Suggested title: Responsive complementary feeding practices in rural Rwanda: Perspective from mothers.

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Abstract

Background: The feeding practices of the mothers, particularly responsive feeding, are critical determinants of acceptance of food, dietary intake as well as the growth of infants and young children (IYC). Responsive feeding refers to the interactions between mother and child that lead to a positive feeding experience, adequate dietary intake and enhanced developmental opportunities. Little is known about mothers responsive feeding practices in Rwanda. Therefore, this study sought to explore mothers' responsive feeding practices as well as the factors that hinder the implementation of recommended practices among mothers from rural Muhanga District. **Method**: This qualitative, longitudinal study, recruited a purposive sample of 29 pregnant women attending prenatal consultations in two rural health centers. They were interviewed and mother-child interactions during mealtime were further observed during one lunch meal feeding episode at 6, 9 and 12 months postpartum. The interviews were recorded, transcribed and thematically analyzed using qualitative software, Atlas.ti. Frequency distribution was generated for each practice observed. **Results:** At 6 months, most mothers reported to verbally encourage their children to eat during feeding and the numbers increased over the age at 9 and 12 months respectively. Less than a half, at all 3 time points, reported to allow their child to self-feed, to smile and talking during feeding. During the observation, the practices were even less than the reported at all 3 time points of the observations. The burden of other responsibilities and poverty were perceived as the major barriers that made mother child- interactions during feeding difficult. **Conclusion:** Findings indicate that what mothers report may not always reflect the responsive feeding practices performed during feeding **.** Nutrition interventions in the study community should consider promoting responsive feeding practices as well as addressing the issue of poverty and the burden of other responsibilities that hinder mother-child interactions.

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Conclusion: Findings indicate that what mothers report may not always reflect the responsive feeding practices performed during feeding**.** Nutrition interventions in the study community should consider promoting responsive feeding practices as well as addressing the issue of poverty and the burden of other responsibilities that hinder mother-child interactions.

Key words: Responsive feeding, mother-child interaction during feeding, infant and young child feeding, Rwanda.

Background

Child undernutrition remains a public health concern in low- and middle- income countries. It has long been documented that one of the major causes of child undernutrition relates to inadequate infant and young child feeding practices [1]. Yet, optimal feeding practices not only depend on what and when to feed the child (the quality, the quantity and the frequency) but also on how the child is fed, the quality of interaction between the mother and the child during feeding [2]. Undernutrition may be due as much to difficulties in the interactions between mothers and children as to a lack of high-quality foods [3]. The interactions between mother and child that lead to a positive feeding experience, adequate dietary intake and enhanced developmental opportunities are referred to "responsive feeding" [4].Preferably, children should be fed responsively [5]. Components of the responsive feeding practices as recommended by the Word Health organization (WHO) include: 1) feeding infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues; 2) feeding slowly and patiently and encouraging children to eat, but not forcing them to eat; 3) Trying other encouragement strategies when children refuse food, experimenting with different food combinations, tastes, textures, and methods of encouragement; 4) minimizing distractions during meals; and 5) remember that feeding times are periods of learning, love and talking to children during feeding, with eye-to-eye contact [5].

Responsive feeding practices are known to promote children's physical, mental and social development [6]. Previous studies in low- and middle-income countries show that responsive feeding practices during the complementary feeding period are linked to increased child acceptance of food [3, 7, 8]and adequate dietary intake and good nutrition status [9, 10]. However, most of these studies are carried out in Asian countries and very little research is available that document responsive feeding practices in the African context.

Rwanda has made progress in decreasing the prevalence of acute malnutrition. However, the rate of chronic

malnutrition (stunting) remains high (33%) particularly in rural areas [11]. Stunting reaches the highest point during the complementary feeding period. Adequate complementary feeding practices remain limited in Rwanda, as only 19% of children between 6-23 months of age meet the minimum acceptable diet in 2019 [11]. Efforts to improve complementary feeding have often focused on nutritional physiological aspects such as timing, composition, and frequency of feeding [12].Very little research is available that documents mother-child interactions during feeding (responsive feeding practices) of Rwandan mothers. Knowledge on current responsive feeding practices may inform policies and programs that aim to improve complementary feeding practices beyond nutritional aspects. The aim of the present study was to investigate mothers' responsive feeding practices, alongside exploring the common barriers that made it difficult to implement the recommended practices.

Methodology

Study design

This study adopted a descriptive and exploratory design. A descriptive qualitative longitudinal methodology was used to explore responsive feeding practices among mothers alongside factors that made it difficult to implement the practices.

Study Context

The study took place in rural Muhanga District that is located in Southern province of the country, approximately 49 Km from the Rwandan capital city of Kigali. The majority of the population in Muhanga district lives in rural area. The main source of income and food in Muhanga district is agriculture. Muhanga district had reduced poverty headcount from 53.3% in 2010/2011 to 30.5% in 2013/2014 [13]. In contrast, the 2019/2020 Rwanda Demographic and Health Survey (RDHS) found that 35 % of children under the age of 5 were stunted; this is above the national rate of 33% [14].

Study population and sampling procedures

This study was conducted between December 2016 and October 2017 as part of a larger qualitative longitudinal study that aimed to explore actual breastfeeding and complementary feeding practices as well as the factors that impede the WHO recommended practices from birth to one year of a child's life. The study details have been published elsewhere [15, 16].

Briefly, pregnant women in their last trimester of pregnancy who came for prenatal care at 2 governmental health centers, Buramba and Rutobwe, from Muhanga district were contacted. They were approached by trained research assistants who provided detailed description of the study and those who agreed to participate signed the informed consents. Recruitment ceased after enrolling 39 women who came first as data saturation had been reached. The inclusion criteria for the study were:1) being pregnant in the last trimester with no serious obstetrical condition, 2) planning to give birth in the local health center and reside in the area within the first 12 months of child's life 3) and willing to be observed during 3 child feeding occasions that are at 6, 9 and 12 months postpartum). The present study focus on a purposive sample of 29 mothers who completed the follow-up from birth to one year of child's life and whose data was available for both the interviews and mealtime observations.

Data collection

Mother-child interactions during complementary feeding were assessed through in- depth interviews and mealtime observations at 6, 9 and 12 months of child's life. Data were collected by the principal investigator and the research assistants. First in-depth interviews were conducted and then observations were made.

In depth interviews

Interview questions developed by ProPAN (Process for the Promotion of Child feeding) (PAHO, WHO, and UNICEF,2013) were adapted and used to collect data about how mothers feed complementary foods to their children at 6, 9 and 12 months of the child's life (responsive feeding practices). Before undertaking the

data collection, interview guides were reviewed and piloted to check that the questions were enabling the most pertinent information to be gathered. Table 1. summarizes the main content of the interview guide. Questions asked the mothers how they fed their children during the main meal (lunch), the day before the interview. Mother encouragement during feeding was assessed by asking mothers (1) if they did anything to encourage the child to eat and what they did, (2) if mothers talked to the child during feeding and what they told to their children and how they managed food refusal. Mothers were also asked what they do if the child stops eating or when she feels her child is still hungry or did not eat enough. Strategies to motivate the child to eat, and if not, the reasons for not motivating the child to eat or difficulties she would have in doing this were also a topic of the interviews. Mothers were also asked if the child was sometimes given the opportunity to self-feed at any time during feeding episode. Each follow-up interview included a review of previous interviews to encourage focus on the longitudinal nature of mother -child interaction during feeding and validate data from the previous interview[17]. For instance, at 9 and 12 months, the interviewer asked the mothers if they made some changes in the ways they interact with their babies during feeding from the last visit. If yes, mothers were invited to talk more about changes they made and the reasons behind changes.

Table1: Interview guide at 6, 9 and 12 months

How did you interact with your baby during the main meal (lunch), yesterday?

Probing questions

1. Yesterday, during the meal time, did you do anything to encourage (child's name) to eat? If yes, what did you do? If no, ask for reasons? Is it always like that or there are situations you do it differently, if yes when and what do you do different and why?
2. Yesterday, during the meal time, while feeding (child's name) did you talk to him/ her? What did you say? Is it always like that or there are situations you do it differently, if yes when and what do you do different and why?
3. Yesterday, during the meal time, did (child's name) self-feed (eat by him/herself, using hands or utensil) at any moment during the meal? If yes, did the child (name) self-feed the whole time, half of the time or a little time? Is it always like that or there are situations you do it differently. What difficulties would you have in doing this?
4. Yesterday, during the meal time, did (child's name) stop eating, and you think he/she did not eat enough, what did you do? Is it always like that or there are situations you do it differently, if yes when and what do you do different and why? If the mother answers: "I motivated her/him to eat": How did you motivate her/him to eat? Is it always like that or there are situations you do it differently, and why?
5. What difficulties would you have in motivating the child to eat when you think he /she did not eat enough?
6. If the mother doesn't say she would motivate: Why wouldn't you motivate?
7. What factors do you think make it difficult for you to interact with your child during feeding? How do they make it difficult your interactions?

Observation of feeding episode

At 6, 9 and 12 months postpartum, data were collected on mother-child interaction during feeding using a structured observation guide to generate a description of daily life of mothers caring for their children in their naturalistic rural setting of Rwanda. Three lunchtime meal observations per child were made. The observations were done when the principal investigator and the research assistants visited mothers to conduct in depth interviews.

The "Opportunistic observation form" developed by ProPAN (Process for the Promotion of Child feeding) (PAHO, WHO, and UNICEF,2013) was used to collect data on responsive feeding and the type of food offered.

Three child practices were assessed: child's interest in food, self-feeding attempts and food refusal during the meal. A child was interested in food if he/she readily opened his/her mouth and moved head towards the spoon or hands when food was offered and not interested if he/she turned away from food every time he/she was offered food. Self-feeding was defined as any bite a child attempted or feed himself/herself without assistance. Mothers' practices that were assessed consisted of encouragement and strategies to overcome food refusal if any. Encouragement was defined as verbally encouraging the child to eat when he/she is eating well and any non-aversive praise offered to the child by the mother, encouraging the child to eat more using gestures, games, or demonstrating how to eat. Mother's encouragement of self-feeding was assessed by observing if the mother verbally encouraged, allowed or supported the child to self-feed him/herself or to hold a spoon or touch food with hand. Other aspects observed included who fed the child, what the child was given to eat, and where the feeding took place. In addition, any social interaction practice, verbal or gestural interaction, that took place during feeding and concerned non-food subjects was recorded. The observation was conducted from the start till the end of the mealtime.

Table 2. Observation guide

TOPIC
1. Mother-child interactions (Responsive feeding at 6, 9 and 12 months)
Who is feeding the child during the mealtime? 1.2 What is the location of mother in relation to child during feeding? 1.3 D
1.4 Does the child eat from his own plate or from a shared plate with family members
1.5 What kinds of foods that are given to the child of about [child's age] months (Foods, dishes, and drinks served to child)
1.6 Does the mother serve additional portions to the child during the meal?
Does the child eat all of the food/ drink he/she is served?
1.8 Does the mother talk to the child, verbally encouraging him/her to eat? What does the mother say?
1.9 Does the mother encourage the child when he/she is eating well? What does the mother do or say?
1.10 Does the mother ever motivate the child to eat more using gestures or games, singing or by demonstrating to her/him
Does the mother ever physically force the child to eat during the meal?
1.12 During the meal, does the child ever refuse the food? What does the mother do?
1.13 Is the child interested in food?

Before undertaking the data collection, 2 research assistants were recruited and trained on using the "opportunistic observation form" and each item of the form was reviewed to ensure proper understanding. The observation form was translated in Kinyarwanda and reviewed again to ensure its conformity with the English version. The form was piloted with mothers of young children located in the neighboring villages of the study community. The observers (the principal investigator and the research assistant) arrived at participants' homes in the morning and remained at the house until the lunch meal is prepared and the child had eaten to fill out the observation form. The date of the visit was not announced to the mothers and the choice of food was free.

Ethical consideration

The study protocol was approved by the Institutional Review Board of the College of Medicine and Health Sciences (Approval notice: No 058/CMHS IRB/2016). Informed consent was obtained from each participant for participation in in-depth interviews and lunchtime meal observations.

Analysis

All in depth interviews were audio-taped and transcribed verbatim in Kinyarwanda. Transcripts of interviews were made anonymous using participants' codes. Analysis of in-depth interviews was conducted using atlas ti. Software. Data analysis for in depth interviews about mother-child interactions during feeding (responsive feeding) followed thematic analysis method which involved reading the transcripts for familiarization with data, generating initial codes, sorting the different codes into potential themes, reviewing and refining themes

as well as reporting [18]. Relevant verbatim quotes, translated from Kinyarwanda language to english, were incorporated in the presentation of the results to help with data understanding.

For the analysis of mealtime observations, the number of times a single practice occurred was counted. An action or a practice that happened at least two times during the meal was considered as present while practices which occurred less than two times were counted as absent [3]. No statistical test was performed, because the sample size was too small. The transcripts of lunch meal were coded by two independent raters that are the principal investigator and the research assistant.

Results

Characteristics of the study participants

Table 3 presents the participants' characteristics. The mean age of our respondents was 33 years (range 20-42). Twenty-three(n=23) were married. Twenty-seven(n=27) had the ability to read and write. Less than a half of the participants completed primary school education (n=10). The main occupation for all participants was agriculture. Most of participants had 1 or 2 children.

Table 3: Characteristics of the study participants

Characteristics	Frequency
Age of the mother (years) n=29	Age of the mother (years) n=29
< 21	2
21–30	9
>30	18
Marital status	
With partner	23
Ability to read and write	Ability to read and write
Yes	27
Education level of the mother	Education level of the mother
Illiterate	2
Primary incomplete	14
Primary complete	10
Secondary incomplete	3
Main occupation	
Farming	29

Overview of the results

The results of the interviews and observations are divided into two major themes: 1) Mother-child interactions during complementary feeding episodes: responsive feeding practices, and 2) barriers to mother-child interactions during complementary feeding.

Mother- Child interaction during complementary feeding: Responsive feeding practices

During the observation at 6 months, the meal served to the child consisted mainly of cereal-based gruel, thin porridge, commonly made from a mixture of two or more flour such as maize, sorghum, soybeans. The consumption of animal-source foods, such as cow's milk was limited. At 9 and 12 months, the varieties of foods offered to children ranged from the aforementioned cereals-based porridge to food from grains, roots and tubers groups (such as potatoes, plantains), legumes (mainly dried beans) and green leafy vegetables (amaranth).

The majority of mothers at all 3 time points (6, 9 and 12 months) reported to verbally encourage their children to eat, most commonly by making positive comments about food. However, at 6 months, some mothers pointed out that they don't see the importance of verbally interacting with such a young child

during feeding. Those women highlighted that they did not understand why they would attempt to converse with a child who is still too young to talk during feeding.

At 9 and 12 months, many of the mothers verbally interacted. They described how their children enjoy dialogue (being talked to) and how their children eat a great amount of food if they are talked to during feeding. For instance, 2 mothers said:

"I verbally encouraged him to eat by telling him that the food is very delicous which made him so happy that he ate the food with more interest." (W-01, month9)

Whenever I feed my kid I talk to him otherwise he doesn't eat. He looks aside in the opposite direction of the food even if he would still want more food." (W-23, month 12)

Furthermore, at 9 and 12 months, some mothers explained that verbally encouraging the child during feeding promotes language development, on top of stimulating the child to eat more. For example, one mother said:

"What I have observed is that when Italk to the child while eating, this motivates the child to eat more and boosts his capacity to speak." (W-27, month 9)

Other mothers reported to motivate the child to eat more by demonstrating the child how to eat while others reported to engage in social interactions unrelated to food during feeding episode.Those non-food related social interactions consisted mainly of drawing out a child's smile through copying and responding to the child's sounds and making funny sounds to get their child to smile whereby the child responded by repetitive sounds (at 6 months). Mothers explained that drawing out a child's smile was used to make the child feel loved by the mother and that it promotes a bond between the mother and the child. Other mothers, at 9 and 12 months, reported talking to their children by calling the child's name or naming things. Some mothers explained that talking softly to the child was used as a way to provide social interaction while others expressed talking to the child to assist the child with language development.

"During feeding, I smile at him and see that the child is happy too". (W-13, 6 months)

"When I hold my child, I sometimes make funny sounds to get the child to smile, and see that the child feels loved". (W-10, 6 months)

"There is a time when he says anything and I respond by copying his sounds. By doing that, I realize that I stimulate the child's language development". (W-8,12 months)

"When he says anything, and I respond by copying the sounds, I see that the child is happy with that". (W-27, 9 month)

The observation of feeding episodes showed that all infants were fed by their mothers and were given food from their own plates. Most children were held by mothers, seated on mothers' laps. Most children accepted food when it was offered. At 6 months, most mothers' feeding practices consisted mainly of putting food into the child's month without any encouraging strategy or social interaction while few mothers were observed demonstrating the child how to eat. At9 and 12 months, close to a half of mothers were observed verbally encouraging their children to eat. In case of food refusals during feeding, most participants reported to encourage their children to eat more. Observations, however, revealed that the majority of mothers did not try any solution in case of food refusal but instead stopped feeding at all 3 points in times. A few mothers were observed using threatening verbalization (giving direct order) for more mouthful acceptance. For example, during the observation at 9 months, one mother said "*I will beat you if you don't eat this food. Eat"* . Another mother was observed to physically force the child to eat more by holding the child's hands down to force food into his mouth and commanding the child to eat.

At 6 months, most mothers reported to feed their infants and not allowing them to feed themselves. During the observation, at 6 and 9 months, all mothers fed their infants the entire time of feeding episode as they reported to believe the children are still too young to feed themselves. At 12 months, almost a half of the mothers provided their children the opportunity to feed themselves small finger foods at some time during

feeding. Those mothers who let their children self-feed reported to recognize a child centered focus related to his/ her development, learning and autonomy, as 2 mothers stated:

"I used to assist him in eating for the entire time of the feeding episode but later I decided to let him feed himself under my supervision as part of his learning process. For instance, I wash his hands and put the food in a small plate. Then the child starts eating himself ." (W-17 month 12)

"I also assume that time will happen when I will not be nearby. Yet the child will have to absolutely eat. Consequently, I sometimes let him self-feed under my supervision as the child needs to know how to feed himself as he grows older ." (W-12, month 12)

Table 4: Reported and observed practices during mealtime at 6, 9 and 12 months

		6 months (n= 29)	6 months (n= 29)	9 months (n=29)	9 months (n=29)	12 months (n=29)	12 months (n=29)
	Reported	Reported	Observed	Reported	Observed	Reported	Observed
Child's actions	Child's actions						
Interest in food	*Interest in food*						
Interested	Interested	29	27	29	25	29	23
Not interested	Not interested	0	2	0	4	0	5
Self-feeding	*Self-feeding*						
Self-feeding attempt	Self-feeding attempt	0	0	4	0	10	13
Mothers' actions	Mothers' actions						
Strategies to encourage the child to eat	*Strategies to encourage the child to eat*						
Verbal encouragement	Verbal encouragement	17	1	22	13	23	14
Modeling eating/swallowing	Modeling eating/swallowing	7	8	2	5	0	0
Encouragement of self-feeding	*Encouragement of self-feeding*						
Allow/support the child to self-feed	Allow/support the child to self-feed	0	0	7	0	12	13
Social actions	*Social actions*						
Smiling/laughing	Smiling/laughing	9	8	11	10	12	13

		6 months (n= 29)	6 months (n= 29)	9 months (n=29)	9 months (n=29)	12 months (n=29)	12 months (n=29)
Talking but not about food (calling the child, naming things, asking a question)	Talking but not about food (calling the child, naming things, asking a question)	0	0	9	6	11	8
Violent behaviors Force feeding by threating verbalization or physical force	*Violent behaviors* Force feeding by threating verbalization or physical force	0	2	0	3	0	3

Barriers to mother-child interactions during complementary feeding.

At 6, 9 and 12 months, some mothers mentioned that the lack of time because of other responsibilities was a barrier to encouraging their children to eat more. For instance, 2 mothers said:

"I admit that this is a rare occasion where I talk to my child during feeding even though I know how important chatting is for the child but due farm and household duties I do not do it neither".(W-25, month 6)

"The child eats under pressure because I press him to finish the food quickly to let me go for my businesses, usually farming. Honestly we do not have time to chat with the child during feeding. During working hours, I always pressurize the child to finish the food so that I get back to farm for weeding, searching for fodder but even at noon sometimes it becomes not possible because you are under pressure to be back to farm." (W-29, month 12)

Other mothers emphasized that poverty played a role in their inability to interact properly with children during feeding. Mothers said that their efforts were more focused to finding financial means to survive due to poverty.

"It is just to find the means to survive due to poverty we only mind our own businesses. And if a mother spends her time conversing with her child, she can't achieve anything. She can't get anything to eat, as the family can't eat it. It is impossible." (W-18, month 12)

Few of the mothers expressed (3 out of 29 at 12 months) their concern related to mess and food waste that may be associated with letting the child self-feed, as two mothers explained:

"*She is too young to feed herself. If I let her instead she drops food on herself and her clothes and can be burnt"* . (W-14, month 12)

"The reason for not allowing the child to self-feed is that the child does not value food, he throws them away rather than eating".(W-7, month 12)

Discussion

This is unfortu-

nate as feeding styles are dynamic and evolve quickly with the age of

the child.

This study aimed to investigate mothers' feeding practices including mother-child interactions during feeding and the common factors that made it difficult to implement the practices. The findings from the interviews and meal observations at 6, 9 and 12 months indicated that the complementary foods offered to children were mainly carbohydrates and leafy vegetables based while the consumption of animal-source foods was limited. . Similar findings were reported in other studies in Sub-Saharan African countries [19, 20]. Animal source foods including eggs, dairy, meats are an important source of proteins and micronutrients and have been linked to improved nutritional status including reduced stunting [21]. Future research should consider understanding the cultural or economic factors that may prevent the use of animal- source foods.

Our findings revealed that most mothers reported to verbally encourage the children to eat during feeding. However, this finding was not supported by our feeding observations as most of the mothers at all three points (at 6, 9, and 12 months) were observed offering food to their children without any verbal encouragement. This discrepancy can be attributed to the fact that mothers are aware of the positive effects of verbal encouragement, yet they can't manage to bring it into practice. This was most noticeable at 6 months, increasing up to almost a half at 9 and 12 months. This latter finding is consistent with the findings of another meal observation study in Kenya, which indicated that mothers were usually passive during meals[22]. However, positive verbalization during feeding is known to be important for greater food acceptance, higher number of mouthfuls eaten and good nutritional status in infant and young children [7, 23, 24].Furthermore, positive mother verbalization during feeding provides a great opportunity to stimulate the child's social and mental development, to promote psychosocial stimulation, and to promote language and cognitive development in infants [23].Therefore, the findings emphasize the need for practice change interventions encouraging mothers to combine feeding and stimulation activities for both better child nutrition and developmental outcomes. Besides the satisfaction of basic needs for children's physical growth during feeding, this is a moment also for learning and love when it is important to talk and maintain visual contact with the child. Mother-child interaction during feeding has been linked to the development of children's eating patterns and socialization [25].Social interactions between mother and child such as speaking to the child, singing, and encouraging him/her also stimulate connections in the child's brain and promote cognitive development [26].Therefore, nutrition interventions should support mothers in developing skills in specific forms of interaction during meal time that promote full cognitive, physical and social emotional development in children.

The findings also indicate that some mothers used negative strategies such as threatening verbalization during feeding, suggesting that mothers lacked problem solving strategies to keep on when feeding become challenging. Similar results have been described in several other different contexts such as in Kenya [22] and Ghana [27].The use of such negative strategies is an indication of non- responsive feeding which results in frequent food refusals by the child [28]. The use of negative strategies has potential to negatively impact child growth, particularly in communities where growth faltering is a major child nutrition problem.

Despite children's psychomotor ability to feed themselves from the age of 9 months[6], mealtime observations found that most mothers did not provide their children the opportunities to self-feed at 9 month observation. Such non-responsive feeding practices, characterized by the lack of adaptation to psychomotor abilities for self-feeding can affect child feeding skills and healthy appetite in the long term[29]. A possible reason for not allowing their children to self-feed may be that at that age children need a long time to self-feed while mothers have competing demands on time due to other responsibilities [30]. Another possible explanation may be avoidance of food wastage, that is more likely to happen when the infant fed her/himself [31].

The findings of this study also indicate that mothers' feeding practices varied with child' age (age-dependent), from 6 months to 12 months. Overtime, for instance, there was an increase(continuity)in mothers' actions that include verbal encouragement, encouragement of self-feeding and social interactions such as talking to children from 6 months to 12 months. This reflects that maternal feeding practices during infancy develop over time with respect to child's developmental stages.

In this study, the experiences of mothers emphasized the common challenges that made it difficult to implement the responsive practices for mother-child interaction during feeding. Some mothers considered lack of time due to the burden of other responsibilities as a barrier to encourage children to eat more during feeding and as a barrier to providing psychosocial stimulation. Many mothers reported to spend most of their time managing the responsibilities of daily living and to have limited time to mother-child conversation. This finding is similar to what has been reported by other studies conducted in other countries in Sub-Saharan Africa [32, 33] and other developing countries such as Bangladesh [31]. The findings point out the need for interventions to encourage mothers to reallocate time to childcare or to integrate the stimulation activities into their daily routines, as even a busy mother can be given the motivation and confidence to talk with a child during feeding [34].Additional possible solution is to engage other family members, males included, into childcare practices to address the barrier of burden of other responsibilities. This possible solution may also help to enhance child's bonding with the father.

Poverty was considered by participants as another challenge for responsive mother-child interaction during feeding. Mothers stated that poverty affects their responsive feeding practices because most of the time, mothers spend time in farming or securing their family finances to buy foods and hence, have limited time to dedicate to interacting with children. This is in line with a study by Affleck et al. [31]which found that household constraints such poverty contributed to mothers 'practice of force feeding the child when he/she refuses to eat what is available due to the inability to offer different food items. There is a need to support mothers in securing their income and access to food so that they can follow the responsive feeding recommendations.

The strengths and limitations

The strengths of this study lies in its qualitative longitudinal nature, which allowed us to prospectively gain a deeper understanding of responsive feeding practices overtime. The use of direct observation provided an opportunity to capture verbal and non-verbal context of behavioral dynamics during feeding that were important yet not captured through self-report interviews. Nevertheless, the study suffered from a number of limitations. Mothers might have answered or modified their feeding practices in ways that they felt were more desirable during the observations due to our presence. We minimized reactivity by having established a sense of rapport and trust with mothers in the first five months of child's life during the exploration of exclusive breastfeeding practices. We believe that the effect of reactivity would have been minimal as mothers were exposed to repeated interviews and observations before they were recorded and observed (at birth, first week, 4 months).More research is needed to explore the association between behavioral factors in complementary feeding and children's nutrient intake.

Conclusion

Our findings provide insights into mother-child interaction during the complementary feeding as well as the common constraints that make it difficult to adopt the recommended practices among mothers in rural Muhanga District. Most mothers reported to verbally encourage the children to eat during feeding. During the observation, mothers rarely provided verbal encouragement during feeding and rarely allowed children to self-feed. The study also revealed that factors such as the burden of other responsibilities and poverty were perceived as barriers to implement the responsive feeding practices (for mother-child interaction during feeding).Therefore, interventions strategies to improve child nutrition should address constraints to the issue of how to feed the child in addition to and above what is fed to the child only.

Recommendations:

The findings from this study have a number of implications for future nutrition interventions that optimize child development through responsive feeding.

- Health professionals should pay greater attention to the behavior components of complementary feeding (responsive feeding) and advise mothers on how to practice it, in addition to what to feed the child.

- Health professionals should develop strategies with mothers to implement what they know and making feeding time an enjoyable moment for children and themselves.
- Health professionals should consider training mothers on age- appropriate and developmentally appropriate mother –child interaction during the complementary feeding period.
- There is a need to support mothers in securing their income and access to food by addressing the competing demands and poverty issues that affect their ability to practice responsive feeding.

List of abbreviations

CHWs: Community Health Workers

EB: Exclusive Breastfeeding

IRB: Institutional Review Board

RDHS: Rwanda Demographic and Health Survey

WHO: World Health Organization

Declarations

Ethical approval and consent to participate

Ethical approval to conduct this study was obtained from the Institutional review board of the College of Medicine and Health Sciences in Rwanda (Approval notice: No 058/CMHS IRB/2016). The study staff explained the purpose of the study and procedures to mothers both verbally and in writing. Then, informed written consent was obtained from every participant mother for the total 12-month study period prior to participation. Mothers were assured that their participation was voluntary, confidential and that they were free to withdraw from the study at any time.

Availability of data and materials

The data generated and analysed during the current study are available from the corresponding author on reasonable request**.**

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JA designed the study protocol, conducted the in-depth interviews, coded and analyzed the data, and wrote the manuscript.**LV and MK** contributed to the design of the study protocol and guided the analysis and the writing of the manuscript, reviewed the manuscript, and approved it for submission. All authors read and approved the final manuscript.

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