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Prevalence and Associated Factors of Malnutrition in HIV-Infected Children Younger than 5 Years at a Teaching Hospital in Bobo-Dioulasso, Burkina Faso

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Abstract

Background: Malnutrition on the background of HIV infection is a complex medical condition that carries significant morbidity and mortality for affected children.

Objectives: This study assessed nutritional status and determined malnutrition-associated factors, including antiretroviral therapy (ART) in HIV-infected children younger than 5 years.

Methods: This study was based on secondary analysis of cross-sectional data collected data from July to September 2014 at Teaching hospital in Bobo-Dioulasso city in Burkina Faso. Socio-demographic, dietary intake, anthropometric, cell counts, and biochemical data were included in this study. A total of 164 child-mother pairs were included.

Results: Of 164 HIV-infected children, 100% had inadequate dietary intake; 65%, 77%, and 63% were stunted, underweight, and wasted, respectively; 29% were anemic and 21% exhibited hypoalbuminemia. Around 41% of HIV-infected children were not on ART and they increased risk for being underweight (OR = 2.07, 95% CI = 1.11, 7.26, P = 0.02) compared to those on ART. CD4 was positively correlated with mid upper arm circumference (r = 0.26, P = 0.001), hemoglobin (r = 0.34, P < 0.001) and albumin (r = 0.37, P = <0.001). Food insecurity (OR = 1.77, 95% CI = 1.01, 3.44, P = 0.03) was associated with poor dietary intake.

Conclusions: Anthropometric, biochemical and dietary intake assessment highlighted a high prevalence of malnutrition in HIV-infected children. In addition to ART, nutritional support should be provided to all the HIV-infected children. Nutrition assessment and maternal education on the nutritional needs of children should be integrated into pediatric HIV management.

Keywords: HIV-Infected Children; Antiretroviral Therapy; Malnutrition

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Introduction

Malnutrition in terms of undernutrition prevalence remains alarming and contributes to nearly half of all deaths in children younger than 5 worldwide [1]. In 2019, the UNICEF estimated that 144 and 47 million children younger than 5 years were stunting and wasting in the world, respectively [1]. In Burkina Faso, two National Nutrition Surveys (NNS) in 2016 and 2020 reported the prevalence of stunting, underweight, and wasting in children younger than 5 years was 27.3% vs 24.9%, 19.2% vs 17.6%, and 7.6% vs 9.1%, respectively [2,3]. These percentages are aligned with the corresponding WHO critical thresholds of 29%, 19%, and 9% [4].

In 2019, the UNAIDS estimated that 1.8 million children were infected with HIV [5,6]. In Burkina Faso, although the Program for the Prevention of Mother-to-Child Transmission (PMTCT) of HIV has been implemented since 2002, HIV/AIDS is still responsible for 4% of deaths in children (Ministry of Health, 2011). UNAIDS reported that in *Burkina Faso an* estimated 13,000 children and 9800 aged 0-14 years were living with HIV in 2014 [6] and 2019, respectively [7]. In 2014, only 2,213 children were on antiretroviral therapy (ART) including 320 registered at a teaching hospital in Bobo-Dioulasso. Of those 320 children, 172 were younger than 5 years and almost all presented moderate or severe acute malnutrition [8].

Although there is no cure for HIV infection, effective ART can control the virus and help prevent transmission. ART has contributed to the global decrease of 20% in the estimated number new infections between 2001 and 2011 [9]. Early initiation of ART is associated with decreased opportunistic infections. Absence or late initiation of ART can be a risk factor for the development of malnutrition in HIV-infected children [10].

According to Page AL, et al. (2013) [11], most studies on infections in malnourished children have been conducted in Southern Africa or Southeast Asia. Only a few studies in the literature have examined the

nutritional status or related topics in HIV-infected children younger than 5 years in Burkina Faso [2,3,12]. Thus, determining the prevalence of malnutrition in more HIV-infected children and providing them appropriate nutrition support or intervention are crucial. The aim of this study was to assess malnutrition and to determine malnutrition-associated risk factors in HIV-infected children younger than 5 years admitted to a teaching hospital in Bobo-Dioulasso by using dietary intake, anthropometric, and biochemical data.

Methods

Study Design and Setting

This study was based on secondary analysis of cross-sectional data collected data from July to September 2014. This study was carried out in a teaching hospital in Bobo-Dioulasso. Data included the socio-demographic characteristics, child feeding and caring practices as independent variables, and dependent or outcome variables such as dietary intake, anthropometric, and biochemical data.

Participants

The participants were the HIV-infected children younger than 5 years admitted to Souro Sanou National Teaching Hospital in Bobo-Dioulasso, the second largest city located in the western part of Burkina Faso which is about 218 miles from Ouagadougou, the capital and the largest city in the country. In 2013, the population of this city was estimated at 813,609 [8]. Children were excluded if:

- They were not infected with HIV and younger than 5 years or
- Their mothers were not willing to provide informed consent.

The population of HIV-infected children younger than five years was 172 and a total of 164 HIV-infected children were included in this study.

Instrument

The data were collected based on a questionnaire adapted from a previous study by Sunguya BF, et al. (2011) [13]. The questionnaire comprised 4 parts. Part 1 contained questions on the sociodemographic characteristics of the children and their mothers, child feeding practices, and an environmental factor, water source type (piped, vendor or well water). Part 2 comprised questions on food insecurity (*defined as "Mother cut the size of child's meals because there wasn't enough money for food in the past 3 months"*), maternal and child caring practices, such as the participation of the mother in the PMTCT of HIV, information of mother on nutrition and care for HIV infection, the number of times the child was hospitalized, ART, vitamin A supplementation in the past 6 months, and health status of the child. Part 3 contained questions on dietary intake in the past month, according to food intake, frequency with 7 categories of food groups: cereals (millet or maize, rice, wheat products); tubers (Irish potato, sweet potato, yam); legumes (beans, peanut); vegetables (green leafy vegetables, tomato, pumpkin, carrot, onion); fruits (orange, mango, papaya, banana, pineapple, avocado); dairy products (milk, cream) and animal products (meat, pork, poultry, fish, eggs). Part 4 contained questions on anthropometric and biochemical data and CD4 and white blood cell (WBC) counts. Anthropometric measurements were height, weight, and mid-upper arm circumference (MUAC) and biochemical data were hemoglobin (Hb) and albumin levels.

Data Collection and Measurements

The questionnaire was administered with an interview for the mothers after the purpose of the study was explained. Food insecurity was defined as "Mother cut the size of child meals because there wasn't enough money for food in the past 3 months." Information on the status of HIV infection was collected from electronic medical charts with the physician's agreement to save the costs.

The anthropometric measurements, weight, height, and MUAC were done in kilograms (to the nearest 100 g) by using an electronic digital scale (Seca model 770; Seca Hamburg, Germany), a stadiometer with a precision of 0.1 cm, and an anthropometric tape (to the nearest centimeter), respectively. The height of children younger than 2 years was measured in a recumbent position [14].

Blood samples were drawn from each child. CD4, WBC (as immunological markers) counts, Hb and albumin (as anemia and protein nutritional status indicators, respectively) were determined. The CD4 cell count was determined using BD FACSCount. The serum albumin level was determined using the ARCHITECT ci4100 Integrated System. The WBC count and hemoglobin levels were determined using Mindray BC-3000 Plus. All laboratory tests were performed at the same teaching hospital in Bobo-Dioulasso. Data on cell counts and biochemical tests were collected from electronic medical charts at the teaching hospital and health districts.

Ethical Considerations

The protocol of this study was reviewed and approved by the National Ethics Committee for Health Research of the Ministry of Health, Burkina Faso (No 2014-1794/MS/SG/DGS/DN). In addition, a permission was obtained from the Department of Pediatrics at Souro Sanou National Teaching Hospital in Bobo-Dioulasso to collect data. A written informed consent was obtained from the mothers. The authors did not seek further ethical clearance because the data were completely anonymous.

Data Analyses

Data analyses were performed using SPSS version 21 (SPSS Inc., Chicago, IL, USA). Descriptive statistics used were mean ± standard deviation (SD) or median with interquartile (IQR) for continuous variables; the frequency, and percentage for categorical variables. The Shapiro-Wilk test was employed, and the data of outcome variables were non-normally distributed with a $P < 0.05$. Chi-square test was done to assess the distribution of HIV-infected characteristics by ART. Spearman's rank correlation coefficient for ordinal data was performed. Risk factors for malnutrition were analyzed through logistic regression. *P* less than 0.05 was considered statistically significant in all tests.

To quantify dietary intake, a score from 0 to 5 for each food item in the 7 food categories was assigned. The sum score of all 7 food categories ranged from 0 to 130 and the cutoff point was 65 in this study. A score above 65 was defined as adequate dietary intake and a score less than 65 was defined as inadequate diet.

WHO Anthro 3.2.2 software [15] was used to calculate height-for-age z (HAZ), weight-for-age z (WAZ), and weight-for-height z (WHZ) scores and the prevalence of malnutrition in terms of stunting, underweight, or wasting was determined. These scores were compared with the WHO standard. In this study, HAZ, WAZ, and WHZ scores below -1SD, -2 SD, and -3 SD, were defined as mild, moderate, and severe stunting, underweight, and wasting, respectively. The definitions from WHO were only included those subjects with moderate and severe stunting, underweight or wasting.

In the cell counts and biochemical data, suppressed immunity was

defined as CD4 < 750 cells/μL or WBC < 4.5 × 10^3/μL. Anemia was defined as a hemoglobin concentration less than 11 g/dL according to the WHO [16]. Low albumin or hypoalbuminemia was defined as an albumin level less than 35 g/Dl [17].

Results

Characteristics of Participants

Of the 164 children, the mean (range) of age was 28.9 ± 14.2 (12-58) and 51.8% were girls. The mean (range) of monthly family income was 104,605 ± 39,255 (30,000-200,000) West Africa CFA francs. Approximately one-seventh were still breastfed, although all children were older than 1 year. The mean weaning age was 6.4 ± 0.7 (6-9) months. Approximately two-thirds were experiencing food insecurity and 59.1% were on ART initiation during data collection. In terms of health status, fair and poor health status were reported in 77.4% and 22.6% of HIV-infected children respectively.

Of 164 mothers, 61.6% were married, 31.7% were single and others were widowed or divorced; 54.3% were Muslims while others were Christians. Only 12.2% had an education from college or university, 56.1% went to primary or secondary schools, and 31.7% were illiterate. All mothers attended the antenatal clinic and gave birth in health facilities. Nearly one-third of mothers received ART to PMTCT and 54.9% received information on nutrition and care for HIV-infected children.

Table 1 summarizes the characteristics of 164 participants by ART or not: age, sex, family income, breastfeeding, weaning age, food security, water source, medications provided to mothers to PMTCT of HIV, information on nutrition and care for HIV provided to mothers, vitamin A supplementation in the past 6 months, the number of time child was hospitalized and health status. Several characteristics such as weaning food (P = 0.004), water source (P = 0.04), number of time child was hospitalized in the past 6 months (P = 0.002), and health status (P <0.001) were significantly associated with ART.

Prevalence of Malnutrition in HIV-Infected Children

All 164 children were on an inadequate diet; 64.6% were stunted, 76.8% were underweight, and 63.4% were wasted. Stunting, underweight, and wasting were further classified into mild, moderate and severe categories according to WHO criteria. A statistically significant relationship was only observed between sex and underweight (P = 0.03).

The proportions of children with values lower than lower limit of reference values for CD4 (< 750 cells/μL), WBC (4.5 × 10^3/μL),

Table 1: Distribution of characteristics by antiretroviral therapy in HIV-infected children younger than 5 years.

Antiretroviral Therapy				
Variable	**Total (n= 164) n (%)**	**Yes (n= 97) n (%)**	**No (n= 67) n (%)**	***P***
Age (mo)				0.71
12-24	78 (47.6)	45 (46.4)	33 (49.2)	
25-58	86 (52.4)	52 (53.6)	34 (50.7)	
Sex				0.58
Male	79 (48.2)	45 (46.4)	34 (50.7)	
Female	85 (51.8)	52 (53.6)	33 (49.2)	
Family income/month (CFA franc) *				0.69
30,000-10,0000	96 (58.5)	58 (59.8)	38 (56.7)	
101,000-200,000	68 (41.5)	39 (40.2)	29 (43.2)	
Still under breastfeeding				0.72
Yes	25 (15.2)	14 (14.4)	11 (16.4)	
No	139 (84.8)	83 (85.5)	56 (83.5)	
Weaning age (mo)				0.004
6	114 (69.5)	59 (60.8)	55 (82.1)	
7-9	50 (30.5)	38 (39.1)	12 (17.9)	
Food security				
Yes	53 (32.3)	30 (30.9)	23 (34.3)	0.64
No	111 (67.7)	67 (69.1)	44 (65.6)	
Water source type				
Piped water	68 (41.5)	46 (47.4)	22 (32.8)	
Vendor water	62 (37.8)	29 (29.9)	33 (49.2)	0.04
Well water	34 (20.7)	22 (22.6)	12 (17.9)	
Medications provided to mothers to prevent MTCT‡ of HIV				
Yes	52 (31.7)	33 (34.0)	19 (28.3)	0.44
No	112 (68.3)	64 (65.9)	48 (71.6)	
Mother awareness on nutrition & HIV				
Yes	90 (54.9)	56 (57.7)	34 (50.7)	0.37
No	74 (45.1)	41 (42.2)	33 (49.2)	
Number of time child was hospitalized in the past 6 months				
0	75 (45.7)	54 (55.6)	21 (31.3)	0.002
1	89 (54.3)	43 (44.3)	46 (68.6)	
Vitamin A supplementation in the past 6 months				
Yes	78 (47.6)	50 (51.5)	28 (41.8)	0.21
No	86 (52.4)	47 (48.4)	39 (58.2)	
Health status of HIV-infected children				
Fair	127 (77.4)	87 (89.6)	40 (59.7)	<0.001
Poor	37 (22.6)	10 (10.4)	27 (40.2)	

*1 US dollar = 544 West African CFA francs February 2021. †Mug is defined as a container of 300 mL; ‡MTCT=mother-to-child transmission.

hemoglobin (11 g/dL), and albumin (35 g/L) were 18.3%, 0.6%, 28.7%, and 21.3%, respectively. These children had suppressed immunity, anemia, or a poor protein nutritional status. Table 2 highlight the prevalence of malnutrition among HIV infected children.

Significant Correlations Between Continuous Variables

Child age was negatively correlated with CD4 (r = -0.20, *P* = 0.02). Family income was positively correlated with dietary intake (r = 0.16, *P* = 0.03). Height was positively correlated with weight (r = 0.72) and MUAC (r = 0.311) at *P* < 0.001. Weight was also positively correlated with MUAC (r = 0.56) at *P* < 0.001. CD4 was positively correlated with MUAC (r = 0.26, *P* = 0.001), hemoglobin (r = 0.34, *P* < 0.001) and albumin (r = 0.37, *P* = <0.001). Hemoglobin was positively correlated with albumin (r = 0.58, *P* < 0.001). WBC was negatively correlated with CD4 (r = -0.25, *P* = 0.001), hemoglobin (r = -0.52, *P* < 0.001) and albumin (r = -0.53, *P* < 0.001).

Associated Factors with Malnutrition in HIV-Infected Children

Table 3 summarizes the results of associated factors with malnutrition in HIV-infected children. Regarding outcome variable

Table 2: Prevalence of malnutrition in 164 HIV-infected children younger than 5 years by gender.

Variables	Total (n=164) N (%)	Boys (n=79) n (%)	Girls (n=85) n (%)	*P*
Inadequate diet* (dietary score < 52)	164 (100.0)	79 (100.0)	85 (100.0)	
Median	32.00 (26, 38)	32.00 (26, 38)	33.00 (27, 38)	0.24
Stunting (HAZ)	106 (64.6)	51 (64.5)	55 (64.7)	0.81
Mild (between -1 and -2 SD)	37 (22.6)	11 (14.0)	26 (30.5)	
Moderate (between -2 and -3 SD)	39 (23.7)	27 (34.1)	12 (14.2)	
Severe (less than -3 SD)	30 (18.3)	13 (16.4)	17 (20.0)	
Underweight (WAZ)	126 (76.8)	60 (75.9)	66 (77.7)	0.03
Mild (between -1 and -2 SD)	30 (18.3)	11 (13.9)	19 (22.3)	
Moderate (between -2 and -3 SD)	46 (28.0)	25 (31.6)	21 (24.7)	
Severe (less than -3 SD)	50 (30.5)	24 (30.3)	26 (30.5)	
Wasting (WHZ)	104 (63.4)	52 (65.8)	52 (61.1)	0.61
Mild (between -1 and -2 SD)	32 (19.5)	14 (17.7)	18 (21.1)	
Moderate (between -2 and -3 SD)	25 (15.2)	11 (13.9)	14 (16.4)	
Severe (less than -3 SD)	47 (28.6)	27 (34.1)	20 (23.5)	
Anemia (hemoglobin < 11 g/dL) †	47 (28.7)	24 (30.3)	23 (27.0)	
Median	10.20 (9.6, 10.6)	10.00 (9.2, 10.4)	10.60 (9.7, 10.8)	0.06
Poor protein nutrition (albumin < 35 g/L) ‡	35 (21.3)	18 (22.7)	17 (20.0)	
Median	32.00 (30, 33)	32.00 (29.7, 33.2)	32.00 (30.5, 33.5)	0.63

*The highest total score of dietary quality and diversity was 51, Reference values: † hemoglobin 11-14 g/dL; ‡albumin: 35-55 g/L.

Table 3: Factors associated with malnutrition in HIV-infected children younger than 5 years.

Characteristics	Poor Dietary Intake		Stunting		Underweight		Wasting		Anemia		Hypoalbuminemia	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age (mo)												
12–24	1		1		1		1		1		1	
25–59	1.5	0.83, 2.85	0.6	0.31, 1.16	1.1	0.55, 2.34	1.1	0.50, 1.98	0.5	0.27, 1.07	1.3	0.59, 2.70
Sex												
Male	1		1		1		1		1		1	
Female	0.7	0.36, 1.23	1	0.53, 1.91	1.2	1.09, 3.46*	0.9	0.73, 2.62	1.1	0.58, 2.24	0.8	0.40, 1.78
Family income/month§ (CFA francs)												
30,000-100,000	1		1		1		1		1		1	
101,000-200,000	0.3	0.16, 0.98*	0.8	0.41, 1.53	0.9	0.42, 1.88	0.7	0.38, 1.40	0.5	0.27, 1.07	0.5	0.24, 1.09
Food security												
Yes	1		1		1		1		1		1	
No	1.8	1.01, 3.44*	1	0.45, 1.81	1.1	0.51, 2.41	1.8	0.94, 2.86	1.1	0.52, 2.20	1.5	0.64, 3.46
Mother participation in PMTCT† of HIV												
Yes	1		1		1		1		1		1	
No	1	0.49, 1.84	1.1	0.54, 2.13	1.4	0.63, 2.89	1	0.50, 1.97	1.8	0.84, 3.98	3.4	1.25, 9.46*
Mother awareness on nutrition & HIV												
Yes	1		1		1		1		1		1	
No	3.7	1.93, 7.14**	0.7	0.38, 1.40	1.1	0.43, 1.84	0.8	0.43, 1.54	1.3	0.67, 2.59	1	0.48, 2.18
ART ‡												
Yes	1		1		1		1		1		1	
No	1.7	0.92, 3.29	1.2	0.62, 2.32	2.1	1.11, 7.26*	1.1	0.55, 2.02	1.5	0.76, 2.96	1.7	0.81, 3.66
Water source type												
Piped water	1		1		1		1		1		1	
Vendor water	1	0.78, 1.16	1.3	0.64, 2.71	0.5	0.21,1.17	0.9	0.46, 1.93	1.3	0.63, 2.79	0.6	0.24, 1.31
Well water	1.1	1.03,3.30**	1.1	0.47, 2.71	0.9	0.36,2.34	1.1	0.45, 2.49	2.5	1.92, 7.00*	1	0.34, 2.94

**P* < 0.05; ***P* < 0.01; † PMTCT= Program for the Prevention of Mother-to-Child Transmission, ‡ART=antiretroviral therapy; §1 US dollar = 544 West African CFA francs February 2021

dietary intake, its risk factors include family income, food insecurity, mother's receiving information on nutrition and care for HIV infection, and water source type. Children with low family incomes (reference OR = 1), food insecurity (odds ratio [OR] = 1.77, 95% CI = 1.01, 3.44, P = 0.03), without mother's receiving information on nutrition and care for HIV (OR = 3.71, 95% CI = 1.93,7.14, P < 0.01), or using well water (OR = 1.10, 95% CI = 1.03, 3.30, P < 0.01) were more likely to increase risk by 69%, 77%, 271%, and 10% for taking poor dietary intake as compared with those with a higher family income (OR = 0.31, 95% CI = 0.16, 0.98, P = 0.01), food security, mother's receiving information on nutrition and care for HIV infection, or using piped water. Children not on ART increased risk for being underweight compared to those on ART (OR = 2.07, 95% CI = 1.11, 7.26, P = 0.02). However, children using well water increased risk for anemia more than those using piped water (OR = 2.54, 95% CI = 1.92, 7.00, P = 0.04). Children whose mothers did not participate in the PMTCT of HIV increase risk for hypoalbuminemia (OR = 3.43, 95% CI = 1.25, 9.46, P = 0.01), as compared with those whose mothers participated in the PMTCT of HIV.

Discussion

This study observed that in 164 HIV-infected children younger than 5 years, nearly two-thirds were in food insecurity; 100% had inadequate dietary intake; 65%, 77%, and 63% were stunted, underweight, and wasted, respectively; 29% were anemic and 21% exhibited hypoalbuminemia. Inadequate diet could be the main contributing factors for malnutrition in HIV-infected children [18]. In South Africa, more than 50% are underweight and stunted, while more than 60% have multiple micronutrient deficiencies in HIV-infected children [19]. This figure was consistent with a previous study done in Tanzania, where they found that stunting, underweight, wasting, and thinness were prevalent among 61.9%, 38.7%, 26.0%, and 21.1% of 748 HIV-infected children aged 6 months to 14 years [20] In south India, where undernutrition was common in HIV-infected children at all stages of the disease, the prevalence of stunting, underweight, and wasting were 58%, 63%, and 16%, respectively [21]. Most of the HIV-infected children experienced malnutrition and were under poor health status.

HIV can be transmitted from an HIV-positive woman to her child during pregnancy, childbirth, and breastfeeding. In this study, less than one-third of mothers received ART to prevent MTCT of HIV; 59% of HIV-infected children younger than 5 were on ART. The two possible reasons for the remaining 41% not on ART were newly diagnosis of HIV infection or shortage of ART. However, the prevalence of HIV-infected children under ART was higher compared to worldwide rate (24%) in the same year [22]. The findings of this study showed that HIV-infected children on ART were less likely to be underweight, had a higher CD4 count, albumin, and better health status, and less hospitalization. Previous studies reported that ART exerts a favorable effect on growth and could help to improve the health status of HIV-infected children [23-25]. Rose AM, et al. (2014) [26], have thoroughly reviewed etiology of malnutrition in HIV-infected children in resource-limited settings and pointed out that the contributory factors include a late presentation to medical services, unavailability of antiretroviral therapy, other issues surrounding healthcare provision and food insecurity in HIV-positive households. HIV-infected children with malnutrition should receive ART and nutrition support at the same time. South Africa has effectively addressed nutritional problems in these children and has provided feeding guidelines for children with malnutrition and during illness [19].

This study has three strengths.

- Participants, 164 HIV-infected children younger than 5 years, could be a representative sample from Souro Sanou National Teaching Hospital.
- Dietary intake, anthropometric, and biochemical data are used to assess nutritional status instead of using only anthropometric measures, the most common practice in many developing countries.
- WHO Anthro3.2.2 software was used to calculate the Z score below -1, -2 and -3 as mild, moderate and severe malnutrition instead of covering only moderate and severe malnutrition as mentioned in previous studies [27,28].

However, this study has several limitations such as the lack of a control group for making comparisons, lack of the cultural factors and barriers to medical or health services.

Conclusion

In conclusion, a high prevalence of malnutrition in terms of inadequate dietary intake, stunting, underweight, and wasting and less prevalence of anemia and protein malnutrition were observed in HIV-infected children younger than 5 years. In addition to ART, nutritional support should be provided to all the HIV-infected children. Nutrition assessment and maternal education on the nutritional needs of growing children should be integrated into pediatric HIV management and care.

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None.

Conflicts of Interest

The authors declare no conflicts of interest.

Authorship

Ghislain Gnimbar Poda, Makoura Barro, Francois Wangraoua conceived the research questions, designed the study, and analyzed data. Lassina Barro and Tamini Severine performed the biochemical exams. All authors read and approved the final version of the manuscript for submission.

Ethical Considerations

The study was reviewed and approved by the National Ethics Committee for Health Research of the Ministry of Health, Burkina Faso (No 2014-1794/MS/SG/DGS/DN).

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