Maternal and Pediatric Nutrition Journal

Adedemy et al., Matern Pediatr Nutr 2016, 2:2
http://dx.doi.org/10.4172/mpn.1000109

Research Article Open Access

Screening for Malnutrition and Nutritional Care in HIV-Infected Children Followed up in the Pediatric Unit of CNHU-HKM in Cotonou

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Abstract

Objective: This study aims to screen malnutrition and assess the effect of systematic nutritional care on the growth of HIV-infected children followed up in the Pediatric Unit of the HKM National University Teaching Hospital (CNHU HKM) in Cotonou.

Method: It is a pilot intervention, descriptive and prospective survey, which was conducted from September 15, 2014 to August 28, 2015 with an exhaustive sampling.

Results: 96 children were included in the study. Sex ratio was 1. On inclusion, malnutrition frequency was 11.45% for severe malnutrition, 15.62% for moderate malnutrition.72.93% of children had a good nutritional status. Comorbidity was found in 29.16% of children 6 months before the intervention started. Among the children included, 71% were at WHO clinical stage 1. At the end of the study, 51.04% were lost to follow up and severe malnutrition frequency was 4.25%, the one of moderate malnutrition was 12.76%, and 82.99% of children followed up enjoyed a good nutritional status. Factors associated with malnutrition were WHO clinical stage (p = 0.00), micronutrient supplementation (p = 0.02) and immunological stage (p = 0.01).

Conclusion: In HIV-infected children receiving ART, nutritional support should be compulsory in order to improve child care in the different cohorts.

Keywords: Screening; Malnutrition; HIV care children

Introduction

Growth is a characteristic of childhood and the harmonious somatic, psychomotor and cognitive development of the latter depends on its nutritional status. In Sub-Saharan Africa, this harmonious growth is impeded by different situations, including malnutrition which seriously affects childhood. In fact, 21% of children under five years of age suffer from underweight, 39% from constitutional growth delay (CGD) and 9%, from failure to thrive [1]. Through the irreversible damages that it causes, malnutrition significantly affects children's cognitive development [2]. It is also the indirect cause of 35% of infant and child death in countries with limited resources [3]. It remains a classification criterion for HIV that it clinically complicates; as well, at socioeconomic level, it represents a major development issue in those countries. Actually, more than 90% of people living HIV in the world live in Sub-Saharan African countries, i.e., more than 3.3 million children, according to UNAIDS sources in 2012 [4]. As regards children with HIV infections, malnutrition creates a permanent vicious circle that health care provider must urgently break to restore well-being in those children. In Sub-Saharan African countries, delayed growth was reported in about 50% of cases in HIV-infected children with three times more risk of dying than in non HIV-infected children [5,6]. The introduction of highly active antiretroviral therapy (HAART) raised hope for correction of growth delay [7,8]. However, the effect of only ART remains insufficient to correct that delay or retardation, thus the need for nutritional support in HIV-infected child care. According to WHO recommendations, people living with HIV have increased energy needs estimated at 10%, 20 to 30 % in case of signs suggesting symptomatic HIV infection or opportunistic infections, and 50 to 100% in case of severe malnutrition [9]. Recent pathophysiological data on child malnutrition and clinical trials on micronutrients [10] and macronutrients [11], supplementation in HIV-infected children on ARV helped improve their nutritional status. In this context, authors deemed it appropriate to determine malnutrition frequency among HIV-infected children attended in the HKM National University Teaching Hospital (CNHU HKM) of Cotonou and assess nutritional care impact on their growth.

Materials and Method

The study was performed in the CNHU-HKM Pediatrics and Medical Genetics Clinic from September 15, 2014 to August 28, 2015 in Cotonou, with a 6-month inclusion period.

Type of study: It is a pilot intervention, descriptive, prospective and analytical study. Study population: children aged 0 to 15 years followed up for HIV-infection in the said unit/clinic.

Inclusion criteria: To be included or involved, children should be followed up in the CNHU-HKM Pediatric Unit during the study period, they should have HIV diagnosis confirmed (positive serology for those above 18 months of age and positive PCR regardless of age), be under 10 years at the time of inclusion and their parents should have given their informed consent to participate to the study.

Exclusion criteria: HIV-infected children suffering from severe acute malnutrition with complication which requires in-patient care

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Received April 04, 2016; **Accepted** April 18, 2016; **Published** April 29, 2016

Citation: Adedemy JD, Zohoun L, Alihonou F, d'Almeida M, Couringa Y, et al. (2016) Screening for Malnutrition and Nutritional Care in HIV-Infected Children Followed up in the Pediatric Unit of CNHU-HKM in Cotonou. Matern Pediatr Nutr 2: 109. doi:10.4172/mpn.1000109

were excluded. Recruitment was exhaustive with consecutive inclusion of all children meeting the eligibility criteria.

Conduct of the study

Weight was measured by means of an electronic baby scale for children with less than 15 kg (100 g precision) and with an electronic scale for those with more than 15 kg (100 g precision). Size was measured in supine position by using a horizontal height gauge for children under 24 months of age and in standing position by using a wall height gauge in children above 24 months of age. Weight and size data enabled to build anthropometric indicators. The medical records of children attended in the unit helped fill in the missing information. Data were collected on a data form designed for that purpose.

All the children selected were screened for malnutrition on inclusion and on each monthly follow up consultation (M1, M2, M3, M4, M5 and M6). Regarding children under 5 years of age malnutrition was defined taking into account WHO classification [12], based on several anthropometric indicators expressed in Z-score: The Weight-for-Height (WHZ) score which determines failure to thrive or acute malnutrition; the Weight-for-Age (WAZ) score which determines growth retardation, the Height-for-Age (HAZ) score which determines delayed growth or chronic malnutrition.

After screening, those children were classified into three (03) categories depending on nutritional care : the 1st Group (G1) was the one of children with good nutritional status and whose WAZ anthropometric index was between -2 and +2 Z-score ; the 2nd Group (G2) was the one of moderately malnourished children with WAZ anthropometric index lower than -2 Z-score and higher or equal to -3 Z-score and the 3rd Group (G3), the one of severely malnourished children with WAZ anthropometric index lower than -3 Z-score. For the children above 5 years of age we used Body Mass Index (BMI) for age. At the end of monitoring, the three groups were respectively reconsidered as G1', G2' and G3'according to the criteria mentioned above.

The main assessment criterion was catch up of normal growth in relation to age after 6 months in children considered as malnourished on inclusion. It was defined as the passage from Z-score lower than -3 to Z-score higher or equal to -2 for severely malnourished children at the beginning of the intervention. Passage from Z-score lower than -2 to a Z-score higher than or equal to -2 for moderately malnourished children at the beginning of the intervention. The same limits were used for children above 5 years of age through BMI.

On each follow-up consultation, after weight and size measurement, each child was examined in order to detect comorbidities. Then, micronutrient supplementation (Iron, Foldine, and Vitamin A) and deworming with albendazole were done. At the end of consultation, nutritional counseling and/or nutritional support were provided according to child condition. Concerning children with good nutritional status, nutritional advices were given to parents, those with moderate malnutrition benefitted from « Cereso » local flour and those with severe malnutrition benefitted from ready-to-use therapeutic foods (RUTF) of Plumpy Nut type. « Cereso » flour is an instant flour of which 100 g contain 80 g of Carbohydrate, 9 g of Protein, 3 g of lipids and vitamin PP, C, B12, B1, B2 and A. Caloric intake for 100 g of that flour is 392 kcal. We presented small bags of 400 g and 1 kg. In this regard, all the children under 2 years of age moderately malnourished benefitted from 200 g of « Cereso » a day i.e., ½ bag of 400 g per day during 1 month. Children above 2 years of age received 250 g of « Cereso » a day i.e., ¼ of bag of 1 kg a day (1 bag of 1 kg every 4 days during one month).

Total Parenteral Nutrition (TPN) was only reserved to severely malnourished children without complication. The Plumpy-Nut used in this study is a peanut-based high-calorie and ready-to-use paste without neither dilution nor previous cooking with high nutritional value, wrapped in an individual packing case. One bag of 92 g provides 500 kcal [13]. Therefore, all the severely malnourished children under 2 years of age benefitted from 2 bags a day during 1 month. Children above 2 years of age received 3 bags of Plumpy-Nut a day during one month.

Children on ART had been reexamined once a quarter to benefit from dosage adjustment for ART but once a month for their weight monitoring and management.

Study variables: the study variables were weight and size, measured in a standardized manner with the same measurement appliance, socio- demographic characteristics, disease clinical stage, and immunologic characteristics: CD4 cell count which enables to define degree of immunodeficiency according to age, therapeutic and outcome characteristics at the end of follow up.

Statistical processing and analysis of data

Anthro Plus software and metric conversion calculator supplied by WHO served to calculate Z-Scores and to identify type of malnutrition. The quantitative data were presented in the form of average with standard deviation and the qualitative ones as percentages. Pearson's Chi-2 Test and Fisher's exact Test were used for qualitative variables and the one of Kruskal-Wallis for quantitative variables.

Ethical and professional considerations

The protocol was approved by the ethics committee of CERBA. It is a study with direct individual benefit for the child and indirect benefit for his family. The intervention aimed to reduce disease complications in the child and facilitate work for the person in charge of child care. An information note was proposed and written consent had been requested from a parent or custodian of the child during inclusion. The foods proposed were previously subject to several studies among the general population and they do not involve any major risks for health. Data were anonymous upon collection of the paper.

Results

Out the 110 children attended in the unit and meeting inclusion criteria, 96 had been recruited for the study (i.e., 87.27%).

Nutritional profile of included children

Among the 96 included children, 11 were severely malnourished (11.46%, G3), 15 moderately malnourished (15.62%, G2) and 70 children had a good nutritional status (72.91%, G1). The flow graph of HIV-infected children attended at CNHU HKM is in (Figure 1).

Characteristics

Children aged 5 to 10 years represented 60%. Mean age was 6.07 years ± 1.90 year with a median of 6.33 years and extremes ranging from 1year to 9 years. Sex-ratio was 1. The Table 1 below shows the sociodemographic characteristics of the children included in the study according to their nutritional status.

Nutritional personal history Most severely malnourished children (82%) had been weaned before the age of 12 months but the difference was not significant (Table 1).

Clinical characteristics

Comorbidities were identified in 28 patients during the follow up

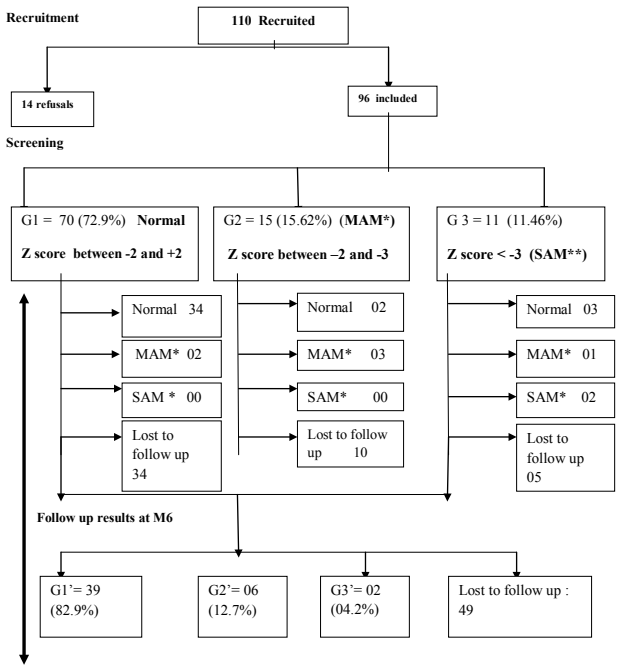

Figure 1: Graph showing flow of HIV-infected children at CNHU HKM of Cotonou included and followed up during the study on screening and nutritional care.
*(SAM=Severe acute malnutrition; **MAM= Moderate acute malnutrition; G2'+G3' = 17.02%)

period. They were mainly malaria (10 cases (10.41%)), pneumonia (10 cases (10.41%)), diarrhea 4 cases (4.16%) and tuberculosis 2 cases (2.08% of cases). Sixty-eight children were at stage I and 4 at stage IV according to WHO classification at the beginning of the study. These details are in (Table 2).

Biological characteristics

Approximately three out of four severely malnourished children (72.73%) had severe immunodeficiency**.** The difference was not significant. Biological characteristics are detailed in (Table 2).

Therapeutic characteristics

In Group 1, 95.7% of the children were on ART, of whom 88.57% were without protease inhibitor (PI). In Group 2, 73.33% were on ART, of whom 33.33% were not on IP and in Group 3, all the 63.63% of children on ART were subject to a regime with PI. Among the children who were on ART containing a PI, 72% had a bad nutritional status, but without significant difference (p = 0.57). All the children included in the study were on cotrimoxazole prophylaxis, except one belonging to Group 1.

Child follow up, overall progression of nutritional status and weight trend

More than half of the children were lost to follow up at the end of the study (51.04%). Details are in (Figure 2).

Eight children out the 47 (17.02%) attended during six months are still malnourished; two of them had severe malnutrition (04.55%).

	Total N = 96 (%)	Normal G1 = 70 (%)	MAM* G2 = 15 (%)	SAM** G3 = 11 (%)	p
Age					**0.28**
< 2 years	09 (09.37)	05 (07.14)	02 (13.33)	02 (18.18)	
[2-5 years]	27 (28.13)	10 (14.28)	11 (73.34)	06 (54.54)	
[5-10]	60 (62.50)	55 (78,58)	02 (13.33)	03 (27.28)	
Sex					**0.44**
Female	48 (50)	36 (51.42)	07 (46.66)	05 (45.45)	
Male	48 (50)	34 (48.58)	08 (53.34)	06 (54.55)	
Vital status of children's parents					**0.51**
Orphans	30 (31.25)	21 (30)	06 (40)	03 (27.27)	
Parents alive	66 (68.75)	49 (70)	09 (60)	0 8(72.72)	
Exposure to PMTCT					**0.35**
Yes	14 (14,58)	10 (14,70)	02 (11,76)	02 (18,18)	
No	82 (85,42)	60 (85,31)	13 (88,24)	09 (81,82)	
Supplementation personal history					**0.002**
Flour food	04 (04.16)	02 (02.86)	02 (13.33)	00 (00)	
Micronutrients	13 (13.55)	09 (12.86)	04 (26.67)	00 (00)	
No supplementation	79 (82.29)	59 (84.28)	09 (60.00)	11 (100)	
Diet during the first 6 months of life					**0.11**
EBF*	36 (37.5)	21 (3.00)	10 (66.67)	05 (45.45)	
BF** + RF***	45 (46.87)	34 (48.57)	05 (33.33)	06 (54.55)	
RF***	09 (09.37)	09 (12.85)	00 (00)	00 (00)	
Unknown	06 (06.25)	06 (08.57)	00 (00)	00 (00)	
Weaning					**0.35**
< 6 months	04 (04.17)	00 (00)	01 (06.66)	03 (27.27)	
[6-12 months]	27 (28.12)	20 (28.57)	05 (33.34)	02 (18.18)	
[12-18 months]	26 (27.08)	24 (34.39)	01 (06.66)	01 (09.09)	
>18 months	06 (06.25)	04 (05.71)	01 (06.66)	01 (09.09)	
Non Weaned	33 (34.38)	22 (31.43)	07 (46.68)	04 (36.36)	
*EBF= exclusive breastfeeding, **BF=breastfeeding, ***RF= replacement feeding					

Table 1: Distribution of HIV-infected children at CNHU HKM of Cotonou according to socio-demographic characteristics, their personal health history and nutritional status.

	Total N = 96(%)	Normal (%) (G1 = 70)	MAM (%) (G2 = 15)	SAM (%) (G3 = 11)	p
Comorbidity					**0.35**
Tuberculosis	02 (02.08)	01 (01.42)	01 (06.66)	00 (00)	
Malaria	10 (10.42)	06 (08.59)	02 (12.32)	02 (18.18)	
Diarrhea	04 (04.17)	04 (05.71)	00 (00)	00 (00)	
Pneumonia	10 (10.42)	04 (05.71)	04 (24.64)	02 (18.18)	
Others	02 (02.08)	00 (00)	02 (12.32)	00 (00)	
Absent	68 (70.83)	55 (78.57)	06 (40)	07 (63.64)	
WHO clinical stages					**0.00**
Stage I	68 (70.83)	65 (92.85)	03 (20)	00 (00)	
Stage II	17 (17.71)	05 (07.15)	08 (53.34)	04 (36.36)	
Stage III	07 (07.29)	00 (00)	03 (20)	04 (36.36)	
Stage IV	04 (04.17)	00 (00)	01 (06.66)	03 (27.28)	
Children's immunological status					**0.018**
No deficiency	58 (60.42)	53 (75.71)	04 (2.67)	01 (09.10)	
Moderate deficiency	22 (22.92)	16 (22.86)	04 (26.67)	02 (18.18)	
Severe deficiency	16 (16.66)	01 (01.43)	07 (46.66)	08 (72.72)	
Viral load					**0.74**
Undetectable	40 (41.66)	32 (45.71)	05 (33.33)	03 (27.27)	
Detectable	56 (58.34)	38 (54.28)	10 (66.66)	08 (72.72)	
Result of nutritional monitoring after 6 months					**0.002**
Normal M6 (G1')	39 (40.63)	34 (48.57)	02 (13.33)	03 (27.28)	
MAM M6 (G2')	06 (06.25)	02 (02.86)	03 (20)	01 (09.09)	
SAM M6 (G3')	02 (02.08)	00 (00)	00 (00)	02 (18.18)	
Unknown M6	49 (51.04)	34 (48.57)	10 (66.67)	05 (45.45)	

*MAM= Moderate acute Malnutrition, **SAM=Severe acute Malnutrition

Table 2: Distribution of children according to their clinical and biological characteristics and the outcome of their follow up depending on their nutritional status.

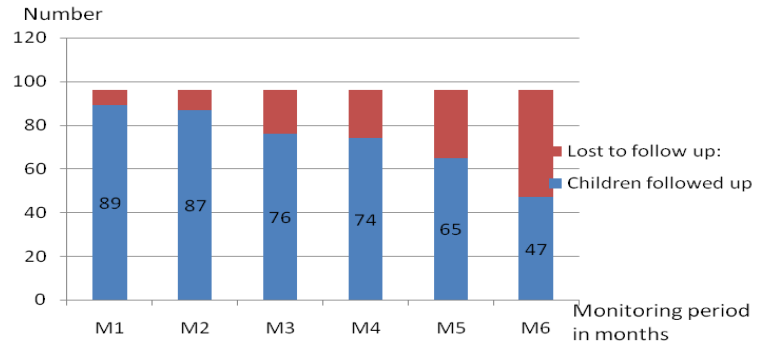

Figure 2: Distribution of HIV-infected children followed up at CNHU HKM of Cotonou according to monitoring duration.

The prevalence of children with normal nutritional status increased from 72.82 % to 82.97% i.e., a gain of 10 points. Severe malnutrition declined by over 9 points from 11.46% to 2.08% at the end of nutritional support (Figure 1 and Table 2).

Weight gain varied from 500 to 2000 g monthly. Average weight gain was 1250 g. Loss of weight was moderate and fluctuated between 300 and 600 g monthly. (Figure 3) indicates progression of monthly average weight gain and monthly average weight loss (Figure 3).

Synopsis of factors associated with malnutrition in children included in the study. The factors associated with occurrence of malnutrition in HIV-infected children were absence of micronutrient supplementation (p = 0.02), WHO clinical stage (p = 0.00) and immunological stage (p = 0.01) (Table 3).

Discussion

The study has enabled us to determine malnutrition frequency in HIV-infected children under 10 years of age attended at CNHU HKM of Cotonou between 2014 and 2015 (27.08%) and to assess the effect of nutritional care on growth through supplementation with therapeutic foods. More specifically, acute malnutrition frequency, before and after nutritional intervention on children in our cohort was respectively 27.08% and 17.02%. At the end of this research work the objectives set were attained. We were able to highlight the associated factors further to a univariate analysis. In this cohort, we have thus identified, in accordance literature, an association between clinical stages and malnutrition occurrence. Indeed, the children less affected were those presenting less advanced WHO clinical stages. The children who benefitted from nutritional support with enriched flour and

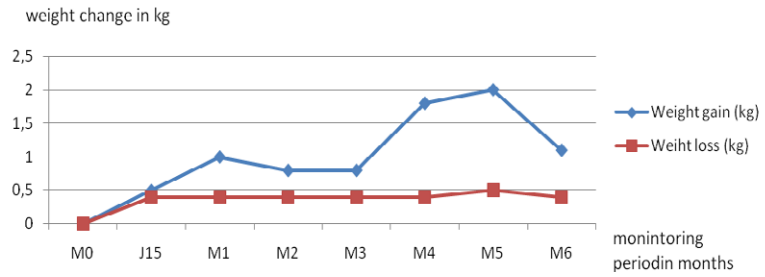

Figure 3: Monitoring of monthly average of weight gains and losses in children followed up.

Characteristics	Malnutrition		Total	p+
	Yes (n = 26)	No (n = 70)	N = 96	
WHO clinical stages				**0.000**
Stage I	10 (14.70)	58 (85.29)	68 (70.83)	
Stage II	06 (35.29)	11 (64.70)	17 (17.71)	
Stage III	10 (90.90)	01 (09.09)	11 (11.45)	
Micronutrient supplementation				**0.02**
No	25 (31.64)	54 (68.35)	79 (82.29)	
Yes	01 (05.88)	16 (94.11)	17 (17.70)	
Immunological status				**0.0018**
No deficiency	10 (17.24)	48 (82.75)	58 (60.41)	
Moderate deficiency	07 (31.81)	15 (68.18)	22 (22.91)	
Severe deficiency	07 (58.33)	05 (41.66)	12 (12.50)	

+ Fisher's exact test p value

Table 3: Synopsis of factors associated with malnutrition.

Plumpy-Nut before inclusion and ARV initiation presented less risk for suffering from malnutrition. Severe immunosuppression was also one of the factors associated with malnutrition occurrence in children within the cohort.

Validity of results: Different measures were taken to make sure that our results are valid and comply with WHO recommendations (anthropometric measures and anthropometric index tables). Nevertheless, some biases are to be addressed. To reduce selection biases, all the patients eligible for the study were contacted to ensure their participation to the study. For various reasons, 14 subjects had refused to participate, (refusal rate estimated at 8.6%). Only the data collected from the 96 patients who followed the study protocol, were the ones analyzed. However, the number of non-included patients did not significantly influence the results. We can say that our sample is fairly representative of the children meeting inclusion criteria. Information was collected by means of a questionnaire administered to patients and/or parents. The data gathered may be somewhat subjective for they cannot be quantified. Actually, due to feeling of guilt or for fear of being judged, a parent may provide inaccurate information. To overturn these biases, we interviewed autonomous parents and children separately, then together and later on we associated the data collected. Therefore, we can say that the results obtained may also be associated with the other HIV-infected children aged under ten years who were not followed up. However, there is an important factor which should be pointed out; it is the important number of lost to follow up which remains a significant constant in the cohorts of subjects living with HIV. Only 47 children had been followed up till the end of the 6 month of study. In fact, although many parents had given their formal consent, they stopped follow up and this, despite the fact that they had been provided financial support for children's transport. The reasons put forward were related to the constraints of frequent and close appointments which may have interfered with their time of activity. But, unlike our cohort, the one reported by Ojeniran et al. in Nigeria had registered only 16% of lost to follow up [14].

Nutritional profile**:** The prevalence of acute malnutrition in our cohort was 27.08% with respective rate of 11.46% for severe form and 15.62% for moderate form. A multicenter study conducted in the Sub-Saharan region in 2011 by Jesson et al. [15] had reported a prevalence of global moderate malnutrition of 16% in HIV-positive children under 5 years of age. In India, Padmapriyadarsini et al. [16] had found out a 16% prevalence for severe malnutrition probably because their cohort did not take into account children aged 5 to 10 years. Everywhere in the world, moderate or severe malnutrition remains a clinical characteristic of HIV.

Sociodemographic characteristics of the study population: The children eligible for this study were those under 10 years of age on inclusion. A study conducted in Nigeria by Ademola [17] among children under 5 years had identified a sex-ratio of 1/1.1 similar to ours. Approximately one third of the children in our cohort were orphans. This condition of orphans may have been one of the factors contributing to malnutrition since it makes them vulnerable and thus exposes them to malnutrition.

Clinical and biological characteristics: In the quarter preceding nutritional intervention, 29% of the children included in the study had presented comorbidity. The pathologies identified were mainly malaria, tuberculosis, pneumonia and diarrhea. Some of those diseases may be due to immunosuppression among those children and were factors which exacerbated the nutritional status of HIV-infected children. The high rate of malaria was related to the fact that that disease remains endemic in Sub-Saharan Africa. The incidence of malaria in Benin in 2014 was respectively 15.27% and 2.1% for simple malaria and severe

malaria [18]. As well, Ezeamama et al. found out that HIV is a risk factor for malaria in Tanzania [19]. Comorbidity with pneumonia is due to the fact that it is one of the main causes of death among children under 5 years with 15% of death in 2013 [20]. Two thirds of the patients were within WHO clinical I stage. This may be due to screening age and to the fact that children were systematically put on early treatment under 2 years old in 2010 (according to WHO strong recommendations) [21].

Among the 92 children whose immune status was known, about 2/3 had no immunodeficiency. This is associated either with early treatment or with a treatment followed properly. On the other hand, children with severe immunodeficiency could improve their nutritional status after starting ART, since treatment reduces significantly opportunistic digestive infections which cause eating disorders. Many other authors had already reported that situation [22-24]. But those remarks may also due to the fact that some of the infected children presented HIV form with slow progression.

Therapeutic characteristics: Most (95%) children were put on ART on inclusion; 2/3 of them were treated before the age of 5 years within the framework of HIV early treatment so as to improve their survival [21]. This high prophylactic coverage rate contributes to reduce opportunistic infections.

Nutritional characteristics, weight gains and follow up: During this study, more than 80% of the children had not benefitted from micronutrient supplementation during the last 6 months before intervention started. Those who benefitted from it got it within the framework of systematic supplementations in accordance with national policy standards. Therefore, HIV-infected children screened as suffering from malnutrition may have benefitted from nutritional support with flour. In Tanzania, vitamin A supplementation among infected children had contributed a lot to improve weight gain and to reduce mortality [25]. As regards feeding pattern during the first 6 months of life, 43.75% had benefitted from exclusive breastfeeding and 40.62% from mixed feeding; only 9% were provided replacement feeding. This result raises again the problems related to difficulty of having a good and appropriate nutrition in HIV context in our countries. This fact confirms the necessity of protected breastfeeding in this context. Twenty-eight percent of the breastfed children had been weaned between 6 and 12 months. By contrast, 4 of our children had been early weaned (before 6 months). Hence, mothers were either ignorant of recommended nutritional practices or were not able to conduct exclusive breastfeeding during many months. Mention should also be made of the early deaths of certain mothers. A study conducted in Nigeria had demonstrated that early weaning before the age of 6 months was significantly associated with occurrence of chronic malnutrition before 5 years old [17]. In contrast, improvement of weight gain in the context of ART and nutritional support had also been reported in the works of Agossou et al. en 2013 conducted in the northern part of Benin with a linear relation [26].

Concerning weight growth or gain in our children, it varied from 500 g to 2000 g monthly with an average of 1250 g. The loss of weight was moderate and fluctuated between 300 and 600 g monthly. It may be due to stoppage of support to some children who had been supplemented. We think that this difference would probably be related to the intervention performed. The loss of weight observed in Group 1 children thanks to follow up suggests that distribution of therapeutic foods not only to children with acute malnutrition (moderate or severe) would have been more beneficial. At the end of monitoring, it was noted that the number of children with normal weight profile increased by 10 % and that the one of children with malnutrition profile decreased by 10% ($p = 0.002$). That gain may have probably been more significant if the protocol had allowed supplementation in all the groups during more time with the same therapeutic food (RUTF). However, this research work has the merit of introducing more easily accessible local flour which proves to be a strategic choice beneficial for intervention sustainability.

Factors associated with malnutrition in children living with HIV: During our study, three factors were identified as significantly associated with malnutrition; these are: absence of previous micronutrient supplementation, WHO immunological stage and clinical stage on inclusion. Micronutrient supplementation 6 months before intervention seems to have a protective effect against occurrence of malnutrition. This may be due to the fact that some micronutrients were recognized as protective. For instance, it is recognized that vitamin A reduces immunosuppression by stimulating B and T lymphocyte functions. Concerning children's immunologic status, it had been observed that the severer immunodeficiency was, the severer malnutrition risk was in our series ($p= 0.0018$). This is an outcome of the vicious circle formed by HIV and malnutrition. These results confirm those reported by Adedemy et al. in 2012 according to which severe acute malnutrition more common in HIV-infected subjects, may be due to a conjunction of factors such as increased metabolism induced by presence of virus, increased loss of nutrients due to diarrheas and malabsorption, anorexia and reduced food intake because of oral lesions [27,28]. As factor associated with acute malnutrition, Jesson et al. had identified, among others, male sex, severe immunodeficiency and absence of ARV [15]. The same applied to WHO clinical stage which was identified as a factor associated with malnutrition in our research work. This is always related to the very infection further to infection effect on nutritional status.

Conclusion

During the 6 months of nutritional survey, 96 HIV-infected children under10 years of age were recruited with a sex ratio estimated at 1 at the time of inclusion. Approximately, one third of the children in our cohort consisted of orphans; about one out three children had comorbidity personal history with malaria and pneumonia during the 6 months preceding the study; two third of our patients were at WHO clinical I stage. Acute malnutrition prevalence in HIV-infected children in Cotonou was 27.08% with respective rates of 11.46% for severe malnutrition and 15.62% for the moderate one. After intervention, that frequency was 17.03% with respective rates of 4.26% for severe malnutrition and 12.77% for the moderate one. The factors associated with malnutrition were absence of micronutrient supplementation, WHO clinical staging and immunological stage. At the end of the research work, nutritional intervention nutritional may be said to be beneficial.

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Citation: Adedemy JD, Zohoun L, Alihonou F, d'Almeida M, Couringa Y, et al. (2016) Screening for Malnutrition and Nutritional Care in HIV-Infected Children Followed up in the Pediatric Unit of CNHU-HKM in Cotonou. Matern Pediatr Nutr 2: 109. doi:10.4172/mpn.1000109