Article

Prevalence and Correlates of Stunting among Children Aged 6-23 Months from Poor Households in Rwanda.

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Abstract: Stunted linear growth continues to be a public health problem that overwhelms the entire world, particularly developing countries. Despite several interventions designed and implemented to reduce stunting, the rate of 33.1% is still high for the proposed target of 19% in 2024. This study investigated the prevalence and associated factors with stunting among children aged 6-23 months from poor households in Rwanda. A cross-sectional study was conducted among 817 mother-child dyads living in poor households in five districts with a high prevalence of stunting. Descriptive statistics were used to determine the prevalence of stunting. In addition, we used bivariate analysis and a multivariate logistic regression model to measure the strength of the Association between childhood stunting and exposure variables. Stunting was at 34.1%. Children aged 19-23 months (AOR= 4.410, CI at 95% [1.911-10.173], p-value=0.01), children aged 13-18 months (AOR=2.788, CI at 95% [1.302-5.968], p-value=0.08), children from households that do not have a vegetable garden (AOR=2.165, CI at 95% [1.201-3.905], p-value<0.01) were more likely to be stunted. On the other hand, children whose mothers were not exposed to physical violence (AOR= 0.145, CI at 95% [0.074-0.287], p-value<0.001), children whose fathers were working (AOR=0.036, CI at 95% [0.005-0.242], p-value=0.001), children whose both parents were working (AOR=0.208, CI at 95% [0.051-0.851], p-value=0.029) and children whose mothers had good hand washing practice (AOR=0.181, CI at 95% [0.091-0.362], p-value<0.001) were less likely to be stunted. Our findings underscore the importance of integrating the promotion of hand-washing practices, owning vegetable gardens, and intimate partner violence prevention in the interventions to fight child stunting.

Keywords: Rwanda; stunting; children; poor; household; factors; intimate partner violence

1. Introduction

Stunted linear growth continues to be a public health problem that overwhelms the entire world, particularly developing countries. Stunting is a chronic undernutrition that affected 149.2 million children worldwide in 2020, 22% of all children under five years old [1]. Sub-Saharan Africa (SSA) carries the most significant burden, with 57 million, or 32.4%, children under five reportedly stunted [1]. This situation is worse in East Africa, where the literature shows that in 2020, 23.1 million (32.6%) children under five suffered from stunted growth [1]. Specifically in Rwanda, in 2020, stunting among under five years old children was at 33.1% (8). Therefore, the problem of stunting is still on the agenda.

Stunting represents the cumulative effect of long-term undernutrition and repetitive infections during early childhood, mainly occurring in the first 1000 days of life [2]. It is

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also impaired linear growth or being too small compared to a child of the same age and sex or as children having a height-for-age Z-score less than minus two standard deviations based on the median height-for-age of the standard population of reference [3, 4]. Finally, it occurs when a child fails to grow in height or length as predicted according to their potential [5].

The negative impact of stunting on child health is well documented. Early childhood stunting is associated with short stature [6], extending even into adolescence and adulthood [7]. It is also associated with poor socio-psychological development [8], poor motor development, and reduced cognitive ability [9], high risks of morbidity and mortality [10]. Stunting also contributes to severe and irreversible damages that lead to a child's physical and mental developmental retardation, increased morbidity, poor schooling performance, and low productivity later in life [4]. In addition, scientists have found that stunting in early childhood is associated with increased rates of obesity later in life [11]. Thus, adverse impacts of stunting attack the development of present generations, and harmful effects may manifest throughout their life journey.

The interrelation of sociodemographics and other factors contributes to the increased risks of stunting. It has been shown many times that poor socioeconomic status was a risk factor for stunting [12–16]. Additionally, stunting is associated directly with diseases and poor feeding practices. A systematic review showed that repetitive diarrheal episodes were associated with stunting [17]. Furthermore, the poor feeding practice was positively associated with stunting [18]. Other factors that affect stunting are maternal nutrition status and education [19] and poor home environment [20]. As the factors associated with stunting are complex, there is a need to explore more factors.

Despite the political will and different programs and interventions that have contributed to the significant decrease of stunting in Rwandan children, the prevalence has not decreased as much as projected. However, there has been no study on the prevalence or risk factors of stunting in poor households that are the most affected. Previous studies in Rwanda focused their interest on all socioeconomic categories using secondary data analysis from the Demographic and Health Survey (DHS) [16, 21, 22]. Others focused their attention on feeding practices only [18, 23]. Thus there is a shortage of studies that comprehensively explored these factors though they could inform effective interventions. This study assessed the prevalence and factors associated with stunting among poor households of children aged 6-23 in Rwanda.

2. Materials and Methods

Study setting and population

A quantitative cross-sectional survey was conducted in Rutsiro, Burera, Nyaruguru, Kayonza, and Gasabo districts from the Western, Northern, Southern, and Eastern Provinces and Kigali City, respectively. These districts were purposively chosen for their high stunting rates in their respective provinces and Kigali City based on the data from Rwanda Comprehensive Food Security & Vulnerability Analysis 2018 [24]. This study's target population was children aged six to twenty-three months. In addition, we included in the study mother-children dyads that belong to the family that has been identified as poor (Category 1&2 of Ubudehe) [25], children born full-term (between 38 weeks and 40 weeks), and singleton (a child that is the only one born at one birth). Otherwise, eligible people who were very sick to the extent that there were not able to participate were excluded from the study.

Sample size and sampling technique

A multi-stage cluster sampling approach was applied where the primary sampling unit was the administrative Village, followed by households. One mother-child dyad was selected from each household fulfilling the inclusion criteria of the survey. From each Village, we selected five households systematically. A total sample of 877 mother-child dyads was recruited to take part in this study based on the formula for estimation of single

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population proportion $n = \frac{Z^2pq}{d^2}$ [26] where n is the desired sample size if the population is higher than 10000, z is the x-coordinate of the standard curve that truncates a range at the ends if the confidence level is 95%, z=1.96 p is the prevalence, and q = 1-p. In this case, the prevalence was 33.1% at an accuracy of 5%.$n = \frac{1.96^2[0.331*(1-0.331)]}{0.05^2} = 340.2$. We used a design effect of 2 and 20% to account for the non-response rate.

Study variables

The primary outcome variable of this study was stunting, where children were categorized into stunted or not stunted. Explanatory variables included variables related to child characteristics such as age, sex, deworming status, Vitamin A supplementation, micronutrient powder supplementation, and minimum dietary diversity. Household characteristics included the father's employment status, Household hunger status [27], household food insecurity access (HFIA) [28], household size, and owning a vegetable garden.

Maternal characteristics included depressive syndrome [29], maternal employment status, maternal disability status, maternal literacy, maternal education, family planning type, breast discomfort during lactation, antenatal care visits, and mode of delivery. Other variables include intimate partner violence (IPV), which involves exposure to controlling behavior, emotional violence, physical violence, sexual violence, and any violence.

The survey also included questions related to Water, Sanitation, and Hygiene (WASH), including a source of drinking water, toilet facility, child stool disposal, handwashing facility, and observation of hand-washing practice. In addition, we considered good hand-washing practices, those who cut their nails and washed their hands with clean water and soap. WASH indicators were grouped and classified into improved and unimproved, following the WHO guidelines [30].

Data analysis

To determine the prevalence of stunting among children aged 6-23 months from poor households, we calculated length-for-age z-scores using the WHO Anthro computer application. Indices were categorized based on the WHO 2010 Child Growth Standards, where stunting was defined as Z-score less than -2SD when comparing weight-for-height and length-for-age weight-for-age, respectively [31]. Univariate analysis, including frequencies, means, and percentages, was calculated. Bivariate analysis was performed between stunting status and predicting variables. We included significant variables from bivariate analysis with $p<0.05$ in the multiple logistic regression with the backward-stepwise technique. In that process, variables with higher p-value ($p > 0.05$) were excluded from the model, starting with the highest and stopping when all remaining variables were statistically significant ($p \leq 0.05$). We reported the results as odds ratios (OR) with a 95% confidence interval (CI).

3. Results

3.1. Socio-demographic characteristics of the study participants.

The results from Table 1 describe study participants by frequency and percentage. 40.5% of children were between 6-12 months, 35% between 13-18 months, and 24.4% between 19-23 months. 71.8% of children received the deworming tablet, 62.8% received micronutrient supplementation powder, and 92.3% received Vitamin A supplementation at six months old. Additionally, 82.2% of all children were breastfed within 1 hour after birth. Results from this study show that 27.5% had received acceptable minimum dietary diversity.

Regarding maternal characteristics, 3.5% of mothers lived with a permanent disability, 21.2% were illiterate, and 11% had never gone to school. However, 86.2% of both parents have an income-generating activity, while 8.1% of fathers work alone in the households, and 5.7% of mothers are the only providers for the household. Further, 13.7% of mothers experienced breast discomfort during lactation. While 65.8% completed the

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standard antenatal care visits, nearly all (98.1%) received assistance from a health professional during delivery. Concerning IPV, 47.7% experienced controlling behavior from their husbands, 29.2% had experienced emotional violence, 27.3% reported physical violence, and 12.8% of all interviewed mothers reported sexual violence; overall, 57.3% experienced any type of violence. Over half of mothers (46.6%) reported depressive syndrome.

In terms of household considerations, 8.1% of fathers were working alone. In addition, 71.5% of households experienced severe food insecurity, 17.8% demonstrated severe hunger, and 51.1% reported having a vegetable garden. About 29% of households fetched drinking water from an unimproved source, 3.5% reported no toilet and 4.4% had unimproved sanitation, and 5.5% reported inappropriate child stool disposal. In terms of WASH, 38.8% showed good hand-washing practices.

Table 1. Socio-demographic characteristics of the study participants.

Variables (N=817)	Frequency	Percentage
Child sex		
Male	413	51.2
Female	394	48.8
Child age (in months)		
6-12	327	40.5
13-18	283	35.1
19-23	197	24.4
The child received a deworming tablet		
No	227	28.2
Yes	580	71.8
The child received Vitamin A supplementation at six months		
No	57	7.7
Yes	685	92.3
The child received micronutrient supplementation at six months		
No	300	37.2
Yes	507	62.8
Early breastfeeding after birth		
Within one hour	650	82.2
After one hour	141	17.8
Child minimum dietary diversity		
No	585	72.5
Yes	222	27.5
Mother lives with a disability		
No	780	96.4
Yes	27	3.5
Mother can read and write		
No	171	21.2
Yes	636	78.8
Maternal education		
No formal education	89	11.0
Primary	505	62.6
Vocational, secondary, and high	213	26.4
Family planning		
No	398	49.5
Yes	406	50.5
Breast discomfort during lactation		
No	696	86.3
Yes	111	13.7
Antenatal care visits		
less than 4	274	34.2
Four visits and higher	529	65.8
Mode of delivery		
Not assisted by a health professional	15	1.9
Assisted by a health professional	792	98.1
Family size		
Less than 5	250	31.0
Over than 5	57	69.0
Mother experienced controlling behavior from her husband		

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Variables (N=817)	Frequency	Percentage
No	422	52.3
Yes	385	47.7
Mother experienced emotional violence from her husband		
No	571	70.8
Yes	236	29.2
Mother experienced physical violence from her husband		
No	587	72.7
Yes	220	27.3
Mother experienced sexual violence from her husband		
No	704	87.2
Yes	103	12.8
Any type of violence from her husband		
No	345	42.7
Yes	462	57.3
Depressive syndrome (EPDS)		
No	431	53.4
Yes	376	46.6
Parents working status		
Mother only works	46	5.7
Father only works	65	8.1
Both parents working	696	86.2
Household food insecurity access (HFIA)		
Food secure and mild insecure access	53	6.6
Moderately Food Insecure Access	177	21.9
Severely Food Insecure Access	577	71.5
Household hunger scale (HHH)		
Little or no hunger	347	77.3
Moderate hunger	22	4.9
Severe hunger	80	17.8
Source of drinking water		
Unimproved	234	29.0
Improved	573	71.0
Presence of latrine		
No	28	3.5
Yes	779	96.5
Toilet facility		
Unimproved	34	4.4
Improved	745	95.6
Child stool disposal		
Into latrine	763	94.5
Elsewhere	44	5.5
Availability of hand washing facility		
No	409	50.7
Yes	398	49.3
Good hand-washing practice		
No	290	38.8
Yes	458	61.2
Owning vegetable garden		
No	395	48.9
Yes	412	51.1

3.2. Prevalence of stunting

Figure 1 shows that the prevalence of stunting was 34.1%.

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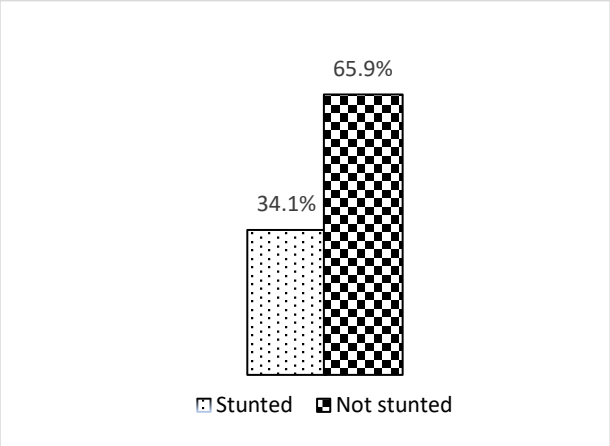

Figure 1: Stunting status.

3.3. Bivariate analysis: Stunting and background characteristics

As shown in Table 2, the following variables were significant (p-value<0.05): child sex, child age, deworming, vitamin A supplementation, micronutrient supplementation, mother living with disability, maternal ability to read and write, maternal education, breast discomfort during lactation, mode of delivery, controlling behavior from the husband, emotional violence from her husband, physical violence from her husband, sexual violence and any violence from her husband, father working alone, household hunger scale, child stool disposal, availability of the hand-washing facility, hand-washing practice and owning a vegetable garden.

Table 2. Bivariate analysis: Stunting and background characteristics.

Background characteristics	Stunting status			p-value
	Stunted % (N)	Not stunted % (N)	Total % (N)	
Child sex				
Male	57.8 (159)	47.7 (254)	51.2 (413)	0.007
Female	42.2 (116)	52.3 (278)	48.8 (394)	
Child age in months				
6-12	27.6 (76)	47.2 (251)	40.5 (327)	
13-18	38.9(107)	33.1 (176)	35.1 (283)	<0.001
19-23	33.5 (92)	19.7 (105)	24.4 (197)	
The child received deworming tablet in the last six months				
No	19.6 (54)	32.5 (173)	28.2 (227)	<0.001
Yes	80.4 (221)	67.5 (359)	71.8 (580)	
The child received Vitamin A supplementation at six months				
No	4.6 (12)	9.3 (45)	7.7 (57)	0.022
Yes	95.4 (247)	90.7 (438)	92.3 (685)	
The child received micronutrient supplementation regularly				
No	31.6 (87)	40.0 (213)	37.2 (300)	0.019
Yes	68.4 (188)	60.0 (319)	62.8 (507)	
Early breastfeeding after birth				
Within one hour	80.4 (217)	83.1 (433)	82.2 (650)	0.340
After one hour	19.6 (53)	16.9 (88)	17.8 (141)	
Child minimum dietary diversity				
No	71.6 (197)	72.9 (388)	72.5 (585)	0.696
Yes	29.4 (78)	27.1 (72)	27.5 (222)	
Mother lives with a disability				
No	94.9 (261)	97.6 (519)	96.6 (780)	0.047
Yes	5.1 (14)	2.4 (13)	3.5 (27)	
Mother can read and write				
No	25.5 (70)	18.0 (101)	21.2 (171)	0.033
Yes	74.5 (205)	81.0 (431)	78.8 (636)	
Maternal education				
No formal education	14.5 (40)	9.2 (49)	11.0 (89)	
Primary	63.6 (175)	62.0 (330)	62.6 (505)	0.018
Vocational, secondary, and high	21.8 (60)	28.8 (153)	26.4 (213)	
Family planning				
No	50.36 (138)	49.06 (260)	49.5 (398)	0.725
Yes	(49.64) 136	50.94 (270)	50.5 (406)	
Breast discomfort				

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Background characteristics	Stunting status			p-value
	Stunted % (N)	Not stunted % (N)	Total % (N)	
No	81.2 (225)	88.5 (471)	86.3 (696)	0.009
Yes	18.2 (50)	11.5 (61)	13.7 (111)	
Antenatal care visits				
less than 4	35.4 (97)	33.5 (177)	34.1 (274)	0.582
Four visits and higher	64.6 (177)	66.5 (352)	65.8 (529)	
Mode of delivery				
Not assisted by a health professional	3.6 (10)	0.9 (5)	1.9 (15)	0.007
Assisted by a health professional	96.4 (265)	99.1 (527)	98.1 (792)	
Family size				
Less than 5	33.1(91)	55.5 (295)	31.0 (250)	0.589
Over than 5	66.9 (184)	44.5 (237)	69.0 (57)	
Mother experienced controlling behavior from her husband				
No	37.1 (102)	60.2 (320)	52.3 (422)	<0.001
Yes	62.9 (173)	39.8 (212)	47.7 (385)	
Mother experienced emotional violence from her husband				
No	56.7 (156)	78.0 (415)	70.8 (571)	<0.001
Yes	43.3 (119)	22.0 (117)	29.2 (236)	
Mother experienced physical violence from her husband				
No	53.8 (148)	82.5 (439)	72.7 (587)	<0.001
Yes	46.2 (127)	17.5 (93)	27.3 (220)	
Mother experienced sexual violence				
No	77.8 (214)	92.1 (490)	87.2 (704)	<0.001
Yes	22.2 (61)	7.9 (42)	12.8 (103)	
Any type of violence from her husband				
No	26.9 (74)	50.9 (271)	42.7 (345)	<0.001
Yes	73.1 (201)	9.1 (261)	57.3 (462)	
Depressive syndrome (EPDS)				
No	51.6 (142)	54.3 (289)	53.4 (431)	0.468
Yes	48.4 (133)	45.7 (243)	46.6 (376)	
Parents working status				
Mother only works	(8.4) 23	(4.3) 23	(5.7) 46	0.001
Father only works	(4.0) 11	(10.2)54	8.1 (65)	
Both parents working	(87.6) 241	(85.5) 455	86.2 (696)	
Household food insecurity access (HFIA)				
Food secure and mild insecure access	4.7 (13)	7.5 (40)	6.6 (55)	
Moderately Food Insecure Access	20.0 (55)	22.9 (122)	21.9 (177)	0.158
Severely Food Insecure Access	75.3 (207)	69.5 (370)	71.5 (577)	
Household hunger scale (HHH)				
Little or no hunger	70.1 (108)	81.0 (239)	77.3 (347)	
Moderate hunger	5.8 (9)	4.4 (13)	4.9 (22)	0.029
Severe hunger	24.0 (37)	14.6 (43)	17.8 (80)	
Source of drinking water				
Unimproved	32.7 (90)	27.1 (144)	74.3 (234)	0.093
Improved	67.3 (185)	72.9 (388)	71.0 (573)	
Presence of latrine				
No	4.4 (12)	3.0 (16)	3.5 (28)	0.318
Yes	95.6 (263)	97.0 (516)	96.5 (779)	
Toilet facility				
Unimproved	4.6 (12)	4.2 (22)	4.4 (34)	0.847
Improved	95.4 (251)	95.7 (494)	95.6 (745)	
Child stool disposal				
Into latrine	90.2 (248)	96.8 (515)	94.5 (763)	<0.001
Elsewhere	9.8 (27)	3.2 (17)	5.5 (44)	
Availability of hand washing facility				
No	56.4 (155)	47.7 (254)	50.7 (409)	0.020
Yes	43.6 (120)	52.3 (278)	49.3 (398)	
Good hand-washing practice				
No	43.7 (90)	16.9 (70)	25.9 (160)	<0.001
Yes	56.3 (116)	83.0 (342)	74.1 (458)	
Owning vegetable garden				
No	53.8 (148)	46.4 (247)	48.9 (395)	0.047
Yes	46.2 (127)	53.6 (285)	51.1 (412)	

3.4. Multivariate analysis: factors associated with stunting

Table 3 presents logistic regression results to explore factors associated with stunting. Children aged 19-23 months were four times more likely to be stunted (AOR= 4.410, CI at 95% [1.911-10.173], p-value=0.01) than those aged 6-12 months. Further, children aged 13-18 months were three times more prone to stunting (AOR=2.788, CI at 95% [1.302-5.968], p-value=0.08) compared to those aged 6-12 months. Additionally, children whose mothers were not exposed to physical violence were less likely to be stunted (AOR= 0.145, CI at

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95% [0.074-0.287], p-value<0.001) compared to those who were exposed. Furthermore, children whose only fathers work were less likely to be stunted (AOR=0.036, CI at 95% [0.005-0.242], p-value=0.001) than those whose only mothers work. Additionally, children whose both parents work were less likely to be stunted (AOR=0.208, CI at 95% [0.051-0.851], p-value=0.029) compared to those whose only mothers are working. Further, children whose mothers had good hand-washing practices were less likely to be stunted (AOR=0.181, CI at 95% [0.091-0.362], p-value<0.001) compared to those who showed insufficient hand-washing practice. Finally, children whose households did not have a vegetable garden were two times more likely to be stunted (AOR=2.165, CI at 95% [1.201-3.905], p-value<0.01) compared to those who have it.

Table 3: Multivariate analysis: factors associated with childhood stunting.

Background characteristics	COR CI at 95%	p-value	AOR CI at 95%	p-value
Child's Sex				
Female	1			
Male	1.500 [1.118-2.012]	0.007		
Child's age				
6-12	1		1	
13-18	2.008 [1.413-2.854]	0.000	2.788 [1.302-5.968]	0.008
19-23	2.894 [1.979-4.230]	0.000	4.410 [1.911-10.173]	0.001
The child received deworming tablet in the last six months				
No	1			
Yes	1.972 [1.392-2.794]	0.000		
The child received Vitamin A supplementation at six months				
No	1		1	
Yes	2.115 [1.098-4.074]	0.025	3.638 [0.77217.140]	0.102
The child received micronutrient supplementation regularly				
No	1		1	
Yes	1.443 [1.061-1.963]	0.020	0.597 [0.303-1.176]	0.136
Mother lives with a disability				
Yes	1			
No	0.467 [0.216-1.008]	0.052		
Mother can read and write				
No	1			
Yes	0.686 [0.485-0.971]	0.034		
Maternal education				
No formal education	1			
Primary	0.650 [0.412-1.025]	0.064		
Vocational, secondary, and high	0.480 [0.287-0.803]	0.005		
Breast discomfort				
Yes	1			
No	0.583 [0.388-0.875]	0.009		
Mode of delivery				
Not assisted by a health professional	1			
Assisted by a health professional	0.251 [0.085-0.743]	0.013		
Mother experienced controlling behavior				
No	1		1	
Yes	2.560 [1.897-3.456]	0.000	1.509 [0.809-2.817]	0.196
Mother experienced emotional violence				
Yes	1			
No	0.370 [0.270-0.506]	0.000		
Mother experienced physical violence				
Yes	1		1	
No	0.247 [0.178-0.342]	0.000	0.145 [0.074-0.287]	0.000
Mother experienced sexual violence				
No	0.301 [0.197-0.460]	0.000		
Yes	1			
Any type of violence				
No	1			
Yes	2.820 [2.056-3.869]	0.000		
Parents working status				
Only Mother works	1		1	
Only Father works	0.203 [0.085-0.485]	0.000	0.036 [0.005-0.242]	0.001
Both parents working	0.529 [0.291-0.963]	0.037	0.208 [0.051-0.851]	0.029
Household hunger scores				
Moderate hunger	1			
Severe hunger	1.243 [0.477-3.236]	0.656		
Little or no Hunger	0.653 [0.271-1.573]	0.342		
Child stool disposal				
Elsewhere	1		1	
Into latrine	0.303 [0.162-0.567]	0.000	0.303 [0.060-1.524]	0.148

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Background characteristics	COR CI at 95%	p-value	AOR CI at 95%	p-value
Availability of hand washing facility				
Yes	1			
No	1.414 [1.055-1.895]	0.020		
Good hand-washing practice				
No	1		1	
Yes	0.264 [0.181-0.384]	0.000	0.181 [0.091-0.362]	0.000
Owning vegetable garden				
Yes	1		1	
No	1.345 [1.004-1.801]	0.047	2.165 [1.201-3.905]	0.010

4. Discussion

This study aimed to assess the prevalence of stunting and associated factors in Rwanda's poor households with children aged 6 to 23. First, we assessed the prevalence of stunting based on the WHO indicators of Child Growth Standards. Despite efforts to reduce stunting since last decade, its prevalence was 34.1%, a little bit higher than the national prevalence [32] and far from achieving the target of 19% projected in 2024 [33]. Furthermore, children aged 6-23 are the most vulnerable to stunting [34]; this indicates the need for more efforts to address all risk factors, particularly among poor households [34].

The results from this study show that the odds of being stunted were higher among older children compared to the youngest. These findings are consistent with other studies where stunting increases as age increases [16]. For instance, a study conducted in Pakistan showed an increased risk of being stunted as age increased [35]. The same findings were shown in another study conducted in Rwanda [36]. We think this could be linked to the fact that some caregivers could give up and reduce efforts in caregiving when the child is older. It could also be explained by the weaning effect and progressive introduction to food that can interfere with infections [37]. It is also possible that children who received prolonged breastfeeding also tend to like it more and accept food with much more difficulty. This can leads children to poor nutrition and exposes them to stunting [38].

Children whose mothers were not exposed to physical violence were less likely to be stunted than those whose mothers were exposed. These results align with a study conducted in Bangladesh, where physical IPV was negatively associated with the linear growth of children [39], as well as a large study conducted in 42 countries [40]. Studies conducted in India and South Africa also found that physical violence was associated with increased risks of childhood stunting [41, 42]. Scholars have explained various pathways by which physical violence can impair child growth. For example, poor psychosocial factors are believed to negatively affect care practice, resulting in poor child growth [43]. In addition, long-lasting violence creates an environment of fear and poverty that leads to poor care practices and deprived nutrition status [44].

Apart from factors that increase the risks of stunting among children, this study showed that when both parents work, their children are mostly protected from stunting. These indicate both parents' contribution to bringing their contribution together in providing income that supports the household, although they are from poor households. For example, a study conducted in Rwanda showed how paternal work contributes the household income and improves the socioeconomic situation of the household [45]. Another study in Ethiopia showed that as family incomes increase, there are reduced risks of stunted children[46]. Similarly, in Rwanda, a study identified a low wealth index as a risk factor for stunting [36].

This study showed that households whose father alone has income-generating activities tend to have fewer stunted children. These show that even though the mothers do not have a paying job, their contribution as housewives is still crucial for child growth. However, some studies have suggested that more men's involvement is not only in providing income but also in child caregiving, which could contribute to the better health of the children. For instance, in a study conducted in Kenya, maternal support from the husband and his participation in household decision-making positively affected the child's linear growth [47]. Conversely, some studies conducted in Ethiopia and Indonesia

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showed that mothers working casually and in the agriculture sector tend to have more stunted children than homemakers and public sector workers [48, 49]. In addition, the mothers invested more in employment; their children are at risk of being affected nutritionally [50]. This could be linked to the insufficient time allocated to the child and affect their nutrition status. Thus, the mechanism of maternal empowerment should provide a window of interaction between mother and child.

The good hand-washing practice was associated with decreased risks of having stunted children. This study explained good hand-washing practice as a combination of washing hands with clean water and soap and having cleaned nails. Like ours, many studies have shown the importance of WASH in the improvement of nutrition status. For example, a study in Guatemala clarified the connection between using soap, water, water availability, and diarrheal diseases [51]. Yet, previous research demonstrated substantial shreds of evidence linking repetitive episodes of diarrheal diseases and stunting [52]. Therefore, stakeholders involved in improving hygiene practices should emphasize having primary materials, such as soap, and better practice of hand washing.

The absence of a vegetable garden seemed to increase the risks of having stunted children. Similarly, a study in Lesotho found that owning a vegetable garden negatively affected stunting [53]. These risks could be due to a lack of food diversification at the household level and an inability to generate some additional income by selling surplus vegetables. However, another study in Rwanda found that owning a vegetable garden was positively associated with stunting, which was explained as a means of survival under hardship [54]. These risks might be explained as well as the fact that having a vegetable garden does not guarantee good production or the better use of its products. More efforts should be made to ensure that vegetable garden is used to support household dietary diversity.

Firstly, our study was limited by the cross-sectional nature that did not allow us to make causal-effects inferences. Secondly, many factors assessed were self-reported without independent verification through records or observations, which could introduce biases, such as social desirability. Thirdly, there are limitations in the classification of wealth category. The "ubudehe classification" used does not scientifically determine the poverty level, and this could bring bias since the classification can vary from one area to another.

5. Conclusions

The present study concluded that child age, physical violence experienced by mothers, absence of employment for both parents, absence of good hand washing practice, and absence of vegetable garden were associated with a higher level of childhood stunting.

The nutrition intervention should focus on IPV mitigation, employment promotion for both parents, good hand-washing practices, and vegetable garden owing.

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Informed Consent Statement: We requested participants to sign an informed consent form if they accepted to participate.

Data Availability Statement: The data will be accessible to anyone who desires to access them for scientific reasons. The request should be made through the corresponding author: jhabimana@cartafrica.org

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