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Perceptions of the mothers on the determinants of undernutrition in Rwanda: a qualitative study



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Abstract

Background Undernutrition is a serious public health concern that, despite numerous efforts to overcome, continues to persist. An integrated nutrition-specific and nutrition-sensitive intervention was implemented in Rwanda over a period of 5 years to combat undernutrition. Following this intervention, quasi-experimental quantitative studies revealed improvements in mothers' practice regarding Infant and Young Child Feeding (IYCF), resulting in increased achievement of the Minimum Acceptable Diet (MAD). The purpose of this study was to provide qualitative data on mothers' perceptions of the determinants of undernutrition to identify whether they understand what the determinants of undernutrition are, and what the possible barriers experienced are. By obtaining this information, the authors plan to use it to improve the integrated nutrition-specific and nutrition-sensitive intervention and to re implement this improved intervention in future. This qualitative study aimed to explore mothers' perceived understandings of the determinants of undernutrition and identify mothers' perceived barriers in addressing it.

Methods This was a qualitative study carried out in four Districts, namely, Nyarugenge, Gasabo, Nyabihu and Ngororero. Data was obtained through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). Overall six FGDs with ten mothers each and thirty KIIs were considered. Both deductive and inductive approaches were utilized to identify codes, with Atlas ti 7.5.18 as the software.

Results Two themes were generated from the data namely, mothers' perceived understandings of the determinants of undernutrition and mothers' perceived barriers related to the determinants of undernutrition. (1) Mothers had a good understanding of the determinants of undernutrition. (2) Knowledge was lacking in terms of practices related to IYCF, specifically complementary feeding initiation and practice. (3) Mothers were unsure of the association between hygiene and vaccination with undernutrition. (4) Participants from FGDs were likely less knowledgeable on the determinants of undernutrition. (5) Perceived barriers: poverty, ignorance, negative beliefs, maternal and child health issues, illnesses and inappropriate parental care practices.

Conclusion Nutrition education programme is needed to address knowledge gaps, and barriers identified should guide the improvement of nutrition interventions.

Keywords Perceptions, Determinants, Understanding, Barriers, Undernutrition

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Introduction

Undernutrition is a physical condition characterized by a nutritional disorder resulting from insufficient food intake (undernourishment) and/or poor absorption and/ or poor biological use of nutrients consumed as a result of repeated infectious disease. It encompasses being stunted (<-2 height-for-age z-scores), wasted (<-2weight-for height z-scores), underweight (<-2 weightforage z-scores) and deficient in vitamins and minerals [1, 2].

According to 2024 World Health Organization (WHO) reports, in 2022, nearly half of deaths among children under 5 years of age were linked to undernutrition which occurs in developing countries [3]. Unfortunately, as a widespread serious problem affecting children in developing countries, progress to tackle all forms of undernutrition remains unacceptably slow [4]. In 2022 for example, globally, 148.1 million children under 5 years old were stunted, 45 million wasted, and 82 million underweight [5, 6].

Stunting among children under 5 years old in Rwanda has decreased from 51% in 2005 to 38% in 2015 and 33% in 2020; wasting has decreased from 5% in 2005 to 2% in 2015 and 1% in 2020; and underweight has decreased from 18% in 2005 to 9% in 2015 and 8% in 2020 [7–9]. However, even though decreasing, the figures continue to be high, and further work is required to keep them down.

Determinants of undernutrition include inadequate food intake; poor caregiving and parenting; improper food practices; infectious comorbidities; food insecurity; and inadequate economic resources at the individual, household, and community levels [10]. Limited or poor access to education, healthcare services, infrastructure and poor hygienic environments are also determinants that affect children under the age of 5 years [11].

According to a study carried out in Sudan, poverty, food insecurity, conflicts and civil war, climate change, displacement, and endemicity of infectious diseases have also been found to be the risk factors contributing to undernutrition. [12].

Based on a scoping review aimed at establishing childhood undernutrition determinants in Southern Africa, it has been found that the nutritional status of children under 5 years was influenced by maternal, child, household, and community-related factors. Regarding maternal-related factors, findings from the review indicated maternal education to be the most common reported determinant of child undernutrition. Factors influencing child nutritional status included child feeding and care practices. One study reported a longer duration of exclusive breastfeeding to be associated with an increased risk of undernutrition. Regarding householdrelated factors, the risk of childhood undernutrition was found to be associated with an increase in poverty rates, household food security, access to water and sanitation and household size. Finally, for community-related factors, residence was singled out to be the most important determinant of childhood undernutrition [13].

There have been various studies of mothers' perceptions on the determinants of undernutrition in the existing literature. Many of them reported a good understanding towards IYCF such as early initiation of breastfeeding within 1 h after birth, initiation of complementary feeding at 6 months and benefits of breastfeeding [14-16]. However, knowledge gap perception has been reported in other studies such as initiation of complementary feeding earlier than 6 months and deterring extended breastfeeding up to 2 years and beyond [17, 18]. In regard to the perceived awareness on WASH (Water, Sanitation and Hygiene) activities and health service utilization, existing studies have shown a good understanding of personal hygiene practice and use of health service especially vaccination in preventing under nutrition [17, 19]. Perceived barriers of the mothers related to the determinants of undernutrition were mostly poverty and ignorance in many studies [20, 21].

Quantitative studies on mothers' knowledge and practices related to IYCF, as well as the effect of nutrition intervention packages on stunting, were recently conducted in two intervention Districts (Nyabihu and Nyarugenge) and two control Districts (Ngororero and Gasabo) following the Gikuriro Nutrition Intervention [22, 23]. The Gikuriro Nutrition Intervention Program was a 5-year (2016–2020) USAID (United States Agency for International Development) funded Integrated Nutrition and WASH Activity (INWA) programme adapted from the Lancet series 2013 [24] (Appendix 1). Lancet series was a special series in the Lancet journal focusing on maternal and child nutrition studies that also provided recommendations on nutrition specific and sensitive interventions [25, 26]. The findings of these aforementioned quantitative studies have shown that an integrated nutrition-specific and nutrition-sensitive intervention package can improve mothers' practice of IYCF and, as a result, increase their achievement of the MAD [22]. However, there was no effect of the nutrition intervention package on stunting [23]. Nevertheless, if the replication of this nutrition program in the future is recommended for the fight against undernutrition, it might not be fully effective if implemented alone. The thoughts and opinions of mothers on the determinants of undernutrition should also be considered to improve it for its re implementation in the future. In fact, it is important to understand mothers' perceptions from a point of view because mothers are charged with the task of feeding and providing care for their children, regardless of the environment or resources available to them [27]; moreover, it is important to recognize that many interventions to improve child health and nutritional status depend on someone's behavior, frequently the mother [28].

Consequently, the specific objective of this study was to explore mothers' perceptions of the determinants of undernutrition in children under 5 years of age. The study was conducted in the general context (not in the context of Gikuriro program described for sub study one and sub study two as mentioned in the manuscript).

Methods

Study design and setting

This was a qualitative study to explore mothers' perceptions of the determinants of undernutrition in children under 5 years of age. This study was carried out in Rwandan four Districts, namely, Nyarugenge and Gasabo, from the city of Kigali, Nyabihu and Ngororero, from the Western Province.

Study participants

Participants for this study were purposely selected from Nyabihu, Ngororero Nyarugenge and Gasabo Districts. In 2015, Nyabihu and Ngororero were classified as the Districts with the highest prevalence rate of stunting [29] while Nyarugenge and Gasabo were among the Districts with the lowest prevalence rate [30]. A non-probability purposive sampling method was used to recruit participants for FGDs. Participants were biological mothers or caregiver mothers of children born between 2016 and 2020. Data collection was carried out at the same period as for data collection of the quantitative studies from May 9th to May 21st 2022. FGDs and KIIs of mothers and caregivers were used. Interviews were done until saturation was reached (no more ideas were emerging from participants) in order to gather sufficient data reflecting real images of mothers' perceptions of the determinants of undernutrition. Additionally, each question was repeated enough during the interview for each participant to understand it. Overall, the qualitative evaluation included 6 FGDs. Each group included 10 participants, for a total of 60 participating mothers. The FGDs included the following participants: FGD 1, in which mothers lived alone (without husbands), were recruited from Nyabihu; FGD 2, in which mothers had secondary school and above, were recruited from Gasabo; FGD 3, in which mothers had more than 5 children, were recruited from Ngororero; FGD 4, in which mothers had 1 to 5 children, were recruited from Nyarugenge; FGD 5, in which mothers were recruited from urban District, from Gasabo; and FGD 6, in which mothers were recruited from rural District from Ngororero. To increase the chance of having heterogeneity in answers, Districts with high and low prevalence of stunting have been combined with varying demographic characteristics from each FGD. The demographic features were chosen based on how likely they were to be found in this District (for instance, rural Districts are more likely to have mothers with more than five children than urban Districts). Additionally, the same feature for each FGD allowed participants to openly share their ideas during discussion. Recruitment was done by Communities Health Workers and mothers willing to participate were invited to the Health Center for interview.

For the KIIs, thirty key informant mothers from the 4 Districts were purposely selected based on their role in the community for in-depth interviews. Again, Communities Health Workers were used to recruit participants for interviews at the Health Center. The participants were as follows: 5 health workers, 5 local leaders, 3 nutritionists, 7 community health workers, 7 educators and 3 agricultural experts. In addition to the nutritionists and agriculture experts, where only 3 Districts were taken into account, each District was considered for every category of recruited KIIs, as detailed in Table 1.

Interview guide

A semi-structured question guide was developed to assess mothers' perceptions of the understandings and mothers' perceptions of the barriers related to the determinants of undernutrition in children under 5 years of age. The interview guide covered the following: knowledge of IYCF, IYCF practice, WASH activities and morbidity and health services utilization. The questions discussed were as follows: What have you heard about the benefits of breastfeeding, and at what time should it start? How do women usually feed young children who are less than 6 months old, and what are the main problems they face in realizing this? For how long should a mother continue breastfeeding his/her child? How do you know it is time to start complementary feeding, and how do you approach it (what foods do you give as complementary feeding, how and when)? What are the difficulties faced by mothers in providing appropriate complementary feeding? Can you explain if there is any relation between hand washing and undernutrition? What are your perceptions of immunization? Is there any relationship between immunization and undernutrition? What is the role of using latrines properly in addressing the problem of undernutrition? What are the challenges you face in getting drinking water, and do you think this can lead to child undernutrition?

Data collection procedures

FGDs and KIIs were used as data collection tools. Mothers who agreed to participate in the study were

Participants	FGD/KII	Sites	Number of participants (N=90)	Average age (range)	Marital status	Occupation	Education level
FGDS	FGD1	Nyabihu	10	38 (26–57)	Single (7) Widowed (1) Divorced (2)	Farming/agricul- ture (6) Self-employed (2) Unemployed (2)	Illiterate (1) Primary level (8) Secondary level and above (1)
	FGD2	Gasabo	10	37 (26–60)	Married (7) Widowed (1) Divorced (1) Single (1)	Salaried employed (4) Self-employed (3) Unemployed (3)	Secondary level and above(10)
	FGD3	Ngororero	10	40 (29–63)	Married (5) Widowed (2) Single (2) Divorced (1)	Farming/agricul- ture (7) Self-employed (1) Unemployed (2)	Illiterate (1) Primary level and above (9)
	FGD4	Nyarugenge	10	35 (27–42)	Married (7) Widowed (1) Divorced (1) Single (1)	Self-employed (4) Salaried employed (3) Unemployed (3)	Primary level (4) Secondary level and above (6)
	FGD5	Gasabo	10	31 (24–42)	Married (9) Single (1)	Salaried employed (3) Self-employed (3) Unemployed (3) Farming/agricul- ture (1)	Primary level (4) Secondary level and above (6)
	FGD6	Ngororero	10	28 (22–37)	Married (10)	Farming/agricul- ture (7) Unemployed (2) Self-employed (1)	Illiterate (1) Primary level (9)
Kils	Health-workers	Nyabihu (1) Gasabo (2) Ngororero (1) Nyarugenge (1)	5	31 (28–35)	Married (5)	Salaried employed (5)	Secondary level and above (5)
	Community health workers	Nyabihu (1) Gasabo (4) Ngororero (1) Nyarugenge (1)	7	45 (35–60)	Married (5) Divorced (1) Widowed (1)	Farming/Agricul- ture/CHW (3) Self-employed/ CHW (3) Salaried/CHW (1)	Primary level (3) Secondary level and above (4)
	Local leaders	Nyabihu (1) Gasabo (2) Ngororero (1) Nyarugenge (1)	5	41 (38–45)	Married (5)	Salaried (5)	Secondary level and above (5)
	Nutritionists	Nyabihu (1) Gasabo (1) Nyarugenge (1)	3	30 (28–33)	Married (3)	Salaried (3)	Secondary level and above (3)
	Educators	Nyabihu (1) Gasabo (4) Ngororero (1) Nyarugenge (1)	7	37(29–43)	Married (6) Divorced (1)	Salaried (7)	Secondary level and above (7)
	Agriculture experts	Nyabihu (1) Gasabo (1) Ngororero (1)	3	29 (25–34)	Married (3)	Salaried (3)	Secondary level and above (3)

Table 1 Sociodemographic characteristics of the study population

invited to the Health Center and before the discussion, they signed a consent form. FGDs and interviews were conducted by two data collectors. One of these collectors acted as a moderator of the discussion, and the other acted as a note taker and observer. The interviews were conducted face to face using voice recorders. All discussions were conducted in Kinyarwanda, and then translated into English. Each FGD had an average duration of 60 min, and the interviews lasted 30 min.

Ethical considerations

Before starting this research, approval to conduct the study was obtained from the Institutional Review Board of the University of Rwanda, College of Medicine and Health Sciences under Approval Notice No301/ CMHS IRB/2021. Authorization for the field data collection was obtained from the Rwandan Ministry of Local Government. Informed consent was obtained from each participant.

Analysis plan

The analysis was performed using Atlas ti 7.5.18 qualitative data analysis software. All interviews and FGDs were conducted face to face in Kinyarwanda. The transcripts were recorded, transcribed verbatim, and translated into English, followed by thematic data analysis. To verify the translation process, the final English transcript was checked and back-translated into Kinyarwanda. All transcripts of the FGDs and KIIs were read and reread for a deep understanding of the collected data. Using both deductive and inductive reasoning designs, statements that indicated perceptions related to the determinants of undernutrition were identified and labeled with different codes. The first author and the main supervisor worked together for coding during analysis. After code identification, a check was performed to determine whether all aspects of the content were covered with respect to the study's objectives. The codes were then grouped together, resulting in subthemes. Broader themes were identified that connected to pre-established subthemes, and finally, analyses and compilation reports were produced.

Results

1. Sociodemographic characteristics of the study population

Table 1 presents the participants' sociodemographic characteristics. Among the participants, 90 had at least a secondary-level education, 50 had an age range of 22 to 63, and the majority of the participants were salaried or self-employed (51 out of 90 participants).

2. Main themes, subthemes and codes (subtheme categories)

Two main themes were identified in this study, namely, Mothers 'perceived understandings of the determinants of undernutrition and mothers' perceived barriers related to the determinants of undernutrition. For each main theme, subthemes were also identified as shown in Table 2. In total, 35 codes (subtheme categories) were identified.

Mothers' perceived understandings on the determinants of undernutrition

Subtheme 1: perceived knowledge of IYCF

This subtheme represents participants' discourse related to their knowledge of IYCF.

Early initiation of breastfeeding and exclusive breastfeeding

Almost all the mothers in FGDs and KIIs reported that as soon as the mother gets out of bed after giving birth, she starts immediately giving the baby the breast to suckle, and for the future, breast milk to come, the child must breastfeed. They also stated that during this period, the child can obtain colostrum from the mother's breastfeeding.

"The baby starts breastfeeding the first hour after birth. Then, they put him on the breast so that he can start breastfeeding colostrum" (Health Worker 2 from Nyabihu).

In response to "how do women feed babies under 6 months old?", almost all the participants said that the mothers should exclusively breastfeed the child without any other mixing while they are still alive and have sufficient breast milk.

Complementary feeding knowledge

Many mothers reported that complementary food starts when the child is 6 months old. However, few mothers from FGD1 stated that complementary food should begin at 9 months, while others stated their views as follows:

"If you start to see that the child picks up small things and puts them in his mouth, it means that even though the child is breastfed, he is not satisfied (full); then, it is a sign that the time to give complementary food is near" (Educator 1 from Ngororero).

"Although we said that complementary food is given at 6 months, it is possible to start it before 6 months. There are times when you realize that a child is very hungry and not satisfied with breast milk, especially when he cries a lot. In this case, maybe at 5 months and half, you may give him complementary feeding." (FGD 3).

Regarding the perceived approach to providing complementary feeding, a range of answers were reported by the participants, some of them lacked knowledge on the subject, such as giving cassava paste at 6 months. Some mothers were tempted to be specific about the type of food that should be provided to their child based on their age; this type of food typically begins with liquid soft food at 6 months, semisolid food at 7–8 months, or solid food from 9 to 23 months.

Main themes	Subthemes	Codes (subtheme categories)		
Mothers' perceived	Perceived knowledge on IYCF	Early initiation of breastfeeding within 1 h after birth		
understandings		Exclusive breastfeeding for the first 6 months of life		
of undernutrition		Complementary feeding knowledge		
		Continuation of breastfeeding up to 2 years and beyond		
	Perceived benefits of breastfeeding	Providing immunity to the child through the first breast milk		
		Emotional bonding between mother and child		
		Promoting healthy newborn growth		
		Nutrients that cannot be obtained from anywhere else		
		Promoting the production of breast milk by the mother		
		Helping in avoiding other foods that can be source of infection		
		Saving money that should have been spent on breast milk replace- ment		
		Preventing unplanned pregnancies for the mother		
		Losing weight and thus protecting against non-communicable diseases		
		Protecting the mother against breast disease		
	Infant and young child practice	Complementary feeding practice		
		Continuation of breastfeeding practice		
	Perceived awareness on wash activities	Knowing about relationship between handwashing and undernutri- tion		
		Knowing that using toilet properly can prevent undernutrition		
		Knowing that unclean water can lead to undernutrition		
	Perceived awareness on health services utilization	Knowing about relationship between vaccination and undernutrition		
Mothers' perceived barri-	Perceived barriers of the mothers on IYCF practice	Poverty		
ers related to the deter-		Having many children		
tion		Lack of knowledge of the mothers and house helps		
		Breast feeding during pregnancy (gusamira ku kiriri)		
		Illness of the mother		
		Illness of the child		
		Death of the mother		
		Perceived lack of enough breast milk		
		Lack of time and leaving children to caregivers (house helps)		
		Conflict at home		
		Early return to work following maternity leave		
	Perceived barriers of the mothers on WASH activities	Insufficiency of water supply at home		
		Limited financial capacity		
		Water use misconception		
		Negative mindset/poor understanding		

 Table 2
 Main themes, subthemes and codes (subtheme categories)

"Starting from 6 months, you can give to the child milk or filtered porridge in which you can add biscuits. At 7 months, you can mash a potato and mix with vegetables, put it in a bowl and chew it well. By the age of 9 months, continue with potatoes and vegetables until you give him solid food like any other child" (Community Health Worker 7 from Gasabo).

Continuation of breastfeeding up to 2 years and beyond

With regard to the continuation of breastfeeding, when participants were asked about how long a child should continue breastfeeding, in addition to the response from several mothers, which was 2 years, some of them gave answers of two and a half years and 3 years. However, two mothers from FGDs gave the following answers: "If breastfeeding lasts for more 2 years, breastmilk is not valuable. After 2 years, the child is fit to eat. After 2 years, breastmilk is useless" (FGD 1).

"It is not recommended to continue breastfeeding after 2 years. Weaning is necessary since failure to do so causes mental retardation in the child" (FGD 6).

Subtheme 2: perceived benefits of breastfeeding

The perceived benefits reported by the participants in this study were pertaining to the child on one side and pertaining to the mothers on the other side as it is detailed in the following statements:.

Perceived benefits pertaining to the child Immunological properties, emotional bonds, and healthy newborn development

The following are some of the views expressed by the mothers in regard to those aspects:

"When a baby is born, the first yellow milk can increase the baby's immunity to certain diseases. There is a large difference when comparing a child who has been breastfed to a child who has been given milk. Breastmilk to the child is of high importance because he gets from breastfeeding immunity" (Community Health Worker 4 from Nyarugenge District).

"The first milk confers immunity to the child and protects him from getting sick" (FGD 3).

"During breast feeding, there is affection between the child and the mother; we do not have to forget that" (Health Worker 1 from Ngororero).

"A newborn must be breastfed in order to grow and be healthy. The newborn must be fed the mother's yellow milk. He should be breastfed twelve times a day by his mother after she gives birth" (FGD 6).

"All children who have been breastfed from birth are healthy up to the age of two. They are not getting sick times to times, and they don't have any other problems. The child is growing well" (Educator 2 from Nyabihu).

"When you breastfeed a child, he will look at you as if you are giving him your breast, and he will be attracted by your beauty and the breast milk will make him growing up well" (FGD 2).

Nutrients not found elsewhere, mothers' production of breast milk and avoidance of other foods that may be sources of infection

Additional benefits of breastfeeding have also been reported by mothers, for example, access to nutrients not found elsewhere, stimulation of the mother's production of breast milk, and avoidance of other foods that may be a source of child infection:

"Breast milk has more nutrients than anything else, and that is why we encourage the mothers to breastfeed very often without mixing breast milk with something else for up to 1000 days. Breast milk has more nutrients than any other baby can have for healthy growth" (Health Worker 1 from Ngororero).

"For the mother, breast milk arrives rapidly during the first hour of life, allowing the child to be breastfed and to develop normally" (Health Worker 2 from Nyabihu).

"Breastfeeding also prevents the child from being given other things that can make him sick during his childhood" (Health Worker 3 from Gasabo).

Perceived benefits pertaining to the mother

Saving money, preventing unplanned pregnancies, losing weight and protecting against breast disease were reported to be beneficial to the mother: some participants reported that breastfeeding saves the mother's money from purchasing breast milk, while others said that breastfeeding keeps the mother from becoming pregnant too soon. Another mother said that during pregnancy, the mother gains weight, but as she breast feeds her baby, it helps her to lose weight and thus protect her from non-communicable diseases such as obesity. In addition, participants reported that mothers who produce large amounts of breast milk are particularly protected against breast disease.

Subtheme 3: IYCF practice

Under the IYCF practice subtheme, participants reported their practice related to complementary feed-ing practice and continuing breastfeeding practice.

Complementary feeding practice and continuing breastfeeding practice

Although the objective of this study was to explore mothers' perceptions of the determinants of undernutrition, when they were asked how they knew when to start complementary feeding and how they approached it, for some mothers, the answers were not their perceptions but rather their practice. The same was true for the continuation of breastfeeding.

"When the child is 6 months old, I start feeding him with porridge and fruits; in a few days, I start giving him vegetables mixed with potatoes, and I give him this mixed food until he is 9 months old, and as he grows up, we share what we eat as well" (Expert agriculture 1).

"I used to breastfeed for a minimum of 2 years and a maximum of 2 years and 2 weeks. When the child is 3 years old, he begins attending school" (Community Health Worker 2).

Subtheme 4: perceived awareness of WASH activities

This subtheme aimed to ascertain the participants' understanding of the relationships between lack of access to safe WASH and undernutrition.

Relationships between handwashing and undernutrition, drinking unclean water and undernutrition, using proper toilet water and preventing undernutrition

Numerous participants from the FGDs and KIIs noted that when mothers feed their children without washing their hands, they are at risk for infection and intestinal worms, which can cause undernutrition. One mother stated that many parents feed their babies using their hands. In particular, without cutting their nails, the microbes under the nails may invade the body of the child, and the child may become malnourished. Another participant said that when a mother is not clean, she may contaminate the child with diseases, such as diarrhea, and he may be malnourished because when he is sick, he is not able to eat normally. Another mother said that if the mother does not wash her hands, they become a source of contamination. She may then think that she has fed her child, whereas intestinal worms have eaten what she has given. Additionally, intestinal worms might suppress appetite. Another participant said that if the mother does not wash her hands and feeds her child, the child can have intestinal worms, and when the child has intestinal worms, he or she is malnourished because he or she gets sick once and while.

One participant, however, expressed her doubts about this subject and said, "You see poor parents who do not have the means, but their children look healthier than children of someone who can afford all of their needs. Why are they like this, whereas their mothers are not clean and are living a miserable life?" (Community Health Worker 1 from Ngororero)

1 from Ngororero).

When asked if having trouble accessing clean water could contribute to undernutrition in children, every mother in FGDs and KIIs responded that there is a direct link between drinking dirty water and undernutrition; for this reason, it is always advisable to boil water if you are unsure if it is safe to drink. A view from one mother was the following:

"When a child drinks contaminated water, he can get diarrhea and could be always sick. A sick child may not grow normally and may experience undernutrition because, although he may eat enough, his health is clearly compromised by his constant diarrhea because of dirty water intake" (Health Worker 2 from Nyabihu).

To determine the mothers' perceptions of the use of latrines properly to address the problem of undernutrition, one participant expressed the following view: "If the house we live in does not have a toilet, we can defecate everywhere. Children who are learning to crawl and walk may eat microbes with dirt, may ingest intestinal worms and may become undernourished because they do not have an appetite (children with intestinal worms do not have an appetite). Me I understand that there may be a relationship between using latrines properly and undernutrition because when there is cleanliness, there is no obstacle for the child to have good nutrition" (FGD3).

Subtheme 5: perceived awareness of health services utilization

The objective of this subtheme was to explore mothers 'perceived understandings of the importance of vaccination for fighting undernutrition.

Relationship between vaccination and undernutrition

In response to the questions about their perceptions of immunization and if there was any relationship between immunization and undernutrition, most participants from the FGDs and KIIs mentioned that immunization contributes to reducing undernutrition because when a child is not vaccinated, he or she is not protected against disease and gets sick. When he is sick, he does not grow well, and undernutrition occurs. However, not everyone was aware of the link between vaccination and undernutrition, and some mothers saw in an immunization program a simple way of identifying their children's nutritional status but not beyond:

"The relation between immunization and undernutrition is the following: you may have a child with undernutrition without knowing it, but when you bring him to the health facility for vaccination, the health professional can tell it to you and at the same time can give you advice" (FGD 3).

Some other mothers did not clearly see what kind of relationship exist between immunization and undernutrition:

"I do not think that immunization can play a role in protecting children from undernutrition because undernutrition is caused by the mother who feeds the child, how she feeds him, or what she feeds him" (Community Health Worker 7 from Gasabo).

Perceived mothers' barriers related to the determinants of undernutrition

Subtheme 1: Perceived barriers of mothers related to IYCF practice

Most of the perceived barriers of the mothers related to the determinants of undernutrition reported by the participants were related to IYCF practice.

Perceived poverty and having many children

Several FGD and KII participants perceived poverty as one of the obstacles mothers confront in providing their children with a healthy diet. For one mother, this was linked to a lack of food, sometimes even a lack of charcoal to cook the little food that was found.

"The challenge happens, for example, when you are poor and you might not have charcoal to cook food; you might not have cooking wood" (FGD 3).

For many other participants, poverty was explained by a lack of jobs, especially for young mothers, who are currently the majority of those bearing children.

"Poverty. Young mothers are the ones bearing children now, and they are also having trouble finding employment. They will not have food if they do not wash someone else's clothing. They can wait 2 months for a job while raising a child at home and are abandoned by their husbands. It turns out that the mothers are unable to breastfeed their children" (Local Leader 1 from Ngororero).

Participants also mentioned that having a large family may be a constraint that can lead to undernutrition.

"Even having many children can cause undernutrition because you may think you have given one fruit to one child, whereas it has been shared by 3 children" (Educator 1 from Ngororero).

Perceived lack of knowledge of mothers and the house helps

Perceived lack of knowledge was reported in terms of preparing a healthy and balanced diet.

"Another challenge that exists is knowing how to prepare a healthy diet for the child. Rwandans still have little knowledge about how to prepare the right diet for a young child. They know that if the family cooks food, they will share it with him. They do not think that he needs soft food compared to what the family eats. They do not know that even though it is the food we eat, we should make it easier for him to be able to eat it" (Health Worker 3 from Gasabo).

"Restricted knowledge: A mother may claim that, in her opinion, the most essential thing is that her child eats and is satisfied, even though he is not receiving the necessary nutrients, such as body-building foods', 'energy foods' or 'disease-protective foods'. Giving him this food without meeting his basic needs will make her believe that the child has eaten a balanced diet and is satisfied" (Community Health Worker 4 from Nyarugenge).

"Even though you are capable, if you lack the knowledge to feed your child, he will suffer from malnutrition" (FGD 6).

Perceived lack of knowledge was also mentioned as a misconception regarding breastfeeding a child born to an HIV (Human Immunodeficiency Virus) -positive mother or a child with diarrhea in the following statements: "The first thing that causes a child not to breastfeed is when the mother is sick, sometimes he is with AIDS infection. You understand that the child will not breastfeed well" (Community Health Worker 5 from Gasabo).

"If the child has diarrhea or gets sick, in such case, you stop breastfeeding" (Educator 7 from Gasabo).

Breastfeeding during pregnancy (gusamira ku kiriri)

Breastfeeding during pregnancy: a woman cannot breastfeed while pregnant, even when the breastfeeding child is a newborn because the child may suffer from diarrhea. This view has been expressed in the following statement:

"Unless the mother becomes pregnant very quickly (gusamira ku kiriri). Sometimes when the child breastfeeds, he may have diarrhea or get sick; in such cases, you stop breastfeeding. If nothing happens, you breastfeed him" (FGD 3).

Illness of the mother, illness of the child, death of the mother

The participants perceived the illness of the mother and the illness of the child as to be a challenge for the good nutrition of the children. Many of the diseases have not been specified, but some participants noted mothers' mental illnesses and pain while breastfeeding especially novice breastfeeding mothers, children's birth defects, and children's abdominal pain commonly called in Kinyarwanda "Icyo mu nda": this is a situation where healthy babies cry inconsolably for several hours and nothing seems to make them better. Death of the mother has been also expressed as follows:

"If the mother passes away after childbirth, the child may occasionally be put on milk even though it is not yet time" (Community Health Worker 6 from Gasabo).

Perceived lack of enough breast milk

A perceived lack of breast milk was mentioned as an additional barrier to breastfeeding, which led to the decision to introduce complementary food. Participants expressed these views as follows:

"The mother may lack breast milk, and immediately, the child is put on milk" (Community Health Worker 6 from Gasabo).

"Sometimes a mother will not produce enough breast milk if she does not find porridge or eats poorly. In these cases, the infant will not develop normally" (Educator 6 from Gasabo).

Lack of time and leaving children to caregivers (house helps)

A perceived lack of time by mothers and leaving their children to caregivers (house helps) has been mentioned many times, and has been identified as a potential source of undernutrition. The caregivers may give food late, or may eat it themselves or may give it to other people. "There are those who have food, but they do not have time to give it to the children, and they leave them to caregivers. The caregivers are looking at themselves, and the children are neglected. If the child becomes malnourished, it is not because of lack of financial capacity of the parents, but it is because of the caregivers who are responsible for undernutrition of the children" (FGD 1).

Those who are capable might also have undernourished children. Patients may employ caregivers to look after their children. Food may be served by the caregivers very late, may not be given at all, or may be eaten by the caregivers themselves or may give it to other people. In this case, the child becomes malnourished" (FGD 2).

Conflict at home

Conflict within the family was also indicated by participants as a perceived potential source of undernutrition. The following statements explain their opinions more:

"Another challenge is family conflict. Taking example on myself, when I'm sad, I do not have breast milk. When there is a conflict between a husband and wife, the child suffers from that" (FGD 4).

"When a child is born in a conflict, the family is fighting, sometimes the mother is deprived of breast milk. When she does not have breast milk, she is obliged to give to the child something else" (Health Worker 3 from Gasabo).

Early return to work following maternity leave

Many participants perceived early return to work after only 3 months of maternity leave to be frequent and may constitute a cause of undernutrition because children are not breastfed exclusively for the first 6 months.

"Another issue is when a mother gives birth while working in a given area; she is only allowed a 2-month leave of absence before being required to return to work and leaves the child behind. If she does so, the child may suffer from undernutrition" (Health worker 3 from Gasabo).

"For example, after giving birth, a mother may leave her child. In our case, we were granted 3 months of maternal leave, but we left our children and went to work after that, which prevented the children from receiving breast milk as needed" (Community Health Worker 4 from Nyarugenge).

Subtheme 2: Perceived barriers of mothers related to WASH activities

The perceived barriers of the mothers related to the determinants of undernutrition reported by the participants and related to WASH activities included insufficient access to clean water at home, limited financial capacity, water misconception and a negative mindset.

Insufficiency of clean water supply at home

Some families have insufficient clean water supplies at home and rely on swamp water, which is one of the reasons why children may suffer from undernutrition as a result of using filthy water.

"The most common obstacle I would say is that sometimes it depends on the area. People who are living in swampy areas occasionally pump the water out of the swamp and drink it, which leads to undernutrition" (Health Worker 1 from Ngororero).

Limited financial capacity

Limited financial capacity was reported as a perceived barrier to WASH activities, where it has been reported that boiling water and making it safe for drinking were sometimes challenges.

"The challenge happens, for example, when you are poor. If you don't have charcoal or cooking wood to cook food, you cannot boil drinking water" (FGD 3).

Water use misconception

Water use misconception was also reported as a perceived barrier for mothers in WASH activities. Participants reported that some mothers were not aware of whether tap water is safe for drinking or not safe, did not know about the importance of boiling water, and could not use "sur'eau" (water purifier) because they said it smells bad, believing that only water from swamps is unclean and that water from taps is clean.

Negative mindset

A negative mindset was another perceived barrier of mothers to WASH activities, as expressed in the following statement:

You will hear people saying that there is no one without intestinal worms and no one without amoebae. This means that you have settled in you that drinking clean water or unclean water does not matter; you will get intestinal worms and amibae (you will get sick), and you don't have anything to add on" (Community Health Worker 2 from Nyabihu).

Discussion

This study analyzed mothers' perceptions of the determinants of undernutrition, and its objective was to explore mothers' perceived understandings of the determinants of undernutrition and to identify mothers' perceived barriers related to the determinants of undernutrition in Districts of Nyabihu, Ngororero, Gasabo and Nyarugenge.

With regard to understanding, the perceived knowledge of IYCF of almost all the mothers in the FGDs and KIIs in this study was in accordance with the WHO and UNICEF (United Nations International Children's Emergency Fund) global strategies for IYCF. This strategy recommends the initiation of breastfeeding within

1 h after birth, exclusive breastfeeding for the first 6 months, and nutritionally adequate and safe complementary feeding starting at the age of 6 months, with continued breastfeeding up to 2 years of age or older [31].

Previous studies conducted on mothers' perceptions of IYCF have shown the same results. For example, in one study conducted in Rwanda, most participants in FGDs reported that initiation of breastfeeding occurs within the first hour after birth, that newborn infants do not receive any food or drink immediately after birth except breast milk until they reach 6 months of age and that the practice of exclusive breastfeeding is for the first 6 months of life [32].

Although the perceptions of many of the participants in this study were that complementary feeding starts at 6 months, as was also found in other studies [33, 34]), few mothers provided incorrect answers, such as complementary feeding starts at 9 months (participant from FGD1), or complementary feeding starts when the mother thinks that the child is not satisfied with breast milk; for example, he starts picking up small things and putting them in the mouth or when he cries a lot (one mother from FGD 3 and one KII). These previous findings were also found elsewhere: In Uganda, participants mentioned in one study that complementary feeding starts at 3 months and one of the reasons given for early complementary feeding was a constant crying of the child because of hunger and therefore, food other than breastmilk was provided [35].

The participants generally perceived that breastfeeding should continue for 2 years or longer. However, two participants from FGD 1 and FGD 6 stated that breast milk should not be continued beyond 2 years because the child is already old enough and has to eat only and that breast milk at that age is of no value and even it can cause mental retardation.

Regarding the perceived approach to providing complementary feeding, a range of answers were reported, with a lack of knowledge on the subject by a participant from FGD1 reporting to give cassava paste at 6 months. This lack of knowledge about appropriate complementary feeding reported in this study was also found elsewhere [36, 37].

In regards to the benefits of breastfeeding, the perceived benefits pertaining to the child and the mother as mentioned previously were also reported in other studies. In a study carried out in Tanzania, giving immunity to the child, promoting bonding between the mother and the child,, increasing the child intelligence quotient, helping in family planning, returning mothers 'body to normal, and economic benefit for the family were cited [15]. Maryse et al., in a study conducted in Rwanda, participants reported better general health for the baby, better growth and cognitive development, and family planning as advantages of breast-feeding [33].

Talking about Infant and Young Child Practice, some mothers reported that they had started complementary feeding at 6 months. This finding is consistent with a prior study from Ghana where, due to the extensive education given by the community health workers at Community-Based Health Centers, mothers waited until their babies were 6 months old to start complementary feeding [14].

Many of the participants in this current study mentioned that feeding children without washing their hands, drinking unclean water, or using latrines improperly can all individually put children at risk for infection and intestinal worms, which can result in undernutrition. Previous studies have also shown similar findings [17, 38]. One participant, however, a KII mother, expressed a negative view on this issue, saying that some children whose mothers are not clean and who live in miserable lives appear to be healthier than some children from families who are able to support themselves. This consideration is of great concern since the link between good health, and hygiene, is well established.

Many of the participants perceived immunization as a mean of reducing undernutrition, a view that was also mentioned in another study in which participants were asked why their children were immunized; all the participants mentioned that immunization prevents disease in young children [39]. However, one mother from FGD 3 and one KII mother did not grasp the relationship between immunization and undernutrition and not knowing that is a big gap: in fact, studies conducted in Thailand and South Asia for example revealed that failure to receive the required vaccination, as recommended, was associated with undernutrition [19, 40].

In summary, regarding the perceived knowledge of IYCF, participants from FGDs seem to be less knowledgeable than KII mothers since 7 participants from FGDs (70%) and 3 KII mothers (30%) expressed a lack of knowledge: on the side of FGDs, starting complementary feeding at 9 months and when the child is not satisfied with breast milk was reported respectively by 2 mothers from FGD1 and one mother from FGD3, breastfeeding should not continue beyond 2 years was reported by one participant from FGD1 and one participant from FGD6, cassava paste can be given at 6 months was reported by a participant from FGD 1, and one mother from FGD 3 was unsure of the association between vaccination and undernutrition. On the side of KIIs, one mother stated that complementary feeding starts when the child is not satisfied with breast milk and 2 mothers were unsure of the association between hygiene and vaccination with undernutrition.

In regard to the barriers of the mothers related to the determinants of undernutrition, perceived barriers related to IYCF such as poverty, having a large family, lack of knowledge in terms of preparing a healthy diet for the children were mentioned. Poverty was linked to a lack of food, sometimes even a lack of charcoal to cook the little food that was found [20]. In general many studies have revealed poverty to be the cause of undernutrition [21, 32, 34, 41]. Having a large family was perceived in this study as limiting the ability of providing adequate nutrition, observation also found in another study conducted in Bangladesh [41]. Lack of knowledge in terms of preparing a healthy diet for the children reported in this study was also mentioned in studies conducted in Kenya where some women have money but do not know the importance of changing food [21] and in Kiribati where most of the mothers lacked the needed knowledge of what a balanced diet should be given to their children [39].

Again, due to a lack of knowledge, it is unfortunate that, in this study, participants perceived that children with diarrhea or born to an HIV-positive mother must stop breastfeeding. This misconception, also found in other studies [42, 43], has to be discouraged, and mothers have to be educated on this problem.

Furthermore, again talking about perceived barriers related to IYCF, some of the mothers stated that a pregnant mother must stop breast feeding otherwise the child may have diarrhea and other diseases according to the culture. This traditional belief (gusamira ku kiriri in Kinyarwanda) was also found in a study carried out in Zimbabwe, where when a breastfeeding mother becomes pregnant, grandmothers and mothers-in-law advise her to abruptly wean the baby from the breast to avoid making the child sick [44].

Again, in the same vein as perceived barriers related to IYCF, maternal and child diseases were identified as perceived barriers related to adequate nutrition. This is in line with what prior studies highlighted in the literature: mothers' diseases were for example, mentioned in studies carried out in South Africa [45] and children's diseases were mentioned in studies conducted in Thailand and Gambia [46, 47] Breast pain during breastfeeding, especially for novice breastfeeding mothers, was also reported in another study conducted in Italy [48]. Death of the mother that can happen and hinder breastfeeding was cited in a study conducted in Ethiopia where participants expressed that whatever kind of good treatment he is receiving, a child who lost his mother and a child who lives with his mother cannot be the same. If his mother is alive, the child could grow with health, receiving simply his mother's breath, breastfeeding and her warmth [49].

Again talking about perceived barriers related to IYCF, participants reported a perceived lack of breastmilk, lack of time and leaving children to caregivers, conflict within the family, and early return to work within 6 months of giving birth.

Previous studies reported similar findings to those of this study: a perceived lack of breast milk was mentioned in studies conducted in Malawi [50], Ghana [51], and Cameroon [52]. In a study carried out in Pakistan, it was reported that children of working mothers were sometimes taken care of by grandmothers, siblings, or other close family members, and children were frequently sick because of unclean and improper caregivers [53].

Conflicts in the family were highlighted by the participants as a potential source of undernutrition, finding mentioned in other studies conducted in Rwanda and in Ethiopia [32, 54].

Previous research has indicated that an early return to work following maternity leave, can be a barrier to exclusive breastfeeding and may result in undernutrition, as it decreases the initiation and continuation of breastfeeding [55–57].

In regards to perceived barriers related to WASH activities, participants reported insufficient access to clean water at home, limited financial capacity, water use misconception, and a negative mindset.

The insufficiency of the clean water supply at home was related to people who occasionally pump and use swampy water without treatment. Limited financial capacity was linked to a lack of charcoal to boil water for drinking. Poor water supply, sanitation, and hygiene (WASH) interventions can affect a child's nutritional status via diarrheal diseases, intestinal parasitic infections, and environmental enteropathy [58].

Perceived barriers related to WASH activities were also related to water use misconceptions, where participants believed that only water from swamps is unclean and that water from tap is clean, do not know the importance of boiling drinking water, cannot use "sur' eau" because they say it smells bad. In one study carried out in India, despite the knowledge, 45% of the participants did not follow any methods of water treatment, and among them, half of the participants felt that the water was already clean; hence, no further treatment was necessary [59].

According to the Centers for Disease Control and Prevention, boiling is the surest method for killing disease-causing pathogens, including viruses, bacteria and parasites [60]. Poor understanding (negative mindset) was also mentioned in this study as a perception of some mothers who believe that no one is without intestinal worms and no one is without amoebas so that drinking clean water or unclean water does not matter. This mindset may play a major role in leading children to undernutrition since, in many studies, *Entamoeba histolytica*, known to be common in people who live in areas with poor sanitary conditions [61] has an effective role in the prevalence of intestinal diseases in humans as well as other animals [62, 63].

Strengths and limitations of the study

The strengths of this study stemmed from the fact that a large number of FGDs and KIIs were considered, and interviews were conducted until no new ideas emerged from participants. To reinforce this idea, the diversity of participants from four distinct Districts, both rural and urban, and made up of various types of individuals allowed us to generate a wide range of answers from the participants. However, limitations remain, such as subjectivity and bias often found in qualitative studies based on researcher interpretations and subjective judgments. Furthermore, even though the final English transcript was checked and back-translated into Kinyarwanda for accuracy, it is possible that the true meaning of some Kinyarwanda statements was lost in the English translation, even though this misinterpretation was unlikely to have had an impact on the study's findings.

Conclusion

The findings from this study showed that mothers' perceived understandings of the determinants of undernutrition were in general good. However, a lack of knowledge related to the early initiation of complementary feeding, continuation of breastfeeding and approach to providing complementary feeding was identified for some participants. Likewise, the relationships between hygiene and undernutrition and between vaccination and undernutrition were unclear for some mothers. We recommend a nutrition education program to minimize the risks involved in too early complementary feeding, to improve the approach to providing complementary feeding, to promote hygiene, continuation of breastfeeding and vaccination. In addition, perceived barriers related to the determinants of undernutrition were identified by the participants in this study: poverty, ignorance, negative beliefs, maternal and child health and illnesses, and inappropriate parental care practices: they may guide implementers in determining where to focus their efforts in developing an effective nutrition intervention package to combat undernutrition.

Abbreviations

IYCFInfant and Young Child FeedingMADMinimum Acceptable Diet

Supplementary Information

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Supplementary material 1

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Author contributions

MH: conception of the work, design of the work, data collection supervision, data analysis, and interpretation; drafted the manuscript. MU, LR and FH provided critical comments on the paper. CM: overall supervision, conceptualization, methodology review and manuscript review. All the authors have read and approved the manuscript for publication.

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Availability of data and materials

All data generated or analyzed during the current study are available from the corresponding author on reasonable request. The following email address will be requested: habinezam@asome.health

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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