RESEARCH
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PREVALENCE AND FACTORS ASSOCIATED WITH UNDERNUTRITION AMONG CHILDREN AGED 6-59 MONTHS IN WESTERN PROVINCE, RWANDA

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Abstract
Undernutrition refers to the inadequate intake of essential nutrients required to maintain optimal health. Globally, the prevalence of stunting is 1.6 times higher, and wasting is 1.4 times more common in rural areas compared to urban regions. In Rwanda, 33% of children under five were found to be stunted, 2% suffered from acute malnutrition (wasting or low weight for length), and 8% were underweight. The Western Province recorded the highest prevalence of stunting, with 40% of children under five being affected, making it a significant public health issue. The first and second districts with the highest stunting rates are located in this province. This study aimed to identify the prevalence and factors associated with undernutrition among children aged 6-59 months in the Western Province of Rwanda. A cross-sectional design was used, and data were drawn from the most recent Rwanda Demographic and Health Survey (RDHS) 2019/2020, which included responses from 868 mothers or primary caregivers of children aged 6-59 months in the Western Province. Data analysis was performed using SPSS version 25. Among the 868 children included in the study, 50.7% were female, 24.4% were aged 25-34 months, 77% had an average size at birth, and the majority (62.9%) did not receive a postnatal checkup within the first two months. The study revealed that the prevalence of undernutrition was 43.0% for stunting, 8.6% for underweight, and 0.7% for wasting. Several factors were significantly associated with stunting, including being aged 24-35 months (AOR=3.884, 95%CI=1.823-8.277, p=0.000), being male (AOR=1.464, 95%CI=1.094-1.961, p=0.01), living in the poorest families (AOR=9.369, 95%CI=5.026-17.463, p=0.000), and having a partner or husband with only primary education (AOR=0.592, 95%CI=0.379-0.926, p=0.022). Underweight was associated with being male (AOR=2.135, 95%CI=1.287-3.540, p=0.003), living in the poorest families (AOR=5.743, 95%CI=1.564-21.091, p=0.008), and having a partner or husband with primary education (AOR=0.443, 95%CI=0.241-0.815, p=0.009). Wasting was linked to non-de jure residence in a household with access to a radio, electricity, and television (AOR=12.738, 95%CI=0.997-162.862, p=0.05). The study concluded that providing financial support to poor families, educating parents, and improving access to healthcare and infrastructure can enhance the nutritional status of children in the Western Province of Rwanda.
Keyword: Undernutrition, Children aged 6-59 months, DHS.

INTRODUCTION

Undernutrition refers to the insufficient intake of essential nutrients required to maintain good health. It is a major public health issue, particularly affecting children aged six to fifty-nine months. In 2020, millions of children in this age group were undernourished, with the World Health Organization (WHO) reporting that 47 million were wasted, 14.3 million were severely wasted, and 144 million were stunted. Nearly 400,000 children die annually from undernutrition, accounting for approximately one-third of all pediatric deaths globally (Debela et al., 2023).

In 2022, around 22.3% of children under five were stunted globally, equating to 148.1 million children. Additionally, 6.8%, or 45 million children, were reported as wasted, and 5.6%, or 37 million, were classified as overweight. Stunting was 1.6 times more common, and wasting 1.4 times more prevalent, in rural areas compared to urban regions (Yamamoto, 2021). Undernutrition, primarily influenced by socioeconomic factors, is widespread in developing regions like Asia and Sub-Saharan Africa (Debela et al., 2023). The incidence of infant and under-five mortality is particularly high in Sub-Saharan Africa, where the under-five mortality rate is fifteen times greater than in industrialized nations. Niger and Burundi have the highest percentages of underweight (40%) and stunting (58%), respectively, while Swaziland and Gabon have the lowest percentages (7% and 21%).

Despite progress, undernutrition remains a severe public health concern, especially among children under five in poor nations, exacerbated by the COVID-19 pandemic. The pandemic's socioeconomic consequences have worsened food insecurity and malnutrition in low- and middle-income countries. One study found that moderate to severe malnutrition among children under five is projected to increase by 14.3% due to the pandemic's economic fallout, significantly contributing to child mortality as it increases susceptibility to infectious diseases. Risk factors for undernutrition include socioeconomic

conditions, feeding practices, maternal and child health, environmental factors, hygiene, and access to healthcare (Debela et al., 2023).

In Rwanda, 33% of children under five are stunted, 2% experience acute malnutrition (wasting), and 8% are underweight (RDHS, 2019). Stunting is more prevalent in rural areas (36%) compared to urban areas (20%). The Western Province has the highest rate of stunting (40%), with Ngororero District leading with a stunting rate of 51%, while Rusizi and Karongi have the lowest at 31%. Nationally, less than 1% of children under five are considered wasted, although Ngororero and Karongi have a slightly higher prevalence (1.7%). Ngororero has the highest stunting rate (50.5%), followed by Nyabihu (46.7%).

Despite significant progress in reducing infant mortality over the past 15 years, stunting persists among children aged 6 to 59 months in Rwanda. Stunting rates have decreased from 51% in 2005 to 38% in 2015, and 33% according to the 2019-2020 RDHS reports. A study in Ngoma District found that the prevalence of stunting was 33.7%, wasting 3.6%, and underweight 6.6% (Alice et al., 2021), higher than the national levels. Similarly, a study in the Western Province found that 4.3% of children were wasted, 6.7% were underweight, and 23.2% were stunted among children aged 6-23 months, indicating that undernutrition remains a public health issue (Ilinde Niyigena et al., 2023). The Western Province's high stunting levels (40%) and the stunting rates in Ngororero (50.5%) and Nyabihu (46.7%) highlight the persistent challenge. Undernutrition leads to increased child morbidity and mortality, impairs learning and productivity, and hinders national socioeconomic development (Ilinde Niyigena et al., 2023). Although various studies have been conducted, limited research has focused specifically on why the Western Province has such high levels of undernutrition. This study aims to determine the prevalence and factors associated with undernutrition among children aged 6-59 months in the Western Province.

MATERIALS AND METHODS

Research design

In this study, the researcher used a cross-sectional research design and adopted a quantitative research approach.

Participants

The study population comprised mothers, fathers, and other caregivers residing in Rwanda's Western Province, caring for children aged six to fifty-nine months. According to Rwandan law, caregivers must be at least eighteen years old and possess a valid identity card. The target population for this study included children aged 6-59 months in the Western Province.

Data was sourced from the Rwanda Demographic and Health Survey (RDHS), a national survey designed to collect comprehensive data for monitoring and evaluating various indicators related to population, health, and nutrition. In this study, a secondary analysis of the 2019–2020 RDHS data was performed, focusing on 4,052 children aged 6 to 59 months. Out of these, 3,814 children under the age of five had their weight and height measured, with a validity rate of 99.7% for the height-for-age measurements.

Inclusion Criteria

All women aged 15–49, males aged 15–59, and children aged 6–59 months who were habitual residents of the selected houses or who spent the night before the survey were eligible.

Exclusion Criteria

Participants were excluded if they were not regular inhabitants of the chosen houses or if they were not within this age range.

Research instruments

The questionnaire design drew from established DHS survey questionnaires as its foundation. The survey team used tablet computers for data collection, which had Bluetooth technology that allowed for remote electronic transfer of files between team supervisors and interviewers. For this study, the instrument that used was online data extraction from the DHS 2019/2020 metadata in children's dataset. After getting approval of using DHS Data and downloaded into SPSS format and started sorting the data set by getting the western province dataset and the study variables that included.

Data analysis procedure

The data analysis was conducted using SPSS (Statistical Package for Social Science). Descriptive statistics, including frequencies and percentages, were used to describe the independent variables in relation to the dependent variables. Multiple logistic regression was employed to control for confounding variables, with a significance level (P-value) set at 0.05 and a 95% confidence interval. Inferential statistics were utilized to assess the relationships between independent and dependent variables. Chi-square tests were applied to examine these relationships. The results of the analysis were presented in tables and figures to clearly display the outcomes.

Ethical consideration

This secondary data analysis of the Rwanda Demographic and Health Survey (DHS) adhered to the ethical principles outlined by the DHS program and the ICF Institutional Review Board (IRB). These principles included informed consent, voluntary participation, ensuring the anonymity of respondents, maintaining data confidentiality, and respecting the norms and customs of the Western Province, the area of study. The study minimized risks to participants by anonymizing all data and ensuring robust data security measures. Ethical approval for the original DHS data collection had already been obtained, and since this secondary analysis did not involve further data collection or direct interaction with participants, no additional ethical approval was required.

RESULTS

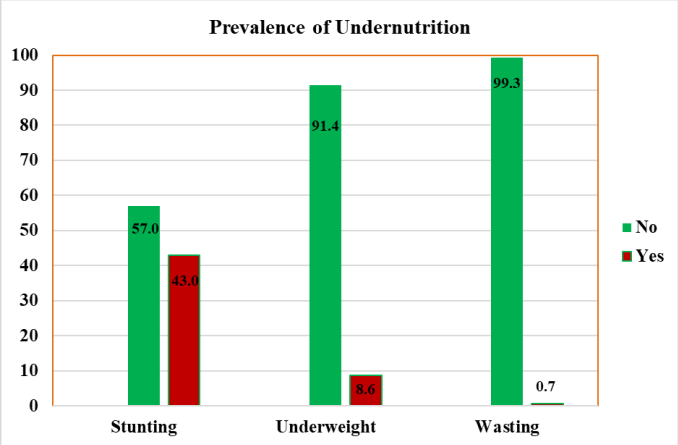

Figure 1. Prevalence of Undernutrition among children aged 6-59 months in Western Province, Rwanda
Source: DHS 2019-2020

Figure 1 shows the prevalence of undernutrition among children aged 6-59 months in Western Province, Rwanda. The data reveals that 43.0% of children were stunted, reflecting chronic undernutrition. Additionally, 8.6% of the children were underweight, indicating both acute and chronic undernutrition, while 0.7% of the children experienced wasting, representing acute undernutrition or severe weight loss.

Table 1: Association of socio-Demographic & Economic Factors with Undernutrition

VARIABLES	Stunting		Underweight		Wasting	
	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)
Age of household head						
<29	72(43.6)	93(56.4)	14(8.5)	151(91.5)	0(0.0)	165(100.0)
30-39	183(43.2)	241(56.8)	37(8.7)	387(91.3)	4(0.9)	420(99.1)
40-49	73(42.7)	98(57.3)	14(8.2)	157(91.8)	0(0.0)	171(100.0)
50+	45(41.7%)	63(58.3)	10(9.3)	98(90.7)	2(1.9)	106(98.0)
	X^2=0.12, p-=0.990		**X^2=0.11, p-=0.991**		**X^2=4.85, p =0.183**	
Sex of household head						
Male	285(42.4)	387(57.6)	64(9.5)	608(90.5)	5(0.7)	667(99.3)
Female	88(44.9)	108(55.1)	11(5.6)	185(94.4)	1(0.5)	195(99.5)
	X^2=0.38, p =0.536		**X^2=2.94, p =0.086**		**X^2=0.12, p=0.728**	
Covered by health insurance						
No	102(49.8)	103(50.2)	21(10.2)	184(89.8)	0(0.0)	205(100.0)
Yes	271(40.9)	392(59.1)	54(8.1)	609(91.9)	6(0.9)	657(99.1)
	X^2=5.04, p=0.025		**X^2=0.88, p=0.350**		**X^2=1.87, p=0.172**	
Type of place of residence						
Urban	70(41.4)	99(58.6)	20(11.8)	149(88.2)	2(1.2)	167(98.8)
Rural	303(43.3)	396(56.7)	55(7.9)	644(92.1)	4(0.6)	695(99.4)
	X^2=0.21, p=0.650		**X^2=2.71, p=0.100**		**X^2=0.74, p=0.389**	
Respondent currently working						
No	84(40.6)	123(59.4)	19(9.2)	188(90.8)	3(1.4)	204(98.6)
Yes	289(43.7)	372(56.3)	56(8.5)	605(91.5)	3(0.5)	658(99.5)
	X^2=0.63, p=0.426		**X^2=0.10, p=0.752**		**X^2=2.28, p=0.131**	
Wealth index combined						
Poorest	126(58.9)	88(41.1)	32(15.0)	182(85.0)	2(0.9)	212(99.1)
Poorer	94(46.3)	109(53.7)	20(9.9)	183(90.1)	2(1.0)	201(99.0)
Middle	73(44.0)	93(56.0)	11(6.6)	155(93.4)	1(0.6)	165(99.4)
Richer	61(39.9)	92(56.0)	9(5.9)	144(94.1)	0(0.0)	153(100.0)
Richest	1914.4)	113(85.6)	3(2.3)	129(97.7)	1(0.8)	131(99.2)
	X^2=67.68, p=0.000		**X^2=20.29, p=0.000**		**X^2=1.53, p=0.821**	
Number of antenatal visit during pregnancy n						
No antenatal visit	10(58.8)	7(41.2)	0(0.0)	17(100.0)	0(0.0)	17(100.0)
1-6 visit	273(43.8)	350(56.2)	59(9.5)	564(90.5)	5(0.8)	618(99.2)
	X^2=1.51, p=0.219		**X^2=1.78, p=0.183**		**X^2=0.13, p=0.711**	
Husband/Partner education level						
No education	61(57.5)	45(42.5)	19(17.9)	87(82.1)	2(1.9)	104(98.1)
Primary	212(40.9)	306(59.1)	43(8.3)	475(91.7)	1(0.2)	517(99.8)
Secondary	32(35.2)	59(64.8)	3(3.3)	88(96.7)	0(0.0)	91(100.0)
Higher	5(16.7)	25(83.3)	1(3.3)	29(96.7)	1(3.3)	29(96.7)
don't know	4(66.7)	2(33.3)	1(16.7)	5(83.3)	0(0.0)	6(100.0)
	X^2=24.83, p=0.000		**X^2=16.99, p=0.005**		**X^2=9.58, p=0.088**	
Educational attainment new						
No education	59(39.6)	90(60.4)	14(9.4)	135(90.6)	2(1.3)	147(98.7)
Primary	259(46.1)	303(53.9)	52(9.3)	510(90.7)	3(0.5)	559(99.5)
Secondary	46(35.4)	84(64.6)	7(5.4)	123(94.6)	1(0.8)	129(99.2)
Higher	9(33.3)	18(66.7)	2(0.7.4)	25(92.6)	0(0.0)	27(100.0)

	X^2=6.99, p=0.072		**X^2=2.17, p=0.537**		**X^2=1.32, p=0.724**	
Current marital status						
Never in union	25(48.1)	27(51.9)	1(1.9)	51(98.1)	1(1.9)	51(98.1)
Married	314(41.8)	437(58.2)	67(8.9)	684(91.1)	4(0.5)	747(99.5)
Widowed	9(39.1)	14(60.9)	1(4.3)	22(95.7)	0(0.0)	23(100.0)
Separated	25(59.5)	17(40.5)	6(14.3)	36(85.7)	1(2.4)	41(97.6)
	X^2=5.80, p=0.122		**X^2=5.29, p=0.152**		**X^2=3.33, p=0.343**	

Source: DHS 2019-2020

Table 1 presents a comprehensive analysis of the association between various socio-demographic and economic factors and undernutrition among children aged 6-59 months in the Western Province. One key finding is that children without health insurance had a significantly higher prevalence of stunting, with 49.8% affected (p-value = 0.025). Additionally, the wealth index was strongly associated with both stunting and underweight (p-value = 0.00). Specifically, 58.9% of children from the poorest families were stunted, and 15.0% were underweight.

The education level of the husband or partner also demonstrated a significant association with undernutrition. Among children whose parents had no education, 57.5% were stunted, and 17.9% were underweight. Other variables included in the study, however, did not show significant associations with stunting, wasting, or underweight, suggesting that certain socio-economic and educational factors play a critical role in influencing child nutrition in this region.

Table 2: Association of child-related Factors with undernutrition

Variables	**Stunting**		**Underweight**		**Wasting**	
	Yes, n(%)	**No, n(%)**	**Yes, n(%)**	**No, n(%)**	**Yes, n(%)**	**No, n(%)**
Child age in months						
6-8	11(23.9)	35(76.1)	4(8.7)	42(81.3)	2(4.3)	44(95.7)
9-11	16(30.8)	36(69.2)	6(11.5)	46(88.5)	1(1.9)	51(98.1)
12-17	33(35.9)	59(64.1)	6(6.5)	86(93.5)	0(0)	92(100)
18-23	48(47.1)	54(52.9)	6(5.6)	96(94.1)	0(0)	102(100)
24-35	103(48.6)	109(51.4)	19(9.0)	193(91.0)	3(1.4)	209(98.6)
36-47	84(44.7)	104(55.3)	13(6.9)	175(93.1)	0(0.0)	188(100)
48-59	78(44.3)	98(55.7)	21(11.9)	155(88.1)	0(0.0)	176(100)
	X^2=15.64, p=0.016		**X^2=5.21, p=0.517**		**X^2=15.61, p =0.016**	
Sex of child						
Male	198(46.3)	230(53.7)	48(11.2)	380(88.8)	3(0.7)	425(99.3)
Female	175(39.0)	265(60.2)	27(6.1)	413(93.9)	3(0.7)	437(99.3)
	X^2=3.72, p=0.054		**X^2=7.08, p=0.008**		**X^2=0.001, p=0.973**	
Baby postnatal check within 2 months						
No	243(44.5)	303(55.5)	54(9.9)	492(90.1)	5(0.9)	541(99.1)
Yes	40(42.6)	54(57.4)	5(5.3)	89(94.7)	0(0.0)	94(100)
	X^2=1.67, p=0.434		**X^2=3.15, p=0.207**		**X^2=1.28, p=0.531**	
Size of child at birth						
Large	25(43.1)	33(56.7)	2(3.4)	56(96.6)	0(0.0)	58(100)
Average	285(42.7)	383(57.3)	62(9.3)	606(90.7)	5(0.7)	663(99.3)
Small	61(43.9)	78(56.1)	10(7.2)	129(92.8)	1(0.7)	138(99.3)
Don't know	2(66.7)	1(33.3)	1(33.3)	2(66.7)	0(0.0)	3(100)
	X^2=0.76, p=0.8		**X^2=5.01, p=0.171**		**X^2=0.46, p=0.928**	
Currently breastfeeding						
No	131(44.1)	166(55.9)	18(6.1)	279(93.9)	1(0.3)	296(99.7)
Yes	242(42.4)	329(57.6)	57(10.0)	514(90.0)	5(0.9)	566(99.1)
	X^2=0.23, p=0.626		**X^2=3.80, p=0.051**		**X^2=0.82, p=0.363**	
Birth order number						
1	72(40.0)	108(60.0)	18(10.0)	162(90.0)	2(1.1)	178(98.9)
2-4	193(43.9)	247(56.1)	36(8.2)	404(91.8)	2(0.5)	438(99.5)
5+	108(43.5)	140(56.5)	21(8.5)	227(91.5)	2(0.8)	246(99.2)
	X^2=0.82, p=0.662		X^2=0.54, p=0.760		X^2=0.87,p=0.647	

Source: DHS 2019-2020

Table 2 details the association between child-related factors and three types of undernutrition: stunting, underweight, and wasting. The findings indicate that children aged 24-35 months had a notably higher prevalence of stunting, with 48.6% affected, compared to other age groups. In contrast, children aged 6-8 months had a prevalence of 4.3% for wasting and were significantly associated with stunting (p=0.016) and wasting (p=0.16). Male children also demonstrated higher rates of stunting (46.3%) and underweight (11.2%) compared to females. The sex of the child was significantly associated with both stunting (p=0.05) and underweight (p=0.008). Additionally, children who were currently breastfeeding exhibited a higher prevalence of underweight (10.0%) and this was associated with underweight (p=0.05). Other variables analyzed in the study did not show significant associations with any form of undernutrition.

Table 3: Association of Household/Environmental factors associated with undernutrition

VARIABLES	Stunting		Underweight		Wasting	
	Yes, n(%)	No, n(%)	Yes, n(%)	No, n(%)	Yes, n(%)	No, n(%)
Household has: electricity						
No	208(42.0)	287(58.0)	45(9.1)	450(90.9)	3(0.6)	492(99.4)
Yes	156(43.7)	201(56.3)	28(7.8)	329(92.2)	2(0.6)	355(99.4)
Not a dejure resident	9(56.3)	7(43.8)	2(12.5)	14(87.5)	1(6.3)	15(93.8)
	X^2=1.41, p=0.494		**X^2=0.71, p=0.699**		**X^2=7.34, p=0.025**	
Household has: radio						
No	248(44.3)	312(55.7)	51(9.1)	509(90.0)	3(0.5)	557(99.5)
Yes	116(39.7)	176(60.3)	22(7.5)	270(92.5)	2(0.7)	290(99.3)
Not a dejure resident	9(56.3)	7(43.0)	2(12.5)	14(87.5)	1(6.3)	15(93.8)
	X^2=2.80, p=0.246		**X^2=0.90, p=0.635**		**X^2=7.40, p =0.025**	
Household has: television						
No	330(43.7)	425(56.3)	67(8.9)	6889(1.1)	4(0.5)	751(99.5)
Yes	34(35.1)	63(64.9)	6(6.2)	91(93.8)	1(1.0)	96(99.0)
Not a dejure resident	9(56.3)	7(43.8)	2(12.5)	14(87.5)	1(6.3)	15(93.8)
	X^2=3.80, p=0.149		**X^2=1.09, p=0.578**		**X^2=7.65, p=0.022**	
Source of drinking water						
Unimproved	106(45.5)	127(54.5)	20(8.6)	213(91.4)	2(0.9)	231(99.1)
Improved	267(42.0)	368(58.0)	55(8.7)	580(91.3)	4(0.6)	631(99.4)
	X^2=0.82, p=0.363		**X^2=0.001, p=0.971**		**X^2=0.13, p=0.719**	
Type of toilet facility						
Unimproved	116(44.1)	147(55.9)	30(11.4)	233(88.6)	3(0.1)	260(98.9)
Improved	257(42.5)	348(57.5)	45(7.4)	560(92.6)	3(0.5)	602(99.5)
	X^2=0.19, p=0.656		**X^2=3.65, p=0.056**		**X^2=1.11, p =0.292**	

Table 3 presents the association between household and environmental characteristics with undernutrition. Significant associations were observed for wasting related to the presence of household amenities. Specifically, children living in households with electricity, a radio, or a television, but who were not de jure residents, exhibited a higher prevalence of wasting. The prevalence of wasting was 6.3% for children in households with electricity (p-value = 0.025), 6.3% for those with a radio (p-value = 0.025), and 6.3% for those with a television (p-value = 0.022).

Table 4: Multivariate analysis of the factors associated with undernutrition among children aged 6-59 months in Western Province, Rwanda

VARIABLES	COR	95%CI		P-Value	AOR	95%CI		P-Value
		Lower	Upper			Lower	Upper	
STUNTING								
Child age in Months								
6-8	**Ref**				**Ref**			
9-11	1.41	0.58	3.47	0.449	1.61	0.63	4.08	0.320

VARIABLES	COR	95%CI		P-Value	AOR	95%CI		P-Value
		Lower	Upper			Lower	Upper	
12-17	1.78	0.80	3.96	0.158	2.11	0.92	4.84	0.079
18-23	2.83	1.30	6.18	**0.009**	3.76	1.67	8.49	**0.001**
24-35	3.01	1.45	6.23	**0.003**	3.88	1.82	8.28	**<0.001**
36-47	2.57	1.23	5.37	**0.012**	3.79	1.76	8.18	**0.001**
48-59	2.53	1.21	5.31	**0.014**	3.32	1.54	7.17	**0.002**
Sex of child								
Male	1.30	1.00	1.71	0.054	1.46	1.09	1.96	**0.010**
Female	**Ref**				**Ref**			
Covered by health insurance								
No	1.43	1.05	1.96	**0.025**	0.98	0.69	1.38	0.898
Yes	**Ref**				**Ref**			
Husband/Partner education level								
No education	**Ref**				**Ref**			
Primary	0.51	0.34	0.78	**0.002**	0.59	0.38	0.93	**0.022**
Secondary	0.40	0.23	0.71	**0.002**	0.75	0.40	1.44	0.390
Higher	0.15	0.05	0.42	**<0.001**	0.54	0.17	1.68	0.285
Don't know	1.48	0.26	8.41	0.661	2.04	0.33	12.51	0.442
Wealth index combined								
Poorest	8.52	4.88	14.86	**<0.001**	9.37	5.03	17.46	**<0.001**
Poorer	5.13	2.93	8.97	**<0.001**	5.64	3.05	10.41	**<0.001**
Middle	4.67	2.63	8.29	**<0.001**	5.23	2.81	9.71	**<0.001**
Richer	3.94	2.20	7.07	**<0.001**	4.27	2.32	7.87	**<0.001**
Richest	**Ref**				**Ref**			
UNDERWEIGHT								
Sex of child								
Male	1.93	1.18	3.16	**0.009**	2.14	1.29	3.54	**0.003**
Female	**Ref**				**Ref**			
Currently breastfeeding								
No	0.58	0.34	1.01	0.053	0.63	0.36	1.12	0.117
Yes	**Ref**				**Ref**			
Husband/Partner education level								
No education	**Ref**				**Ref**			
Primary	0.42	0.23	0.75	**0.003**	0.44	0.24	0.82	**0.009**
Secondary	0.16	0.05	0.55	**0.004**	0.25	0.07	0.94	**0.039**
Higher	0.16	0.02	1.23	**0.078**	0.44	0.05	4.00	0.464
Don't know	0.92	0.10	8.30	0.938	0.82	0.09	7.76	0.861
Wealth index combined								
Poorest	7.56	2.27	25.22	**0.001**	5.74	1.56	21.09	**0.008**
Poorer	4.70	1.37	16.15	**0.014**	3.50	0.93	13.22	0.065
Middle	3.05	0.83	11.17	0.092	2.62	0.66	10.35	0.171
Richer	2.69	0.71	10.14	0.145	2.45	0.62	9.71	0.203
Richest	**Ref**				**Ref**			
WASTING								
Household has: electricity								
No	**Ref**				**Ref**			
Yes	0.92	0.15	5.56	0.931	0.59	0.07	5.38	0.642
Not a dejure resident	10.93	1.07	111.34	**0.043**	12.74	1.00	162.83	**0.050**
Household has: radio								
No	**Ref**				**Ref**			
Yes	1.28	0.21	7.71	0.787	0.89	0.11	7.38	0.916
Not a dejure resident	12.38	1.22	126.02	**0.034**	12.74	1.00	162.83	**0.050**
Household has: television								

VARIABLES	COR	95%CI		P-Value	AOR	95%CI		P-Value
		Lower	Upper			Lower	Upper	
No	**Ref**				**Ref**			
Yes	1.96	0.22	17.68	0.550	2.33	0.16	35.00	0.541
Not a dejure resident	12.52	1.32	118.77	**0.028**	12.74	1.00	162.83	**0.050**

Source: DHS 2019-2020

Age was a significant factor; children aged 24-35 months were found to be 3.0 times more likely to be stunted compared to younger or older age groups (COR=3.007, 95% CI=1.450-6.233, p=0.003). After adjusting for other variables, the likelihood increased to 3.8 times (AOR=3.884, 95% CI=1.823-8.277, p=0.000). Gender also played a role, with male children being 1.4 times more likely to be stunted (AOR=1.464, 95% CI=1.094-1.961, p=0.01) compared to female children. Moreover, males were 1.9 times more likely to be underweight before adjustment (COR=1.932, 95% CI=1.182-3.159, p=0.009) and 2.0 times more likely after adjustment (AOR=2.135, 95% CI=1.287-3.540, p=0.003).

Health insurance coverage was another significant factor; children without health insurance were 1.4 times more likely to be stunted before adjustment (COR=1.432, 95% CI=1.046-1.962, p=0.025). The wealth index revealed that children living in the poorest families were 8.5 times more likely to be stunted before adjustment (COR=8.516, 95% CI=4.878-14.878, p=0.000) and 9.3 times more likely after adjustment (AOR=9.369, 95% CI=5.026-17.463, p=0.000). These children were also 7.5 times more likely to be underweight before adjustment (COR=7.560, 95% CI=2.266-25.221, p=0.001) and 5.7 times more likely after adjustment (AOR=5.743, 95% CI=1.564-21.091, p=0.008).

Partner's education level was inversely related to undernutrition. Children whose partners had only primary education were less likely to be stunted (COR=0.511, 95% CI=0.335-0.780, p=0.002; AOR=0.592, 95% CI=0.379-0.926, p=0.022) and underweight (COR=0.415, 95% CI=0.231-0.745, p=0.003; AOR=0.443, 95% CI=0.241-0.815, p=0.009). Household environment factors also showed significant associations. Children from households without de jure residency but with electricity were 10.9 times more likely to be wasted (COR=10.933, 95% CI=1.216-111.337, p=0.043). Similarly, children from non-de jure households with radios were 1.2 times more likely to be wasted (COR=1.280, 95% CI=1.216-126.021, p=0.034). Those in non-de jure households with televisions were 1.96 times more likely to be wasted (COR=1.956, 95% CI=1.319-118.786, p=0.028) and 12 times more likely after adjustment (AOR=12.738, 95% CI=0.997-162.862, p=0.05).

DISCUSSION

The current study on the prevalence of undernutrition among children aged 6-59 months in the Western Province of Rwanda reveals the following rates: 43.0% for stunting, 8.6% for underweight, and 0.7% for wasting. These figures are notably higher compared to other studies conducted in similar settings. For instance, a study by Alice et al. (2021) in Ngoma District reported lower rates of stunting (33.7%), wasting (3.6%), and underweight (6.6%), indicating a less severe burden of undernutrition in that region. The current study's stunting rate of 43.0% also exceeds previous estimates for the Western Province and national averages.

Comparing the current study with national data from the Rwanda Demographic and Health Survey (RDHS, 2019), which reported a stunting prevalence of 33% and a wasting rate of 1%, reveals that the present study's stunting rate is higher, though wasting is lower. The RDHS data indicate a persistent challenge with stunting, despite a decrease from 47% in 2014-2015 to 43% recently. Underweight prevalence has decreased from 11.7% to 8.6%, while wasting has improved from 2.2% to 0.7%. This suggests progress in addressing acute malnutrition but highlights ongoing challenges in managing chronic malnutrition.

Regional comparisons show variations in undernutrition rates. For example, Asmare and Agmas (2023) reported stunting at 34.7%, underweight at 14.8%, and wasting at 5.1% in East Africa, while Cameroon had stunting at 31.2%, underweight at 6.3%, and wasting at 5.1% (Ndohtabi et al., 2024). Iran's 2014 study (Kavosi et al., 2014) reported lower stunting (9.5%) but higher rates of underweight (9.7%) and wasting (8.2%) compared to Rwanda. In contrast, the United States shows minimal undernutrition with stunting at 3.4% and wasting at 0.1%, reflecting a higher standard of living (Global Nutrition Report, 2022).

The current study found significant associations between stunting and various factors. Children aged 18-59 months, male children, those from the poorest families, and those without health insurance were more likely to experience stunting. Specifically, being male was associated with a higher likelihood of both stunting and underweight. Additionally, children with a partner having only primary education were less likely to be stunted or underweight.

For underweight, similar patterns emerged with the poorest families and male children being more affected. Wasting was notably higher among children not residing de jure in households with electricity, radio, and television.

These findings are consistent with other studies indicating that socioeconomic factors, gender, and household assets significantly impact undernutrition. For instance, the wealth index was a strong determinant of stunting, with children from the poorest households being more likely to be stunted and underweight, aligning with findings from Ngoma District (Alice et al., 2021) and other research (Habimana & Biracyaza, 2019). Male children were consistently found to be at higher risk of stunting and underweight compared to females, reflecting broader regional trends (Amare et al., 2016; Ndohtabi et al., 2024). Furthermore, children with less educated partners and those without health insurance were more susceptible to stunting, similar to findings from Western and Eastern provinces (Habimana & Biracyaza, 2019).

The high association between non-de jure residency and wasting underscores the vulnerability of migrant or non-resident children, who face greater nutritional risks due to instability and limited access to resources (UNICEF, n.d.). This finding aligns with broader research on the impact of socioeconomic conditions on undernutrition (WHO, 2021).

In summary, while there has been progress in reducing some forms of undernutrition in Rwanda, significant challenges remain, particularly for the poorest families and children with limited access to healthcare and education.

Study Limitations: This study on undernutrition among children aged 6-59 months in the Western Province of Rwanda has several limitations. Firstly, the cross-sectional design limits the ability to establish causality between the identified factors and undernutrition. Additionally, self-reported data on variables such as health insurance coverage and household assets may be subject to reporting bias or inaccuracies. The study's reliance on existing data sources and regional statistics might not fully capture local variations or emerging trends in undernutrition. Moreover, the sample size and representativeness of the study may affect the generalizability of the findings to other regions or populations within Rwanda. Finally, factors such as cultural practices and regional differences that could influence undernutrition were not explored in depth.

Study Implications: The findings from this study have significant implications for public health and policy interventions aimed at reducing undernutrition in Rwanda. The strong associations between stunting, underweight, and various socio-economic factors highlight the need for targeted interventions that address poverty, access to health services, and education. Programs that improve health insurance coverage and increase educational opportunities for caregivers, particularly in the poorest households, could be crucial in mitigating undernutrition. Additionally, addressing the specific needs of male children and those living in non-de jure residency situations may require tailored strategies. The study underscores the importance of ongoing monitoring and localized approaches to ensure that interventions are effective in reducing undernutrition and improving child health outcomes.

CONCLUSION

In conclusion, the study highlights the prevalence and factors associated with undernutrition among children aged 6-59 months in the Western Province of Rwanda. The high rates of stunting, underweight, and wasting among this population underscore the ongoing challenge of addressing both chronic and acute forms of malnutrition. Key determinants of undernutrition include age, gender, health insurance coverage, and socioeconomic status. Specifically, younger children, particularly those aged 24-35 months, and male children, are at a higher risk of stunting and underweight. Additionally, lack of health insurance and living in impoverished conditions are significant risk factors. The level of education of a child's partner and household environment also play a crucial role, with lower educational attainment and non-de jure residency contributing to higher likelihoods of undernutrition. These findings underscore the need for targeted interventions that address these socio-economic and environmental factors to effectively combat undernutrition in the region.

Recommendations

To address the high prevalence of undernutrition among children aged 6-59 months in Western Province, authorities should enhance community-based nutrition programs, improve access to health services in remote areas, and support economic empowerment initiatives to boost household incomes and food security.

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