

Factors Associated with Childhood Stunting among Children Under Five Years in Nyabihu District, Rwanda

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Abstract

Child 'stunting is an abnormal condition caused by chronic exposure to a comparative or complete insufficiency of one or more vital nutrients. Little is known on the factors contributing to increased prevalence of stunting in children of less than five years at Districts level in Rwanda. Therefore, this study was conducted to assess the factors associated with childhood stunting among children under five years in Nyabihu District, Rwanda. The cross-sectional study design had been used in this study. The design was selected since it takes participants in a single point at moment and it helps to remove assumptions. An interview was conducted to mothers of 384 under-five children of rural areas of Nyabihu District and data was analyzed using Statistical Package for Social Scientist (SPSS) version 21. In this study, the majority of children 53% were female, 72.2% belonged in second wealth category. Bivariate analysis of maternal and child related characteristics showed that there was statistically significant association between sex of the child, child's interval to previous sibling, to have diarrhea within past two weeks, to fall sick frequently and stunting with < 0.05 P-value calculated to 95% CI. This study revealed that the families with number of members ranging from 6 - 10 members were more likely to be stunted [AOR = 3.87; 95%CI = 2.62 - 5.71 and P = 0.001] compared to the families with less than six family members. The sensitization programs on childhood malnutrition and design effective health education, counseling and communication special strategies enhancing improvement of child health should be increased.

Keywords: *Childhood Stunting; Nyabihu District*

Introduction

Under-five childhood stunting is the major public health challenge where 162 million under five global children are stunted [1]. Children stunting is a state of being excessively short compared to the age of a child. For a stunted child, a child's height is more than 2 standard deviations less than the normal reference set by the World Health Organization. Childhood stunting is mainly permanent result of insufficient nutrition and repeated sessions of infectious diseases occurring in the first 1000 days of a child's life and it denotes an abnormal status consequential from chronic exposure to a comparative or complete shortage of one or more vital nutrients in diet [2].

The child's stunting can be primary caused by socio-economic factors and shortage of nourishment. In his study conducted in Afar Regional State, Northeast Ethiopia [3] found that the secondary malnutrition occurs in the children that have diseases, loss of calories and

reduced consumption of calories or with all these three factors combined. It is the results of reduced nutrients intake in food or problems in the absorption of the nutrients [3].

Malnutrition has many risk factors. Those factors are various, intertwined each other and hierarchically related. The review of Mengistu mentioned that the greatest direct factors associated with stunting are poor food intake and infectious diseases. Poor diet in the family and repeated infections are result of other factors that include domestic diet insecurity, parental and child health conditions and availability of medical care and healthy environment of their community [2]. A study of Siddiqi demonstrated that family income, parental education status, maternal medical care during pregnancy, maternal age Body Mass Index at birth are among the main factors of child's stunting status. The related financial state of the family and stunting of the under-five children [4].

Among under-five children that were found at Health Centers in Iranshahr in Iran by [5], the following problems were the causes of nutrients absorption difficulties. Those problems are insufficient number of meals per day, little food intake, psychosomatic causes, congenital abnormalities, illnesses that affect nutrients absorption, reduced appetite, digestion difficulties, conditions such as diarrhea and vomiting that result into nutrients wastage, allergies to some kind of food, impaired mother-child relationship affecting child's emotions, absence of parental care, maternal illiteracy, socio-economic and political causes, prematurity and Low Birth Weight (LBW) and the household children's birth order [5].

Good child nutrition and adequate feeding is required for health growing and normal development for every child [3]. In his study Mengistu defined child stunting as an abnormal condition caused by chronic exposure to a comparatively or complete lack of one or many important food nutrients essential in order to grow and develop for a child. In this nutritional state, the tallness for age indices is less than -2 of Z-score developed by the National Center for Health Statistics references [2,5]. The study of Mohammadinia states that child stunting typically happens during the first five years after birth because in those years the consummation of calories is unable to deliver all body's requirement for metabolism. When the caloric requirements are not supplied, the body will consume the nutrients stored in the tissues in order to preserve life.

All over the world, stunting has been among the major public health problems [6]. [7] mentioned that under-nutrition was affecting 165 million under-five children worldwide of which up to 26% among them had stunting. However, the number of stunted children decreased by 35% from 253 million of under-five children that were affected by under-nutrition in 1990. In that year the frequency of stunted children was 36% in African countries and 27% in Asian countries [7]. According to UNICEF report (2013), Africa and Asia had more than 90% stunting children [8].

Compared to other global regions, Sub-Saharan Africa plus Southern Asia had a total of 79% of stunted kids in the world, with 40% and 39%, correspondingly [9]. De Onis report also mentioned that among 40% of Sub-Saharan stunted children there were 16% of under-five children [8]. Studies that were done in sub-Saharan Africa in Hidabu Abote District of Ethiopia indicated that there is a higher burden of death resulting from chronic malnutrition. He reported that over 50 per cent of under-five deaths were credited to acute or chronic malnutrition [2]. The mainstream of researches that were done in African and southern Asian countries all described the commonness of stunting among children of less than five years and they did analysis of its association with socio-economic, demographic and cultural factors. In a study of Kandala conducted in Democratic Republic of Congo, stunting was related to geographical location. He also reported that stunting was above 40% countrywide and this was mainly favored by the country's financial crisis, increases prevalence of childhood medical conditions, poor infrastructure, and wars and insecurity ever since 1990s that lead due limited food productivity [10]. Ojofeitimi conducted a research studying on how economy and social parameters were influencing the stunting state among children of a country-side region of Osun state, Nigeria and discovered that the stunted children were 26.7% [4].

In East African Countries stunting prevalence vary. According to Buzigi, in Uganda the occurrence of stunting among under-five children reduced from 38.3% in 1995 to 29% in 2016. The yearly decrease rate of stunting was 0.45%. The features that were causing stunting among under-five children were living in rural community, health status of a child, home usage water source, deficiency of charcoal and firewood, absence of milk feeding, and limited hygiene and sanitation [11]. The study of Sunguya indicates that the occurrence of stunted children among under-five children dropped by 30% in the spell of 25 years between 1991 and 2016 in Tanzania. Children in the households where the mother was the chief of the family were most likely to be stunted than the families where they were headed by the husbands. In additions, children aged 24 - 35 months, born with low-birth-weight and with inconsistent or without breastfeeding has a high risk of being stunted than others [12]. A study conducted by Bloss among under-five children in local villages of Siaya District, western Kenya found that 47% Kenyan were stunted. Factors that were influencing stunting were children below two years, children who were weaned early, being out-to-date to vaccines, reports of respiratory health conditions or any recent disease and orphans [13]. Nkurunziza mentioned that Burundi is the country with the peak number of stunting in East Africa with the prevalence of stunting 53%. In her results, predictors for stunting were ages of the child, number of the children at home, family income and being a male child [14].

In Rwanda, the Ministry of Health ranks malnutrition among ten leading causes of death before the fifth birthday of the children with concealed or unrecognized stunting contributing to more than 50 percent of under-five children's deaths [15]. Although Sustainable Development Goal (SDG) that target on wasting (acute malnutrition) has already been met and there have been evident decrease in stunting in past years, the stunting rate has been remained stubbornly high with a 38% in 2015. Moreover, stunting is highly distributed in rural areas in [16].

Currently Rwanda has a new vision on agenda targeting 2050. This vision come after 2020 agenda for further improvements in the standard of living by addressing food insecurity and child stunting especially in rural areas of the country [17]. There is a broad based recognition that stunting represents an impediment to Rwanda's aspiration to become a middle-income country, given its long negative effects on human capital development [17].

The factors associated with stunting are numerous but major important are education status of the parents, family income and how it is distributed, source of water supply, hygiene and sanitation, easily access healthcare, children's age and sex and his or her health status. The factors that affects stunting vary among regions, municipal and overtime. All of these indicate that studying the factors of stunting in a specific location and district was required to detect influences affecting stunting in any country. In addition to that, various studies about under-five stunting have been made but was lacking an association of stunting to the socio-economic categories. Last but not least, it was better to assess the factors affecting malnutrition status at certain specific community level.

Severe malnutrition imposes significant cost on Rwandan economy as it is one of major principal causes of death for children before their fifth birthday. Concealed or unrecognized stunting contributes to more than 50 percent of under-five children's deaths [15]. Children's deaths related to stunting contribute to the reduction and loss of the financial potential of the country. Although the prevalence of stunting in Rwanda was relatively documented no data were available and thus little was known on the factors associated with increased number of stunted children at districts level. These factors were required in order to develop for new policies for eradicating children stunting in rural areas of Rwanda. Therefore, this research was conducted with the aim of assessing the factors associated with childhood stunting among children under five years in Nyabihu District, Rwanda.

Methods

Study design

In this study quantitative research was applied and a representative sample has been chosen throughout a cross sectional study design as the framework to assess the influencing risk factors among children under five years in Nyabihu district, Rwanda.

Target population

Population targeted by this research was 43,583 under-five children in Nyabihu District [18].

For being included in this study, the participant's necessity was being a permanent inhabitant of Nyabihu district, aged between 6 - 59 months old. Children under 6 months were excluded since it seemed hard to tell whether they are already stunted. Seriously, ill and involuntarily participants were also excluded.

Sample size and sampling procedure

This research had the sample of 385 under-five children. The sample was the approximate obtained from Cochran formula calculation in population exceeding 10000. The structure of Cochran formula is $n = n_0 / [1 + (n_0 - 1) / N]$. N defines the target population of 43583, n stands for the sample size to be calculated and n_0 is the random sample of 385 given by the formula. The participants were obtained via a stratified method of sampling that was conducted in three different stages called strata. In stratum number one, proportionate sampling of all 12 Sectors of Nyabihu District was used to give a total of all 385 study participants. This shows that 32 participants were selected from each Sector. In the stratum number two, in each Sector, four Cells were randomly selected by tossing their names. Therefore, each Cell of those three selected cells provided 8 participants. In the last stratum, those 8 participants were conveniently selected according to the prearrangement of their homes in the first villages of the selected cells according to alphabetic order of the village names.

Reliability and validity of questionnaire

Validity is an indicator of how sound is the research study. It is also the closeness of what are being measured or intended to be measured. It entails if variables represent the objective being measured. In order to make sure that this research is valid, the test study was conducted prior to official data collection.

Reliability means the honesty of the processes and data collected. It makes sure that the research findings can be repeated and attributed to other situations. This study is reliable since it was cross-sectional design, data collection method and its sampling procedure present the true phenomenon of stunted children in Nyabihu District. The study findings can be generalized countrywide.

Data analysis and ethical consideration

The data recorded on the questionnaire during data collection were entered and coded into the Microsoft Excel Database. After then they were exported into Statistical Package for the Social Studies (SPSS) software version 21, in order to analyze them statistically. Frequency statistics of demographic characteristics were calculated and results are displayed in tables. Frequency distribution of the participant's demographic characteristics were calculated and finally the factors associated with stunting were identified by doing cross tabulation and Pearson chi-square test. P-value less than 0.05 was considered as statistically significant. Multivariate analysis was done to identify the predictors of stunting among under-five children.

The ethical permission was obtained from the Mount Kenya University (MKU) Institutional Review Board. Another permission of conducting this study was obtained from the Mayor of Nyabihu District. Collecting data was done to only volunteering participants were interviewed after signing a consent form. Instead of using names of the participant's codes were used on the questionnaire. The confidentiality, respect, integrity and dignity of the data collected were ensured. This study carried no risk for the participants. The benefit of participation is that the risk factors of child stunting in Nyabihu District population are known and will be addressed by policy makers and stakeholders during making future decisions.

Results

Demographic characteristics of respondents

The participants of this study were 385 under-five children from 12 sectors of Nyabihu district. Each sector provided 32 participants and all sectors share a representation of 8.33% of the total population. The table 1 below presents the socio-economics and demographic characteristics of parents or caregivers of under-two years old children located in Nyabihu district.

Variable	Frequency	Percentage
Household size		
< 6 Members	342	88.8
6 - 10 Members	43	11.2
Ubudehe category		
First category	45	11.7
Second category	278	72.2
Third category	62	16.1
Mother marital status		
Married or living together	325	84.4
Alone (Single, divorced, widowed)	60	15.6
Head of household		
Male	336	87.3
Female	49	12.7
Father's occupation		
Unemployed	45	11.7
Agriculture/Breeding	304	79
Formal job	17	4.4
Business/Informal job	19	4.9
Mother's occupation		
Agriculture/Breeding	347	90.1
Formal job	13	3.4
Business/Informal job	25	6.5
Number of children < 5 years		
< 2 years	348	90.4
2 and above years	37	9.6
Mother's education level		
None	185	48.1
Primary	200	51.9
Presence of Cows		
Yes	51	13.2
No	334	86.8
Household meal per day		
< 2 meals per day	36	9.4
2 meals per day	341	88.6
> 2 meals per day	8	2.1
Mother's ages at delivery		
20 - 29 Years	182	47.3
30 - 39 Years	164	42.6
> 40 Years	39	10.1

Table 1: Socio-economic and demographic characteristics.

Table 1 of socio-economic and demographic shows that 278 (72.2%) of parents with children under five years old belonged in second wealth category and 336 (87.3%) of males were the head of the family. The majority of the families 348 (90.4%) had less than two children who were under-five years old and more than a half of the mothers 200 (51.9%) had primary level of education. 341 (88.6%) of respondents used to have two meals per day, 182 (47.3%) of mothers, their age range at delivery was 20 - 29 years old and the majority of fathers and mothers their occupation was agriculture/breeding 304 (79%) and 347 (90.1%) respectively.

Maternal and child’s related characteristics

The table 2 below presents the maternal and child’s related characteristics of parents or caregivers of under-two years old children located in Nyabihu district.

Variable	Frequency	Percentage
Sex of child		
Male	181	47
Female	204	53
Years of child		
6 - 11 Months	68	17.7
12 - 23 Months	92	23.9
24 - 35 Months	97	25.2
36 - 47 Months	79	20.5
48 - 59 Months	49	12.7
Child’s interval to previous sibling		
Single child	150	39
< 24 Months	49	12.7
> 24 Months	186	48.3
Distance to elder		
< 3	48	12.5
3 - 6	148	38.4
> 6	189	49.1
Child had diarrhea within past two weeks		
Yes	134	34.8
No	251	65.2
Child has additional feeding		
Yes	384	99.7
No	1	0.3
Presence of stunted sibling		
Yes	4	1
No	381	99

Child has specific meal		
Yes	4	1
No	381	99
Is the child fall sick frequently		
Yes	73	19
No	312	81
Child is currently sick		
Yes	64	16.6
No	321	83.4
Child was exclusively breastfed		
At four months	15	3.9
At six months	370	96.1
Maternal chronic diseases		
Yes	9	2.3
No	376	97.7
Child is currently on breastfed		
Yes	179	46.5
No	206	53.5
Vaccinated		
Yes	385	100
No	0	0

Table 2: Maternal and child’s related characteristics.

Primary source.

Table 2 describes the maternal and child’s related characteristics including: sex of the child, years of the child, child’s birth order, child’s interval, mother’s chronic disease, current on breast feeding, exclusively breastfed, sick currently, having diarrhea, specific meal for a child, stunted sibling and being vaccinated. The table above also shows that 181 (47%) children were male while 204 (53%) children were female, 68 (17.7%) children were aged between 6 - 11 months, 92 (%) were aged between 12 - 23 months and 79 (29.5%) children were aged between 36 - 47 months. Among children 384 (99.7%) children had additional feeding, 64 (16.6%) children were currently sick and all study children 385 (100%) were vaccinated.

Prevalence of stunting among children of less than five years in Nyabihu district

The general objective of this study was to assess the factors associated with childhood stunting among children of less than five years in Nyabihu district, Western Province of Rwanda and the prevalence of stunting was also determined by considering height-for-age is -2 degrees of separation underneath the WHO child development standard median.

The figure 1 above presented the prevalence of stunting where 246 (63.9%) were not stunted and 139 (36.1%) had stunting.

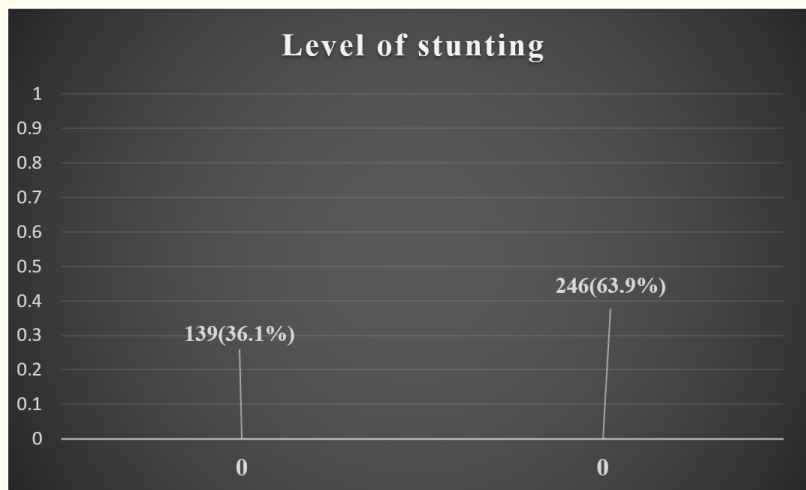


Figure 1: Prevalence of stunting.

Presentation of findings

The findings of this study are presented according to research objectives which are to determine the maternal and child’s related factors associated with childhood stunting to identify the socio-economic and demographic factors associated with childhood stunting and to determine the environmental factors associated with childhood stunting among under-five children of Nyabihu district, Western Province of Rwanda.

Maternal and child’s related factors associated with childhood stunting among under five children of Nyabihu district

The objective one of this study was to determine the maternal and child’s related factors associated with childhood stunting among under-five children in Nyabihu district and was determined by assessing fourteen variables under < 0.05 P-value calculated to 95% CI.

Variables	Stunting		P-Value
	Stunted N (%)	Not Stunted N (%)	
Sex of child			
Male	68 (37.6)	113 (62.4)	0.02
Female	71 (34.8)	133 (65.2)	
Years of child			
6 - 11 months	16 (23.5)	52 (76.5)	0.123
12 - 23 months	39 (42.4)	53 (57.6)	
24 - 35 months	34 (35.1)	63 (64.9)	
36 - 47 months	29 (36.7)	50 (63.3)	

48 - 59 months	21 (42.9)	28 (57.1)	
Child's interval to previous sibling			
Single child	73 (36.7)	126 (63.3)	0.001
More than two children	66 (35.5)	120 (64.5)	
Distance to elder			
< 3	20 (41.7)	28 (58.3)	0.391
3 and above	119 (35.3)	218 (64.7)	
Child had diarrhea within past two weeks			
Yes	57 (42.5)	77 (57.5)	0.03
No	82 (32.7)	169 (67.3)	
Is the child fall sick frequently			
Yes	23 (31.5)	50 (68.5)	0.01
No	116 (37.2)	196 (62.8)	
Child is currently sick			0.163
Yes	28 (43.8)	36 (56.3)	
No	111(34.6)	210 (65.4)	
Child was exclusively breastfed			
At four Months	7 (46.7)	8 (53.3)	0.272
At Six Months	132 (35.7)	238 (64.3)	
Child is currently on breastfed			
Yes	60 (33.5)	119 (66.5)	0.19
No	79 (38.3)	127 (61.7)	

Table 3: Maternal and child's related factors associated with childhood stunting among under-five children of Nyabihu district (Bivariate analysis).

Primary source.

Table 3 shown that there was statistically significant between sex of the child, child's interval to previous sibling, to have diarrhea within past two weeks and to fall sick frequently and stunting with < 0.05 P-value calculated to 95% CI. The findings from bivariate analysis revealed that among the children 68 (37.6%) males stunted while 133 (65.2%) females were not stunted. The children who had diarrhea within past two weeks, 57 (42.5%) of them stunted, children who used to fall sick frequently, 23 (31.5%) of them stunted and among the children who were currently on breastfeeding, 60 (33.5%) of them stunted.

Table 4 revealed that male children were more likely to be stunted [ARO = 1.77; 95%CI = 1.27 - 2.48 and P = 0.008] compared to female children. The children who did not have diarrhea within past two weeks were less likely to be stunted [ARO = 0.47; 95%CI = 0.06 - 2.048 and P = 0.03] compared to children who were sick within past two weeks.

Socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu district

The objective two of this study was to identify the socio-economic and demographic factors associated with childhood stunting among under-five children in Nyabihu district and was determined by assessing eleven variables under < 0.05 P-value calculated to 95% CI.

Variables	AOR	95%CI	P-Value
Sex of child			
Male	1.77	1.27 - 2.48	0.008
Female	Ref		
Child's interval to previous sibling			
Single child	2.81	1.25 - 8.77	0.573
More than two children	Ref		
Child had diarrhea within past two weeks			
Yes	Ref		
No	0.47	0.06 - 2.048	0.03
Is the child fall sick frequently			
Yes	Ref		
No	0.81	0.25 - 4.77	0.364

Table 4: Maternal and child's related factors associated with childhood stunting among under-five children of Nyabihu district (Multivariate analysis).

Primary source.

Variables	Stunting		P-Value
	Stunted (n%)	Not Stunted (n%)	
Size of the family			
< 6 Members	122 (35.7)	220 (64.3)	0.001
6 - 10 Members	17 (39.5)	26 (60.5)	
Ubudehe category			
First category	17 (37.8)	28 (62.2)	0.144
Second category	97 (34.9)	181 (65.1)	
Third category	25(40.3)	37 (59.7)	
Mother marital status			
Married or living together	115 (35.4)	210 (64.6)	0.704
Alone (Single, divorced, widowed)	24 (40)	36 (60)	
Head of household			
Male	121 (36)	215 (64)	0.04
Female	18 (36.7)	31 (63.3)	
Mother's occupation			
Agriculture/Breeding	135 (36.3)	237 (63.7)	0.684
Business/Informal job	4 (30.8)	9 (69.2)	
Father's occupation			
Agriculture/breeding	34 (42)	47 (58)	0.03
Business/informal job	105 (34.5)	199 (65.5)	
Number of children < 5 years			
< 2 years	123 (35.3)	225(64.7)	<0.001
2 and above years	16 (43.2)	21(56.8)	

Mother's education level			
None	61(33)	124 (67)	0.844
Primary	78 (39)	122 (61)	
Presence of Cows			
Yes	23 (45.1)	28 (54.9)	0.006
No	116 (34.7)	218 (65.3)	
Household meal per day			
< 2 meals per day	13 (36.1)	23 (63.9)	0.999
> 2 meals per day	126 (36.1)	223 (63.9)	
Mother's ages at delivery			
20 - 29 Years	61 (33.5)	121 (66.5)	0.567
30 - 39 Years	64 (39)	100 (61)	
> 40 Years	14 (35.9)	25 (64.1)	

Table 5: Socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu district (Bivariate analysis).

Primary source.

Table 5 shown that there was statistically significant between size of the family, head of household, father's occupation, number of children < 5 years and presence of cows and stunting with < 0.05 P-value calculated to 95% CI. The findings from bivariate analysis on socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu district revealed that among the children who's their families belonged to second wealth category 97 (34.9%) of them stunted and to be a head of the family was the factor associated with stunting where within the families with head of household was male, 121 (36%) of their children stunted. The father's occupation has showed to be the factor which is associated with stunting and the fathers who were doing informal job 105 (34.5%) of their children stunted and the families with no cows 116 (34.7%) of their children stunted.

Variables	AOR	95%CI	P-Value
Size of the family			
< 6 Members	Ref		
6 - 10 Members	3.87	2.62 - 5.71	0.001
Head of household			
Male	Ref		
Female	2.4	1.72 - 3.36	0.22
Father's occupation			
Agriculture/breeding	1.77	1.27 - 2.48	0.04
Business/informal job	Ref		
N of children <5 years			
< 2 children	Ref		
2 and above children	1.241	2.24 - 4.56	<0.001
Presence of cows			
Yes	0.026	0.137 - 1.66	0.02
No	Ref		

Table 6: Socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu district (Multivariate analysis).

Primary source.

Table 6 revealed that the families with number of members ranging from 6 - 10 members were more likely to be stunted [ARO = 3.87; 95%CI = 2.62 - 5.71 and P = 0.001] compared to the families with less than six family members. An occupation of the father shown to be the factor which is associated with stunting, the fathers who were doing agriculture/breeding, their children were more likely to be stunted [ARO = 1.77; 95%CI = 1.27 - 2.48 and P = 0.04] compared to the children who their fathers were doing business/Informal job. The children who had 2 and above siblings aged less than five years old were more likely to be stunted [ARO = 1.241; 95%CI = 2.24 - 4.56 and P = 0.04] compared to the children with less than two siblings aged less than five years old. The children from the families reared cows were less likely to be stunted [ARO = 0.026; 95%CI = 0.137 - 1.66 and P = 0.02] compared to the children from the families without cows.

Environmental factors associated with childhood stunting among under-five children of Nyabihu district

The objective three of this study was to find out the environmental factors associated with childhood stunting among under-five children of Nyabihu district and was determined by assessing fourteen variables under < 0.05 P-value calculated to 95% CI.

Variables	Stunting		P-Value
	Stunted n (%)	Not Stunted n (%)	
Kitchen garden			
Yes	85 (35.3)	156 (64.7)	0.006
No	54 (37.5)	90 (62.5)	
Presence of toilet			
Yes	135 (35.9)	241 (64.1)	0.419
No	4 (44.4)	5 (55.6)	
Source of water			
Protected	128 (35.7)	231 (64.3)	0.495
Unprotected	11 (42.3)	15 (57.7)	
Roof of the house			
Iron sheets	127 (36.5)	221 (63.5)	0.384
Roof tires	12 (32.4)	25 (67.6)	
Living in paved house			
Yes	97 (35.8)	174 (64.2)	0.467
No	42 (6.8)	72 (63.2)	
Number of rooms of the house			
< 3 Rooms	39 (36.4)	68 (63.6)	0.1
3 and above	100 (36)	178 (64)	

Table 7: Environmental factors associated with childhood stunting among under-five children of Nyabihu district (Bivariate analysis).

Primary source.

The table 7 shown that there was statistically significant between having kitchen garden and stunting with < 0.05 P-value calculated to 95% CI. The findings from bivariate analysis of environmental factors associated with childhood stunting among under-five children revealed that the families which had kitchen garden, 156 (64.7%) their children are not stunted. The researcher couldn't perform multi-variate analysis with only single significant variable.

Maternal and child’s related risk factors associated with childhood stunting among under five children of Nyabihu district

The objective four of this study was to determine the maternal and child’s related risk factors associated with childhood stunting among under-five children in Nyabihu district and was determined by assessing fourteen variables under < 0.05 P-value calculated to 95% CI.

Variables	Stunting		P-Value
	Stunted N (%)	Not Stunted N (%)	
Child had diarrhea within past two weeks			
Yes	57 (42.5)	77 (57.5)	0.03
No	82 (32.7)	169 (67.3)	
Is the child fall sick frequently			
Yes	23 (31.5)	50 (68.5)	0.01
No	116 (37.2)	196 (62.8)	
Child is currently sick			0.163
Yes	28 (43.8)	36 (56.3)	
No	111(34.6)	210 (65.4)	
Child was exclusively breastfed			
At four Months	7 (46.7)	8 (53.3)	0.272
At Six Months	132 (35.7)	238 (64.3)	
Child is currently on breastfed			
Yes	60 (33.5)	119 (66.5)	0.19
No	79 (38.3)	127 (61.7)	

Table 8: Maternal and child’s related risk factors associated with childhood stunting among under-five children of Nyabihu district (Bivariate analysis).

Primary source.

Table 8 shown that there was statistically significant between having diarrhea within past two weeks and to fall sick frequently and stunting with < 0.05 P-value calculated to 95% CI.

Among the children who had diarrhea within past two weeks, 57 (42.5%) of them stunted, children who used to fall sick frequently, 23 (31.5%) of them stunted and among the children who were currently on breastfeeding, 60 (33.5%) of them stunted. The researcher couldn’t perform multivariate analysis with only two significant variables.

Discussion of the Study Findings

Under-five childhood stunting continues to be a major public health problem in developing countries including Rwanda. Under-five children are most vulnerable to malnutrition because of low dietary intakes, infectious diseases, lack of appropriate care and inequitable distribution of food within the household in developing countries [1] therefore, the current study aimed to assess the factors associated with stunting among under-five children in Nyabihu District, one of the rural community of Western Rwanda and the present study revealed that among those children a significant percentage of study population (study children under five years old in Nyabihu district) 36.1% was stunted.

The present study revealed that there were some maternal and child related factors associated with stunting which were statistically significant between sex of the child, child's interval to previous sibling, to have diarrhea within past two weeks and to fall sick frequently and stunting with < 0.05 P-value calculated to 95% CI. The findings from bivariate analysis revealed that among the children 68 (37.6%) males stunted while 133 (65.2%) females were not stunted. The children who had diarrhea within past two weeks, 57 (42.5%) of them stunted, children who used to fall sick frequently, 23 (31.5%) of them stunted and among the children who were currently on breastfeeding, 60 (33.5%) of them stunted. This study revealed that male children were more likely to be stunted [ARO = 1.77; 95%CI = 1.27 - 2.48 and P = 0.008] compared to female children. The children who did not have diarrhea within past two weeks were less likely to be stunted [ARO = 0.47; 95%CI = 0.06 - 2.048 and P = 0.03] compared to children who were sick within past two weeks.

This study was in the same line with the study conducted by Alphonse which was assessing the factors of stunting among children under five years old and revealed that girls were less likely to be stunted compared to boys and stated that this is just because boys tend to grow at low rate compared to girls [8].

The present study revealed also that there were some socio-economic and demographic factors associated with stunting including the family size, head of household, father's occupation, number of children < 5 years and presence of cow. The multivariate analysis of socio-economic and demographic factors associated with childhood stunting among under-five children revealed that the families with number of members ranging from 6 - 10 members were more likely to be stunted [ARO = 3.87; 95%CI = 2.62 - 5.71 and P = 0.001] compared to the families with less than six family members. An occupation of the father shown to be the factor which is associated with stunting, the fathers who were doing agriculture/breeding, their children were more likely to be stunted [ARO = 1.77; 95%CI = 1.27 - 2.48 and P = 0.04] compared to the children who their fathers were doing business/informal job. The children who had 2 and above siblings aged less than five years old were more likely to be stunted [ARO = 1.241; 95%CI = 2.24 - 4.56 and P = 0.04] compared to the children with less than two siblings aged less than five years old. The children from the families reared cows were less likely to be stunted [ARO = 0.026; 95%CI = 0.137 - 1.66 and P = 0.02] compared to the children from the families without cows.

This was in the same line with study conducted from University of Toronto jointly with Aga Khan University in Pakistan, which revealed that socioeconomic status, maternal health services access and pregnancy spacing constituted the main factors of stunting among children [3].

The present study revealed that having a kitchen garden was environmental factor which was associated with stunting among under-five years' children. The findings from bivariate analysis of environmental factors associated with childhood stunting among under-five children revealed that the families which had kitchen garden, 156 (64.7%) of their children not stunted.

This was contrary with the study conducted by Vilcins and his colleagues which stated that there are a number of environment determinants that were proven to increase the risks of childhood stunting, for instance the lack of access to better-quality sanitation was found to be linked with stunting in childhood, the issue of not owning the basic latrine in a given household and/or the high rates of lack of latrine in a given area is mostly subject to increasing the risks of stunting among the children [11].

The study conducted from rural area of Bangladesh was assessing socio-economic determinants of severe and moderate stunting among under-five children was in the same line with the present study where it revealed that region, father's education, toilet facilities, child's age, birth order of children and wealth index were important determinants of children's nutritional status [18].

Conclusion

The purpose of this study was to assess the factors associated with childhood stunting among children of less than five years in Nyabihu district, Western Province of Rwanda. The study revealed that in general almost a half of study population (study children under

five years old in Nyabihu district) had stunting and that stunting was statistically associated with both socio-economic and demographic factors, maternal and child related factors and environmental factors. The results can't be generalized for whole country in consideration of the study design, sample size and the characteristics of study population in one rural District area can differ from those characteristics in other Districts as well as urban population.

Recommendation

The sensitization programs on childhood malnutrition and design effective health education, counseling and communication special strategies enhancing improvement of child health should be increased.

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