Original Article

Feeding Practices and Nutritional Status among Children Aged from Six to 23 Months in Western Province, Rwanda: A cross-sectional study

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Abstract

Background

Rwandan children's nutritional status is characterized by higher undernutrition rates. Infant and young child feeding practices (IYCF) have a direct impact on how well-nourished youngsters under two years old are.

Objectives

This study aimed to assess feeding practices and nutritional status among children aged six to 23 months in Nyabihu district.

Methods

A cross-sectional study was conducted in 164 households having children aged six to 23 months in December 2020. A structured questionnaire was used to collect infants' and young children's feeding practices. Using SPSS version 20.0, data were entered and analysed. Binary logistic regression was utilized to identify association between feeding practices and nutritional status.

Results

Breastfeeding initiation within the first hour of life was 94.5%, and exclusive breastfeeding was 79.9%. Complementary foods were given timely to 73.2% of children, 47.6% had minimum meal frequency (MMF), 23.2% had minimum dietary diversity (MDD), and 15.9% were fed a minimally acceptable diet (MAD). However, 4.3% of children were wasted, 6.7% were underweight, and 23.2% were stunted. There was no significant association when variables were passed to a binary logistic regression-adjusted model.

Conclusion

Complementary feeding practices remain suboptimal. These practices should be improved to sustain children's nutritional status.

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Keywords: Infant and young child feeding practices (IYCF), children aged six to 23 months, wasting, underweight, stunting.

Introduction

Infant and young child feeding (IYCF) practices remain suboptimal despite guidelines provided by the World Health Organization (WHO).[1] Globally, breastfeeding practices, including early initiation, exclusive breastfeeding, and continued breastfeeding remain low, nearly 45%.[2] On the other hand, complementary feeding practices such as timely introduction of foods and minimum meal frequency (MMF) are relatively above 50% despite minimum dietary diversity (MDD) and minimally acceptable diet (MAD) that fall below 30%.[3]

Even with the high rates of breastfeeding practices in Rwanda, there are still issues with achieving ideal MMF, MDD, and MAD.[4] Poor practices are attributed to home delivery, lack of knowledge, not attending antenatal care visits, low birth spacing, young mothers and absence of formal education, low household income, and food insecurity.[5–7] Consequently, Poor feeding practices among children aged under two result in undernutrition.[8,9]

The prevailing form of undernutrition, stunting, has affected 149 million children under the age of five worldwide, with 58.8 million in Africa in the past five years, while wasting has affected 49.5 million children, with 14 million being Africans.[10] In Rwanda, with a stunting rate of 33%, it stands above the average of 31.5% in SSA.[2,10] Moreover, 46.7% of children in Nyabihu district are stunted, ranking second highest nationally.[4] Undernutrition contributes to child morbidity and mortality, which later affects learning and working capacity and reduces the nation's socioeconomic growth.[4,11]

Despite the magnitude and impact of undernutrition, little is known about IYCF practices and nutritional status in Rwanda. Most studies have assessed the predictors of stunting and the knowledge about IYCF and their effects on stunting.[12–15] Therefore, this study evaluated IYCF and nutritional status among children aged six to 23 months in Nyabihu district.

Materials and methods

Study design and setting

A cross-sectional study was conducted in December 2020 in Mukamira sector of Nyabihu District to assess feeding practices and the nutritional status among children aged six to 23 months. Nyabihu district hosts a high prevalence of undernutrition as it ranks second countrywide after Ngororero district.[4] Mukamira sector was selected randomly to host this study by picking a piece of paper from 12 pieces each bearing a name of one of the 12 sectors of Nyabihu district.

Study population and sample

Among seven cells that made the sector of Mukamira, the researcher selected three cells using a simple random sampling technique, assuming the existence of no variability among feeding practices within cells. This was done by writing all cells on separate papers, and then three pieces were randomly selected. All villages were chosen within the three selected cells, making 15 villages. Within the villages, 278 households with children aged six to 23 months were drawn from Community Health Workers' (CHWs) records. The sample calculation used Taro Yamane Formula

$$n = \frac{N}{1+N(e)^2}$$

Where,
N is population size=278,
e is the sampling error of 0.05, assuming a precision level of 95%.[16]
n=164
The lottery method was applied to randomly select eleven households from each of the 15 villages. However, one village had only ten households with children aged 6 to 23 months and they were all included in the study.

Inclusion and exclusion criteria

The elder children were chosen in households with more than one child within this age category. However, a child was allowed to participate in the study only if he or she did not have any congenital malformation to ensure accurate length measurement, and if his/her caregiver provided consent. The data collectors ensured that the procedures were followed by explaining the importance and process of the study to the caregiver, asking if she agreed to participate, and observing children for any physical malformation.

Data collection methods

The standard WHO questionnaire, which was originally developed to evaluate the infant and young child feeding (IYCF)

practices was adapted and used in this study. [17] The tool is accessible online for public use. A few modifications, were made, such as the addition of identification information (socio-economic and demographic) and anthropometric measurements section, exclusion of the household roster module and some questions in the breastfeeding module that were not specific to this survey. The questionnaire was also translated into Kinyarwanda, the language of the participants. Data collectors used portable length boards and weighing scales for taking child anthropometric measurements. Children vaccination cards were also used for determining the child's accurate age. The data collectors went from one selected home to another, guided by the village Community Health Workers (CHW).

Data analysis

Children's length-for-age, length-for-weight and weight-for-age z-scores were first calculated using WHO Anthro software. Children whose length-for-age z-score was below -2 SD were deemed to be stunted, those whose weight-for-length z-score was below -2SD were wasted, and those whose weight-for-age z-score was below -2 SD were considered as underweight.[18]

Data were checked, coded and entered into IBM SPSS Statistics for Windows version 20.0 (IBM Corp, Armonk, NY, USA) for analysis. Descriptive statistics giving frequencies and percentages were used for the characteristics of the child, mother, household and feeding practices. Fisher exact test was utilized to evaluate if there was a significant association between feeding practices and nutritional status. P-values less than or equal to 0.05 were considered statistically significant. Variables with significant P-values were sent to binary logistic regression model for assessing the nature of the association.

Ethical considerations

The University of Rwanda approved the study through the College of Medicine and Health Sciences Institutional Review Board (CMHS/IRB/358/2020); and the sector of Mukamira granted authorization for data gathering. Participants were given information about the study objectives and procedures; and then they signed consent forms before interviews started. The data collectors ensured participants' confidentiality and privacy by not keeping personal identification information; instead, they used a code in place of name of each participant.

Results

Children's Characteristics and household socio-demographic profile

Table1. Child, mother, and household characteristics

Characteristics		n(%)
Child's sex	Boys	64(39.0)
	Girls	100(61.0)
Child's age	6-11 months	70(42.7)
	12-17 months	51(31.1)
	18-23 months	43(26.2)
Age of the mother	Less than 20	5(3.0)
	Between 20 and 34	119(72.6)
	35 and above	40(24.4)
Marital status	Married	143(87.2)
	Unmarried	21(12.8)
Education	No formal education	18(11)
	Primary	99(60.4)
	Secondary and above	47(28.7)
Occupation	Housewives	12(7.3)
	Casual labor	125(76.2)
	Get salary	24(14.6)
Household size	Less than or equal to 4	92(56.1)
	Greater than 4	72(43.9)
Household head gender	Male	131(79.9)
	Female	33(20.1)
Source of food	own production	21(12.8)
	market and other	143(82.3)
Kitchen garden	Yes	46(28.0)
	No	118(72.0)
Wealth category	1-2 category	133(81.1)
	3-4 category	31(18.9)

Children's characteristics, and household socio-demographic profile of caregivers, are presented in Table 1. The findings show that more than half of the children, 61% were girls. Based on child's age categories, the 6 to 11 months old infants were the most (42.7%) of all the groups. As for the mothers, majority were aged between 20-34 years (72.6%), married (87.2%), of primary education (60.4%), and casual labourers (76.2%). The findings show that 56.1% of the households comprised less than or equal to four members, and males headed 79.9% of households. Regarding food sources, 82.3% of the caregivers said that the market was their primary food source. Most households (72%) own kitchen gardens, and 81.1% belong to the first or second wealth category, locally known as UBUDEHE.

Feeding practices among children aged six to 23 months

Table 2 shows that the prevalence of breastfeeding within an hour after delivery was 94.5%; 79.9% were exclusively breastfed during the first six months, and 93.3% were continuously breastfed at one year. Almost three out of four, 73.2%, children received complementary foods on time at 6 months. A little less than a half (47.6%), of the children attained MMF; 23.3% were fed MDD, and 15.9% achieved MAD. When taking into account gender, 49% of the girls met MMF, compared to 45.3% of the males. Only 17% of girls and 32.8% of boys have diets that are minimally diverse, while 21.9% of boys experienced MAD compared to 12% of girls.

Table 2. Feeding practices among children aged from 6 to 23 months

Feeding Practices	Sex of child		Total
	Boy n (%)	Girl n (%)	n (%)
Initiation of breastfeeding			
Within an hour	59 (92.2)	96 (96)	155 (94.5)
Don't remember	5 (7.8)	4 (4)	9 (5.5)
The child was fed before 6 months			
No	56 (87.5)	75 (75)	131 (79.9)
Yes	8 (12.5)	25 (25)	33 (20.1)
Continued breastfeeding between age 12-15 months			
No	7 (10.9)	4 (4)	11 (6.7)
Yes	57 (89.1)	96 (96)	153 (93.3)
Initiation of complementary Feeding			
At 6 months	46 (71.9)	74 (74)	120 (73.2)
Before/ after 6	18 (28.1)	26 (26)	44 (26.8)
Minimum meal frequency (MMF)			
No	35 (54.7)	51 (51.0)	86 (52.4)
Yes	29 (45.3)	49 (49.0)	78 (47.6)
Minimum dietary diversity (MDD)			
No	43 (67.2)	83 (83.0)	126 (76.8)
Yes	21 (32.8)	17 (17.0)	38 (23.2)
Minimum acceptable diet (MAD)			
No	50 (78.1)	88 (88.0)	138 (84.1)
Yes	14 (21.9)	12 (12.0)	26 (15.9)

Nutritional status of children aged six to 23 months

Table 3 shows that almost a quarter (23.2%) of the children were stunted, while 4.3% were wasted, and 6.7% were underweight. The prevalence of stunting among boys and girls was equal to 50% respectively, while the prevalence of underweight (63.6%) and wasting (100%) were more prominent among girls. Regarding age, stunting at 39.5%, and wasting, at 57.1%, were more prevalent among children aged 6-11 months; whereas underweight was more prevalent in older children aged 18-23 months at 45.5%.

Table 3. Children's Nutritional status stratified by sex and age

Nutritional Status	Total n (%)	Sex		Age		
		Boys n (%)	Girls n (%)	6-11 months n (%)	12-17 months n (%)	18-23 months n (%)
Stunted						
Yes	38 (23.2)	19 (50.0)	19 (50.0)	15 (39.5)	13 (34.2)	10 (26.3)
No	126 (76.8)	45 (35.7)	81 (64.3)	55 (43.7)	38 (30.2)	33 (26.2)
Underweight						
Yes	11 (6.7)	4 (36.4)	7 (63.6)	3 (27.3)	3 (27.3)	5 (45.5)
No	153 (93.3)	60 (39.2)	93 (60.8)	67 (43.8)	48 (31.4)	38 (24.8)
Wasted						
Yes	7 (4.3)	0 (0.0)	7 (100.0)	4 (57.1)	1 (14.3)	2 (28.6)
No	157 (95.7)	64 (40.8)	93 (59.2)	66 (42.0)	50 (31.8)	41 (26.1)

Association between nutritional status and feeding practices

From the bivariate analysis results, MMF (P = 0.024) and MAD (P=0.011) were associated with stunting. The child's gender was associated with wasting (P = 0.043).

In the unadjusted binary logistic regression model MMF and MAD were found to be significant negative predictors of stunting with [OR: 0.419 ; 95% CI, 0.194, 0.904] and [OR: 0.109; 95% CI, 0.014, 0.834] with P values of 0.027 and 0.033 respectively. However when sent to the adjusted model the association became statistically non-significant.

Table 4. Bivariate analysis of nutritional status and feeding practices (N=164)

Characteristic	Height for age		P value	Low weight for age		P value	Low weight for height		P value
	Not Stunted	Stunted		normal weight	under weight		Not wasted	Wasted	
sex of child									
Male	45(35.7)	19(50)	0.114	60(39.2)	4(36.4)	0.851	64(40.8)	0	**0.043***
Female	81(64.3)	19(50)		93(60.8)	7(63.6)		93(59.2)	7(100)	
Age in months									
6-11	55(43.7)	14(36.8)	0.694	66(43.1)	3(27.3)	0.309	66(42)	3(42.9)	0.151
12-17	38(30.2)	14(36.8)		49(32)	3(27.3)		50(31.8)	2(28.6)	
18-23	33(26.2)	10(26.3)		38(24.8)	5(45.5)		41(26.1)	2(28.6)	
Marital status									
Married	110(87.3)	33(86.8)	0.941	134(87.6)	9(81.8)	0.481	138(87.9)	5(71.4)	0.202
Unmarried	16(12.7)	5(13.2)		19(12.4)	2(18.2)		19(12.1)	2(28.6)	
Education level									
No formal	12(9.5)	6(15.8)	0.479	16(10.5)	2(18.2)	0.351[a]	17(10.8)	1(14.3)	0.619
Primary	76(60.3)	23(60.5)		92(60.1)	7(63.6)		96(61.1)	3(42.9)	
Secondary and above	38(30.2)	9(23.7)		45(29.4)	2(18.2)		44(28)	3(42.9)	
Occupation									
Housewives	10(7.9)	5(13.1)	0.632	11(7.3)	1(9.1)	1[a]	12(7.8)	0	0.092
Casual labour	98(77)	27(71)		116(77.3)	9(81.8)		121(78.6)	4(57.1)	
Other	18(14.2)	6(15.7)		23(15.3)	1(9.1)		21(13.6)	3(42.9)	

a Fisher's exact test P-value, Abbreviations: CF, Complementary feeding;MAD, Minimum acceptable diet; MDD, Minimum dietary diversity; MMF, Minimum meal frequency. *Significant at P < 0.05

Table 4

Characteristic	Height for age		P value	Low weight for age		P value	Low weight for height		P value
	Not Stunted	Stunted		normal weight	under weight		Not wasted	Wasted	
Household size									
≤ 4	72(57.1)	20(52.6)	0.623	88(57,5)	4(36.4)	0.172	87(55.4)	5(71.4)	0.468[a]
> 4	54(42.9)	18(47.4)		65(42.5)	7(63.6)		70(44.6)	2(28.6)	
Household head gender									
Male	101(80.2)	30(78.9)	0.87	122(79.7)	9(81.8)	0.868	127(80.9)	4(57.1)	0.125
Female	25(19.2)	8(21.1)		31(20.3)	2(18.2)		30(19.1)	3(42.9)	
Food source									
Own production	16(12.7)	5(13.2)	0.941	18(11.8)	3(27.3)	0.137	20(12.7)	1(14.3)	0.75
Market and other	110(87.3)	33(86.8)		135(88.2)	8(72.7)		137(87.3)	6(85.7)	
Own vegetable garden									
No	36(28.6)	10(26.3)	0.786	43(28.1)	3(27.3)	0.953	43(27.4)	3(42.9)	0.515
Yes	90(71.4)	28(73.7)		110(71.9)	8(72.7)		114(72.6)	4(57.1)	
Ubudehe category									
1-2	99(78.6)	34(20.7)	0.132	126(82.4)	7(63.6)	0.126	127(80.9)	6(85.7)	0.102
3-4	27(21.4)	4(2.4)		27(17.6)	4(36.4)		30(19.1)	1(14.3)	
Breastfeeding initiation									
<1 hour	119(94.4)	36(94.7)	0.945	145(94.8)	10(90.9)	0.587	148(94.3)	7(100)	0.569
Others	7(5.6)	2(5.3)		8(5.2)	1(9.1)		9(5.7)	0	
Initiation of CF									
At 6 months	92(73)	28(73.7)	0.935	111(72.5)	9(81.8)	0.503	113(72)	7(100)	0.799
others	34(27)	10(26.3)		42(27.5)	2(18.2)		44(28)	0	
MDD									
No	94(74.6)	32(84.2)	0.219	117(76.5)	9(81.8)	0.687	120(76.4)	6(85.6)	0.569
Yes	32(25.4)	6(15.8)		36(23.5)	2(18.2)		37(23.6)	1(14.3)	
MMF									
No	60(47.6)	26(68.4)	**0.024***	78(51)	8(72.7)	0.163	82(52.2)	4(57.1)	1[a]
Yes	66(52.4)	12(31.6)		75(49)	3(27.3)		75(47.8)	3(42.9)	
MAD									
No	101(80.2)	37(97.4)	**0.011***	127(83)	11(100)	0.136	131(83.4)	7(100)	0.241
Yes	25(19.8)	1(2.6)		26(17)	0		26(16.6)	0	
Continued breastfeeding									
No	9(7.1)	2(5.3)	0.685	10(90.9)	1(9.1)	0.744	90.9%	1(9.1)	0.413
Yes	117(92.9)	36(94.7)		143(93.5)	10(6.5)		147(96.1)	6(3.9)	

a Fisher's exact test P-value, Abbreviations: CF, Complementary feeding;MAD, Minimum acceptable diet; MDD, Minimum dietary diversity; MMF, Minimum meal frequency. *Significant at P < 0.05

Discussion

This study assessed the nutritional status and feeding practices among children aged six to 23 months. The indicators of nutritional status were stunting, underweight, and wasting. Stunting, underweight, and wasting prevalence in this study were at 23.2%, 6.7%, and 4.3% respectively. However, in a survey of nutritional trends and inequalities in young children in Rwanda by Yourkavitch, it was reported that stunting among under two years was 30.6%, wasting 4%, and underweight 8.9%.[19] This difference could be attributed to different nutrition programs implemented by various nutrition stakeholders in Nyabihu District and other regions of the country.

Hence we may assume that programs or projects may have different achievements. Some of the critical interventions include the GIKURIRO program implemented from, 2015, until 2020 (which aimed to improve nutrition, water, hygiene, and sanitation) implemented by Catholic Relief Service (CRS) and Netherlands Development Organization (SNV).[20] HINGA WEZE implemented from 2017 to 2022, also aimed to increase smallholder farmers' income and improve children's and women's nutritional status.[21] In addition to that, the reduced stunting prevalence in this study may also be attributed to many unmeasured interventions that are implemented at different scales, either small or large. In villages, interventions like regular growth monitoring, village's kitchen locally known as "Igikoni cy' umudugudu", and special child meals locally known as "agakono k' umwana" among others, are used and monitored by local leaders to ensure child growth is improving. Moreover, at the Health Centre level, other significant unmeasured interventions such as the provision of fresh milk, fortified blended porridge locally known as "Shisha Kibondo", vitamins and mineral supplements also known as "Ongera intungamubiri" are also implemented for children aged under five years in the aim of improving children nutrition status.[22,23]

Moreover, in Nyabihu district, the Rwanda Demographic and Health Survey (RDHS) 2019-2020 reported stunting at 46.7%, underweight at 4.4%, and no case of wasting was reported.[4] This difference could be attributed to differing child age categories, as the current study considered children aged between six to 23 months, whereas the RDHS included children aged under five years. The RDHS also reports that 40% of children aged between 24 and 35 months are stunted, which may reflect the highest stunting rate among children over two years.[4] There was no significant association reported between wealth categories and any of the nutritional status indicators. This contrasts with the recent RDHS results which reported a significant association between wealth categories (UBUDEHE), underweight and stunting.[4] The absence of a relationship in the current study may be explained by a socioeconomically homogeneous population.

Also, Findings revealed that in Mukamira sector, 94.5% of the children received breastmilk within an hour after delivery, which is higher than the prevalence of 85% reported in the RDHS 2019-2020.[4] This difference might be partly due to the slight rise in hospital delivery, which increased from 91% to 93% between 2015 and 2020.[4,24] Delivering at hospitals has created an opportunity for healthcare providers to promote breastfeeding within an hour after delivery.[4] In addition, CHWs contribute to initial breastfeeding by encouraging mothers to initiate breastfeeding within the first hour of delivery. Similar to another study conducted from the 2015 RDHS, there was no significant association found between early breastfeeding initiation and nutritional status in this study.[14]

The WHO endorses exclusive breastfeeding for the first six months and continued breastfeeding for at least up to two years. In this study, 79.9% were exclusively breastfed which is slightly lower than the 81% reported in the RDHS 2019-2020.[4] The difference might be attributed to socio-economic differences, as most respondents were casual laborers who spent most of their time separated from their children, and their siblings introduced them to other foods early. In this study, 93.3% of the children were continuously breastfed which is slightly lower than the 95.1% reported in RDHS 2019-2020.[4] This study found no significant association between exclusive breastfeeding and nutritional status which is in agreement with a secondary study from the 2010 RDHS which also found no significant association between exclusive breastfeeding and nutritional status.[14] Furthermore, the current study found no significant association between continued breastfeeding and nutritional status. Contrary to a publication on the 2010 RDHS data, continued breastfeeding was

significantly associated with stunting with P<0.001.[14] Moreover, other studies also reported a significant association between continued breastfeeding and nutritional status.[25,26]

To ensure optimal child growth, caregivers should introduce adequate balanced, and diversified complementary food in terms of all essential nutrients on time. Most of this study's participants, amounting to 73.2%, have timely introduced complementary foods at six months, which is lower than the 81% that was reported by RDHS 2019-2020.[4] The untimely introduction of complementary foods in the current study might be attributed to low exclusive breastfeeding rates. Since more children were introduced to other foods early, the rate of timely complementary feeding declined immediately. Moreover, high workload either in fields or at home among caregivers in rural settings has been also reported to be a barrier to appropriate child-feeding practices.[27] The current study found no significant association between the time of introducing complementary foods and nutritional status which is in agreement with findings from a secondary study from the 2015 RDHS and another primary cross-sectional study conducted in Musanze district.[13,14]Howevever, the absence of association in this study contrasts with another study conducted in Ghana which reported that children that are timely introduced to complementary food have 25% low risks of being undernourished than their counterparts.[28]

This study has again shown that only 23.2% of children have received min imum dietary diversity(MDD) which falls below the 2019-2020 national prevalence of 34%.[4] Inadequate dietary diversity in Mukamira sector may be attributed to inadequate income, as most of the study participants were casual laborers spending most of their income on buying only staple food, which limited their capacity to diversify foods[29]. In addition to low income, a high workload also inhibits caregivers from having adequate time to prepare a minimally diversified diet for their children.[27]

The current study found no significant association between MDD and nutritional status however other studies reported a significant association between them. [30,31]

Children among 6-23 months need more energy to sustain their growth and have limited stomach capacity which compromises meeting their increased nutritional needs therefore giving them small frequent meals helps in achieving nutrient requirements for growth.[32] This study reports that 47.6% of the children were fed per minimum Meal Frequency (MMF), which is slightly higher than 46% reported nationally by the RDHS 2019-2020.[4] However, this prevalence is inadequate and this inadequacy is attributed to the low income and heavy workload of the caregivers as most of them were casual laborers.[27,33] There no significant association between MMF and any of the nutritional status indicator which is in contrast with a study from Nigeria which reported this association to be significant. [28] However another study carried out in Ghana also didn't find any association between MMF and stunting.[36]

A minimum acceptable diet (MAD) is essential for ensuring a child's growth and development; however, only 15.9% were fed a MAD, which is low compared to the 22% that the RDHS 2019-2020 has reported.[4] This prevalence is also lower than 27.5% which was reported in another study that assessed the factors related to stunting among poor households in Rwanda.[34] Shallow MAD roots from high poverty that exists among the study participants, as most lived in the poorest wealth category and research from Sub Saharan DHS has shown that poverty is negatively associated with MAD.[35] The current study reported a bivariate significant association between MAD and nutritional status, however in multivariate analysis there was no significant association reported. This finding is in line with onother study done in Ghana [36] and other studies, including a study on secondary data analysis on the 2010 RDHS and another done in Indonesia, which did not find a significant link between MAD and nutritional status.[14,37]

Limitations

The limitation of this study is that data were based on caregivers' self-reporting, they might have provided a socially acceptable answer instead of a truthful one.[38] We were unable to establish any causal relationships because the data were cross-sectional and the sample size was small. Despite these drawbacks, our findings have provided greater insight into the relationship between the infant and young child feeding prectices and their nutritional status.

Conclusion

Breastfeeding practices were generally optimal; however, complementary feeding practices were suboptimal because a high percentage of children aged six to 23 months did not attain MDD, MMF, and MAD. The nutritional status findings were also slightly below the findings in RDHs. Good results are due to higher adherence to breastfeeding in the first hour of birth. Therefore, more and more extensive studies can be recommended for tracking the association between young children's feeding practices and nutritional status to get more reliable findings that can attract evidence-based solutions.

Author's contribution

DIN, CAS, MM, NN and SFX contributed to the original study through data collection, analysis, and manuscript writing. DI, along with JDH, supervised the process.

Conflict of interest

The authors declare that they have no competing interests.

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References

1. World Health Organization, UNICEF. Indicators for assessing infant and young child feeding practices Definitions and measurement methods. *Geneva, New York: WHO, UNICEF*; 2021.
2. Global breastfeeding scorecard 2021: Protecting Breastfeeding through bold national actions during the covid-19 pandemic and beyond. *United Nations Children's Fund (UNICEF), World Health Organization (WHO)* October 2021. https://www.who.int/publications-detail-redirect/WHO-HEP-NFS-21.45 Accessed 29 June 2023
3. WHO. Global Nutrition Report. 2020. *https:www.un.org.nutrition/files/global_nutrition_report_2021.pdf* Accessed 29 June 2023
4. NISR, MoH, ICF. Rwanda Demographic and Health Survey 2019-2020 Final Report. *Kigali, Rwanda, and Rockville, Maryland, USA: NISR and ICF.* 2021. https://dhsprogram.com/publications/publication-FR370-DHS-Final-Reports.cfm. Accessed 5 July 2023
5. Hoche S, Meshesha B, Wakgari N. Sub-Optimal Breastfeeding and Its Associated Factors in Rural Communities of Hula District, Southern Ethiopia: A Cross-Sectional Study. *Ethiop J Health Sci.* 2018;28(1):49-62. doi: 10.4314/ejhs.v28i1.7.
6. Issaka AI, Agho KE, Page AN, Burns PL, Stevens GJ, Dibley MJ. Original Article Determinants of suboptimal complementary feeding practices among children aged 6 – 23 months in four anglophone West African countries. *Matern Child Nutr.* 2015;11:14–30.
7. Issaka AI, Agho KE, Page AN, Burns PL, Stevens GJ, Dibley MJ. Original Article Determinants of suboptimal complementary feeding practices among children aged 6 – 23 months in seven francophone West African countries. *Matern Child Nutr.* 2015;11:31–52.

8. Sunguya BF, Poudel KC, Mlunde LB, Shakya P, Urassa DP, Jimba M, et al. Effectiveness of nutrition training of health workers toward improving caregivers' feeding practices for children aged six months to two years: A systematic review. *Nutr J.* 2013;12:66. doi: 10.1186/1475-2891-12-66.
9. Mesfin A, Henry C, Girma M, Whiting SJ. Use of pulse crops in complementary feeding of 6-23-month-old infants and young children in Taba Kebele , Damot Gale District , Southern Ethiopia. *J Public Health Africa.* 2015;6:1–6.
10. UNICEF, WHO, World Bank. Levels and trends in child malnutrition. 2019.
11. Ijarotimi OS. Determinants of Childhood Malnutrition and Consequences in Developing Countries. *Curr Nutr Rep.* 2013;2:129–33.
12. Veldkamp A, Uwiringiyimana V, Ocké MC, Amer S. Data on child complementary feeding practices , nutrient intake and stunting in Musanze District , Rwanda Data in Brief Data on child complementary feeding practices , nutrient intake and stunting in Musanze District , Rwanda. *Data Br. Elsevier Inc.*; 2018;21:334–42.
13. Uwiringiyimana V, Ocké MC, Amer S, Veldkamp A. Predictors of stunting with particular focus on complementary feeding practices: A cross-sectional study in the northern province of Rwanda. *Nutrition.* 2019;60:11–8.
14. Nsereko E, Mukabutera A, Iyakaremye D, Umwungerimwiza YD, Mbarushimana V, Nzayirambaho M. Early feeding practices and stunting in Rwandan children: a cross-sectional study from the 2010 Rwanda demographic and health survey. *Pan Afr Med J.* 2018;29:157. doi: 10.11604/pamj.2018.29.157.10151
15. Umwali N. Influence of Maternal Nutrition Knowledge on Infant and Young Child Feeding Practices and Nutrition Status of Children in Musanze District , Rwanda. *University of Nairobi*; 2020.
16. Yamane T. Statistics: An Introductory Analysis. 2nd ed., *New York: Harper and Row*. 1967.
17. WHO. Indicators for assessing infant and young child feeding practices part 2 measurement. 2010. *https://apps.who.int/iris/handle/10665/44306*. Accessed 2 March 2023
18. WHO. Nutrition Landscape Information System country prophile indicators: interpretation Guide. 2010. *https://apps.who.int/iris/handle/10665/44397*. Accessed 10 June 2023
19. Yourkavitch J. Trends and Inequalities in Young Child Nutrition in Rwanda. 2014. *https://dhsprogram.com/pubs/pdf/FA109/FA109.pdf*. Accessed 5 February 2023
20. CRS, SNV. GIKURIRO Program - The Integrated Nutrition and WASH Activity. 2017. *https://pdf.usaid.gov/pdf_docs/PA00MFBV.pdf*
21. Cultivating New Frontiers in Agriculture (CNFA). Feed the future Rwanda HINGA WEZE activity. 2018. *https://www.cnfa.org/program/feed-the-future-rwanda-hinga-weze-activity/* Accessed 10 December 2022
22. UNICEF. Nourishing a New Generation in Rwanda: Scaling-up the point-of-use fortification programme nationwide. 2019. *https://www.unicef.org/media/94076/file/Field-Report-Nutrition-Rwanda-Final.pdf* Accessed 15 November 2022
23. Piatti-Fünfkirchen M, Liang L, Akuoku JK, Mwitende P. Rwanda Nutrition Expenditure and Institutional Review 2020. *Rwanda Nutr. Expend. Institutional Rev.* 2020.
24. NISR, MoH, and ICF International. Rwanda Demographic and Health Survey 2014-2015. *Rockville, Maryland, USA: NISR, MOH, and ICF International.* https://dhsprogram.com/pubs/pdf/FR316/FR316.pdf. Accessed 12 December 2022

25. Syeda B, Agho K, Wilson L, Maheshwari GK, Raza MQ. Relationship between breastfeeding duration and undernutrition conditions among children aged 0–3 Years in Pakistan. *Int J Pediatr Adolesc Med. Elsevier Ltd*; 2021;8:10–7.
26. Caulfield LE, Bentley ME, Ahmed S. Is prolonged breastfeeding associated with malnutrition? Evidence from nineteen demographic and health surveys. *Int J Epidemiol.* 1996;25:693–703.
27. Umugwaneza M, Havemann-Nel L, Vorster HH, Wentzel-Viljoen E. Factors influencing complementary feeding practices in rural and semi-urban Rwanda: a qualitative study. *J Nutr Sci.* 2021;10:e45.
28. Udoh EE, Amodu OK. Complementary feeding practices among mothers and nutritional status of infants in Akpabuyo Area, Cross River State Nigeria. Springerplus. *BMC Public Health*; 2016;5:2073.
29. Nigussie E, Ferede A, Markos M. Diversified dietary intake and associated factors among pregnant mothers attending antenatal care follow-up in public health facilities of Dire Dawa, Eastern Ethiopia. *PLOS Glob Public Heal.* 2022;2:1–17.
30. Aboagye RG, Seidu A, Ahinkorah BO, Arthur-holmes F, Cadri A, Dadzie LK, et al. Dietary Diversity and Undernutrition in Children Aged 6–23 Months in Sub-Saharan Africa. MDPI. 2021;13:1–22.
31. Kimiywe J, Chege P. Complementary feeding practices and nutritional status of children 6-23 months in Kitui County, Kenya. *J Appl Biosci.* 2015;85:7881_7890.
32. Roba KT, O'Connor TP, Belachew T, O'Brien NM. Infant and Young Child Feeding (IYCF) Practices Among Mothers of Children Aged 6–23 Months in Two Agro-ecological Zones of Rural Ethiopia. *Int J Nutr Food Sci.* 2016;5:185–94.
33. Ahishakiye J, Bouwman L, Brouwer ID, Matsiko E, Armar-Klemesu M, Koelen M. Challenges and responses to infant and young child feeding in rural Rwanda: A qualitative study. *Journal of Health, Population and Nutrition.* 2019;38:1–10.
34. Habimana JDD, Uwase A, Korukire N, Jewett S, Umugwaneza M, Rugema L, et al. Prevalence and Correlates of Stunting among Children Aged 6–23 Months from Poor Households in Rwanda. *Int J Environ Res Public Health.* 2023;20:4068.
35. Belay DG, Taddese AA, Gelaye KA. Minimum acceptable diet intake and its associated factors among children age at 6–23 months in sub-Saharan Africa: a multilevel analysis of the sub-Saharan Africa demographic and health survey. *BMC Public Health. BioMed Central;* 2022;22:1–18.
36. Saaka M, Wemakor A, Abizari A-R, Aryee P. How well do WHO complementary feeding indicators relate to nutritional status of children aged 6 – 23 months in rural Northern Ghana? *BMC Public Health.* 2015;15:1–12.
37. Limardi S, Hasanah DM, Utami NMD, Sidiartha IGL. Investigating the effect of unachieved minimum acceptable diet and low infant and child feeding index as risk factors of stunting in children aged 6-23 months. *Paediatr Indones.* 2020;60:259–68.
38. Scott A, Balthrop AT. The consequences of self-reporting biases: Evidence from the crash preventability program. *J Oper Manag.* 2021;67:588–609.