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Original Article

Prevalence and Factors Associated with Undernutrition Among Under Five Years' Children Attending Health Centers in Rulindo District, Rwanda.

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Abstract

Undernutrition remains a critical global health concern, particularly affecting children under five, with nearly 144 million stunted children worldwide. In sub-Saharan Africa, approximately 58 million children suffer from stunting, with Rwanda reporting 33% stunting prevalence. Despite government initiatives like the National Strategy for Transformation, factors including poverty, food insecurity, and limited awareness of proper feeding practices continue to impede progress, especially in rural areas. This study was conducted to determine the prevalence and factors associated with undernutrition among under five years' children attending health centers in Rulindo district, Rwanda. The quantitative cross-sectional study design was used. Data collection included anthropometric measurements (weight and height) and structured questionnaires. Sample size (339) was determined using Cochran formula with stratified sampling techniques across 22 health centers. Data analysis employed WHO Anthro software for nutritional assessment and SPSS for statistical analysis, with significance set at $p<0.05$. The results showed that the prevalence of stunting was 35.4%, underweight 25.7%, and wasting 6.5%. The results also revealed that 42% of the children in the sample experienced undernutrition. Through multivariate analysis, several factors were found to significantly affect the nutritional status of the children, including the child's place of residence, the mother's occupation and knowledge of balanced diet preparation. Children residing in rural areas were significantly more likely to suffer from undernutrition compared to those living in urban areas (AOR = 0.595, 95% CI: 0.361– 0.980, p = 0.042). Additionally, maternal occupation, especially among cultivators, was significantly linked to undernutrition (AOR = 2.489, 95% CI: 1.159–5.342, p = 0.019). The study also revealed that maternal knowledge regarding the preparation of balanced diets contributed to lower undernutrition rates (AOR = 0.938, 95% CI: 0.576–1.527, p = 0.046). The study underlines the importance of improving maternal education and addressing rural poverty to combat undernutrition in young children. This can be achieved through strengthened community nutrition programs, education on dietary diversity, and ongoing preventive measures.

Keywords: Under 5 years' children, Undernutrition, Health Center

Introduction

Undernutrition remains one of the critical pressing health concerns globally, particularly affecting children under five. The World Health Organization (WHO, 2022) reports that undernutrition is responsible for almost 50% of deaths of children under five, manifesting in conditions such as stunting, wasting, and underweight (African, 2022). It is estimated that 40% of children under five in the East African Community (EAC) region are affected by some form of undernutrition, primarily stunting (Tesema et al., 2021). In Rwanda, malnutrition also poses a significant public health issue affecting the health and development of children under five. Efforts to address malnutrition in Africa have encountered challenges, especially in rural and low-income communities where poverty, food insecurity, limited access to healthcare, and maternal illiteracy exacerbate the problem; although African nations have implemented policies to address these issues, the progress has been slow and uneven, with rural areas being disproportionately affected (African, 2022). Data from the 2019-20 Rwanda Demographic and Health Survey (DHS) highlight that 33% of Rwandan children under five are stunted, 8% are wasted, and 13% are underweight (Ndagijimana et al., 2023). Data from the Maternal and Child Health (MCH) Week conducted in June and November 2023 indicated that the prevalence of stunting among children under five in Rulindo District slightly decreased from 30.3% in June 2023 (2790 out of 9214 children) to 27.8% in
November 2023 (2804 out of 10096 children) (Rwanda Ministry of Health, 2023). These findings suggest a persistent challenge in tackling undernutrition at the community health level in Rulindo, despite Rwanda's commitment to reducing malnutrition. While national data exist, few studies have focused specifically on localized facility-level assessments in rural districts like Rulindo. The persistence of undernutrition in Rulindo District underscores the need for a more detailed investigation into its prevalence and associated factors. The absence of comprehensive data constrains efforts to design and implement targeted, effective strategies that tackle the root causes of undernutrition at the district level.

Methods and Materials

Study design

A cross-sectional study design incorporating quantitative research method approach was used. The researcher used structured questionnaire and the anthropometric measurements of the children were taken. This approach allowed for the assessment of associations between undernutrition and its potential contributing factors among under five years' children.

Study setting

This study was conducted at 22 health centers within Rulindo District. The latter has a population of approximately 360,144 people and consists of 17 sectors (NISR, 2022). According to the data from SISCOM data in 2024 total of 44,625 under 5 years were recorded in Rulindo district. Rulindo District is characterized by hilly mountains, which can limit access to services such as healthcare and markets. Rulindo District is located in the Northern Province of Rwanda and is predominantly rural, with most of the population engaged in agriculture activity. Socio-economic challenges in Rulindo include limited income opportunities, food insecurity, and inadequate infrastructure, all of which can contribute to poor nutrition and health outcomes, particularly among children under five (Security, 2018)

Study Population

The study population consists of children under five attending the health centers for different services. Respondents include mothers or guardians of these children from the respective health centers.

Sample Design Sample Size

The sample size was calculated using the Cochran formula N = Z2 P (1-P)/e2, where N represents the required sample size, Z is the standard score or the desired level of confidence (1.96 for a 95% confidence level), P is the estimated proportion of the population that has a certain characteristic or attribute, (1 - P) represents the proportion of the population without the characteristic and e is the margin of error. In addition, direct proportion sample size calculation was used to calculate the participants from health center. n= sample size. P = Prevalence of undernutrition in Rulindo District (P) is 27.8 % or 0.278) (Rwanda Ministry of Health, 2023). Zα/2= Critical value of the normal distribution at α/2 is equal to 1.96 when a confidence level of 95%, while α is equal to 0.05. d = Margin of error (5% or 0.05), n= (1.96)20.278 (0.722)/ (0.05)2 n=308 by adding of 10% of sample size to cover non respondent subjects and then sample size that was used was 339.

Sampling Technique and Data Collection

The stratified sampling method was used where each health center represents a stratum. Anthropometric measurements, including body weight and height of children were taken. Using standard procedures and equipment, trained healthcare workers (nutritionists) measured each child's height and weight, allowing for the calculation of indices such as weight-for-age, height- for-age, and weight-for-height. These indices were compared to World Health Organization growth standards to classify children’s nutritional status as normal, underweight, stunted, or wasted. The structured questionnaire used in this study was adapted from a similar study

of Marthe Uwamariya which is in line with Rwandan context. Also it was pre-tested and refined according to the feedback given. Data were collected from participants present during 23rdJanuary to 07th February 2025.

Data Analysis

Anthropometric measurements were entered into WHO Anthro ® software version 3.2.2 and standardized Z-scores were generated for comparison with WHO reference populations where height for age Z-score (HAZ) < -2SD was categorized as stunting, weight for height Z score (WHZ) < -2SD categorized as wasting and weight for age Z-score (WAZ) < -2SD categorized as underweight. Data entry and analysis was completed using Statistical package for social sciences software (SPSS) version 27. Data were entered and cleaned in SPSS version 27 for consistency and accuracy. Descriptive analysis was done both frequencies and percentage. Both bivariate and multivariate regression analyses were conducted to identify factors associated with undernutrition among the study population.

Ethical consideration

Ethical approval for this study was obtained from the Mount Kenya University Rwanda Institutional Review Board (MKU/ETHICS/28/11/2024). Additionally, permission was secured from the management of Rulindo District Health Department before data collection commenced. Written informed consent was obtained from all caregivers of participating children after explaining the study purpose, procedures, potential risks, and benefits in their preferred language. Confidentiality was maintained by using coded identifiers instead of names, and all data was stored securely with password protection.

Results

Demographic and Socioeconomic Characteristics of the Respondents.

The study revealed that the majority of caregivers were female (91.4%) and male were 8.6%, most of the respondents resided in rural areas (68.4%) while 31.6% lived in urban areas. A large proportion of the caregivers (61.4%) were engaged in farming, 12.4% are self-employed, 8.8% government employed and 17.4% were unemployed. Education levels varied, with over half (52.2%) having completed primary school, 21.8% attended secondary school, 19.5% had never attended school, while a small proportion (6.5%) attained university education. Most caregivers (67.6%) were married, 25.7% were single, 3.8% widowed and 2.9% were divorced. The majority of respondents had health insurance (95.0%) while 4.4% did not have. The households with more

than three members were 79.6% while 20.4% had three or fewer individuals. Income levels were generally low, with 64.0% earning less than 30,000 Rwf monthly, 14.7% reported a monthly income between 30,000 and 60,000 Rwf, while 7.7% earned between 60,000 and 100,000 Rwf and 46 (13.6%) had a monthly income exceeding 100,000 Rwf. Most respondents (69.6%) had only one child under five, 25.1% had two children, 4.4% had three children and small proportion 0.9% had six or more children. The largest age group among caregivers 44.0% was 26–35 years, 32.7% aged 25 years or younger, 22.4% were between 36-45 years, while 0.9% were aged 46 years and above. A minority reported family conflicts (17.1%) while 82.9% had no such issues. A majority, 63.7% did not receive assistance from their partners during child caring, and 36.3% received support from their partners.

Distribution of factors related to Child Characteristics

The study examined several child-related factors influencing health and nutrition, including gender, birth weight, age, illness history, and participation in nutrition programs. Among the children studied, 54.6% were male and 45.4% female, with slight male predominance. Most children (82.6%) had normal birth weights, while 10.9% were born underweight and 6.5% were macrosomic. The majority of the children 66.7% were aged 7–24 months, a critical stage for dietary transitions, while 27.7% were aged between 27-59 months who remain at risk for malnutrition and stunting if proper dietary needs are not given and smaller proportions of 4.4% were infants aged 2-6 months. Diarrhea affected 38.3% of children in the previous four weeks highlighting vulnerability to illness-related undernutrition while 61.7% had not experienced the condition. Additionally, only 44.8% of children were enrolled in nutrition support programs, indicating a significant gap in service that help children grow up healthy and the need to expand access to interventions that can improve child health and nutritional outcomes.

Distribution of Factors Related to Child Healthcare Access and Nutritional Awareness This section examines the healthcare access and nutrition practices among caregivers of children under five years' old who attend health centers in Rulindo District, focusing on routine check- ups, access to health centers, deworming and vitamin A supplementation and involvement in community nutrition programs. While the majority of caregivers (64%) take their children for monthly check-ups, 13.6% visit the health facility only when their child is sick which can delay early intervention, 9.7% makes health checking for their children once every three months while 12.7% reported rarely or never seeking routine medical check-ups for their children. Access remains a challenge as 64.6% of caregivers use more than 30 minutes to reach a facility while 35.4% reach a health center within 30 minutes. Deworming and vitamin A supplementation prevent malnutrition and support healthy growth as 91.4% of children received deworming or vitamin A in the past six months while 8.6% did not. The study shows that 84.4% of caregivers participated in nutrition programs while 15.6% caregivers reported not participating in such

programs. However, gaps still exist in service coverage and participation, pointing the need for targeted awareness campaigns, improved outreach and greater access to health and nutrition support, especially in remote areas.

Presentation of Child Feeding Patterns and Nutritional Factors

This section explored the dietary habits, feeding frequency, and nutritional awareness among caregivers of children under five in Rulindo District. The findings revealed that only 11.8% of children ate fish, 16.8% ate meat, and 37.8% consumed eggs in the past week indicating gap in dietary diversity possibly due to financial constraints or limited access to protein sources. While 63.7% of children ate sweet potatoes which contribute to energy needs and these should be complemented with proteins, healthy fats, and other nutrients to ensure a well-balanced diet. Feeding frequency also raised concern as 9.4 % of the children fed only once per day, 43.4% had two meals daily, 22.4% fed three times, 13% had four meals and only 11.8% received more than four meals per day. Although 82.0% of caregivers reported to know how to prepare a balanced diet while 18.0% lacked this knowledge. These results underscore the need for enhancing nutrition education and food access strategies to promote frequent, balanced meals using locally available ingredients.

Presentation of Cultural, Household and Hygiene Practices Factors Affecting Child Nutrition

This part explored social-cultural, and environmental factors affecting child nutrition in Rulindo District, Rwanda. According to the findings, 44% of children experienced dietary restrictions due to cultural or religious beliefs, and this limits their nutritional diversity. The study revealed that 36.3% of spouse contributed to food preparation and child care, while the majority, 63.7%, did not participate in these activities and this shows a gender gap in caregiving the children. Alcohol consumption among caregivers was reported by 54% while 46% did not, which may divert resources from household needs like food and child care, raising awareness on its impact could help to mitigate its negative effects on child health. About water treatment, 67.3% of households did not treat drinking water, exposing children to health risks. Only 31.9% boiled water and just 0.9% used filter. While 73.5% of families had access to proper sanitation, 26.5% lacked such facilities, which increases the risk of infections that can lead to malnutrition. Hand hygiene was also inconsistent as 41.6% of caregivers regularly washed their hands after using the toilet, while 58.4% did not. On the other hand, 57.8% of caregivers practiced handwashing before eating, while 42.2% did not. Encouraging proper sanitation and hygiene practices is essential to prevent undernutrition. Positively, 83.5% of households had kitchen gardens, enhancing access to homegrown vegetables which can enhance child nutrition.

Distribution of Nutritional Status of Children Based on Different Anthropometric Measurements.

The table 1 presents an analysis (by using WHO Anthro ® software) results of children's nutritional status based on different growth measurements. Concerning the Weight for Height category, 22 children (6.5%) were classified as wasted while 317 children (93.5%) were not wasted. About the Height for Age category, 120 children (35.4%) were identified as stunted, and 219 children (64.6%) were considered non-stunted. Lastly, in the Weight for Age category, 87 children (25.7%) were categorized as underweight, while 252 children (74.3%) were classified as non-underweight.

Table 1 Distribution of Nutritional Status of Children Based on Different Anthropometric Measurements.

Variable		Frequency	Percent
Wight for height Category	Wasting (<-2 SD)	22	6.5
	Non wasted (>=-2 SD)	317	93.5
Height for age category	Stunted children (<-2 SD)	120	35.4
	Non stunted children (>=-2 SD)	219	64.6
Weight for age category	Underweight (<-2 SD)	87	25.7
	Not Underweight (>=-2 SD)	252	74.3

Prevalence of undernutrition among children

The figure 1 presents the undernutrition status of a sample of 339 individuals. Out of the total, 144 individuals (42%) were identified as undernourished, while 195 individuals (58%) were not undernourished. The total number of individuals in the sample is 339, representing 100% of the population in the study.

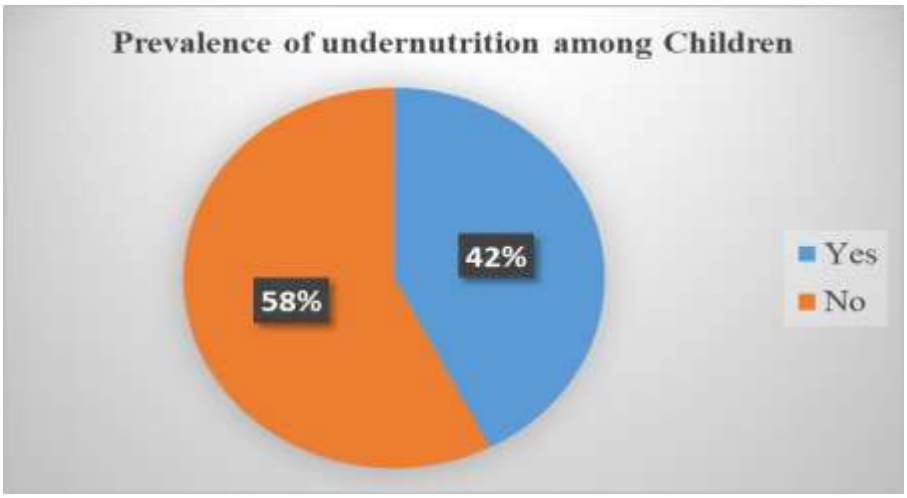

Figure1: Prevalence of* undernutrition *among children

Bivariate Analysis of the Factors Associated with Stunting Among Under 5 Years' Children Attending at the Health Centers in Rulindo District.

The analysis explores various aspects such as the gender, education, and occupation of the mother or guardian, along with the child's health behaviors and access to nutrition-related services. Regarding the gender of the mother or guardian, the majority of children were under the care of female guardians, with very few children having male guardians. The analysis showed no significant association between the gender of the guardian and the child's nutritional status, as indicated by the high p-value (0.789). Similarly, the education level of the respondent did not show a significant impact, with the p-value of 0.976 suggesting that different education levels, ranging from no formal education to university, were not associated with the undernutrition status of the children. Marital status also did not show a strong relationship with undernutrition, as the p-value of 0.316 indicated no significant difference between married, single, widowed, and divorced guardians. However, there was a notable distinction based on residence, with rural areas showing a higher prevalence of undernutrition compared to urban areas. This finding, with a p- value of 0.013, suggests that children in rural areas are more likely to experience undernutrition. The occupation of the mother or guardian was another important factor, with cultivators having a higher proportion of undernourished children. The occupation was found to be statistically significant (p-value = 0.038), indicating that the mother's or guardian's employment type may influence the nutritional status of the child. On the other hand, health insurance status did not show a significant effect on undernutrition, as reflected by a p-value of 0.716. In terms of household composition, children living in households with more than three members did not show a significant difference in undernutrition status compared to those in smaller households,

as the p-value of 0.085 suggests that the number of household members does not play a major role in undernutrition outcomes.

The frequency with which children visited the health center was analyzed, but it did not seem to affect their nutritional status significantly (p-value = 0.741). Additionally, the child's gender (male vs. female) did not show a significant correlation with undernutrition (p-value = 0.569). When it comes to family income, there were no significant differences found in the nutritional status of children from families with varying income levels. The p-value of 0.302 shows that monthly income does not appear to be a strong predictor of undernutrition. The number of under- five children in the household also did not show a significant association with undernutrition, with a p-value of 0.557 indicating that this factor did not influence undernutrition status. Child birth weight had some differences between low birth weight and normal birth weight groups, but the p-value of 0.619 suggests that birth weight is not a major determinant of undernutrition in this context. The analysis of child age showed that children between 7-24 months had the highest proportion of undernourished children, but the p-value of 0.738 indicates no significant relationship.

The age of the mother or guardian did not show a strong effect on undernutrition, with a p-value of 0.101, suggesting that maternal age is not a significant factor in determining undernutrition status. Similarly, the time it takes to reach a health center (p-value = 0.248) and the presence of diarrhea in the past four weeks (p-value = 0.192) were not significantly related to undernutrition. Several dietary habits were analyzed, including whether the child ate fish, meat, or eggs in the last seven days, and there was no significant relationship found between these dietary factors and undernutrition, with p-values ranging from 0.149 to 0.776. The frequency of feeding the child per day also did not show a strong association with undernutrition, as indicated by the p-value of 0.466. The use of deworming medicine or vitamin A supplementation in the last six months was not statistically associated with undernutrition either, with a p-value of 0.789. Additionally, cultural or religious restrictions on the child's diet did not significantly affect undernutrition (p- value = 0.549).

A significant finding in this analysis was that knowledge of how to prepare a balanced diet for the child was associated with a lower prevalence of undernutrition, with a p-value of 0.048 indicating its importance in child nutrition. However, the spouse's involvement in child care and nutrition did not significantly influence undernutrition status, with a p-value of 0.153. The analysis also explored the effects of conflicts with a partner, alcohol consumption, and the type of water treatment used for drinking, but none of these factors showed significant associations with undernutrition, with p-values ranging from 0.289 to 0.297. Sanitation facilities at home and regular handwashing after using the toilet did not show strong links to undernutrition, with p- values

of 0.954. However, handwashing before eating approached significance (p-value = 0.05), indicating that this practice may play a role in improving child nutrition.

The presence of a kitchen garden at home (p-value = 0.262) and participation in community nutrition programs (p-value = 0.288) did not significantly correlate with undernutrition status. Finally, the number of under-five children in the household did not show any significant effect on undernutrition, with a p-value of 0.226. In few words, the analysis indicated that factors like residence (rural vs. urban), occupation of the mother (cultivator), and knowledge of preparing a balanced diet are significantly associated with undernutrition in children. Other factors, such as marital status, education, and health behaviors, did not show significant associations.

Table 2 Bivariate analysis of the factors associated with stunting among under 5 years' children attending at the health centers in Rulindo District.

Category	Subcategory	Undernutrition Status: Yes	Undernutrition Status: No	P-Value
Gender of the Mother or Guardian	Female	131	179	0.789
	Male	13	16	
Education Level of Respondent	No formal education attended	28	38	0.976
	Primary	77	100	
	Secondary	30	44	
	University	9	13	
Marital Status of Mother or Guardian	Married	102	127	0.316
	Single	32	55	
	Widowed	4	9	
	Divorced	6	4	
Residence	Urban	35	72	**0.013**

	Rural	109	123		
Occupation of the	Cultivator	95	113		**0.038**
Mother/Guardian					
	Self employed	11	31		
	Government employee	9	21		
	Unemployed	29	30		
Insurance	Yes	135	187		0.716
	No	7	8		
Number of Members in the Household	<= 3 members	23	46		0.085
	>= 3 members	121	149		
Frequency of Health	Every 3 months	16	17	0.741	
Center Visits					
	Monthly	94	123		
	Only when a child is sick	18	28		
	Rarely/Never	16	27		
Gender of the Child	Female	68	86	0.569	
	Male	76	109		
Family Income per Month (Rwf)	>30,000 Rwf	94	123	0.302	
	30,000-60,000 Rwf	23	27		
	60,000-100,000 Rwf	13	13		
	>100,000 Rwf	14	32		

Children in the Household Under Five	1 child	98	138	0.557
	2 children	36	49	
	3 children	9	6	
	6 children and above	1	2	
Child Birth Weight Category (grams)	Low Birth Weight (<=2500 grams)	13	24	0.619
	Normal Birth Weight (2500.01-4000 grams)	121	159	
	Macrosomia (>=4000.01 grams)	10	12	
Age Group Categories of the Child (months)	<= 1 month	1	3	0.738
	2-6 months	8	7	
	7-24 months	96	130	
	25-59 months	39	55	
Age Group of the Mother/Guardian	<=25 years	46	65	0.101
	26-35 years	68	81	
	36-45 years	27	49	
	>=46 years	3	0	

Duration to Reach a Health Center (minutes)	<=30 minutes	56	64	0.248
	>=31 minutes	88	131	
Child had Diarrhea in the Last 4 Weeks	Yes	61	69	0.192
	No	83	126	
Child Beneficiary of any Nutrition Supportive Program	Yes	60	92	0.313
	No	84	103	
Child Ate Fish in the Last 7 Days	Yes	15	25	0.498
	No	129	170	
Child Ate Meat in the Last 7 Days	Yes	22	35	0.516
	No	122	160	
Child Ate Eggs in the Last 7 Days	Yes	48	80	0.149
	No	96	115	
Child Ate Sweet Potatoes in the Last 7 Days	Yes	93	123	0.776
	No	51	72	
Frequency of Feeding a Child per Day	Once	10	22	0.466
	Twice	69	78	

	Thrice	29	47	
	Four	18	26	
	>4 times	18	22	
Child Received Deworming Medicine and/or Vitamin A Supplementation in Last 6 Months	Yes	131	179	0.789
	No	13	16	
Any Cultural or Religious Restrictions on the Child's Diet	Yes	66	83	0.549
	No	78	112	
Mother/Guardian Knows How to Prepare a Balanced Diet for the Child	Yes	125	153	**0.048**
	No	19	42	
Her Spouse Helps with Balanced Diet and Child Care	Yes	46	77	0.153
	No	98	118	
Conflicts with Partner (If Any)	Yes	21	37	0.289
	No	123	158	
Drink Alcohol Status	Yes	73	110	0.297
	No	71	85	

Kind of Water Treatment Used to Prepare Drinking Water	Boiling	45	63	
	Filter	0	3	
	No treatment	99	129	
Having Proper Sanitation Facilities (Latrine) at Home	Yes	106	143	0.312
	No	38	52	
Practicing Handwashing Regularly After Using the Toilet	Yes	52	89	0.954
	No	92	106	
Practice Handwashing Regularly Before Eating	Yes	75	121	**0.05**
	No	69	74	
Having a Kitchen Garden at Home	Yes	124	159	0.262
	No	20	36	
Participating in Community Meetings or Programs Focused on Child Nutrition	Yes	125	161	0.288
	No	19	34	
Number of Under-Five-	1 child	23	46	0.226

Year-Old Children in the		
Household		
2 children	101	125
>= 3 children	20	24
Total	144	195

Multivariate Analysis of Factors Associated with Undernutrition Among Under 5 Years' Children Attending at the Health Centers in Rulindo District.

The multivariate analysis was conducted to identify factors associated with undernutrition among children under five years' old who visited health centers in Rulindo District. The results highlighted the influence of several variables. Residence emerged as a significant factor, with children living in urban areas being less likely to experience undernutrition compared to those in rural areas. The odds ratio (AOR) for urban residence was 0.595, with a confidence interval (CI) ranging from 0.361 to 0.980 (P-value = 0.042), indicating a protective effect of urban living against undernutrition. Occupation of the mother or guardian was another important determinant. Cultivators had a higher risk of undernutrition in their children, with an AOR of 2.489 (95% CI = 1.159 to 5.342, P-value = 0.019), suggesting that children of cultivators were more likely to be undernourished. Self-employed guardians showed an AOR of 2.180 (95% CI = 0.918 to 5.178), though this was not statistically significant. Government employees had an AOR of 0.813 (95% CI = 0.450 to 1.470), showing no significant difference in undernutrition risk. Unemployed guardians had an AOR of 1.852 (95% CI = 0.969 to 3.540), indicating a moderate but non- significant increase in undernutrition risk. Mother/guardian knowledge of how to prepare a balanced diet for the child also played a significant role. Those who knew how to prepare a balanced diet were less likely to have undernourished children, with an AOR of 0.938 (95% CI = 0.576 to 1.527, P-value = 0.046). This suggests that knowledge of balanced diet preparation may contribute to preventing undernutrition. Handwashing practices were slightly associated with undernutrition. Children whose guardians did not practice regular handwashing before eating had an AOR of 2.489 (95% CI = 1.159 to 5.342), though the P-value of 0.07 suggests this relationship is not statistically significant.

Table 3 Multivariate analysis of factors associated with under nutrition among under 5 years' children attending at the Health Centers in Rulindo District.

Variables	**Variables Sub-category**	**Undernutrition Status**		**AOR**	**95% CI**		**P-value**
					Lower	**Upper**	
		Yes	**No**				
Residence	Urban	35	72	.595	.361	.980	**0.042**
	Rural	109	123				
Occupation of the Mother/Guardian	Cultivator	95	113	2.489	1.159	5.342	**0.019**
	Self employed	11	31	2.180	.918	5.178	
	Government employee	9	21	.813	.450	1.470	
	Unemployed	29	30	1.852	.969	3.540	
Mother/Guardian Knows How to Prepare a Balanced Diet for the Child	Yes	125	153	.938	.576	1.527	**0.046**
	No	19	42	.595	.361	.980	
Practice Handwashing Regularly Before Eating	Yes	75	121			0.07	
	No	69	74	2.489	1.159	5.342	

Discussions

The study conducted in Rulindo District, Rwanda, revealed that 35.4% of children were stunted, 25.7% underweight, 6.5% were wasted. In total 42% of children under five years old were affected by undernutrition. In contrast, findings from the 2019-20 Rwanda Demographic and Health Survey (RDHS) indicated that, at the

national level, 33% of children under five were stunted (low height-for-age), 8% were underweight (low weight-for-age), and 2% were wasted (low weight-for-height) (National Institute of Statistics of Rwanda (NISR) [Rwanda] & International, 2021).

The higher prevalence of undernutrition in Rulindo District suggests that regional disparities exist in child nutrition within Rwanda. Similarly, the Western Province reported a stunting rate of 40%, with districts such as Nyabihu and Ngororero experiencing even higher rates at 59% and 56%, respectively (National Institute of Statistics of Rwanda (NISR), 2021). These findings support previous research indicating that malnutrition is more prevalent in rural areas due to challenges such as limited access to healthcare, poor dietary diversity, and economic hardships (Nguyen et al., 2017). These differences emphasize the need for region-specific interventions to enhance child nutrition outcomes throughout Rwanda. Recommended strategies include improving access to a variety of nutritious foods, increasing maternal education on proper child feeding practices, and enhancing healthcare services, particularly in rural regions (National Institute of Statistics of Rwanda (NISR) [Rwanda] & International, 2021)

The analysis indicated that the occupation of the mother or guardian plays a crucial role in the nutritional status of children. Specifically, children of cultivators had significantly higher odds of undernutrition. This finding is consistent with research indicating that families dependent on agriculture may experience food insecurity due to variability in crop yields, market access, and seasonal fluctuations (FAO, 2021). Despite being engaged in food production, cultivators may struggle to meet the dietary needs of their children due to limited economic resources, which is exacerbated by environmental factors such as droughts and soil degradation (FAO et al., 2020). Interestingly, self-employed guardians also showed a higher risk of undernutrition in their children, possibly due to irregular income sources, which could affect their ability to consistently provide for their children's nutritional needs.

On the other hand, government employees showed no significant association with undernutrition, this could suggest that formal employment may provide more stable incomes, contributing to better access to nutritious foods and healthcare services for children. However, the non- significant finding in this category warrants further investigation, as it may be influenced by other unmeasured variables like education, household income, and geographical location. The study highlighted the importance of maternal knowledge regarding the preparation of a balanced diet for children. Mothers who were aware of how to prepare a balanced diet had children with lower odds of undernutrition. This finding corroborates previous research that underscores the importance of maternal education in improving children's nutritional outcomes (Kismul, 2015). Nutritional knowledge empowers mothers

to make informed decisions about their children's diets, incorporating essential nutrients such as proteins, vitamins, and minerals into daily meals. In contrast, the lack of knowledge about proper nutrition and diet preparation can lead to poor feeding practices, contributing to the risk of stunting and other forms of undernutrition (Jard et al., 2021).

Handwashing before meals is another significant factor identified in this study, with children whose guardians did not practice regular handwashing being at a higher risk of undernutrition. Poor hygiene practices are strongly associated with diarrheal diseases, which can result in malnutrition and stunting in children (Umallawala et al., 2022). The practice of regular handwashing is a key intervention to prevent gastrointestinal diseases, particularly in areas where access to clean water and sanitation facilities may be limited. This finding is consistent with global evidence showing that improving hygiene practices, such as handwashing, significantly reduces the risk of infection-related undernutrition in young children (Calder & Jackson, 2000).

Recommendations

Based on the study results, several tailored recommendations are proposed to improve the nutritional status of children under five years old in Rulindo District, Rwanda. For Rulindo District, it is advised to enhance rural development initiatives by launching community-based projects that improve access to nutritious food, healthcare, and sanitation, particularly for rural and farming households. Public health efforts should promote hygiene and handwashing education through regular campaigns to reduce disease-related malnutrition. Improving access to healthcare in rural areas, such as deploying mobile health units, would support child nutrition and offer essential services to remote families. For Kinihira and Rutongo District Hospitals, it is recommended to strengthen maternal nutrition education through community campaigns and practical demonstrations on preparing nutritious meals using local ingredients.

Conclusion

This study provides valuable insights into the factors associated with undernutrition among children under five years in Rulindo District, Rwanda, where the prevalence of malnutrition stands at 42%, making it a significant public health concern. The findings highlight the substantial impact of residence, maternal occupation and knowledge of balanced diets on children's nutritional outcomes. Specifically, rural children were more likely to experience undernutrition compared to their urban counterparts, reflecting disparities in access to resources and healthcare. The study also found that maternal occupation, particularly among cultivators, as well as knowledge about balanced diets, played a crucial role in determining the nutritional status of children. This study underscores

the need for targeted interventions aimed at improving the nutritional status of children, particularly in rural areas and among households engaged in agricultural activities. Longitudinal study would help to gain a deeper understanding of how maternal knowledge, occupation, and residence evolve and their long-term influence on the nutritional status of children.

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