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Factors of Chronic Malnutrition in Children Less than Five Years of Age: A Study Conducted at Cibitoke Hospital, Burundi

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Abstract

Children in Cibitoke province face chronic malnutrition at a high and persistent rate. Although several organizations have tried to face this situation, various factors are causing it and the problem persists. This is why a preliminary study is worthwhile to identify the determining factors of this persistent malnutrition. Therefore, a cross-sectional study with an analytical purpose was conducted at Cibitoke Hospital in 2023. The purposive sampling technique was used to include children less than five years of age and their mothers, resulting in a sample of 1048 children and 1048 mothers. Data were collected using a questionnaire encoded with KoboCollect and it was completed face-to-face with participants. Multiple variables were analyzed simultaneously. The univariate, the bivariate and the multivariate analyses were performed with SPSS 25.0. Only variables with a $p < 0.05$ in the multivariate logistic regression were considered to be significantly associated with chronic malnutrition. As findings, the descriptive analysis showed a prevalence of chronic malnutrition of 55% in children less than five years of age in our sample. Multiple logistic regression identified factors associated with chronic malnutrition as: child age (p=0.000), household size (p=0.011), household standard of living (p=0.000), duration of breastfeeding (p=0.029), setting of residence (p=0.016) and source of drinking water (p=0.022). This research shed light on the determinants of chronic malnutrition in children less than five years of age at Cibitoke Hospital. So, interventions to reduce this public health problem must target these identified factors.

Keywords: Chronic Malnutrition, Children Less Than 5 Years of Age, Factors of Malnutrition

Introduction

Maternal and child health is a global priority due to the increased vulnerability of these groups to a variety of conditions, including malnutrition [1]. In developing countries, chronic malnutrition in children under 5 years of age remains a major public health issue [2]. Several studies have demonstrated its harmful effects on cognitive and physical development, health and life expectancy. According to 2020 estimates, an estimated 148.1 million children under the age of 5 are chronically malnourished worldwide. In addition, nearly 45 million children suffer from severe energy and protein deficiencies [3]. Burundi, like other countries in sub-Saharan Africa, is facing a major crisis of child malnutrition, which is a serious public health problem. Of the 21 countries with a chronic malnutrition rate of more than 40% among children less than 5 years of age, 15 are in Africa, and Burundi ranks the second [4]. According to Burundi's Demographic and Health Surveys [5], the prevalence of chronic malnutrition in Burundi was 53% in 1987, 58% in 2010 and 56% in 2016-2017. The results of the 2018 national survey on the nutritional situation and mortality rate in Burundi revealed that 57.0% of children were chronically malnourished, of which 25.6% were severely malnourished. This prevalence index, equivalent to almost 6 out of 10 children, far exceeds the alert threshold of 40% set by the WHO [6]. In 2019, according to the National Survey on the Nutritional Situation and Food Security in Burundi, the prevalence of chronic malnutrition as measured by the height-for-age ratio in Burundi was 54.2% [7]. At the provincial level, with the exception of Bujumbura Capital City and Mwaro province, the other 16 provinces exceed the critical threshold of 40% set by the WHO. In Cibitoke province where this research area is located, the prevalence of chronic malnutrition is 56.5% [7]. Other surveys have also revealed that in this province, the prevalence of chronic malnutrition remains consistently above the critical threshold of 40% set by the WHO. According to the EDSB-II, in the Western region of Burundi

where Cibitoke is located, the prevalence of chronic malnutrition was 55% [8]. In addition, the overall analysis of food security, nutrition and vulnerability in Burundi [9] indicated a prevalence of chronic malnutrition of 47.1% in Cibitoke, while according to the National Survey on the Nutritional Situation and Mortality in Burundi [6], it was 56.8% among children aged 0 to 59 months. Malnutrition is not always closely related to household food insecurity [9]. According to the report analyzing the situation of malnutrition among children under five years of age in Burundi, causes of chronic malnutrition are multiple and interconnected, among others, to socio-economic and demographic factors add food insecurity, inappropriate complementary feeding and health care practices for young children; precarious hygiene and sanitation conditions.

This clearly demonstrates the multisectoral aspect of the fight against malnutrition and that nutrition is not only a matter of agricultural production [10]. The persistence of chronic malnutrition at a high rate in this province of Cibitoke sparked our interest in carrying out this study at the Cibitoke hospital, with the aim of contributing to its fight.

Materials and methods

This is a cross-sectional study with an analytical purpose that was conducted at Cibitoke Hospital throughout 2023. Purposive sampling was used to include children below five years of age and their mothers, resulting in a sample of 1048 children and 1048 mothers. Data were collected using a questionnaire encoded with KoboCollect and completed face-to-face with participants. The child's height was measured in centimeters, using a horizontal height chart for children under 2 years of age and vertical for those of 2 years and older, with an accuracy of 0.1 cm. Height and age were used to calculate the height-for-age (T/A) ratio, expressed in Z-score and compared to WHO standards [11]. Chronic malnutrition, a dependent variable, is categorized into "malnutri" (height-for-age index < -2 Z-scores) and "normonutri" (height-for-age index ≥ -2 Z-scores).

The database was created with Microsoft Excel 2013. Multiple variables were analyzed simultaneously; These variables involve age(P), place of residence(P), sex of the child(S), birth order(O), household size(T), standard of living of the household(N), economic activity of the mother(E), level of education of the mother(L), marital status of the mother(M), religion of the mother(R), age of the mother at childbirth(U), the duration of breastfeeding(D) and the source of a drink of water(W). Univariate, bivariate and multivariate analyses were performed with SPSS 25.0. Only variables with a p< 0.05 in the multivariate logistic regression were considered to explain the chronic malnutrition.

Results

Descriptive study

Frequency

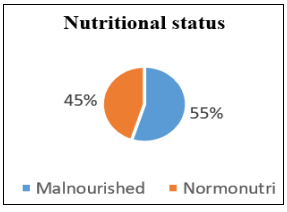

Fig 1: Nutritional status of children

Out of 1048 children in our study, 576 children were chronically malnourished (height-for-age ratio <-2 Z score), i.e. an estimated prevalence of chronic malnutrition of 55% as shown in Fig 1.

86.4% of respondents lived in rural areas compared to 13.6% living in urban areas. 206 children, representing 19.7% of the sample, were between 0 and 11 months old, while 20.8% of the children were between 48 and 59 months old. The sex ratio was 1.043 for males. 7.9% were children in rank 1 and those in rank 5 and above were 43.8%. Small households were represented at 24.2% compared to 40.5% of large households. The majority of the mothers surveyed were married, i.e. 92.3% (Table 1).

Table 1: Socio-demographic factors (n=1048)

Explanatory variables	n	%
Residential setting		
Urban	143	13.6
Rural	905	86.4
Age of the child in months		
0-11 months	206	19.7
12-23 months	241	23.0
24-35 months	201	19.2
36-47 months	182	17.4
48-59 months	218	20.8
Sex of the child		
Male	535	51.0
Female	513	49.0
Birth order		
Rank 1	83	7.9
Rank 2	172	16.4
Rank 3	165	15.7
Rank 4	169	16.1
Rank 5 and above	459	43.8
Household size		
Small Size	254	24.2
Medium Size	370	35.3
Large size	424	40.5
Marital status of the mother		
Bachelor	11	1.0
Bride	967	92.3
Divorcee	51	4.9
Widow	19	1.8

36.2% of households were poor, 21.4% had an average living standard and 42.5% were rich. The majority of mothers in the study were women farmers, 77.8% compared to 3.2% of managerial mothers (Table 2).

Table 2: Socio-economic factors (n=1048)

Explanatory variables	n	%
Household standard of living		
Poor	379	36.2
Medium	224	21.4
Rich	445	42.5
Mother's economic activity		
Inactive	104	9.9
Farmer	815	77.8
Merchant	60	5.7
Frame	34	3.2
Services and workers	35	3.3

Illiterate mothers were mostly 50.2% compared to 0.6% with a higher educational level. Catholic was the most

practiced religion, 49.2% compared to 36.8% of Protestants and 13.9% of other religions (Table 3).

Table 3: Socio-cultural factors (n=1048)

Explanatory variables	n	%
Mother's level of education		
Without	526	50.2
Primary	427	40.7
Secondary	89	8.5
Upper	6	0.6
Mother's religion		
Catholic	516	49.2
Protestant	386	36.8
Other	146	13.9

1.2% were mothers with a childbirth age of 18 years or less, 44.3% were those between 19-29 years of age and 12.5% were those aged 40 years and over. Children who were breastfed for less than 18 months, breastfed for up to 18 months and those breastfed for more than 18 months successively have ratios 54.9%, 29.5% and 15.6%. 81.4% of drinking water sources were for drinking clean water and 18.6% were for those who take dirty water (Table 4).

Table 4: Socio-medical factors (n=1048)

Explanatory variables	n	%
Mother's age at delivery		
Less than or equal to 18 years of age	13	1.2
19-29 years old	464	44.3
30-39 years old	440	42.0
40 years and over	131	12.5
Duration of breastfeeding of the child		
Less than 18 months	575	54.9
Breastfed up to 18 months	309	29.5
Breastfed for more than 18 months	164	15.6
Source of drinking water		
Clean water	853	81.4
Non-potable water	195	18.6

Analytical study

Bivariate analysis

Sociodemographic factors: place of residence (p=0.000), age of children (p=0.000), birth order of children (p=0.003) and household size (p=0.005) were associated with chronic malnutrition. There was no association between the child's sex (p=0.323), marital status (p=0.050) and chronic malnutrition (Table 5).

Sociodemographic factors associated with chronic malnutrition

Table 5: Sociodemographic factors associated with chronic malnutrition

Chronic malnutrition					
	Yes		No		
Explanatory variables	N	%	**N**	**%**	**P**
Residential setting					**0.000**
Urban	55	38.5	88	61.5	
Rural	521	57.6	384	42.4	
Age of the child in months					**0.000**
0-11 months	61	29.6	145	70.4	
12-23 months	135	56	106	44	
24-35 months	121	60.2	80	39.8	
36-47 months	112	61.5	70	38.5	
48-59 months	147	67.4	71	32.6	
The child's gender					**0.323**
Male	302	56,4	233	43.6	
Female	274	53.4	239	46.6	
Birth order					**0.003**
Rank 1	37	44.6	46	55.4	
Rank 2	77	44.8	95	55.2	
Rank 3	89	53.9	76	46.1	
Rank 4	101	59.8	68	40.2	
Rank 5 and above	272	59.3	187	40.7	
Household size					**0.005**
Small Size	117	46,1	137	53.9	
Medium Size	213	57.6	157	42.4	
Large size	246	58	178	42	
Marital status of the mother					**0.050**
Bachelor	3	27.3	8	72.7	
Bride	530	54.8	437	45.2	
Divorcee	28	54.9	23	45.1	
Widow	15	78.9	4	21.1	

The living standard (p=0.000) and the economic activity of the mother (p=0.000) were statistically associated with chronic malnutrition (Table 6)

Table 6: Socio-economic factors associated with chronic malnutrition

Chronic malnutrition					
	Yes		No		
Explanatory variables	n	**%**	**n**	**%**	**P**
Household standard of living					**0.000**
Poor	246	64.9	133	35.1	
Medium	137	61.2	87	38.8	
Rich	193	43.4	252	56.6	
Mother's economic activity					**0.000**
Inactive	48	46.2	56	53.8	
Farmer	472	57.9	343	42.1	
Merchant	34	56.7	26	43.3	
Frame	8	23.5	26	76.5	
Services and workers	14	40	21	60	

The mother's education level (p=0.000) as well as the mother's religion (p=0.002) showed statistically significant associations with chronic malnutrition (Table 7).

Table 7: Sociocultural factors associated with chronic malnutrition

Chronic malnutrition					
	Yes		No		
Explanatory variables	n	%	**n**	**%**	**P**
Mother's level of education					**0.000**
Without	313	59.5	213	40.5	
Primary	243	56.9	184	43.1	
Secondary	19	21.3	70	78.7	
Upper	1	16.7	5	83.3	
Mother's religion					**0.002**
Catholic	312	60.5	204	39.5	
Protestant	190	49,2	196	50.8	
Other	74	50.7	72	49.3	

Regarding socio-medical factors, the duration of breastfeeding of the child (p=0.000) and the source of drinking water supply (p=0.000) were statistically associated with chronic malnutrition. On the other hand, no significant association was found between the mother's age at childbirth (p=0.110), and chronic malnutrition (Table 8).

Table 8: Socio-health factors associated with chronic malnutrition

Chronic malnutrition					
	Yes		No		
Explanatory variables	**n**	**%**	**n**	**%**	**P**
Mother's age at childbirth					**0.110**
Less than or equal to 18 years of age	5	38.5	8	61.5	
19-29 years old	239	51.5	225	48.5	
30-39 years old	255	58	185	42	
40 years and over	77	58.8	54	41.2	
Duration of breastfeeding of the child					**0.000**
Less than 18 months	360	62.6	215	37.4	
Breastfed up to 18 months	113	36.6	196	63.4	
Breastfed for more than 18 months	103	62.8	61	37.2	
Source of drinking water					**0.000**
Clean water	444	52.1	409	47.9	
Non-potable water	132	67.7	63	32.3	

Multivariate analysis

Raw model

In this section, we determined the multiple logistic regressions. We regressed the log odds on the explanatory variables in our study.

The variables that were significantly associated with malnutrition were: mother's religion (p=0.030), child's age in months (p=0.000), household size (p=0.013), household's living standard (p=0.000), duration of breastfeeding (p=0.031), place of residence (p=0.024), and water for drinking supply (p=0.019). There was no relationship between the mother's level of education (p=0.638), the sex of the child (p=0.195), the mother's economic activity (p=0.116), the mother's age at childbirth (p=0.948), and the mother's marital status (p=0.132) with chronic malnutrition (Table 9).

Table 9: Output of the raw model

Explanatory variables	B	Sig.	Exp(B)
Mother's religion	0.202	0.030	1.224
Mother's level of education	-0.033	0.638	0.967
Age of the child	-0.276	0.000	0.759
Household size	-0.252	0.013	0.777
Household living standard	0.391	0.000	1.479
Sex of the child	0.172	0.195	1.188
Mother's economic activity	-0.107	0.116	0.898
Duration of breastfeeding of the child	0.193	0.031	1.213
Mother's age at delivery	0.006	0.948	1.006
Residential setting	-0.454	0.024	0.635
Marital status of the mother	-0.322	0.132	0.725
Source of drinking water	-0.428	0.019	0.652
Birth order	0.050	0.393	1.051
Constant	1.721	0.043	5.590

To solve the problem of non-significant variables in the model, we phased them out so that only the significant variables were kept in the final model.

Final model

The final model includes only variables significantly associated with chronic malnutrition in children less than five years of age at Cibitoke Hospital (Table 10).

Table 10: Final Model Output

Explanatory variables	B	Sig.	Exp(B)	95% confidence interval for EXP(B)	
				Inferior	Upper
Mother's religion(R)	0.201	0.030	1.222	1.020	1.464
Age of the child(A)	-0.276	0.000	0.759	0.691	0.833
Household size(T)	-0,213	0.011	0.808	0.685	0.953
Household living standard(N)	0.396	0.000	1.486	1.276	1.731
Duration of breastfeeding of the child(D)	0.194	0.029	1.214	1.020	1.445
Residential setting(P)	-0.479	0.016	0.619	0.420	0.914
Source of drinking water(W)	-0.415	0.022	0.661	0.464	0.941
Constant	1.013	0.081	2.753		

Equation of the estimated final model

$$\log\left(\frac{\widehat{P_i}}{1-P_i}\right)=1.013+0.201R_i-0.276A_i-0.213T_i+0.396N_i+0.194D_i-0.479P_i-0.415W_i$$

When analyzing nutritional status as a dependent variable, it was found that the variables "Mother's religion", "Household living standard" and "Duration of breastfeeding" have a positive influence on nutritional status. In contrast, the variables "Age of child in months", "Household size", "Place of residence" and "Source of drinking water" have a negative influence. These interpretations must be confirmed taking into account the limitations of logistic analysis.

Suitability and Validation of the Model

The value of the Chi-squared test of the model fit test (Pearson) was 112.767 with a probability of 0.000 less than 5% and the value of the Chi-squared test of the Hosmer-Lemeshow test (model validation test) was 7.794 with a probability of 0.454 greater than 5%, this showed us that there was no significant difference between the observed values and the predicted values. So the model is reliable and valid.

Table 11: Adequacy and validation of the model

	Model Adequacy (Pearson)	Model Validation (Hosmer-Lemeshow)
Chi-squared	112.767	7.794
Sig.	0.000	0.454

Discussion

This study estimated the prevalence (with univariate and bivariate analysis) and identified factors associated with chronic malnutrition (with multivariate analysis) in children less than five years of age at Cibitoke Hospital. The prevalence of chronic malnutrition was estimated at 55%, which is higher than the rate of 54.7% reported by the Guéra study in Chad [12] and the rate of 32.0% found by the study conducted in Benin in 2018 [13]. In Lokossa, a chronic malnutrition rate of 50.2% was reported in 2015, which is still lower than our prevalence [14]. Our prevalence rate exceeded the very high threshold of 30% defined by the WHO [11].

Analysis of the malnutrition rate according to the different age groups showed that 29.6% of children aged 0 to 11 months were malnourished. This rate increased to 56% in children aged 12 to 23 months, reached 60.2% in those aged 24 to 35 months, and peaked at 61.5% in children aged 36 to 47 months and 67.4% in children aged 48 to 59 months. There was a significant association between the age of the children and chronic malnutrition (p=0.000). These results are more consistent than those observed by other researchers [15, 16]. The study in Benin also found a correlation between the age of children and chronic malnutrition, with a rate of 5.1% in children under 6 months of age and 45.2% in those aged 12 to 23 months (p=0.000) [17]. As children grow older, their nutritional needs increase, and the transition from breastfeeding to complementary feeding can introduce nutritional deficiencies if this diet is not well balanced and adapted to their needs. In addition, chronic malnutrition can develop following a prolonged period of nutritional deprivation, which is why malnutrition rates increase with age.

Interestingly, our study did not find a significant link between gender (p=0.195) and chronic malnutrition. However, other studies have sometimes found different results. This is the case of a study carried out in Niger which showed a higher prevalence of chronic malnutrition in boys than in girls, with a very significant p-value (p=0.000). This difference could be due to variations in the researched populations, data collection methods, or other contextual factors [18].

The results of our study showed a significant association of the place of residence with chronic malnutrition (p=0.016) and that the prevalence of malnutrition is high in rural areas (57.6%) than in urban areas (38.5%). This observation is as consistent as several other research studies conducted in various contexts [19, 20]. In Burkina Faso, a study also found a higher prevalence of chronic malnutrition among children living in rural areas (39.9%) compared to those living in urban areas (16.7%) [21]. Similarly, a study in Benin showed that children in rural areas were more likely to suffer from chronic malnutrition due to poor feeding and nutrition practices [22].

Our study found that child birth order (p=0.393) was not associated with chronic malnutrition, which is different from the findings of other researches [18]. A study conducted in Ethiopia came to the same conclusions as ours, no significant association (p=0.070) was found between birth order and stunting [23].

There was a statistically significant association between chronic malnutrition and household size (p=0.011). Indeed, the level of malnutrition was higher for households, 58%; it is slightly low in small households, 46.1%. These results are in agreement with Guy's study which found a location between household size and chronic malnutrition rate (p = 0.010) [17]. Malnutrition is more common in large households, with a rate of 44%. In contrast, smaller households have a slightly lower malnutrition rate, at 41.5%. Household size and composition are key determinants of children's vulnerability to malnutrition [24].

There was no link between maternal marital status (p=0.132) and chronic malnutrition in our study. This differs from some studies that have found a significant association [25, 22]. Other studies have found the same result as ours [26, 27].

The household living standard was statistically significant with chronic malnutrition in children (p=0.000). A rate of 43.4% of chronic malnutrition was observed among children from wealthier households, while this rate reached 64.9% among those living in disadvantaged households. Poverty is strongly associated with a higher prevalence of malnutrition among children due to financial barriers to accessing healthy diets and quality health services [28]. Maternal economic activity was not related to chronic malnutrition (p=0.116). Unlike our findings, UN Women France demonstrates that women's economic empowerment is key to reducing chronic malnutrition. When women become economically empowered, they invest more in their children's nutrition. However, inequalities in accessing agricultural resources between men and women can limit this positive impact [29].

The mother's level of education did not show a significant association with chronic malnutrition (p=0.638). However, various studies have shown that the level of education of the mother is a determining factor in chronic malnutrition among children. A study in Benin found that children whose mothers had a secondary or higher education had significantly lower rates of malnutrition compared to those whose mothers had no education [30]. This is because educated mothers are better informed about food and health practices, and can therefore better meet the nutritional needs of their children [31].

The duration of breastfeeding of the child is significantly associated with chronic malnutrition (p=0.029). The rate of chronic malnutrition was 62.6% among children breastfed for less than 18 months, compared to 36.6% for those breastfed up to 18 months. Breastfeeding provides essential nutrients, antibodies and growth factors that protect children from diseases such as infection, thereby reducing malnutrition [32, 33]. In contrast, not breastfeeding or shortening breastfeeding duration puts children at increased risk of diseases and malnutrition due to food insecurity and limited access to health care [34].

Our study showed that drinking water quality has a significant influence on chronic malnutrition (p=0.022), with a rate of 67.7% in children consuming non-potable water compared to 52.1% in those who drank clean water. This is comparable to other studies that have also highlighted the link between access to safe drinking water and the reduction of chronic malnutrition [35, 36, 37, 38]. Non-potable water often contains pathogens that cause frequent intestinal infections, leading to poor nutrient absorption and rapid weight loss [39, 40]. These repeated infections weaken children's immune systems, making them more vulnerable to chronic malnutrition [41, 42, 43].

Conclusion

The prevalence of chronic malnutrition among children under 5 years of age at Cibitoke Hospital-Burundi has been estimated. The place of residence, the age of the children, the size of the household, the living standard of the household, the religion of the mother, the duration of breastfeeding of the child, and the source of drinking water supply were identified as factors associated with chronic malnutrition in our study. Interventions must therefore focus on these factors in order to reduce the problem of chronic malnutrition. A reduction in its prevalence will undoubtedly contribute to a better health state among children and help to create conducive conditions to welfare and development within communities.

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