Assessment of Nutritional Status and Associated Factors in Infants Aged 6 to 23 Months in Rural Burundi

Michel Baseka[1,2,3]*, Jonathan Niyukuri[2,3], Alice Ndayishimiye[4], Sedki Az-Eddine[5], Ferdinand Ndikuryayo[6], Vestine Ntakarutimana[7]

[1]Ph.D. Student in Health Nutrition, Doctoral School, University of Burundi, Bujumbura, Burundi
[2]Food Science and Technology Research Center (CRSTA), Department of Food Science and Technology (STA), Faculty of Agronomy and Bioengineering (FABI), University of Burundi, Bujumbura, Burundi
[3]East African Nutritional Sciences Institute, Bujumbura, Burundi
[4]Faculty of Medecine, University of Burundi, Bujumbura, Burundi
[5]Department of Biology, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco
[6]Centre Universitaire de Recherche et de Pédagogie Appliquées aux Sciences, Laboratoire de Nutrition-Phytochimie, d'Ecologie et Environnement Appliqués, Institut de Pédagogie Appliquée, Université du Burundi, Bujumbura, Burundi
[7]Center of Research in Natural and Environmental Sciences, Faculty of Sciences, University of Burundi, Bujumbura, Burundi
Email: *maomichel68@gmail.com

Abstract

This study was carried out in the Health districts of Kayanza and Gahombo. Its aim was to assess the nutritional status and associated factors of infants aged between 6 and 23 months. This descriptive and cross-sectional study was carried out in the health centers of the action zone during medical consultations in community medicine from 13 to 22 February 2023. For this purpose, 53.0% of a sample of 398 mothers of infants aged 6 - 23 months were male, and the most represented age group was 12 - 23 months with 53.8%. Mothers were asked about the diet of their children. All the children involved in this study were vaccinated, whereas 99.2% were given vitamin A supplements. The most frequent illnesses in this age group were acute respiratory infection (ARI) (73.4%), fever (66.6%), diarrhea (53.8%), and vomiting (40.5%). Analysis of nutritional status showed that infants had severe (8.3%) and moderate (70.4%) acute malnutrition. Factors associated with infant nutritional status comprised the occupation of mother ($P = 0.009$), level of education of mother ($P = 0.0625$), and prolonged diarrhea ($P = 0.004$). To remedy this problem, concrete nutritional and educational interventions are needed to promote optimal infant nutrition during the first two years of life.

Keywords

Nutritional Status, Infant, Complementary Feeding, Burundi

1. Background

In Burundi, particularly in Kayanza Provincial Health Office where our study was carried out, the prevalence of chronic malnutrition and severe malnutrition is 58.2% and the prevence of severe malnutrition is the 6%. The aim of this study was to measure the nutritional status of infants receiving complementary foods and associated factors.

2. Introduction

According to the World Health Organization (WHO), diversification or complementary feeding is defined as the introduction of nutritionally adequate complementary foods to meet the growing nutritional needs of infants from 6 to 23 months of age [1]. During the first 1.000 days of an infant's life, complementary feeding is period of transition from an exclusive milk diet to varied diet tending towards an autonomous adult model [2]. According to the WHO, malnutrition is a pathological state resulting from the relative or absolute insufficiency or excess of one or more essential nutrients, whether manifested clinically, or detectable only by biological, anthropometric or physiological analyses [3]. Child malnutrition remains a global health challenge, leading to high morbidity and mortality as well as stunted growth [4]. The effects of childhood malnutrition are long-lasting and persist into adulthood [5]. For proper growth and harmonious development, WHO recommends that infants should be exclusively breastfed for the first six months of life, and that to meet changing nutritional needs, infants should receive safe and nutritionally adequate complementary foods from 6 months of age, while breastfeeding should continue until two years of age or beyond [6]. Poor feeding practices for mothers, infants, and young children are associated with high levels of malnutrition [1]. Optimal breastfeeding and complementary feeding practices have been shown to be effective for harmonious child development [7]. Around one third of infant mortality is caused by malnutrition linked to inappropriate complementary feeding practices, especially for children under five years [8]. Malnutrition in all its forms increases the risk of illness and early death [9]. Inadequate nutrition remains a critical factor in the growth and development of children, especially those under two years [1].

According to the latest National Nutritional Safety and Mortality Survey, only 26% of Burundian infants aged between 6 and 23 months achieve minimum dietary diversity. Also, the survey showed that 66% of these infants achieve minimum meal frequency. The prevalence of malnutrition in children aged between 6 and 23 months was 52.2% for chronic malnutrition, 9.8% for moderate acute malnutrition, and 1.1% for severe acute malnutrition [10]. According to this national survey, the prevalence rate of chronic malnutrition, moderate acute malnutrition, and severe acute malnutrition in Gahombo Health District (HD) were found to be 68.3%, 7%, and 1%, respectively. Similarly, the rates of these indicators of nutriotional status and mortality were respectively 58.2%, 5.7%, and 0.3% Kayanza HD [10]. To our knowledge, data on complementary feeding and its

impact on the nutritional status of children aged between 6 and 23 months and their associated factors were not available in the two studied HDs, namely Kayanza and Gahombo. This challenge is linked to the lack of research on complementary feeding of children aged between 6 and 23 months. The objective of this study is to assess the nutritional status of infants during complementary feeding and to determine the associated factors in order to shed light on the correlation between nutritional status and infant health. The results of this study could enrich the knowledge of mothers on complementary feeding in Burundi, and more specifically in the HDs of Kayanza and Gahombo

3. Materials and Methods

3.1. Description of Study Site

The study is carried out in two HDs of Kayanza and Gahombo in Kayanza province in the north of Burundi. The study area lies between 2°47'16" and 3°13'78" South Latitude and 29°25'11" and 29°55'95" East Longitude, with a surface area of 783.06 Km², representing 63.49% of the area of Kayanza province. It is bordered to the north by the Republic of Rwanda, to the west by Cibitoke province, to the south and south-east by Butaganzwa and Rango communes of Kayanza province, and to the east by Ngozi province. These two HDs cover six communes, namely Kayanza, Muruta, Kabarore, Gatara, Gahombo, and Muhanga out of 9 communes that constitute the Kayanza province. The area of interest had a population of 614,772 inhabitants with a density of 785 inhabat/km² [11] (Figure 1).

3.2. Period and Type of Study

Based on an anonymous questionnaire, the date of this cross-sectional, descriptive, and analytical study were collected from 13 to 22 February 2023.

3.3. Inclusion and Non-Inclusion Criteria

All children aged 6 to 23 months whose mothers had consented to participate were included in the study.

However, children of the same age whose mothers refused to consent were excluded.

3.4. Sample Size

The minimum sample size was calculated using the formula as follows:

$$n = \frac{t^2 \cdot N}{t^2 + (2e)^2 (N-1)}$$

With n the sample size, t the risk of error associated with the confidence interval, which is equal to (1.96), N the total population of the two districts (31035), e the desired absolute precision expressed as a fraction of 1. ($e = 0.05$). After calculation, n was found to be equal to 379.4. With 5% of 379 (*i.e.*, 19) non-respondents during our survey, we arrived at $n = 398$ infants to be surveyed.
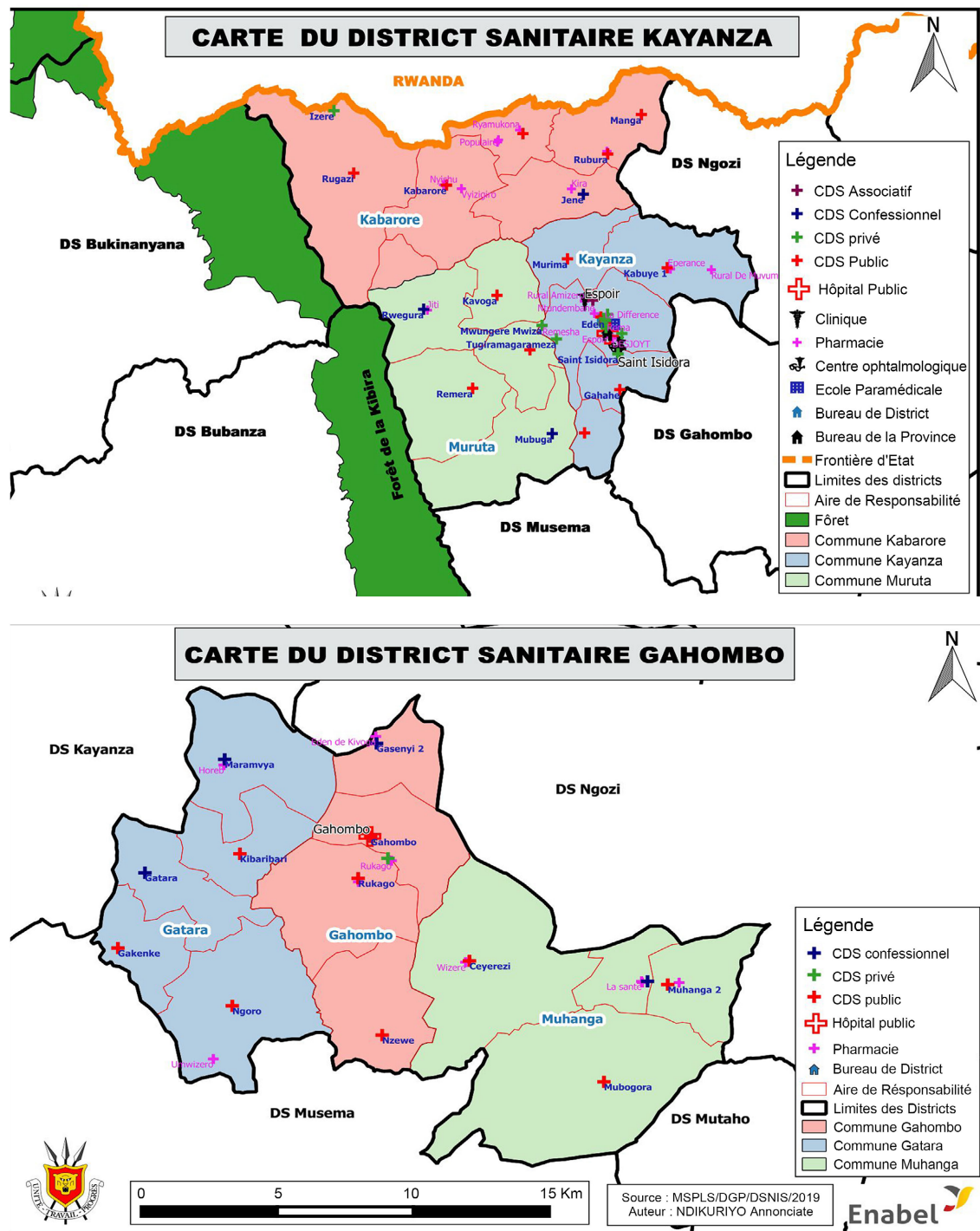
Figure 1. National health information system (NHIS) 2018.

3.5. Data Collection Techniques and Tools

3.5.1. Data Collection Process

Prior to the survey, authorization was obtained from a health center manager, and the interviewers received training. Anthropometric measurements of all children were carried out using an electronic scale with a digital display dial capable of weighing from 1 kg to 150 kg, or a combination of the two.

To validate the questionnaire, a preliminary survey of 20 mothers has been conducted. Anthropometric measurements of all children were carried out using an electronic scale with a digital display dial capable of weighing from 1 kg to 150 kg or a hanging scale with a capacity of up to 25 kg for children to measure the weight. The height and the brachial perimeter of children were recorded using a toise and mid-arm circumference (MUAC).

The survey was carried out on the basis of a questionnaire administered to the mothers to collect data relating to nutritional status, socio-demographic characteristics, preventive aspects, and feeding practices. Nutritional status comprised anthropometric measurements (weight, height, sex, and age) of all selected children that were surveyed to identify the different forms of malnutrition and their respective degrees and (severe, moderate, overall). As a result, MUAC is also a measurement and nutritional indicator divided into three zones. A green zone above 12.5 cm means that the child is normal, a yellow zone between 12.4 cm and 11.5 cm means a risk of malnutrition and the child should be examined and monitored, and receive nutritional supplements. The red zone measures less than 11.5 cm and indicates severe malnutrition requiring stabilization treatment.

Socio-demographic characteristics included the age and sex of the child, and the age and maritus status of the mother as well as her level of education. Preventive aspects focused on vitamin A intake in children and infant vaccination. Feeding practices comprised the breastfeeding and complementary feeding practices.

3.5.2. Data Analysis

Data were entered using Kobocollect software and then exported to SPSS 25 for statistical analysis to derive percentages. The odds ratios (OR) were presented with a 95% confidence interval. The significance level was set at 5%.

3.6. Ethical Considerations

The free and informed consent of the mothers surveyed was obtained after explaining the objectives of the study before the administration of the questionnaire. The data collected were analyzed in strict compliance with the confidentiality and anonymity of the respondents.

4. Results

4.1. Socio-Demographic Characteristics of Mothers and Their Infants Aged between 6 and 23 Months

Globally, 53.04% of the infants were aged between 12 and 23 months, and the male sex was predominant at 53.0%. The majority (94.2%) of infants had birth weights ranging from 2500 g to 4000 g and 89.2% of infant weights were between 5.1 kg to 10 kg Similarly, 8.3%, 21.44%, and 70.4% of infants had a brachial perimeter (BP) less than 115 mm, from 115 mm to 125 mm, and higher than 125 mm, respectively. Among the respondent mothers, 80.2% were married, 76.1% were in school, 83.9% had a profession, and 71.6% were aged between 20 and 29 (Table 1).

Table 1. Socio-demographic characteristics of infant and mother.

Features		Number (n = 398)	(%)
marital status of mothers	Single	27	6.8
	Bride	319	80.2
	Common-law union	18	4.5
	Widowed/Divorced	34	8.5
level of education of mothers	Out of school	95	23.9
	Schoolchildren	303	76.1
occupations of mothers	With profession	334	83.9
	No profession	64	16.1
Age of mothers	<20 years	27	6.8
	20 - 29 years	285	71.6
	30 - 40 years	79	19.8
	41 and over	7	1.8
gender of child	Male	211	53.0
	Female	187	47.0
age of child	12 - 23 months	214	53.8
	6 - 8 months	77	19.3
	9 - 11 months	107	26.9
Birth weight in g	<2500 g	1	0.3
	2500 g	18	4.5
	>4000 g	4	1.0
	2500 - 4000 g	375	94.2
Current weight in kg	≤5 Kg	3	0.8
	10.1 - 15 Kg	40	10.1
	5.1 - 10 Kg	355	89.2
Brachial Perimeter (BP) in mm	<115 mm	33	8.3
	>125 mm	280	70.4
	115 - 125 mm	85	21.4

4.2. Infant Health Characteristics

The health characteristics of the infants are described in Table 2. 99.2% of infants had received vitamin A supplementation while 90.7% had vaccination cards, and 100% of had been correctly vaccinated according to the vaccination schedule in force in Burundi. Illnesses contracted in the last two weeks were in the following order (Table 2): ARI (73.4%), fever (66.6%), diarrhea (53.8%), and vomiting (40.5%). The majority of mothers (60.6 %) had between one and two children.

4.3. Prevalence of Malnutrition by Brachial Circumference (BP)

Concerning the prevalence of malnutrition in relation to brachial perimeter, the results showed that 70.4% of infants had a BP greater than 125 mm (no malnutrition), 21.4% had a BP between 115 and 125 mm (moderate acute malnutrition) and 8.3% had a BP less than 115 mm (severe acute malnutrition/stunting) (Table 3).

Table 2. Infant health parameters.

Characteristics (n = 398)		Workforce	(%)
Possession of vaccination card	No	37	9.3
	Yes	361	90.7
Child's vaccination status	Yes	398	100.0
Vit A supplementation	No	3	0.8
	Yes	395	99.2
Presence of signs of illness/Vomiting	No	237	59.5
	Yes	161	40.5
Frequency of signs of illness/Fever	No	133	33.4
	Yes	265	66.6
Frequency of signs of illness/Diarrhea	No	184	46.2
	Yes	214	53.8
Frequency of signs of illness/ Cough with fever (ARI)	No	106	26.6
	Yes	292	73.4

Table 3. Prevalence of malnutrition by brachial circumference.

Characteristics (n = 398)		Workforce	%
Brachial perimeter (BP) in mm	<115 mm	33	8.3
	>125 mm	280	70.4
	115 - 125 mm	85	21.4

4.4. Factors Associated with the Nutritional Status of Infants

Table 4 shows the factors associated with infant nutritional status in the bivariate analysis. A non-significant association was found between infant nutritional status and child gender, infant age, marital status of the mother and cough, vomiting, and fever as illnesses contracted within the last two weeks before the survey. The association between the nutritional status of infants and the occupation of mothers was statistically significant (P = 0.009). Similar significance was also observed with reference to the level of education (P = 0.0625) and diarrhoea as a disease contracted in the last two weeks before the survey (P = 0.004).

5. Discussion

The aim of this study was to assess the nutritional status of children aged between 6 and 23 months and associated factors. In the surveyed population, 80.2% of mothers were married. This result was lower than those of other sub-Saharan African researchers in their studies conducted by Dagnew *et al.* in Ethiopia (91%) [12], Marinda *et al.* in Zambia (99.4%) [13], Mbusa *et al.* in Democratic Republic of Congo (DRC) (83.6%) [6], and Tafese *et al.* in Ethiopia (85.3%) [14]. This observation could be explained by the advanced level of education in the previous countries. The study also showed that 76.1% of mothers attended school, a result similar to those of other researchers such as Princillia *et*

al. in Senegal (74.5%) [15], Chiabi *et al.* in Cameroon (83.3%), [1], Ran Laadjel *et al.*, who found that 55.71% of mothers attended school in Algeria [16]. Thus, the levels of education of mothers could justify the relatively high rates of healthy children. Nevertheless, in our study population, 83.9% of women had a profession. In the DRC the results of Mbusa *et al.* [6] were close to ours observation (71%). Similar resultas were also observed in the study of Chiabi *et al.* in Cameroon (70.7%) [1] and Rania Laadjel *et al.* in Algeria (71.62%) [17]. For our population, infants aged between 12 and 23 months were more preponderant with 53.8%. This result is close to that found in the last national survey on the nutritional situation and mortality [10]. And those found by other researchers such as Reynold *et al.* (50%) in Kenya [18], Zhang *et al.* 98 in China (75%) [5], Tafese *et al.* in Ethiopia (73.2%) [14], and Ariyo *et al.* in their studies conducted in Nigeria (85.9%) [4].

Table 4. Factors associated with infant nutritional status

		Brachial Perimeter (BP) in mm			
		<115 mm	>125 mm	115 - 125 mm	P-value
		(%)	(%)	(%)	
gender of child	Female	5.8	34.7	12.6	0.914
	Male	2.5	35.7	8.8	
Age of child	12 - 23 months	4.5	38.7	10.6	0.123
	6 - 8 months	1.5	15.1	2.8	
	9 - 11 months	2.3	16.6	8.0	
marital status of mothers	Single	1.3	3.0	2.5	0.540
	Bride	4.3	60.3	15.6	
	Common-law union	1.5	1.5	1.5	
	Widowed/Divorced	1.3	5.5	1.8	
Occupations of mothers	With profession	7.8	55.8	20.4	0.009
	No profession	0.5	14.6	1.0	
level of education of mothers	Out of school	4.0	11.8	8.0	0.0625
	Schoolchildren		58.5	13.3	
Vomiting	No	2.8	47.7	9.0	0.245
	Yes	5.5	22.6	12.3	
Fever	No	2.5	23.4	7.5	0.598
	Yes	5.8	47.0	13.8	
Diarrhoea	No	2.5	38.9	4.8	0.004
	Yes	5.8	16.6	16.6	
Cough with fever (ARI)	No	2.5	16.3	7.8	0.125
	Yes	5.8	54.0	13.6	

In this study, the results showed that the male sex was preponderant at a rate of 53.0%. Similar results were found by other researchers, including Rochoy *et al.* in his study conducted in Ethiopia (58%) [19], Princillia *et al.* in Senegal (57%) [15], and Ariyo *et al.* in Kenya (56.2%) [4]. In addition, the birth weight of children in our population was between 2500 g and 4000 g, which was more prevalent in 94.2% of births. This observation was in line with the study of Mbusa *et al.* in the DRC (85.1%) [6].

With regard to nutritional aspect, 99.2% of children received vitamin A supplementation from birth to two years of age. The same observation was made during the last national survey on nutritional security and mortality in Burundi [10]. Nevertheless, this proportion is in line with the recommendations of the WHO [20]. Similar results were found by Diaby in his study carried out in Senegal (90.4%) [21]. In addition, 90.7% of children had vaccination cards, and 100% of children in our population received at least one vaccine. This observation could be explained by the fact that all respondent mothers were met when caming to the vaccination department for a consultation. This approach is far superior to that of Mounkaila *et al.* in Niger, 68.6% of children having received full vaccinations [9]. Moreover, these results are slightly higher than those observed in the national survey carried out in 2020 [10]. This could be explained by the involvement of health staff and light mom raising community awareness.

In this study, 8.3% and 70.4% of children were severely and moderately malnourished, respectively. WHO standards for brachial circumference (BMI) show that in a well-nourished population there are very few children with a BP below 115 mm in the children aged between 6 and 60 months. Children with a BMI below 115 mm have a higher risk of death than those with a BMI above 115 mm [22]. This is due to inappropriate complementary feeding for reasons of lack of diversified foods in quantity and quality according to the opinions of the mothers surveyed. Similar results were found by Mbusa *et al.* in their study in the DRC with 98.3% for a PB more or less great than 125 mm [6].

With regard to the level of education of mothers, this study showed a significant association with complementary feeding of children (P = 0.0625). This finding was by Chiabi in his study conducted in Cameroon [1]. This situation could be explained by the high level of education of mothers as the majority has attended school. These mothers have little time to look after their children. However, the same results showed a statistically significant association between the occupation of mothers and the nutritional status of children (P = 0.009). This finding is in line with the results of the study of Mbusa et al. in the DRC [6]. Diarrhea also had a significant influence on the nutritional status of children (P = 0.004). Similar observation has been made by Allomasso in his study conducted in Benin [23].

Study Limitations

The limitations of this study were that mothers with malnourished children were unwilling to complete the entire questionnaire, and caregivers did not facilitate

the conversation between the respondent and the interviewer.

6. Conclusion

The nutritional situation of infants and its associated factors in the two HDs of Kayanza and Gahombo remains a public health problem, although some health indicators are at a satisfactory level. The immunization status of the infants studied is at a very high level. Diarrhea, vomiting, fever, cough and ARI are the most frequent diseases encountered in the area of responsibility of the two districts, but diarrhea conditions have a real impact on nutritional status. Vitamin A supplementation for children, which boosts their immune systems, is at a very satisfactory level of 99.2%. Moderate acute malnutrition is by far the most frequent form of malnutrition (70.3%), while severe acute malnutrition is 8.3%. Factors statistically associated with infant nutritional status were mother's occupation (P = 0.009), mother's level of education (P = 0.0625) and recent diarrhea (P = 0.004).

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this paper.

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