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Evaluation of Nutritional Management of Acutely Malnourished HIV-Infected Children Aged 0-59 Months at the Institute of Nutrition and Child Health in Guinea

Kolie Fassou[1, 2, *], Diakite Djiba[3], Sow Abdoulaye[3], Sidibe Sidikiba[3, 4], Amadou Sadjo Diallo[5], Delpeuch Francis[1], Alexandre Delamou[3, 4]

[1]Health Department, Senghor University of Alexandria, Alexandria, Egypt

[2]Food and Nutrition Division, Ministry of Health and Public Hygiene, Conakry, Guinea

[3]Faculty of Health Sciences and Techniques, Gamal Abdel Nasser University, Conakry, Guinea

[4]African Centre of Excellence for the Prevention and Control of Communicable Deseases, Faculty of Health Sciences and Techniques, Gamal Abdel Nasser University, Conakry, Guinea

[5]Faculty of Sciences, Gamal Abdel Nasser University, Conakry, Guinea

Email address:

koliefassou73@gmail.com (Kolie Fassou), djibadiakite943@gmail.com (Diakite Djiba), drsowab@msn.com (Sow Abdoulaye), layesidikiba@gmail.com (Sidibe Sidikiba), dasgobicko2000@yahoo.fr (Amadou Sadjo Diallo), francis.delpeuch@ird.fr (Delpeuch Francis), adelamou@gmail.com (Alexandre Delamou)

[*]Corresponding author

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Abstract: Context: In the Republic of Guinea, undernutrition and inadequate health care are responsible for many child deaths every year, victims of the vicious circle between malnutrition and infectious diseases. Acute malnutrition in young HIV-infected children is a particular problem. Aims: Objective: To evaluate the nutritional management of children, and compare the evolution of malnourished children hospitalized according to their HIV status. Methods: A 6-month evaluative descriptive study study of 130 children aged 0-59 months. A case of moderate acute malnutrition was defined for a P-T index < -2 Z-score, and a severe case for a P-T index < -3 Z-score. HIV serology was confirmed by second-generation immune cum. Results and Discussion: 40 children (31%) were infected with HIV. All suffered from acute malnutrition, 97% of them severe. The occurrence of diarrhea ($p<0.001$) and malaria ($p = 0.013$) was statistically associated with HIV+ status, while the absence of weight gain ($p<0.001$) and stabilization ($p<0.001$) was also associated with the HIV+ status of malnourished children. Death in acutely malnourished children was statistically associated with HIV status ($p<0.001$), with a death rate of 60% versus 7% in HIV-negative children. Conclusion: The death rate among HIV+ children is alarming. Prevention of mother-to-child transmission remains essential.

Keywords: Assessment, Acute Malnutrition, Child Aged 0-59 Months, HIV, Guinea

1. Introduction

According to the World Health Organization (WHO), malnutrition is a pathological condition resulting from a relative or absolute deficiency or excess of one or more essential nutrients, whether manifested clinically or detected only by biochemical, anthropometric, or pathophysiological analyses [1]. The concept of malnutrition covers three major groups of conditions: the first is undernutrition, which includes stunting, wasting, and underweight; the second is micronutrient malnutrition, which includes micronutrient deficiency (lack of essential vitamins and minerals) or excess of micronutrients; and the third includes overweight, obesity and diet-related non-communicable diseases such as diabetes and cardiovascular disease [1, 2].

In 2021, 45 million children under the age of 5 suffered

from wasting, the deadliest form of childhood malnutrition. In the World Health Organization (WHO) African Region, 7.3 million children suffered from wasting in 2019. Undernutrition plays a role in around 45% of deaths in children under the age of 5. These deaths occur mainly in low- and middle-income countries. At the same time, in these same countries, rates of overweight and obese children are on the rise [1-3].

Malnutrition is a public health problem in Guinea. According to the SMART survey carried out in 2022, the prevalence of global acute malnutrition was 6.7%, of which 1.3% was severe, and that of stunting was 25.5%, of which 8.4% was severe [4]. Concerning micronutrient deficiencies, anemia affects nearly eight out of ten children (77%), according to data from the Demographic Health Survey (DHS). Nationwide, only 41% of children under five have received vitamin A supplements [5].

As for Human Immune Virus (HIV), according to the WHO, 39 million people were living with HIV worldwide in 2022, and 1.3 million people were newly infected with HIV in the same year [6]. In Guinea, HIV prevalence is particularly high among women (1.9%), who account for 52% of all adults living with HIV [7].

However, the number of people living with HIV is said to be on the rise, as a direct consequence of the increased life expectancy of people living with HIV (PLHIV) thanks to antiretroviral treatment (ARV), and the consequent fall in AIDS-related deaths [8]. Mother-to-child transmission is the predominant way in which children are infected with HIV worldwide. However, vertical transmission is close to zero in many countries [9]. Vertical transmission of HIV is the main route by which children are infected with HIV in Guinea. An HIV-infected woman can transmit the virus to her child during pregnancy, childbirth, or breastfeeding. In the absence of any intervention, the combined risk of transmission from mother to child in utero and during childbirth is 15 - 30% and the increased risk in breastfed children is 20 to 45% [10, 11]. According to the 2016 UNAIDS report, Guinea, with 293 prevention of mother-to-child transmission (PMTCT) sites throughout the country, was unable to curb the ever-increasing mother-to-child transmission of HIV.

In Guinea, as in all developing countries, poverty, malnutrition, and inadequate health services are responsible for the deaths of millions of people every year, the majority of them children who die malnourished, victims of the vicious circle between malnutrition and five or six infectious diseases [12, 13]. In addition to severe acute malnutrition, specific micronutrient deficiencies also have an impact on immunity, leading to an increased risk of mortality from infection [14, 15]. Acquired immunodeficiency secondary to malnutrition leads to a fall in defense potential, and hence lower resistance to infection [12, 13].

Studies have shown that adult and pediatric patients who start antiretroviral treatment while suffering from malnutrition are two to six times more likely to die within the first six months of treatment than well-nourished patients [16, 17].

The above background led us to the following question: is the nutritional management regimen at INSE for malnourished HIV-infected children aged 0-59 months effective in improving their nutritional status?

Thus, this study aimed to evaluate the performance of nutritional management of acutely malnourished HIV-infected children aged 0-59 months received at the Institute of Nutrition and Child Health (INSE) in Guinea.

2. Materials and Methods

We conducted our survey in the Nutrition-Food Department of the Donka Institute of Nutrition and Child Health (INSE).

2.1. Type and Period of Study

This was an evaluative descriptive study. The study extended over six months, from May to October 2018.

2.2. Study Population

The study population consisted of acutely malnourished children aged 0-59 months received at INSE in Guinea.

2.3. Inclusion Criteria

All acutely malnourished children aged 0-59 months received and/or hospitalized at INSE de Guinée at the time of the survey were included.

2.4. Exclusion Criteria

All acutely malnourished children aged 0-59 months whose mothers refused hospitalization at INSE at the time of our survey were excluded.

2.5. Sampling

Sampling was exhaustive since all acutely malnourished children aged 0-59 months hospitalized at INSE at the time of the study were selected. The sample size was 130 acutely malnourished children aged 0-59 months.

2.6. Data Collection

A dual approach was used to collect quantitative data. The first consisted of administering a questionnaire to the mothers of malnourished children, while the second was based on documentary analysis using consultation registers and patient files. Survey forms were pre-established as data collection tools. As soon as the children were received, anthropometric parameters were measured: weight using a Salter scale (children aged 6-59 months) or a baby scale (children aged 0-5 months), and height using a toise, in the supine position for children whose height was less than 87 cm, and in the standing position for children whose height was greater than or equal to 87 cm. Determination of acute malnutrition was based on the weight-for-height (WFH) index in z-score relative to the median of the WHO growth standard, with the following thresholds: moderate malnutrition if the WFH index < -2 z-score and ≥ -3 z-score, severe malnutrition if the WFH index < -3 z-score [18]. Anemia was determined from hemoglobin (THb) determination using the hemocue and classified

according to WHO standards. A child was considered anemic if THb was below 11 g/dl. Children with hemoglobin levels greater than or equal to 11g/dl were considered not anemic [19].

2.7. Dependent Variable

The dependent variable in this study was the discharge criterion for acutely malnourished children aged 0-59 months. If the acutely malnourished children had HIV, the variable was coded as "1", and if the acutely malnourished children had no HIV, the variable was coded as "0". Discharge criteria for HIV-infected malnourished children aged 0-59 months were classified according to the WHO standard sphere: death rate, drop-out rate, average weight gain, and average length of stay [18].

The death rate was classified as "acceptable" if it was < 5% and "alarming" if it was 15%. The dropout rate was classified as "acceptable" if it was < 15% and "alarming" if it was > 25%. Weight gain was calculated as follows: Weight Gain = [Output weight (g) - Minimum weight (g)/ Minimum weight (kg)] /Total number of days. Mean weight gain was classified as alarming (mean weight gain less than 8g/kg/d) and acceptable (mean weight gain greater than or equal to 8g/kg/d) [18]. The mean length of stay was classified as alarming (mean length of stay greater than 6 weeks) and acceptable (mean length of stay less than 4 weeks) [18].

2.8. Independent Variables

Independent variables included: i) sociodemographic data: child's age (< 24 months; 24 to 59 months), child's sex, child's weight during hospitalization, type of breastfeeding, area of residence, mother's educational level, mothers' occupation; ii) biological data: hemoglobin assay (THb), thick drop (GE), retroviral serology (SRV); iii) associated infections or pathologies: digestive candidiasis, bronchitis, malaria, diarrhea, anemia; iv) therapeutic aspects: on antiretroviral treatment or not.

For nutritional management, all children received F75 therapeutic milk (children aged 6 months and over) and diluted F100 milk (children under 6 months) from the first day of hospitalization, in phase 1. In the transition phase, children received F100 milk every 3 hours for a total of 8 meals a day. In phase 2, children received F100 milk every 3 hours for a total of 6 meals a day. After stabilization, the children were transferred to CRENAS for follow-up.

2.9. Data Analysis

The data collected was entered into Excel 2013 and then exported to Stata 14.2 for analysis. Data were coded and cleaned. Data consistency was checked by running frequencies and cross-tabulations. Descriptive statistics were used to calculate percentages and averages. The relationship between the HIV status of acutely malnourished children and the independent (explanatory) variables was highlighted using Pearson's Chi 2 test. Finally, the discharge criteria (drop-out rate, death rate, average weight gain, and average length of stay) were compared with the performance indicators of a WHO CRENI [18].

3. Results

3.1. Characteristics of Participants

The sample was made up of 53% girls, nearly 75% of the children were under 24 months old, and 66.9% were anemic. It should also be noted that 78% of the mothers of these children had no education and 57% were unemployed (Table 1).

Table 1. *Sociodemographic, clinical, and anthropometric characteristics of acutely malnourished children at INSE Donka in 2018.*

Variables	Categories	Number	Percentage
Gender	M	61	46.9
	F	69	53.1
Age group (months)	< 24	98	75.4
	24–59	32	24.6
Children's HIV status	HIV+	40	30.8
	HIV-	90	69.2
Mothers' HIV status	HIV+	40	30.8
	HIV-	90	69.2
Anemia	No	43	33.1
	Yes	87	66.9
Weight gain level (g/kg/d)	≤ 10	85	65.4
	> 10	45	34.6
Type of breastfeeding	Combined	117	90.0
	Artificial	13	10.0

3.2. Relationship Between HIV Status and Diseases

Acute malnourished children infected with HIV (HIV+) were at greater risk of diarrhea (p = 0.000) and malaria (p = 0.013) compared with acute malnourished children not infected with HIV (HIV-) (Table 2).

Table 2. *Relationship between HIV status and risk of various diseases in acutely malnourished children at INSE Donka in 2018.*

Variables	Categories	HIV status-	HIV status+	p
		n (%)	n (%)	
Malaria	No	76 (74.5)	26 (25.5)	
	Yes	14 (50.0)	14 (50.0)	0.013
Anemia	No	30 (69.8)	13 (30.2)	
	Yes	60 (69.0)	27 (31.0)	0.926
Candidosis	No	14 (66.7)	7 (33.3)	
	Yes	76 (69.7)	33 (30.3)	0.781
Bronchitis	No	35 (72.9)	13 (27.1)	
	Yes	55 (67.1)	27 (32.9)	0.486
Diarrhea	No	83 (86.5)	13 (13.5)	
	Yes	7 (20.6)	27 (79.4)	<0.001

3.3. Relationship Between HIV Status and Performance Indicators

Exposure to death was higher (p = 0.000) in acutely malnourished HIV+ children than in acutely malnourished HIV- children. Acute malnourished HIV+ children were less likely to gain weight during hospitalization (p = 0.001) than acute malnourished HIV- children. Non-stabilization was also associated with HIV+ status (p = 0.000). On the other hand, treatment discontinuation was not statistically different between HIV+ and HIV- status (p = 0.130) (Table 3).

Table 3. *Relationship between HIV+ status and hospital course of acutely malnourished children at Donka INSE in 2018.*

Variables	Categories	HIV status-	HIV status+	p
		n (%)	n (%)	
Malaria	No	76 (74.5)	26 (25.5)	
	Yes	14 (50.0)	14 (50.0)	0.013
The average length of stay (< 4 weeks)	No	7 (77.8)	2 (22.2)	
	Yes	83 (68.6)	38 (31.4)	0.438
Weight gain level (≥ 8g/kg/d)	No	40 (57.1)	30 (42.9)	
	Yes	50 (83.3)	10 (16.7)	0.001
Stabilization	No	8 (22.2)	28 (77.8)	
	Yes	82 (87.2)	12 (12.8)	<0.001
Discontinuation	No	87 (70.7)	36 (29.3)	
	Yes	3 (42.9)	4 (57.1)	0.130
Death	No	84 (84.0)	16 (16.0)	
	Yes	6 (20.0)	24 (80.0)	<0.001

Table 4. *Performance indicators for the care of malnourished children aged 0-59 months at Guinea's INSE according to their HIV status at Donka INSE in 2018.*

WHO performance indicators *			HIV status	Discharge results for acutely malnourished children	Evaluation
Indicators	Acceptable	Alarming			
Death rate	< 5%	> 15%	HIV-	6 %	± Acceptable
			HIV+	60%	Alarming
Abandonment rate	< 15%	> 25%	HIV-	3%	Acceptable
			HIV+	10%	Acceptable
Weight gain level	≥ 8g/kg/d	< 8g/kg/d	HIV-	9.8 g/kg/d	Acceptable
			HIV+	5.6 g/kg/d	Alarming
The average length of stay	< 4 weeks	> 6 weeks	HIV-	< 4 weeks	Acceptable
			HIV+	< 4 weeks	«Alarming»*

* Discharge results for acutely malnourished children were compared with WHO performance indicators.

3.4. Performance Indicators for the Management of Severe Acute Malnutrition

In HIV-infected acutely malnourished children, the death rate was 60% versus 6% in HIV-uninfected acutely malnourished children. In HIV-infected acutely malnourished children, mean weight gain was 5.6 g/kg/d versus 9.8 g/kg/d in HIV-uninfected acutely malnourished children. The average length of stay was less than 4 weeks for HIV-infected acutely malnourished children (Table 4).

The average length of stay for HIV+ acutely malnourished children was less than 4 weeks because most of them had died, so it was classified as "alarming".

4. Discussion

Our study aimed to assess the quality of care provided to acutely malnourished children at INSE Donka according to their HIV status. Of 130 acutely malnourished children, 30.8% were HIV-infected. This result is similar to that of Nguefack F [19, 20] in 2015 in Cameroon, who found 32.9%. This result is higher than that of a study carried out in a reference health center in Bamako, where HIV prevalence among malnourished children was 13.5% [21]. Most of the children's mothers were housewives with a low level of education. All the acutely malnourished HIV-infected children were born to HIV-positive mothers who had not attended antenatal clinics and had just learned their HIV status for the first time. Most of these cases of acute malnutrition were because mixed breastfeeding was practiced by the majority of mothers, with the early introduction of solid foods into the child's diet a highly probable cause of diarrhea and malnutrition.

In our study, HIV+ acutely malnourished children developed the most diarrhea. Our results differ from those found by Creek TL et al. who conducted a study in Botswana in 2006 on 153 non-breastfed children with diarrhea, of whom only 18% were HIV-positive [22]. The high frequency of diarrhea in HIV-acutely malnourished children is thought to be due to a dual alteration in their immunity.

In this study, we observed the presence of malaria in HIV-acutely malnourished children. Dia Sanou et al. in Burkina Faso, in a study published in 2008, following 61 children grouped in the Guilongou village orphanage, found malaria in 7.78% of cases [23]. Another study focusing on the impact of malaria on viral replication by Martin-Blondel et al. also demonstrated the interaction between malaria and HIV [24]. The low frequency of malaria in hospitalized acutely malnourished children could be explained by the systematic treatment of malaria in children in most acute malnutrition management centers.

In that study, we found no statistically significant relationship between anemia and HIV status in acutely malnourished children at INSE. Our results differ from those found by Costa K. Mwadianvita et al. who conducted a study between May 2010 and May 2011 of anemia in antiretroviral treatment-naive HIV-positive children in Lubumbashi, DRC, involving 152 children, and found that 11.4% of severe anemia was significantly associated with HIV clinical stage [25].

Our study showed that weight gain of less than 5g/kg/d was statistically associated with HIV status and stabilization.

Nguefack F et al. in Cameroon found that weight gain of less than 5g/kg/d was not significantly associated with the stabilization of children [20].

We found very low drop-out rates, below the WHO acceptability threshold. These results differ from those found by Emmanuel Goumou et al. who carried out a study between April 2011 and September 2012 on the drop-out factors for nutritional recovery of children under five in Guinea and found a higher drop-out rate. The main causes identified were family burdens (44.19%) and caregiver travel (37.21%) [26]. This difference could be explained by the fact that our study focused on hospitalized children, whereas theirs involved outpatient children. Hospitalization of malnourished children promotes good nutritional recovery and considerably reduces the drop-out rate.

One of the main findings of our study was that the death rate among HIV-positive children was "alarming" with WHO indicators. Our results are far superior to those of Mali, with a death rate of 22.2% among HIV+ malnourished children and 5.2% among HIV- malnourished children [21].

In a similar study in 2011 on the epidemiological, clinical, and evolutionary profiles of HIV-infected malnourished children at the Intensive Nutritional Therapeutic Unit of the pediatric ward of the Jason Sendwe referral hospital in Lubumbashi, DRC, TP Ngwej et al. found a death rate among HIV+ malnourished children equal to 43.8% and 5.6% among HIV- [27]. These studies in different countries highlight the complexity of nutritional management in HIV+ malnourished children. This could be explained, on the one hand, by the lack of a specific scheme for their management, and on the other, by the poor application of the officially monitored scheme.

In their study, Loze et al. conducted a study between January 2010 and December 2011 of HIV-infected children hospitalized for SAM in three hospitals in Ouagadougou; they looked at the effect of ARV treatment on 89 children, all benefiting from the WHO 2012 nutritional protocol, and found a death rate of 34% [28]. This difference with our study could be due to the the HIV-positive SAM children in our study were not treated with ARVs. This was due to the shortage of ARVs in the country at that time. A comparison of these two studies suggests that HIV+ malnourished children benefit from receiving ARV treatment during their nutritional care.

The average length of stay was less than 4 weeks for acutely malnourished HIV-infected children but was considered "alarming" given that most of these children died before the 4th week.

5. Conclusion

The study carried out at Guinea's INSE clearly shows that while the death rate among HIV-negative malnourished children is close to the rate considered acceptable, reflecting fairly satisfactory nutritional management, the death rate among HIV+ children not treated with ARVs is alarmingly high, well above the WHO threshold.

Early screening during prenatal consultations, prevention of mother-to-child transmission (PMTCT) of HIV, and treatment of HIV-infected children remain the most effective means of ensuring the well-being of children under five.

ORCID

Kolie Fassou: 0009-0003-7609-1017

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Conflicts of Interest

The authors declare no conflicts of interest.

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