











**Table 1 Demographic characteristics of children and mothers**

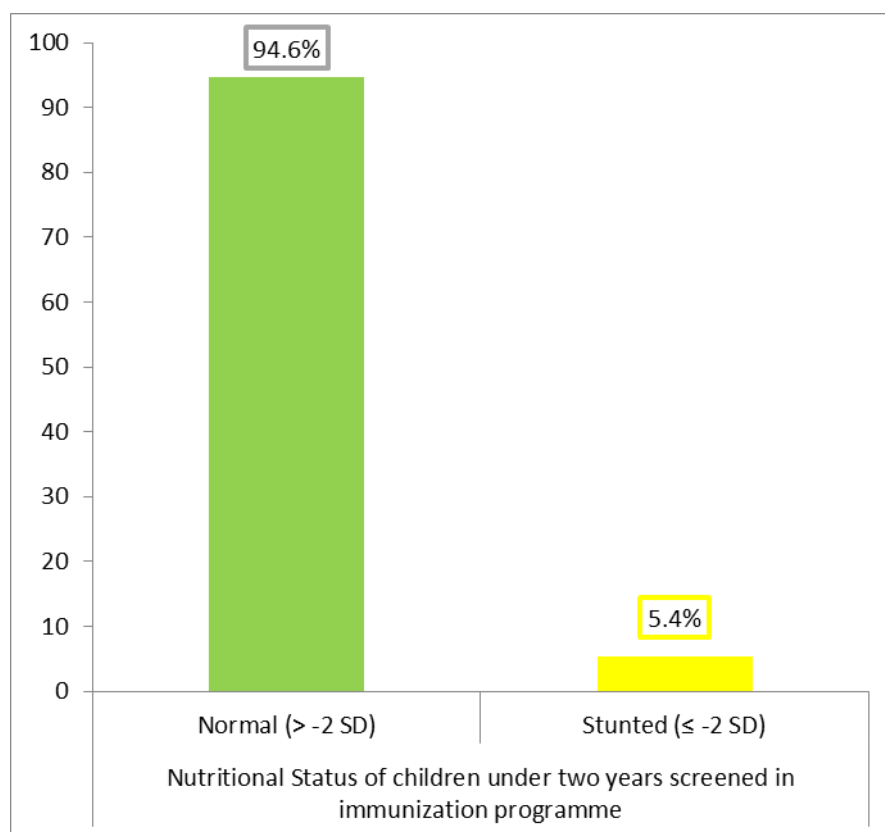
Variables	Frequency	Percentage
<b>Child characteristics</b>		
<b>Age of child in months</b>		
0-6	132	37.5
6-24	220	62.5
Mean±SD (8.94±5.87)		
<b>Sex of a child</b>		
Male	181	51.4
Female	171	48.6
<b>Maternal characteristics</b>		
<b>Marital status</b>		
Single mother	60	17.0
Married	292	83.0
<b>Number of children in the family</b>		
≤3	270	76.7
>3	82	23.3
<b>Education level</b>		
No formal education	44	12.5
Primary	196	55.7
TVET/Secondary and above	112	31.8
<b>Ubudehe category</b>		
One	55	15.6
Two and Three	297	84.4
<b>Occupation</b>		
Housewife	184	52.3
Monthly salary/Business	168	47.7
<b>Monthly income (Rwf)</b>		
None	73	20.8
30,000 and above	279	79.3

A total of 352 children under two years and mother's pairs attended immunization program in Nyabihu District from March to April 2022 under two years. Among the children 220 (62.5%) were aged between 6-24 months, few number of studied children 132(37.5%) were aged between 0 to 6 months. More than a half 181(51.4%) of children were males and less than a half 171(48.6%) were females. Considering maternal characteristics, marital status majority of mothers 292(83%) were married and few of them were single 60(17%). Referring to the number of children in the family, a big number of families 270(76.7%) had more than three children and few of them 82(23.3%) had three or less than three children. Based on the level of education, 196(55.7%) completed primary school, 112(31.8%) attended secondary school, TVET and above, 44(12.5%) had no education level. Under Ubudehe category, the majority of the respondents 297(84.4%) are in ubudehe two and three and few of them 55(15.6%) were in ubudehe category one. Regarding the occupation of the mothers, 184(52.3%) were housewives and 168(47.7%) had monthly salary or were in business. Lastly, earning monthly income was considered as key indicators where 279(79.3%) earn more than 30,000 Rwandan Francs and 73(20.8%) had no monthly income

#### 4.2. Nutritional status of children under two years screened in immunization program

The first objective of this research was to assess nutritional status of under two years children attended immunization program in March and April 2022.

##### Figure 1. Child Nutritional Status



In order to calculate the prevalence of stunting among children, the nutritional status of children under two years who attended immunization program in Nyabihu District from March to April 2022 was determined. Majority of children 94.6% had normal nutritional status/height for age and few of them 5.4% were stunted. Therefore, the predominance of stunting among children under two years attending immunization program in Nyabihu District was 5.4%.

### 4.3. Socio-demographic and economic factors associated with stunting among under two children screened in immunization program

**Table 2. Bivariate analysis of Socio- demographic and economic factors associated with Stunting**

Variables	Nutritional status		Chi-square	P-value
	Normal n (%)	Stunted n (%)		
<b>Age of child in months</b>			0.300	0.584
0-6	126(95.5)	6(4.5)		
6-24	207(94.1)	13(5.9)		
<b>Sex of a child</b>			2.324	0.127
Male	168(92.8)	13(7.2)		
Female	165(96.5)	6(3.5)		
<b>Marital status</b>			0.228	0.633
Single mother	56(93.3)	4(6.7)		
Married	277(94.9)	15(5.1)		
<b>Number of children in the family</b>			0.103	0.749
≤3	256(94.8)	14(5.2)		
>3	77(93.9)	5(6.1)		
<b>Education level</b>			1.107	0.575
No formal education	41(93.2)	3(6.8)		
Primary	184(93.9)	12(6.1)		
TVET/ Secondary and above	108(96.4)	4(3.6)		
<b>Ubudehe category</b>			3.878	<b>0.049</b>
One	49(89.1)	6(10.9)		
Two and three	284(95.6)	13(4.4)		
<b>Occupation</b>			8.211	<b>0.004</b>

Farmer/Housewife	168(91.3)	16(8.7)		
Monthly salary job/Business	165(98.2)	3(1.8)		
<b>Monthly income ( Rwf)</b>			3.168	0.075
None	66(90.4)	7(9.6)		
Below 30,000	267(95.7)	12(4.3)		

As presented in Table 2, the findings from bivariate analysis show that ubudehe category (P=0.049) and occupation (P=0.004) of mothers were significantly associated with stunting. Despite, the statistical significance, the results from this research showed that the majority of stunted children were aged 6 months and above (5.9%). According to gender, male (7.2%) were more stunted than female. Stunting was more prevalent among children born from single mothers (6.7%), children born from a family with more than 3 children (6.1%). When compared to children born to educated mothers, the prevalence of stunting was higher in children born to mothers with no formal education (6.8%), and children born to mothers with only primary education (6.1%). The data suggest that children born into impoverished families have a greater rate of stunting (9.6%) than those born into homes with a monthly income of at least 30,000 Rwf

#### 4.4. Feeding practices associated with stunting among under two years children screened in immunization program

The third objective of the study was to identify the feeding practices associated with stunting among children attending immunization program.

**Table 3. Bivariate analysis of Child feeding practices associated with Stunting**

	Nutritional status		Chi-square	P-value
	Normal n (%)	Stunted n (%)		
<b>Exclusively breastfeed</b>			0.603	0.437
Yes	128(93.4)	9(6.6)		
No	205(95.3)	10(4.7)		
<b>Feed a child a balanced diet</b>			4.717	<b>0.030</b>
Always	93(98.9)	1(1.1)		
Sometimes	240(93.0)	18(7.0)		
<b>Feeding time</b>			3.334	0.189
5 and more	87(94.6)	5(5.4)		
3 times and less	246(94.6)	14(5.4)		
<b>Facing a child while feeding</b>			3.276	0.070
Always	140(97.2)	4(2.8)		
Sometimes	193(92.8)	15(7.2)		
<b>Time for feeding</b>			0.167	0.683
Less than 20 Minutes	249(94.3)	15(5.7)		
20 minutes and more	84(95.5)	4(4.5)		
<b>Times for breastfeeding</b>			28.400	<b>&lt;0.001</b>
Less than 8 times	59(81.9)	13(18.1)		
8-12 times and more	274(97.9)	6(2.1)		
<b>Time spending while playing with a child</b>			2.306	0.129
Less than 15 minutes	225(93.4)	16(6.6)		
15 minutes and more	108(97.3)	3(2.7)		
<b>Feed a child animal food</b>			5.164	<b>0.023</b>
Always	72(100.0)	0(0.0)		
Sometimes	261(93.2)	19(6.8)		
<b>Seeking care for a sick child</b>			36.839	<b>&lt; 0.001</b>
Always	269(98.5)	4(1.5)		
Sometimes	64(81.0)	15(19.0)		
<b>Hand washing practices</b>			25.662	<b>&lt;0.001</b>
Always	249(98.4)	4(1.6)		
Sometimes	84(84.8)	15(15.2)		

The results from bivariate analysis revealed that time for breastfeeding a child (P<0.001), seeking care for a sick child (P<0.001), hand washing practices (P<0.001), feeding a child with balanced diet (P=0.030), feeding a child with animal source food (P=0.023) were significantly associated with stunting among children under two



years. Prevalence of stunting was higher (15.2%) among children whose mothers had poor hand hygiene practices. Stunting was more prevalent (6.8%) among children who were not fed with animal source food. Besides that, stunting rate was 4.7% in children who were not exclusively breastfed, 5.4% in children who were fed less than three times and 7.2% in children who are sometimes facing by their mothers while being fed. In addition to these children who are fed less than 20 minutes were stunted (5.7%) and children whose parents spend less than 15 minutes playing with them were stunted (6.6%).

**Table 4: Logistic regression analysis: Factors associated with Stunting among children under two years**

	AOR	95%CI	P-value
Ubudehe category			
One	1.34	0.420-4.292	0.620
Two/Three	Ref.		
Occupation			
Farmer/Housewife	2.93	0.763-11.280	0.117
Monthly salary job/Business	Ref.		
Feed a child a balanced diet			
Always	Ref.		
Sometimes	3.70	1.045-13.135	<b>0.043</b>
Times for breastfeeding			
Less than 8 times	1.62	0.352-7.486	0.535
8-12 times and more	Ref.		
Seeking care for a sick child			
Always	Ref.		
Sometimes	9.36	2.032-43.165	<b>0.004</b>
Hand washing practices			
Always	Ref.		
Sometimes	1.82	0.364-9.169	0.463

The results from logistic regression analysis revealed that children who were sometimes fed with balanced diet were more likely to be of short stature for their age than those who were always fed with balanced diet (AOR=3.70, 95% CI: [1.045-13.135], P=0.043). Children whose mothers sometimes seek care when they sick were nine times more likely to have low height for their age than the ones whose mothers always seek care when they are sick (AOR=9.36, 95% CI: [2.032-43.165], P=0.004). Children born from family classified in ubudehe category one had 34% higher risk of stunting compared to children born from families in other ubudehe categories, but no statistical significance observed. Children who born from housewife mother are 3 times to be stunted compared to those born from mothers with monthly salary or in business. In the same way, Children who were breastfed less than 8 times had 62% risk of stunting compared to those who were breastfed between 8 and 12 times. Based on handwashing, Children whose mothers didn't wash their hand had 82% risk of being stunted compared to those who wash their hand after toilet, cleaning a child and before breastfeeding or eating.

### 5. Discussion of Findings

A cross-sectional study was conducted in Nyabihu District to investigate the factors related with stunting/height for age among children under two years attending immunization program in Nyabihu District. A total of number of 352 children –mother's pairs participated in this study. In 352 children screened for nutritional status, 5.4% were stunted. These results indicated that children who regularly attend immunization program are at low risk of being stunted. These results were not far from those of the study conducted in Ethiopia revealed that a big number of children who were vaccinated of measles were associated to low rate of acute malnutrition in children under the age of five (Chiara, Tefera, & Debarati, 2016). Similarly, a study conducted in Kenya, reported children who are regularly vaccinated were 27% less likely to be stunted (Constance & Nanette, 2012). This consistence may due to the fact that the growth of children with more contact in immunization program is regularly monitored and interventions are designed to address the problem of malnutrition in real time. In accordance with our results, A research conducted in Papua New Guinea (PNG) aimed to determine the vaccination and nutritional status of children less than 5 years old in the remote and rural Karawari area of PNG. 85% of children had incomplete vaccination, children above the median age of 32 months (34%) were more likely to be fully vaccinated for their age,  $\chi^2 (1) = 23.294, P < 0.005$ . In addition, and 25.5% below the -1 SD for height-for-age compared to WHO standards. A large proportion of children had poor nutrition status and lack protection from vaccine preventable diseases (Louis Samiak, 2017).

Regarding social demographic and economic factors, ubudehe category (P=0.049) and occupation (P=0.004) of mothers were significantly associated with stunting. The findings of this study were similar to the one piloted in India where it was found that most (92.20%) of the mothers were housewives or were unemployed, though

greatest beneath nutrition (88.46%) was found in children whose mothers were unskilled laborer by occupation, though children of housewives were found to be as it were 59.22% undernourished (Shaili Vyas, 2011). The same findings from DHS 2020 showed that 11% of children in lowest wealth quintile were stunted (DHS, 2020). In accordance with our findings, a secondary data analysis of RDHS Conducted in 2018 found that childhood stunting was negatively associated with high household income OR=0.38, P<0.001 (Etienne, et al., 2018).

In sub-Saharan Africa, a study conducted on determinants of stunting in young Children, mother's occupation and household income were among the determinants associated to stunting (Susan , Guy, Grace, & Bart, 2014). In addition to this , many studies in developing countries found results like those from our study. A study conducted in India revealed that stunting was found to be highly correlated with economic status of the population, Children in poorest households have higher risk of stunting compared to those from highest quintiles (Barun Kanjilal, 2010). These findings showed that the more the mothers are jobless or poorest, they are not able to access nutritious foods and health services which can expose their children to all forms of malnutrition.

In terms of feeding practices, children who were sometimes fed a balanced diet were 3.7 times more likely than those who were always fed a balanced diet to have short stature for their age (AOR=3.70, 95% CI: [1.045-13.135], P=0.043). This association between children who are sometimes fed with a balanced diet and stunting is justified by the lack of required amount of nutrients for a child which led the child faltering growth. Children whose mothers sometimes seek care when they are sick were nine times more likely to have short stature for their age than children whose mothers always seek care when they are sick (AOR=9.36, 95% CI: [2.032-43.165], P=0.004). In line with our study, the study conducted by World Bank in Ecuador where it was found out that inadequate food intake in children was associated with stunting in children (World Bank, Nutrition Failure in Ecuador, 2007). In contrast with our study findings, a study conducted in Indonesia found out that there was no affiliation between nourishing practices and nutrition status (height for age) P>0.05, where each variable of feeding practices (breastfeeding duration, snacking and frequency of meal time and balanced diet) was not associated with nutritional status (height for age) P>0.05 (Ika, Susetyowati, Reza, & Farah, 2019).

In the same way, a study conducted by Betzabé in Ecuador found that Children who did not receive the minimum frequency of meals for their age had higher odds of stunting (OR 3.28; 95% CI 1.3, 8.27). Children from age 19 to 23 months who consumed foods rich in iron showed lower probabilities of stunting (OR 0.04; 95% CI 0.00, 0.51) (Betzabé Tello 1 2, 2022). The findings in this study revealed a strong relationship between feeding practice and seeking care for a sick child with child growth, this means that more children are sometimes fed with nutritious food and don't seek care when they are sick, may be exposed to poor growth/stunting. In contrast, a study conducted in 2019 by the World Bank in Rwanda found that having adequate food alone was not associated with a stunting (Demas, et al., 2019). This discrepancy from the above study and our study may be due to the sample size that has been used or other intervening factors.

## 6 Conclusions and Recommendations

**In conclusion,** Children attending immunization program in Nyabihu District had good nutritional status with a lower prevalence of stunting. Stunting were associated with poverty, poor feeding practices (not seeking care for a sick child, lack of balanced diet, low frequency of breast feeding , lack of animal source food and poor hand washing practices)

### Recommendations

The implication of this study is that the high prevalence was found in children more than 6 months and found that frequency for breastfeeding a child, seeking care for a sick child, hand washing practices, feeding a child with balanced diet feeding a child with animal source food, poverty and unemployment were associated with stunting, therefore we propose the following recommendations

To reinforce integration nutrition services especially Maternal Infant Young Child Nutrition and growth monitoring in routine immunization program because children who had more contacts in immunization have lower risk of being stunted.

To advocate for the poorest and unemployed mothers to access income generating activities and social protection as children from poorest and unemployed mothers have high risk of being stunted. The employment and income will allow them to access nutritious food and health services and other needs for better growth of their children. To improve the caring, feeding styles and practices with emphasis on a balanced diet comprising animal source foods and hygiene practices. To early seek care when their children are sick as the results revealed that not seeking care when a child is sick was associated with stunting.

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