







Evaluation of the Nutritional Status of Children under 5 Years Old Hospitalized in the Kabezi Health District Hospital in Burundi during the Period from 2015 to 2022

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Abstract

A study on the assessment of the nutritional status of children under 5 years old was carried out in the Kabezi Health District. Data recorded at the Therapeutic Stabilization Service (SST) on cases of malnutrition, in the period from 2015 to 2021, were analyzed. It was revealed that 9 health centers out of 23 in the Kabezi Health District (HD) had cases of malnutrition. The most affected was the Kabezi health center, which alone accounted for 19% of the cases identified. The entropometric parameters made it possible to know the extent and severity of the nutritional status of children under 5 years old. The Body Mass Index highlighted the minimum weigh registered was 5 kg/m² while the general average was 10 kg/m². The analysis of the presence of edema showed that 51% suffered from kwashiorkor while 49% suffered from marasmus. The study of the evolution over time revealed that the trend of the decrease in cases and severity is positive but with a low rhythm. The estimated projections indicate that 0 cases of marasmus and kwashiorkor will be reached in 2046. Thus, this study shows how much decision-makers can make efforts to completely eradicate these sufferings in children under 5 years old and which have consequences on the overall development of the country.

Keywords

Marasmus, Kwashiorkor, Malnutrition and Nutritional Status of Children

1. Introduction

According to WHO, malnutrition is a pathological state resulting from the relative or absolute insufficiency or excess of one or more essential nutrients, whether this state manifests itself clinically or is detectable only by biological, anthropometric or physiological analyses. This definition excludes nutritional disorders related to metabolic errors or malabsorption [1]. However, people who are overweight or obese may also be affected by nutritional imbalance if their diet does not contain all the nutrients their body needs [2]. In young people, malnutrition is synonymous with growth disorders, with malnourished children being shorter and lighter than their age would like [3].

Nearly half (49%) of the household population is composed of children under 15 years of age [4]. The population is characterized by high growth. It has an increase of 66.08% every 22 years [5] [6]. More than 90% live from agriculture, however, there are cases of malnutrition and the severity depends on the age groups.

The most affected are children under 5 years old. More than half of children under 5 years old (56%) are too small for their age and are therefore stunted [4]. The causes of this malnutrition are multiple. There are those linked to low production due to rudimentary methods and the small size of arable land. There are problems related to low household income. There is also poor knowledge about nutrition. This means that even the available foods are not consumed according to the needs of the body for different age groups. This weighs heavily on the overall development of the country.

Malnutrition leads to poor growth and development of the human body [7]. Children suffering from malnutrition due to poor diet and/or recurrent infections are more exposed to serious diarrheal episodes. It thus becomes more susceptible to certain infectious diseases, such as malaria, measles and pneumonia, diseases that have a negative impact on its growth, leading to a vicious circle that is difficult to break [8]. Many studies have also shown that intellectual development is delayed or even stopped due to malnutrition at the age of less than 5 years [9]-[11]. This will increase the population with a low contribution to the country's development and gradually poverty sets in. It is in sub-Saharan Africa that we observe the prevalence of malnutrition among children to be very high [9]-[11]. This part of Africa records 64% of global mortality in the 0 - 4 age group and 78% of mortality in the 5 - 14 age group [12]-[14].

In Burundi, the rate of chronic malnutrition, or stunting, in children under 5 years old is 57.0%. The most affected groups are those aged 24 to 59 months according to Smart 2018. The Kabezi health district has a prevalence of chronic malnutrition of 55.5% and 6.0% of acute malnutrition; a rate higher than the WHO threshold

(Nzitunga 2023). In view of the above, we proposed to conduct a study on malnutrition in children under 5 years of age in the Kabezi health district during the period from 2015 to 2021 and especially among children hospitalized in a Kabezi hospital in order to contribute to the promotion of public health. The objective of the study was to assess the nutritional status of children born in rural areas.

2. Material and Methods

2.1. Geographical Location of the Kabezi District Hospital

The Kabezi district hospital is located in the west of the country, in the Kabezi commune, Migera zone on Kabezi hill in the province of Bujumbura. It is located at the following geographical coordinates: Latitude (3°32'00"), Longitude (29°20'32"), Altitude (790 m). The Kabezi health district serves a total population of 273,641, 15.5% of whom are children under 5 years old (Burundi). It is made up of 30 different health facilities (**Table 1**).

Table 1. Number of health facilities in the Kabezi Health District.

| Health structures | Public | Approved | Private | Total |
|-----------------------------------|--------|----------|---------|-------|
| Health Center | 14 | 4 | 8 | 26 |
| District Hospital (1st Reference) | 1 | 0 | 0 | 1 |
| Communal Hospital | 2 | 0 | 0 | 2 |
| Medical Clinic | 0 | 0 | 1 | 1 |
| Total | 17 | 4 | 9 | 30 |

2.2. Study Population

This study was carried out at the Therapeutic Stabilization Service (SST) of Kabezi Hospital with children under 5 years of age suffering from severe acute malnutrition coming for consultation for their nutritional care. The study was carried out for 7 months, from May to November 2021. It concerned the collection of data from previous years (from 2015 to 2020) plus data from 2021.

2.3. Type of Study

This was a descriptive cross-sectional study with retrospective data collection.

Included in the study are all the files of children under 5 years of age admitted to the therapeutic stabilization service suffering from severe acute malnutrition during the study period.

The following are not included in the study:

- ✓ Children whose files are poorly completed;
- ✓ Severely malnourished children over 59 months of age.

2.4. Data Collection Procedures

2.4.1. Data Collection Material and Study Variables

The data were collected from the hospitalization records of severely malnourished

children from 2015 to 2021 and by taking anthropometric (height and weight) measurements of children referred to the Outpatient Therapeutic Service (STA) and in consultation. The data to be collected concerned all of the child's anthropometric measurements: age, weight, height. All data on children admitted and registered at the STA from 2015 to 2020 were collected from the hospital registers. For 2021, the year of the study, they were collected on site as they were admitted to the STA. Thus, from 2015 to 2020, 99, 70, 76, 60, 80, and 60 children were registered respectively. In 2021, 53 were registered (**Figure 1**). Which gave a total of 498 children.

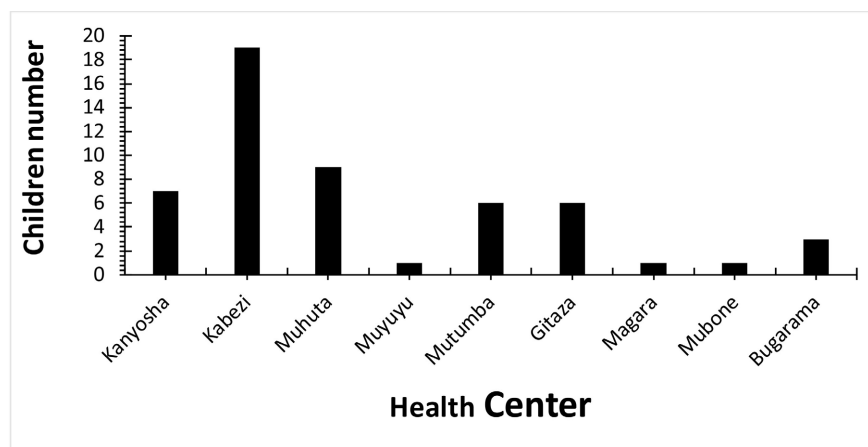


Figure 1. Children referred to Kabezi hospital in 2021.

2.4.2. Ethical Considerations

The survey was only conducted after obtaining the consent of the administration of the structure and the mother or accompanying person according to the consent proposal in the preamble to the survey form. In order not to disseminate medical confidentiality by revealing the identity of the child and medical data, each child was represented by a number.

2.4.3. Statistical Analysis

Data analysis was performed using IBM SPSS statistic 20. Results were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's multiple comparison test. Correlation between various parameters was also investigated. Significance was determined at $p < 0.05$ level and the results were expressed as mean values \pm standard error (SE). All tests were performed in triplicate.

3. Presentation and Discussion of Results

3.1. Children Referred to the Hospital in 2021 According to Their Origins

The Kabezi District Hospital serves an area of responsibility of 23 Health Center. Throughout 2021, 9 Health Center (or 39%) were able to transfer children to the Therapeutic Stabilization Service (SST) of the Kabezi hospital (**Figure 1**). We focused on the current year of study, to see the area where malnutrition still persists.

The results show that the Kabezi Health Center was the one that referred more malnourished children at a percentage of 37.5% of the total number of patients referred to the Kabezi health district hospital in 2021. The Muyuyu, Magara and Mubone sites referred only one patient each, which was equivalent to a percentage of 2.08%. Looking at these results, it is clear that there are many children who will have a poor future. Undernutrition affects the development of the child's brain, impairing learning and future earning capacity [15]. These conditions increase child mortality, deepen poverty, create profound intergenerational disadvantage, and hinder a country's economic future. Goal 2 of the Sustainable Development Goals (SDGs) calls for ending malnutrition in all its forms by 2030 [16].

3.2. Marasmus

The word marasmus comes from the Greek “marasmos” which means drying out. It can also mean athrepsia, starvation and sometimes used as a syndrome of [17]. According to the same author, marasmus is associated with nutritional deficiencies of folic acid, copper, iodine, vitamin A, vitamin B, vitamin C, vitamin D and vitamin K. This study revealed that since 2015 the number of marasmic children has decreased (Figure 2, curve E0). If the situation continues to improve at this rate (trend line = $Y = -1.9119x + 3912$), there will be 0 cases of marasmus in 2046. This is in line with the government's view that the country will be emerging in 2040. However, from 2021 to 2046, 20 years ago, which shows that there will be many people who have suffered from poor growth. This affects the country's overall development. Studies have reported that a child under 3 years old who has suffered from malnutrition diseases has poor growth, and weak intellectual and cognitive development cognitif [18] [19]. This implies that the government will have to take all possible measures to reduce cases of marasmus to zero as quickly as possible.

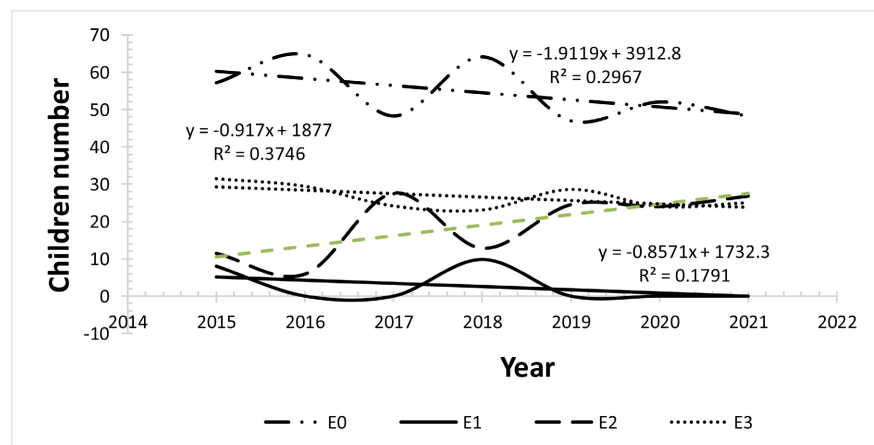


Figure 2. Evolution of edema from January 2015 to December 2021 (E0 represents the proportion of marasmic children; E1 represents the proportion of children who had edema on a single part of the body (generally on the cheeks, arms, legs); E2 represents the proportion of children who had edema on two parts of the body; E3 represents on tree parts of the body.

3.3. Kwashiorkor

Kwashiorkor and marasmus are two clinical syndromes observed in severe acute malnutrition. The depletion of antioxidants, vitamins and minerals was more severe in kwashiorkor than in marasmus. This was consistent with the severe and uncontrolled oxidative stress associated with the depletion of intestinal anaerobic bacteria and the relative proliferation of intestinal aerotolerant bacteria [20] [21].

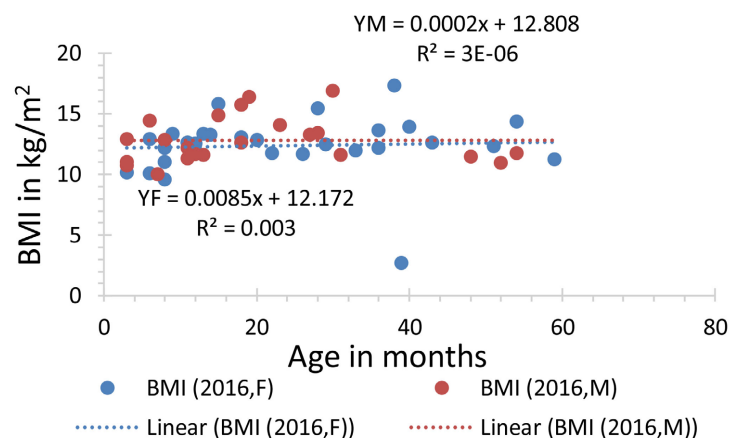
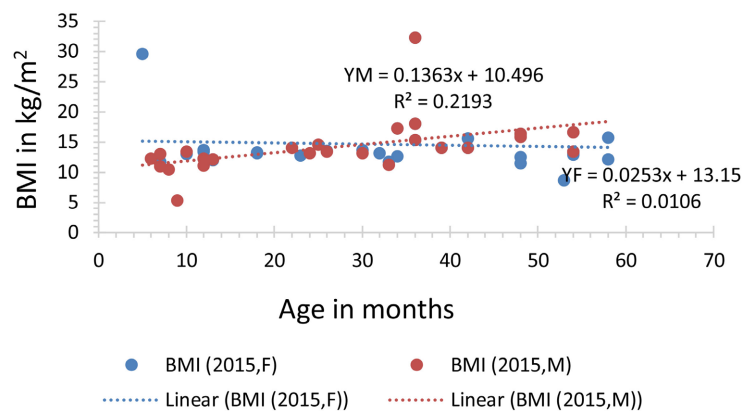
Kwashiorkor syndrome, one of the most common and severe forms of protein-energy malnutrition, is characterized by significant edema, skin and hair changes, neurological abnormalities, and hepatic steatosis [22]. In this study, the identification of children with Kwashiorkor was done based on the different presence of edema. **Figure 2** shows that edema can manifest in three ways: on one part of the body (usually on the cheeks, arms, legs) (E1), on two parts of the body (E2) and on three parts of the body (E3). This study revealed that during this entire period children presenting edema on three parts of the body are always high.

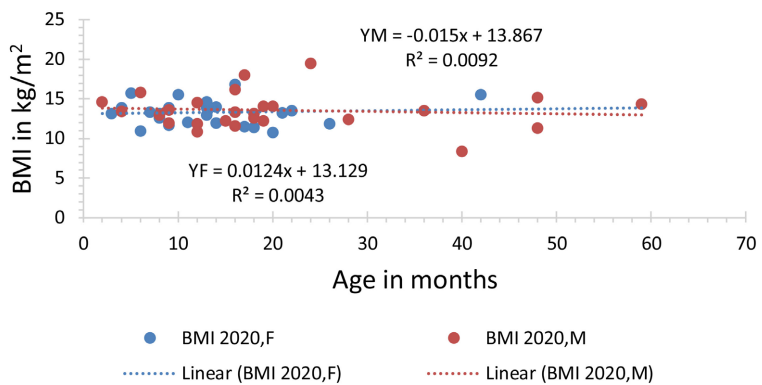
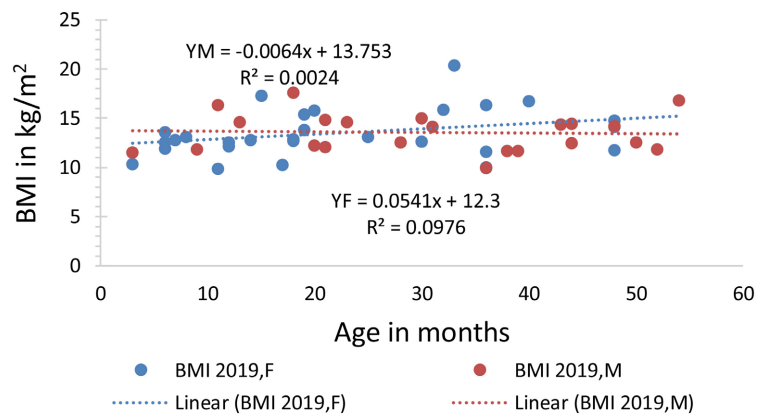
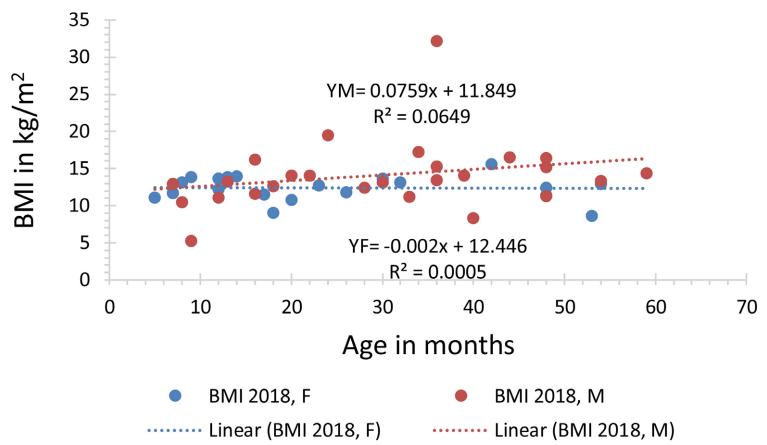
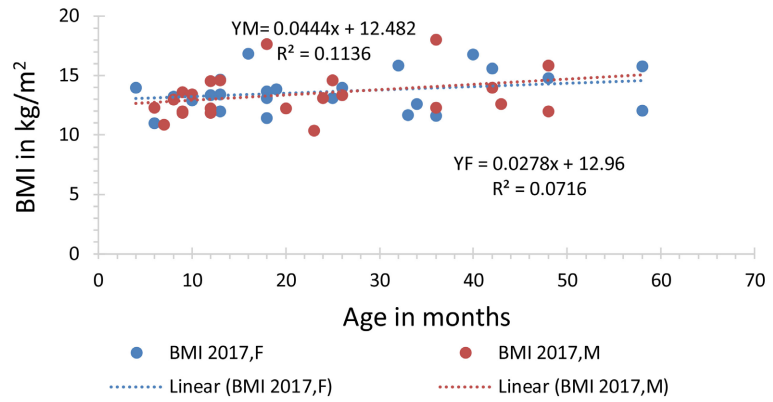
Highly significant differences ($p > 0.05$) were observed for a given year in this order: $E3 > E2 > E1$. This cannot directly explain why there are few children who present these signs on a body part, rather it is probably due to the fact that the population seeks health care facilities late. Based on the equation of the trend curve ($y = -0.8571x + 1732.3$), we see that the number of children with edema on one side would have been zero in 2021. However, this is to be treated with an eye. Opposite phenomena have been observed in children with edema on two sides. Instead of evolving positively, the number of patients increases over the years. The trend curve is an increasing linear function ($y = 2.8289x - 5689.8$). Although the numbers are high in children with edema on three sides, we realize that the patients decrease over time. However, to reach zero cases of children with edema on three sides will take a long time. According to this trend equation ($y = -1.9119x + 3912.8$), the disease will end in 2046. By comparing the “curves” (E1, E2 and E3), patients go to the hospital after noticing edema on two parts of the body.

3.4. Evolution of the Ponderal Index of Children

Birth weight shows the nutritional status of the child and the mother at the time of conception. It also indicates the speed of the child’s growth after birth and has repercussions on the child’s life [23]. The results show that, during the 7 years, children under 5 years of age in the Therapeutic Stabilization Service of the Kabezi health district hospital were characterized by a state of malnutrition. A positive correlation was observed between BMI and age for both girls and boys for the years 2015, 2016, 2017 and 2021, for boys only the year of 2018, for girls only the year of 2019 and 2020 (**Figure 3**). Based on the WHO Child Growth Standards curve based on length/height, weight and age [24], it was revealed that at the corresponding age, the children of the therapeutic center are very far from the aver-

age. For example, at 10 months WHO stipulates that BMC varies from 13 to 20 [24], while these children of Kabezi vary from 5 to 15 (Figure 3). In addition to the results on marasmus and kwashiorkor, these data on BMI, provide concrete information on the nutritional status of children. The trend of BMI in developing countries instead of turning into underweight is turning into overweight. At the time when the average BMI was 14 kg/m², in Peru it was 18 kg/m² [25]. The nutritional status of these children being lower than the average, intertropical climate characterized by great biological diversity; which supposes that in Kabezi can grow diverse plants. In addition, Kabezi touches Lake Tanganyika which contains a multitude of fish. Thus, whether it is breastfeeding mothers or infants, there are fewer products of diversified and nutritionally rich foods. Studies have reported that even natural forest ecosystems can provide food to diversify. A dozen plant species were found with significant contents of oils of different composition including omega 3 and 6 [26] [27] essential for the development and growth of the child. Through these same results, it was revealed that the years 2018 (for girls), 2019 (for boys), 2020 (for boys) were characterized by a negative slope, which supposes that a small evolution was recorded according to age. However, there is no scientific justification for this state of affairs, or there is an evolution either in girls only or in boys only.





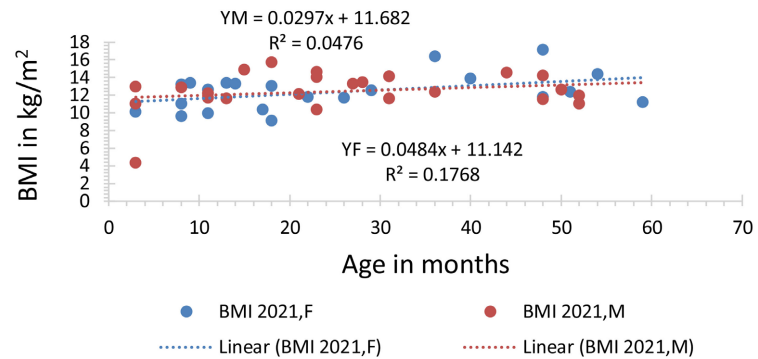


Figure 3. Body Mass Index evolution curve from 2015 to 2021 (YM = Trend curve equation for males, YF= Trend curve equation for females).

3.5. Evolution of the Weight Index of Children under 5 Years of Age since 2015 to 2021

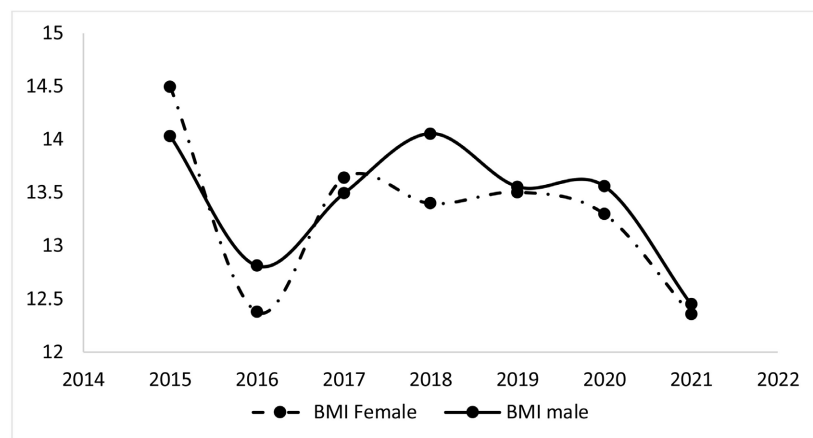


Figure 4. Evolution of the average weight-to-height ratio for children under 5 years old from 2015 to 2021.

Since 2015, cases of children suffering from malnutrition diseases have been observed that persist. The average BMI for these children decreased over the years (**Figure 4**). This last table shows us that those who were sick never exceeded the BMI of 14.5 kg/m² during the 7 years. The evolution since 2015 has been characterized by a deterioration in the health of children under 7 years. Since we do not have such data available for Burundi for comparison, let us talk about the average BMI of other countries to give us an idea. In 2016, the BMI in Ethiopia was 16.6 kg/m², in India it was 17.5 kg/m², in Peru 20.8 kg/m² and in Vietnam 18.7 kg/m² [25]. In this present study of Burundi, in the same year of 2016, very low values of BMI (12.8 kg/m²) were recorded in patients. Probably these results were the consequence of the crisis that the country experienced in 2015 [28] [29]. In the 4 years (2017, 2018, 2019 and 2020) that followed, a small improvement was observed where the average had turned around 13 kg/m². Surely, there are many causes that prevent the provision of sufficient food such as the smallness of the land, the population that increases at a galloping pace and others. It was also noted that like

2016 which followed a crisis of 2015, 2021 which followed the electoral periods were also characterized by very low BMI values (12.4 kg/m²).

4. Conclusion

In light of these results, it was found that children under 5 years of age who suffered from acute malnutrition still existed in Burundi. From 2015 to 2021, this study revealed the presence, at the Kabezi health district hospital, of children suffering from kwashiorkor and marasmus. During the year 2021, out of 23 HEALTH CENTERS that made up the Kabezi Health District, 9 (or 36%) still recorded cases of severe malnutrition. Based on the results of the presence of edema, the trend curves showed a positive evolution but at very low slopes that projected the disappearance of malnutrition cases by the year 2046. The status of children under 5 years old was also evaluated using the Body Mass Index. During all 7 years, values of 5 kg/m² were recorded while the average was around 10 kg/m². These results show that there may be children who will have very serious consequences due to malnutrition even in adulthood like low physical and intellectual productivity, which gives them poor learning abilities, osteoporosis due to low calcium accumulation, increased risks of developing chronic diseases [30]. This state of affairs will negatively impact the overall development of the country, which requires synergy of efforts by all stakeholders (responsible for health care, education, agriculture, public authorities, etc.) to prevent them.

Conflicts of Interest

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

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