems (work-related and non-work related) and for sometimes allowing me to just complain. And of course, thank you to Barek, our cook, and Maksuda, our maid, for keeping us comfortable and well-fed during our time in Gaibandha.

The JiVitA staff is incredible and always made me feel like anything was possible. Even those not working directly on my project would pitch in to make sure I had what I needed to stay on schedule and accomplish what I needed to for my project, and for that I could not be more thankful. In particular, my qualitative data collection team—Neela Jaman, Shamima Akhter, and Mousumi Jahan worked tirelessly on a project that
was new to them; they practiced and accepted my criticisms and gave up some of their free days to make sure I had the best quality data possible. Rashidul and Abu Bakkar kept my study running smoothly and on time by helping me schedule my interviews and trainings and recruiting participants, and mostly by troubleshooting when we ran into unforeseen problems, which were truly so hard to predict (like the time we had to ‘build’ a road out in the rice paddies so the Land Cruiser could make it out to the site for our focus group discussions). To the rest of the staff who helped me with my transcriptions, your help was immeasurable. Transcribing interviews by hand is not an easy task and I will forever be grateful for the many hours you put in to doing that for me. Thank you all for teaching me so much about Gaibandha, the Bangladeshi culture, the people, and the language.

My study participants will always hold a place in my heart. I sat for hours with women in rural Gaibandha and spoke to them about their lives, including their hardships and their joys. They welcomed me into their homes and let me play with their children, giving me insight into their lives while showing interest in mine. I’m truly blessed to have had the opportunity to spend time with the people in this community. Working closely with them helped me understand the setting and get close to the data in a way I could not have otherwise, and for that I am so thankful. I left Bangladesh hoping to translate my findings into something meaningful which could one day aid them or their progeny.

Stephen Kodish came out to Gaibandha as a consultant on my qualitative project and I would like to thank him for preserving the quality of my data. He did a wonderful job training my data collectors and taught me so much about qualitative data collection and team management in the process. Thank you to Lee Wu, Brian Dyer, and Maithilee Mitra for your help with my frantic data and statistical needs, and thank you Sucheta
Mehra for helping orient me to the JiVitA field site and for always having an answer for all my concerns out there.

Thank you to all the people who have provided moral support to me not only through this process, but continually throughout my life. My father, Golam Chowdhury, has instilled the passion for seeking knowledge in me and never once allowed me to make excuses for not achieving the very best in my academic endeavors. Thank you for working so hard in your early life so we wouldn’t have to in ours. Thank you to my mother, Tahmina Chowdhury, for cultivating my bond with Bangladesh from such a young age, and for being adamant about teaching us the Bangla language. Thank you for encouraging my personal enrichment in the form of faith, culture and travel, and for helping me balance work with fun; you are the best travel partner! My brother, Zareef Chowdhury has been my personal cheerleader from day 1; thank you for all the times you’ve followed up my ranting with a simple “you’ve got this.” Thank you for all the pep talks and positive reinforcement and sometimes the tough love. And thank you lastly to Mushfique Ahmed, for listening to every single detail of every single day of my time in the field and through this dissertation-writing process, for being proud of me, and for truly never giving up on me.

Lastly, I’d like to thank and dedicate my dissertation to my grandmother, Farida Rashid Ahmed. You have forever been my role model, from being an independent woman in Bangladesh to rising above your rank, to being patient and tolerant and kind, and most of all for putting the needs of others above your own. Since childhood I have watched you champion the needs of those less fortunate than you. You are so humble and I aspire to one day alleviate the lives of others as you have. I thank you for strengthening my ties to Bangladesh, for keeping me safe and well-fed and comfortable
there and always making sure someone is keeping an eye on me even when you aren’t around. You are an incredible human being. Love and duahs for you always, nani.
Table of Contents

Abstract................................................................................................................................. ii
Acknowledgements................................................................................................................iv
Table of Contents ....................................................................................................................ix
List of Tables and Figures ..................................................................................................... x
Abbreviations and Acronyms............................................................................................... xii

Chapter 1. Introduction and Specific Aims ........................................................................ 1
Chapter 2. Literature Review ............................................................................................. 8
Chapter 3. Study Design and Methodology ........................................................................ 41
Chapter 4. Understanding caregiver feeding behaviors in rural Bangladesh: a qualitative study .................................................................................................................. 70
Chapter 5. Systematic development and validation of a theory-based questionnaire to assess caregiver feeding behaviors in rural Bangladesh ........................................................................ 110
Chapter 6. Exploring the relationship between feeding behaviors and growth and dietary diversity in 24-month old children in rural Bangladesh ........................................................................ 146
Chapter 7. Conclusions ....................................................................................................... 177
Appendix 1: Data collection forms ...................................................................................... 188
Appendix 2: Supplemental results tables ............................................................................ 229
Curriculum Vitae .................................................................................................................. 239
List of Tables and Figures

Chapter 1

Figure 1.1. Conceptual framework of the specific aims investigated in this study surrounding child feeding behaviors\(^1\) .......................................................... 7

Chapter 2

Figure 2.1 UNICEF child undernutrition framework. Adapted by Black et al. 2013....9
Figure 2.2. Mean height-for-age z-scores by age, relative to the WHO standard, according to region (1-59 months)\(^{12}\) .......................................................... 14
Figure 2.3. Parenting styles and corresponding feeding styles\(^{60}\) ......................... 20
Figure 2.4. Characteristics of responsive feeding studies, as summarized by Bentley et al. 2011.\(^{54}\) .......................................................... 29

Chapter 3

Table 3.1. Research objectives and associated methods ........................................ 42
Table 3.2. Overview of study participants .................................................................. 46
Table 3.3. Overview of study instruments and procedures ......................................... 51

Chapter 4

Table 4.1. Overview of study participants ................................................................. 108
Table 4.2. Demographic characteristics of study participants ................................... 108

Chapter 5

Table 5.1. Baseline parental and household characteristics of enrolled children at 24 months, by responsive and forceful feeding behaviors (n=4846) ..... 134
Figure 5.1. Scree plot of eigenvalues following factor analysis ................................. 136
Table 5.2. Factor-loading matrix of 3-factor solution .................................................. 137
Table 5.3. Prevalence of responsive, forceful and indulgent feeding in sample of 24-month old children (n=4846) .......................................................... 138
Table 5.4. Factor-loading matrix of 2-factor solution ........................................... 138
Table 5.5. Parental and household characteristics of enrolled children at 24 months, by responsive and forceful feeding behaviors (n=4846) ............ 139
Table 5.6. Parental and household characteristics across feeding behaviors of caregivers of enrolled children at 24 months ................................. 141
Appendix 5.1 List of items included in the original (n=51), intermittent (n=15 after pilot test), and final (n=13 after EFA) Caregiver Feeding Behaviors Questionnaire (CFBQ) ............................................................. 143

Chapter 6

Figure 6.1. Dietary intake in the past 24 hours by food group at 24 months in rural Bangladesh. Data based on a 24-hour dietary recall of a 24-month follow up interview of a randomized controlled food supplementation trial (n=4846) ........................................................................................................ 170
Table 6.1. Baseline parental, child and household characteristics of enrolled children at 24 months (n=4846) ................................................................. 171
Table 6.2. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and diet among children at 24 months of age ................. 173
Table 6.3. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and change in LAZ, WAZ, WLZ, length, weight among children at 24 months of age ...................................................... 174
Table 6.4. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and change in prevalence of stunting, wasting and underweight among children at 24 months of age ............................. 176
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFBQ</td>
<td>Caregiver Feeding Behaviors Questionnaire</td>
</tr>
<tr>
<td>CFS</td>
<td>Complementary food supplement</td>
</tr>
<tr>
<td>DDS</td>
<td>Dietary diversity score</td>
</tr>
<tr>
<td>EBF</td>
<td>Exclusive breastfeeding</td>
</tr>
<tr>
<td>EED</td>
<td>Environmental enteric dysfunction</td>
</tr>
<tr>
<td>EFA</td>
<td>Exploratory factor analysis</td>
</tr>
<tr>
<td>F/V</td>
<td>Fruits and vegetables</td>
</tr>
<tr>
<td>FGD</td>
<td>Focus group discussion</td>
</tr>
<tr>
<td>JHSPH</td>
<td>Johns Hopkins Bloomberg School of Public Health</td>
</tr>
<tr>
<td>HIC</td>
<td>High income countries</td>
</tr>
<tr>
<td>IDI</td>
<td>In-depth interview</td>
</tr>
<tr>
<td>IFSQ</td>
<td>Infant Feeding Styles Questionnaire</td>
</tr>
<tr>
<td>IHO</td>
<td>In-home observation</td>
</tr>
<tr>
<td>IUGR</td>
<td>Intrauterine growth restriction</td>
</tr>
<tr>
<td>IYCF</td>
<td>Infant and young child feeding</td>
</tr>
<tr>
<td>LAZ/HAZ</td>
<td>Length/height-for-age z-score</td>
</tr>
<tr>
<td>LMIC</td>
<td>Low and middle income country</td>
</tr>
<tr>
<td>LSI</td>
<td>Living standards index</td>
</tr>
<tr>
<td>MDD</td>
<td>Minimum dietary diversity</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized controlled trial</td>
</tr>
<tr>
<td>SES</td>
<td>Socioeconomic status</td>
</tr>
<tr>
<td>SGA</td>
<td>Small-for-gestational age</td>
</tr>
<tr>
<td>SSC</td>
<td>Secondary school completion exam</td>
</tr>
<tr>
<td>TFBQ</td>
<td>Toddler Feeding Behaviors Questionnaire</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children's Fund</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>Vit.</td>
<td>Vitamin</td>
</tr>
<tr>
<td>WASH</td>
<td>Water, sanitation and hygiene</td>
</tr>
<tr>
<td>WAZ</td>
<td>Weight-for-age z-score</td>
</tr>
<tr>
<td>WFP</td>
<td>World Food Programme</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WLZ/WHZ</td>
<td>Weight-for-length/height z-score</td>
</tr>
<tr>
<td>WSB++</td>
<td>Wheat-soy blend plus plus</td>
</tr>
</tbody>
</table>
Chapter 1. Introduction and Specific Aims

Malnutrition in children, including both undernutrition and overweight, has implications for survival, development, incidence of acute and chronic illnesses, and future economic productivity and contribution to society. Child growth is often used as a measure of nutritional status, of which stunting (defined as length-for-age z-score (LAZ) less than 2 below the WHO growth standard median) is a concern, particularly in low and middle income countries (LMIC). The global prevalence of stunting is 23.8% among children under age 5, with nearly half of stunted children living in Asia. The “first 1,000 days” as the period from conception to 24 months of age is referred to as, is the most critical time for growth and stature in later life. During the period of 6 to 24 months, the complementary feeding period, children are most vulnerable to insults caused by inadequate diet and/or exposure to infection, both of which can exacerbate the cycle of undernutrition. Bangladesh has the second highest estimated rates of child undernutrition in South Asia, with 36% of children less than 5 years of age being underweight. In rural areas, 43% of children are stunted and 16% of children are wasted. Stunting reflects the cumulative effects of undernutrition and infections from before birth through early childhood, and can result in lifelong consequences that affect later health and productivity. Although the period from birth to 24 months is especially critical for optimal growth, only 21% of children between 6-23 months of age are fed according to infant and young child feeding recommendations. Inadequate feeding practices likely contribute to poor diets, infections, and the high rates of stunting and wasting in children growing up in rural areas of Bangladesh.

Mother-child interactions, or feeding behaviors refer to the interactive behavior between mothers and children that occur during meals. A responsive feeding behavior is categorized by the caregiver observing and responding to a child's cues of hunger and
satiety in a manner that is high in nurturance and structure, while employing tactics of mutual responsiveness\(^9\). A *non-responsive feeding* behavior has been categorized by excessive control (force or restrictive feeding), uninvolved feeding (parent makes little effort to encourage eating), and indulgent feeding (parent is lax with quantity and quality of foods fed)\(^9\). Behavioral observations of mealtime with children between 6 and 24 months in some countries have found low levels of responsive feeding behaviors, high levels of forceful or controlled feeding and an inappropriate amount of self-feeding with regards to the child’s age\(^6\)–\(^8\). In addition, results from observational studies show that children aged less than 3 years often reject food offered by their mothers, despite being undernourished. This finding has been related to non-responsive feeding on the mother's part, particularly in response to the child’s psychomotor abilities and appetite signals.

Few studies have shown a significant improvement in nutritional status in relation to responsive feeding interventions; however\(^10\), caregiver interactions and verbalization have been postulated to encourage acceptance of food by the child, which may improve dietary intake and eventually growth\(^7,8,10,11\). Many caregivers in both high and low income countries use non-responsive feeding behaviors\(^10,12,13\). Especially among lower income populations, where food availability is unstable and children live in a less stimulating environment, responsive feeding may show a marked improvement in children's dietary diversity and subsequent growth, as well as child development.

A complementary food supplementation (CFS) trial in rural Northwestern Bangladesh provided a unique and time-sensitive opportunity to study caregiver feeding behaviors and how they relate to diet and growth in a setting with high undernutrition. The JiVitA-4 trial evaluated 4 CFSs and compared them to a control, with all groups getting child feeding counseling between 6-18 months of age. The 4 formulations of complementary food supplements were: rice lentil (locally produced), chickpea (locally produced), and WSB++ (wheat-soy blend ++, produced by the World Food Programme),
Plumpy-doz (positive control); in addition to only child feeding counseling (negative control), which was delivered to all 5 arms. The overall trial found benefits of the CFSs for linear growth and prevention of stunting\textsuperscript{14}. Stunting prevalence was 5-6\% lower in the Plumpy-doz and chickpea arms as compared to the counseling-only group. Additionally, all groups had declines in LAZ between 6 and 18 months, but children in the Plumpy-doz, rice-lentil and chickpea had less LAZ decline relative to the counseling-only group.

My dissertation research was conducted among the children and mothers enrolled in the trial during the 24-month follow up interview, which was 6 months after the end of the supplementation study, to characterize responsive feeding behaviors in this population. Formative research in the form of in-depth interviews, focus group discussions and in-home observations was conducted in order to develop a caregiver feeding behaviors questionnaire, which was administered to a sample of mothers at 24 months of age living in rural Gaibandha, Bangladesh. Following formative research and questionnaire development, a cross-sectional analysis examining the relation between maternal reported feeding behaviors (responsive and non-responsive) and child’s nutritional status (anthropometry and dietary diversity) was conducted with the same sample of 24-month old children enrolled in the trial. Nesting this study within the larger trial allowed for this data to be combined with the routine anthropometric and dietary assessment that was taken throughout the duration of the study. The conceptual diagram in Figure 1.1 illustrates the aforementioned relationships.

**Specific Aims**

**Aim 1:** To conduct qualitative research with mothers of children 15-23 months of age living in rural Gaibandha, Bangladesh to gain knowledge about attitudes and experiences related to responsive feeding behaviors.
Aim 2: To develop and validate a scale to measure caregiver feeding behaviors among caregivers of 24-month old children participating in a randomized controlled food supplementation trial in rural Gaibandha, Bangladesh, and to use the scale to identify feeding dimensions present in that population.

Aim 3: To examine the relationship between feeding behaviors and dietary diversity and growth among 24-month old children using a semi-quantitative 24-h food frequency questionnaire and anthropometric measures.

Hypothesis 3.1: Children of women who report higher responsive feeding behaviors have higher dietary diversity than children of women who report fewer responsive and/or higher non-responsive feeding behaviors.

Hypothesis 3.2: Children of women who report higher responsive feeding behaviors have better growth measures (higher WAZ, WHZ, LAZ scores) than children of women who report fewer responsive and/or higher non-responsive feeding behaviors.

To address these aims, we used mixed methods and interdisciplinary constructs/theories, drawn from the nutrition, infant and young child feeding, and early child development literature. The findings from this study shed light on the current feeding behaviors among mothers in this setting, as well as provide evidence for their relationship with dietary diversity and early growth. The results will be useful to inform programs and interventions on care and feeding recommendations for young children, particularly those living in LMIC.

This dissertation has 7 chapters; following this introductory chapter, Chapter 2 will discuss the links between feeding behaviors (including responsive and forceful feeding) and growth and diet. These links will be described through a review of the existing literature on these topics, beginning with a description of child undernutrition
(nutritional and non-nutritional causes) and an overview of the study aims. Chapter 3 provides details on the methods used to address these aims, including an overview of the parent trial, and methods organized by individual study. Chapters 4, 5 and 6 contain the results of this study presented in the format of individual papers. Each paper includes an introduction, methods, results and discussion section based on the addressed research questions. Chapter 4 focuses on the qualitative research conducted exploring caregiver feeding behaviors in rural Bangladesh, giving us an idea of how feeding is characterized in this area. Chapter 5 describes the development and validation of a scale designed to measure caregiver feeding behaviors in this setting. In Chapter 6, we examine the relations between caregiver feeding behaviors (using the previously described scale to measure feeding behaviors in our sample) with growth and dietary outcomes. The concluding chapter, Chapter 7, contains a summary of the results and a discussion of the overall study and findings.
References


Figure 1.1. Conceptual framework describing contributing factors for different child feeding behaviors and their subsequent relationship with dietary patterns and growth. Causal or contributing factors for child feeding behaviors were explored through the qualitative data. The relationship between child feeding behaviors, dietary patterns and growth were explored quantitatively using data from the Responsive Feeding Questionnaire, anthropometric measures, and diet module collected during the C24MOI.

Qualitative Analysis (Aim 1)

Causal/contributing factors
- appetite
- temperament
- illness
- multiple caregivers
- mother's age
- # of children
- SES
- education
- family structure
- barriers
  - food insecurity
  - time

Child feeding behaviors
- responsive
- controlling
- restrictive
- indulgent
- uninvolved

Quantitative Analysis (Aims 2 and 3)

Infant dietary patterns
- food intake
- dietary diversity

Infant growth
- proportional growth
Chapter 2. Literature Review

Introduction

Child growth is often used as a measure of children's nutritional status, of which stunting is a global concern, particularly in low and middle income countries (LMIC). WHO estimates (2015) of global rates of underweight (weight-for-age z-scores < -2 below the WHO standard), stunting (length/height-for-age z-scores < -2 below the WHO standard) and wasting (weight-for-length/height z-scores < -2 below the WHO standard) (15.0%, 24.5% and 7.7%, respectively) reflect an abundance of children under 5 who are at risk for or are privy to inadequate diets or exposure to infection, both of which can exacerbate the occurrence and cycle of undernutrition. It has been estimated that 3.1 million deaths of children under 5 years of age can be attributed to undernutrition; specifically stunting, severe wasting, fetal growth restriction, suboptimal breastfeeding, and vitamin A and zinc deficiencies. According to 2014 estimates, prevalence of undernutrition in Bangladesh is high, with 38.7 % stunting and 18.1 % wasting in children under 5 years of age. In rural areas, 37.9 % of children are stunted and 15.1 % of children are wasted. Among other factors, inadequate feeding practices and/or behaviors contribute to the increased rates of stunting and wasting in children growing up in rural Bangladesh, resulting in short- and long-term consequences that can reduce their quality of life and future productivity. Results from observational studies indicate that children under the age of 3 often reject food offered by their mothers, despite being undernourished. This finding has been at least partially attributed to fewer responsive feeding behaviors on the caregiver's part, particularly in response to the child's psychomotor abilities, appetite signals, and health and nutrition status. In this chapter,
the role of caregiver feeding behaviors will be placed in the context causes and consequences of childhood undernutrition.

Childhood undernutrition: burden, causes and consequences

The term undernutrition is a subset of malnutrition, juxtaposing overnutrition by encompassing nutritional outcomes including stunting, wasting and micronutrient deficiencies. **Figure 2.1** illustrates an adaptation of the 1990 UNICEF undernutrition framework which covers the means to optimum fetal and child growth and development. Impoverished communities experience high rates of undernutrition and increased exposure to infectious diseases as a result of inadequate diet and sanitation, among other factors. Although nutritional outcomes are most often used to characterize undernutrition, undernutrition is a multi-factorial problem.

**Figure 2.1 UNICEF child undernutrition framework. Adapted by Black et al. 2013.**

The UNICEF child undernutrition framework (Figure 2.1) outlines the determinants and causes of undernutrition and death in children, and programs and
approaches that have targeted each of these levels, from social to household to personal factors. The basic determinants at the base of the framework include knowledge and evidence in the form of political and social structure, and economic context as the basis for available family and community resources. This has been tackled through interventions to build an enabling environment, including evaluations, capacity investments, legislation, and leadership programs that strengthen this foundation (see dashed boxes in Figure 2.1). These resources influence the level of information, education and communication that exists within households and family members. If insufficient, these may translate to household food insecurity and inadequate child care, as well as an overall unhealthy environment and insufficient access to health services. Nutrition sensitive programs and approaches (e.g. those that address the underlying causes of undernutrition\(^9\)), include targeting the broader family structure through agriculture and food security, maternal mental health, women’s empowerment, water and sanitation, and health and family planning services, among others (see dotted boxes in Figure 2.1). These are underlying determinants that may contribute to undernutrition, as they can directly and indirectly result in inadequate dietary intake and/or illness, which in turn affect each other and can exacerbate the vicious cycle of infection and undernutrition that may lead to an overall state of malnutrition and eventually mortality, among other deficits throughout the life course. Nutrition specific interventions (e.g. those that address the immediate determinants of nutrition\(^9\)) and programs have targeted nutrition at the individual level to combat these factors, focusing on adolescent health and preconception nutrition, dietary supplementation, micronutrient supplementation/fortification, breastfeeding and complementary feeding, and disease prevention, among others (see blue boxes in Figure 2.1).
Within this framework, the current study addresses feeding and caregiving practices (see bold box in Figure 2.1) and its association with child nutritional status in order to better understand areas for improvement and potential interventions as a means to decrease the burden of undernutrition in the context of rural Bangladesh.

Growth Faltering

In the early 1990s Pelletier et al. established that more than 50% of child deaths are associated with growth faltering\textsuperscript{10}. Since then, more specific delineations to measure the severity and implications of growth faltering have been created. The pattern of growth faltering is one that highlights the crucial period of time in which the persistence of stunting should be tackled. Weight-for-length/height (WLZ/WHZ), length/height-for-age (LAZ/HAZ) and weight-for-age z-scores (WAZ) are anthropometric indices used to classify undernutrition among children under five years of age\textsuperscript{11}. Of the WHO-designated regions, South Asia exhibits the lowest mean WAZ from birth, starting out at -1.25 standard deviations below the international growth standard and decreasing to -2.00 by 21 months of age, at which point a child can be deemed "underweight"\textsuperscript{1,12}. South Asia also has the lowest WHZ throughout the time from birth to 5 years compared to the rest of the world; however, the burden of stunting far exceeds that of wasted (WLZ/WHZ \textless -2) children on a global scale\textsuperscript{1,13}. Stunting is defined as a HAZ of more than 2 standard deviations below the international growth standard, and is associated with a number of morbidities and disabilities that can significantly reduce the quality of life and may even result in mortality\textsuperscript{14}. The timing of the emergence of stunting varies by region, but in South Asia about 30% of infants are stunted at birth, followed by a stability in growth for the first few months of life, followed by a progressive worsening between 3 and 24 months of life\textsuperscript{12}. Stunting that still exists at 24 months tends to persist into adulthood\textsuperscript{4}. As
such, the first two years of life is often referred to as a "window of opportunity" for nutrition interventions in order to intercede the progression or onset of undernutrition.

Linear growth retardation is highly prevalent among impoverished children. Over shorter time periods, a temporary decline in growth can be corrected through the mechanism of “catch-up growth” upon recovery. However, in settings where challenges to growth are more chronic and children are perpetually battling nutritional insults, child growth is stunted as a result of not affording the period of time for catch-up growth to work. For example, Checkley et al. found that diarrhea that occurred before 6 months of age was associated with a period of slower growth, while children with a history of diarrhea after 6 months of age were found to experience a period of catch-up growth following a period of height deficit.15

Consequences of stunting

Stunting, severe wasting and IUGR (intrauterine growth restriction) contribute more to global deaths and disability-adjusted life years in children under 5 years of age than any other risk factor7. Annually, approximately 6.5 million preterm or SGA (small-for-gestational age; or weighing below the 10th percentile of a population-based birth weight reference curve for gestational age) births in LMIC may be associated with short maternal stature16. Kozuki et al (2015) found that the proportion of preterm SGA associated with maternal short stature was up to 23.3% in Southeast Asia; or 16.5% of the global total (95% CI: 13.7%, 18.9%)16. Stunted women are more likely to give birth to smaller babies, introducing the risk of suboptimal growth and development17. This introduces a cycle of stunting that can only be broken by rectifying the presence of stunting within the first 24 months; otherwise, stunted girls may grow up to be stunted adults and have children who are also stunted at birth, among other poor pregnancy outcomes including perinatal mortality (stillbirths and deaths during the first 7 days
following birth) as a result of obstructed labor\textsuperscript{18}. Short-term consequences of stunting include mortality, morbidity, and disability, while long-term consequences include adult size, intellectual ability, economic productivity, reproductive performance, and metabolic and cardiovascular disease\textsuperscript{19}. Observational and intervention studies have shown that adults of short stature have poorer school performance and lower total school achievement, lower IQs, decreased physical work capacities and lower earnings than adults of normal stature\textsuperscript{4}.

**Causes of undernutrition**

Non-Nutritional Causes

*Environment*

As outlined in the UNICEF framework, individuals living in impoverished communities are more exposed to environmental pathogens and infectious disease as a result of poor water and sanitation, as well as overcrowding\textsuperscript{2}. Globally, the population using improved drinking water sources is 89\%, and the population with access to an improved sanitation facility is 64\%\textsuperscript{1}. In Bangladesh, these numbers are 85\% and 57\%, respectively\textsuperscript{1}. In the linear growth faltering curve explained previously (Figure 2.2, pictured below), the stability in the curve for the first 3 months of life followed by a sharp decrease in LAZ score can be explained by the early introduction of complementary foods and weaning off of breastmilk that trends in many countries. In Bangladesh over 90\% of infants are breastfed, but only 64\% are exclusively breastfed through the first 6 months of life, a practice recommended by the WHO\textsuperscript{1,3}. Early weaning is accompanied by early exposure to environmental pathogens through the introduction of contaminated complementary foods and water, as well as through the presence of fecal matter on household surfaces from the surrounding environment that makes its way to the infant's
Studies done among newborns in Guatemala were among the first to provide evidence of the correlation between early weaning and infectious disease\textsuperscript{21-23}. The growth curve of one child showed growth at a normal rate during the first 6 months of life (while breastfed), but later showed affliction with a series of infectious diseases upon weaning\textsuperscript{22}. This vicious cycle of infection and undernutrition has been applied as a mechanism for the case fatalities related to many infectious diseases; most commonly diarrhea, malaria and acute lower respiratory infections\textsuperscript{24}.

Katona and Katona-Apte describe this "vicious cycle" of malnutrition and infection as follows\textsuperscript{25}: malnutrition can increase susceptibility to infection through weight loss, lowered immunity, mucosal damage, and pathogenic invasion. In response to the presence of a foreign pathogen, the infant's body mounts an immune response which requires the aid of energy and nutrient stores, simultaneous with an increase in nutrient requirement and malabsorption and/or altered metabolism. For infants who are not receiving the required amount of energy and nutrients through their diet, undernutrition
reduces their immunological capacity to fight off future infections, further exacerbating inadequate dietary intake through a loss of appetite.

There is limited evidence on the impact of WASH interventions in conjunction with nutrition interventions in reducing stunting\textsuperscript{26}. However, in Bangladesh, a hygiene education intervention implemented in rural regions by the NGO BRAC showed positive effects on the incidence of diarrhea in children under 5 years of age\textsuperscript{27}.

One of the conditions that can result from constant ingestion of fecal matter is environmental enteric dysfunction (EED), which involves the development of leaky gut epithelium in the small intestine as well as villous atrophy and crypt hyperplasia\textsuperscript{28,29}. Decreased intestinal surface area that results from villous atrophy reduces the absorption of nutrients through the intestinal wall, contributing to undernutrition\textsuperscript{20}. In addition, increased gut permeability as a result of mucosal damage has been associated with the increased translocation of macromolecules (e.g. endotoxins) into the bloodstream, in addition to food proteins and other organisms that may stimulate local and systemic inflammatory and immune reactions\textsuperscript{20}. These reactions may exacerbate the mucosal damage, contributing to the cycle of poor growth and making recovery a difficult process. EED has been defined as the presence of intestinal inflammation and permeability in the absence of acute diarrheal illness, regardless of recent morbidity history\textsuperscript{30}. There is limited evidence on the link between EED and WASH exposures; however, there has been recent discussion regarding the link between unhygienic environments and poor child growth as summarized by Jean Humphrey (2009)\textsuperscript{31}.  

15
Nutritional Causes

*Current infant and young child feeding recommendations*

Adequate nutrition during infancy and early childhood is crucial to the development of each child’s full human potential, particularly during the first 2 years of life. The "Guiding Principles for Complementary Feeding of the Breastfed Child" were developed as guidelines to promote optimal feeding of infants and young children. They are: (1) duration of exclusive breastfeeding and age of introduction of complementary foods; (2) maintenance of breastfeeding; (3) responsive feeding; (4) safe preparation and storage of complementary foods; (5) amount of complementary food needed; (6) food consistency; (7) meal frequency and energy density; (8) nutrient content of complementary foods; (9) use of vitamin-mineral supplements or fortified products for infant and mother; and (10) feeding during and after illness.

The World Health Organization (WHO) recommends exclusive breastfeeding (EBF) for the first 6 months of life, followed by the introduction of complementary foods alongside breast milk up until the infant is 2 years old. Exclusive breastfeeding is the practice of feeding only breast milk to the infant, and is recommended as the best feeding practice for infants as a protective effect against morbidity and mortality. The recent Lancet series on breastfeeding suggests that universal exclusive breastfeeding for 6 months and until an infant is 2 years old could prevent 823,000 annual deaths in children under 5 years. In LMIC, exclusive breastfeeding can be life-saving, and offers significant benefits for infant health.

There are different approaches to promoting appropriate child feeding practices, and the range of outcomes relating to these practices have an impact on the well-being of both the child and the caregiver. Early introduction of non-breast milk foods (before the recommended 6 months of age) increases the overall nutrient uptake in a child, but
could also introduce infectious disease and have detrimental effects on nutrient bioavailability, as well as the growth patterns of the child\textsuperscript{33}. Delaying the introduction of complementary foods beyond 6 months, recommended because around that age the child's nutrient requirements increase beyond what can be provided through breast milk alone. While no direct associations have been made between breastfeeding and linear growth, mixed feeding (i.e. feeding complementary foods alongside breast milk) before the recommended 6 months of age could increase susceptibility to environmental pathogens, subsequently affecting growth. Breastfeeding has been shown to reduce mortality in infants and young children\textsuperscript{7}. However, despite the benefits of breastfeeding, only 36\% of infants globally are exclusively breastfed (EBF) for the first 6 months of life\textsuperscript{1}. Although the duration of breastfeeding is longer in LMIC and is greater than in high income countries, only 50\% of the mothers practice EBF for 6 months\textsuperscript{33}.

More recently, the 2015 WHO World Health Statistics Report reported that in discord with the WHO recommendation, only 64\% of infants in Bangladesh are exclusively breastfed\textsuperscript{1}. While it is higher than the global rate (36\%)\textsuperscript{1} and even the South Asia region (47\%)\textsuperscript{36}, there are various factors that render infants in Bangladesh more susceptible to undernutrition in the absence of EBF than infants living in HIC.

In order to promote optimal feeding practices, it is imperative to understand the different reasons for non-exclusive breastfeeding and types of complimentary foods that are given in Bangladesh, where both premature and delayed complimentary feeding are practiced. Infants are often fed non-breast milk liquids/solids before 6 months of age, and conversely the introduction of solid or semi-solid foods is often delayed\textsuperscript{37}. In settings where maternal undernutrition and preterm birth are common, infants are born replete of stores of essential micronutrients, which may prove to be more harmful is breastfeeding is stopped earlier than the infant can physiologically manage\textsuperscript{35}. 
Complementary feeding, food diversity and nutrient intake

After 6 months of age, children require appropriate quantity and quality of complementary foods for optimal growth and development while breastfeeding is continued\(^7\). In addition, improper timeliness, frequency of intake and caloric intake are also important causes of undernutrition. Lack of dietary diversity is particularly problematic among impoverished populations where diets are predominantly starch-based and include few or no animal products or fruits and vegetables\(^{38}\). These diets often result in protein-energy malnutrition as well as micronutrient deficiencies that take a significant toll on the health and development of children, particularly those under 5 years of age. Most micronutrient deficiencies do not directly affect linear growth, with the exception of zinc\(^8\). A multiple country analysis from African, Asian and Latin American countries found a positive association between dietary diversity higher HAZ among children aged 2-23 months\(^{38}\). Similarly, another study in Burkina Faso showed a positive association between IYCF index and HAZ in all groups of children 6-35 months of age\(^{39}\).

Dietary diversity is now included as a recommendation in the guide for complementary feeding of the breastfed child\(^{32}\). There are a number of studies linking dietary diversity to nutrient intake in developed countries\(^{40}\). Although some studies indicate a positive association between dietary diversity and increased intake of energy and other nutrients among young children in developing countries\(^{41-43}\), additional research is required for a more detailed characterization of the relationship between dietary diversity and nutrient intake and adequacy. Dietary diversity has also been associated with improved nutritional status in young children\(^{38,41,44,45}\), suggesting that there may be an association between dietary diversity and dietary quality, indicating a higher likelihood of meeting daily energy and nutrient requirements. Consuming a higher
number of food items and food groups is associated with improved nutritional dietary adequacy\textsuperscript{41}.

However, studies have also shown a strong association between dietary diversity and SES, particularly as a result of food insecurity and the inability to purchase varied foods\textsuperscript{45,46}. Another aspect surrounding this topic that lacks exploration is the relationship between caregiver feeding behaviors, or the way caregivers feed their children, and dietary diversity, which could potentially provide a further understanding of dietary intake.

\textit{Responsive feeding behaviors in the context of IYCF}

Undernutrition is often directly attributed to inadequate intake, which can be attributed to a myriad of factors, including infant and young child feeding behaviors and other care practices, as well as the support and resources required to provide that care\textsuperscript{47}. The WHO's Global Strategy for Infant and Young Child Feeding\textsuperscript{48} states that being properly fed is an important part of complementary feeding. This involves feeding in a way that is consistent with the child's signals of appetite and satiety, while encouraging the child to consume a sufficient amount of food through self-feeding, as suitable for age\textsuperscript{48}. \textit{Responsive feeding is third on the list of the 10 guiding principles for complementary feeding that were outlined by the PAHO and the WHO}\textsuperscript{32}.

Caregiver-child interactions, or feeding behaviors refer to the interactive behavior between caregivers and children that occur during meals\textsuperscript{49}. The different feeding behaviors originate from the parenting literature, where parenting styles have been categorized into four categories based on the level of responsiveness and structure by which they are characterized\textsuperscript{50}. \textbf{Figure 2.3} displays the four parenting styles and their corresponding feeding behaviors (underlined and bolded).
The suggestion that feeding behaviors are an extrapolation of parenting styles was studied and concluded by Hughes et al., who found that parents with more controlling parenting styles were more inclined to exhibit authoritarian feeding behaviors, while those who exhibited more responsive parenting habits were associated more with authoritative feeding behaviors\textsuperscript{51}. However, while typically authoritative parents exhibit authoritative feeding behaviors, they may switch to a more authoritarian feeding behavior if they are concerned about their child’s eating habits or dietary intake\textsuperscript{52}.

Hughes described the classification of feeding dimensions within the parenting paradigm as varying levels of intersecting structure and responsiveness as follows\textsuperscript{51}:

<table>
<thead>
<tr>
<th>Level of Responsivity</th>
<th>Level of Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Authoritative</td>
<td>Responsive</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>Controlling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Responsivity</th>
<th>Level of Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Authoritative</td>
<td>Permissive</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>Uninvolved</td>
</tr>
</tbody>
</table>

- **Responsive feeding behaviors** are imbedded in an overall authoritative style of parenting and characterized by caregiver guidance and appropriate response to child’s cues of hunger and satiety.
- **Non-responsive feeding behaviors** are characterized by a lack of developmentally appropriate/sensitive reciprocity between the caregiver and

---

\textsuperscript{50} Figure 2.3. Parenting styles and corresponding feeding styles

\textsuperscript{51} The suggestion that feeding behaviors are an extrapolation of parenting styles

\textsuperscript{52} However, while typically authoritative parents exhibit authoritative feeding behaviors, they may switch to a more authoritarian feeding behavior if they are concerned about their child’s eating habits or dietary intake.
child, through excessive caregiver control (forcing/pressuring or restricting food intake), excessive parental passivity or child control (indulgence), or caregiver disregard (uninvolved). Caregivers who force or restrict food intake may be more authoritarian overall in their parenting, or may have specific concerns about their child’s dietary intake, appetite, size/growth, and propensity to under eat or refuse food, leading to more controlling feeding behaviors. Caregivers who exhibit uninvolved or indulgent feeding behaviors may be more permissive in their parenting overall, may make little effort to encourage eating or may rely on food rewards to manage their child’s behavior, regardless of the developmental/dietary appropriateness of their response. Few studies have been conducted to explore the relationship between responsive feeding and child growth, and even fewer have shown a significant improvement in nutritional status in relation to responsive feeding interventions. However, caregiver interactions and verbalization have been postulated to encourage acceptance of food by the child, which may improve dietary intake and eventually growth.

Appropriate complementary feeding practices are composed of three components: 1) adapting the method of feeding to the child's psychomotor abilities; 2) responsive feeding; and 3) creating an ideal feeding environment by limiting distractions, sticking to a consistent feeding schedule, and supervising feeding. Especially among lower income populations, where food availability is unstable and children live in a less stimulating environment, responsive feeding may show a marked improvement in children's dietary diversity and subsequent growth. However, responsive feeding in LIC is not a well-studied topic, and the feeding behaviors mentioned in the literature have emerged from studying feeding behaviors in HIC settings, largely among children at risk for overweight/obesity.

The second year of life is a crucial time for the developmental changes related to eating, including self-feeding, an increase in dietary diversity, and the transition to the
family diet and meal patterns. During this period, the caregiver’s misinterpretation of their child’s cues during mealtimes can result in stressful mealtime interactions, potentially resulting in denial of responsive feeding behaviors that are important for the development of healthy eating behaviors and improved growth\textsuperscript{53}. In LMIC, including Ethiopia, Bangladesh and Kenya, parental responsivity varies and has been positively linked to children’s language development\textsuperscript{57,58}. Intervention trials have been successful in increasing parental responsivity and found positive association with children’s social and emotional development, including attachment.

Non-responsive feeding can be linked to a number of behaviors, including late child self-feeding and lack of maternal responsiveness. Children acquire psychomotor abilities to begin initiating some self-feeding behaviors by 9 months. Despite this fact, a recent study found that self-feeding among Bangladeshi children was delayed beyond 24 months\textsuperscript{59}. In Bangladesh, responsive feeding behavior is challenged by the caregiver’s desire to continue to feed their children, despite children’s increasing motor capabilities and desire to feed themselves\textsuperscript{59}. Interviews with women participating in an educational program addressing child self-feeding and maternal responsiveness revealed some of the facilitators and barriers to proper responsive feeding practices\textsuperscript{60}. In their mixed methods study\textsuperscript{60}, Affleck and Pelto found that the most prominent barrier to letting a child feed him/herself is time constraints; children tend to eat slowly when they are feeding themselves. The mess involved with child-feeding was an additional barrier; mothers found it to be extra and unnecessary work to clean up after a child who has made a mess while feeding himself. There was also a common understanding that children cannot feed themselves properly because they are too young to do so. In addition, there was a general view that food is wasted when a child is feeding himself, since more of the food ends up on the ground or on the child’s clothes instead of being consumed\textsuperscript{60}. 
Barriers to responding verbally to the child during feeding times include the following: a misunderstanding of 'responsive feeding' to mean simply sitting with the child while s/he eats, or paying attention to what the child is eating. Mothers who did practice verbal responsiveness reported that it took longer to feed their children but that their children enjoyed being spoken to and would often eat more food if they were spoken to during meals. Finally, some mothers did not see any point to converse with a child who is too young to respond coherently.

Other general barriers to responsive feeding are economic poverty and cultural restrictions. Many women who wanted to offer a diverse array of food to the child if they refused to eat certain foods could not afford to have any variety. There is often a cultural barrier that restricts women from going grocery shopping, so the husband will bring home food from the market and the woman will make do with what she has. Another common feeling among the women interviewed was the satisfaction of force feeding; mothers tended to experience a feeling of success if they could get the child to eat a predetermined amount of food. Some reasons behind this include: the child is too young to know what they need, they will not eat enough on their own to get adequate nutrition, and without force feeding there will be negative health consequences such as undernutrition, morbidity and risk of morbidity.

The majority of nutrition education programs addressing responsive feeding patterns have focused on the relationship between the mother and child. While improving the mother-child bond is ideal and the most common scenario for childcare, the social constraints on mothers deem it necessary for interventions to put more emphasis on garnering support from other household members. For example, many women in urban slums in Bangladesh are employed in homes as maids, garment factories, or other such professions that keep them away from the home for long hours during the day. During this time, children are most commonly cared for by grandmothers,
neighbors or older siblings. As such, an educational program to promote responsive feeding practices may be better geared towards an entire family unit, or even a concentrated community unit in settings where childcare extends beyond the immediate family\textsuperscript{61}.

The current evidence for responsive feeding on child growth is promising, but lacking, due to the lack of interventions that can isolate the impact of responsive feeding\textsuperscript{54}. Studies exploring the relations between responsive feeding and dietary intake report an improvement in intake of essential nutrients and complementary foods, but again were not designed to isolate the effects of responsive feeding\textsuperscript{62–65}. In a trial of just nutrition education, Penny et al. found that fewer children in the intervention groups failed to meet dietary requirements for energy (8 months: 30 [18\%] of 170 vs 45 [27\%] of 167, p=0·04; 12 months: 64 [38\%] of 168 vs 82 [49\%] of 167, p=0·043), iron (8 months: 155 [91\%] of 170 vs 161 [96\%] of 167, 9 months: 152 [93\%] of 163 vs 165 [99\%] of 166, p=0·047), and zinc (9 months: 125 [77\%] of 163 vs 145 [87\%] of 166, p=0·012) than did controls. Another nutrition education intervention found that energy intakes from complementary foods overall were significantly higher in the intervention group children at 9 months (mean ± SD: 1556 ± 1109 vs.1025 ± 866 kJ; p: 0.001) and 18 mo (3807 ± 1527 vs. 2577 ± 1058 kJ; p: 0.001).There is evidence that caregiver verbalization matters in improving child growth, but the role of other behaviors including physical actions, maternal encouragement and child autonomy requires further research\textsuperscript{54}. However, two studies, both conducted in Bangladesh, did isolate the effects of responsive feeding on diet and growth; one found a significant increase in weight gain (d=0.48, p=0.002) and the other did not find any significant change in weight despite an increase in maternal verbal responsiveness (d=0.36) and child self-feeding (d=0.37)\textsuperscript{6,66}.

While responsive feeding messages are commonly included in nutrition and/or complementary feeding interventions\textsuperscript{63,65,67}, limited studies have looked at the
associations between responsive and non-responsive feeding and undernutrition or the effects of providing responsive feeding messages on improving dietary diversity and growth patterns\textsuperscript{54}. Current interventions often include responsive feeding messages despite limited evidence regarding association between responsive feeding and undernutrition or the efficacy of responsive feeding programs\textsuperscript{68}. There is still a paucity of research on how to best measure responsive feeding and how to incorporate responsive feeding into interventions in an effective way\textsuperscript{54}.

**Interventions to reduce undernutrition**

As mentioned earlier, the PAHO/WHO guidelines for complementary feeding of the breastfed child focus on appropriate timing and duration of breastfeeding as well as complementary feeding practices, and employing responsive feeding behaviors throughout\textsuperscript{32}. The following section will review some interventions that have been instrumental in reducing undernutrition.

*Breastfeeding Promotion*

As one of the most cost-effective methods of preventing morbidity and mortality, breastfeeding promotion programs have long been used in LMIC. These programs encourage timely initiation of breastfeeding (and refraining from prelacteal feeding), exclusive breastfeeding for the first 6 months, and continuing breastfeeding alongside provision of complementary foods through 24 months of age\textsuperscript{32}. Exclusive breastfeeding is emphasized the most through these programs, because many mothers in the world, including those in countries that are attempting to achieve the MDGs, do not practice proper exclusive breastfeeding practices\textsuperscript{69}.

A review of breastfeeding promotion programs by Pérez-Escamilla et al. suggests that there are three key programs that are most effective in promoting
breastfeeding\textsuperscript{69}. The first, communications and mass media campaigns, are necessary for widespread promotion or introduction of breastfeeding awareness in settings where an intervention will be introduced\textsuperscript{70–74}. Facility-based message delivery, such as the Baby-Friendly Hospital Initiative launched by WHO and UNICEF and community-based exclusive breastfeeding programs have also been commonly used. Hospital-based initiatives were long promoted because of the authority and expertise of certified physicians that later shifted to the dissemination of promotional messages through community-based mediums\textsuperscript{33,71,74–78}. The latter involves the use of community health workers, peer counselors, and mother-to-mother support groups\textsuperscript{70,74,79,80}. However, the aforementioned methods have been used in combination to develop all-encompassing promotion programs that reach the public through mass media campaigns, as well as narrowing in on women in health facilities and in their community settings.

In the realm of attempting to utilize behavior change as a way to improve infant and young child feeding practices, counseling through community-based workers or volunteers has been found to be highly effective\textsuperscript{62–64,67,81–87} as well as through health workers or health facility staff\textsuperscript{65,88}, although studies directly comparing the two methods are scarce\textsuperscript{89}.

Furthermore, 62\% of children in Bangladesh are born at home, so facility-based initiatives do not even reach a large part of the affected population\textsuperscript{3}. Peer-counseling and the use of community health workers has increasingly become the medium for maternal and child health information, and recent reports from Alive & Thrive suggest that exclusive breastfeeding rates have increased as a result\textsuperscript{90}. The increase in use of peer-counselors and home visits also represents a shift from education-oriented to action-oriented teaching.
Complementary feeding programs

A number of studies have looked at the delivery of complementary feeding education, provision of complementary food supplements (CFS), or a combination of both and their effects on growth. A recent systematic review summarized by Bhutta et al. has found that similar benefits of such interventions have been found through dietary diversification, education and food supplementation in both food secure and insecure populations, although slightly greater effects were seen in food insecure populations. An 8 month intervention done in India showed that a group receiving both food and education gained 250 g and 0.4 cm more than the control group, while the group receiving only education gained just 90 g more with no difference in linear growth. A similar intervention in Bangladesh showed that the growth outcomes in the education-only group were in between those of the group receiving both education and food and the control group. Children with low WAZ at baseline were targeted for this intervention, and a relatively large impact on weight but not length was seen in the intervention groups. Complementary food fortification studies were found to have less of an effect on growth but a greater impact on the improvement of micronutrient status (whichever micronutrients were used to fortify). Further effectiveness trials are needed in food insecure populations looking at fortified foods, intervention duration, cost effectiveness and a variation in outcome definition.

Energy and micronutrient-rich complementary food supplements (CFS) have also been the focus of many field trials testing the impact on growth during the complementary feeding period. Field trials have consistently shown improvements in the nutrient adequacy of the diet, benefits from recovery from moderate malnutrition, and even improved rates of growth and/or reduced risk of stunting. The randomized controlled complementary food supplementation trial held in rural northwestern Bangladesh, within which this ancillary study of feeding behaviors was
conducted, tested four CFS formulations and their impacts on growth, among other secondary outcomes. The trial found reductions in the decline in LAZ from between 0.02-0.04/ month from 6-18 months of age in children receiving Plumpy’doz (p= 0.02) and two locally produced CFSs (chickpea and rice-lentil blend) (p<0.01 for both). They also found a reduced prevalence of stunting in the groups receiving Plumpy’doz and the chickpea CFS (lower by 5-6%, P<0.01)\textsuperscript{101}. This study directly compared the provision of food with an educational intervention to just education. Another trial conducted in Chad found a modest gain in HAZ (+0.03 Z-score/mo; 95% CI: 0.01, 0.04)\textsuperscript{99}. Although they have shown an effect on growth, supplementation trials do not allow for isolating the component of the diet that the changes in linear growth can be attributed to.

Review of responsive feeding trials and outcomes

A number of studies have been done in LMIC to look at feeding behaviors in the context of infant feeding\textsuperscript{54}. In a recent review done by Bentley and others\textsuperscript{54}, 21 studies were identified. Figure 2.4 presents a summary of these studies, as summarized by Bentley et al. (2011)\textsuperscript{54}. Research surrounding feeding behaviors has most commonly been conducted either through ethnographic methods, observation, or through feeding interventions.
A mixed methods study conducted in Mali in the 1980s first used ethnographic observation to characterize the feeding behaviors in the population, then used their observations of general laissez-faire feeding behaviors to develop a questionnaire to characterize maternal attitude\textsuperscript{102}. The results suggest that children of attentive mothers showed better growth measures than those of laissez-faire mothers\textsuperscript{102}. Four
observational studies have documented positive associations of responsive feeding with at least one growth outcome (WAZ, HAZ, etc.)\textsuperscript{102-105}. However, measurement of responsive feeding varied between these studies, including the development of a maternal attitude scale\textsuperscript{102}, an active feeding scale\textsuperscript{106,107}, the number of positive expressions during feeding\textsuperscript{103} and the use of hand-feeding\textsuperscript{104}. Interventions surrounding responsive feeding have varied in design. Of the 9 studies reviewed by Bentley et al., 8 showed an improvement in growth outcomes\textsuperscript{66}, including study in Peru (2005) that found higher odds of stunting at 18 months in the control group vs. intervention (adjusted OR: 3.04, 95% CI: 1.21-7.64)\textsuperscript{65}. A study in India (2001) found higher attained length in the intervention group among 12 (0.51 cm, 95% CI: 0.03, 0.98) and 18 month old (0.37, 95% CI: 0.08, 0.66) males\textsuperscript{63}. However, the effect of responsive feeding on growth was not isolated in any of these interventions; in some of the interventions responsive feeding was embedded within an education and/or food supplementation package\textsuperscript{63-65,67,108}. Mixed results were seen in 2 studies that were designed to promote responsive feeding; one study found no significant differences between the control and intervention group\textsuperscript{66}, while the other one found significantly increased weight gain in the intervention group compared to the control\textsuperscript{6}. The results of interventions designed to understand the influence of responsive feeding on dietary intake and nutrient intake all showed improved intakes of key nutrients or complementary foods, but again there was no focus on isolating the effects of responsive feeding\textsuperscript{62,63,65,107}.

One of the cluster-randomized trials designed to isolate the effect of responsive feeding on diet and growth was conducted in rural Bangladesh\textsuperscript{66}. This trial involved child health, development, and feeding education for all participants, and an addition responsive feeding message component that was delivered to the intervention arm. Maternal verbal responsiveness was significantly higher in the intervention arm (d = 0.36) and child refusals were significantly lower among intervention children at post-test
(d=0.27) but not follow-up. However, there were no differences in attained weight or WAZ between the control or intervention arms. However, there was no prior formative research done to understand the current feeding behaviors in the region; more research is required.

While there are numerous studies that have examined the relationship between responsive feeding and overnutrition in high income countries, the current state of knowledge regarding the role of responsive feeding on undernutrition and nutritional outcomes in LMIC is limited.

**Research Gaps and Opportunities**

The current state of knowledge regarding the role of responsive feeding on nutritional outcomes is limited. Thus, understanding the current responsive and non-responsive feeding behaviors in this setting and understanding their relationship with child dietary diversity and growth will allow us to explore different approaches to improving nutritional status in children in not only rural Bangladesh, but similar low-income settings where improving responsive feeding practices may improve infant and young child growth. Caregiver-focused early child feeding interventions can be addressed by 1) integrating key nutrition messages on infant and young child and nutrition in all information, education and communication materials; 2) developing the skills of caregivers on optimal child feeding practices, caregiver-child interactions and psycho-social stimulation; and 3) supporting mothers and primary caregivers to adopt healthy lifestyles to improve their nutritional status and that of their young children. In socially adverse environments, where the most vulnerable children and women live, mothers are more likely to be the poorest, most undernourished, mentally vulnerable and/or depressed and less responsive to their child’s needs. In such settings, programs
can combine feeding behavior interventions so that mothers are better equipped to provide optimal childcare for that setting.
References


73. UNICEF & WHO. Indicators for assessing infant and young child feeding practices. 1–52 (2010).


Chapter 3. Study Design and Methodology

Overview

The overarching goal of this study was to understand the way caregivers in this rural Bangladeshi setting feed their children, the factors surrounding the decisions to feed their children in those ways, and how those feeding behaviors relate to nutritional outcomes and dietary diversity. Qualitative research methods were used to explore feeding in this context, and quantitative methods were used to quantify feeding behaviors and relate them to nutritional outcomes and dietary diversity.

For the first research objective, understanding caregiver feeding behaviors in rural Bangladesh, qualitative data was collected among a sample of caregivers and children living in Gaibandha district, in rural northwestern Bangladesh. Sixty-nine caregivers participated in in-depth interviews and focus group discussions to provide their descriptions and narratives of the ways young children are fed in this setting this setting, as well as factors influencing the feeding behaviors used. In addition, 10 caregivers and 11 children participated in in-home video observations of mid-day feeding episodes.

For the second research objective, a scale was developed, translated, pretested and refined to measure caregiver feeding behaviors of mothers of children participating in a randomized-controlled food supplementation trial in Gaibandha. For the third research objective, the feeding behaviors scale was administered to all mothers of children (n= 4846) enrolled in the trial and the relationship between caregiver feeding behavior and nutritional outcomes of children enrolled in the trial was assessed at 24 months of age (Table 3.1). Study design, methodology, and analytic approach for each objective are described in the following sections.
**Table 3.1. Research objectives and associated methods**

<table>
<thead>
<tr>
<th>Research Objective</th>
<th>Method and Sample Size</th>
<th>Data Analysis</th>
</tr>
</thead>
</table>
| **Research Objective 1:** To understand attitudes and experiences related to responsive feeding behaviors among caregivers of children 15-24 months of age living in rural Gaibandha, Bangladesh. | - 30 in-depth interviews  
  - 25 mothers  
  - 3 grandmothers  
  - 2 fathers  
  - 5 focus group discussions  
  - 3 with mothers  
  - 1 with grandmothers  
  - 1 with fathers  
  - 10 in-home observations  
  - 10 mothers  
  - 11 children | Inductive and deductive coding |
| **Research Objective 2:** To develop and validate a context-specific caregiver feeding behaviors questionnaire to measure feeding behaviors among caregivers of 24-month olds in rural Gaibandha, Bangladesh. | - Developed Caregiver Feeding Behaviors Questionnaire  
  - Assessed construct validity  
    - 4846 mother-child dyads | Factor analysis |
| **Research Objective 3:** To explore the relationship between feeding behaviors and dietary diversity and grown among 24-month old children. | - Administered Caregiver Feeding Behaviors Questionnaire  
  - Administered Semi-quantitative 24-hour food frequency questionnaire  
  - Collected anthropometric measurements (height, weight)  
    - 4846 mother-child dyads | Multiple linear and logistic regression |

**Description of the Randomized Controlled Trial**

**Context**

The JiVitA-4 trial is the fourth nutrition intervention trial to be conducted within the JiVitA field site that was established in northwestern, rural Bangladesh in 2000. The study area comprises 19 unions within the districts of Rangpur and Gaibandha. This
area was identified based on population characteristics showing mothers and children to have a high risk and exposure to poor health and nutrition. These characteristics include lower school attendance, lower female literacy, earlier age at marriage, less access to antenatal care, fewer assisted deliveries, and more home births. The study area spans approximately 435 km², with a population of about 650,000 people. In addition to the population characteristics that make the study area fairly representative of rural Bangladesh, the size of the study area and dense population make Gaibandha a feasible and appropriate site for maternal and child nutrition-centered research. The site has been host to numerous studies involving maternal and infant/young child health, including 3 randomized controlled micronutrient supplementation trials.

Study Design

The JiVitA-4 trial was a non-blinded cluster-randomized controlled trial designed to compare the efficacy of 4 complementary food supplements (CFSs) and their impact on growth, LAZ, WLZ, morbidity, micronutrient status, and cognitive development among children from 6-18 months of age conducted between September 2012 to October 2014. The energy density and micronutrient content of complementary foods in developing countries are generally insufficient and do not meet the WHO recommendations and the acceptability and efficacy of supplemental complementary foods in this setting is unknown. Of the 4 CFSs that were tested in this study, 2 were locally produced. Plumpy’doz, a prepackaged, lipid-based supplement that has been shown to improve nutritional status among children in Niger was used as the standard for comparison. The 5 arms of the study included the following: a World Food Program-developed Wheat-Soy Blend (WSB++), a regionally produced chickpea-based Ready-to-Use Food for Children product (RUFC), a rice meal and lentil-based locally-formulated CFS, Plumpy’doz (which served as a positive control) and nutrition education about
optimal breastfeeding and complementary feeding practices from 6-18 months of age (negative control) that was provided to all study participants. There was an additional follow-up at 24 month of age, 6 months after the end of supplementation.

The main supplementation trial results were published in 2015, and the study design and methods are described in detail therein\(^5\). Briefly, 5,941 children were eligible for enrolment in the trial, based on enumerated births and infants less than 6 months of age who were living in the study area. Of these, parental consent was obtained for 5,536 children, and after accounting for loss to follow-up by the end of the enrolment period (September 2012 – April 2013), 5,449 were enrolled in the trial at 6 months of age. Participants were allocated into intervention groups by cluster; cluster randomization of the 596 pre-determined sectors of the study area was done by blocks of 19 sectors. The 4 arms receiving CFSs were supplemented daily for one year (from 6 to 18 months), and all arms of the study received nutrition, feeding and hygiene counseling from child feeding counselors every 1-2 months for one year. Demographic characteristics of each household was taken by interview at baseline to gather information about the household and individual household members, including education, age, occupation, measures of socioeconomic status, and food security. Every 3 months following the beginning of supplementation, interviewers measured diet, breastfeeding, and anthropometry of the child. Additionally, there were weekly assessments of supplementation adherence and morbidity. A follow-up interview was done at 24 months of age, 6 months after the end of supplementation, to assess the extended effects of the intervention. The dietary, anthropometric, morbidity, SES, food security, and household demographic data collected at this visit were used to address Aims 2 and 3 of the present study.

The following sections will describe the specific methods and analytic strategy used in the 3 papers.
Paper 1: Qualitative research to understand caregiver feeding behaviors

Caregiver perceptions of child growth, feeding and nutrition are culturally bound, and imperative to understand in order to address behaviors contributing to poor nutrition and growth. The objective of this study was to understand behaviors and attitudes that influence feeding behaviors (e.g. responsive vs. non-responsive) among young children (15-24 months) in rural northwestern Bangladesh. Three qualitative research methods were used in the study; in-depth interviews (IDI), focus group discussions (FGD), and in-home observations (IHO) as described later in this section.

Study site and participants

This study took place in Gaibandha and Rangpur districts in Northwestern Bangladesh. Since the JiVitA trial participants were receiving child feeding counseling, we wanted to explore caregiver feeding behaviors within caregivers not receiving IYCF messaging to reduce contamination. Participants were recruited from outside the JiVitA study area with the help of the field supervisors, quality control officers, and team leader interviewers working with the JiVitA study population. In qualitative research, each participant is carefully selected based on how their participation will contribute to answering the research questions. In this way, participants are selected to include both typical and atypical cases until saturation of the data is reached, in order to ensure that the emergent theory can be applied to any scenario in the greater population\(^9\). Further generalizability is assured by testing the validity of our study. These details can be found later in this chapter. We selected participants and interviewed until we reached saturation. An overview of the study participants can be found in Table 3.2.
Table 3.2. Overview of study participants

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Age of Child</th>
<th>Participants (primary caregivers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-depth interviews (at home)</td>
<td>15-24 months</td>
<td>25 mothers, 3 grandmothers, 2 fathers</td>
</tr>
<tr>
<td>Focus group discussions (at central location)</td>
<td>15-24 months</td>
<td>3 groups of 7-8 mothers, 1 group of 8 grandmothers, 1 group of 8 fathers</td>
</tr>
<tr>
<td>Observations (at home)</td>
<td>15-24 months</td>
<td>11 children and 10 caregivers</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>79 adults and 11 children</strong></td>
</tr>
</tbody>
</table>

**Sampling Method**

Our qualitative study began with criterion-based convenience sampling of the participants. We wanted to begin the study with the experiences and knowledge of any type of mother with a child in the age range 15-24 months. We wanted a range of experiences at the beginning in order to let the findings drive further sampling. This was done to avoid any pre-supposed notions to guide the sampling in the beginning. The sampling process is not mutually exclusive from data analysis; because findings emerged that mothers with more children are different from mothers with fewer children, older mothers are different from younger mothers, and mothers with lower levels of education are different from mothers with higher levels of education, we followed up the convenience sampling by purposefully sampling from mothers who exhibited these differences. After one third of the projected sample size was collected (n=9 IDIs), we moved on to criterion-based purposive sampling.

**Criterion-based purposive sampling**

After the initial convenience sampling, we began to sample using the following guidelines:

- We identified new participants from our FGDs; some were deviant cases, and others were participants we found to be information-rich.
• We identified mothers who were more open and willing to share.
• We purposefully sampled based on our findings: older mothers, mothers with more or less children, mothers with varying levels of education.

Final set of criteria:
• Open and information rich
• Gender of child: male or female
• Religion: Hindu or Muslim
• SES: low, medium, high
• Other criterion [based on findings]:
  o Number of children
  o Age
  o Level of education
  o Family structure: joint vs. divided

The criteria were defined using context-appropriate definitions through local opinions and discussion with the data collectors, all of whom are familiar with the context.

• **Low SES:** those who have to depend on others for their daily income; live day-to-day. Examples: van drivers, rickshaw drivers, day laborers (bricks, farming, etc.)

• **Medium SES:** Those who can handle the day’s meals on their own; do not need to rely on others for their income. Low SES workers often come and work for them on their land; they have some farms, ponds, animals, etc. Examples: People who have crops etc., they have businesses (electrician, general stores), they own a mill, or work salaried jobs (teacher, etc.)
• **High SES**: High SES participants may also have any of the qualities of medium SES, but in greater magnitude. Their homes are usually not made of tin; they may have homes closer to the city. They may have multiple businesses or a combination of things (owning a bus, a business, having low or medium SES people work for them.)

• **Joint Family**: Extended family all cooks from the same stove and eats from the same pot. There is one person who is the “head” of the family (e.g. the oldest brother, the father, etc.) and everyone else deposits their earnings to him, keeping a bit for himself. From that pot of money the entire family's groceries and clothes are purchased. After everything is taken care of, they are able to use that money to purchase something under the entire family's name, like some crops or a mill. If someone does not want to share his/her money, then s/he separate from the joint family and only provides for his/her own nuclear family.

• **Divided Family**: The nuclear family cooks and eats from a separate stove or pot as the rest of the extended family.

• **Illiterate**: no formal education; cannot read or write (except for their name, in some cases)

• **Low education**: Formal education between class 1-5

• **Medium education**: Formal education between class 6-10

• **High education**: Formal education of SSC or higher

Ideally, a qualitative study is done until we reach data saturation, and the sample size is extended beyond the proposed sample size if data saturation has not been reached. The 30 interviews and 5 FGDs were proposed based on literature and guidelines from other qualitative researchers. Thirty interviews were found to be appropriate given the scope of the project, and saturation was reached on numerous
topics before the completion of our allotted sample size for mothers. However, we may have learned more from fathers and their ideas and influence on child feeding behaviors with further data collection. Another FGD with fathers would have been beneficial; however, given our limited time, we were unable to extend our proposed sample size.

*Eligibility and Consent*

Participants were purposively selected for this study if they met the following eligibility criteria: 1) if they were living outside of the JiVitA study area, and 2) if they were the mother, father, or grandmother of a 15-24 month-old child. Children were eligible for the in-home-observations if they were 15-24 months of age, and if their primary caregiver met the aforementioned criteria. One of the JiVitA male Team Leaders assessed eligibility by visiting homes and asking if there were any children who met the eligibility criteria. If so, he would record their information and participants would be selected from that list. Participants who were selected were then asked when would be a convenient time for them to be visited by one of our interviewers for an interview. Once given a time, the data collector would visit the household and gather written consent before the interview. The consent form was read out loud to the participant, and the participant could ask any questions to the data collector or were given the contact information of the supervisor for any additional questions. Participants were given a copy of the consent form.

*Personnel requirements/training*

All interviews and focus group discussions were conducted by 3 trained female JiVitA staff, as they were most familiar with the local dialect and had already established rapport with the community members. Zaynah Chowdhury, the student investigator working on this study, and Mousumi Jahan, the project Quality Control Officer (QCO)
oversaw and facilitated all data collection activities. The data collectors were trained by the student investigator and QCO on qualitative research methodology, including practice interviews until they were comfortable using the field guides and conducting qualitative interviews. Following training, the data collectors were expected to understand the different feeding behaviors and the implications of each one, as well as exhibit a high level of comfort with questioning and probing using the field guides. Transcription of the interviews and focus group discussions was completed by the data collectors and other JiVitA staff, translations to English were done by the student investigator and QCO with the help of the other data collectors, and all data analysis was completed by the student investigator.

**Initial training**

There were 6 data collectors invited to the initial training, all JiVitA staff. Training covered concepts including an overview of the study objectives, the different feeding behaviors, qualitative theory and methods, IDI techniques, and FGD techniques. This was followed with a few days of practicing interviewing each other, then in the field with JiVitA field distributors who had children in this age range, until the data collectors were exhibiting the ability to ask open-ended questions, evoke rich information, and probe on salient topics during practice sessions. From the 6 invited to training, those who exhibited the most comfort with interviewing techniques and showed improvement with practice were retained (n=3).

**Refresher training**

After about 1/3 of data collection was completed, we identified gaps in the data collection methods and data in general and decided to conduct a refresher training. Stephen Kodish, an expert in qualitative theory and methods from JHSPH, traveled to
Gaibandha to help conduct this training. Signs that a refresher training was needed included the following: 1) a large number of closed ended questions in the transcripts, 2) a lack of probes, 3) a large number of "why" questions in the transcripts, and 4) a lack of rich data (sparse data lacking thick descriptions and narratives necessary to answer the research questions). The refresher training covered a qualitative research overview, in depth interviews, and focus group discussions. This was followed by field practice with incorporation of feedback from the trainers. At the end of the 5-day training, the trainees were given a certificate of completion for their records, signed by the trainers (Stephen Kodish and Zaynah Chowdhury).

Instrument Development

We conducted in-depth interviews and focus group discussions with a variety of informants including mothers, fathers, and grandmothers of 15-24 month-old children. The data collectors conducted IDIs and FGDs in Bangla, following semi-structured field guides.

Table 3.3. Overview of study instruments and procedures.

<table>
<thead>
<tr>
<th>Data Collection Instrument</th>
<th>Population &amp; recruitment process</th>
<th>Duration</th>
<th>Consent &amp; Recruitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDI guide for mothers, fathers, or grandmothers</td>
<td>Primary caregivers (mothers, fathers, grandmothers, or other) of 15-24 month-old children will be identified by data collectors and asked to participate in an IDI.</td>
<td>60 to 90 minutes</td>
<td>IDI consent form, demographic form</td>
</tr>
<tr>
<td>FGD guide for mothers, fathers, or grandmothers</td>
<td>Primary caregivers (mothers, fathers, grandmothers, or mixed groups) of 15-24 month-old children will be identified by data collectors and asked to participate in an FGD.</td>
<td>60 to 90 minutes</td>
<td>FGD consent form, demographic form</td>
</tr>
<tr>
<td>Video recording device</td>
<td>Caregivers of 15-24 month-old children will be identified by data collectors and asked to participate in an in-home observation of their child's feeding episode.</td>
<td>10 to 30 minutes</td>
<td>In-home observation consent form, demographic form</td>
</tr>
</tbody>
</table>
The IDI guide (Appendix A1.1) explored topics pertaining to child feeding and feeding behaviors, including a description of the child’s meals throughout the day, what makes feeding the child difficult or easy, appetite, temperament, illness and multiple caregivers. We began with a semi-structured IDI guide and made changes to it through training and the beginning of data collection. Changes were made to the guide when we were not eliciting the information we were looking for. In addition, the data collectors were following the guide too closely and asking the proposed questions verbatim, so we reworded the questions to make the guide more bulleted and open-ended. Fictional narratives were added to evoke responses of how the mother would react to those situations (forceful and indulgent feeding).

The original FGD guide that was submitted to the IRB was altered based on information from the original 9 IDIs. We identified topics we wanted to triangulate and we introduced findings into the new guide as prompts for further discussion. The guide was restructured to act as a stimulus for evoking responses that support or contradict developing theory around feeding behaviors in this area. The final guide can be seen in Appendix A1.2.

Demographic information was collected from all participants after gathering written consent. Each participant was given a unique identifier. Consent forms can be found in Appendix A1.3, A1.4 and A1.5.

Protocol for In-depth Interviews

Interviews were conducted in the home of the respondent, in a private setting. Prior to beginning the interview, the data collector ensured that the setting was private and managed any curious onlookers or interruptions appropriately. She then took note of
the surroundings, documenting characteristics of the respondent, the home, the atmosphere, etc. All forms and notes were labeled with the unique identifier assigned to the participant. Once complete, she would turn on the digital voice recorder (Sony ICD-PX333 Digital Flash Voice Recorder) and commence, using the IDI guide to guide the interview and probing along the way. After completing the interview, she thanked the participant, turned off the recorder, and answered any questions the respondent had. The participants were given a melamine mug and a ball as a gift for their participation. Following the interview, the data collector returned to the office and added the IDI to the progress reporting log, then sat with the student investigator and other data collectors and complete a debriefing form, focusing on any outstanding topics or any emerging themes from the interview. The recording of the interview was uploaded to the student investigator's computer.

An average of 2 IDIs/week were conducted to leave time for transcription and translation. For example, if an IDI were conducted on Sunday, the data collector and student investigator would translate it over the next day and a half, while the other data collectors would go out and collect data at that time. This pacing was done to ensure ample time for analysis of the data to identify emerging themes, data saturation, need for further iterations, and further sampling concurrently with data collection.

Protocol for Focus Group Discussions

The FGDs were held in various central locations. Upon obtaining consent, participants were assigned a number that was noted on their demographic form, then they were seated in a circle in order of number assigned. The moderator began by introducing herself and the notetaker, followed by explaining the process of a FGD and what they may expect to happen. The notetaker would draw a map of the room and seating chart and turn on the tape recorder, noting down the number of the person
speaking in her notes throughout the FGD. Once finished, the moderator answered any questions the respondents may have, then gave each respondent a mug and a ball as a gift for their participation. Field notes were expanded by the moderator and notetaker together, then the debriefing form was completed during a debriefing meeting with the student investigator and the other data collectors, during which we identified any emerging themes, or discussed other ways to probe in order to elicit more of the information that we wanted.

Protocol for In-Home Observations

In-home video observations were conducted among 10 households in the presence of the data collector, who held the camera. The data collector emphasized that we want the caregiver to feed the child as they normally would. The nature of the recording process depended on how the child was fed; if the caregiver and child sat in one place and ate, the data collector would sit in one place, holding the camera for the duration of the feeding episode. If the caregiver and child moved around during the feeding episode, the data collector would hold the video recorder (Canon PowerShot ELPH 350 HS) and follow the movements of the caregiver and child. Once the feeding episode was complete, the caregiver was asked if she would like to exclude anything from the recording, and if they have any questions. If not, they were thanked for their time and given a mug and a ball as a gift for their participation.

Data Handling and Analysis

Interviews were transcribed from the recordings into Bangla by various JiVitA staff members. Transcribers were chosen based on the accuracy of their transcription when compared to the recording, their penmanship, speed, and the proximity of their home to the Gaibandha office. We began with 4 transcribers and increased as needed (based on availability of recorders), until we had 10 transcribers working on a rotation.
The written transcripts were then checked against the recordings and changes were made where necessary. All the transcripts were scanned and saved as PDF documents. The written transcripts were archived at the JiVitA Data Management Center.

Translations into English were done by the student investigator and QCO following each interview. After every interview, the student investigator would sit with the data collectors and write up a debriefing form identifying emerging themes, etc. For the initial 9 interviews, summary translations were created and memos were written to aid in the iterative process and to drive data collection; we used generalized coding to identify broad themes, and used broad findings to make programmatic decisions in the field. When the entire dataset was collected and general findings were elucidated, a more detailed analysis was conducted.

After all the interviews were translated, coding was completed in Atlas.ti 7 (Atlas.ti GmbH, Berlin). The interview and focus group discussion transcripts were first read by the first author to get a holistic view of the data. Emic terms were pulled from the text and translated in a database of local terms. Then, a list of codes containing 50 categories of information was developed in the data analysis software from emerging themes. An a priori thematic code list was initially developed using Responsive Feeding Theory\textsuperscript{10}, and emergent codes were added during the coding process. Line-by-line coding was used in initial transcripts as recommended by Charmaz to guide decisions on what topics require further exploration\textsuperscript{11}. The final list of codes were categorized into 11 broader categories, including “responsive feeding behaviors”, “indulgent feeding behaviors”, “forceful feeding behaviors”, “uninvolved feeding behaviors”, “restrictive feeding behaviors”, “barriers to desired feeding behaviors”, “feeding behaviors”, “concerns about child feeding”, “infant and young child feeding”, “illnesses”, and “other”. The codes were aggregated to paragraphs of text to detect recurring patterns. The
quotations that best described caregiver feeding behaviors were used to illustrate the findings. The final codebook can be seen in Appendix A1.6.

The research objectives guided a data analysis focused on child feeding from the start of data collection. Data were analyzed by applying codes to pieces of text in the data, and then they were grouped and analyzed by the student investigator. Common themes were identified; initial coding revealed various feeding methods (e.g. sitting and feeding the child vs. walking around with the child) that we adjusted our guides to include as we moved forward with data collection. Once all the codes were assigned, they were sorted and each set of coded quotes were compared and categorized. When a concept could not be described within the existing definitions, either the definition was expanded or a new code was created with its own definition until no new concepts or themes emerged.

We sought to ensure transferability of our findings by presentation of detailed, contextually rich results. Triangulation of data collection techniques as well as participants also strengthened our findings by highlighting areas of convergence within the data. The use of IDIs, FGDs and in-home observations improved the validity of our study. We were able to triangulate our findings in order to draw conclusions about feeding behaviors and contributing factors in this setting. In particular, the use of video observations was a strength of our study. Observation data on feeding behaviors provides useful information on actual behaviors and enhances the caregiver’s assessment of what occurs during feeding episodes. Caregiver behaviors during the meal are also likely to be influenced by the child’s behavior, which contributes to better capturing the actual dynamics of the feeding interaction. Using video observations rather than direct observations allows the convenience of analyzing behaviors afterwards, so the episode can be rewatched and even coded differently if the
researchers decide to look at different things at a later time\textsuperscript{13}. The observational methodology was generally well accepted among caregivers.

**Paper 2: Scale Development and Validation**

The second paper sought to develop and validate a scale to measure caregiver feeding behaviors in this context. The results from this study can be found in Chapter 5. The process was done in 4 stages: 1) assessment of content validity, 2) pilot testing, 3) exploratory factor analysis, and 4) assessment of construct validity (convergent validity).

**Content Validity**

Content validity refers to the extent to which a set of items reflects a specific domain\textsuperscript{14}. To maximize the content validity of the scale, we adapted questions from pre-existing questionnaires that had previously undergone review by an expert panel, including ~7 members of the *Consortium for Responsive Feeding & Care for Growth and Development* (an interdisciplinary group of ~75 colleagues with expertise in child feeding behaviors)\textsuperscript{15}. This panel reviewed and commented on the item pool, applying their knowledge of the feeding paradigm to judge whether the items on the scale were representative of the construct they were intended to measure. All items were translated into the local language, Bangla, and then reviewed with the women who were data collectors for the qualitative study, 3 women who are familiar with the context and could provide input on the cultural appropriateness and relevance of the items on the scale. Items thought to highlight context-specific feeding behaviors were added, and those thought to lack relevance or clarity for this context were removed or adapted.

The initial set of items was 53 items. The first exclusion was done soon after the translation into Bangla and reviewed with the data collectors, when 6 questions were
removed due to contextual irrelevance (e.g. Are you concerned that your toddler will have to diet in order to maintain a desirable weight?). One question was double-barreled (How often do you bribe or trick your toddler to get him or her to eat?) and was split into 2 questions. Another question was added to assess restrictive feeding: “How often do you limit the types of food you give your child?” Two additional items were added to the scale because they were thought to highlight context-specific feeding behaviors that did not fit the aforementioned categories. These two items were the following: “How often do you show your toddler animals to encourage him to eat?” and “How often do you allow your toddler to feed him/herself?” After assessment of content validity, the questionnaire consisted of 51 items.

Pilot testing

The 51-item CFBQ was pilot-tested in 15 women in the community with children aged between 15-24 months. The same 3 women who were involved with content analysis conducted the pilot testing. These women were trained to administer the questionnaire to ensure standardization. They asked the questions and recorded the responses using the Likert scale. Following each question, the respondent was asked about content and clarity of the question (e.g. “what did you think of this question? Does it make sense?”) The CFBQ was reviewed after the pilot test. Item deletion was based on between-subject variability (if all mothers responded to a question the same way, it was dropped), and relevance or clarity as reported by the pilot sample and data collectors. The final 17-item questionnaire was administered to a larger sample (n=124). JiVitA interviewers (n=45) were trained on administering the CFBQ to ensure standardized administration to all participants. An initial training was conducted on February 8th, 2014, and interviewers were given a methodology for administering the modified CFBQ. Administration of the CFBQ began on February 12th and continued for
2 weeks. A refresher training was held with the interviewers to discuss their progress and any concerns about the way the questions were asked or interpreted. After this discussion, items that were being misinterpreted by the majority of mothers were dropped, leaving a final CFBQ with 15 items that was administered to the participants in the parent study (n=4846). All versions of the CFBQ can be seen in Appendix A1.7.

Exploratory Factor Analysis

Exploratory factor analysis (EFA) was conducted on data collected from the 4846 mothers who completed the 15-item CFBQ. This enabled us to explore patterns of latent variables or factors underlying an item set (e.g., responsive feeding factor, forceful feeding factor, etc.). We used an orthogonal rotation and eigenvalues>1. An orthogonal rotation was used to account for the intercorrelations between items. An eigenvalue represents the amount of information captured by a factor. The eigenvalue rule asserts that factors with eigenvalues less than 1.0 (and thus containing less information than the average item) should not be retained. The number of factors was informed by examination of a scree plot. Single item deletions were based on predefined, systematic procedure defined by factor loadings (>0.30), double loadings, low variance, and theory.

The final factors, or feeding behaviors, were dichotomized to represent low and high responsive/involved or non-responsive feeding behaviors separately (e.g. low responsive/involved or high responsive/involved) and combined to create a 2x2 factorial variable (e.g. low responsive/involved and high forceful).

Assessment of Construct Validity

Construct validity refers to the extent to which a measure behaves the way it is expected to behave, with regard to established measures of other constructs. Or, how well the items measured reflect the domains of feeding that they are expected to
measure. Construct validity was assessed by evaluating convergent validity, or assessing how the extracted factors and demographic characteristics of the sample are related to further assess the extent to which the measured items were behaving as expected.

Assessment of Convergent Validity

Convergent validity provides evidence of similarity between measures of theoretically measured constructs\textsuperscript{14}. We evaluated convergent validity by examining associations between household and parental sociodemographic variables and mean feeding factor scores using linear and logistic regression.

Descriptive statistics were run on all sociodemographic variables (described above) to explore distributions, percentages, means and SDs. Simple linear and logistic regression models were used to assess associations between feeding behaviors and demographic characteristics as a means of measuring convergent validity. Statistical analyses were conducted using Stata 14.0 (StataCorp, College Station, TX, USA). Statistical significance was set at p-value <0.05.

Assessment of Reliability

The Cronbach’s alpha coefficient and split-half reliability coefficient were used to assess the reliability of the questionnaire. The Cronbach’s alpha coefficient of each factor was computed to evaluate the extent of respondents answering the items consistently. The Cronbach’s alpha coefficient can range from 0 to 1; a coefficient of \( \geq 0.70 \) demonstrates acceptable reliability\textsuperscript{18}. Another assessment that measures internal consistency of the scale is the split-half reliability coefficient. Items of the final scale were divided into two half-scales so that they are as equivalent as possible, then the
Spearman-Brown prophecy formula was applied to calculate the correlation of the two half-scales, allowing another estimation of reliability of the total scale.

Data Management

All JiVitA-4 field data were collected on standardized forms by trained interviewers (n=45). Forms were transported to the JiVitA Project Data Management Center in Gaibandha, Bangladesh, where trained data entry operators entered the data into form-specific data entry screens. Possible errors were sent back to the field for verification (e.g. if entered values fell outside of the predefined ranges on the data entry screen). Anthropometry data, in addition to being recorded on the paper form, were entered onto a mobile platform and sent daily to the office for immediate verification. If values were outside of the plausible ranges, they were sent out to the field for re-measuring. Paper forms are archived in climate controlled conditions at the Data Management Center for a minimum of 7 years after data collection. All data stored on the computers were backed up daily on site and on remote servers. Data were cleaned in Baltimore by a data management team and the cleaned data were used produce standard final datasets for analysis.

All data collection instruments and procedures were approved by the Ethical Review Committee (ERC) at the International Centre for Diarrhoeal Disease Research (icddr, b), Bangladesh and the Institutional Review Board (IRB) of the Johns Hopkins Bloomberg School of Public Health, MD, USA. Written parental consent was obtained at the time of enrolment; all participants were informed that their participation is voluntary, and were assured of the confidentiality of the data collected throughout data collection, entry and archiving. Electronic data were protected by encryption.
Variable creation

Sociodemographic characteristics were collected by interviewer-administered surveys at baseline as part of the JiVitA-4 trial. Demographic and economic questions included the age, education and occupation of the parents, land ownership, cattle ownership, household size, type of latrine, and electricity. Maternal and paternal education were categorized into 4 categories: no education, class 1-9, SSC passed, or 11 years and above. Maternal and paternal occupation were categorized into 4 categories as well: no occupation, field laborer, service worker, other. Household food insecurity (HFI) was assessed using the validated 9-item Food Access Survey Tool (FAST); the score was derived by summing the 5 ordered responses (1= never, 2= rarely, 3= sometimes, 4= often, and 5= mostly)⁵.¹⁹. The final HFI score ranged from 9-45; and was categorized into 3 categories: HFI 9 (food secure), HFI 10-15 (moderate food security), and HFI ≥ 16 (severe food insecurity). Assets (cattle, any land, and electricity) were dichotomized to reflect “owns” and “does not own”. SES indicators were used to create a living standards index (LSI)²⁰ that was categorized into quartiles in order to deal with skewness of the data. A continuous household size variable was created by summing the number of members residing in the same household as collected on the original SES form; this was used to create a dichotomous variable for children living in the household under the age of 5 (not including the index child). Daily child morbidity data was used to create separate variables: a dichotomous variable for any illness in the past 3 months (yes or no), and dichotomous variables to measure incidence of diarrhea, respiratory illness, fever, or dysentery in the past week.
Paper 3: Feeding behaviors and how they relate to diet and growth

Data Collection

The data for this paper was derived from the 24-month follow-up interview of the JiVitA-4 trial (Appendix A1.8). The CFBQ was administered as a module of the interview; child anthropometry and dietary intake were also assessed at this time.

Feeding behaviors

Two theoretically derived feeding behaviors emerged in this setting: responsive/involved (5 items) and forceful (6 items). Participants were given a score for each of these constructs, ranging from 3-20 for responsive/involved (median 16) and from 0-24 on forceful (median 7). This score was created by summing up the participants’ responses for each item of that category, which could range from 0-4. For example, if someone responded with “2: half the time” for all 5 of the responsive/involved items, their score for that construct would be 10. These scores were dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive/involved [70%], low forceful [66%]). These were used as the primary exposure in our analysis. In addition, the dichotomized constructs were used to produce 4 categories for additional analysis: 1) high responsive/low forceful; 2) high responsive/high forceful; 3) low responsive/high forceful; and 4) low responsive/low forceful.

Growth measures

Children’s anthropometric measures were taken during the 24-month follow-up interview. Weight was measured using a Tanita scale (model BD585, Tanita Corporation of America, Arlington Heights, IL, USA) and length was measured using a locally
manufactured length board standardized against the Shorrboard (Weight and Measure, LLC, Olney, MD, USA). Weights and lengths were converted to z-scores using the WHO child growth standards. Length-for-age Z-score (LAZ), weight-for-age Z-score (WAZ), and weight-for-length Z-score (WLZ) < -2 were dichotomized and classified as stunting, underweight and wasting, respectively. Observations were excluded if LAZ, WAZ or WLZ were > 6 or < -6.

Diet measures

Children's dietary diversity was assessed by creating a 7-group DDS according to UNICEF guidelines. Diet data were obtained through the semi-structured 24-hour dietary recall administered during the 24-month follow up interview, in which caregivers were asked, “In the past 24 hours, did your child eat [insert name of food]?” A mixed methods recipe development study was done to capture perceptions and preparation methods of the most commonly consumed foods for children in this area. The process is described in detail elsewhere (Hurley et al., unpublished). All foods reported on the 24-hour dietary recall, including “other” foods listed by participants, were categorized into the following food groups: 1) grains, 2) legumes, 3) dairy, 4) meat, 5) eggs, 6) vitamin-A rich fruits and vegetables, or 7) fruits and vegetables. If the child consumed more than one food item that fell within a certain group (e.g. rice and bread), they were only given one point for that group. The DDS was constructed by summing the total number of groups that were reportedly consumed by that child during the 24 hours previous to the interview. DDS was treated as a continuous variable, and was also dichotomized to create a variable for Minimum Dietary Diversity (MDD). Children with a DDS < 3 did not meet MDD, and those with a DDS ≥ 4 met MDD. An 8th group was created, snacks/desserts, and examined separately from the DDS and MDD. Each of the 8 food groups was treated as a dichotomous variable, defined as either “ate” or “did not eat”.

64
Analytic Strategy

Descriptive statistics were used to explore the distribution, frequencies, means and SD for study variables. Maternal and paternal education were categorized as no education, Class 1-9, SSC (secondary school completion exam) passed, or 11 years and above. Maternal and paternal occupation were categorized as no occupation, field laborer (e.g. farmer, etc.), service worker (e.g. government worker), or other. SES indicators were used to create a living standards index (LSI) that was categorized into quartiles. Using the responses from the FAST, household food insecurity was categorized into 3 categories to represent food secure (HFI= 9), food insecure (HFI= 10-15), or severely food insecure (HFI>16). Household assets were dichotomized to reflect “owns” or “does not own” (cattle, land, or electricity). Sanitation facilities were categorized as none/field/bush, open latrine, pit latrine, water sealed/slab, or flush toilet. Morbidity was defined by dichotomized variables of incidence of diarrhea, dysentery, pneumonia, or fever in the past week, as well as any morbidity in the past 3 months. A dichotomized variable was also created to determine whether or not a household had more than one child under the age of 5, in addition to the child enrolled in the trial. Stunting, wasting and underweight variables were created by dichotomizing LAZ, WLZ, and WAZ at a cutoff of -2 z-scores relative to their respective reference medians.

Responsive/involved and forceful feeding variables were both dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive/involved [70%], low forceful [66%]). In addition, a 2x2 factorial variable was created using the dichotomized constructs to produce 4 categories: 1) high responsive/involved and low forceful (responsive/involved); 2) low responsive/involved and high forceful (forceful); 3) high
responsive/involved and high forceful (high on both); and 4) low responsive/involved and low forceful (uninvolved).

Associations between demographic characteristics and feeding behaviors were explored using bivariate linear or logistic regression models in order to determine potential confounders. These results are described in Chapter 5. Associations between dietary diversity and growth with feeding behaviors (4 combination categories of responsive/involved and forceful feeding behaviors) were assessed using multivariate linear and logistic regression models with high responsive/low forceful as the reference category. For the continuous outcomes of DDS, WAZ, LAZ, and WLZ we used a linear regression model to compute the difference in the outcome indicators among mothers who use high force as compared to those who use low force adjusted for confounding factors. For dichotomous outcomes of MDD, consumption of individual food groups, stunting, wasting, and underweight, logistic regression analyses were conducted to estimate an odds ratio (OR) (e.g. change in odds of meeting MDD among mothers who use high force as compared to those who use low force). Effect modification between feeding behavior and child sex were tested with the inclusion of an interaction term. Estimates were adjusted for potential confounding variables including maternal and paternal age, education, and occupation, child sex, child age, morbidity in the last 3 months, morbidity in the past 7 days, living standards index (LSI), household food insecurity (HFI), household assets (cattle, electricity, land, type of latrine), household size, and having another child under the age of 5. Potential confounding variables were selected based on the responsive feeding literature and on responsive feeding theory, and were tested on whether they met the definition of a confounder. Covariates that were significantly associated with both the exposure (feeding behavior) and the outcome (diet or growth) at the 0.05 significance level were retained in the model. All analyses
were also adjusted for intervention status as well as clustering at the sector level to account for the possibility that respondents living in the same place could be responding to the CFBQ in more similar ways.
References


Chapter 4. Understanding caregiver feeding behaviors in rural Bangladesh: a qualitative study

Abstract

Background: Caregiver perceptions of child growth, feeding and nutrition are culturally bound, and important to understand in order to address behaviors contributing to poor nutrition and growth.

Objective: The objective of this study was to understand behaviors and attitudes that influence feeding behaviors (e.g. responsive vs. non-responsive) among young children (15-24 months) in rural northwestern Bangladesh.

Methods: In-depth interviews (n=30), focus group discussions (n=5), and direct mealtime observations (n=10) were conducted with mothers, grandmothers, and fathers of children. Data were analyzed using Atlas.ti software using a codebook developed from existing theory and emergent themes.

Results: In the context of high undernutrition, most mothers provided little mealtime structure and employed feeding behaviors they thought would increase consumption. Few mothers described feeding behaviors that could be classified as responsive but a salient theme that emerged was a concern that their children were not eating enough food. To promote more food intake in children mothers often described using force such as verbal threats or tricks. Indulgent behaviors were commonly observed such as allowing children to eat whatever and whenever they wanted including getting them store-bought foods if they did not like rice (the staple food). Many respondents expressed financial and time constraints as the primary barriers to feeding children, such as by stating a desire to feed more fruits and meat if they could afford them, or
attributing their lack of attention during mealtimes to being occupied with other household chores.

**Conclusion:** Mothers tended to use non-responsive feeding strategies in an attempt to ensure adequate food consumption among children in this rural setting in Bangladesh. Understanding feeding behaviors and barriers to responsive feeding may help identify strategies for promoting healthy dietary patterns and growth among young children.
Background

Bangladesh has the second highest estimated rates of child undernutrition in South Asia, with 32.6 percent of children less than 5 years of age being underweight \(^1\). Undernutrition, manifested as stunting (height-for-age Z-score<-2), wasting (weight-for-height Z-score<-2), or underweight (weight-for-age Z-score<-2), may have long term effects on physical and mental health\(^2\)–\(^4\). A recent Demographic Health Survey (2014) found that in Bangladesh, 36.1 percent of children were stunted and 14.3 percent of children were wasted\(^1\). In rural areas, 37.9 percent of children were stunted and 15.1 percent of children were wasted \(^1\).

Undernutrition is increasingly attributed to factors beyond inadequate access to good quality food. Infant and young child feeding guidelines include duration and maintenance of exclusive breastfeeding and introduction of complementary foods, providing timely, adequate, frequent and safe food for the child, feeding appropriately during and after illness, and feeding the child in a proper way\(^5\). Although the period from birth to 24 months is especially critical for optimal growth, only 23% of children between 6-23 months of age in Bangladesh are fed according to at least 3 of the 10 infant and young child feeding recommendations\(^1\). Cultural norms in these areas generally support mixed breastfeeding and bottle-feeding, but there is lack of support for appropriate infant and young child feeding practices from health professionals\(^6,7\). Inadequate feeding practices likely contribute to poor diets, infections, and the high rates of stunting and wasting in children in rural Bangladesh\(^8\). In addition, results from observational studies show that children aged less than 3 years often reject food offered by their mothers, despite being undernourished\(^9\). This finding has been related to non-responsive feeding on the mother’s part, particularly in response to the child’s psychomotor abilities and appetite signals\(^9\).
Children are particularly vulnerable to nutritional insults during the complementary feeding period, during which it is important that their nutritional needs are met\textsuperscript{10}. Specified guidelines including the timeliness, adequacy and safety of the foods they are fed have also been coupled with being fed in a proper manner, or responsive feeding\textsuperscript{10}. Caregiver-child interactions, or feeding behaviors refer to the interactive behavior between caregivers and children that occur during meals. 

Responsive feeding behaviors are categorized by the caregiver observing and responding to a child's cues of hunger and satiety in a manner that is high in nurturance and structure, while employing tactics of mutual responsiveness\textsuperscript{11–13}. Non-responsive feeding behaviors have been categorized by excessive control (force or restrictive feeding), uninvolved feeding (parent makes little effort to encourage eating), and indulgent feeding (parent is lax with quantity and quality of foods fed)\textsuperscript{13}.

While responsive feeding messages are commonly included in nutrition and/or complementary feeding interventions \textsuperscript{14–16}, limited studies have looked at the associations between responsive and non-responsive feeding and undernutrition or the effects of providing responsive feeding messages on improving dietary diversity and growth patterns\textsuperscript{17}. As a guiding principle for complementary feeding \textsuperscript{5}, responsive feeding should be included in the context of breastfeeding and complementary feeding when designing interventions; they should not be considered mutually exclusive\textsuperscript{17}. Current interventions often include responsive feeding messages despite limited evidence regarding association between responsive feeding and undernutrition or the efficacy of responsive feeding programs\textsuperscript{17}.

Few studies have shown a significant improvement in nutritional status in relation to responsive feeding interventions; however, caregiver interactions and verbalization have been postulated to encourage acceptance of food by the child, which may improve
dietary intake and eventually growth\textsuperscript{17}. Studies exploring the relations between responsive feeding and dietary intake report an improvement in intake of essential nutrients and complementary foods\textsuperscript{18–20}, but again were not designed to isolate the effects of responsive feeding\textsuperscript{17,21}. Especially among low income (LIC) populations, where food availability is unstable and children live in a less stimulating environment, responsive feeding may show a marked improvement in children's dietary diversity and subsequent growth, as well as child development\textsuperscript{17}. There is evidence that caregiver verbalization matters in improving child growth, but the role of other behaviors including physical actions, maternal encouragement and child autonomy requires further research\textsuperscript{17}.

Limited knowledge exists about attitudes and experiences related to caregiver feeding behaviors in rural Bangladesh and how it may influence child dietary intake and growth. The goal of this study was to examine caregiver feeding behaviors and their relationship with diet and growth in young children as part of a larger food supplementation trial\textsuperscript{22}, but in order to do that we must first understand the context in which these children are being fed. Thus, we conducted a qualitative study with the objective of characterizing young child feeding in a rural area of Bangladesh and exploring the factors and influences surrounding the feeding of young children as expressed by multiple caregivers. We conducted in-depth interviews (IDIs), focus group discussions (FGDs) and in-home observations with mothers, fathers and grandmothers of children living in rural Gaibandha district, Bangladesh in order to elicit their perspectives on child feeding, nutrition and growth and reasons for feeding children the way they are fed in an environment where undernutrition is high.
Methods

The study was conducted in the context of a complementary food supplementation trial in Gaibandha, located in rural northwestern Bangladesh. The JiVitA-4 trial is the fourth nutrition intervention trial to be conducted within the JiVitA field site that was established in northwestern Bangladesh in 2001 under the ‘JiVitA Project’ of the Johns Hopkins University. The study area comprises of 19 Unions within the Districts of Rangpur and Gaibandha, divided into 596 clusters. The study area spans approximately 435 km², with a population of about 650,000 people. The majority of the population is Muslim, with a poor, agrarian economy. JiVitA-4 study design and protocol are described in detail as part of the primary treatment effects paper published previously. The trial participants all received nutrition counseling, so this qualitative study was conducted with caregivers living just outside the JiVitA study area in order to capture perceptions and practices that were uninfluenced by counseling related to infant and child feeding.

We aimed to answer the following questions: 1) how are children in this area fed, and 2) what are the factors contributing to these feeding behaviors? To answer these questions, we used IDIs, FGDs, and in-home observations. IDIs allowed us to get detailed individual narratives to obtain a broader context of feeding behaviors in this environment. FGDs helped us identify social norms and assess areas of agreement and disagreement among groups, as well as developing consensus on certain emergent themes. In-home observations were used to assess actual behavior in the natural context, while also capturing information that respondents don’t recall in IDIs or FGDs. Using these three methods allowed us to triangulate our findings and put together a complete picture of what child feeding looks like in this region.
Study sample

The concept of saturation was the guiding principle which defined the study sample size for this study. In our study, each participant was carefully selected based on how their participation would contribute to answering the research questions. In this way, participants were selected to include both typical and atypical cases until saturation of the data is reached, in order to ensure that the emergent theory could be applied to any scenario in the greater population. Data saturation was reached when the data that are being collected do not provide new insights. Based on similar studies, a sample size between twenty and thirty participants was deemed to constitute a sufficient sample size when inductive methodology is used for data collection.

A purposeful sample of 30 primary caregivers of children between 15-24 months of age was selected for IDIs. Participants were recruited with the assistance of a local data collector who had already built rapport with the community. The first 9 participants were selected using criterion based convenience sampling, in which we sampled respondents from the larger population based on some broader criteria (e.g. having a child between 15-24 months of age) in an attempt to learn about a range of caregiver experiences in order to let the findings drive further sampling. This was done to avoid any pre-supposed notions to guide the sampling in the beginning. Findings emerged that suggested that mothers with more children are different from mothers with less children, older mothers are different from younger mothers, and mothers with lower levels of education are different from mothers with higher levels of education, so we purposefully sampled from mothers who exhibited these differences. After one third of the projected sample size was collected (n=9 IDIs), we moved on to criterion-based purposive sampling.
Given the family structures in this community, the involvement of fathers and grandmothers in child feeding was deemed an important perspective for exploration. Although mothers are the most common primary caregivers in this setting, fathers and grandmothers may act as primary or even secondary caregivers. To triangulate data sources, 3 fathers and 2 grandmothers were interviewed in addition to 25 mothers. Caregivers were recruited in a similar way for FGDs, and 10 mother-child dyads were selected for in-home observations. To ensure data trustworthiness and that comprehensive valid data were collected, multiple discussions were undertaken and data collection continued until theoretical sufficiency was achieved. Feasibility of data collection was also taken into consideration; limitations of time and resources were factored into the final sample size.

Data Collection

Data collection was performed by one team composed of 3 data collectors and the student investigator (ZC). The 3 data collectors included a child feeding counselor and two members of the quality control team of the JiVitA-4 trial; all were local women who were familiar with the environment and cultural context. They were trained in qualitative methods and feeding behaviors with practice conducting interviews and focus group discussions by the first author, followed by a refresher training conducted by a qualitative research consultant after 9 IDIs were conducted. ZC did not interview respondents but was present for about a third of the interviews, acted as a notetaker during the focus group discussions, and conducted all the in-home observation recordings. In addition, ZC moderated daily team debriefing meetings to discuss findings and strategies for probing emerging issues and make decisions about further sampling.

IDIs were conducted in the homes of the participants. Interviews were conducted with 25 mothers, 3 grandmothers, and 2 fathers. FGDs were conducted at a central
location; one with a group of low SES mothers (n=7), one with a group of high SES mothers (n=8), one with a mix of mothers who lived in a joint family structure and those who did not (n=8), one with a group of fathers (n=8), and one with a group of grandmothers (n=8). All participants were recruited under the condition that they had a child or grandchild between 15-24 months of age. Additionally, 10 in-home observations were conducted with a mother and her child, during a mid-day feeding episode which was video recorded in each home. Caregivers were asked to feed their child as they normally would while the data collector created a video recording. Table 4.1 provides the participant breakdown for each data collection category. All recordings and debriefing forms were stored on a password-protected computers, and all paper forms and transcripts were stored at the JiVitA Data Management Center.

Semi-structured Interview Guides

Interview guides were developed to explore perspectives on feeding behaviors in this setting. Topics explored on the guides were drawn from responsive feeding theory and structured in a manner that would best inform the researchers on how feeding is structured and carried out in this setting. The original guides were adapted through iterations of field testing as well as iterations of early rounds of data collection. The final IDI and FGD field guides can be found in the appendices (Appendix A1.1 and A1.2).

Data Analysis

The design and analyses for this qualitative study were based on both deductive and inductive methodology. Inductive methodology is particularly useful for looking at previously researched phenomena through a different lens\textsuperscript{24}, which we did by identifying emergent themes surrounding the reasoning behind actions of caregivers in this setting. Deductive methodology takes existing theory and develops research questions to narrow the scope of the study\textsuperscript{24}. Qualitative research uses an exploratory and iterative
approach, often referred to as emergent design\textsuperscript{26}. We applied the iterative approach by analyzing the data throughout data collection, so we could use any themes that emerged to inform our further data collection in ways that would be informative to answer our research question. We used the framework of Responsive Feeding Theory\textsuperscript{29} to guide our data collection and analysis, and then applied an inductive approach to explore new topics surrounding child feeding that emerged throughout.

Qualitative data analysis was conducted following thematic analysis procedures as discussed by Benner\textsuperscript{30}. All IDIs and FGDs were recorded with digital recording devices in the local language (Bangla), transcribed into Bangla, and then translated into English. The analysis of the transcriptions was an iterative process, beginning with memo-writing during the initial interviews in order to inform further data collection\textsuperscript{24}. After all the interviews were translated, coding was completed in Atlas.ti 7 (Atlas.ti GmbH, Berlin). The IDI and FGD transcripts were first read by the first author to get a holistic view of the data. Emic terms were pulled from the text and translated in a database of local terms. Then, a list of codes containing 50 categories of information was developed in the data analysis software from emerging themes. An a priori thematic code list was initially developed using Responsive Feeding Theory\textsuperscript{12}, and emergent codes were added during the coding process. Line-by-line coding was used in initial transcripts as recommended by Charmaz\textsuperscript{24} to guide decisions on what topics require further exploration. The final list of codes was categorized into 5 broader categories of feeding behaviors, including 1) responsive, 2) indulgent, 3) forceful, 4) uninvolved, 5) restrictive, and other topics including 6) barriers to desired feeding behaviors, 7) feeding behaviors, 8) concerns about child feeding, 9) infant and young child feeding, 10) illnesses, and 11) other. The codes were aggregated to paragraphs of text to detect recurring patterns. The quotations that best described caregiver feeding behaviors were used to illustrate
the findings. Although we explored these topics, the results are presented to reflect the most salient themes that emerged from the data.

**Results**

**Study Sample**

Transcripts from 30 in-depth interviews and 5 focus group discussions with mothers, fathers and grandmothers of children 15-24 months of age were used (Table 4.2). Video-recordings of the in-home observations were also used to supplement the data from the transcripts. Mothers made up about three quarters of the total participants (n=58); of the remaining participants 11 were grandmothers and 10 were fathers. From the total sample, 11.4% (n=9) of participants came from households with high socioeconomic status (SES), 10.1% (n=8) from upper medium SES, 29.1% (n=23) from medium SES households and 49.4% (n=39) from low SES. Participants from Muslim families made up more than three quarters of the sample (n=69), and the rest (n=10) were from Hindu families. Of the 58 mothers, 22 (37.9%) had no formal education, 11 (19.0%) were educated between class 1-5, 8 (13.8%), and 17 had a SSC or higher (29.3%). Of the 10 fathers, about a third of had no formal education, another third had a secondary school education, and a third had a SSC or higher. One father had a primary school education. None of the grandmothers had any formal education.

There were 40 male and 42 female children included in the sample. The children fell into 3 age categories, with approximately one third of the sample in each group: 15-17 months, 18-20 months, and 21-24 months. There was one set of twins included in the sample; data were collected in the form of an IDI with the mother, an FGD with the mother, and an in-home observation with the mother and twins.
This population was a largely agrarian with only some families living in homes with cement or brick walls while the majority lived in homes made of tin with tin or thatched roofs. In most households, the father was the primary provider for the family, working as either a day laborer, a business owner (e.g., electrician, corner shop owner, etc.), or farmers. There were few who worked in salaried jobs, but those who did worked as teachers. In some households fathers lived in other cities and worked there, either sending money home for the family or coming back periodically themselves. In these households, mothers were in charge of purchasing food for the household in the absence of the father. Most employed mothers worked in agriculture during the harvest season. If they were employed by other higher SES families who owned livestock and crops, they took care of the animals and tended to the crops as needed.

The following section will highlight the emergent theory that lay a basis for the rest of our findings about child feeding in this area. Additional quotations used to supplement the findings can be found in Appendix A2.1.

Feeding behaviors that caregivers thought would increase food intake

The most salient theme we found in our study is the overarching concern among caregivers in this setting that their child did eat enough. This concern drives the way caregivers feed their children: in any way that they think would increase food intake. In an area of high undernutrition and food insecurity, caregivers appeared to feed in a way that they believed would increase food intake in their children, and used this intention to interpret the manifestations of child feeding in this setting.

In order to address this concern, caregivers most often cited forceful feeding behaviors and indulgent feeding behaviors as methods used to increase food intake among their children. Generally non-responsive feeding behaviors, such as a lack of
structure surrounding mealtimes, were also characteristic of feeding in this population. When probed about reasons surrounding the way children are fed, mothers most often commented that they just wanted to feed in any way that would facilitate increasing the child’s food intake.

_He can eat whatever he wants. If it keeps his stomach full, then he can eat it. That’s what I think._

_Mother of 19-month old, IDI_

This was supported by fathers and grandmothers, as well. For example, in our FGD with fathers, one father said:

_We feed our child in that way so his belly will be full. If he wishes to eat sitting down then we feed him like that. If he feels good eating while walking around then [we] have to feed him like that. Perhaps you will see, he will take food in the mouth and then he will run to one place, to another young child, then again he comes when there is rice in his mouth, like this. Meaning, we feed in a way so that the child’s belly will be full; however the child wants; [we] feed him like that._

_Father of 18 month-old, FGD_

During their interviews, caregivers often expressed prioritizing that their child eats, even if it meant that they themselves cannot. This was mentioned both as a general desire for their child to eat an adequate amount, and also in the context of food insecurity. Fathers in a focus group discussion discussed how they had the opportunity to eat whatever they would like to, but their children did not. This was followed up by saying that as adults, it is not a problem if [they] eat less food; but children should eat as much as necessary.

_We have to feed [our] children even if we can’t feed ourselves._

_Grandmother of 16 month-old, FGD_
Grandmothers also emphasized that children should be fed no matter what, even if there was work to be done. In the event that the mothers were too busy to feed the child, the grandmothers assumed responsibility for making sure the child was fed. This finding was reinforced by what we heard from mothers; if they had to rush to work they would leave the child with another family member. In most cases this would be the paternal grandmother, but could also be older siblings of the child or other family members who lived nearby or in the same household.

[We] must leave the rice paddies and feed the children, no matter how much work [we have]. Work can wait, [we have to] leave work and take care of children first. If their mothers can't take them, then we have to do it. When mothers can't give [food] then we have to give it; we must, if their mother can't give it then we must give it.

Consensus among grandmothers, FGD

A similar consensus was reached in an FGD with mothers:

It doesn’t matter how much work we have, when our child wants to eat, we [give food to our children].

Consensus among mothers, FGD

Diet

We learned from our participants that the diet in this region consisted primarily of grains, legumes, and fruits/vegetables, with fish, meat, eggs and dairy being less frequently consumed. Vegetables were eaten based on seasonality; at any given time of year there were an assortment of locally-grown gourds, leafy vegetables, and root vegetables. Young children were fed according to what was available in the household; however, according to our respondents the ideal complementary foods for children were khichuri, and meat, liver, or eggs if available.

Khichuri is a composite dish made from rice, lentils, and an assortment of vegetables (based on seasonality). All of it is cooked together in one pot and is prepared
separately for the child. Another complementary food prepared specifically for the child was *suji*, a dish made from granulated durum wheat and cooked into a porridge with either water or milk or a combination of both. Sugar was almost always added to *suji* to make it more palatable for the child, although there was a common perception that increased sugar intake causes the development of worms in the child’s belly.

When caregivers did not prepare *khichuri* separately for the child, they fed the child whatever was being cooked for the rest of the family. This was most commonly rice with some sort of vegetable dish (depending on seasonality), and fish or meat if they were available, although these were less common. Children were also fed large fish (when available) more than small fish, since the bones were easier to remove. Eggs, bananas, and liver were also considered good foods for children to eat, although eggs and liver were not easily accessible for many families.

There were a multitude of snack foods available in this area, easily accessible from corner stores and vendors who went door to door with their foods. Snack foods that were popular among children under 24 months of age include biscuits (similar to cookies; sold in bulk or individually packaged), locally produced chips, pound cake, fried snacks (e.g. *shingara, papor*), locally made sweets that were dairy or flour-based and often soaked in sugar syrup (e.g. *jilapi, khurma*), or rice-based snacks (e.g. *khoi, muri, cheera*). The most common were biscuits, which could be purchased and stored at home or bought from the store and given to the child. Bananas were also a locally-available and common snack food for children. Other exported fruits such as grapes, apples, and oranges were not fed to children as often due to their lack of accessibility, although many respondents spoke of their desire to feed these things if they could.
Respondents reported that children in the age range of 15-24 months were still breastfeeding alongside the rest of their diet. According to caregivers, some children had more of an appetite for food than others; those with a smaller appetite relied on breast milk as their primary diet. Respondents also stated that when children were ill and did not have an appetite, all they wanted was breast milk.

**Characteristics of feeding in this setting**

**Forceful feeding behaviors**

In this setting, forceful feeding was expressed through physical force, scaring or threatening the child, tricking the child, or distracting the child in order to get them to accept food.

Physical force was reported as holding the child in place while feeding or holding their mouth open and forcefully putting food into their mouth. Using physical force either stemmed from a lack of patience or time on the caregiver’s part, or was driven by the desire to get the child to consume more food.

*He doesn’t want to eat so I have to hold his cheeks and feed him. I have to get mad and feed him; he doesn’t want to eat on his own.*  
_Mother of 21 month old, IDI_

Another common technique for feeding the child against their will was tricking them by distracting them and putting the food in the child’s mouth when they are laughing or distracted.

*She doesn’t want to eat so I have to force her to eat. I call her ‘ammu’ then I show her jackfruits, mangos… I feed her [by] doing this. I go here and there to walk around when I feed her [while] putting rice into her mouth.*  
_Mother of 17 month old, IDI_

While the idea of forceful feeding was not endorsed by all caregivers, descriptions of feeding behaviors practiced with their own children and other children in
their surroundings revealed forceful behaviors that were common practice. Among these are the use of fear or threats as a motivator for eating. The use of forceful verbalizations, such as repeatedly telling the child to “Eat” is also used. Caregivers interpreted these forceful verbalizations and threats as a form of encouragement to get the child to eat.

**R:** If she’s hungry she’ll eat. Then I don’t get upset with her. And when she doesn’t eat then I get a bit angry, then someone else comes and carries her away, and they feed her. Then I don’t have to do anything.

**I:** When she doesn’t eat and you get upset, what do you do?

**R:** I say, "I'll hit you", I say many things; "I'll leave you with the ghost, I'll leave you with the cow", then she gets scared.

**I:** Does she eat then?

**R:** Yes, then she eats. She eats once she's scared.

*Mother of 18 month old, IDI*

Another mother spoke about the way her mother-in-law uses fear to feed her child in her absence, by telling the child that if the child doesn’t eat, the mother will come home and yell at the grandmother for not being able to feed the child, and may punish the child as well.

Forceful feeding behaviors were also endorsed by fathers in our sample. Upon hearing a story about a child who is physically forcefed, a father responded:

**R:** No, no, this is good. What problem is there with feeding the child like this?

**I:** By good you mean...?

**R:** Yes, that happens to us sometimes too. Sometimes he doesn’t eat, he spits it out. Perhaps he spits the food out, then we forcefeed him.

**I:** Then how do you forcefeed him?

**R:** Like that, by forcing the food into his mouth, putting the food into his mouth [and saying], "Eat." This is how we feed him.

*Father of 21 month old, IDI*

One of the mothers in our study spoke of the encouragement to forcefeed that came from her husband out of concern for their child’s appearance. If the child looks halka (bangla word for lightweight), the father gets angry with the mother for not forcefeeding the child. However, although the mother disagrees and thinks a young child should not
be forced to eat more than their appetite dictates, she still does it in response to the father's concerns.

Mothers in both IDIs and FGDs cited having household or other work to do as a difficulty when it comes to feeding their child. Despite the widespread opinion that work should not take precedence over child feeding, mothers often stated they have no choice. In some cases mothers cited forcefeeding to save time, if they were in a rush. In an FGD with mothers, we gathered consensus on this matter:

"That's not right, but [what if] I don't have anyone in my house? I have to do all kind of household work alone, like cooking, working with the crops, and taking care of children. [If] my child doesn't eat, or doesn't want to eat, then I feed them by force.

Consensus among mothers, FGD

Indulgent feeding behaviors

In the realm of feeding behaviors, indulgence is characterized by less control and more responsivity during feeding on the part of the caregiver. Indulgent feeding behaviors in this setting were driven by perceptions of low food intake or poor appetite in the child, driving the philosophy that the child should be allowed to eat whatever they want to eat, as long as something is going to their stomach.

"Now if [the children] say, "I want to eat this," perhaps they go to the store and take white bread, perhaps they take ‘mola’ [a local puffed rice and molasses snack food], whatever they desire, let them eat it. Whatever they eat, whatever they want to eat, I feed it to them. I feed it to them, what's the problem [with that]? … The child needs to be fed, after all.

Father of 21 month old, IDI

The desire to increase food intake also drives caregivers to immediately prepare or offer the child something different to eat if they refuse to eat the food that is served to them.
When they don’t eat, then I put those foods aside and I tell someone to go to the bazaar to buy biscuits…when they bring them I feed them those and they become peaceful.

Mother of 16 month old twins, IDI

Snack foods are commonly described being used as a way to manage behavior in this setting. Management of behavior included using food to reward children or keep them preoccupied. Mothers who were busy with other work sometimes used food to keep the child occupied while she finished her work. In most cases the food that was used was store bought biscuits, which were a frequently consumed and readily available snack for children living in this area.

Little mealtime structure

In this setting, all caregivers denied having a specific place where they fed their child. Child feeding occurred in the following ways: sitting together as a family and feeding the child (either from the same plate, or the child would run from person to person during the family mealtime and get fed by numerous people), giving the child their own plate of food and letting them eat on their own, holding the child and carrying them around while feeding them, or following the child around (e.g. in the courtyard, around the housing compound, etc.) while they walk around. We found that families generally do not sit at a table to eat together, nor does a designated spot exist for child feeding (e.g. a high-chair). Children were often fed outdoors, either as they walked around on their own and the caregiver followed them around and fed them, or carried around by the caregiver.

I have to show him lots of things. I take him to the cow and he does mischief and then I slip food into his mouth and he eats it instantly, and if you take him and sit him down somewhere he doesn’t eat. I take him close to the rickshaw or van-gari, then he eats. He eats if I take him to the cow. I can't feed him sitting down.
Of our 10 in-home observations, 5 were conducted outdoors and 5 were inside the home. In 3 of the observations the mother followed the child with the food as the child walked around on their own, either in the courtyard or inside the home. In 2 observations the mother held the child while standing and feeding them. In one of these observations, the child did not accept food when offered, and eventually the mother began breastfeeding. In another observation, the child was given a bowl of food so she could feed herself. She held the bowl in her hands and moved to different places in and around the home, sitting and feeding herself while periodically relocating throughout the recording. The mother kept an eye on her, but did not follow her around and sit with her while she ate. In 4 of the recordings the mother sat down with the child (or children, in the observation with twins) to feed them.

In our observations, there were very few caregiver verbalizations, and hardly any eye contact even during the mealtimes in which both caregiver and child were sitting together. While feeding outdoors already presents numerous distractions, such as the presence of other people, we found that the distractions were used to facilitate feeding in many cases. Caregivers spoke of taking the child outside just so they could watch the cows, dogs, or goats, or go by the road and watch the vehicles go by as a distraction during the feeding episode. In other cases, distractions were not used on purpose but were a part of the environment. One of our observations was done outdoors, where a mother fed her twin boys in the courtyard. She first gave them biscuits and bananas in bowls and watched them from the side as they ate on their own, and then a bit later she left to go and get a bowl of rice and vegetables to feed them. In her absence one of the boys urinated on the ground and dropped a biscuit in the urine, and then the other boy picked the biscuit up and took a bite out of it. In the meantime there was a dog in the
courtyard who was also interested in their food and overall feeding. It was clear during the feeding episode that the dog was interfering and that the children were getting distracted. In these situations in other settings as well, supervision is essential so animals don’t end up eating or contaminating the child’s food\textsuperscript{12}.

Self-Feeding

Varying opinions about self-feeding existed among caregivers in this setting, although some caregivers themselves had opposing viewpoints on the matter. Self-feeding was endorsed because it saved time for the caregiver, was convenient, and because the child should learn to eat on their own as they grow older. Children who could feed themselves required less attention during mealtimes, so the mother could do other things around the home while the child was eating. In an environment where the mother has many responsibilities both in and outside of the household, especially during the harvest season, this was endorsed as a large convenience for the mother. Another reason for endorsing self-feeding was the idea that only the child knows when they are full, so when they feed themselves they are able to eat until they have reached satiety.

\textit{If he eats by himself then it's easier for me to work.}

\textit{Mother of 17 month old, IDI}

However, caregivers also stated the opposing view that self-feeding should not be encouraged because a child does not know when they are full and therefore should not feed themselves. Self-feeding was discouraged for hygiene-related reasons as well; children don’t clean their hands before they eat and they touch things everywhere, so they can fall ill if they eat with their own hands.

\textit{A little child cannot eat much food with their own hand. Meaning, they cannot fill their stomach. So, the mother should feed their child. Little children eat such a little amount of food that even their mother cannot fill their stomach.}

\textit{Mother of 23 month old, IDI}
At this [current] age it's best to feed her with my own hands. If I give her food now she will drop it on the floor and then pick it up from the floor and eat it, so it's better if I feed her myself. The food will be clean then. If she eats from the floor then she will have a stomach illness, that's why I feed her myself.

Mother of 16 month old, IDI

Some caregivers stated that they would like it if their child fed themselves, but did not allow them to because they would spill and waste food, which was a financial concern. This is addressed below in the section about factors that contribute to feeding in this setting.

Responsive feeding behaviors

Responsive feeding is characterized by a give and take relationship during feeding between the caregiver and child; where the caregiver is feeding based on cues of hunger and satiety from the child\textsuperscript{12}. While much of the feeding behaviors practiced in this setting were driven to address the concern that the child does not eat enough, there were reports of responsive feeding behaviors as well.

[R]: When her appetite is alright, then her mood is okay too. And when her appetite is bad, then she has a bad temper. She doesn't want to eat. Then she starts crying. If I want to force-feed her, I find that at times her temper gets so bad that if I put a bowl in front of her, she takes the bowl from my hand and tries to throw it.

[I]: Then what do you do?

[R]: When she doesn't want to eat, I don't force her too much. Because, is it possible to force her to eat so much? I stop feeding her. I think that not forcing her to eat is right. I don't force-feed her.

Mother of 18-month old, IDI

Additionally, while caregivers did mention behaviors that were characteristic of forceful and indulgent feeding, their intentions were most often to behave in a way that they believe to be best practice. However, attempts at active feeding were often displayed as pressuring or forceful and may have been interpreted as such by the child.
Multiple caregivers

The family structure in this population is such that in each household there could be extended family that lived within the same housing compound. In many families, although the mother was the primary caregiver there were other family members who also provided care for the child when the mother was unable to be there. In smaller nuclear families, the child’s paternal grandmother, or “dadi”, often lived with the family and helped with childcare. She either helped with the housework, or watched the child while the mother did her work.

*Those [mothers] who have a mother-in-law in their home, they have to face less [trouble]. The mother-in-law finishes all of the work.*

Consensus from mothers, FGD

Having family members in the household was mentioned as a helpful factor in childcare. One mother gave an example of the difficulties a neighboring mother faced with feeding her children without any help:

> Next door I have an aunt-in-law. She has small children, small children and baby cows. *She has 3 kids and no mother-in-law, and she has a sister-in-law who [lives] separately… [so] the kids can’t eat on time.* The kids can’t eat on time, can’t bathe on time, she can’t carry them [pick them up] on time, can’t put them to bed on time. She has a lot of hard work of her own, how will she do it? If she goes to tend to her cows and goats then she can’t [look after her children]. And when she doesn’t clean her children, she takes them in her lap and she feeds them, then the cows and goats don’t get looked after. Nearby, around here I have seen this. I see this kind of thing all the time.

Mother of 24 month old, IDI

If there were older children in the household, they helped as well. And in families that had more extended family that lived nearby, aunts and cousins often helped with child feeding. Aside from mealtimes, caregivers reported that children in this setting often wander around the housing compound and neighboring housing compounds, so
during these times if they visit other homes they were sometimes given a snack (e.g. a biscuit) or a mouthful of rice here and there.

We found in this setting that although grandmothers did offer advice and input on child feeding, the result was less influential and mothers often received their influence on decision-making surrounding child feeding from an amalgam of sources, or from experience with previous children. Rather than feeling pressured to feed in a way that is contrary to what they consider best practice, mothers in this setting were more likely to adopt behaviors that they thought would be best for the child.

*In the olden days son’s wives had to listen to what their mother-in-law said. We couldn’t do anything without their order. Nowadays the son’s wives [are the ones who] teach the mother-in-law.*

*[They say] this is my household, I will do things my way.*

*Consensus from grandmothers, FGD*

The role of multiple caregivers was endorsed by fathers as well, who referred to the harvest season as a time when they needed to step in and help take care of the child in the mother’s absence. Caregivers reported that in this largely agrarian community, the males are most involved during the planting and watering seasons, and then the females help harvest the crops in the following season. During the day the women work to release the rice and wheat from the stalks, and boil them and lay them out in the sun to dry. If the family employed people to work on their crops rather than harvesting their own or working on other people’s crops, the responsibility of the mother lay in supervising or cooking food for the people they had employed. During this busy time especially, other family members looked after the children.

*In the village there is such a time in which the harvest season comes. During this time, children don’t receive the proper care... during this time we have to look after them. We have to look after the children. [I tend to] my business.*
After completing my business, in the midday at lunchtime I go home and I give my child a bath, then I go back [to work].

Father of 21 month old, FGD

Factors that contribute to feeding in this setting

Caregivers cited lack of time, lack of finances, having another child close in age to the youngest child, appetite, illness, and hygiene as factors that influence the way children are fed, and often stated them as barriers to feeding the way that they would like to feed their children. The idea of “chehera”, or appearance, also drove the way some caregivers gauged their child’s health and nutritional status.

Lack of time

Particularly during the harvest season, mothers were especially busy and either left the child with another relative, or altered the way they fed the child in order to accommodate their busy schedules. When probed about involvement in child feeding, caregivers answered affirmatively to knowing when and what the child had eaten throughout the day. However, mothers cited using uninvolved behaviors specifically at times when they had too much work to do.

Today I am home so I have time, I will feed him myself. The days I’m not home or am in a hurry I quickly feed him myself or I put the food on a plate for him and then leave. If he eats he eats, if not then he doesn’t.

Mother of 21 month old, IDI

Most commonly, caregivers mentioned giving the child a biscuit first thing in the morning to tide them over until the main meal (e.g. rice and a vegetable dish) was done being prepared. Biscuits were also used to keep the child occupied if the caregiver was otherwise occupied.

“When I give her the biscuit she stays quiet, and she stays sitting. Then I can do my other work. She eats, and I work. That’s why I give it to her.”

Mother of 18 month old, IDI
There are times when I will have to feed him myself, [but] I can’t feed him because I don’t have time. Then if I put a biscuit in the child’s hand he can eat the biscuit on his own. That’s what I am thinking when I put the biscuit in his hand.

Mother of 18 month old, IDI

Food insecurity or lack of finances

Food insecurity or a lack of finances were cited frequently when caregivers were probed about what influences child feeding in their area. Caregivers discussed feeding the child themselves instead of letting the child self-feed in order to avoid waste.

He puts his hand in the food, or spills the rice, or pours water in it. That’s why I feed him before we eat, then I put toys in front of him and he plays and we sit to eat. ‘Kena chaaler bhaat’ [purchased rice], he wastes so much of it; 1 kg of rice costs 35 taka. Doesn’t it cost money to buy rice?

Mother of 21 month old, IDI

There were multiple accounts of caregivers stating, “If we had money, we could buy...”, referencing the different kinds of food that would be purchased for the child if the family could afford them. These foods were most often foods that were thought to be healthy for the child (e.g. meat), or foods that were special (e.g. storebought foods like shingara, or non-local fruits like apples or grapes). There are also foods that are prepared especially for children such as khichuri and suji, but could not be regularly prepared in households that could not afford it.

[We feed them] khichuri with lentils, vegetables, then green leafy vegetables, if we can [afford] fish, then small fish, or big fish, I mean, according to their need. Or meat. Everything has to be fed to them, but we cannot afford it.

Consensus from fathers, FGD

In households in which the father worked in another city and came home periodically, the mother was in charge of running the household only with the income that her husband sent her. In these households, mothers expressed having to refuse their children when they asked for storebought snacks. In other instances, mothers
mentioned having to borrow money from neighboring homes or buying on credit from the storekeepers so they could purchase whatever food the child requested.

_We are poor people; we cannot afford everything. But she eats [well] when there is milk, or fish, or eggs. She wants to eat these foods, but we cannot afford them._

_Mother of 16 month old, IDI_

Other kids close in age

In one household from our study, the family had three children: a 9 year-old daughter, a 20 month-old daughter, and a 6 month old daughter. The father’s mother lived in another room in the same housing compound, so she took care of the 6-month old and the mother cared for the older two children. The 6 month old was fed baby formula from birth and occasionally given breast milk, but the 20 month old was primarily fed breast milk. The mother’s plan to wean her 20-month old child off of breast milk was to take her to her father’s house to be raised there. Similarly, other mothers mentioned struggling with taking care of two young children simultaneously.

_Many mothers give birth again when they have a little baby already. Then that child’s appearance gets ruined. That child only eats rice, eats rice, and when children are fed [only] rice their belly [swells]. Their body feels bad because they have worms in their belly._

_Consensus among mothers, FGD_

When asked about other families in the village, one mother shared the difficulties associated with having young children who are close in age. Her commentary also provides insight on the convenience of having other family members in the home to help take care of children.

_Then there are [women who] have a 2 year old child and have another [younger] child. They have another child, so this child doesn't get taken care of as well. That child doesn't get taken care of as well… sometimes [they touch] dirty things, they don't wash the child's hands, [and there is] hunger in [the child's] stomach. Other times the mother carries the little one so she can't pick up the_
[older] one. And when she can't take [the older one] then there is hunger in her stomach; she runs around, she eats her food with dirty hands, she sits and she eats, then she gets ill.

Mother of 24 month old, IDI

Appetite and Illness

The perception of a poor appetite was the most salient theme that arose when investigating difficulties surrounding child feeding. Loss of appetite was mentioned frequently as a source of concern, coinciding with the overarching concern that children are not eating enough. Respondents cited illness and subsequent loss of appetite as the only time when it would become difficult to feed their child. The common solution to treating a poor appetite was taking the child to the village doctor or sometimes the doctor in the Gaibandha town, who would give a vitamin “vial” to cure the child's appetite.

She has a [good] appetite, but it is not the same every day. Some days she has a good appetite, then it decreases. Then everyone says she is ill, go to the doctor. Then I go to the doctor to bring her medicine. She takes a vial to increase appetite. Then she eats rice.

Mother of 16 month old, IDI

A mother in our study spoke of more specific advice she was given by the doctor in Gaibandha regarding her child’s refusal to consume anything but milk.

I went to Malik doctor, he said, "That child is such a big child and still doesn't want to eat? Meaning, you must forcefeed her. Make cow's liver into a paste and feed it to her. Take it with a spoon and put it down her throat." When I can't do anything else, I do it like that. I put it in with a spoon. I forcefeed her.

Mother of 17 month old, IDI

When probed about how children ate when they had a poor appetite, caregivers mentioned that the child did not have an appetite for complementary foods, but just wanted to drink breast milk, which caregivers deemed insufficient for the child’s nourishment. This also ties into the concern that too much breastfeeding would make the mother weak, which would then lead to undernutrition in the child as well.
That children who get more breast milk, they will drink it. Those children don’t want to eat other foods much. The mother suffers from malnutrition then because of it. **For that reason mothers and children suffer from malnutrition.**

*Mother of 15 month old, FGD*

Aside from vitamin vials to increase appetite, children in this area were given a medication to kill intestinal parasites. Worms were most commonly thought to develop as a result of eating too much sugar, or some respondents said it was linked to eating outside foods. There is an idea that whatever is fed to the child, the worms in his stomach will eat them and then the food won’t “stick” to the child’s body.

*I don’t feed her very much sugar, if I feed her sugar she will have worms in her stomach, that’s why I don’t feed her much of it.*

*Mother of 20 month old, IDI*

**Hygiene**

The concept of hygiene and its link to illness was brought up repeatedly. Caregivers across all SES strata endorsed washing their hands and washing the child’s hands before feeding the child. When probed about reasons surrounding decreased appetite, grandmothers in the FGD came to a consensus that decreased appetite is linked to illness, which is linked to uncleanness during feeding.

*From what I know, if you feed them routinely and in a clean state, then they don’t have any problems. Their appetite stays okay. And if they are unclean, then if they eat in that unclean state their appetite is spoilt. They don’t have any [inclination] towards food. They’ll eat, but they won’t find satiety.*

*Mother of 20 month old, IDI*

Respondents gave multiple accounts of children getting ill because they ate with dirty hands, or ate something from a vendor or store that was likely dirty. One mother mentioned that she only fed her child the more expensive packaged biscuits (2 taka each) rather than the 1 taka biscuits that are kept in a jar and can be purchased individually, because those are exposed to the outside and flies may sit on them.

Another caregiver spoke of how people save bottles and other recyclable items to trade
for snacks from the food vendors, so when the vendors touch the bottles and then reach into the containers for the food, children could get sick from eating those things.

Perceptions of “Chehera”

The idea of “chehera”, or appearance, was one that was used to describe how caregivers gauged the child’s well-being. When probed about chehera, respondents gave examples of other children who had good chehera, using phrases like “look at his chehera, my child doesn’t look like that”. They also used this term when speaking to the child to get them to eat food, saying “If you eat this, your chehera will look better. Look at you, you don’t have anything” referring to low weight. This concept was also coupled with shasto, which is a local term for weight-related health. For example, a child with good shasto has a good chehera and therefore is a healthy-looking child.

*When I see my child's face I think of that, that if the child eats then it will be good. The child's chehera will improve, his strength will improve.*

*Mother of 18 month old, IDI*

**Discussion**

To our knowledge, this is the first in-depth, qualitative research exploration into characterizing feeding behaviors in rural Bangladesh. The study illustrated how children in this area are being fed, and why they are being fed in that way. Our findings demonstrate that the underlying motivator for feeding in this setting is the concern that children are not eating enough, perhaps due to illness or poor appetite, so caregivers feed in any way they think will increase food intake. This was exercised mostly as forceful and indulgent feeding behaviors; caregivers either physically pressured or tricked their child into eating, or let them eat whatever they wanted to just so something would go to their stomach.
Using physical and verbal force, distractions, or tricking the child to get them to eat was mentioned repeatedly throughout the interviews. Each time, caregivers reasoned that the child would not eat in any other way. Caregivers interpreted these forceful verbalizations and threats as a form of encouragement to get the child to eat. However, previous research has shown that caregivers’ active attempts at feeding are sometimes poorly times, inappropriate or insensitive, so may be interpreted as controlling or pressuring by the child\textsuperscript{19}. The relationship between forceful feeding behaviors and food acceptance and subsequent nutritional outcomes is unclear; under the circumstances of forced feeding, children may be unable to learn to regulate their intake physiologically\textsuperscript{34}. Forceful or pressuring verbalizations have been associated with both increased\textsuperscript{18} and decreased\textsuperscript{20,35} acceptance of food. While there are studies that show forceful feeding behaviors to be associated with higher adiposity in high-income countries\textsuperscript{36,37}, the literature on force-feeding and it’s relation to nutritional outcomes in low and middle income countries is limited.

There was widespread knowledge and concern regarding types of complementary foods that should be fed to children, hygiene practices (e.g. hand-washing), and care practices for ill children (e.g. taking them to the doctor, breastfeeding). However, time and financial constraints were mentioned as barriers to feeding children the way caregivers believed to be best practice. In the context of high food insecurity, caregivers still felt the need to provide store bought foods by taking loans or buying on credit if the child wanted them, again driven by the desire to increase their child’s food intake. Although there was concern surrounding the nutritional and hygienic quality of store bought foods, caregivers still felt compelled to feed them if their child refused to eat home-cooked foods.
Caregivers in this study endorsed autonomy in self-feeding, but did not always allow it due to time or financial restrictions. While active feeding behaviors were common, caregivers reported that they rarely offered positive verbal encouragement. Previous studies have shown that positive caregiver verbalizations\textsuperscript{18–20} are associated with higher child acceptance of food, while physical pressure was associated with lower acceptance\textsuperscript{20}. In addition, lack of mealtime structure was also reported frequently across our sample. Mealtime structure is a tenet of responsive feeding that is thought to encourage healthy eating behaviors in children when they are young as well as later in life\textsuperscript{31}. This includes scheduled times and specific places designated just for eating, neither of which were endorsed by our participants when probed about them.

Our study had several strengths. The broadness of our scope allowed to us to inductively explore feeding in this setting, rather than narrowing our research question to focus on a specific aspect of feeding behaviors. As such, our findings reflect the range of ways in which children are fed in this region, as well as the range of factors that contribute to them.

We sought to ensure transferability of findings by presentation of detailed, contextually rich results. Triangulation of data collection techniques as well as participants also strengthened our findings by highlighting areas of convergence within the data. The use of IDIs, FGDs and in-home observations improved the validity of our study. We were able to triangulate our findings in order to draw conclusions about feeding behaviors and contributing factors in this setting. In particular, the use of video observations was a strength of our study. Observation data on feeding behaviors provided useful information on actual behaviors and enhances the caregiver’s assessment of what occurs during feeding episodes\textsuperscript{38}. Caregiver behaviors during the meal are also likely to be influenced by the child’s behavior, which contributes to better
capturing the actual dynamics of the feeding interaction\textsuperscript{38}. Using video observations rather than direct observations allows the convenience of analyzing behaviors afterwards, so the episode can be rewatched and even coded differently if the researchers decide to look at different things at a later time\textsuperscript{39}. The observational methodology was generally well accepted among caregivers.

As a native Bangla speaker, ZC was able to translate the transcripts herself and debrief with the data collectors after each interview in order to inform further data collection. This proved to be valuable during data collection, when it was imperative to fully understand gaps in the data collection and research questions in the field and identify emerging themes before moving forward. This was also helpful during the video observations; it was easy to establish rapport with the caregiver and child before videotaping the feeding episode, limiting reactivity.

Due to a limitation of time and funding, we were only able to include a small sample size for fathers and grandmothers in our study. More FGDs with both groups would have allowed us to compare and contrast the different groups. However, given that mothers are the most common primary caregivers in the setting, it was appropriate to allocate the bulk of our limited sample size to data collection with mothers, whose input was most representative of primary caregiver feeding in this area.

Also given more time and funding we would have liked to do more in-home observations. A larger sample size would allow us to apply a coding system and analyze the footage quantitatively, as we would have a more representative group. Given the novelty of video observations in this setting, it was difficult to troubleshoot with only 10 observations. In one household, we were unable to isolate the caregiver and child without drawing the attention of the surrounding community. As a result, the large crowd created an environment that is atypical of a usual mealtime for that child, and the child
was too distracted and upset to eat. However, although we only had 10 observations, we did find them to be informative and a good visual supplementation to the caregiver’s accounts and opinions about the way they feed their children.

More demographic information, such as age of the caregiver, would have been beneficial for comparing groups and stratifying the results. However, in this setting there is poor documentation of age and birth date for people born more than a decade ago, so this factor was not in our control. Although we did collect caregiver age, they were estimates and in many cases were clearly far off from the true age. Collecting child weight would also have added another dimension to our analysis; giving us the option to select participants based on the child’s nutritional status and then stratifying the analysis that way. For this study, however, this was not possible due to limited funding and resources.

Additionally, we must consider the possibility of social desirability bias when interpreting our results. Particularly during the in-home observations, there is a possibility that caregivers were not revealing their true behaviors. However, as child feeding is not a sensitive topic, caregivers may not have felt compelled to hide their actual behaviors, since most caregivers practiced what they thought to be best for their child and were therefore unlikely to feel shame in reporting these behaviors.

In the context of high undernutrition, mothers tended to use non-responsive feeding strategies in an attempt to ensure consumption. The findings from this study informed the development and administration of a questionnaire designed to quantitatively assess feeding behaviors among mothers in this region. The data collected from the Feeding Behaviors Questionnaire will be used to examine the relationship between feeding behavior and dietary diversity, and with growth. Understanding the link between feeding behaviors and diet, and subsequently growth
will facilitate the tailoring of a context-specific intervention to improve nutritional status of children in a setting with high undernutrition. While the results of this study are not expected to be generalizable to other populations, the development and addition to the Responsive Feeding Theory is expected to be generalizable. Our findings are consistent with Responsive Feeding Theory, as well as with other work done surrounding feeding behaviors in similar settings.\textsuperscript{18,27,33,40} However, recommendations for infant and young child feeding behaviors should be tailored to the cultural context; methods and recommendations for optimal feeding in one context would not necessarily produce the same outcome in another context. For example, while indulgent feeding behaviors have been associated with higher sugar and fat intake and obesity in high-income countries\textsuperscript{41} and controlling behaviors in the form of restriction are also related to obesity, in rural Bangladesh where undernutrition is high, indulgent and controlling feeding are driven by different concerns. Future recommendations should address the concern of inadequate intake among caregivers in this setting, and interventions should isolate the effects of each feeding behavior in order to truly understand the impact of each.
References


Tables and Figures

Table 4.1. **Overview of study participants**

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Age of Child</th>
<th>Participants (primary caregivers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-depth interviews (at home)</td>
<td>15-24 months</td>
<td>25 mothers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 grandmothers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 fathers</td>
</tr>
<tr>
<td>Focus group discussions (at central location)</td>
<td>15-24 months</td>
<td>3 groups of 7-8 mothers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 group of 8 grandmothers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 group of 8 fathers</td>
</tr>
<tr>
<td>Observations (at home)</td>
<td>15-24 months</td>
<td>11 children and 10 caregivers</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>79 adults and 11 children</td>
</tr>
</tbody>
</table>

Table 4.2. **Demographic characteristics of study participants**

<table>
<thead>
<tr>
<th>Caregiver Characteristics (n=79)</th>
<th>Mothers</th>
<th>Grandmothers</th>
<th>Fathers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Number of participants (% of total sample)</td>
<td>58 (73.4)</td>
<td>11 (13.9)</td>
<td>10 (12.7)</td>
<td>79 (100.0)</td>
</tr>
</tbody>
</table>

Household socioeconomic status

- High: 6 (10.3) Mothers, 0 (0.0) Grandmothers, 3 (30.0) Fathers, 9 (11.4) Total
- Upper Medium: 7 (12.1) Mothers, 1 (9.1) Grandmothers, 0 (0.0) Fathers, 8 (10.1) Total
- Medium: 18 (31.0) Mothers, 1 (9.1) Grandmothers, 4 (40.0) Fathers, 23 (29.1) Total
- Low: 27 (46.6) Mothers, 9 (81.8) Grandmothers, 3 (30.0) Fathers, 39 (49.4) Total
<table>
<thead>
<tr>
<th>Religion</th>
<th>50 (86.2)</th>
<th>10 (90.9)</th>
<th>9 (90.0)</th>
<th>69 (87.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu</td>
<td>8 (13.8)</td>
<td>1 (9.1)</td>
<td>1 (10.0)</td>
<td>10 (12.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Education (%)</th>
<th>22 (37.9)</th>
<th>11 (100.0)</th>
<th>3 (30.0)</th>
<th>36 (45.6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No formal education</td>
<td>11 (19.0)</td>
<td>0 (0.0)</td>
<td>1 (10.0)</td>
<td>12 (15.2)</td>
</tr>
<tr>
<td>Primary education (class 1-5)</td>
<td>8 (13.8)</td>
<td>0 (0.0)</td>
<td>3 (30.0)</td>
<td>11 (13.9)</td>
</tr>
<tr>
<td>Secondary education (class 6-10)</td>
<td>17 (29.3)</td>
<td>0 (0.0)</td>
<td>3 (30.0)</td>
<td>20 (25.3)</td>
</tr>
</tbody>
</table>

**Child characteristics (n=82)**

<table>
<thead>
<tr>
<th>Age of child (months)</th>
<th>82 (100.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-17</td>
<td>30 (36.6)</td>
</tr>
<tr>
<td>18-20</td>
<td>26 (31.7)</td>
</tr>
<tr>
<td>21-24</td>
<td>26 (31.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender of child</th>
<th>40 (48.8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>42 (51.2)</td>
</tr>
<tr>
<td>Female</td>
<td>-</td>
</tr>
</tbody>
</table>
Chapter 5. Systematic development and validation of a theory-based questionnaire to assess caregiver feeding behaviors in rural Bangladesh

Abstract

Background

Caregiving behaviors are embedded within dimensions of overall parental responsivity and control and have been used to describe caregiver feeding behaviors. In a rural Bangladeshi setting where there is high food insecurity and high rates of underweight, stunting, and wasting, it is important to consider the role of caregiver feeding behaviors in child growth and diet. Although numerous questionnaires have been developed to assess young child feeding behaviors, they are mostly geared towards caregivers living in high and middle income countries, and none are entirely transferrable to this context.

Objectives

This paper describes the development and validation of an 11-item context-specific questionnaire designed to assess caregiver feeding behaviors in rural Bangladesh.

Methods

The development of the Caregiver Feeding Behavior Questionnaire (CFBQ) was based on previously existing questionnaires and adapted to fit the context of rural Bangladesh. Content validity included review of the 51-item questionnaire by an expert panel (n=7) including ~7 members of the Consortium for Responsive Feeding & Care for Growth and Development, and testing in a pilot sample of mothers (n=15) of children aged 15-24 months. After multiple iterations of the questionnaire with item deletions and additions according to responsive feeding theory and feedback from local mothers and the data
collectors, a item questionnaire was administered to caregivers of 24 month old children (n=4846) enrolled in a complementary food supplementation trial in Gaibandha, Bangladesh. Exploratory factor analysis was conducted on the dataset to identify feeding factors. Data on child, parental and household demographics were collected by interviewer- administered questionnaires at baseline. Univariate analyses were conducted in order to explore convergent validity and determine potential confounding relationships between feeding behaviors and demographic characteristics. Cronbach’s alpha coefficient and split-half reliability coefficients were used to estimate the internal reliability of the questionnaire.

**Results**

Exploratory factor analysis revealed three empirically derived constructs of feeding in this region: responsive/involved (5 items), forceful (6 items), and indulgent (2 items). However, due to only 2 items loading with the indulgent factor, a final set of 11 items was used to produce two factors: forceful (range: 0-24; median: 7) and responsive/involved (range: 3-20; median: 16). Each was dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive/involved [70%], low forceful [66%]). Households of mothers exhibiting high responsive behaviors had a higher living standards index (LSI), higher maternal and paternal education, and improved sanitation facilities vs those with low responsive behaviors (all p<0.05). Factors associated with high vs. low forceful behaviors included lower maternal and paternal age, higher maternal education and LSI, having electricity and lower likelihood of having another child under 5 years of age (all p<0.05). The Cronbach’s alpha coefficient of the responsive/involved factor and forceful factor were 0.435 and 0.801, respectively. The split-half reliability coefficient (Spearman-Brown coefficient) was 0.794.
Conclusion

The development of the CFBQ provides a brief instrument that can be administered in 10 minutes to examine how caregivers report feeding behaviors in a rural South Asian context. These data can be used to explore the relationship between self-reported feeding behaviors and child growth and diet.
Introduction

Childhood undernutrition is a major public health problem that can have long-term health consequences. Global rates of underweight (weight-for-age Z-score< -2), stunting (length-for-age Z-score< -2) and wasting (weight-for-length Z-score< -2) (15.0%, 24.5% and 7.7%, respectively) reflect an abundance of children who are at risk for or are privy to inadequate diets and/or exposure to infection, both of which can exacerbate the cycle of undernutrition. Bangladesh has the second highest estimated rates of child undernutrition in South Asia, with 37.9 percent of children less than 5 years of age being stunted in rural areas. Infant young child feeding is influenced by caregiver behaviors, making the first few years of life a crucial time to promote healthy eating in order to prevent undernutrition and later health consequences. The introduction of complementary foods at 6 months, when breast milk alone may no longer be adequate to meet the nutritional needs of the child, is an important transition that has numerous guidelines. The timing, frequency, amount and quality of food given is important for the child’s nutritional status; additionally, the way a child is fed has also been included in the guidelines for complementary feeding of the breastfed child.

Parenting behaviors are embedded within a paradigm of responsivity and control and have been applied to characterizing caregiver feeding behaviors. Responsive feeding is characterized by balancing caregiver guidance with responding to the child’s cues of hunger and satiety. These behaviors should promote the child’s attentiveness and interest in eating, hone their internal cues of hunger and satiety, and promote their ability to communicate their feeding-related needs to their caregiver as a process of attaining independent feeding. Nonresponsive feeding is characterized by a lack of developmentally appropriate or sensitive reciprocity between the caregiver and child, which includes excessive caregiver control (forcing/pressuring or restricting food intake),
excessive parental passivity or child control (indulgence), or lack of caregiver attention or interaction with the child during feeding (uninvolved)\textsuperscript{6}. Studies from Bangladesh have revealed that responsive feeding is limited in that children are prevented from feeding themselves despite their psychomotor abilities, and caregivers often use a forceful style of feeding\textsuperscript{7}. Caregivers who force or restrict food intake may be more authoritarian overall in their parenting or may have specific concerns about their child’s dietary intake, appetite, size, and inclination to eat less or refuse food, leading to more controlling (e.g. forceful) feeding behaviors\textsuperscript{6}.

Responsive parenting has benefits for the child that include better health outcomes and cognitive and psychosocial development\textsuperscript{9}. Observational and interventional studies have found responsive feeding to be linked to increased food acceptance\textsuperscript{7,10–12}; additionally, various observational studies found a positive association between responsive feeding and various growth outcomes, such as WAZ or HAZ\textsuperscript{13–17}. Conversely, behavioral observations of mealtimes in some low income countries have shown high levels of force or control and a lack of age-appropriate self-feeding\textsuperscript{7,11,18}. These behaviors are associated with fewer mouthfuls of food taken by the child and more refusal of food, even in the presence of undernutrition\textsuperscript{19}. As a result, caregiver feeding behaviors likely contribute to the dietary intakes and nutritional status of young children in these countries\textsuperscript{19}.

Validated caregiver-reported questionnaires such as the Child Feeding Questionnaire (CFQ)\textsuperscript{20}, the Infant Feeding Style Questionnaire (IFSQ)\textsuperscript{21}, the Infant Feeding Questionnaire (IFQ)\textsuperscript{22} and the Toddler Feeding Behavior Questionnaire (TFBQ)\textsuperscript{8} have been used to assess feeding behaviors of infants and young children in the United States of America. The CFQ assesses parental perceptions and concerns around child feeding, and the IFSQ, IFQ and TFBQ all used established patterns of
responsivity and control to assess 5 theorized feeding dimensions (responsive, forceful, restrictive, indulgent and uninvolved)\textsuperscript{6,20–22}. Although these were geared towards assessing feeding behavior in obesogenic environments and primarily among Caucasian, African American and Latino populations, the items reflect paradigms of infant and young child feeding that can be adapted for other settings. While most literature focuses on restrictive feeding and its relations with obesity, qualitative work done in Bangladesh suggests that caregivers use excessive non-responsive behaviors to address concerns about their child’s intake in an environment with high undernutrition (see Chapter 4).

The present study describes the development and validation of a modified, culturally adapted 11-item Caregiver Feeding Behaviors Questionnaire (CFBQ), to assess responsive and non-responsive caregiver feeding behaviors in a rural Bangladeshi context where childhood undernutrition is high. The objectives of this study were to: 1) develop a context-specific caregiver self-report questionnaire to assess feeding behaviors in rural Bangladesh and 2) to evaluate the content, construct, and convergent validity of the questionnaire among a sample of mothers of 24-month of children in rural Bangladesh, at an age critical to the development of appropriate eating behaviors.

**Methods**

**Study design and sample**

The Caregiver Feeding Behaviors Questionnaire (CFBQ) was developed and administered within the context of the JiVitA-4 study, a cluster-randomized controlled trial comparing the efficacy of 4 complementary food supplements on growth between 6-24 months\textsuperscript{23}. The JiVitA research area is located in Gaibandha, in rural northwestern
Bangladesh. The CFBQ was designed and pilot-tested to be administered during the 24 month follow-up interview to caregivers of children enrolled in the trial. The JiVitA-4 study design and protocol have been published previously.23

Enrolment in the JiVitA-4 study was done from September 2012 until May 2013. Sociodemographic characteristics were collected by interviewer-administered surveys at the time of enrollment.23 Demographic and economic variables included age, parental education and occupation of the parents, household and land ownership, cattle ownership, size, type of latrine, and electricity. Household food insecurity (HFI) was assessed using a 9-item Food Access Survey Tool and summing the 5 ordered responses (1= never, 2= rarely, 3= sometimes, 4= often, and 5= mostly), with scores ranging from 5-45.23

Development of the Caregiver Feeding Behaviors Questionnaire

We created an initial Caregiver Feeding Behaviors Questionnaire (CFBQ) consisting of 53 items to measure the 5 theorized dimensions of feeding (responsive, forceful, restrictive, indulgent, and uninvolved). The questionnaire was based on theories of parenting and feeding, and adapted from the CFQ20, IFSQ21, and TFBQ8. Each question could be answered on a 5-point Likert scale as follows: 0 (never), 1 (seldom), 2 (half the time), 3 (most of the time), and 4 (always).

The initial, intermittent and final questionnaires are provided in Appendix A1.7. After designing the preliminary questionnaire the following five activities were undertaken: 1) assessment of content validity, 2) pilot testing and finalization of the questionnaire, 3) administration of the questionnaire in the full sample, 4) exploratory factor analysis, and 5) assessment of construct validity (convergent validity).
Assessment of Content Validity

Content validity refers to the extent to which a set of items reflects a specific domain\textsuperscript{24}. To maximize the content validity of the scale, we adapted questions from pre-existing questionnaires that had previously undergone review by an expert panel, including \textasciitilde7 members of the Consortium for Responsive Feeding & Care for Growth and Development (an interdisciplinary group of \textasciitilde75 colleagues with expertise in child feeding behaviors)\textsuperscript{8}. This panel reviewed and commented on the item pool, applying their knowledge of the feeding paradigm to judge whether the items on the scale were representative of the construct they were intended to measure. All items were translated into the local language, Bangla, and then reviewed with local interviewers, 3 women who are familiar with the context and could provide input on the cultural appropriateness and relevance of the items on the scale. Items thought to highlight context-specific feeding behaviors were added, and those thought to lack relevance or clarity for this context were removed or adapted. The first exclusion was done soon after the translation into Bangla and reviewed with the data collectors, when 6 questions were removed due to contextual irrelevance (e.g. Are you concerned that your toddler will have to diet in order to maintain a desirable weight?). One question was double-barreled (How often do you bribe or trick your toddler to get him or her to eat?) and was split into 2 questions. Another question was added to assess restrictive feeding: “How often do you limit the types of food you give your child?” Two additional items were added to the scale because they were thought to highlight context-specific feeding behaviors that did not fit the aforementioned categories: “How often do you show your toddler animals to encourage him to eat?” and “How often do you allow your toddler to feed him/herself?”
Pilot testing

Following assessment of content validity, a 51-item CFBQ was pilot-tested in 15 women in the community with children aged between 15-24 months. The same 3 women who were involved with content analysis conducted the pilot testing. These women were trained to administer the questionnaire to ensure standardization. They asked the questions and recorded the responses using the Likert scale. Following each question, the respondent was asked about content and clarity of the question (e.g. “what did you think of this question? Does it make sense?”) The CFBQ was reviewed after the pilot test by first author and data collection team. Item deletion was based on between-subject variability (e.g. low variance; are all the respondents responding to the question the same way?), and relevance or clarity as reported by the pilot sample and data collectors. A final 17-item questionnaire was created and administered to a larger sample of women of children enrolled in the parent trial at the 24-month follow-up interview (n=124). JiVitA interviewers (n=45) were trained on administering the CFBQ to ensure standardized administration. An initial training was conducted followed by a refresher training to discuss any concerns about the way the questions were asked or interpreted. After this discussion, items that were being misinterpreted by the majority of mothers were dropped, leaving a final CFBQ with 15 items that was created and later administered to the participants in the larger study sample (n=4846).

Of the 51 items that were pilot-tested, 24 correlated with each other as theoretically expected. Of those that didn’t correlate, 3 were dropped due to lack of variability in the responses. All 51 items were again reviewed with the team of 3 interviewers, and feedback from the pilot sample were factored in at this stage. Of the 24 questions that showed the expected correlation, 3 were dropped. Two of these were deemed to be culturally irrelevant (e.g. How often do you offer sweets to your toddler as
a reward for good behavior?). Interviewers reported that one of the questions was too complex for the mother to understand, so the mother would either misinterpret the question or ask multiple times for the question to be repeated or for an example to be given. There were also items or concepts that were unfamiliar to the mothers or seemed to hold little relevance. For example, for the item, “How often do you warn your toddler that you will take something away other than food if he/she doesn’t eat?”, mothers responded that the child was too young to understand the concept of toys, so they would not understand the warning of getting something taken away.

Although multiple items that did not correlate as expected, 6 were added back into the questionnaire based on feedback from the pilot test from mothers and interviewers. These either showed a variability in responses from the mothers, were well-understood, or were judged to be representative of the specified feeding construct in that setting. There was a total of 27 items in the revised CFBQ: responsive (n=8), forceful (n=8), indulgent (n=4), restrictive (n=3), and uninvolved (n=4).

Upon further review with team members, the 27-item CFBQ was reduced to <20 items in order to reduce participant burden as it would be administered as a module of an extensive 24 month follow-up interview with mothers of children enrolled in the JiVitA-4 trial. Given the length of the parent questionnaire, it was decided to remove items that were most repetitive in order to reduce participant burden. These items were reduced based on results of the pilot test, past questionnaires and theory, between-subject variability, and feedback from the mothers and interviewers during pilot testing. Thus, the 27-item CFBQ was reduced to 17 items: responsive (n=5), forceful (n=4), indulgent (n=3), restrictive (n=2), and uninvolved (n=3).
After 2 weeks of administering the 17-item CFBQ (n=124), 2 more items that were being misinterpreted by the majority of mothers were dropped, leaving a final CFBQ of 15 items: responsive (n=5), forceful (n=4), indulgent (n=3), and uninvolved (n=3). The 2 items dropped were those measuring restrictive feeding behaviors; mothers' immediate reaction to these questions were negative, and the concept of restricting food was met with aversion. The final 15-item was administered to the study participants as part of the 24 month follow-up interview (n=4846).

**Exploratory Factor Analysis (EFA)**

EFA was conducted on data collected from the 4846 mothers who completed the 15-item CFBQ. This enabled us to explore patterns of latent variables or factors underlying an item set (e.g., responsive feeding factor, forceful feeding factor, etc.). We used an orthogonal rotation and eigenvalues>1. An orthogonal rotation was used to account for the intercorrelations between items. An eigenvalue represents the amount of information captured by a factor. The eigenvalue rule asserts that factors with eigenvalues less than 1.0 (and thus containing less information than the average item) should not be retained. The number of factors was informed by examination of a scree plot. Single item deletions (n=2) were based on predefined, systematic procedure defined by factor loadings (>0.30), double loadings, low variance, and theory. The final questionnaire had 13 items.

Using an orthogonal rotation, we ran a forced 3-factor solution with 15 items and found that the items “How often does your child eat in the same place every day” and “How often do you eat with your child” loaded below 0.3 on all factors. These items were dropped and the remaining 13 items were run as a forced 3-factor solution. We categorized the three emerged factors as the following: responsive/involved, forceful,
and indulgent. The item “How often do you encourage your toddler to try a new food?” was dropped because it was double loading with a factor loading above 0.3 with the indulgent and forceful factors. Although the item “How often do you eat with your child?” did not load above 0.30 on both factors, it loaded higher with the responsive/involved factor, which we decided to keep it with based on responsive feeding theory. We added this back in, once again making it a 13-item model.

The final factors were dichotomized to represent low and high responsive/involved or non-responsive feeding behaviors separately (e.g. low responsive/involved or high responsive/involved) and combined (e.g. low responsive/involved and high forceful). The responsive/involved category will be referred to as ‘responsive’ in the rest of the chapter.

Assessment of Construct Validity

Construct validity refers to the extent to which a measure behaves the way it is expected to behave, with regard to established measures of other constructs26, or, how well the items measured reflect the domains of feeding that they are expected to measure. Construct validity was assessed by evaluating convergent validity, that is by assessing how the extracted factors and demographic characteristics of the sample were related to further assess the extent to which the measured items were behaving as expected.

Assessment of Convergent Validity

Convergent validity provides evidence of similarity between measures of theoretically measured constructs24. We evaluated convergent validity by examining
associations between household and parental sociodemographic variables and mean feeding factor scores using linear and logistic regression.

Maternal and paternal education were categorized into 4 categories: no education, class 1-9, SSC passed, or 11 years and above. Maternal and paternal occupation were grouped into 4 categories as well: no occupation, field laborer, service worker, other. A final HFI score ranging from 9-45 was classified into 3 categories: HFI 9 (food secure), HFI 10-15 (moderate food security), and HFI ≥ 16 (severe food insecurity). Asset ownership (cattle, any land, and electricity) variables were measured as dichotomous variables to reflect “owns” and “does not own”. SES indicators were used to create a living standards index (LSI) that was categorized into quartiles in order to deal with skewness of the data. Descriptive statistics were run on all study variables to explore distributions, percentages, means and SDs. Simple linear and logistic regression models were used to assess associations between feeding behaviors and demographic characteristics as a means of measuring convergent validity. Statistical significance was set at p-value <0.05. Statistical analyses were conducted using Stata 14.0 (StataCorp, College Station, TX, USA).

Assessment of Reliability

The Cronbach’s alpha coefficient and split-half reliability coefficient were used to assess the reliability of the questionnaire. The Cronbach’s alpha coefficient of each factor was computed to evaluate the extent of respondents answering the items consistently. The Cronbach's alpha coefficient can range from 0 to 1; a coefficient of ≥0.70 demonstrates acceptable reliability. The split-half reliability coefficient is another assessment of that measures internal consistency of the scale. Items of the final scale were divided into two half-scales so that they are as equivalent as possible, then the
Spearman-Brown prophecy formula was applied to calculate the correlation of the two half-scales, allowing another estimation of reliability of the total scale.

**Ethical approval**

All data collection instruments and procedures were approved by the Ethical Review Committee (ERC) at icddr,b, Bangladesh and the Institutional Review Board (IRB) of the Johns Hopkins Bloomberg School of Public Health, MD, USA. Written parental consent was obtained at the time of enrolment; all participants were informed that their participation was voluntary, and were assured of the confidentiality of the data collected.

**Results**

**Characteristics of Study Participants**

Of the 5,411 mothers who completed the 24 month-follow up interview, 4,848 completed the 13-item CFBQ. Reasons for loss to follow up included caregivers not being met until 25 months after birth (n=409), children being given away for adoption (n=1), caregivers refusing to complete the interview (n=14), the family permanently moving (n=4), or if the child died (n=11). Of the remaining 4972 who did complete the interview, 124 were dropped because their interviews were conducted before the CFBQ was ready to be administered. Two additional participants were dropped from the analysis due to missing values from the questionnaire responses; the final dataset used in the analysis included 4846 children. Mean overall household size in this sample was 5 members, with around 20% of households having at least 1 other child under age 5 (Table 5.1). Mean (SD) maternal age was 24 (5.4) years; about a quarter of mothers had no education and only about 11% had at least a high school education. Most mothers had no occupation, and 11% were service workers. About half of fathers worked as field
laborers (farming) and the other half as service workers (small business, office job, etc.). Household food insecurity was high (99.9%) with more than a quarter of the sample being severely food insecure. More than half the sample owned some land, around half owned cattle, and only about a third of the families had electricity. Around 80% of households had access to improved sanitation.

**Exploratory Factor Analysis**

EFA conducted on the overall sample confirmed the presence of 3 feeding dimensions: responsive, forceful, and indulgent. The scree plot (Figure 5.1) did not exhibit a defined bend; however, the earliest bend begins at the 3rd plot point, suggesting a 2-factor model. In our preliminary factor analysis including all 15 items, we found that after the first 2 factors the eigenvalues dropped below 1.0. The first factor in our original model explains 76.21% of variance of the factor, and the second factor explains 28.43% of variance. The third factor explains 14.42% of variance, after which the proportions explained by subsequent individual factors drop below 10%.

**3-factor model**

Table 5.2 shows the factor-loading matrix of the 3-factor model, including responsive (5 items), forceful (6 items), and indulgent feeding (2 items) and the items included in each factor. Around 70% of mothers reported high responsive behaviors, around a third reported high force and around 43% reported high indulgent feeding behaviors (Table 5.3). **2-factor model**

For the purpose of testing convergent validity, however, we only included responsive and forceful feeding factors, since the indulgent factor only had 2 items (Table 5.4). When switching to a 2-factor solution, we found that the factor loading for
the item “How often can you tell when your toddler does not like the food” increased from 0.13 to 0.28. Although still below 0.30, we included this item and “How often do you eat with your toddler” based on responsive feeding theory. All 6 items in the forceful feeding factor loaded above 0.30. The two factors, responsive and forceful, were used to assess construct validity.

**Convergent Validity**

High responsive feeding was associated with small but significantly higher maternal and paternal education ($p<0.001$), higher SES as measured by a living standards index (26.1% as compared to 23.0%, $p=0.002$) and higher ownership of an improved latrine (83.6% as compared to 80.6%, $p<0.001$) (Table 5.5) Conversely, high forceful feeding was associated with lower maternal and paternal age and higher maternal but not paternal education as compared to low forceful feeding. Husbands of mothers reporting high force were more likely to be service workers than field laborers ($p=0.035$). Higher force was also associated with higher SES as measured by a higher living standards index (28.6% as compared to 23.4%, $p<0.001$) and access to electricity (33.4% as compared to 30.2%, $p=0.026$). Lower force was associated with having another child under the age of 5, in addition to the index child (23.8% as compared to 18.2% in high force, $p<0.001$). Household food insecurity was not significantly associated with either responsive feeding or forceful feeding factors.

Demographic characteristics were also compared across the 2x2 factorial variable created using the dichotomous forceful and responsive constructs (Table 5.6). About 47% of mothers reported high responsive and low forceful behaviors (“responsive”), 10% of mothers reported low responsive and high forceful behaviors (“forceful”), 24% of mothers reported high on both responsive and forceful (“high on
both”), and 19% of mothers reported low responsive and low forceful (“uninvolved”). Maternal and paternal age and education all differed significantly between groups. Maternal age (mean (SD): 23.6 (5.2), p<0.001) and paternal age (mean (SD): 30.4 (6.9), p<0.001) were lowest in households of mothers report “high on both”. These households also had the lowest proportion of mothers and fathers with no education (18.5% and 32.7%, respectively; p<0.001), while households of “uninvolved” mothers had the highest proportion of mothers and fathers with no education (29.3% and 42.6%, respectively; p<0.001). Feeding behavior was also associated with SES as measured by LSI and type of latrine; with the lowest SES among “uninvolved” mothers (28.2% lowest LSI quartile, p<0.001; 20.3% with no improved sanitation, p<0.001), and the highest SES indicators among mothers reporting “high on both” (20.8% lowest LSI quartile, p<0.001; 14.4% with no improved sanitation, p<0.001). Having at least 1 other child under age 5 in the household was also associated with feeding behaviors (p<0.001); there were fewer of these households among mothers reporting “high on both” (17.3%), while more of these households had mothers reporting “responsive” (23.8%) and “forceful” (23.7%).

**Reliability**

The Cronbach’s alpha coefficients of the 3 dimensions were 0.44, 0.80, and 0.57 for the responsive/involved, forceful and indulgent factors, respectively (Table 5.3). According to the results of the split-half reliability analysis, the Spearman-Brown coefficient was 0.7932.

**Discussion**

We developed a valid 11-item instrument to assess two theoretically derived feeding behaviors among a large sample of mothers of 24-month old children in rural Bangladesh who were participating in a trial of child food supplementation. Similar
validated questionnaires have been used to assess feeding behaviors in the United States in obesogenic settings\(^8,20,21,28\); however, none have been used in LMIC in the presence of high undernutrition. The majority of these questionnaires have used established patterns of responsivity and control to assess 5 theorized feeding dimensions (responsive, forceful, restrictive, indulgent and uninvolved)\(^8,20–22\). While most literature focuses on restrictive, controlling and indulgent feeding and their relations with overweight/obesity\(^29\), qualitative work done in Bangladesh suggests that caregivers use excessive non-responsive behaviors to address concerns about their child’s intake in an environment with high undernutrition (Chapter 4). The feeding dimensions identified by the CFBQ, responsive and forceful feeding, are based on a theory of interactive feeding that incorporates caregivers’ responses to concerns about their children’s dietary intake, preferences, appetite, and behavior\(^6\), rather than relying exclusively on caregiver behaviors independent of child factors. The construct validity of the questionnaire suggests that an interactive perspective that acknowledges the concerns that caregivers have about their child’s feeding behaviors may be useful in formulating caregiver feeding recommendation in the future.

The responsive factor included a number of items that were in the original questionnaire to measure both responsive and uninvolved feeding. These items grouped together to create a factor characterized by involved feeding, including awareness of when and what the child is eating, eating with the child, and cognizance about the child’s satiety and preferences. Our 4 category feeding behaviors variable included a category capturing mothers who reported using responsive and forceful behaviors simultaneously. Qualitative work done in this area (Chapter 4) suggests that feeding in this context is highly driven by a desire to increase intake in children, stemming from concerns about child appetite, size and overall dietary intake. Although different behaviors, 24% of
caregivers simultaneously reported using both feeding behaviors, suggesting that feeding behavior may vary by caregiver mood or circumstance. For example, high force was employed in reaction to the concern that the child was not eating enough, which stems from caregiver attentiveness/concern that is characteristic of motivations driving responsive feeding as well.

Although the question “How often do you talk to your toddler during meals?” was included as an item to assess responsive feeding, it loaded with the forceful feeding factor. We found in our qualitative work that mothers were interpreting “talking” to the child during feeding to include any sort of talk, including reprimanding or forceful verbalizations. In addition, positive verbalizations or encouragement were rare in this setting, so children were often only spoken to during meals if they were not eating in a way the caregiver found to be appropriate. This supports the importance of transferability; while there are questionnaires that assess caregiver feeding behaviors using similar items, the difference in context results in a difference in interpretation of the measured behaviors. Additionally, understanding the context behind the behaviors surrounding feeding in this setting will allow the development of appropriate feeding guidelines, rather than apply guidelines from another setting.

In our univariate analyses we found that households of mothers reporting high responsive behaviors and high force had younger parents with overall higher education and higher SES, and were less likely to have another child under the age of 5 as compared to households of mothers reporting high responsive behaviors and low force. Perhaps caregivers from households with these conditions are more likely to employ all tactics they think are necessary to feed the child (using both force and responsiveness) because they have more time (less young children) and more resources (higher SES and higher education). Conversely, households with mothers reporting low
responsiveness/involvement and low force (19% of mothers), which we categorized as uninvolved feeding, had the highest parental age and lowest education, lower SES than any other the other groups, and were more likely to have another child under the age of 5. These uninvolved feeding behaviors could be related to an increase in household duties or work outside of the home as often associated with lower SES, or having to split their attention among other young children. Although we cannot make these associations based solely on univariate analyses, we can control for these sociodemographic factors as confounding variables when examining the relationship between feeding behaviors and dietary intakes and nutritional status (see Chapter 6).

Our questionnaire has some limitations. Due to being administered as a module within a larger interview, items from the original questionnaire were reduced in order to reduce participant burden. Additionally, we had planned to use formative research to inform the development of the questionnaire; however, due to the timeline of the study we were not able to do so in time for administering to the larger sample at the 24 month follow-up interview. Lastly, the questionnaire could have been validated against direct observations so we would have a better idea of whether or not the item responses and extracted factors were true to the actual situation.

However, the resulting 11-item questionnaire was brief and easy to administer, increasing the ease and feasibility in which feeding behaviors can be assessed. Currently, this is the only feeding behaviors questionnaire that has been adapted for this setting, and can be applied to assess feeding behaviors in areas where child undernutrition is high. Forceful feeding behaviors have been associated with fewer mouthfuls of food taken by the child and more refusal of food\textsuperscript{19}, so in settings where undernutrition is high it may be beneficial to focus on addressing feeding behaviors as an avenue for improving child nutrition acutely.
While most studies to understand feeding behaviors are observational, these are time-consuming, expensive and burdensome on both participant and researcher. This was a short questionnaire that allowed us to quickly assess feeding behaviors in about 10 minutes. Our findings support the need for further longitudinal and observational studies, both to understand the development and directionality of relationships between feeding behaviors and nutritional outcomes (see Chapter 6), as well as direct observations to assess the concordance between self-report feeding behaviors and actual feeding behaviors. The CFBQ can be adapted for similar settings with high undernutrition and used to assess relationships between feeding behaviors and child growth.
References


Tables and Figures

Table 5.1. Baseline parental and household characteristics of enrolled children at 24 months, by responsive and forceful feeding behaviors (n=4846)

<table>
<thead>
<tr>
<th>Parental and household characteristics</th>
<th>Overall mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>Paternal age</td>
<td>31.1 (7.2)</td>
</tr>
<tr>
<td>Maternal age</td>
<td>24.2 (5.4)</td>
</tr>
<tr>
<td>Maternal education</td>
<td>n (%)</td>
</tr>
<tr>
<td>No education</td>
<td>1140 (23.6)</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>3163 (65.4)</td>
</tr>
<tr>
<td>SSC passed</td>
<td>238 (4.9)</td>
</tr>
<tr>
<td>11 years and above</td>
<td>294 (6.1)</td>
</tr>
<tr>
<td>Paternal education</td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>1732 (36.8)</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>2236 (47.5)</td>
</tr>
<tr>
<td>SSC passed</td>
<td>254 (5.4)</td>
</tr>
<tr>
<td>11 years and above</td>
<td>489 (10.4)</td>
</tr>
<tr>
<td>Maternal occupation</td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>4272 (88.4)</td>
</tr>
<tr>
<td>Field laborer</td>
<td>32 (0.7)</td>
</tr>
<tr>
<td>Service worker</td>
<td>520 (10.8)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (0.2)</td>
</tr>
<tr>
<td>Paternal occupation</td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>52 (1.1)</td>
</tr>
<tr>
<td>Category</td>
<td>Value</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Field laborer</td>
<td>2331 (48.8)</td>
</tr>
<tr>
<td>Service worker</td>
<td>2368 (49.6)</td>
</tr>
<tr>
<td>Other</td>
<td>27 (0.6)</td>
</tr>
<tr>
<td>Household food insecurity</td>
<td></td>
</tr>
<tr>
<td>HFI 9</td>
<td>5 (0.1)</td>
</tr>
<tr>
<td>HFI 10-15</td>
<td>3464 (71.6)</td>
</tr>
<tr>
<td>HFI &gt;=16</td>
<td>1372 (28.3)</td>
</tr>
<tr>
<td>Living Standards Index (LSI)</td>
<td></td>
</tr>
<tr>
<td>First quartile</td>
<td>1204 (24.9)</td>
</tr>
<tr>
<td>Second quartile</td>
<td>1214 (25.1)</td>
</tr>
<tr>
<td>Third quartile</td>
<td>1209 (25.0)</td>
</tr>
<tr>
<td>Fourth quartile</td>
<td>1214 (25.1)</td>
</tr>
<tr>
<td>Assets</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>2541 (52.5)</td>
</tr>
<tr>
<td>Any land</td>
<td>3429 (70.8)</td>
</tr>
<tr>
<td>Electricity</td>
<td>1515 (31.3)</td>
</tr>
<tr>
<td>Latrine</td>
<td></td>
</tr>
<tr>
<td>None/field/bush</td>
<td>836 (17.3)</td>
</tr>
<tr>
<td>Open latrine</td>
<td>48 (1.0)</td>
</tr>
<tr>
<td>Pit latrine</td>
<td>202 (4.2)</td>
</tr>
<tr>
<td>Water sealed/slab</td>
<td>3752 (77.5)</td>
</tr>
<tr>
<td>Flush toilet</td>
<td>3 (0.1)</td>
</tr>
<tr>
<td>Household has at least 1 other child under age 5</td>
<td>1058 (21.8)</td>
</tr>
</tbody>
</table>
Figure 5.1. Scree plot of eigenvalues following factor analysis
<table>
<thead>
<tr>
<th>Description of individual feeding behavior items as grouped by factor</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1. Responsive Feeding</strong></td>
<td></td>
</tr>
<tr>
<td>How often do you know what your toddler eats throughout the day?</td>
<td>0.62</td>
</tr>
<tr>
<td>How often do you know when your toddler eats throughout the day?</td>
<td>0.63</td>
</tr>
<tr>
<td>How often can you tell when your toddler is full?</td>
<td>0.37</td>
</tr>
<tr>
<td>How often can you tell when your toddler does not like the food?</td>
<td>0.13</td>
</tr>
<tr>
<td>How often do you eat with your toddler?</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Factor 2. Forceful Feeding</strong></td>
<td></td>
</tr>
<tr>
<td>How often do you force your toddler to eat?</td>
<td>0.76</td>
</tr>
<tr>
<td>How often do you beg or plead with your toddler to eat?</td>
<td>0.67</td>
</tr>
<tr>
<td>How often do you physically struggle with your toddler to get him/her to eat?</td>
<td>0.67</td>
</tr>
<tr>
<td>How often do you yell at or threaten your toddler to be sure he/she eats enough?</td>
<td>0.62</td>
</tr>
<tr>
<td>How often do you talk to your toddler during meals?</td>
<td>0.59</td>
</tr>
<tr>
<td>How often does your toddler walk around while eating or drinking?</td>
<td>0.38</td>
</tr>
<tr>
<td><strong>Factor 3. Indulgent Feeding</strong></td>
<td></td>
</tr>
<tr>
<td>If your toddler does not like what is being served, how often do you immediately give him/her something else?</td>
<td>0.52</td>
</tr>
<tr>
<td>When your toddler whines or cries, how often do you give him/her a biscuit, cake or something else to eat?</td>
<td>0.51</td>
</tr>
</tbody>
</table>

*Table 5.2. Factor-loading matrix of 3-factor solution*
### Table 5.3. Prevalence of responsive, forceful and indulgent feeding in sample of 24-month old children (n=4846)

<table>
<thead>
<tr>
<th>Feeding Subscale</th>
<th>items, n</th>
<th>median (range)</th>
<th>&quot;High&quot; n (%)</th>
<th>EFA factor loadings</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsive</td>
<td>5</td>
<td>16 (3-20)</td>
<td>3339 (70.5)</td>
<td>0.15-0.63</td>
<td>0.4353</td>
</tr>
<tr>
<td>Forceful</td>
<td>6</td>
<td>7 (0-24)</td>
<td>1608 (34.0)</td>
<td>0.39-0.78</td>
<td>0.8011</td>
</tr>
<tr>
<td>Indulgent</td>
<td>2</td>
<td>3 (0-8)</td>
<td>1256 (43.3)</td>
<td>0.51-0.52</td>
<td>0.5726</td>
</tr>
</tbody>
</table>

### Table 5.4. Factor-loading matrix of 2-factor solution

**Description of individual feeding behavior items as grouped by factor**

**Factor 1. Responsive Feeding (n=5)**
- How often do you know what your toddler eats throughout the day? 0.63
- How often do you know when your toddler eats throughout the day? 0.61
- How often can you tell when your toddler is full? 0.40
- How often can you tell when your toddler does not like the food? 0.28
- How often do you eat with your toddler? 0.15

**Factor 2. Forceful Feeding (n=6)**
- How often do you force your toddler to eat? 0.78
- How often do you beg or plead with your toddler to eat? 0.69
- How often do you physically struggle with your toddler to get him/her to eat? 0.67
- How often do you yell at or threaten your toddler to be sure he/she eats enough? 0.63
- How often do you talk to your toddler during meals? 0.61
- How often does your toddler walk around while eating or drinking? 0.39
<table>
<thead>
<tr>
<th>Parental and household characteristics</th>
<th>Low Responsive mean (SD)</th>
<th>High Responsive mean (SD)</th>
<th>p-value</th>
<th>Low Force mean (SD)</th>
<th>High Force mean (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>5.0 (1.8)</td>
<td>5.0 (1.9)</td>
<td>0.840</td>
<td>5.0 (1.8)</td>
<td>5.0 (2.0)</td>
<td>0.970</td>
</tr>
<tr>
<td>Paternal age</td>
<td>31.2 (7.4)</td>
<td>31.0 (7.0)</td>
<td>0.350</td>
<td>31.4 (7.2)</td>
<td>30.5 (7.1)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Maternal age</td>
<td>24.4 (5.6)</td>
<td>24.1 (5.3)</td>
<td>0.076</td>
<td>24.4 (5.4)</td>
<td>23.7 (5.3)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Household size</td>
<td>5.0 (1.8)</td>
<td>5.0 (1.9)</td>
<td>0.840</td>
<td>5.0 (1.8)</td>
<td>5.0 (2.0)</td>
<td>0.970</td>
</tr>
<tr>
<td>Paternal age</td>
<td>31.2 (7.4)</td>
<td>31.0 (7.0)</td>
<td>0.350</td>
<td>31.4 (7.2)</td>
<td>30.5 (7.1)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Maternal age</td>
<td>24.4 (5.6)</td>
<td>24.1 (5.3)</td>
<td>0.076</td>
<td>24.4 (5.4)</td>
<td>23.7 (5.3)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Maternal education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>372 (26.7)</td>
<td>734 (22.0)</td>
<td>0.001*</td>
<td>791 (25.4)</td>
<td>314 (19.5)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>891 (64.0)</td>
<td>2205 (66.2)</td>
<td>0.001*</td>
<td>2013 (64.6)</td>
<td>1082 (67.3)</td>
<td></td>
</tr>
<tr>
<td>SSC passed</td>
<td>55 (3.9)</td>
<td>180 (5.4)</td>
<td></td>
<td>150 (4.8)</td>
<td>85 (5.3)</td>
<td></td>
</tr>
<tr>
<td>11 years and above</td>
<td>75 (5.4)</td>
<td>213 (6.4)</td>
<td></td>
<td>162 (5.2)</td>
<td>126 (7.8)</td>
<td></td>
</tr>
<tr>
<td>Paternal education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>559 (41.2)</td>
<td>1135 (35.0)</td>
<td>&lt;0.001*</td>
<td>1151 (38.0)</td>
<td>542 (34.5)</td>
<td>0.078</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>616 (45.4)</td>
<td>1562 (48.1)</td>
<td>&lt;0.001*</td>
<td>1419 (46.8)</td>
<td>758 (48.2)</td>
<td></td>
</tr>
<tr>
<td>SSC passed</td>
<td>55 (4.1)</td>
<td>197 (6.1)</td>
<td></td>
<td>159 (5.2)</td>
<td>93 (5.9)</td>
<td></td>
</tr>
<tr>
<td>11 years and above</td>
<td>127 (9.4)</td>
<td>353 (10.9)</td>
<td></td>
<td>301 (9.9)</td>
<td>179 (11.4)</td>
<td></td>
</tr>
<tr>
<td>Maternal occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>1237 (88.9)</td>
<td>2939 (88.2)</td>
<td>0.550</td>
<td>2771 (88.9)</td>
<td>1403 (87.4)</td>
<td>0.400</td>
</tr>
<tr>
<td>Field laborer</td>
<td>12 (0.9)</td>
<td>20 (0.6)</td>
<td></td>
<td>19 (0.6)</td>
<td>13 (0.8)</td>
<td></td>
</tr>
<tr>
<td>Service worker</td>
<td>140 (10.1)</td>
<td>367 (11.0)</td>
<td></td>
<td>321 (10.3)</td>
<td>186 (11.6)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 (0.1)</td>
<td>7 (0.2)</td>
<td></td>
<td>5 (0.2)</td>
<td>4 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Paternal occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>11 (0.8)</td>
<td>40 (1.2)</td>
<td>0.290</td>
<td>31 (1.0)</td>
<td>20 (1.3)</td>
<td>0.035*</td>
</tr>
<tr>
<td>Field laborer</td>
<td>694 (50.3)</td>
<td>1587 (48.3)</td>
<td>1548 (50.2)</td>
<td>732 (46.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------------</td>
<td>-------------</td>
<td>-------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service worker</td>
<td>667 (48.3)</td>
<td>1647 (50.1)</td>
<td>1484 (48.2)</td>
<td>829 (52.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>9 (0.7)</td>
<td>15 (0.5)</td>
<td>18 (0.6)</td>
<td>6 (0.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household food insecurity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFI 9</td>
</tr>
<tr>
<td>HFI 10-15</td>
</tr>
<tr>
<td>HFI &gt;=16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Living Standards Index (LSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First quartile</td>
</tr>
<tr>
<td>Second quartile</td>
</tr>
<tr>
<td>Third quartile</td>
</tr>
<tr>
<td>Fourth quartile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
</tr>
<tr>
<td>Any land</td>
</tr>
<tr>
<td>Electricity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Latrine</th>
</tr>
</thead>
<tbody>
<tr>
<td>None/field/bush</td>
</tr>
<tr>
<td>Open latrine</td>
</tr>
<tr>
<td>Pit latrine</td>
</tr>
<tr>
<td>Water sealed/slab</td>
</tr>
<tr>
<td>Flush toilet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household has at least 1 other child under age 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>315 (22.6)</td>
</tr>
</tbody>
</table>

*p<0.05
Table 5.6. Parental and household characteristics across feeding behaviors of caregivers of enrolled children at 24 months

<table>
<thead>
<tr>
<th>Parental and household characteristics</th>
<th>High R/Low F [Responsive]</th>
<th>Low R/Low F [Uninvolved]</th>
<th>Low R/High F [Forceful]</th>
<th>High R/High F [High on both]</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean (SD)</td>
<td>mean (SD)</td>
<td>mean (SD)</td>
<td>mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>5.0 (1.9)</td>
<td>5.0 (1.7)</td>
<td>5.0 (2.1)</td>
<td>5.0 (1.9)</td>
<td>0.990</td>
</tr>
<tr>
<td>Paternal age</td>
<td>31.4 (7.1)</td>
<td>31.4 (7.4)</td>
<td>30.9 (7.4)</td>
<td>30.4 (6.9)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Maternal age</td>
<td>24.3 (5.3)</td>
<td>24.5 (5.7)</td>
<td>24.1 (5.5)</td>
<td>23.6 (5.2)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td><strong>Maternal education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>525 (23.8)</td>
<td>266 (29.3)</td>
<td>106 (21.9)</td>
<td>208 (18.5)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>1449 (65.6)</td>
<td>564 (62.2)</td>
<td>326 (67.2)</td>
<td>756 (67.4)</td>
<td></td>
</tr>
<tr>
<td>SSC passed</td>
<td>118 (5.3)</td>
<td>32 (3.5)</td>
<td>23 (4.7)</td>
<td>62 (5.5)</td>
<td></td>
</tr>
<tr>
<td>11 years and above</td>
<td>117 (5.3)</td>
<td>45 (5.0)</td>
<td>30 (6.2)</td>
<td>96 (8.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Paternal education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>777 (36.1)</td>
<td>374 (42.6)</td>
<td>184 (38.5)</td>
<td>358 (32.7)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>1024 (47.6)</td>
<td>395 (45.0)</td>
<td>221 (46.2)</td>
<td>537 (49.1)</td>
<td></td>
</tr>
<tr>
<td>SSC passed</td>
<td>125 (5.8)</td>
<td>34 (3.9)</td>
<td>21 (4.4)</td>
<td>72 (6.6)</td>
<td></td>
</tr>
<tr>
<td>11 years and above</td>
<td>226 (10.5)</td>
<td>75 (8.5)</td>
<td>52 (10.9)</td>
<td>127 (11.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Maternal occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>1960 (88.7)</td>
<td>811 (89.5)</td>
<td>425 (87.8)</td>
<td>978 (87.2)</td>
<td>0.73</td>
</tr>
<tr>
<td>Field laborer</td>
<td>13 (0.6)</td>
<td>6 (0.7)</td>
<td>6 (1.2)</td>
<td>7 (0.6)</td>
<td></td>
</tr>
<tr>
<td>Service worker</td>
<td>233 (10.5)</td>
<td>88 (9.7)</td>
<td>52 (10.7)</td>
<td>134 (11.9)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4 (0.2)</td>
<td>1 (0.1)</td>
<td>1 (0.2)</td>
<td>3 (0.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Paternal occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>23 (1.1)</td>
<td>8 (0.9)</td>
<td>3 (0.6)</td>
<td>17 (1.5)</td>
<td>0.11</td>
</tr>
<tr>
<td>Field laborer</td>
<td>1090 (49.9)</td>
<td>458 (51.1)</td>
<td>236 (48.9)</td>
<td>496 (44.9)</td>
<td></td>
</tr>
</tbody>
</table>

141
### Service worker

<table>
<thead>
<tr>
<th></th>
<th>1059 (48.5)</th>
<th>425 (47.4)</th>
<th>241 (49.9)</th>
<th>588 (53.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>12 (0.5)</td>
<td>6 (0.7)</td>
<td>3 (0.6)</td>
<td>3 (0.3)</td>
</tr>
</tbody>
</table>

### Household food insecurity (HFI)

<table>
<thead>
<tr>
<th>HFI</th>
<th>1 (&lt;1)</th>
<th>0 (0.0)</th>
<th>1 (0.2)</th>
<th>3 (0.3)</th>
<th>0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFI 9</td>
<td>1609 (72.7)</td>
<td>626 (68.9)</td>
<td>339 (69.9)</td>
<td>813 (72.4)</td>
<td></td>
</tr>
<tr>
<td>HFI &gt;=16</td>
<td>603 (27.2)</td>
<td>282 (31.1)</td>
<td>145 (29.9)</td>
<td>307 (27.3)</td>
<td></td>
</tr>
</tbody>
</table>

### Living Standards Index (LSI)

<table>
<thead>
<tr>
<th>Quartile</th>
<th>552 (24.9)</th>
<th>256 (28.2)</th>
<th>131 (27.0)</th>
<th>234 (20.8)</th>
<th>&lt;0.001*</th>
</tr>
</thead>
<tbody>
<tr>
<td>First quartile</td>
<td>563 (25.4)</td>
<td>237 (26.1)</td>
<td>126 (26.0)</td>
<td>256 (22.8)</td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>564 (25.5)</td>
<td>218 (24.0)</td>
<td>104 (21.4)</td>
<td>297 (26.4)</td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>534 (24.1)</td>
<td>197 (21.7)</td>
<td>124 (25.6)</td>
<td>336 (29.9)</td>
<td></td>
</tr>
</tbody>
</table>

### Assets

<table>
<thead>
<tr>
<th>Asset</th>
<th>1178 (53.2)</th>
<th>480 (52.9)</th>
<th>241 (49.7)</th>
<th>593 (52.8)</th>
<th>0.570</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>1563 (70.6)</td>
<td>648 (71.2)</td>
<td>326 (67.2)</td>
<td>809 (72.0)</td>
<td>0.270</td>
</tr>
<tr>
<td>Any land</td>
<td>669 (30.2)</td>
<td>274 (30.2)</td>
<td>151 (31.1)</td>
<td>386 (34.4)</td>
<td>0.085</td>
</tr>
</tbody>
</table>

### Latrine

<table>
<thead>
<tr>
<th>Latrine</th>
<th>385 (17.4)</th>
<th>184 (20.3)</th>
<th>85 (17.5)</th>
<th>162 (14.4)</th>
<th>&lt;0.001*</th>
</tr>
</thead>
<tbody>
<tr>
<td>None/field/bush</td>
<td>20 (0.9)</td>
<td>9 (1.0)</td>
<td>15 (3.1)</td>
<td>4 (0.4)</td>
<td></td>
</tr>
<tr>
<td>Open latrine</td>
<td>88 (4.0)</td>
<td>47 (5.2)</td>
<td>21 (4.3)</td>
<td>41 (3.7)</td>
<td></td>
</tr>
<tr>
<td>Pit latrine</td>
<td>1719 (77.7)</td>
<td>668 (73.6)</td>
<td>364 (75.1)</td>
<td>915 (81.5)</td>
<td></td>
</tr>
<tr>
<td>Water sealed/slab</td>
<td>1 (&lt;1)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (0.1)</td>
<td></td>
</tr>
</tbody>
</table>

### Household has at least 1 other child under age 5

|            | 528 (23.8) | 216 (23.7) | 99 (20.4)  | 194 (17.3) | <0.001* |

*p<0.05
Appendix

Appendix 5.1. List of items included in the original (n=51), intermittent (n=15 after pilot test), and final (n=13 after EFA) Caregiver Feeding Behaviors Questionnaire (CFBQ)

<table>
<thead>
<tr>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminated after pilot test</td>
</tr>
<tr>
<td>Eliminated after EFA</td>
</tr>
<tr>
<td>Final Version</td>
</tr>
</tbody>
</table>

Responsive:

<table>
<thead>
<tr>
<th>How often can you tell when your toddler is hungry?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often can you tell when your toddler likes the food?</td>
</tr>
<tr>
<td>How often do you praise your toddler for eating?</td>
</tr>
<tr>
<td>How often do you say something positive about your toddler's eating?</td>
</tr>
<tr>
<td>How often do you talk to your toddler about the food he/she is eating?</td>
</tr>
<tr>
<td>How often do you encourage your toddler to try a new food?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often do you eat with your toddler?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often can you tell when your toddler is full?</td>
</tr>
<tr>
<td>How often can you tell when your toddler does not like the food?</td>
</tr>
<tr>
<td>How often do you talk to your toddler during meals?</td>
</tr>
</tbody>
</table>

Forceful:

<table>
<thead>
<tr>
<th>How often do you reason with your toddler to get him/her to eat?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you make sure that your toddler eats all the food on his/her plate?</td>
</tr>
</tbody>
</table>
How often do you have to bribe or trick your toddler to get him/her to eat?
How often do you try to get your toddler to eat even a small amount of food?
How often is your toddler punished for not eating?
How often do you let your toddler know you are upset if he/she will not eat?
How often do you warn your toddler that you will take something away other than food if he/she doesn't eat?
How often do you hurry your toddler when eating?
If your toddler says or signals "I'm not hungry", how often do you try to get him/her to eat anyway?
If your toddler will not try a new food, do you work hard to have him/her try it during that meal?

How often do you yell or threaten your toddler to be sure he/she eats enough?
How often do you beg or plead with your toddler to eat?
How often do you force your toddler to eat?
How often do you physically struggle with your toddler to get him/her to eat?

Restrictive:
Are you concerned your toddler eats too much of his/her favorite foods?
How often do you carefully control how much your toddler eats?
How often are you concerned that your toddler is eating too much?
How often are you concerned that your toddler eats too many sweets?
If you did not limit your toddlers eating, would he/she eat too much?
How often do you limit the amount your toddler eats?
How often do you limit the types of food your toddler eats?

Uninvolved:
How often does your toddler eat at the same time every day?
How often are you responsible for the amount of food that your toddler is offered?
How often are you responsible for the kinds of food that your toddler is offered?
How often does your toddler eat at the same place every day?
**Do you know what your toddler eats throughout the day?**

**Do you know when your toddler is eating?**

**Indulgent:**

- If your toddler prefers sugary drinks (i.e. soda, juice), how often do you let him/her have them?
- If your toddler wants something for a meal that you think is inappropriate, how often do you give it to him or her?
- How often do you offer your toddler's favorite food in exchange for good behavior?
- How often do you give your toddler something to eat or drink if he/she is upset or having a temper tantrum?
- If your toddler prefers to eat while playing, how often do you let him/her?
- How often do you offer your toddler's favorite food in exchange for good behavior?
- How often do you let your toddler eat whatever he/she wants?
- How often do you promise your toddler something other than food if he/she eats?
- How often do you offer sweets (biscuits and cakes) to your toddler as a reward for good behavior?
- How often do you encourage your toddler to eat by using food (i.e. dessert) as a reward?

**How often does your toddler walk around while eating or drinking?**

- If your toddler does not like what is being served, do you immediately make something else?

**When your toddler whines or cries, how often do you give him/her something to eat or drink?**

**New Questions:**

- How often do you show your toddler animals to encourage him to eat?
- How often do you allow your toddler to feed him/herself?
Chapter 6. Exploring the relationship between feeding behaviors and growth and dietary diversity in 24-month old children in rural Bangladesh

Abstract

Background: Caregiver interactions and verbalization may encourage acceptance of food by the child, which may improve dietary intake and eventually growth in settings where undernutrition is high. However, few studies have explored the relationship between responsive feeding practices or interventions and child growth.

Objective: This study examined the relationship between maternal feeding behaviors (responsive and nonresponsive) and children’s dietary diversity and anthropometry at 24 months of age in rural Bangladesh where child undernutrition is high.

Methods: Data were collected on 4846 mother-child dyads enrolled in a complementary food supplementation trial. Anthropometry (weight, length) and child diet (24-h recall) were collected. Factor analysis using data from context-specific 11-item feeding behaviors module revealed 2 theoretically derived constructs of feeding: responsive/involved (5 items) and forceful (6 items). Each was dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive [70%], low forceful [66%]). Dietary diversity score (DDS; range 0-7) derived using the diet recall data was used to define minimum dietary diversity (MDD; DDS of 4 to 7). Stunting (height-for-age Z-score≤-2), wasting (weight-for-height Z-score<-2) and underweight (weight-for-age Z-score≤-2) variables were created from anthropometric measures. The association between feeding behaviors and continuous and dichotomous dietary and anthropometry
outcomes were examined using multivariable linear and logistic regression models, respectively, adjusting for socioeconomic and other confounders, intervention arm, and cluster-randomized study design.

**Results:** The mean (SD) DDS in the study was 3.8 (1.4), with 58% of children meeting MDD. Stunting, wasting and underweight occurred at 40%, 19%, and 42%, respectively. Responsive/involved feeding (high vs. low) was positively associated with DDS (adjusted $\beta$: 0.11, 95% CI: 0.03, 0.19) and increased consumption of meat (adjusted OR: 1.15, 95% CI: 1.00, 1.32). However, it was not associated with MDD or any of the anthropometric outcomes ($p>0.05$). Conversely, forceful feeding (high vs. low) was negatively associated with WAZ (adjusted $\beta$: -0.16, 95% CI: -0.22, -0.11), WLZ (adjusted $\beta$: -0.20, 95% CI: -0.25, -0.14), DDS (adjusted $\beta$: -0.13, 95% CI: -0.21, -0.05) and meeting MDD (adjusted OR: 0.78, 95% CI: 0.68, 0.88) and positively with underweight (adjusted OR: 1.38, 95% CI: 1.22, 1.56), and wasting (adjusted OR: 1.55, 95% CI: 1.33, 1.81). Forceful feeding was also associated with lower consumption of legumes (adjusted OR: 0.84, 95% CI: 0.73, 0.96), meat (adjusted OR: 0.83, 95% CI 0.73, 0.94) and vitamin A-rich fruits/vegetables (adjusted OR: 0.81, 95% CI: 0.72, 0.91). Neither forceful nor responsive/involved feeding were associated with LAZ (adjusted $\beta$: 0.04, 95% CI: -0.12, 0.10; adjusted $\beta$: -0.04, 95% CI: -0.10, 0.02, respectively) or stunting (adjusted OR: 0.93, 95% CI: 0.83, 1.05; adjusted OR: 1.07, 95% CI: 0.93, 1.22, respectively). **Conclusion:** Findings suggest that in the context of high undernutrition, non-responsive feeding behaviors (especially forceful) are associated with poor growth and dietary diversity among young children and responsive/involved feeding is associated with improved dietary diversity. Future longitudinal research is needed to better understand causality and test the efficacy of responsive feeding interventions on the promotion of child growth and diet.
Introduction

Global estimates of child growth measures reveal a concerning number of children at risk for or privy to inadequate diets and/or exposure to infection, both of which can exacerbate the cycle of undernutrition\(^1\). Stunting (length/height-for-age < -2 z-scores below the reference median\(^2\)) is of particular concern, as it is associated with an increased risk of childhood morbidity and mortality, and may persist into adulthood and be a detriment to health and productivity later in life. These detriments are characterized by cognitive deficits, metabolic dysfunction, poorer performance in school and work, and adverse pregnancy outcomes that exacerbate the cycle of stunting into future generations\(^3\)–\(^5\). Nearly half of stunted children live in Asia; Bangladesh has the second highest estimated rates of child undernutrition in South Asia, with 32.6 percent of children less than 5 years of age being underweight. In rural areas, 37.9 percent of children are stunted and 15.1 percent of children are wasted, reflecting an even higher burden among rural populations and of the lowest socioeconomic status\(^6\).

After 6 months of age, children require appropriate quantity and quality of complementary foods for optimal growth and development\(^3\). During feeding infants and young children are often not provided sufficient encouragement to ensure they consume sufficient amounts and variety of foods, which vary by age and breastfeeding status. In addition, even when food resources are available in the home, caregivers may not make the best use of them due to lack of knowledge of the best foods for young children, cultural practices and inappropriate advice\(^7\). Thus, lack of diversity next to inappropriate consistency, low nutrient density and quantity of foods is a major contributing factor to inadequate nutrient intake among infants and children during the complementary feeding period. This lack of diversity has been attributed to poor dietary quality, lack of economic
access to sufficient foods\textsuperscript{8}, low coverage of counseling to support knowledge of feeding practices among caregivers, as well as the lack of a supportive environment\textsuperscript{9}. Lack of dietary diversity is a particularly severe problem among impoverished populations where diets are predominantly starch-based and include few or no animal products or fruits and vegetables\textsuperscript{10}. These diets often result in protein-energy malnutrition as well as micronutrient deficiencies and nutrient inadequacy of complementary foods that take a significant toll on the health and development of children, particularly those under 5 years of age\textsuperscript{11,12}.

Behavior change and nutritional interventions in early infancy show some promise for improving linear growth among children, although the evidence is weak\textsuperscript{13}. In some studies done in food secure populations, education on complementary feeding showed a significant increase in height gain, HAZ and improved weight gain; however, rates of stunting were not different between groups. Complementary feeding education in one food insecure population also improved linear growth and weight gain, and additionally showed 29\% reduced odds of stunting\textsuperscript{14}. In seven studies that provided complementary foods with or without education in food-insecure populations, HAZ was higher among those in the intervention group, but height and weight gain and stunting prevalence were not significantly different\textsuperscript{14}. Our study was conducted within a cluster-randomized controlled trial of four formulations of complementary food supplements (CFS) and child feeding counseling for mothers, versus child feeding counseling only\textsuperscript{15}. The trial demonstrated benefits of the CFSs for linear growth between 6-18 months of age and prevention of stunting at 18 months\textsuperscript{15}. Other lipid-nutrient supplementation studies have shown no statistically significant differences in height gain over time, although increased growth velocity has been observed\textsuperscript{16,17}. Dietary diversity is included as a recommendation in the guide for complementary feeding of the breastfed child\textsuperscript{18}. 
Although some studies indicate a positive association between dietary diversity and increased intake of energy and other nutrients among young children in developing countries\textsuperscript{19–21}, additional research is required for a more detailed characterization of the relationship between dietary diversity and nutrient intake and adequacy. Dietary diversity has also been associated with improved nutritional status in young children\textsuperscript{21–23}, suggesting that there may be an association between dietary diversity and dietary quality, indicating a higher likelihood of meeting daily energy and nutrient requirements.

Another aspect that lacks exploration is the relationship between feeding behaviors and dietary diversity, which could potentially provide a further understanding of dietary intake. Mother-child interactions, or feeding behaviors refer to the interactive behaviors between mothers and children that occur during meals. Responsive feeding is characterized by a give and take relationship between caregiver and child, where the caregiver is feeding the child based on the child’s cues of hunger and satiety\textsuperscript{24}. Non-responsive feeding behaviors are characterized by a lack of developmentally appropriate/sensitive reciprocity between the caregiver and child, through excessive caregiver control (forcing/pressuring or restricting food intake), excessive parental passivity or child control (indulgence), or caregiver disregard (uninvolved)\textsuperscript{25}. Responsive feeding is also included as a recommendation in the guide for complementary feeding of the breastfed child\textsuperscript{18}. Until recently, undernutrition in young children has focused primarily on foods and nutrients with attention on the quality, diversity and amount of food being offered to children\textsuperscript{8}. Increasingly, however, there is attention being paid to the role of caregiver feeding behaviors.\textsuperscript{8}

The current evidence for responsive feeding on child growth is promising, but lacking in interventions that can isolate the impact of responsive feeding\textsuperscript{26}. Studies exploring the relations between responsive feeding and dietary intake report an
improvement in intake of essential nutrients and complementary foods, but again were not designed to isolate the effects of responsive feeding\textsuperscript{26}. There is evidence that caregiver verbalization matters in improving child growth, but the role of other behaviors including physical actions, maternal encouragement and child autonomy requires further research\textsuperscript{26}.

While responsive feeding messages are commonly included in nutrition and/or complementary feeding interventions\textsuperscript{27–29}, limited studies have looked at the associations between responsive and non-responsive feeding and undernutrition or the isolated effects of providing responsive feeding messages on improving dietary diversity and growth patterns\textsuperscript{26}. Current interventions often include responsive feeding messages despite limited evidence that responsive feeding leads to improved nutritional status. As mentioned earlier, as one of the guiding principles for complementary feeding\textsuperscript{18}, responsive feeding is included in the context of breastfeeding and complementary feeding when designing interventions; they are not mutually exclusive\textsuperscript{26}. There is still a paucity of research on how to best measure responsive feeding and how to incorporate responsive feeding into interventions in an effective way. Using cross-sectional data collected as part of a complementary feeding trial\textsuperscript{15}, this study aimed to explore the relationship between different feeding behaviors and dietary diversity and growth among 24- month old children in a rural Bangladeshi setting.

**Methods**

**Setting and study population**

This study was nested within the JiVitA-4 randomized controlled supplementation trial, which compared the efficacy of four complementary food supplements and their
impact on growth, LAZ, WLZ, morbidity, micronutrient status, and cognitive development among children from 6-18 months of age, in addition to provision of nutrition counseling to all participants vs. a control group which received nutrition counseling alone. A 24 month follow-up was planned to examine the sustained impact of the intervention after feeding had been discontinued at 18 months of age.

The JiVitA-4 was conducted in a study area comprising 19 unions within the districts of Rangpur and Gaibandha, divided into 596 community clusters. The study area spans approximately 435 km$^2$, with a population of about 650,000 people$^{30}$. The majority of the population is Muslim, with a poor, agrarian economy$^{15,30}$. JiVitA-4 study design and protocol are described in detail as part of the primary treatment effects paper published previously$^{15}$. All data were collected as part of the parent trial over a number of visits from 6 to 24 months of age. Data collection methods used in the present analyses are described below.

**Data Collection**

**Socioeconomic Indicators**

Data on socioeconomic variables including parental age, occupation, education, household asset ownership (cattle, electricity, land, type of latrine used), household food insecurity, household size, child sex and child age were collected by trained project interviewers at the time of enrollment. An interview was administered to the primary caregiver who consented to participate in the study in the week of their child’s 6 month birthday. Caregiver perceptions of household food insecurity were assessed using a 9-item Food Access Survey Tool (FAST)$^{31}$.

**Feeding behaviors**
We developed an 11-item self-report questionnaire to assess responsive and non-responsive feeding behaviors. The questionnaire was based on theories of parenting and feeding, and adapted from the Child Feeding Questionnaire\textsuperscript{32}, Infant Feeding Styles Questionnaire\textsuperscript{33}, and the Toddler Feeding Behaviors Questionnaire\textsuperscript{34}. Each question could be answered on a 5-point Likert scale as follows: 0 (never), 1 (seldom), 2 (half the time), 3 (most of the time), and 4 (always). The initial questionnaire consisted of 53 items created to measure the 5 dimensions of parenting with respect to feeding behaviors (responsive, forceful, restrictive, indulgent, and uninvolved). Factor analysis done on the full dataset revealed 2 theoretically derived constructs of feeding: responsive/involved and forceful. The responsive/involved factor will be referred to as ‘responsive’ in the rest of the manuscript. The full development of the scale is described in Chapter 5. The final version of the Caregiver Feeding Behaviors Questionnaire was administered 2 weeks after the 24 month follow up interviews had begun, so interviews conducted before this time were dropped from the analysis.

Dietary diversity

Children’s dietary diversity was assessed by creating a 7-group DDS according to UNICEF guidelines\textsuperscript{35}. Diet data were collected using a semi-structured 24-hour dietary recall administered during the 24-month follow up interview, in which caregivers were asked, “In the past 24 hours, did your child eat [insert name of food]?” All foods reported on the 24-hour dietary recall, including “other” foods listed by participants, were categorized into the following food groups: 1) grains, 2) legumes, 3) dairy, 4) meat, 5) eggs, 6) vitamin-A rich fruits and vegetables, or 7) fruits and vegetables. If the child consumed more than one food item that fell within a certain group (e.g. rice and bread), they were only given one point for that group. The DDS was constructed by summing the total number of groups that were reportedly consumed by that child during the 24 hours.
previous to the interview. DDS was treated as a continuous variable, and was also
dichotomized to create a variable for Minimum Dietary Diversity (MDD). Children with a
DDS ≤ 3 did not meet MDD, and those with a DDS > 4 met MDD. An 8th group was
created, snacks/desserts, and examined separately from the DDS and MDD. Each of the
8 food groups was treated as a dichotomous variable, defined as either “ate” or “did not
eat”. Individual food group consumption was examined in relation to each exposure
(Figure 6.1).

Growth

Children’s anthropometric measures were taken during the 24-month follow-up
interview. Weight was measured using a Tanita scale (model BD585, Tanita Corporation
of America, Arlington Heights, IL, USA) and length was measured using a locally
manufactured length board standardized against the Shorrboard (Weight and Measure,
LLC, Olney, MD, USA). Weights and lengths were converted to z-scores using the WHO
child growth standards.

Statistical analyses

Descriptive statistics were used to explore the distribution, frequencies, means
and SD for study variables. Maternal and paternal education were categorized as no
education, Class 1-9, SSC (secondary school completion exam) passed, or 11 years
and above. Maternal and paternal occupations were categorized as no occupation, field
laborer (e.g. farmer, etc.), service worker (e.g. government worker), or other. SES
indicators were used to create a living standards index (LSI) that was categorized into
quartiles. Using the responses from the FAST tool, household food insecurity was
categorized into 3 groups to represent food secure (HFI= 9), food insecure (HFI= 10-15),
or severely food insecure (HFI>16). Household assets were dichotomized to reflect
“owns” or “does not own” (cattle, land, or electricity). Sanitation facilities were categorized as none/field/bush, open latrine, pit latrine, water sealed/slab, or flush toilet. Morbidity was defined by dichotomized variables of incidence of diarrhea, dysentery, pneumonia, or fever in the past week, as well as any morbidity in the past 3 months. A dichotomized variable was also created to determine whether or not a household had more than one child under the age of 5, in addition to the child enrolled in the trial. Stunting, wasting and underweight variables were created by dichotomizing LAZ, WLZ, and WAZ at a cutoff of -2 z-scores relative to their respective reference medians.

Responsive and forceful feeding variables were both dichotomized to reflect low and high feeding behaviors, with approximately 2/3 of the sample reporting optimal feeding behaviors for both constructs (high responsive [70%], low forceful [66%]). In addition, a 2x2 factorial variable was created using the dichotomized constructs to produce 4 categories: 1) high responsive and low forceful (responsive); 2) low responsive and high forceful (forceful); 3) high responsive and high forceful (high on both); and 4) low responsive and low forceful (uninvolved).

Associations between demographic characteristics with feeding behaviors and growth/dietary outcomes were explored using bivariate linear or logistic regression models. Characteristics that were statistically significantly associated with both the exposure and outcome were included in the final model as a means of controlling for potential confounding. These results are described in Chapter 5. Associations between dietary diversity and growth with feeding behaviors (4 combination categories of responsive and forceful feeding behaviors) were assessed using multivariable linear and logistic regression models with high responsive/low forceful as the reference category. For the continuous outcomes of DDS, WAZ, LAZ, and WLZ we used a linear regression model to compute the difference in the outcome indicators among mothers who use high
force as compared to those who use low force adjusted for confounding factors. For
dichotomous outcomes of MDD, consumption of individual food groups, stunting,
wasting, and underweight, logistic regression analyses were conducted to estimate odds
ratios (OR) (e.g. change in odds of meeting MDD among mothers who use high force as
compared to those who use low force) and 95% confidence intervals (CI). Effect
modification between feeding behavior and child sex were tested with the inclusion of an
interaction term. Estimates were adjusted for potential confounding variables including
maternal and paternal age, education, and occupation, child sex, child age, morbidity in
the last 3 months, morbidity in the past 7 days, living standards index (LSI), household
food insecurity (HFI), household assets (cattle, electricity, land, type of latrine),
household size, having another child under the age of 5, and forceful or responsive
feeding (forceful feeding included in models testing responsive feeding, and vice versa).
Confounding variables were selected based on the responsive feeding literature and on
responsive feeding theory, and were tested on whether they met the definition of a
confounder. Covariates that were significantly associated with both the exposure
(feeding behavior) and the outcome (diet or growth) at the 0.05 significance level were
retained in the model. All analyses were also adjusted for intervention status as well as
clustering at the sector level to account for the possibility that respondents living in the
same place could be responding to the CFBQ in more similar ways. Statistical
significance was set at p-value <0.05. Statistical analyses were conducted using Stata
14.0 (StataCorp, College Station, TX, USA).

**Ethical considerations**

All data collection instruments and procedures were approved by the Ethical
Review Committee (ERC) at icddr,b, Bangladesh and the Institutional Review Board
(IRB) of the Johns Hopkins Bloomberg School of Public Health, MD, USA. Written
parental consent was obtained at the time of enrolment; all participants were informed that their participation is voluntary, and were assured of the confidentiality of the data collected.

**Results**

The current study used diet data and growth outcomes of trial participants at the 24-month follow up. There were 5411 children in the original dataset, but only 4972 completed the 24 month follow up interview. Because the 13-item CFBQ was being field tested and was not administered until 2 weeks after the beginning of the 24-month interview, the 124 interviews completed without the CFBQ were dropped from the analysis. Of the remaining interviews, 2 interviews were incomplete and were dropped from the analysis. This left 4846 mother-child dyads who were included in the final analysis.

**Characteristics of Study Participants**

Parental, child and household characteristics of study participants are described in Table 6.1. Mean (SD) household size in this sample is 5 (1.9) members, with about a fifth of households that have more than one child under the age of 5. About a quarter of households were severely food insecure (28%), half of households owned cattle (53%), three fourths owned land (71%), about a third had electricity (31%), and around 83% had access to an improved sanitation facility. Mean (SD) maternal age in our sample was 24.2 (5.4) years, and mean (SD) paternal age was 31.1 (7.2) years. About three quarters of mothers has some education (76%), but only 11% were educated beyond high school. Most mothers had no occupation (88%), and the ones who did were service workers (11%). About a third of fathers had no education (37%), and 15% had at least a high
school education. Half of fathers were field laborers, while the other half were service workers.

Mean (SD) dietary diversity at 24 months was 3.7 (1.4) food groups consumed, and 58% met MDD. Dietary intake of the children at this age as reported on the 24-hr dietary recall are presented in Figure 6.1. Almost all the children were eating grains at this age (99%), and 71% were eating fruits and vegetables. Around 57% of children were eating some sort of meat, and around a third of children were eating legumes (36%), dairy (36%) or eggs (34%). Almost half of children were eating vitamin A-rich fruits and vegetables (48%). Around 80% of children were eating snacks/desserts.

Feeding behaviors and diet

About 70% of mothers reported high responsive feeding, and 34% of mothers reported high forceful feeding. After adjustment for a number of confounding variables, responsive feeding was positively associated with DDS (adjusted β: 0.11, 95% CI: 0.03, 0.19) and higher consumption of meat (adjusted OR: 1.15, 95% CI: 1.00, 1.32). Conversely, forceful feeding was negatively associated with DDS (adjusted β:-0.13, 95% CI: -0.21, -0.054), and reduced odds of meeting MDD (adjusted OR: 0.78, 95% CI: 0.68, 0.88) (Table 6.2). Forceful feeding was also associated with lower consumption of legumes, meat and vitamin A-rich fruits/vegetables (adjusted OR: 0.84, 95% CI: 0.73, 0.96; adjusted OR: 0.83, 95% CI: 0.73, 0.94; adjusted OR: 0.81, 95% CI: 0.72, 0.91, respectively) (Figure 6.1).

Using the combined 4 category variable for responsive and forceful feeding, 47% of mothers reported high responsive and low forceful behaviors (“responsive”), 10% of mothers reported low responsive and high forceful behaviors (“forceful”), 24% of mothers reported high on both responsive and forceful (“high on both”), and 19% of mothers
reported low responsive and low forceful ("uninvolved"). Adjusting for confounders, we found that as compared to children of mothers who reported optimal feeding, or "responsive" feeding, children of mothers who reported "forceful" feeding had lower DDS (adjusted β: -0.28, 95% CI: -0.41, -0.15), and were less likely to achieve MDD (adjusted OR: 0.64, 95% CI: 0.52, 0.79). In the same way, children of mothers who reported "high on both" were less likely to achieve MDD (adjusted OR: 0.83, 95% CI: 0.72, 0.97). These results are reported in Appendix A2.2.

The exploration of potential interaction effect of child sex and diet showed no evidence of an interaction in the relation between feeding behaviors and DDS, MDD or consumption of individual food groups by child sex (p>0.05) (data not shown).

**Feeding behaviors and growth**

In multivariable models, responsive feeding was not significantly associated with any differences in anthropometric measures (p>0.05) (Table 6.3 and 6.4). However, forceful feeding was negatively associated with WAZ (adjusted β: -0.16, 95% CI: -0.22, -0.11), WLZ (adjusted β: -0.20, 95% CI: -0.25, -0.14), and weight (adjusted β: -0.18, 95% CI: -0.24, -0.12). Children of mothers reporting high forceful feeding also had higher odds of being wasted (adjusted OR: 1.55, 95% CI: 1.33, 1.81) or underweight (adjusted OR: 1.38, 95% CI: 1.22, 1.56) (Table 6.4). No significant relationship was seen with stunting, LAZ, or change in length.

We found that as compared to children of mothers who reported optimal feeding (combination of high responsive and low forceful behaviors), children of mothers who were "forceful" had lower WAZ (adjusted β: -0.19, 95% CI: -0.28, -0.10), WLZ (adjusted β: -0.25, 95% CI: -0.34, -0.15), and weight (adjusted β: -0.20, 95% CI: -0.31, -0.10). They were also more likely to be wasted (adjusted OR: 1.63, 95% CI: 1.29, 2.05) and
underweight (adjusted OR: 1.39, 95% CI: 1.15, 1.69). In the same way, children of mothers who reported “high on both” had lower LAZ (adjusted β: -0.07, 95% CI: -0.14, -0.01), WAZ (adjusted β: -0.16, 95% CI: -0.23, -0.10), WLZ (adjusted β: -0.16, 95% CI: -0.23, -0.10), length (adjusted β: -0.24, 95% CI: -0.45, -0.03) and weight (adjusted β: -0.18, 95% CI: -0.25, -0.10). They were also more likely to be wasted (adjusted OR: 1.43, 95% CI: 1.18, 1.73) and underweight (adjusted OR: 1.36, 95% CI: 1.16, 1.59). Lastly, children of mothers who were “uninvolved” had lower LAZ (adjusted β: -0.09, 95% CI: -0.16, -0.01) and length (adjusted β: -0.30, 95% CI: -0.53, -0.07) and had a higher odds of being stunted (adjusted OR: 1.18, 95% CI: 1.01, 1.37) (Appendix A2.3 and A2.4).

Child sex was explored as an effect modifier with the inclusion of an interaction term. The exploration of potential interaction effect of child sex and growth showed no evidence of effect in the relation between feeding behaviors and LAZ, WAZ, WLZ, stunting, wasting, underweight, weight, or length (p>0.05) (data not shown).

Discussion

In rural northwestern Bangladesh, in a population where undernutrition is high, we found associations between caregiver feeding behaviors and child growth and dietary status at 24 months. Our findings demonstrate that responsive feeding is associated with better diet, and conversely, children of mothers employing forceful feeding behaviors have significantly poorer growth and dietary outcomes. In fact, the evidence for the negative effect is stronger than that of a positive effect. Children of mothers reporting high force had 38% greater odds of being underweight and 55% greater odds of wasting, as compared to those reporting low force. They also had lower DDS and an 18% reduced odds of meeting minimum dietary diversity. Qualitative work done in this population (see Chapter 4) showed that the way children are fed is driven by an
overarching concern among caregivers that their child is not eating enough, and different tactics as deemed necessary are employed to ensure intake. Given that this is cross-sectional data, the causality could go in either direction: thinner children are more likely to be forcefed, and forceful feeding could also lead to wasting. Previous studies have shown controlling feeding behaviors to be associated with lower acceptance of food\textsuperscript{37}, which could possibly contribute to lower intake and subsequently poorer growth. Conversely, responsive feeding behaviors have been associated with higher acceptance of food\textsuperscript{37}. Several attempts to promote responsive feeding have been incorporated within messages about providing more nutritious foods, but feeding behaviors were not assessed in these studies\textsuperscript{27,29,38}. More recently, mother who attended 6 behavior-change sessions in Bangladesh had children with greater weight gain; however, maternal responsiveness did not increase\textsuperscript{39}.

Combinations of responsive and forceful feeding behaviors allowed us to explore dimensions of feeding behaviors that incorporate both behaviors at once, since feeding behaviors are rarely mutually exclusive of each other. Particularly of interest, we would expect that children who are fed with both high responsive and high forceful feeding behaviors would perhaps show better growth and diet outcomes since their caregivers are employing a multi-faceted approach to feeding. Almost a quarter of mothers reported this modality; these are mothers who are employing all tactics they deem necessary to get their child to eat; for example, a mother who eats with her child and knows when and how much her child eats throughout the day (responsive feeding) and also feeds using threats or physical force (forceful feeding). However, we found that incorporating force, even in conjunction with responsive behaviors, was significantly related to lower LAZ, WAZ, WLZ, and DDS as well as greater odds of being underweight, wasted and not meeting minimum dietary diversity. Children of mothers reporting high force and low
responsive behaviors had children with 39% greater odds of being underweight and 63% greater odds of wasting. These findings highlight that integrating force during feeding, whether on its own or with responsive behaviors, is associated with poorer growth and dietary outcomes than employing only responsive behaviors.

We also found that children of uninvolved mothers (reporting low responsive and low force) had 18% greater odds of being stunted, compared to children of mothers reporting high responsive behaviors and low force. Although there is no literature looking at specific feeding behaviors and associations with growth outcomes, these findings are consistent with findings from previous studies that have shown positive associations between growth and responsive feeding in observational studies\textsuperscript{40–43} and in interventions\textsuperscript{27–29,38,39,44,45}. In a community-based responsive feeding program in rural Bangladesh in which responsive feeding messages were isolated in the analysis, Aboud et al. (2008) found a significantly higher weight, weight gain and child self-feeding in the intervention group\textsuperscript{39}. Another study found increased self-fed mouthfuls and increased number of responsive verbalizations among the responsive feeding intervention group, but no change in weight gain, which is likely due to the lack of change in types of foods and the already small quantities that children consume\textsuperscript{45}. However, in the studies with multiple messages or interventions the effect of responsive feeding was not isolated, so the effects on growth are not entirely reflective of a relationship with responsive feeding\textsuperscript{26}. Children require guidance when developing eating habits in early childhood, so chronic lack of attention during feeding for the first 2 years (uninvolved feeding) would explain the higher odds of stunting at 24 months.

Additionally, our results show that in this setting children of caregivers who are feeding with force are less likely to receive highly vitamin and nutrient- dense foods, which likely puts them at a higher risk for micronutrient deficiencies and protein-energy...
malnutrition. Incorporating force during feeding was associated with 29-32% lower odds of eating vitamin-A rich fruits and vegetables. Children of caregivers using uninvolved and forceful feeding behaviors were 16% and 22% less likely (respectively) to consume meat as compared to responsive feeding, while high responsive feeding was associated with 19% greater odds of eating meat, as compared to low responsive feeding. Only a handful of intervention studies have examined the influence of responsive feeding on child diet and/or nutrient intake\textsuperscript{27,29,43,46}; all reported positive findings between intervention and intake of key nutrients or complementary foods. An educational intervention by Bhandari et al. (2004) found significantly higher energy intakes from complementary foods in their intervention group at 9 months [mean (SD): 1556 (1109) vs. 1025 (866) kJ; p<0.001] and 18 months [mean (SD): 3807 (1527) vs. 2577 (1058) kJ; p<0.001]\textsuperscript{27}. Similarly, a cluster-randomized trial in Peru found that fewer children in the intervention group failed to meet dietary intake requirements for energy (8 months: 30 [18%] of 170 vs 45 [27%] of 167, p=0.04; 12 months: 64 [38%] of 168 vs 82 [49%] of 167, p=0.043), iron (8 months: 155 [91%] of 170 vs 161 [96%] of 167, 9 months: 152 [93%] of 163 vs 165 [99%] of 166, p=0.047), and zinc (9 months: 125 [77%] of 163 vs 145 [87%] of 166, p=0.012) as compared to the controls\textsuperscript{29}. However, the effects of the responsive feeding intervention were not isolated in these trials.

There are few studies that have explored feeding behaviors and their associations with growth and diet the way we have in our study. Those that have been conducted in similar settings have explored the relations between responsive feeding and growth, but have not isolated the effects of responsive feeding. Rather, responsive feeding messages have been incorporated with messages including nutrition education and/or food \textsuperscript{27–29,38,44}. Mixed results were seen in 2 studies that were designed to promote responsive feeding; one study found no significant differences between the
control and intervention group, while the other one found significantly increased weight gain in the intervention group compared to the control. The results of interventions designed to understand the influence of responsive feeding on dietary intake and nutrient intake all showed improved intakes of key nutrients or complementary foods, but again there was no focus on isolating the effects of responsive feeding.

One of the strengths of this study includes data from a large trial that was available for the analysis with appropriate dietary and anthropometric measurements as well as measures of numerous confounders and effect modifiers. Another strength is that the CFBQ was developed and validated in this population, so it is specific to this context. There are several questionnaires that assess child feeding behaviors and caregiver attitudes with regards to feeding in the context of overweight; however, to our knowledge this is the first that has been designed in the context of high undernutrition. The 11-item questionnaire was brief and easy to administer, increasing the ease and feasibility of assessing feeding behaviors in this setting.

Despite the strength of the associations we observed, a limitation is that the study has a cross-sectional design, so we are unable to determine temporality or directionality of the relationships examined. We were unable to distinguish whether the feeding behavior was causing a specific growth or dietary pattern, or if the specific growth or dietary pattern influenced the feeding behavior. More specific inferences could be made if the children were followed from infancy in a longitudinal study design and external factors that may influence caregiver behaviors were explored. A preferred approach might have been to assess feeding behaviors at each time point throughout the trial; or every 3 months between 6 to 18 months of age and then again at the 24 month follow-up. However, the scale was not developed until after the 18 months of intervention, so we were only able to use it at the 24 month follow-up interview.
Conclusions

Future work should include longitudinal studies beginning as early as 6 months of age and assessing caregiver feeding behaviors, growth and dietary outcomes in order to determine temporality. If found that feeding behaviors are driving changes in growth and diet, further research should include randomized controlled trials designed to isolate a responsive feeding intervention in populations where undernutrition is high. These RCTs should be coupled with direct observations to determine how the messages are being interpreted; as we learned in the development of the CFBQ, even after messages or concepts are tailored to address a certain context, they may not be interpreted as they are intended to be (see Chapter 5). Given the findings surrounding negative effects associated with forceful feeding, responsive feeding interventions should include messaging about feeding responsively (e.g. eat with your child, feed your child according to their cues of hunger and satiety, talk to your child about the food s/he is eating), and simultaneously deliver messages discouraging forceful or uninvolved feeding behaviors. However, we cannot focus on solely responsive feeding messaging unless the intervention is done in a very carefully controlled trial in which we make sure children aren’t losing weight. It is a possibility that the uptake of the messages will not show the effects that we intend them to; for example, if caregivers interpret responsive feeding to mean leaving their child alone or being less involved (in contrast to forceful feeding), the uninvolved behavior could result in subsequent weight loss. If in these populations a responsive feeding intervention is found to improve child nutritional status, recommendations can be made to incorporate context-specific responsive feeding interventions in populations where undernutrition is high.
References


12. Working Group on Infant and Young Child Feeding Indicators. Developing and validating simple indicators of dietary quality and energy intake of infants and young children in developing countries: summary of findings from analysis of 10 data sets. (Food and Nutrition Technical Assistance Project (FANTA), FHI 360, 2006).


Figure 6.1. Dietary intake in the past 24 hours by food group at 24 months in rural Bangladesh. Data based on a 24-hour dietary recall of a 24-month follow up interview of a randomized controlled food supplementation trial (n=4846)

Note: bars indicate the percentage of children consuming each food group at 24 months, as collected by the 24-hour dietary recall. The last bar indicates the percentage of children meeting MDD (DDS ≥4). The snacks/desserts group was not included in the DDS.

*Indicates groups in which intake differed significantly (p<0.05) by feeding behavior. After adjustment for a number of confounding variables, responsive feeding was associated with a higher consumption of meat (adjusted OR: 1.15, 95% CI: 1.00, 1.32). Conversely, forceful feeding was associated with lower consumption of legumes, meat and vitamin A-rich fruits/vegetables (adjusted OR: 0.84, 95% CI: 0.73, 0.96; adjusted OR: 0.83, 95% CI 0.73, 0.94; adjusted OR: 0.81, 95% CI: 0.72, 0.91, respectively)

Abbreviations: Vit A; Vitamin A; F/V; fruits and vegetables; MDD; minimum dietary diversity; DDS; dietary diversity score; OR: odds ratio.
Table 6.1. Baseline parental, child and household characteristics of enrolled children at 24 months (n=4846)

<table>
<thead>
<tr>
<th>Parental and household characteristics</th>
<th>Overall mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>Paternal age</td>
<td>31.1 (7.2)</td>
</tr>
<tr>
<td>Maternal age</td>
<td>24.2 (5.4)</td>
</tr>
<tr>
<td>Child age</td>
<td>24.1 (0.3)</td>
</tr>
<tr>
<td>Child sex, male</td>
<td>2424 (50)</td>
</tr>
<tr>
<td>Supplementation group</td>
<td></td>
</tr>
<tr>
<td>Plumpy doz</td>
<td>1324 (27.3)</td>
</tr>
<tr>
<td>CFC</td>
<td>1275 (26.3)</td>
</tr>
<tr>
<td>WSB++</td>
<td>764 (15.8)</td>
</tr>
<tr>
<td>Rice Lentil</td>
<td>746 (15.4)</td>
</tr>
<tr>
<td>Chickpea</td>
<td>737 (15.2)</td>
</tr>
<tr>
<td>Maternal education</td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>1140 (23.6)</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>3163 (65.4)</td>
</tr>
<tr>
<td>SSC passed</td>
<td>238 (4.9)</td>
</tr>
<tr>
<td>11 years and above</td>
<td>294 (6.1)</td>
</tr>
<tr>
<td>Paternal education</td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>1732 (36.8)</td>
</tr>
<tr>
<td>Class 1 to 9</td>
<td>2236 (47.5)</td>
</tr>
<tr>
<td>SSC passed</td>
<td>254 (5.4)</td>
</tr>
<tr>
<td>11 years and above</td>
<td>489 (10.4)</td>
</tr>
<tr>
<td>Maternal occupation</td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>4272 (88.4)</td>
</tr>
<tr>
<td>Field laborer</td>
<td>32 (0.7)</td>
</tr>
<tr>
<td>Service worker</td>
<td>520 (10.8)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (0.2)</td>
</tr>
<tr>
<td>Paternal occupation</td>
<td></td>
</tr>
<tr>
<td>No occupation</td>
<td>52 (1.1)</td>
</tr>
<tr>
<td>Field laborer</td>
<td>2331 (48.8)</td>
</tr>
<tr>
<td>Service worker</td>
<td>2368 (49.6)</td>
</tr>
<tr>
<td>Other</td>
<td>27 (0.6)</td>
</tr>
<tr>
<td>Household food insecurity (HFI)</td>
<td></td>
</tr>
<tr>
<td>HFI 9</td>
<td>5 (0.1)</td>
</tr>
<tr>
<td>HFI 10-15</td>
<td>3464 (71.6)</td>
</tr>
<tr>
<td>HFI &gt;=16</td>
<td>1372 (28.3)</td>
</tr>
<tr>
<td>Living Standards Index (LSI)</td>
<td></td>
</tr>
<tr>
<td>First quartile</td>
<td>1204 (24.9)</td>
</tr>
<tr>
<td>Second quartile</td>
<td>1214 (25.1)</td>
</tr>
<tr>
<td>Third quartile</td>
<td>1209 (25.0)</td>
</tr>
<tr>
<td>Fourth quartile</td>
<td>1214 (25.1)</td>
</tr>
<tr>
<td>Assets</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>2541 (52.5)</td>
</tr>
<tr>
<td>Any land</td>
<td>3429 (70.8)</td>
</tr>
<tr>
<td>Electricity</td>
<td>1515 (31.3)</td>
</tr>
<tr>
<td>Latrine</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>None/field/bush</td>
<td>836 (17.3)</td>
</tr>
<tr>
<td>Open latrine</td>
<td>48 (1.0)</td>
</tr>
<tr>
<td>Pit latrine</td>
<td>202 (4.2)</td>
</tr>
<tr>
<td>Water sealed/slab</td>
<td>3752 (77.5)</td>
</tr>
<tr>
<td>Flush toilet</td>
<td>3 (0.1)</td>
</tr>
</tbody>
</table>

| Household has at least 1 other child under age 5 | 1058 (21.8) |
Table 6.2. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and diet among children at 24 months of age

| Diet measures | High Responsive Feeding | | | High Forceful Feeding | | |
|--------------|------------------------|--|------------------------|--|------------------------|
| DDS, mean (SD) | 3.86 (1.35) |  | 3.76 (1.39) |  |
| Treatment effect $\beta$ (95%CI) | 0.17 (0.08, 0.25)** | 0.11 (0.03, 0.19)** | -0.07 (-0.16, 0.01) | -0.13 (-0.21, -0.05)** |
| MDD (DDS≥4), % | 59.8 |  | 55.8 |  |
| Odds ratio (95%CI) | 1.22 (1.08, 1.39)** | 1.14 (1.00, 1.30) | 0.86 (0.76, 0.97)* | 0.78 (0.68, 0.88)** |

[1] Univariate linear (DDS) and logistic (MDD) regression
[2] Multivariable linear regression for DDS, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[3] Multivariable logistic regression for MDD, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[4] Multivariable linear regression for DDS, adjusted for responsive feeding, maternal age, maternal education, child age, child sex, paternal occupation, fever in the last 3 months, morbidity in the past 7 days, living standards index, electricity, having another child under age 5, and supplementation group.
[5] Multivariable logistic regression for MDD, adjusted for responsive feeding, maternal education, child age, child sex, paternal occupation, fever in the last 3 months, morbidity in the past 7 days, living standards index, electricity, having another child under age 5, and supplementation group.

*p<0.05
Table 6.3. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and change in LAZ, WAZ, WLZ, length, weight among children at 24 months of age

<table>
<thead>
<tr>
<th>Growth measures</th>
<th>High Responsive Feeding</th>
<th></th>
<th></th>
<th></th>
<th>High Forceful Feeding</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LAZ, mean (SD)</td>
<td>-1.75 (0.94)</td>
<td></td>
<td></td>
<td></td>
<td>-1.78 (0.97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>0.07 (0.01, 0.13)*</td>
<td>0.04 (-0.12, 0.10)</td>
<td></td>
<td></td>
<td>-0.01 (-0.06, 0.05)</td>
<td>-0.04 (-0.10, 0.02)</td>
<td></td>
</tr>
<tr>
<td>WAZ, mean (SD)</td>
<td>-1.79 (0.94)</td>
<td></td>
<td></td>
<td></td>
<td>-1.89 (0.95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>0.05 (-0.01, 0.11)</td>
<td>0.03 (-0.03, 0.09)</td>
<td></td>
<td></td>
<td>-0.14 (-0.29, -0.08)*</td>
<td>-0.16 (-0.22, -0.11)*</td>
<td></td>
</tr>
<tr>
<td>WLZ, mean (SD)</td>
<td>-1.21 (0.93)</td>
<td></td>
<td></td>
<td></td>
<td>-1.34 (0.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>0.02 (-0.04, 0.08)</td>
<td>0.02 (-0.05, 0.08)</td>
<td></td>
<td></td>
<td>-0.20 (-0.25, -0.14)</td>
<td>-0.20 (-0.25, -0.14)*</td>
<td></td>
</tr>
<tr>
<td>Length cm/mo, mean (SD)</td>
<td>81.3 (3.05)</td>
<td></td>
<td></td>
<td></td>
<td>81.3 (3.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>0.26 (0.07, 0.45)*</td>
<td>0.15 (-0.03, 0.34)</td>
<td></td>
<td></td>
<td>0.11 (-0.08, 0.29)</td>
<td>-0.13 (-0.31, 0.06)</td>
<td></td>
</tr>
<tr>
<td>Weight kg/mo, mean (SD)</td>
<td>9.67 (1.11)</td>
<td></td>
<td></td>
<td></td>
<td>9.58 (1.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>0.07 (0.004, 0.14)*</td>
<td>0.04 (-0.03, 0.11)</td>
<td></td>
<td></td>
<td>-0.11 (-0.18, -0.04)*</td>
<td>-0.18 (-0.24, -0.12)*</td>
<td></td>
</tr>
</tbody>
</table>

[1] Univariate linear (LAZ, WAZ, WLZ, length, weight) regression
[3] Multivariable linear regression for WAZ, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[5] Multivariable linear regression for length, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[7] Multivariable linear regression for LAZ, adjusted for responsive feeding, maternal education, paternal occupation, child age, child sex, morbidity in the past 7 days, living standards index, electricity, having another child under age 5, and supplementation group.
[8] Multivariable linear regression for WAZ, adjusted for responsive feeding, maternal education, paternal occupation, child age, child sex, fever in the past 3 months, morbidity in the past 7 days, living standards index, electricity, having another child under age 5, and supplementation group.
[9] Multivariable linear regression for WLZ, adjusted for responsive feeding, maternal education, paternal occupation, child age, child sex, symptoms of respiratory illness in the past 3 months, fever in the past 3 months, morbidity in the past 7 days, living standards index, electricity, and supplementation group.

[10] Multivariable linear regression for length, adjusted for responsive feeding, maternal education, paternal occupation, child age, child sex, living standards index, electricity, having another child under age 5, and supplementation group.

[11] Multivariable linear regression for weight, adjusted for responsive feeding, maternal education, paternal occupation, child age, child sex, fever in the past 3 months, morbidity in the past 7 days, living standards index, electricity, having another child under age 5, and supplementation group.

*p<0.05
Table 6.4. Relationship between high responsive feeding (as compared to low responsive feeding) and high forceful feeding (as compared to low forceful feeding) and change in prevalence of stunting, wasting and underweight among children at 24 months of age

<table>
<thead>
<tr>
<th>Growth measures</th>
<th>High Responsive Feeding n=3339</th>
<th>High Forceful Feeding n=1608</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stunting (LAZ&lt;-2), %</td>
<td>39.1</td>
<td>40.0</td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>0.91 (0.80, 1.04)</td>
<td>0.93 (0.83, 1.05)</td>
</tr>
<tr>
<td>Underweight (WAZ&lt;-2), %</td>
<td>41.4</td>
<td>46.3</td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>0.96 (0.85, 1.09)</td>
<td>0.99 (0.87, 1.13)</td>
</tr>
<tr>
<td>Wasting (WLZ&lt;-2), %</td>
<td>19.2</td>
<td>24.0</td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>1.00 (0.86, 1.17)</td>
<td>1.02 (0.87, 1.19)</td>
</tr>
</tbody>
</table>

[1] Univariate logistic (stunting, underweight, wasting) regression
[2] Multivariable logistic regression for stunting, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[3] Multivariable logistic regression for underweight, adjusted for forceful feeding, maternal education, paternal education, child age, child sex, living standards index, type of latrine, and supplementation group.
[6] Multivariable logistic regression for underweight, adjusted for responsive feeding, maternal education, child age, child sex, fever in the past 3 months, living standards index, electricity, having another child under age 5, and supplementation group.
[7] Multivariable logistic regression for wasting, adjusted for responsive feeding, maternal education, child age, child sex, fever in the past 3 months, morbidity in the past 7 days, electricity, and supplementation group.

*p<0.05
Chapter 7. Conclusions

Stunting, defined as a height-for-age Z-score >-2, afflicts a large number of children worldwide, with the highest burden among the poorest households in low- and middle- income countries. The burden in Bangladesh is quite high, with 2014 estimates placing 36% of children as being stunted. Until recently, undernutrition in young children has focused primarily on foods and nutrients with attention on the quality, diversity and amount of food being offered to children. Increasingly, there is attention being paid to the role of caregiver feeding behaviors. Responsive feeding, or feeding the child based on the child’s cues of hunger and satiety, is one of the guiding principles of infant and young child feeding and has been associated with increased acceptance of food, which may improve dietary intake and eventually growth. Non-responsive feeding behaviors, characterized by a lack of developmentally appropriate/sensitive reciprocity between the caregiver and child, can be manifested through excessive caregiver control (forcing/pressuring or restricting food intake), excessive parental passivity or child control (indulgence), or caregiver disregard (uninvolved). Particularly in low income countries (LIC), where the burden of undernutrition is high, understanding caregiver feeding behaviors could help explain one part of the multi-factorial problem of poor nutritional status in young children.

We had a unique, time-sensitive opportunity to assess caregiver feeding behaviors in the context of a randomized controlled complementary food supplementation (CFS) trial in rural northwestern Bangladesh. The trial tested 4 CFSs against one control, with child feeding counseling provided to all groups from 6-18 months of age. The main study found a reduced rate of decline in LAZ over the
supplementation trial in 3 of the CFS groups (chickpea, rice-lentil, and Plumpy doz), and reduced prevalence of stunting in children receiving chickpea and Plumpy doz\(^8\).

The goal of this study was to understand the ways in which children in rural Gaibandha are fed and explore the relationship between these feeding behaviors and diet, and subsequently growth. We used qualitative research methods to explore what kind of behaviors there are in this environment and the factors contributing to them, and developed an 11-item scale to assess caregiver feeding behaviors. Using this scale, we assessed the relations between caregiver feeding behaviors and child diet and growth using diet and anthropometry data from the 24-month follow-up visit conducted 6 months after the end of the supplementation trial.

**Summary of findings**

In our qualitative study (Chapter 4), our primary finding was that caregivers in this environment feed children in a way that they think will increase intake, which was manifested mostly as forceful and indulgent feeding behaviors. This was fueled by the overarching concern that children are not eating enough. Caregivers either physically pressured or tricked their child into eating, or allowed them to eat whatever they want just so something would be going to their stomach. Caregivers repeatedly mentioned using physical and verbal force, distractions, or tricking the child to get them to eat, stating that the child would not eat any other way. There was widespread knowledge and concern regarding types of complementary foods that should be fed to children, hygiene practices (e.g. hand-washing), and care practices for ill children (e.g. taking them to the doctor, breastfeeding). However, time and financial constraints were mentioned as barriers to feeding children the way caregivers believed to be best practice. In the context of high food insecurity, caregivers still felt the need to provide storebought foods
by taking loans or buying on credit if the child wanted them, again driven by the desire to increase their child’s food intake. Although there were concerns about the nutritional and hygienic quality of storebought foods, caregivers still felt compelled to feed them if their child refused to eat home-cooked foods. Caregivers in this study endorsed autonomy in self-feeding, but did not always allow it due to time or financial restrictions. While active feeding behaviors were common, caregivers rarely offered positive verbal encouragement. However, involvement in child feeding was widespread and most feeding behaviors were driven by a desire to feed in a way that was thought to be best for the child.

We used our qualitative research findings to inform the next step, in which we developed a scale to assess and quantify caregiver feeding behaviors among mothers of children enrolled in the JiVitA-4 trial (Chapter 5). The Caregiver Feeding Behaviors Questionnaire (CFBQ) is an 11-item context-specific scale that we adapted from existing scales measuring dimensions of feeding behaviors in high resource settings. The questions were translated to Bangla, the local language, and pilot tested. Feedback from the mothers and the data collectors were taken into account for the following iteration of the CFBQ until the remaining 13 items were administered as part of the 24-month follow-up visit that was conducted 6 months after the last supplementation visit of the trial.

Factor analysis on the 13-item scale revealed 3 theoretically-derived constructs of feeding: responsive/involved (referred to as responsive from here on), forceful feeding and indulgent feeding (n=2 items). However, only responsive and forceful feeding were used in our further analysis, since the indulgent factor had so few items, leaving an 11-item instrument that could assess two feeding behaviors. Each factor was dichotomized, with about 70% of mothers reporting high responsive feeding, and about a third reporting high forceful feeding. Convergent validity of the scale was assessed by running
univariate analyses on our data and determining whether the emergent constructs of feeding matched with what is expected based on the literature (e.g. is higher responsive feeding behaviors associated with higher parental education).

The CFBQ data was used with the anthropometric and dietary recall data from the 24-month follow up interview to assess how caregiver feeding behaviors were related to diet and growth at 24 months in 4846 mother-child dyads (Chapter 6). In multivariable analysis, after adjusting for a number of confounders, high responsive feeding behaviors were related to a higher dietary diversity score (DDS, adjusted β: 0.11, 95% CI: 0.03, 0.19, as well as higher consumption of meat (adjusted OR: 1.15, 95% CI: 1.00, 1.32) as compared to low responsive feeding behaviors. Conversely, high forceful feeding behaviors were negatively associated with DDS (adjusted β:-0.13, 95% CI: -0.21, -0.05) and reduced odds of meeting MDD (adjusted OR: 0.78, 95% CI: 0.68, 0.88), as compared to low forceful feeding behaviors. Forceful feeding was also associated with lower consumption of legumes, meat and vitamin A-rich fruits/vegetables (adjusted OR: 0.84, 95% CI: 0.73, 0.96; adjusted OR: 0.83, 95% CI 0.73, 0.94; adjusted OR: 0.81, 95% CI: 0.72, 0.91, respectively).

Responsive/involved feeding was not significantly associated with any differences in anthropometric measures (p>0.05). However, forceful feeding was negatively associated with WAZ (adjusted β: -0.16, 95% CI: -0.22, -0.11), WLZ (adjusted β: -0.20, 95% CI: -0.25, -0.14), and weight (adjusted β: -0.18, 95% CI: -0.24, -0.12). Children of mothers reporting high forceful feeding also had a higher odds of being wasted (adjusted OR: 1.55, 95% CI: 1.33, 1.81) or underweight (adjusted OR: 1.38, 95% CI: 1.22, 1.56) (Table 6.3). No significant relationship was seen with stunting, LAZ, or change in length.
Strengths and limitations

A strength of this research was the use of mixed-methods to get a full picture of caregiver feeding behaviors in relation to child diet and growth in this Bangladeshi context. Beginning with our qualitative research, the broadness of our scope allowed to us to inductively explore feeding in this setting, rather than narrowing our research question to focus on a specific aspect of feeding behaviors. As such, our findings reflect the range of ways in which children are fed in this region, as well as the range of factors that contribute to them. We were able to triangulate our findings through the use of multiple research methods (IDIs, FGDs and in-home observations) in order to draw conclusions about feeding behaviors and contributing factors in this setting. In particular, the use of video observations was a strength of our study. Observation data on feeding behaviors provides useful information on actual behaviors and enhances the caregiver’s assessment of what occurs during feeding episodes. Caregiver behaviors during the meal are also likely to be influenced by the child’s behavior, which contributes to better capturing the actual dynamics of the feeding interaction. Using video observations rather than direct observations allows the convenience of analyzing behaviors afterwards, so the episode can be rewatched and even coded differently if the researchers decide to look at different things at a later time.

We developed a context-specific tool that allowed us to assess self-reported feeding behaviors, and our qualitative work helped us understand the context behind the associations between feeding behaviors and diet and growth. We were able to nest the study within a larger trial, providing us with a culturally embedded infrastructure and large database with which we could supplement our analyses. The 11-item questionnaire we developed was tailored to the context and was brief and easy to
administer, making it a feasible tool for assessing feeding behaviors in similar environments. At present, the CFBQ is the only feeding behaviors questionnaire that has been adapted for this setting, and can be applied to assess feeding behaviors in areas where child undernutrition is high.

Our study is not without some limitations. Although we did explore the perspectives of multiple caregivers, we could have benefited from more IDIs and FGDs with fathers. We could also have learned more from conducting more in-home observations of feeding episodes; particularly if they were conducted with the same mothers we had conducted in-depth interviews with in order to get a more specific triangulation of the data. With observations, there is always a possibility of social desirability bias. However, due to the non-controversial nature of the topic being studied, we expect that caregivers were feeding their children in the videos as they normally would, performing what they thought to be best practice. This actually gave us a clearer idea of what mothers consider to be ideal feeding, adding to the data we gathered from the IDIs and FGDs.

Our questionnaire has some limitations. Due to being administered as a module within a larger interview, items from the original questionnaire were reduced in order to reduce participant burden. The questionnaire could also have been validated against direct observations so we would have a better idea of how the questions were being interpreted by the respondents.

Lastly, our multivariable analysis is cross-sectional, so although we found associations between caregiver feeding behaviors and diet and growth, we cannot draw conclusions about the directionality of these associations. A preferred approach might have been to assess feeding behaviors at eat time point throughout the trial; or every 3
months between 6 to 18 months of age and then again at the 24 month follow-up. However, the scale was not developed until after the 18 months of intervention, so we were only able to use it at the 24 month follow-up interview.

Implications

The current evidence for responsive feeding on child growth is promising, but lacking in interventions that can isolate the impact of responsive feeding. Our findings support the need for further longitudinal and observational studies, both to understand the development and directionality of relationships between feeding behaviors and nutritional outcomes (see Chapter 6), as well as direct observations to assess the concordance between self-report feeding behaviors and actual feeding behaviors. The CFBQ can be adapted for similar settings with high undernutrition and used to assess relationships between feeding behaviors and child growth. Future work should include longitudinal studies beginning as early as 6 months of age and assessing caregiver feeding behaviors, growth and dietary outcomes in order to determine temporality. If found that feeding behaviors are driving changes in growth and diet, further research should include randomized controlled trials designed to isolate a responsive feeding intervention in populations where undernutrition is high. These RCTs should be coupled with direct observations to determine how the messages are being interpreted; as we learned in the development of the CFBQ, even after messages or concepts are tailored to address a certain context, they may not be interpreted as they are intended to be (see Chapter 5).

To our knowledge, the CFBQ is the only existing scale used to assess feeding behaviors in low-resource settings. Other existing scales (e.g. Child Feeding Questionnaire, Infant Feeding Styles Questionnaire, Toddler Feeding Behavior Questionnaire) have been used primarily in the United States and other high-resource
countries, among populations of children with higher rates of risk for overweight and/or obesity. In these contexts, the feeding constructs of restriction and indulgence exist alongside responsive and forceful/pressuring. The majority of these studies report significant associations between parental feeding control and child weight status; parental pressure during feeding was associated with lower BMI/weight gain\textsuperscript{11,15–19}, and restriction was related to higher BMI and/or overweight/obesity\textsuperscript{20–25}. However, similar to our study, the cross-sectional nature of these studies makes it difficult to determine the direction of the association\textsuperscript{26}.

Given the findings surrounding negative effects associated with forceful feeding in our study, responsive feeding interventions should include messaging about feeding responsively (e.g. eat with your child, feed your child according to their cues of hunger and satiety, talk to your child about the food s/he is eating), and simultaneously deliver messages discouraging forceful or uninvolved feeding behaviors. However, we cannot focus on solely responsive feeding messaging unless the intervention is done in a very carefully controlled trial in which we make sure children aren’t losing weight. It is a possibility that the uptake of the messages will not show the effects that we intend them to; for example, if caregivers interpret responsive feeding to mean leaving their child alone or being less involved (in contrast to forceful feeding), the uninvolved behavior could result in subsequent weight loss. If in these populations a responsive feeding intervention is found to improve child nutritional status, recommendations can be made to incorporate context-specific responsive feeding interventions in populations where undernutrition is high.
References


Appendix 1: Data collection forms

Appendix A1.1. In-depth interview field guide

Appendix A1.2. Focus group discussion field guide

Appendix A1.3. In-depth interview consent form

Appendix A1.4. Focus group discussion consent form

Appendix A1.5. In-home observation consent form

Appendix A1.6. Responsive feeding codebook

Appendix A1.7. Caregiver Feeding Behaviors Questionnaire

Appendix A1.8. Child 24-month interview form (C24MOI)
Appendix A1.1 Final in-depth interview field guide

I. Can you tell me about your community?
   - What do the people do?
   - What kinds of things are there in the village?
   - What kind of crops do they have?

II. Okay, now tell me a bit about your family.

III. Great, now can you tell me about your child [insert name]?

If participant mentions food/feeding, probe on the following:

1. Tell me about your child's feeding episodes throughout the day.
   (main meals and snacks)
   i. Morning/afternoon/night meals
   ii. Details about snacks
      o What do you do while the child is eating?
      o Where, how, in what position does the child typically eat?
      o Advice
      oProbe on mother-child interactions:
        ▪ When child is hungry
        ▪ When child wants to eat more
        ▪ When the child is full
        ▪ Encouraging child to eat
        ▪ When child doesn't want to eat very much
   iii. Probe on self-feeding

IV. Can you tell me about some things that make feeding your child harder for you?
Can you tell me about some things that make feeding your child easier for you?
   - Probe: time constraints, appetite, temperament, assistance/lack thereof from family members, illness, etc.

V. What is the best way to feed children? Why do you think this?
**Story**

There is an 18 month old child who lives next door to me. His name is Mamun. His mother always feeds him. He has a red bowl. His mother always fills the red bowl with rice and sits down to feed him. Sometimes Mamun eats half the bowl of rice and doesn’t want to eat anymore. Then his mom squeezes his cheeks to hold his mouth open and puts rice in his mouth. Then, Mamun sometimes spits the food in his mouth out. Then his mom puts food in his mouth again. Mamun's mom continues to feed him this way until the bowl is empty.

What do you think about this story?

- From what you’ve seen, what are some different ways children can be fed?
- What do you think about these ways?

**Story**

There is a 20 month old child named Shumi. She enjoys eating store-bought foods like chips, cake, etc. more than home-cooked foods. Her mother gives her rice 3 times a day, but Shumi doesn't want to eat it. Rather, she wants to eat store-bought food. Her mother always tells Shumi's father to bring outside food for her. Aside from this, when the snack food vendor comes, her mother buys her food from there.

What do you think of this story?

**VI. Probe on mention of multiple caregivers (for example):**

- Who typically takes cares of your child?
- Do others ever feed your child?
- What does the child do when other kids or people are around during feeding episodes?
- When does the child eat when you have to go out? How does s/he eat?

**Sample questions from feeding questionnaire**

*Explain: Please answer the following questions with never (0), seldom (1), half the time (2), most of the time (3), or always (4). If you do not understand the question, please let me know so I can clarify.*

**Responsive**

1. How often do you talk to your toddler during meals?
2. How often do you eat with your toddler (from the same plate or different plate)?
3. How often do you encourage your toddler to try a new food?
Pick one or two questions they endorse or do not endorse and ask: Why or why not?

**Forceful**

1. How often do you yell or threaten your toddler to be sure he/she eats enough?
2. How often do you physically struggle with your toddler to get him/her to eat?
3. How often do you force your toddler to eat?

Pick one or two questions they endorse or do not endorse and ask: Why or why not?

**Indulgent**

1. If your toddler does not like what is being served, how often do you immediately give him/her something else?

Pick one or two questions they endorse or do not endorse and ask: Why or why not?

**Uninvolved**

1. How often do you know what your toddler eats throughout the day?
2. How often do you know when your toddler is eating?

Pick one or two questions they endorse or do not endorse and ask: Why or why not?

Is there anything else you'd like to share?

That is the end of our interview today. Thank you so much for your time. Do you have any questions for me? [Answer any questions.] If you have any additional thoughts or questions, feel free to contact me.
Appendix A1.2. Final focus group discussion field guide

INTRODUCTION

1. Tell the respondents why they were chosen for this FGD.
2. Introduce yourself as an outsider.
3. Tell the respondent what you want to hear: a discussion between all of them about child feeding practices in their area. We want to hear areas of agreement and disagreement.
4. Tell the respondent you are there to listen to what she has to say.
5. Let respondent know you will be taking brief notes.

RULES

1. One person speak at a time.
2. No side conversations
3. Turn off mobile phones

PARTICIPANT INTRODUCTION

My name is __________ and I will be moderating the discussion today. This is __________, she will be taking some notes on our discussion.

Just to get started, let's go around the circle and share our names and a bit about our families.

ICEBREAKER (~5 minutes)

Let's start with a general question. Why don't you tell me about your community?

FEEDING BEHAVIORS IN THIS AREA (~15 minutes)

Can you tell me how children in this area are fed?

Story

There is an 18 month old child who lives next door to me. His name is Mamun. His mother always feeds him. He has a red bowl. His mother always fills the red bowl with rice and sits down to feed him. Sometimes Mamun eats half the bowl of rice and doesn't want to eat anymore. Then his mom squeezes his cheeks to hold his mouth open and puts rice in his mouth. Then, Mamun sometimes spits the food in his mouth out. Then his mom puts food in his mouth again. Mamun's mom continues to feed him this way until the bowl is empty.

What do you think about this story?
BARRIERS AND FACILITATORS TO FEEDING (~10 minutes)

What are some of the things that influence how you feed your children?
- Probe on barriers (time constraint, money, season, lack of knowledge, illness)
- Probe on facilitators (family, temperament, appetite)

SELF-FEEDING (~10 minutes)

Could you talk a little bit about when it is an appropriate time for children to start feeding themselves?
- Some things we've heard in interviews from mothers is that children should start feeding themselves before 2 years of age, whereas other mothers say they should start feeding themselves after 2 years. To what extent do you agree or disagree with these opinions?

CRYING/WHINING (~10 minutes)

Now let's talk about when your child is upset. What kind of things do caregivers do to get their child to stop crying/fussing?
- Probe on indulgent behaviors (giving biscuits/something else to relieve crying)
- Probe on forceful behaviors (force feeding, getting upset if child doesn't want to eat)
- Probe on breastfeeding

Let's imagine that your child isn't accepting very much food, what happens?
- Probe on pressuring to eat; not concerned (does nothing); talking with others, trying later, giving something else to eat

Story

There is a 20 month old child named Shumi. She enjoys eating store-bought foods like chips, cake, etc. more than home-cooked foods. Her mother gives her rice 3 times a day, but Shumi doesn't want to eat it. Rather, she wants to eat store-bought food. Her mother always tells Shumi's father to bring outside food for her. Aside from this, when the snack food vendor comes, her mother buys her food from there.

What do you think of this story?

LEARNING HOW TO FEED CHILDREN (~10 minutes)
I've heard a lot of interesting things here today and it’s clear that you're all very knowledgeable about how to feed young children. Now I would like to know where a mother in this community gets that knowledge about infant and young child feeding.

Thank you for all your input today. We're about to finish up. Is there any additional information or comments anyone would like to share about our discussion today
Introduction
Assalamu alaikum. I am a worker of the JiVitA Project, being implemented by Johns Hopkins University (USA, PI: Parul Christian). I am visiting you to learn and understand from your practices for feeding children in your community in order to come up with ways to improve child health and nutrition.

Purpose
We want to learn about how your children/grandchildren are fed, what they eat, and their meal time conditions and behaviors in this community. You have a child/grandchild between 15-24 months of age so we would like to include you in our study.

Procedures
We will ask you to discuss and give us your opinions about how your children/grandchildren are fed, their diet, and meal time conditions and behaviors. The interview will take about 1.5 to 2 hours of your time. We will tape record your answers if you agree. You do not have to answer all the questions and you can stop me at any time.

Risks/Discomforts
There is no risk to you in participating in this study. Your participation will require up to 2 hours of your time.

Benefits
There is no direct benefit to participating in this study. However, information gathered in this study will be applied to improve feeding practices and the overall health of children in the future.

Oral consent script 1_Minimal Risk_non US_17Nov2011
Confidentiality
We will keep all information collected from you/your child confidential, locked in a secure place under the responsibility of the principal investigators from JHU and icddr,b. No one other than this group of investigators, and regulatory authorities would have access to such information. Your child’s name and identity will not be disclosed while analyzing or publishing the results of this study. Any future use of the information will also be done maintaining confidentiality.

Payment
No money will be provided for your time. We will only do the interview at a convenient time for you. We will provide a small gift to your family for taking part in this research.

Voluntary Participation
You do not have to agree to be in this study, and you may change your mind at any time. If you have any questions or problems about the study, I can answer them now or you may contact our area coordinator (mention area coordinator’s name) in the local field office. For questions about your rights as human subjects in this project you may contact Dr. Hasmot Ali, senior project officers, through the Gaibandha JiVItA office (tel: 0541-61283) or contact Mr. Salam Khan at the local IRB office in Dhaka (tel: +880-2-8860523-32, extension 3206).

Permission to Proceed
Are you willing to participate in the group discussion? If you agree, please put your signature or your left thumb impression below.

Thank you for your cooperation.

__________________________________________  _______________________
Signature or Mark of Participant                  Date

__________________________________________  _______________________
Signature of Person Obtaining Consent            Date

Oral consent script 1_Minimal Risk_non US_17Nov2011
The JiVitA-4 Project
and
Johns Hopkins Bloomberg School of Public Health, Baltimore, USA

Responsive Feeding Formative Research – Focus Group Discussion
(Completed by Data Collector)

Study Title: Evaluation of Complementary Food Supplements For Reducing Childhood Undernutrition

Principal Investigator: Parul Christian (JHU), Tahmeed Ahmed (ICDDR,B)
IRB#: 00003703
Version Date: v1, Jan 5, 2014

Introduction
Assalamu alaikum. I am a worker of the JiVitA Project, being implemented by Johns Hopkins University (USA, PI: Parul Christian). I am visiting you to learn and understand from your practices for feeding children in your community in order to come up with ways to improve child health and nutrition.

Purpose
We want to learn about how your children/grandchildren are fed, what they eat, and their meal time conditions and behaviors in this community. You have a child/grandchild between 15-24 months of age so we would like to include you in our study.

Procedures
We will ask you to sit with a group of people and discuss and give us your opinions about how your children/grandchildren are fed, their diet, and meal time conditions and behaviors. The discussion will take about 1.5 to 2 hours of your time. We will tape record your answers if you agree. You do not have to answer all the questions and you can stop me at any time.

Risks/Discomforts
There is no risk to you in participating in this study. Your participation will require up to 2 hours of your time.

Benefits
There is no direct benefit to participating in this study. However, information gathered in this study will be applied to improve feeding practices and the overall health of children in the future.

*Oral consent script 1_Minimal Risk_non US_17Nov2011*

196
Confidentiality
We will keep all information collected from you or your child confidential, locked in a secure place under the responsibility of the principal investigators from JHU and icddr,b. No one other than this group of investigators, and regulatory authorities would have access to such information. Your child’s name and identity will not be disclosed while analyzing or publishing the results of this study. Any future use of the information will also be done maintaining confidentiality.

Payment
No money will be provided for your time. We will only do the interview at a convenient time for you. We will provide a small gift to your family for taking part in this research.

Voluntary Participation
You do not have to agree to be in this study, and you may change your mind at any time. If you have any questions or problems about the study, I can answer them now or you may contact our area coordinator (mention area coordinator’s name) in the local field office. For questions about your rights as human subjects in this project you may contact Dr. Hasmot Ali, senior project officers, through the Gaibandha JIVIA office (tel: 0541-61283) or contact Mr. Salam Khan at the local IRB office in Dhaka (tel: +880-2-8860523-32, extension 3206).

Permission to Proceed
Are you willing to participate in the group discussion?
If you agree, please put your signature or your left thumb impression below.

Thank you for your cooperation.

________________________________________  _______________________
Signature or Mark of Participant  Date

________________________________________  _______________________
Signature of Person Obtaining Consent  Date

*Oral consent script 1_Minimal Risk_non US_17Nov2011*
The JivitA-4 Project and
Johns Hopkins Bloomberg School of Public Health, Baltimore, USA

Responsive Feeding Formative Research – In Home Observations
(Completed by Data Collector)

Study Title: Evaluation of Complementary Food Supplements For Reducing Childhood Undernutrition

Principal Investigator: Parul Christian (JHU), Tahmeed Ahmed (ICDDR,B)
IRB#: 00003703
Version Date: v1, Jan 5, 2014

Introduction
Assalamu alaikum. I am a worker of the JivitA Project, being implemented by Johns Hopkins University (USA, PI: Parul Christian). I am visiting you to learn and understand from your practices for feeding children in your community in order to come up with ways to improve child health and nutrition.

Purpose
We want to learn about how your children/grandchildren are fed, what they eat, and their meal time conditions and behaviors in this community. You have a child/grandchild between 15-24 months of age so we would like to include you in our study.

Procedures
I will spend up to 2 hours with you and observe while you prepare meals and feed your child. I may also record a video of the duration of your child’s mealtime (20-30 minutes) and leave your home while you feed your child. I will not interact with you or your family during this time. During this time, you would feed your child as you normally would, and let me know when the meal is over. Later, we will watch the video in order to observe the feeding of your child. You may ask to stop the recording at any time. You can also ask us to erase any part that you did not want recorded.

Risks/Discomforts
There is no risk to you in participating in this study. Your participation will require up to 2 hours of your time.

Benefits
There is no direct benefit to participating in this study. However, information gathered in this study will be applied to improve feeding practices and the overall health of children in the future.

Oral consent script 1_Minimal Risk_non US_17Nov2011

198
Confidentiality
We will keep all information collected from you/your child confidential, locked in a secure place under the responsibility of the principal investigators from JHU and icddr,b. No one other than this group of investigators, and regulatory authorities would have access to such information. Your child’s name and identity will not be disclosed while analyzing or publishing the results of this study. Any future use of the information will also be done maintaining confidentiality.

Payment
No money will be provided for your time. We will only do the interview at a convenient time for you. We will provide a small gift to your family for taking part in this research.

Voluntary Participation
You do not have to agree to be in this study, and you may change your mind at any time. If you have any questions or problems about the study, I can answer them now or you may contact our area coordinator (mention area coordinator’s name) in the local field office. For questions about your rights as human subjects in this project you may contact Dr. Hasmot Ali, senior project officers, through the Gaibandha Jivita office (tel: 0541-61283) or contact Mr. Salam Khan at the local IRB office in Dhaka (tel: +880-2-8860523-32, extension 3206).

Permission to Proceed
Do we have permission to observe you and your child and do the video recording?

If you agree, please put your signature or your left thumb impression below.

Thank you for your cooperation.

______________________________  ____________________
Signature or Mark of Participant  Date

______________________________  ____________________
Signature of Person Obtaining Consent  Date
**Appendix A1.6. Responsive feeding codebook**

<table>
<thead>
<tr>
<th>No.</th>
<th>Mnemonic Code</th>
<th>Full description of code</th>
<th>When to use and when not to use the code. Examples of use of the code to assist coders.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.0 RESP</td>
<td><strong>Endorsing Responsive Feeding Behaviors</strong></td>
<td>Use 1.0 RESP for grouping codes according to parameters listed under 1.1-1.xx.</td>
</tr>
<tr>
<td>2.</td>
<td>1.1 RESP.ENC</td>
<td>Description of encouraging the child to accept food.</td>
<td>Use this code for statements where participant describes any form of encouraging the child to accept food.</td>
</tr>
<tr>
<td>3.</td>
<td>1.2 RESP.TALK</td>
<td>Description of talking to the child during the feeding episode.</td>
<td>Use this code for statements where participant describes talking to the child while they are feeding them, either about the food or otherwise.</td>
</tr>
<tr>
<td>4.</td>
<td>1.3 RESP. STRUC</td>
<td>Description of any specific feeding schedule or times.</td>
<td>Use this code for statements where participant describes having specific feeding times or a feeding schedule that they follow.</td>
</tr>
<tr>
<td>5.</td>
<td>1.4 RESP. HYG</td>
<td>Description of hygiene practices.</td>
<td>Use this code for statements where participant describes hygiene practices performed before or after feeding.</td>
</tr>
<tr>
<td>6.</td>
<td>1.5 RESP. OTHER</td>
<td>Description or endorsement of any other responsive behaviors</td>
<td>Use this code for statements where participant describes or endorses any other responsive feeding behaviors; or expresses attitudes against non-responsive behaviors.</td>
</tr>
<tr>
<td></td>
<td>2.0 IND</td>
<td>Endorsing Indulgent Feeding Behaviors</td>
<td>Use 2.0 IND for grouping codes according to parameters listed under 2.1-2.xx.</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6.</td>
<td>2.1 IND.BISC</td>
<td>Description of indulgent behaviors surrounding giving biscuits to the child.</td>
<td>Use this code for statements where participant describes giving the child a biscuit. e.g. giving a biscuit to keep the child busy, to calm the child, to curb their hunger, etc.</td>
</tr>
<tr>
<td>7.</td>
<td>2.2 IND.MANAGE</td>
<td>Description of controlling the child with food.</td>
<td>Use this code for statements where participant describes using food to manage the child's behavior. e.g. giving the child a sweet to stop them from crying.</td>
</tr>
<tr>
<td>8.</td>
<td>2.3 IND.REWARD</td>
<td>Description of rewarding the child with food.</td>
<td>Use this code for statements where participant describes using food to reward the child for their behavior. e.g. &quot;If you eat your dinner, I will give you candy&quot;</td>
</tr>
<tr>
<td>9.</td>
<td>2.4 IND. BEG</td>
<td>Description of begging or pleading with the child to get them to accept food.</td>
<td>Use this code for statements where participant describes begging or pleading with the child to get them to accept food.</td>
</tr>
<tr>
<td>10.</td>
<td>2.5 IND. FOOD</td>
<td>Description of immediately giving child another food when they do not want to eat what they are given.</td>
<td>Use this code for statements where participant describes immediately giving the child something else to eat if they do not want to eat what they are given. This includes immediately making something else, or bringing something from elsewhere (a store or neighbor, etc.) to feed the child.</td>
</tr>
<tr>
<td>11.</td>
<td>2.6 IND.OTHER</td>
<td>Description of any other indulgent behaviors.</td>
<td>Use this code for statements where participant describes or endorses any other indulgent feeding behaviors.</td>
</tr>
<tr>
<td>12.</td>
<td>3.1 FORCE PHYS</td>
<td>Description or endorsement of physically forcing the child to eat.</td>
<td>Use this code for statements where participant describes or endorses physically forcing the child to eat. e.g. holding the child's mouth open and putting food in their mouth against their will.</td>
</tr>
<tr>
<td>13.</td>
<td>3.2 FORCE YELL</td>
<td>Description or endorsement of yelling at or threatening the child to get him/her to eat.</td>
<td>Use this code for statements where participant describes or endorses yelling at, chastising, or threatening the child to get him or her to accept food. e.g. &quot;If you don't eat, the dogs will come and catch you&quot;.</td>
</tr>
<tr>
<td>14.</td>
<td>3.3 FORCE HIT</td>
<td>Description or endorsement of using physical force to punish the child for not eating.</td>
<td>Use this code for statements where participant describes or endorses using physical force to punish the child for not accepting food. e.g. hitting or slapping the child if they are not eating properly.</td>
</tr>
<tr>
<td>15.</td>
<td>3.4 FORCE REAS</td>
<td>Description of reasons why force-feeding occurs.</td>
<td>Use this code for statements where participant describes reasons why children are force-fed, or why force-feeding occurs. e.g. force-feeding because the child is sick and isn't eating regularly.</td>
</tr>
<tr>
<td>16.</td>
<td>3.5 FORCE DIST</td>
<td>Description or endorsement of distracting the child in order to get them to accept food.</td>
<td>Use this code for statements where participant describes or endorses distracting the child in order to get them to accept food or to open their mouth so the caregiver can put food inside.</td>
</tr>
<tr>
<td>17.</td>
<td>3.6 FORCE OTHER</td>
<td>Description or endorsement of any other forceful feeding behaviors.</td>
<td>Use this code for statements where participant describes or endorses any other forceful feeding behaviors.</td>
</tr>
<tr>
<td></td>
<td>4.0 UNINV</td>
<td>Endorsing Uninvolved Feeding Behaviors</td>
<td>Use 4.0 UNINV for grouping codes according to parameters listed under 4.1-4.xx.</td>
</tr>
<tr>
<td>---</td>
<td>-----------</td>
<td>---------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>18.</td>
<td>4.1 UNINV.BEHAV</td>
<td>Description or endorsement of uninvolved feeding behaviors.</td>
<td>Use this code for statements where participant describes any uninvolved feeding behaviors e.g. participant doesn't know what or how many times child eats throughout the day</td>
</tr>
<tr>
<td>19.</td>
<td>4.2 UNINV.SELF</td>
<td>Description of the child eating on his/her own, in the absence of the primary caregiver.</td>
<td>Use this code for any description of the child eating on their own, without any supervision of any caregivers.</td>
</tr>
<tr>
<td>20.</td>
<td>4.3 UNINV. OTHER</td>
<td>Description or endorsement of, or reasons given surrounding uninvolved feeding.</td>
<td>Use this code for statements where the participant describes or endorses or gives any reasons for uninvolved feeding.</td>
</tr>
<tr>
<td></td>
<td>5.0 REST</td>
<td>Endorsing Restrictive Feeding Behaviors</td>
<td>Use 5.0 REST for grouping codes according to parameters listed under 5.1-5.xx.</td>
</tr>
<tr>
<td>21.</td>
<td>5.1 REST.INSECUR</td>
<td>Description of restricting the types and amounts of food the child consumes due to food insecurity or lack of finances.</td>
<td>Use this code for statements describing not giving the child more food when they ask for it because of food insecurity e.g. not having enough fish to give the child another piece when they ask for it</td>
</tr>
<tr>
<td>22.</td>
<td>5.2 REST.OTHER</td>
<td>Any other description of restricting types and amounts of food the child consumes.</td>
<td>Use this code for any other statements describing not giving the child more food when they ask for it. e.g. not giving child more food if they ask for it because too much food will make them sick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>6.0 BARR</strong></td>
<td><strong>Barriers and Difficulties to Desired Feeding Behaviors</strong></td>
</tr>
<tr>
<td>----</td>
<td>---</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>23.</td>
<td></td>
<td><strong>6.1 BARR.TIME</strong></td>
<td>Description of lack of time as a barrier for optimal feeding.</td>
</tr>
<tr>
<td>24.</td>
<td></td>
<td><strong>6.2 BARR.FINAN</strong></td>
<td>Description of lack of finances as a barrier for optimal feeding.</td>
</tr>
<tr>
<td>25.</td>
<td></td>
<td><strong>6.3 BARR.CHILD</strong></td>
<td>Description of an inability to take care of the older child because there is a younger child to care for.</td>
</tr>
<tr>
<td>26.</td>
<td></td>
<td><strong>6.4 BARR.OTHER</strong></td>
<td>Any other description of barriers or difficulties pertaining to feeding their child.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>7.0 FEED</strong></td>
<td><strong>Feeding Behaviors</strong></td>
</tr>
<tr>
<td></td>
<td>7.1 FEED.WALK</td>
<td>Description or endorsement of the child walking around during a feeding episode.</td>
<td>Use this code for statements where participant describes the child walking around on their own or following the child around during the feeding episode.</td>
</tr>
<tr>
<td>---</td>
<td>---------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>28.</td>
<td>7.2 FEED. CARRY</td>
<td>Description or endorsement of carrying and feeding the child while walking around.</td>
<td>Use this code for statements where participant describes or endorses carrying the child and walking around while feeding the child. e.g. walking around the courtyard, showing them animals, etc.</td>
</tr>
<tr>
<td>29.</td>
<td>7.3 FEED. SIT</td>
<td>Description or endorsement of sitting and feeding the child.</td>
<td>Use this code for statements where participant describes or endorses sitting and feeding the child (as opposed to walking around with them, or the child feeding his/herself in the absence of the caregiver).</td>
</tr>
<tr>
<td>30.</td>
<td>7.4 FEED. SELF</td>
<td>Description or endorsement of self-feeding.</td>
<td>Use this code for statements where participant describes or endorses the child feeding his/herself or eating on their own. Also use this code for any reasons given for endorsement of self-feeding.</td>
</tr>
<tr>
<td>31.</td>
<td>7.5 FEED.TOGETH</td>
<td>Description of sitting and eating with the child.</td>
<td>Use this code for statements where participant describes or endorses sitting and eating with the child, or the whole family sitting together and eating with the child.</td>
</tr>
<tr>
<td></td>
<td>8.0 CONC</td>
<td>Concerns About Child Feeding</td>
<td>Use 8.0 CONC for grouping codes according to parameters listed under 8.1-8.xx.</td>
</tr>
<tr>
<td>32.</td>
<td>8.1 CONC.SIZE</td>
<td>Description of child's size as a concern about the child's food intake.</td>
<td>Use this code for statements where participants mention the child's size or appearance in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>relation to their food intake, any comparisons of the child's size to other children their age, etc.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>33.</td>
<td>8.2 CONC.APP</td>
<td>Description of poor appetite as a concern about the child's food intake.</td>
<td>Use this code for statements where participants mention concerns about the child's appetite or describe the child's poor appetite in relation to their eating habits or caregiver's feeding behaviors. Also use for statements made about perception that the child &quot;doesn't eat&quot;.</td>
</tr>
<tr>
<td>34.</td>
<td>8.3 CONC. TEMP</td>
<td>Description of temperament as a concern about the child's food intake.</td>
<td>Use this code for statements where participants mention concerns about the child's temperament or describe the child's temperament in relation to their eating habits or caregiver's feeding behaviors.</td>
</tr>
<tr>
<td>35.</td>
<td>8.4 CONC. ILL</td>
<td>Description of illness as a concern about the child's food intake.</td>
<td>Use this code for statements where participants mention concerns about the child's illness or describe the child's illness in relation to their eating habits or caregiver's feeding behaviors.</td>
</tr>
<tr>
<td>36.</td>
<td>8.5 CONC. OTHER</td>
<td>Description of any other concerns pertaining to feeding the child.</td>
<td>Use this code for statements where participant describes any other concerns regarding feeding their child. This includes any perceived reasons about why the child does not eat the way the caregiver thinks they should.</td>
</tr>
<tr>
<td></td>
<td>9.0 IYCF</td>
<td>Infant and Young Child Feeding</td>
<td>Use 9.0 IYCF for grouping codes according to parameters listed under 9.1-9.xx.</td>
</tr>
<tr>
<td></td>
<td>Code</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>37</td>
<td>9.1 IYCF.BF</td>
<td>Description of breastfeeding the child.</td>
<td>Use this code for statements where participant mentions breastfeeding the child.</td>
</tr>
<tr>
<td>38</td>
<td>9.2 IYCF.FOOD</td>
<td>Description of the quality of the child’s diet or food offered to the child.</td>
<td>Use this code for statements where participant describes the types of food they offer the child, offering a variety of foods, etc. Also use this code for descriptions of what child should or should not eat. e.g. “Children should eat home-cooked foods because they are nutritious.”</td>
</tr>
<tr>
<td>39</td>
<td>9.3 IYCF.JUNK</td>
<td>Description of feeding the child junk food.</td>
<td>Use this code for statements where participant describes purchasing, storing or feeding the child storebought junk foods, including biscuits, chips, candy, etc.</td>
</tr>
<tr>
<td>40</td>
<td>9.4 IYCF.TIME</td>
<td>Description of the timing of certain foods.</td>
<td>Use this code for statements where participants describe when a certain food should be introduced.</td>
</tr>
<tr>
<td>41</td>
<td>9.5 IYCF.FREQ</td>
<td>Description of the frequency at which the child eats.</td>
<td>Use this code for statements where participants describe how often they feed their child or how often the child eats (if not fed by the caregiver).</td>
</tr>
<tr>
<td>42</td>
<td>9.6 IYCF.CARE</td>
<td>Description of how caregivers other than the mother feeds the child.</td>
<td>Use this code for statements where participants describe multiple caregivers, how other caregivers feed the child, and/or how other caregivers influence how the child is fed.</td>
</tr>
<tr>
<td>43</td>
<td>9.7 IYCF.ADV</td>
<td>Description of advice sought or received regarding child feeding.</td>
<td>Use this code for statements where participants describe seeking or receiving advice from others (e.g. relatives, mother-in-law, husband, doctor, neighbors) on how to feed the child. This includes the types of foods and methods of feeding.</td>
</tr>
<tr>
<td></td>
<td>9.10 IYCF. APP</td>
<td>Description of child's appetite.</td>
<td>Use this code for statements where participants describe the child's appetite.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>44.</td>
<td>10.0 ILL</td>
<td>Illnesses</td>
<td>Use 10.0 ILL for grouping codes according to parameters listed under 10.1-10.xx.</td>
</tr>
<tr>
<td>45.</td>
<td>10.1 ILL.APP</td>
<td>Description of seeking medical care for loss of appetite.</td>
<td>Use this code for statements where participant describes seeking medical care for their child's loss of appetite. Also use to code for any treatment or medications taken to increase appetite.</td>
</tr>
<tr>
<td>46.</td>
<td>10.2 ILL.DIARR</td>
<td>Description of seeking medical care for diarrheal disease.</td>
<td>Use this code for statements where participant describes seeking medical care any time their child has loose stools or GI problems. Also use to code for any treatment or medications taken to treat the loose stools.</td>
</tr>
<tr>
<td>47.</td>
<td>10.3 ILL.DIRTY</td>
<td>Description of attributing any illness to uncleanliness.</td>
<td>Use this code for statements where participants describe uncleanliness as a cause for or contributing factor to any illness.</td>
</tr>
<tr>
<td>48.</td>
<td>10.4 ILL.OTHER</td>
<td>Description of any other illness.</td>
<td>Use this code for statements where participants describe any other kind of illness or reason for illness. e.g. respiratory illness</td>
</tr>
<tr>
<td></td>
<td>11.0 OTHER</td>
<td>Other Comments</td>
<td></td>
</tr>
<tr>
<td>49.</td>
<td><strong>11.1 OTHER</strong></td>
<td>Any other important comments, experiences, or opinions left by people when given the chance to provide their thoughts.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A1.7. List of items included in the original (n=51), intermittent (n=15 after pilot test), and final (n=13 after EFA) Caregiver Feeding Behaviors Questionnaire (CFBQ)

<table>
<thead>
<tr>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminated after pilot test</td>
</tr>
<tr>
<td>Eliminated after EFA</td>
</tr>
<tr>
<td>Final Version</td>
</tr>
</tbody>
</table>

**Responsive:**

- How often can you tell when your toddler is hungry?
- How often can you tell when your toddler likes the food?
- How often do you praise your toddler for eating?
- How often do you say something positive about your toddler’s eating?
- How often do you talk to your toddler about the food he/she is eating?
- How often do you encourage your toddler to try a new food?
- **How often do you eat with your toddler?**
- How often can you tell when your toddler is full?
- How often can you tell when your toddler does not like the food?
- How often do you talk to your toddler during meals?

**Forceful:**

- How often do you reason with your toddler to get him/her to eat?
- How often do you make sure that your toddler eats all the food on his/her plate?
<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you have to bribe or trick your toddler to get him/her to eat?</td>
</tr>
<tr>
<td>How often do you try to get your toddler to eat even a small amount of food?</td>
</tr>
<tr>
<td>How often is your toddler punished for not eating?</td>
</tr>
<tr>
<td>How often do you let your toddler know you are upset if he/she will not eat?</td>
</tr>
<tr>
<td>How often do you warn your toddler that you will take something away other than food if he/she doesn't eat?</td>
</tr>
<tr>
<td>How often do you let your toddler know you are upset if he/she will not eat?</td>
</tr>
<tr>
<td>How often do you let your toddler know you are upset if he/she will not eat?</td>
</tr>
<tr>
<td>If your toddler says or signals &quot;I'm not hungry&quot;, how often do you try to get him/her to eat anyway?</td>
</tr>
<tr>
<td>If your toddler will not try a new food, do you work hard to have him/her try it during that meal?</td>
</tr>
<tr>
<td>How often do you yell or threaten your toddler to be sure he/she eats enough?</td>
</tr>
<tr>
<td>How often do you beg or plead with your toddler to eat?</td>
</tr>
<tr>
<td>How often do you force your toddler to eat?</td>
</tr>
<tr>
<td>How often do you physically struggle with your toddler to get him/her to eat?</td>
</tr>
</tbody>
</table>

**Restrictive:**

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you concerned your toddler eats too much of his/her favorite foods?</td>
</tr>
<tr>
<td>How often do you carefully control how much your toddler eats?</td>
</tr>
<tr>
<td>How often are you concerned that your toddler is eating too much?</td>
</tr>
<tr>
<td>How often are you concerned that your toddler eats too many sweets?</td>
</tr>
<tr>
<td>If you did not limit your toddlers eating, would he/she eat too much?</td>
</tr>
<tr>
<td>How often do you limit the amount your toddler eats?</td>
</tr>
<tr>
<td>How often do you limit the types of food your toddler eats?</td>
</tr>
</tbody>
</table>

**Uninvolved:**

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often does your toddler eat at the same time every day?</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>How often are you responsible for the amount of food that your toddler is offered?</td>
</tr>
<tr>
<td>How often are you responsible for the kinds of food that your toddler is offered?</td>
</tr>
<tr>
<td>How often does your toddler eat at the same place every day?</td>
</tr>
<tr>
<td>Do you know what your toddler eats throughout the day?</td>
</tr>
<tr>
<td>Do you know when your toddler is eating?</td>
</tr>
</tbody>
</table>

**Indulgent:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>If your toddler prefers sugary drinks (i.e. soda, juice), how often do you let him/her have them?</td>
<td></td>
</tr>
<tr>
<td>If your toddler wants something for a meal that you think is inappropriate, how often do you give it to him or her?</td>
<td></td>
</tr>
<tr>
<td>How often do you offer your toddler's favorite food in exchange for good behavior?</td>
<td></td>
</tr>
<tr>
<td>How often do you give your toddler something to eat or drink if he/she is upset or having a temper tantrum?</td>
<td></td>
</tr>
<tr>
<td>If your toddler prefers to eat while playing, how often do you let him/her?</td>
<td></td>
</tr>
<tr>
<td>How often do you let your toddler eat whatever he/she wants?</td>
<td></td>
</tr>
<tr>
<td>How often do you promise your toddler something other than food if he/she eats?</td>
<td></td>
</tr>
<tr>
<td>How often do you offer sweets (biscuits and cakes) to your toddler as a reward for good behavior?</td>
<td></td>
</tr>
<tr>
<td>How often do you encourage your toddler to eat by using food (i.e. dessert) as a reward?</td>
<td></td>
</tr>
<tr>
<td>How often does your toddler walk around while eating or drinking?</td>
<td></td>
</tr>
<tr>
<td>If your toddler does not like what is being served, do you immediately make something else?</td>
<td></td>
</tr>
<tr>
<td>When your toddler whines or cries, how often do you give him/her something to eat or drink?</td>
<td></td>
</tr>
</tbody>
</table>

**New Questions:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you show your toddler animals to encourage him to eat?</td>
<td></td>
</tr>
<tr>
<td>How often do you allow your toddler to feed him/herself?</td>
<td></td>
</tr>
</tbody>
</table>
Child 24-Month Interview (C24Mol)

Week of Interview: [ ] [ ] Date: [ ] [ ] [ ] [ ] [ ]
Worker ID: [ ] [ ] Initials [ ]

SECTION A: IDENTIFIERS/ADDRESSES
(Note to TLI: Confirm name and identifiers of the woman and child either on the barcode sticker or written by the TLI. Please draw a ‘✓’ beside each checked identifier if they are correct.)

TLI PLACE
Child UID
STICKER HERE

If no sticker, TLI complete from CTL:

[ ] [ ] [ ] [ ] Union [ ] [ ] [ ] [ ] Mauza [ ] [ ] [ ] [ ] TL PIN [ ] [ ] [ ] [ ] Sector

Mother UID: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
Mother's Name: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
Father's Name: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Child UID: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
Child's name: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Sex: [ ] 1=Male [ ] 2=Female
[ ] Child name change verified by TLI

Date of birth (TLI complete from CTL): [ ] [ ] [ ] [ ] [ ] [ ]

TLI Complete:

NOTE: Interview Mother or Primary care-giver of the child:

Primary Care-giver [ ] 1=Mother [ ] 2=Father [ ] 3=Grandparents [ ] 4=Aunt / Uncle [ ] 5=Neighbor / Friend [ ] 6=Step mother [ ] 7=Step father [ ] 8=Other, Specify:

Form Status:

[ ] 1=Form completed [ ] STOP Interview
[ ] 2=Not met until 25 months of age [ ] STOP Interview: TLI Schedule CVBA
[ ] 5=Child given away for adoption
[ ] 6=Refused Interview
[ ] 7=Permanently moved

(TLI Note: If the child’s name is known, replace “this child” with the actual name in the questions below)
**SECTION B: MORBIDITIES**

I will now ask you some questions about any illnesses your child had in the past three months.

1. In the past three months did your child have a cough, cold, or difficulty breathing?  
   - [ ] 0 = No (Go to 2)  
   - [ ] 1 = Yes (Go to 1a, 1b)  
   - [ ] 9 = Don’t know (Go to 2)

   1a. During the past three months how many times has the child had a cough, cold or difficulty breathing?  
      - [ ] 1-7 = No. of times  
      - [ ] 8 = 8 or more times  
      - [ ] 9 = Don’t know

   1b. Of these ___ times, I will now ask you about the worst / only time. During the worst/only time of cough, cold or difficulty breathing:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>...did the child have cough?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>...was the child breathing faster than usual?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.</td>
<td>...did the child have chest indrawing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV.</td>
<td>...did the child make wheezing sounds while breathing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V.</td>
<td>...did the child make grunting sounds while breathing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI.</td>
<td>...did the child have high fever, felt like the body was burning?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VII.</td>
<td>...were the child’s body, arms and legs cold to touch?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIII.</td>
<td>...did the child have 4 or more loose watery stools per day?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IX.</td>
<td>...did the child have bloody stools?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   During the worst/only time of cough, cold or difficulty breathing:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X.</td>
<td>...how many days did this illness last?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XI.</td>
<td>...how old was the child (TLT: Calculate In completed month)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XII.</td>
<td>...was your child treated for this illness? If so, by whom or where was the child treated?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (TLT: Refer to treatment provider card)  
   (TLT: complete HSP ID if HSP code 207)

1c. How many days in the past 7 days has your child had a cough, cold or difficulty breathing?  
   - [ ] 0-7 = No. of days  
   - [ ] 9 = Don’t know
2. During the past three months did your child have any day with 4 or more loose watery stools or diarrhea?

2a. During the past three months, how many times did the child have 4 or more loose watery stools in a day or diarrhea?

2b. Of these times, I will now ask you about the worst/only time. During the worst/only time of loose watery stools or diarrhea …

   I. ....how many days did this last?

   II. ....what was the maximum number of stools per day?

   III. ....how old was the child (TLI: Calculate In completed month)?

   IV. ....was your child treated for this illness? If so, by whom or where was the child treated?

2c. How many days in the past 7 days has your child had loose watery stools or diarrhea?

2d. For the diarrhea in the past three months, has your child been treated with zinc tablets? (TLI: If yes, show the card to make sure)
3. During the past three months did your child have any bloody stool?

3a. During the past three months, how many times did the child have bloody stools?

3b. Of these times, I will now ask you about the worst/only time. During the worst/only time of bloody stools ...

   I...how many days did the bloody stools last?

   II...what was the maximum number of bloody stools per day?

   III...did the child have a fever?

   IV...how old was the child (TLI: Calculate in completed month)?

   V...was your child treated for this illness? If so, by whom or where was the child treated?

3c. How many days in the past 7 days has your child had bloody stools?
JIVRA-4 / Form 213, C24Mo1, v1.1, March 2, 2014

4. During the past three months, did your child have a high fever, that is, it seemed that the child’s body was burning up (hot to touch)?

- 0=No (go to section C)
- 1=Yes (go to 4a, 4b)
- 9=Don’t know (go to section C)

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a. During the past three months, how many times did the child have a high fever, that is, it seemed that the child’s body was burning up (hot to touch)?</td>
<td>1-7=No. of times, 8-8 or more times, 9=Don’t know</td>
</tr>
<tr>
<td>4b. Of these times, I will now ask you about the worst/only time. During the worst/only time of high fever...</td>
<td></td>
</tr>
<tr>
<td>I... how many days did the high fever last?</td>
<td>01-90=No. of days, 91-91 or more days, 99=Don’t know</td>
</tr>
<tr>
<td>II... how old was the child (TLU: Calculate in completed month)?</td>
<td>21-25=months, 99=Don’t know</td>
</tr>
<tr>
<td>III... was your child treated for this illness? If so, by whom or where was the child treated?</td>
<td>(TLU: Refer to treatment provider card) (TLU: complete HSP ID if HSP code Late)</td>
</tr>
<tr>
<td>4c. How many days in the past 7 days has your child had a high fever?</td>
<td>0-7=No. of days, 9=Don’t know</td>
</tr>
</tbody>
</table>
SECTION C: CHILD IMMUNIZATION RECORD AND VITAMIN A

Note: Ask mother for the infant's vaccine card and examine it.

1. In the past six months was this child given or fed any vaccination to prevent him/her from getting diseases?
   - D = No (Go to section D)
   - 1 = Yes (Go to 2a)
   - 5 = Don't know (Go to section D)

2. Please tell me if (CHILD NAME) received a ... in the past six months.
   - 0 = No
   - 1 = Yes
   - 9 = Don't Know
   - 1-8 = No. of times
   - 9 = Don't know

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Yes</th>
<th>No</th>
<th>Card, no doses</th>
<th>Card, yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Polio vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Vitamin A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Measles-Rubella (MR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Measles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. DPT booster</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI. Typhoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VII. Other specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION D: BREAST FEEDING

1. Are you currently breastfeeding this child?
   - D = No (Go to 1a, 1b)
   - 1 = Yes (Go to 2)
   - 8 = Mother Died (Go to Section E)

   1a. How old was your child when you stopped breastfeeding him/her?
   - 01-25 = Age in months
   - 99 = Don't Know
   - 1 = Mother was ill or weak
   - 2 = Child was ill or weak
   - 3 = Nipple/Breast problem
   - 4 = Insufficient Milk
   - 5 = Mother busy working
   - 6 = Child refused breast milk
   - 7 = Child had reached a certain age/ was too old
   - 8 = Other, Specify
   - 9 = Don't Know

   1b. Why did you stop breastfeeding?

   Go to Section E

2. During all of yesterday and last night how many times did you breastfeed this child?
   - 1 = 0-1 times
   - 2 = 1-10 times
   - 3 = 11-20 times
   - 4 = 21 or more times
**SECTION E: CHILD DIET**

I will now ask you some questions about this child’s diet yesterday over a period of 24 hours, i.e. from yesterday morning to today morning.

<table>
<thead>
<tr>
<th>1a From yesterday morning to today morning, has the child been fed?</th>
<th>1b How much of the food was offered to the child?</th>
<th>1c How much did the child eat?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = No 1 = Yes (go to 1b)</td>
<td>01 = Tsp 1 02 = Tsp 2 03 = Tbsp 3 04 = Tbs 4 05 = Bowl 1 06 = Bowl 2</td>
<td>01.00-9.00 = Whole units 0.50 = Half of it 0.25 = Quarter 0.75 = Three quarters 0.33 = One third 0.67 = Two thirds</td>
</tr>
<tr>
<td>I. Cow or goat or sheep or buffalo milk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Powdered milk (Powder only) (Dano, Red Cow, Anchor, “Freshmilk” etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Baby formula (Powder only) (My Boy, Cereal, Lactogen etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v. Sufi / Payesh (with milk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi. Sufi / payesh (without milk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vii. Dal (soup, upper portion of dal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>viii. Dal (thick, lower portion of dal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ix. Khichuri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x. Potato</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xi. Leafy Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xii. Other Vegetables, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xiii. Egg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xiv. Fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xv. Meat / chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xvi. Liver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xvii. Ripe banana</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1a. From yesterday morning to today morning, has the child been fed?  

<table>
<thead>
<tr>
<th></th>
<th>0 = No</th>
<th>1 = Yes (go to 1b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>xviii. Other fruit, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xix. Roti / bread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xx. Biscuits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxi. Added oil or ghee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxi. Added sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxi. Yoghurt or other dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxiv. PushlAtta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxv. Juice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxvi. Cake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxvii. Puffed/flat rice, kholi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxviii. Chips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxi. Gulaai / goga / balasa / khorma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxx. Chocolate, lollipop, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxx. Sprinkles (monimix, pusticona)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxi. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxii. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxi. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxiv. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxv. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxvi. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xxxvii. Other, Specify_________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SECTION F: CHILD FEEDING PRACTICES

Now I will ask you a few questions about hand washing.

<table>
<thead>
<tr>
<th></th>
<th>Unprompted</th>
<th>Prompted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1A.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Can you tell me from yesterday morning to today morning, when have you washed your hands?</td>
<td>d. What, if anything did you use to clean your hand?</td>
<td></td>
</tr>
<tr>
<td>(If mentioned in a)</td>
<td>(Ask those categories not mentioned in a.)</td>
<td></td>
</tr>
<tr>
<td>0=Not mentioned (Ask only those in c)</td>
<td>0=No</td>
<td></td>
</tr>
<tr>
<td>1=Mentioned (Go to b.)</td>
<td>1=Yes (Go to d.)</td>
<td></td>
</tr>
<tr>
<td><strong>I. Before cooking</strong></td>
<td><strong>II. Before eating</strong></td>
<td><strong>III. Before feeding the child</strong></td>
</tr>
<tr>
<td><strong>V. After going to toilet</strong></td>
<td><strong>VI. After handling chicken, cow, duck or other animal feces</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1B.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Can you tell me from yesterday morning to today morning, when have you washed your child’s hands?</td>
<td>d. What, if anything did you use to clean your child’s hand?</td>
<td></td>
</tr>
<tr>
<td>(If mentioned in a)</td>
<td>(Ask those categories not mentioned in a.)</td>
<td></td>
</tr>
<tr>
<td>0=Not mentioned (Ask only those in c)</td>
<td>0=No</td>
<td></td>
</tr>
<tr>
<td>1=Mentioned (Go to b.)</td>
<td>1=Yes (Go to d.)</td>
<td></td>
</tr>
<tr>
<td><strong>I. Before feeding the child</strong></td>
<td><strong>II. After the child goes to toilet</strong></td>
<td></td>
</tr>
<tr>
<td>2. From yesterday morning to today morning, did you offer your child any home cooked food?</td>
<td>0=No</td>
<td></td>
</tr>
<tr>
<td>1=Yes (Go to 2a)</td>
<td>0=No</td>
<td></td>
</tr>
<tr>
<td>1=Yes (Go to 2a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a. If yes, what was the longest time after cooking the food that you fed it to your child?</td>
<td>00-99=Time</td>
<td></td>
</tr>
<tr>
<td>1=Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2=Hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. From yesterday morning to today morning, did you refeed leftover cooked food to your child?  
   3a. If yes, after how long from the time of cooking did you feed the child?  
      □ 0=No  □ 1=Yes (Go to 3a, 3b)  
      □ □ □ Time  
      □ 0=0 Minutes  □ 1=0 Hours  
   3b. If yes, did you heat the leftover food before feeding?  
      □ 0=No  □ 1=Yes  

4. From yesterday morning to today morning, did you use a bottle to feed your child?  
   □ 0=No  □ 1=Yes  

5. Who is the person who most often feeds ______ (name of the child)? (order by frequency of feeding)  
   1=Mother  
   2=Father  
   3=Grandparents  
   4=Aunt / Uncle  
   5=Neighbor / Friend  
   6=Other sibling  
   7=Domestic help  
   8=Other, specify  
   9=Don't know  

6. Do you never, sometimes or always sit down to feed ______ (name of the child) at meal times?  
   □ 0=Never  □ 1=Sometimes  □ 2=Always  

7. What do you do to encourage your child________ to eat? (order by frequency of behavior)  
   □ 0=Do nothing  
   □ 1=Force the child to eat  
   □ 2=Feed slowly  
   □ 3=Play with/entertain the child  
   □ 4=Threaten or scare the child  
   □ 5= Bribe the child  
   □ 6=Give other types of food  
   □ 7=Show TV  
   □ 8=Other, specify  

8. What do you do when the child refuses to eat? (order by frequency of behavior)  
   □ 0=Do nothing / don't feed  
   □ 1=Force the child to eat  
   □ 2=Claress or hold the child  
   □ 3=Play with / entertain the child  
   □ 4=Threaten or scare the child  
   □ 5=Bribe the child  
   □ 6=Give other types of food  
   □ 7=Show TV  
   □ 8=Other, specify  

9. When ______ (name of the child) has no appetite for a few days/weeks, what do you do? (order by frequency of behavior)  
   □ 0=Do nothing  
   □ 1=Child always has appetite  
   □ 2=Give foods child likes  
   □ 3=Give vitamins / syrup  
   □ 4=Take to a health center / doctor  
   □ 5=Take to traditional healer  
   □ 6=Homeopathy  
   □ 7=Take to village doctor  
   □ 8=Other, specify
10. Does the child normally eat from your plate or another family member's plate? (order by frequency of behavior)
   - [ ] 0=No, eats from own bowl/plate
   - [ ] 1=From shared plate with mother
   - [ ] 2=From shared plate with father
   - [ ] 3=Shared plate with sibling
   - [ ] 4=Shared plate with other, specify

11. How do you know when ___ is hungry?
   - [ ] 1=Feed at specific times every day
   - [ ] 2=When child cries or is fussy
   - [ ] 3=When child makes sucking actions
   - [ ] 4=When child chews on things
   - [ ] 5=When child points to food or asks for it
   - [ ] 6=When child is irritable
   - [ ] 8=Other specify

12. How do you know when ___ is full?
   - [ ] 1=When child finishes what is offered
   - [ ] 2=When child turns face away or pushes food away
   - [ ] 3=When the child burps
   - [ ] 4=By feeling the child's belly
   - [ ] 8=Other, specify

13A. On the days while the child had (I, II, III)___, compared to the amount usually fed, how much did you feed the child (a, b, c, d)___?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I. diarrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. cough and cold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13B. On the days after the child had (I, II, III)___, compared to the amount usually fed, how much did you feed the child (a, b, c, d)___?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I. diarrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. cough and cold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION G: HOSPITALIZATION AND MEDICATION
1. Has (name of child) been taking any medicines in the past 7 days?
   0=No □ 1=Yes (Go to 1a, 1b) 9=Don't know
   1a. What medicine is (name of child) currently taking? (If so, please show me the medication).
      □ I. Antibiotic
      □ II. Antipyretic/cough/cold paracetamol and other
      □ III. Analgesic
      □ IV. Antihistamine
      □ V. Vitamins
      □ VI. Zinc/ORS
      □ VII. Homeopathic
      □ VIII. Other specify
      □ IX. Don't know
   1b. Write down name of medicine or condition for which medicine given:

2. Was (name of the child) hospitalized in the past 3 months?
   0=No (Go to Section H) □ 1=Yes (Go to 2a) 9=Don't know (Go to Section H)
   2a. If yes, for what condition was s/he hospitalized?
      □ I. Pneumonia/ALRI
      □ II. Diarrhea/Dehydration
      □ III. High Fever
      □ IV. Accident/Injury
      □ V. Severe malnutrition
      □ VI. Unconsciousness
      □ VII. Jaundice
      □ VIII. Other, specify
      □ IX. Don't know

SECTION H: APPETITE
Now I will say a few statements about your baby's appetite. Please tell me if you agree, disagree or neither agree nor disagree with these statements about (name of child):

1. ... eats appropriately for his/her age □
2. ... is usually happy or content when s/he is eating □
3. ... often asks for food □
4. ... is often fussy or irritable when s/he is eating □
5. ... often refuses food or spits food out of his/her mouth □
6. ... often wants to take food from other people’s plates □
7. ... eats or breastfeeds frequently □
8. ... wants to eat only his/her favorite foods □
9. Overall, is (name of child)'s appetite good, so-so, or poor □

1=Agree □ 2=Neither agree nor disagree □ 3=Disagree □
1=Good □ 2=So-so □ 3=Poor □
SECTION I: SLEEP

1. How long does your child sleep during day-time in all?  
   □ 00:<1 hour  
   □ 01-15=No. of hours

2. How long does your child sleep during night-time in all?  

3. How many times during the night-time does s/he usually wake up and cry or call for attention?  
   □ 0=Never  
   □ 1-8=No. of times  
   □ 9=Don't know

SECTION J: FEEDING BEHAVIOURS

The next questions are about feeding your child. For each question please respond by saying never, seldom, half the time, most of the time, or always.

1. How often do you eat with your toddler?  

2. How often do you yell or threaten your toddler to be sure he/she eats enough?  

3. How often do you know what your toddler eats throughout the day?  

4. How often does your toddler walk around while eating or drinking?  

5. How often do you talk to your toddler during meals?  

6. How often do you physically struggle with your toddler to get him/her to eat?  

7. How often can you tell when your toddler is full?  

8. If your toddler does not like what is being served, how often do you immediately give him/her something else?  

9. How often can you tell when your toddler does not like the food?  

10. When your toddler whines or cries, how often do you give him/her a biscuit, cake or something else to eat?  

11. How often do you know when your toddler eats throughout a day?  

12. How often do you encourage your toddler to try a new food?  

13. How often do you beg or plead with your toddler to eat?  

14. How often does your toddler eat at the same place every day?  

15. How often do you force your toddler to eat?
**SECTION K: FOOD SECURITY**

I will now ask you some questions about food availability in your household.

1. In the past 6 months, that is since the (TODAY'S DATE) of (BANGLA MONTH 6 months ago) until today, how often did _____?

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. ...you eat three 'square meals' (full stomach meals) a day (not a festival day)?</td>
<td>1=Never</td>
</tr>
<tr>
<td></td>
<td>2=Rarely (1-3 times)</td>
</tr>
<tr>
<td></td>
<td>3=Sometimes (4-6 times)</td>
</tr>
<tr>
<td></td>
<td>4=Often (a few times each week)</td>
</tr>
<tr>
<td></td>
<td>5=Morely (3 meals each day)</td>
</tr>
<tr>
<td>ii. ...you or any of your family have to eat wheat (or another grain) although you wanted to eat</td>
<td></td>
</tr>
<tr>
<td>rice (not including when you were sick)?</td>
<td></td>
</tr>
<tr>
<td>iii. ...you yourself skip entire meals due to scarcity of food?</td>
<td></td>
</tr>
<tr>
<td>iv. ...you personally eat less food in a meal due to scarcity of food?</td>
<td></td>
</tr>
<tr>
<td>v. ...food stored in your home run out and there was no money to buy more that day?</td>
<td>1=Never</td>
</tr>
<tr>
<td></td>
<td>2=Rarely (1-3 times)</td>
</tr>
<tr>
<td></td>
<td>3=Sometimes (4-6 times)</td>
</tr>
<tr>
<td></td>
<td>4=Often (a few times each month)</td>
</tr>
<tr>
<td></td>
<td>5=Morely (most days per week)</td>
</tr>
<tr>
<td>vi. ...you worry about where food would come from?</td>
<td></td>
</tr>
<tr>
<td>vii. ...your family purchase rice?</td>
<td></td>
</tr>
<tr>
<td>viii. ...your family take food (rice, lentils etc.) on credit (or loan) from a local shop?</td>
<td></td>
</tr>
<tr>
<td>ix. ...your family have to borrow food from relatives or neighbors to make a meal?</td>
<td></td>
</tr>
<tr>
<td>x. ...your household sell or mortgage things to obtain food?</td>
<td></td>
</tr>
</tbody>
</table>
**SECTION L: INFANT ANTHROPOMETRY**

1. Weight: ________________ kg  
   - 00.00 = Refused  
   - 99.99 = Not possible to measure

2. MUAC (cm)  
   - a. ________________  
   - b. ________________  
   - c. ________________

3. Chest Circ. (cm)  
   - a. ________________  
   - b. ________________  
   - c. ________________

4. Head Circ. (cm)  
   - a. ________________  
   - b. ________________  
   - c. ________________

5. Length (cm)  
   - a. ________________  
   - b. ________________  
   - c. ________________

---

**NOTE:** Enter "1" for Form Status on Page 1
Appendix 2: Supplemental results tables

**Table A2.1.** Additional quotations that supplement qualitative findings about caregiver feeding behaviors in rural Bangladesh.

**Table A2.2.** Relationship between feeding behavior and DDS and MDD among children at 24 months of age

**Table A2.3.** Relationship between feeding behavior and change in LAZ, WAZ, WLZ, length, weight among children at 24 months of age

**Table A2.4.** Relationship between feeding behavior and prevalence of stunting, wasting and underweight among children at 24 months of age
### Table A2.1. Supporting quotations by theme and subtheme from a qualitative study exploring caregiver feeding behaviors in rural Bangladesh.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding behaviors that caregivers thought would increase food intake</td>
<td>Whatever they eat, imagine, if they eat white bread then go ahead. If they eat cake, fine. Or perhaps they eat rice with vegetables, fine. Whatever they want. Perhaps they want to drink milk, then they drink milk. Feeding like that… I don't have any problems with feeding them. Whatever they want to eat, let them eat. There are no problems regarding feeding. Imagine they won't eat rice, and they want to eat something else, let them eat. Still, just feed the child. Father of 21-month old, IDI</td>
<td>…Children, they don’t go outside always, they don't eat, or don't get [the things we do]. Perhaps we went to Gaibandha and we ate rice and other things in a restaurant. But that doesn’t happen to children. For that reason, we are older… [so] there will be no problem if we eat a bit [less food]. We never want that a child would eat less; we want them to eat more than needed. Father of 18 month-old, FGD</td>
</tr>
<tr>
<td>Characteristics of feeding in this setting</td>
<td>Forceful feeding behaviors R: Sometimes I scare her. When she doesn't eat, I scare her. I say, &quot;Ammu, eat.&quot; When she runs away I scare her, then she eats. I: How do you scare her? R: [I say] &quot;Ammu, eat.&quot; Perhaps I hold her hand, I get mad, and I say, &quot;I'll hit you, I'll do this, I'll do that.&quot; Then she eats. I: How often do you do this with her? R: She doesn't throw a fit very often. Only when she fusses; [which is] rarely. I: So you tell her you will get mad or you will hit her? R: Yes, she [then] eats out of fear, she doesn't take very long [to eat]. Mother of 18-month old, IDI</td>
<td></td>
</tr>
</tbody>
</table>
“Eat, or they'll take your rice away. They'll take babu's rice away. They won't let you eat rice, they won't let you eat, abbu. You eat, or they'll take your rice away.”
Mother of 20-month old, In-home observation

The child is with his grandmother. [Grandmother tells the child], "Now if I don't feed you, then that might start an argument [with your mom]."Why weren't you able to feed the child?' your mother will say." Then, like that, the grandmother forces the child to eat rice. "Baba eat rice, [or] your mother will fight with me. Or she will hit you. I don't want to see this, [so] baba, you eat rice." Then, she scares him and feeds the child.
Mother of 17-month old, IDI

R: Everyone says a child can't be forcefed. But even after that I always forcefeed.
I: For what reason do you force her?
R: To keep the child healthy. The child that stays healthy, their health stays well, [but] even after all that forcefeeding my child is extremely 'halka'.
I: What do you mean by 'halka'?
R: You know, can't you see her appearance? Her health [weight] isn't [improving], nothing is happening. Her father gets angry… imagine I don't feed the child based on her appetite. I always feed her, but even after that her father isn't satisfied. If he comes back from school and sees that her feeding has become irregular, his anger makes me think he's going to turn into fire! I feed her so much, [but] she doesn't eat, so I forcefeed her. But even after that how much more can I force such a young child?
Mother of 15-month old, IDI
Indulgent Feeding Behaviors

My child mostly eats at 8-9 in the morning, that's when I finish cooking. Sometimes almost 10 am. When the baby wakes up she drinks breast milk, then I give her store bought food such as biscuits, cake, shingara, or nashta (e.g. chal cheera, khoi, muri) from the store. Or I give her other things that her father brings from the market. We keep a stock of store bought foods to give the baby if she cries to stop her crying. I give her these when she wakes up.

Mother of 16-month old, IDI

Self Feeding

There is peace in eating with one's own hand. Is there any peace if other people put food into your mouth? There is peace when people [children] eat with own hand and then they will go to grandmother and eat a mouthful from her, and they will go to grandfather and sit there, and eat a mouthful from him. This is called peace.

Grandmother of 24-month old, FGD

I tell [my neighbor], "Why do you feed your child yourself? When you feed your child, does your child find peace? Whatever she will eat with her own hands, that is [enough]."

Mother of 17-month old, IDI

Multiple caregivers

When I cook my mother-in-law takes my child; she takes care of my child’s eating, she takes them out, she does everything. If I start doing something, and if I get angry with [my child] my mother-in-law takes them and walks around.

Consensus from mothers, FGD
R: [People] get mad, they say, "Why do you go through so much trouble to feed your child? Give the food to the child and if he eats it he will, if he won't he won't. Why should you have to feed the baby with so much trouble?" That's what people in the village say. My mother-in-law says if he doesn't eat rice then just feed him milk. [But] feeding so much milk is so intolerable to me, apa.
I: Why does she say this?
R: Because the baby cries about eating rice, and I have to walk around with him, and give him toys, so she says just give him milk, he'll eat quickly and then you can go to work. But I say milk isn't enough for him, he's not healthy, he has nothing. That's why I make time to feed him.
Mother of 21-month old, IDI

<table>
<thead>
<tr>
<th>Factors that contribute to feeding in this setting</th>
<th>Lack of time</th>
</tr>
</thead>
<tbody>
<tr>
<td>R: I went to the field, [so] I couldn't take care of her. She's lost weight.</td>
<td>I: Why couldn't you take care of her?</td>
</tr>
<tr>
<td>R: I was harvesting the corn, I was harvesting the corn and ran out of time and couldn't bathe her until the asr prayer. She has gotten dirt all over her. She has a runny nose, she has respiratory illness, my child. That's why my child has lost weight.</td>
<td></td>
</tr>
<tr>
<td>Mother of 18-month old, IDI</td>
<td></td>
</tr>
<tr>
<td>Food insecurity or lack of finances</td>
<td>[If] I had [money], then we would gather food separately and make it for the child, and we would cook separately for ourselves. But we aren't able to do it.</td>
</tr>
<tr>
<td>Mother of 17-month old, IDI</td>
<td></td>
</tr>
<tr>
<td>If I had money perhaps I would bring biscuits, perhaps I would bring apples, perhaps I would bring oranges, perhaps I would bring grapes. Perhaps I would bring an egg, perhaps I would bring fish. Perhaps I would bring some fish and mash them. I would mash them and we could eat it for 2 days, or eat it 3 days, [we could] heat it up and eat it.</td>
<td></td>
</tr>
<tr>
<td>Grandmother of 19-month old, IDI</td>
<td></td>
</tr>
</tbody>
</table>
whatever kinds of snacks there are in the market, her father brings those and feeds those to her when he is at home. Now her father is not at home... I am a woman, now I have to be economical when running the household. There are times when my sons and daughters don't get excess food. Then they can only eat rice and vegetables.

Mother of 24-month old, IDI

Appetite and illness

You know Malik doctor in Gaibandha? I took him to that doctor. When my child wasn't eating, then I took him there and he gave me a vitamin vial.

Mother of 18-month old, IDI

He doesn't want to eat khichuri either. I brought him appetite medication and fed it to him but he still won't eat. He just wants to drink milk. [...] If I feed milk all the time then even my health deteriorates, and I don't have time either.

Mother of 21-month old, IDI

I don't feed her mishti [sweets] frequently, because [she] will get worms.

Mother of 24-month old, IDI

If I feed him, imagine every three months I have to give him a dose of worm medication, what to do at which time. If I feed it to him he doesn't have worms then my son has a good appetite. And when he has worms, then perhaps [...] the stomach is swollen. Then I can understand, "No. The baby has a problem." Then I pour so much money, I just keep feeding vitamins, I keep feeding vitamins, but his appetite doesn't come back. My child has a problem, and if I don't tend to that problem and just keep feeding vitamins, then that isn't going to solve the problem. When you get rid of the worms and feed vitamins, then green leafy vegetables, vegetables, whatever you feed him, imagine, the baby will have nutrition. And if there are worms in his stomach then the food won't do any good. Whatever I feed him, the worms will eat them and sit there, and the food won't stick to my child's body.

Mother of 18-month old, IDI
Hygiene

There is an issue of cleanliness, isn't there? Nowadays mothers are dirty, they don't wash their children, they don't clean their children, they don't have [any idea] what food they will feed. They don't keep [their children's] hands and feet clean, they don't keep children's body clean, they don't keep plate and utensils clean, they don't do that and they give [food] to children. Flies sit on [the food], and if children are fed these they get sick. For this reason illness is always with them. If [you] keep children clean they will not get ill. Children play, right? If [you] keep them clean and then [you] give them food they will not get sick. Those children will be healthy.
Consensus among grandmothers, FGD

Chehera

When he doesn't eat, maybe i'll slap him. Or I just speak angrily, I say, "Eat, what's going to happen if you don't eat, you have no shasto, nothing".
Mother of 21-month old, IDI
Table A2.2 Relationship between feeding behavior and DDS and MDD among children at 24 months of age

<table>
<thead>
<tr>
<th>Diet measures</th>
<th>High R/Low F [Responsive]</th>
<th>Low R/Low F [Uninvolved]</th>
<th>Low R/High F [Forceful]</th>
<th>High R/High F [High on both]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude</td>
<td>Adjusted</td>
<td>Crude</td>
<td>Adjusted</td>
</tr>
<tr>
<td>DDS, mean (SD)</td>
<td>3.73 (1.38)</td>
<td>3.61 (1.43)</td>
<td>3.54 (1.42)</td>
<td>3.67 (1.45)</td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td>-0.13</td>
<td>-0.09</td>
<td>-0.19</td>
<td>-0.20</td>
</tr>
<tr>
<td>MDD (DDS≥4), %</td>
<td>57.6</td>
<td>52.0</td>
<td>50.1</td>
<td>54.6</td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>0.80 (0.68, 0.84)</td>
<td>0.74 (0.61, 0.73)</td>
<td>0.89 (0.77, 0.81)</td>
<td>0.81 (0.69, 0.95)</td>
</tr>
</tbody>
</table>

[1] Crude model coefficients estimated using univariate linear regression
[2] Adjusted model coefficients estimated using multivariate linear regression, adjusted for maternal age, maternal education, paternal education, child age, child sex, fever in past 3 months, morbidity in the past 7 days, living standards index, type of latrine, having another child under age 5 in the household, and supplementation group.
[3] Crude model coefficients estimated using univariate logistic regression
[4] Adjusted model coefficients estimated using multivariate logistic regression, adjusted for maternal education, paternal education, child age, child sex, fever in past 3 months, morbidity in the past 7 days, living standards index, type of latrine, having another child under age 5 in the household, and supplementation group.

*p<0.05
Table A2.3. Relationship between feeding behavior and change in LAZ, WAZ, WLZ, length, weight among children at 24 months of age

<table>
<thead>
<tr>
<th>Growth measures</th>
<th>High R/Low F [Responsive] n=2215</th>
<th>Low R/Low F [Uninvolved] n=910</th>
<th>Low R/High F [Forceful] n=485</th>
<th>High R/High F [High on both] n=1123</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude</td>
<td>Adjusted</td>
<td>Crude</td>
<td>Adjusted</td>
</tr>
<tr>
<td>LAZ, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[1] [2]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.11</td>
<td>-0.09</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>WAZ, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[1] [3]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.05</td>
<td>-0.02</td>
<td>-0.19</td>
<td>-0.19</td>
</tr>
<tr>
<td>WLZ, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[1] [4]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.05</td>
<td>0.03</td>
<td>-0.25</td>
<td>-0.25</td>
</tr>
<tr>
<td>Length cm/mo, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[1] [5]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.37</td>
<td>-0.30</td>
<td>-0.04</td>
<td>-0.10</td>
</tr>
<tr>
<td>Weight kg/mo, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[1] [6]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment effect β (95%CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.06</td>
<td>-0.035</td>
<td>-0.19</td>
<td>-0.20</td>
</tr>
</tbody>
</table>
[1] Crude model coefficients estimated using univariate linear regression
[2] Adjusted model coefficients estimated using multivariate linear regression, adjusted for maternal education, paternal education, child age, child sex, morbidity in the past 7 days, living standards index, type of latrine, having another child under age 5, and supplementation group.
[3] Adjusted model coefficients estimated using multivariate linear regression, adjusted for maternal education, paternal education, child age, child sex, fever in the past 3 months, morbidity in the past 7 days, living standards index, type of latrine, having another child under age 5, and supplementation group.
[4] Adjusted model coefficients estimated using multivariate linear regression, adjusted for maternal education, paternal education, child age, child sex, symptoms of respiratory illness in the past 3 months, fever in the past 3 months, morbidity in the past 7 days, living standards index, type of latrine, and supplementation group.
[6] Adjusted model coefficients estimated using multivariate linear regression, adjusted for maternal education, paternal education, child age, child sex, morbidity in the past 7 days, living standards index, type of latrine, having another child under age 5, and supplementation group.

*p<0.05
Table A2.4. Relationship between feeding behavior and prevalence of stunting, wasting and underweight among children at 24 months of age

<table>
<thead>
<tr>
<th>Growth measures</th>
<th>High R/Low F [Responsive] n=2215</th>
<th>Low R/Low F [Uninvolved] n=910</th>
<th>Low R/High F [Forceful] n=485</th>
<th>High R/High F [High on both] n=1123</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude</td>
<td>Adjusted</td>
<td>Crude</td>
<td>Adjusted</td>
</tr>
<tr>
<td>Stunting (LAZ&lt;-2), %</td>
<td>38.3</td>
<td></td>
<td>42.5</td>
<td></td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>-</td>
<td>-</td>
<td>1.19</td>
<td>(1.02, 1.39)*</td>
</tr>
<tr>
<td>Underweight (WAZ&lt;-2), %</td>
<td>39.1</td>
<td></td>
<td>39.7</td>
<td></td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>-</td>
<td>-</td>
<td>1.02</td>
<td>(0.87, 1.20)</td>
</tr>
<tr>
<td>Wasting (WLZ&lt;-2), %</td>
<td>17.2</td>
<td></td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Odds ratio (95%CI)</td>
<td>-</td>
<td>-</td>
<td>0.89</td>
<td>(0.72, 1.10)</td>
</tr>
</tbody>
</table>

[1] Crude model coefficients estimated using univariate logistic regression
[2] Adjusted model coefficients estimated using multivariate logistic regression, adjusted for maternal education, paternal education, child age, child sex, living standards index, type of latrine, having another child under age 5, and supplementation group.
[3] Adjusted model coefficients estimated using multivariate logistic regression, adjusted for maternal education, paternal education, child age, child sex, fever in the past 3 months, living standards index, type of latrine, having another child under age 5, and supplementation group.
[4] Adjusted model coefficients estimated using multivariate logistic regression, adjusted for maternal education, child age, child sex, fever in the past 3 months, morbidity in the past 7 days, type of latrine, and supplementation group.

*p<0.05
Curriculum Vitae

CURRICULUM VITAE

ZAYNAH T. CHOWDHURY

100 Hepburn Road
Apt. 10E
Clifton, NJ 07012
Tel: 480-452-6367
E-mail: zchowdh1@jhu.edu

Program in Human Nutrition
Department of International Health
The Johns Hopkins University
Bloomberg School of Public Health
615 North Wolfe St.
Baltimore, MD 21205

EDUCATION

2011-2016  PhD, Program in Human Nutrition in the Department of International Health. The Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

Dissertation: Caregiver Feeding Behaviors and Nutritional Status in Rural Bangladesh.

2009-2010  MPH, Global Family and Child Health. Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ.


2006-2009  BS, Major: Molecular and Cellular Biology, graduated with honors. University of Arizona, Tucson, AZ.

BS Health Science, Major: Physiology. University of Arizona, Tucson, AZ.

Honors thesis: Dynamics of a Bacteriophage in Its Aphid Host

PROFESSIONAL EXPERIENCE

2015  Teaching Assistant, Assessment of Nutritional Status
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

Responsibilities: grading assignments and administrative duties for the graduate level course
2015  Teaching Assistant, *Principles of Human Nutrition*  
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.  
**Responsibilities:** Grading assignments and exam, managing the course website, fielding student inquiries, and facilitating discussions.

2015  Section Instructor, *Fundamentals of Epidemiology*  
Johns Hopkins University, Baltimore, MD.  
**Responsibilities:** Instructing a weekly lab section for an undergraduate public health course; facilitating discussion and answering questions regarding the weekly exercise, conducting office hours, and correspondence with students.

2015  Teaching Assistant, *Managing Non-Governmental Organizations in the Health Sector*  
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.  
**Responsibilities:** Grading assignments and exam, managing the course website, fielding student inquiries, and facilitating discussions for a graduate level public health course.

2013-2014  Graduate Research Assistant, Program in Human Nutrition  
JiVitA Bangladesh, Gaibandha, Bangladesh.  
**Responsibilities:** quantitative and qualitative data collection for dissertation research involving feeding behaviors among caregivers of 15-24 month-old children in rural Gaibandha. Training data collectors; conducting in-depth interviews, focus group discussions and in-home observations; developing a feeding behaviors questionnaire; primary and secondary data analysis.

2013  Teaching Assistant, *Nutrition: Concepts and Controversies*  
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.  
**Responsibilities:** grading exams and assignments, writing exam questions and corresponding with students for an undergraduate level course.

2013  Student Investigator, Helping Up Mission (HUM)  
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.  
**Responsibilities:** Contributed to the protocol design and development of field guides for a qualitative research study designed to evaluate and develop the recovery program at Helping Up Mission (HUM), a
substance abuse treatment center in Baltimore, MD. Conducted and transcribed in-depth interviews and focus group discussions, analyzed data using qualitative data analysis techniques, manuscript writing, and presentation of preliminary findings to fellow students and faculty at JHSPH as well as at HUM.

2012-2013 Graduate Research Assistant, Program in Human Nutrition
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: assistance with materials development for a study involving the measurement of dietary intake for adults and children before and after the opening of a supermarket in a low-income, neighborhood with limited food resources. Materials development included the development and formatting of a mail-in survey for distribution to participants, development of an online survey, and IRB submission for the final products.

2012 Teaching Assistant, Assessment of Nutritional Status
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: grading assignments and administrative duties for a graduate level course.

2012 Teaching Assistant, Introduction to International Health
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: grading and giving feedback on term papers, facilitating discussion sessions, and consulting with students during office hours, attending lectures, and writing exam questions for a graduate level course.

2012 Graduate Research Assistant, Program in Health Systems
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: assisted with writing formative research protocol, training health workers, conducting formative research through ICDDR,B for a Center for Global Health-funded Kangaroo Mother Care project in Gopalganj, Bangladesh.
2012  Course Instructor, *Introduction to Infectious Disease*
Discover Hopkins Program, Johns Hopkins University, Baltimore, MD.
**Responsibilities:** created a curriculum for and taught the course *Introduction to Infectious Disease* for Discover Hopkins, a program for high school students who want to take a summer class at JHU. Gave lectures, assessed student performance, organized and facilitated field trips, and recruited guest lecturers.

2012-2013  Study Consultant, Study Consulting Program
Johns Hopkins University, Baltimore, MD.
**Responsibilities:** worked with undergraduate students to strengthen their academic skills, adjust to college and balance their schoolwork.

2010  Student Investigator
International Centre for Diarrhoeal Disease Research, Bangladesh.
**Responsibilities:** conducted research on a World Bank-funded project involving training community nutrition volunteers (CNVs) to teach proper nutrition and feeding practices to slum-dwelling mothers. Created/administered a client satisfaction survey to evaluate satisfaction with the CNVs and the program.

2010  Teaching Assistant, *Drugs and Society*
Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ.
**Responsibilities:** gave lectures, graded exams and quizzes, wrote exam questions and served as a liaison between the students and instructor for an undergraduate upper-level public health course.

2009  Graduate Research Assistant, Department of Health Policy
Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ.
**Responsibilities:** compiled research and wrote a book chapter for publication about the cost-benefit analysis of the supplement Pycnogenol and its relation to cardiovascular disease.

2007-2009  Lab Assistant, Department of Entomology
University of Arizona, Tucson, AZ.
**Responsibilities:** worked with *Aphidius ervi* and parasitoid wasps, testing for specific symbiont presence or development in different aphids that may be a barrier from being parasitized.
PRESENTATIONS

April 2017  Poster Presentation, Experimental Biology Conference 2017
Chicago, IL

October 2016  Poster Presentation, Micronutrient Forum 2016
Cancun, Mexico

San Diego, CA

Yokohama, Japan
ZT Chowdhury, KM Hurley, M Jahan, S Kodish, S Shaikh, S Mehra, KP West, P Christian. Qualitative Research to Understand Caregiver Feeding Behaviors and Attitudes in Rural Bangladesh. 2015.

March 2015  Poster Presentation, Experimental Biology Conference 2015
Boston, MA
ZT Chowdhury, KM Hurley, M Jahan, S Kodish, S Shaikh, S Mehra, KP West, P Christian. Qualitative Research to Understand Caregiver Feeding Behaviors and Attitudes in Rural Bangladesh. 2015.

April 2012  Poster Presentation, Clinton Global Initiative University Conference
Washington, D.C.
ZT Chowdhury, MA Henderson. Stamping Out Water-Borne Disease, One Greeting at a Time. 2012.

December 2010  Oral Presentation, MEZCOPH Internship Conference 2010
University of Arizona, Tucson, AZ.

**SOCIETY MEMBERSHIPS**

2014-pres  American Society for Nutrition
            Global Nutrition Council

**AD HOC REVIEWS**

2014  Journal of Child Health Care
2013  Food and Nutrition Bulletin

**ACADEMIC SERVICE**

2011-2012  International Health Student Group Treasurer
            Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
            **Responsibilities:** Oversee and manage the IHSG’s financial records; assure prudent use and disbursement of organization’s funds.

2010  Member of UNICEF-UA
            University of Arizona, Tucson, AZ.
            **Responsibilities:** Various community service projects, including leading the UNICEF Tap Project (recruited local restaurants to charge money for tap water to send to Haiti) in Tucson.

2010  Planning Committee Chair, Women’s Leadership Conference
            University of Arizona, Tucson, AZ.
            **Responsibilities:** planned and prepared for the 8th annual Women’s Leadership Conference, including recruiting speakers and attendees, raising money, and advertising.

2009  Global Opportunities Committee Chair, Global Health Alliance
            Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ.
Responsibilities: collaborated with public health students to compile contacts and resources for global opportunities and establish an accessible database for students and faculty.

2009  Volunteer, Hyderabad Medical Program
       Hyderabad, India.
       Responsibilities: participated in numerous public health awareness activities, including aid at various medical camps in rural areas, and visiting with patients at government and private hospitals.

2009-2010  Support Group Facilitator, Tu Nidito
           Tucson, AZ.
           Responsibilities: facilitated a support group for children with cancer, and children who have a parent with cancer. Coordinated activities and group support discussions.

2008  Treasurer and Student Teacher, Nutritional Health Awareness Tucson, AZ.
       Responsibilities: oriented a group of student teachers for weekly teaching sessions at Mansfeld Middle School. Taught nutrition and health lessons, focusing on a different aspect of health each week.

2008-2010  Preceptor and Student Volunteer, Odyssey Inpatient Hospice Home
           Tucson, AZ.
           Responsibilities: oriented new volunteers through clinical orientation at the inpatient center, assisted nurses and certified nursing assistants with patient care.

2008  Tutor for CARE (Care for the Advancement of Refugee Education)
       Tucson, AZ.
       Responsibilities: tutored refugees from various backgrounds at Amphitheater High School, aided them with math and reading comprehension.

LANGUAGES

Bangla -- fluent speaker.

HONORS AND AWARDS
Honors

2006-2009  Dean's List
            University of Arizona, Tucson, AZ.

2006-2009  Member of Honors College
            University of Arizona, Tucson, AZ.

Scholarships and Awards

2017  Johns Hopkins Sight and Life Global Nutrition Research Institute Scholarship
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2016  2nd place, ASN’s Emerging Leaders in Nutrition Science Poster Competition
      Experimental Biology Conference 2016, San Diego, CA.

2016  Richard and Barbara Hall Fund
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2015  Young Investigator Award, ACN2015 Award Selection Committee
      12th Asian Congress of Nutrition, Yokohama, Japan.

2015  Elsa Orent Keiles Fellowship in Human Nutrition in International Health Award
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2015  George G. Graham Professorship Endowment
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2014  Harry D. Kruse Fellowship in Nutrition
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2011  The Bacon Field Chow Memorial Fellowship
      Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

2010  Nichols Initiative Scholars Award for research on a World Bank funded project in Dhaka, Bangladesh.
      University of Arizona, Tucson, AZ.
2006-2009  University Grant  
University of Arizona, Tucson, AZ.

2006-2009  Wildcat Excellence Scholarship  
University of Arizona, Tucson, AZ.

2006-2008  Academic Competitiveness Grant  
University of Arizona, Tucson, AZ.

PUBLICATIONS


Collaborating author on the CHW Reference Guide: