



## **Factors Associated with 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. In current major public health problems, stunting is significant and is ranked as major contributor to mortality as well morbidity in Low and Middle Income Countries. Under-nutrition is affecting 165 million under-five children worldwide among which up to 26% are stunted. Out of 40% of Sub-Saharan stunted children, 16% are under-five children. 38% Rwandan under-five children are Stunting. Stunting imposes significant cost on Rwandan economy as it is among the main causes of child deaths. Children's deaths related to stunting have negative impact on the country's financial status. Little was known on the factors contributing to increased prevalence of stunting in children of less than five years at Districts level in Rwanda. Therefore, this was conducted to assess the influence factors related with childhood stunting in children of less than five years in Nyabihu District of Rwanda. 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. Statistics helped to generate tables, charts and graphs for socio-economic and demographic characteristics of respondents, where multivariate analysis helped to examine the factors associated with stunting at a significant level of  $<0.05$ . In this study, the majority of children 53% were female, 72.2% belonged in second wealth category. Multivariate analysis of maternal and child related characteristics showed 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. 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 [AOR=3.87; 95%CI=2.62-5.71 and P=0.001] compared to the families with less than six family members. It is concluded that a significant number of under five years' children in Nyabihu District had stunting which was statistically associated with both maternal and child related factors, socio-economic and demographic characteristics and environmental factors. It is therefore recommended that the government take into consideration to the children less than five years by working hand in hand with organizations in charge of children to ensure strong collaboration, and partnership for effective prevention of stunting.

**Keywords:** *Factors, Stunting, Children, Rwanda*

## I. BACKGROUND

Good child nutrition and adequate feeding is required for health growing and normal development for every child (Gebre, 2019). In his study, Mengistu (2013) 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 (Mengistu, 2013). Mohammadinia (2012) 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 (Mohammadinia, 2012).

The child's stunting can be primary caused by socio-economic factors and shortage of nourishment (Taheri, 2006). In his study conducted in Afar Regional State, Northeast Ethiopia, Gebre (2019) 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 (Mohammadinia, 2012). Among under-five children that were found at Health Centers in Iranshahr in Iran by Mohammadinia (2012), 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 (Mohammadinia, 2012).

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 (Binagwaho, 2011). 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 remain stubbornly high with a 38% in 2015. Moreover stunting is highly distributed in rural areas in Rwanda (RDHS, 2016).

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 (Rwanda National Food and Nutrition Policy., 2014). 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 (Rwanda National Food and Nutrition Policy., 2014). Study findings described above, 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.

This research addressed the following specific objectives:

- i. To determine the maternal and child's related factors associated with childhood stunting among under-five children of Nyabihu District, Western Province of Rwanda.
- ii. To identify the socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu District, Western Province of Rwanda.
- iii. To determine the environmental causes associated with stunting among under-five children of Nyabihu District, Western Province of Rwanda.
- iv. To identify maternal and child related risk factors associated with childhood stunting among under-five children of Nyabihu District, Western Province of Rwanda

## **II. LITERATURE REVIEW**

### **Stunting and global health priorities**

Under-five childhood Stunting is the major public health challenge where 162 million under five global children are stunted (World Health Organization, 2014). 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. (Mengistu, 2013).

Dop (2016) said that a stunted child is short in stature. This child did not grow in length or health as he or she should have at his or her ages. Effects of childhood stunting range from individual level to the whole society since it affects the developmental cognition and physical growth, poor health decreased productive potential and vulnerable to different burden of diseases.

There are estimates that in 2025 more than 127 million of under-five children will be stunted if nothing is done on the current situations. This indicates the needs of actions and investing in this area so that the 2025 WHO target of aimed at reducing that number to 100 million would be achieved (World Health Organization, 2014).

World Bank estimated that one percent of under-five children deaths resulting from stunting costs 1.4% of monetary output. There is an estimate of 20% less economic gain and earning among adults that were stunted in childhood when compared to adults that were not affected by stunting during their young ages (World Health Organization, 2014). There are five global nutrition targets among which childhood stunting is included. Those targets are stunting, anemia in pregnant mothers, low-birth-weight, breastfeed exclusively, and wasting. (Bloem, 2013). Actions addressing one of the above targets results in the reduction of the other. When there is increase in number of exclusive breastfeeding rates, reduction of anemia pregnant mothers, and reduced rate of low birth weight infants there will be eventually a decrease in the total figure of stunting among children less than five years (Black, 2013).

### **Stunting compared to other under-nutrition terminologies**

Dop (2016) mentioned that different terms are used to mean specific form of malnutrition. Undernourishment is the state where energy or nutrients consumption are less than their minimum body requirements and needs. It is also defined as the chronic hunger since the body is not satisfied with its need in other words it is insufficient food consumptions. Hunger is a sensation of uneasiness, distress or physical weakness as a result of lacking food, together with the wish of eating. Many of us know how the hunger feels (Dop, 2016). Under-nutrition is the Protein Energy Malnutrition (PEM) and micronutrient shortages whereas over-nutrition is used to mean overweight and obesity according to Body Mass Index (BMI). The latter is usually associated with health consequences for instance Diabetes and cardiac illnesses. In some

cases, there exists a scenario of co-existence of under-nutrition and over-nutrition and it is referred to as the “double burden of malnutrition”. (Dop, 2016).

Contrary to stunting, acute malnutrition or wasting is a pathological condition caused by acute exposure to a comparative or complete shortage of one or more important food nutrients. Dop (2016) said that a wasted child is tinny and he or she has lost fats and muscle mass. Unfortunately a co-existence of these burdens of stunting and wasting can happen simultaneously (Dop, 2016). As it is mentioned by a study conducted in Sudan by Ola (2011), an additional difference between stunting and wasting is based on their original cause and etiology. Stunting is a long lasting process that usually starts during pregnancy mainly due to maternal nutritional problems, poor nutritional quality food, lacking vitamins and mineral salts as well as diseases and infections (Ola, 2011). This means that stunting of the child can have a maternal cause due to conditions of the mother during pregnancy.

### **The maternal and child’s related factors associated with childhood stunting.**

Under-five years 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 (Gebre, 2019) Malnutrition has many risk factors. Those factors are various, intertwined each other and hierarchically related. The review of Mengistu (2013) 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. A research 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 (Vaivada et al., 2020). the study conducted by Vilcins and his colleagues which stated that there were a number of environment determinants that were proven to increase the risks of 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(Vilcins et al., 2018).

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(Mostafa, 2017).A study of Siddiqi (2011) 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 (Siddiqi, 2011). Another research of Ojofeitimi (2003) related financial state of the family and stunting of the under-five children. In his results a relatively low family income and household overcrowding were directly associated with an increased number of stunted children in the family. (Ojofeitimi, 2003). Other factors identified as having an association with stunting among under-five children are oldness and gender of the child, where stunting state was high in males compared to females, maternal BMI, hygiene and sanitation of the family, caloric diet intake in the family, source of water they consume and presence or absence of toilet at home. Maternal ages and maternal education were the strongest factors affecting stunting state of children below five years (Mengistu, 2013).

The research of Asres (2011) mentioned that health conditions such as diarrheal and respiratory diseases were influencing stunting among under-five children. Child caring behaviors such as denial of colostrum, breastfeeding frequency and duration, pre-lacteal feeds, type of food, and weaning ages (Asres, 2011). In the Study of Demissie (2013) stunted growth was in association with presence or absence of recent health conditions such as fever and diarrhea. Other factors like low birth size at birth, maternal income and presence or absence of cow at home were in association with stunted growth among under- five children (Demissie, 2013).

### **The socio-economic and demographic factors associated with childhood stunting among under-five children.**

Across multiple areas there are actions that can result into reduced stunted growth once applied by policy makers. For example, refining ideal application of exclusive breastfeeding is important in order to ensure a child's normal growth and development. Timely commencement and exclusive breastfeed in the first 6 months protects against gastroenteritis and other conditions that results into great loss of nutrients in case of diarrhea and mal-absorption that eventually end up with stunting (Kramer, 2012). Breast milk also serves as an origin food nutrients and immunity for diseases protection. Researchers conducted in areas with poverty communities found that nonexclusive breastfeeding influence stunting since nutrients-rich breast milk are displaced or replaced by less important food and beverages and expose child to diarrhea and other abdominal diseases (Saha, 2008). Correspondingly, continuing to breastfeed after second adds meaningfully consumption of major nutrients that cannot be found in supplementary foods in under privileged families (Krebs, 2011). Additionally, the greatest real intervention for preventing stunting among under-five children is to avail the food with animal sources such as red meats, milk and yogurt since they contain proteins required for body muscles constructions.

(Onyango, 2013). Other environmental health interventions such as practicing health and sanitation such as washing hands with soap, behavioral change, cooking water, sanitizing toilet, best quality food and household hygiene from the bogy to living environment resulted in the reduction of stunted growth in the community (Fink, 2011).

### **Importance of assessing stunting at community level**

Dop (2016) mentioned that it is important assess nutrition status at community level since it helps a researcher to know what is the proportion of the population affected by the problem and how the severity is the problem compared to local communities. Assessing nutritional status at community level helps to find answers to the questions like who, where and when. These questions help to identify factors like age, sex, socio-economic status. Additionally, when nutritional status is assessed at community level, it is easy to know whether the problem is worsening or improving, causes are identified and interventions that are efficient are easily identified and their effectiveness is monitored.

### **The environmental factors associated with childhood stunting among under-five children.**

Stunting itself is infrequently a straight cause of death. It can only cause death in case of extreme famine. However according to Dop (2016), stunting causes the frequency and aggravation of death-causing diseases and even the common sickness like pneumonia and diarrhea can results into death in the stunted under-five children (Dop, 2016). Deaths in stunted children are higher in comparison with non-stunted children. Siham (2014) did a study in Mohamed Alamin Pediatric Hospital, Sudan indicates that stunting is a great important cause of about 300,000 annual deaths among under-five children. Other health and physical consequences associated with stunting that can contribute to death or affect the community and the country includes delay in motor development, greater behavioral difficulties, lower Intellectual Quotient (IQ), as well as high susceptibility to contacting infections due to reduced immunity, Moreover recent study of Gebre (2019) added that childhood stunting was found to be linked with higher level of chronic diseases and health problems in adult life which eventually may have long term consequences as stunted women were found to have high probability of having fetal growth restrictions.

### **The maternal and child related risk factors associated with childhood stunting among under-five children**

Malnutrition has many risk factors. Those factors are various, intertwined each other and hierarchically related. The review of Mengistu (2013) 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. Across multiple areas there are actions that can

result into reduced stunted growth once applied by policy makers. For example, refining ideal application of exclusive breastfeeding is important in order to ensure a child's normal growth and development. Timely commencement and exclusive breastfeed in the first 6 months protects against gastroenteritis and other conditions that results into great loss of nutrients in case of diarrhea and mal-absorption that eventual end up with stunting (Kramer, 2012). Breast milk also serves as an origin food nutrients and immunity for diseases protection. Researchers conducted in areas with poverty communities found that nonexclusive breastfeeding influence stunting since nutrients-rich breast milk are displaced or replaced by less important food and beverages and expose child to diarrhea and other abdominal diseases (Saha, 2008). Correspondingly, continuing to breastfeed after second adds meaningfully consumption of major nutrients that cannot be found

in supplementary foods in under privileged families (Krebs, 2011). Additionally, the greatest real intervention for preventing stunting among under-five children is to avail the food with animal sources such as red meats, milk and yogurt since they contain proteins required for body muscles constructions. (Onyango, 2013). Other environmental health interventions such as practicing health and sanitation such as washing hands with soap, behavioral change, cooking water, sanitizing toilet, best quality food and household hygiene from the boggy to living environment resulted in the reduction of stunted growth in the community (Fink, 2011).

Research findings described in this literature review mentioned that the etiological factors of stunting that were mentioned are mother's medical and nutritious conditions, insufficient childhood nourishing habits, and diseases. Childhood stunting was related to education status of the parents, family income and how it is distributed, maternal health and conditions, household hygiene and sanitation, and child's health and conditions. The factors influencing stunting status vary between regions, community and overtime. Innumerable researches have been made but they lack an association of stunting with five major etiological categories of stunting that are: child characteristics, Socio-economic and demographic, child caring practices, maternal caring and characteristics and environmental factors in local rural District or any particular location.

### **III. MATERIALS AND METHODS**

The target population consisted of 43,583 under-five children in Nyabihu District. (National Institute of Statistics of Rwanda, 2016). The sample size was 385 under-five Children of rural areas of Nyabihu District. The sample was the approximate obtained from COCHRAN FORMULA calculation in population exceeding 10000. The structure of COCHRAN FORMULA is  $n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$ . Questionnaire was used to collect data and was analyzed using SPSS of version 21. Data collection tool was developed based on the specific objectives of this study. Thus, the tool was translated into Kinyarwanda language to make more clarifications of the questions to the participants.

#### IV. RESULTS AND DISCUSSIONS

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.

**Table 1 Maternal and child's related factors associated with childhood stunting among under-five children of Nyabihu District (Bivariate analysis).**

Variables	Stunting		P-Value
	Stunted	Not Stunted	
	N(%)	(n%)	
<b>Sex of child</b>			
Male	68 (37.6)	113 (62.4)	<b>0.02</b>
Female	71 (34.8)	133 (65.2)	
<b>Years of child</b>			
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)	
<b>Child's interval to previous sibling</b>			
Single child	73 (36.7)	126 (63.3)	<b>0.001</b>
More than two children	66 (35.5)	120 (64.5)	
<b>Distance to elder</b>			
<3	20 (41.7)	28(58.3)	0.391
3 and above	119 (35.3)	218(64.7)	
<b>Child had diarrhea within past two weeks</b>			
Yes	57 (42.5)	77 (57.5)	<b>0.03</b>
No	82 (32.7)	169 (67.3)	
<b>Is the child fall sick frequently</b>			
Yes	23 (31.5)	50 (68.5)	<b>0.01</b>
No	116 (37.2)	196 (62.8)	
<b>Child is currently sick</b>			0.163
Yes	28 (43.8)	36 (56.3)	
No	111(34.6)	210 (65.4)	
<b>Child was exclusively breastfed</b>			
At four Months	7 (46.7)	8 (53.3)	0.272
At Six Months	132 (35.7)	238 (64.3)	
<b>Child is currently on breastfed</b>			
Yes	60 (33.5)	119 (66.5)	0.19
No	79 (38.3)	127 (61.7)	

Table 1 shown that there was significance 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.

The bivariate analysis findings shown 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 2 Maternal and child's related factors associated with childhood stunting among under-five children of Nyabihu District (Multivariate analysis).**

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

Table 2 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 stunting among under-five children in Nyabihu District.**

Objective number 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.

**Table 3 Socio-economic and demographic factors associated with stunting among under-five children in Nyabihu District (Bivariate analysis).**

Variables	Stunting		P-Value
	Stunted	Not Stunted	
	(n%)	(n%)	
<b>Size of the family</b>			
<6 Members	122 (35.7)	220 (64.3)	<b>0.001</b>
6-10 Members	17 (39.5)	26 (60.5)	
<b>Ubudehe category</b>			
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)	
<b>Mother marital status</b>			
Married or living together	115 (35.4)	210 (64.6)	0.704
Alone (Single, divorced, widowed)	24 (40)	36 (60)	
<b>Head of household</b>			
Male	121 (36)	215 (64)	<b>0.04</b>
Female	18 (36.7)	31 (63.3)	
<b>Mother's occupation</b>			
Agriculture/Breeding	135 (36.3)	237 (63.7)	0.684
Business/Informal job	4 (30.8)	9 (69.2)	
<b>Father's occupation</b>			
Agriculture/breeding	34 (42)	47 (58)	<b>0.03</b>
Business/informal job	105 (34.5)	199 (65.5)	
<b>Number of children &lt;5 years</b>			
< 2 years	123 (35.3)	225(64.7)	<b>&lt;0.001</b>
2 and above years	16 (43.2)	21(56.8)	
<b>Mother's education level</b>			
None	61(33)	124 (67)	0.844
Primary	78 (39)	122 (61)	
<b>Presence of Cows</b>			
Yes	23 (45.1)	28 (54.9)	<b>0.006</b>
No	116 (34.7)	218 (65.3)	
<b>Household meal per day</b>			
<2 meals per day	13 (36.1)	23 (63.9)	0.999

>2 meals per day	126 (36.1)	223 (63.9)	
<b>Mother's ages at delivery</b>			
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 4 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.

The bivariate analysis findings 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.

**Table 4 Socio-economic and demographic factors associated with childhood stunting among under-five children of Nyabihu District (Multivariate analysis).**

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

Table 4 revealed that the families with number of members ranging from 6-10 Members were more likely to be stunted [ARO=3.87; 95%CI=2.62-5.71and 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=1.27-2.48and 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=2.24-4.56and 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=0.137-1.66and 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.

**Table 5 Environmental factors associated with childhood stunting among under-five children of Nyabihu District (Bivariate analysis).**

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

Table 5 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 multivariate 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.

**Table 6 Maternal and child’s related risk factors associated with childhood stunting among under-five children of Nyabihu District (Bivariate analysis).**

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

Table 6 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.

**V. DISCUSSION**

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 (Gebre, 2019) 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 et al.,2019) 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

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 (Vaivada et al., 2020).

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(Vilcins et al., 2018).

## **VI. CONCLUSION**

The study was to assess the factors associated with childhood stunting among children aged less than five years in Nyabihu District, Western Province of Rwanda. The study revealed that male children were more likely to be stunted compared to female children , the children who did not have diarrhea within the past two weeks were less likely to be stunted compared to children who were sick within the past two weeks, the children who had two or more siblings aged less than five years old were more likely to be stunted compared to the children with less than two siblings aged less than five years old, the children from the families with a kitchen garden were less likely to be stunted compared to the children from the families without a kitchen garden were less likely to be stunted compared to the children from the families without a kitchen garden were less likely to be stunted compared to the children from the families without a kitchen garden. In general, the study showed that stunting of children under five years in Nyabihu district was statistically associated with socio-economic and demographic factors, maternal and child-related factors, and environmental factors.

## **VII. FUTURE RESEARCH**

Further research towards factors associated with childhood malnutrition must be considered in order to generalize data to the country level to be able to improve children related sensitization strategies basing on evidence. During further studies qualitative data involving deep interview with open ended questions as well as group discussions must be conducted to understand participants and parent view on the factors contributing to childhood stunting in Nyabihu District.

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Let me ask the Almighty God to guarantee healthy life to all of you

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