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Association Between Nutritional Status of Children Under Five Years and Malaria in Koila Bamanan, an Endemic Area in Mali

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ABSTRACT

Malaria and malnutrition are common in Mali and may mutually worsen each other especially in children under 5 years old. A cross sectional survey was done in Koila Bamanan in November 2019 involved 233 children aged 6-59 months to investigate association between the two diseases. The data were collected on malaria, malnutrition and mother's sociodemographic characteristics. STATA14 was used for data analyze with a significant p value at 0.05. The prevalence of malnutrition was 14.6%, 40% and 10.7% respectively for underweight, stunting and wasting. The prevalence of malaria infection was 12.5%, 57.9% of children did at least one episode during transmission season and 52.8% for anemia prevalence. In multivariate analysis, anemia was associated with higher risk of underweight (OR = 6.91; 95% IC [2.41-19.73]) and stunting (OR=3.28, 95% IC [1.68-6.24]). However, the polygamy was associated with underweight (OR = 0.36; 95% IC [0.15-0.84]) and stunting (OR=0.45 95% IC [0.23-0.87]) reduction. A significant correlation was not found between parasitemia and child nutritional status.

The prevalence of malnutrition is high in children, an association between malnutrition and malaria was not found. More studies are required to investigate another factor associated with malnutrition in the area.

KEYWORDS

Malnutrition, Malaria, Children, Mali

BACKGROUND

In Sub-Saharan Africa countries, malnutrition remains always a major public health problem and represents an additional burden in malaria endemic areas [1]. It is responsible for 45% of child mortality, especially in countries with a precarious health system [2]. In Mali, the prevalence of stunting, underweight and wasting are 24.1%, 18.6% and 10%, respectively and its distribution presents a large variability according residence areas [3].

Malnutrition result mainly of inadequate food intake and/or following repeated infectious disease. Malnutrition and infection are largely interrelated and are the major cause of child mortality in low income countries [4]. Malaria is largely invoked among infectious diseases incriminated in undernutrition occurrence in African [5]. Association between malaria and malnutrition has been reported in sub-Saharan Africa areas and malaria might increase the risk of undernutrition occurrence in children [6]. Their associations constitute a major concern due the impact on child's learning, cognitive and physical development [5,7,8].

In Mali, undernutrition and malaria are common and may mutually worsen each other especially in children under 5 years old. Koila

village, rice growing area irrigated by Markala hydraulic barrage, is an endemic malaria area [9] and also one of International Center for Excellence in Malaria Research (ICEMR) project site where we collected data on malaria indicators the beginning and the end of transmission season. During the June 2019 cross sectional survey, our findings show a high prevalence of anemia (31%) whose 71% in children under five years mostly that anemia is considered the main symptom of malaria and malnutrition in endemic areas [10]. This study was conducted in Koila to determine the prevalence of malaria and malnutrition, and investigate their association in children under five years during the cross sectional survey in the end of 2019 transmission season with a perspective to proposing an appropriate strategy for the two diseases.

MATERIALS AND METHODS

Study site and participants

This study was conducted in Koila Village, one of the West African ICEMR field sites in Mali since 2012. It is located at 45 km from Markala health center and 385 km northeast of Bamako. The population of Koïla village estimated at 2,944 inhabitants including 312 children under 5 years old (source: GIS/UCRC census, 2017). Malaria transmission is continuous whole year with seasonal variations. Malaria control interventions ongoing are seasonal malaria chemoprevention, malaria cases management after rapid test diagnosis, use of insecticide treated nets and intermittent preventive treatment in pregnant women. It was a site of millennium challenge until 2012 and currently ICEMR project, UNICEF and Terre des Hommes doing research on malaria and malnutrition respectively.

Study Design and Procedure

Data were collected on malaria and nutrition status during November cross sectional survey in children under five years to investigate association between malaria and undernutrition. This study as part of the ICEMR project whose the protocol has already been approved by Ethical Committee of Faculties of Medicine, Pharmacy and Odontostomatology of University of Sciences, Techniques and Technologies of Bamako (N°2019/04/FMPOS). After obtaining written inform consent from the parents/guardians, temperature, age, weight and height were measured in each child, also the blood sample were collected to perform blood smear (and RDT for child with symptom) and hemoglobin level. Then data were collected in each child mother (age, professional activity, educational level and wedding regime). Each cases of malaria or undernutrition has been referred to physician for best management.

Data Collection and Analysis

Sample size has been estimated from the prevalence of undernutrition in children under five years in Mali (18.6%) [3]. Assuming a confidence level of 95%, a sample size of 233 participants was selected. Electronic data capture was used for data collection in children's and case report form for mothers. Data were export in Excel 2010 and analyzed with STATA 14. Anthropometric indices were calculated with ENA for SMART. Logistic regression was used to determine association between nutritional status of children, malaria and mother's characteristics. Pearson correlation was used to determine the correlation between parasitemia and z-score of anthropometric indices with a significant p value at 0.05.

Malaria infection was defined as having blood smear positive with Plasmodium, malaria episode as number of malaria cases (confirmed with RDT) during transmission season) and anemia as hemoglobin (Hb) <11 g/dl. The undernutrition was defined by z-score < -2 standard deviation for height/age (stunting), weight/age (underweight) and weight/height (wasting).

RESULTS

A total of 233 children under five years were selected for this study. Age group 24-59 months represents 72.1% and 55.8% for mother from 25 to 34 years. More than half of children's mothers lived in polygamous regime (53.2%), the large majority was illiterate (90.6%) and mainly housewife (94%), and only 9.4% did at least primary school. The prevalence of malaria infection was 12.5%, 57.9% of children did at least one episode during transmission season and 52.8% for anemia prevalence. The prevalence of malnutrition was 14.6%, 40% and 10.7% respectively for underweight, stunting and wasting (Table 1).

In multivariate logistic regression analysis, anemia was associated with a high risk of underweight (OR = 6.91; 95% IC [2.41-19.73]) and stunting (OR=3.28, 95% IC [1.68-6.24]). Children age group from 24 to 59 months was associated a high risk of wasting (OR=8.37 CI 95% [1,06-25,68]). However, the polygamy was associated with underweight (OR = 0.36; 95% IC [0.15-0.84]) and stunting (OR=0.45 95% IC [0.23-0.87]) reduction. Older mothers (OR=0.25 CI 95% [0,08-0,73]) and children (OR=0.16 CI 95% [0,07-0,34]) were associated to wasting reduction. A significant association between malaria and undernutrition was not found (Table 2).

A significant correlation was not found between parasitemia and z-score of different anthropometric indices. But we trend to observe a small decrease in parasitemia in children having underweight (r=0.25 p=0.180 and stunting (r=0.27 p=0.15) (Figure 1).

DISCUSSION

Malaria and undernutrition are common in Mali mainly in children under five years and their association is responsible of a high mortality rate in Sub-Sahara Africa [11]. Investigate their association, especially in malaria endemic areas, might allow to discovering a new approach low-cost and effective combining a strategy at a same time against malaria and malnutrition. In 233 children under five years involved, age group from 24 to 59 months was the most represented. The mothers from 25 to 34 years were majority followed by age group 15-24 years and those from 35 to 44 years (Table 1). More than half of mothers lived in polygamous regime, the large majority was illiterate and mainly housewife (Table 1). The representativeness of age group of children and their mothers varies according the study

Table 1: Characteristics of Children and their Mothers

Variables	n (%)
6-23 months	65 (27)
24-59 months	168 (72)
Malaria infection	
No	204 (87.6)
Yes	29 (12.4)
Malaria episode number	
0	98 (42.1)
>= 1	135 (57.9)
Anemia	
No	110 (47.2)
Yes	123 (52.8)
Educational level	
No education	211 (90.6)
A last primary school	22(9.4)
Wedding regime	
Monogamy	109 (46.8)
Polygamy	124 (53.2)
Activities of mothers	
Housewife	219 (94)
Seller	14(6)
Age groups of mothers	
15-24 years	64 (27.5)
25-34 years	130 (55.8)
35-44 years	39(16.7)
Nutritional status	
Underweight	34 (14.6)
Stunting	95 (40.8)
Wasting	25 (10.7)

Table 2: Association Between Malaria and Nutritional Status Using Logistic Regression

Independents Variables	Under Weight			Stunting			Wasting		
	OR	IC 95%	*P*	OR	IC 95%	*P*	OR	IC 95%	*P*
24-59 months	0.83	[0.32-1.16]	*0.7*	0.16	[0.07-0.34]	*0.001*	8.37	[1.06-25.68]	*0.04*
Malaria infection	0.99	[0.33-3.01]	*0.9*	1.74	[0.67-4.54]	*0.2*	1.70	[0.47-6.13]	*0.4*
Malaria episode>=1	2.05	[0.84-5.02]	*0.1*	0.53	[0.27-1.04]	*0.06*	1.41	[0.53-3.69]	*0.4*
Anemia	6.91	[2.41-19.73]	*0.001*	3.28	[1.68-6.42]	*0.001*	0.51	[0.19-1.32]	*0.1*
Educational level									
No education	Ref.			Ref.			Ref.		
Education	0.83	[0.20-3.88]	*0.8*	1.12	[0.36-3.51]	*0.8*	0.95	[0.13-4.74]	*0.9*
Wedding regime									
Monogamy	Ref.			Ref.			Ref.		
Polygamy	0.36	[0.15-0.84]	*0.02*	0.45	[0.23-0.87]	*0.02*	0.41	[0.16-1.01]	*0.051*
Activities of mothers									
Housewife	Ref.			Ref.			Ref.		
Seller	0.46	[0.05-3.98]	*0.4*	0.34	[0.06-1.74]	*0.2*	0.49	[0.06-4.22]	*0.5*
Age group of mothers									
15-24 years	Ref.			Ref.			Ref.		
25-34 years	0.84	[0.33-2.11]	*0.7*	0.53	[0.25-1.12]	*0.1*	2.32	[0.70-7.71]	*0.1*
35-44 years	0.37	0.09-1.58]	*0.1*	0.25	[0.08-0.73]	*0.01*	2.07	0.43-9.81]	*0.3*

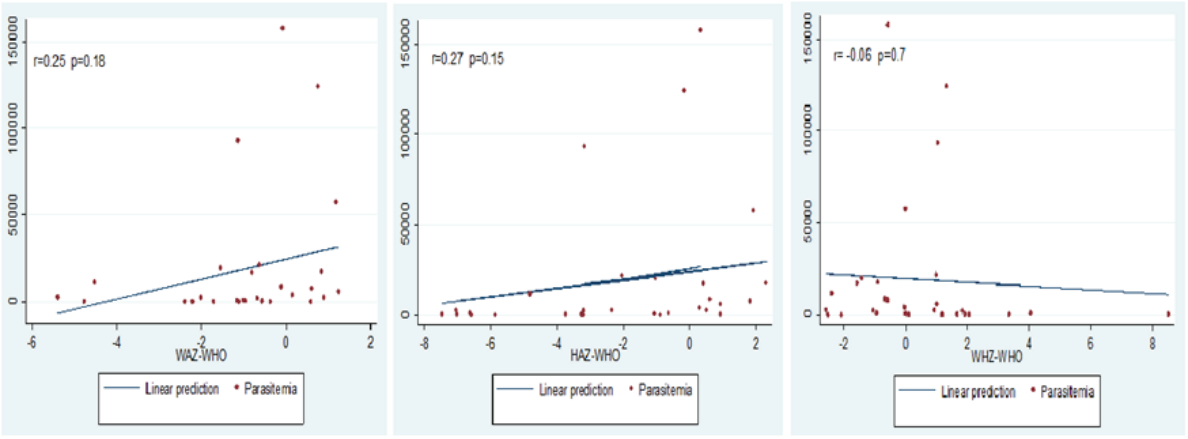

Figure 1: A significant correlation was not found between parasitemia and z-score of different anthropometric indices. But we trend to observe a small decrease in parasitemia in children having underweight (r=0.25 p=0.180 and stunting (r=0.27 p=0.15)

design [11-13]. The predominance of young mothers and housewives without educational level were already reported in national survey on nutrition and can be explained by general composition of African population and particularly in Mali [3, 14]. The high proportion of polygamous regime reflects the general situation in Mali and particularly in rural areas where the most majority of men opt for this regime [14].

The prevalence of malaria infection was 12.5%, more than half of children did at least one episode of malaria and had anemia during transmission season as previously reported in Mali [15,16]. The prevalence of malnutrition according anthropometric indices was high and proves that the nutritional situation in Koila remains serious in children in terms of public health [3].

In multivariate analysis, anemia was associated with a higher risk of underweight (OR = 6.91; 95% IC [2.41-19.73]) and stunting (OR=3.28, 95% IC [1.68-6.24]). The children from 24 to 59 months was associated with a higher risk (OR=8.37 CI 95% [1006-25.68]) of wasting. However, the polygamy was associated to underweight (OR = 0.36; 95% IC [0.15-0.84]) and stunting (OR=0.45 95% IC[0.23-0.87]) reduction. The older mothers (OR=0.25 CI 95% [0.08-0.73]) and children (OR=0.16 CI 95% [0.07-0.34]) were associated to wasting reduction. A significant association between the type of nutritional status according anthropometric indices and malaria infection and malaria episode number was not found (Table 2). Despite significant association not found between nutritional status of children and malaria, the role of parasite infection on undernutrition occurrence has been demonstrated in endemic areas previously [17, 18]. In areas where undernourishment remains a major public health problem, a repetitive infectious diseases quickly induce malnutrition in children [19] as mentioned in several studies in Africa [20-23]. Repeated infections contribute to decrease the nutrient absorption and increase basal metabolism, leading an imbalance between nutrients requirement and intakes, mechanisms advanced to explain infectious diseases role, especially malaria, in the occurrence of undernutrition in children living in endemic areas [6,11]. In our study, all children received four doses of sulfadoxine-pyrimethamine plus Amodiaquine during 2019 seasonal malaria chemoprevention campaign and could be explain the not association between malaria and undernutrition in children. Combined nutritional interventions with seasonal malaria chemoprevention in malaria endemic areas could be have benefits impact on nutritional status improvement in children [24]. Family income, mother's education, good sanitary conditions, older mother have been reported by Caroline in Mali [25], Deribew [26] in Ethiopia and Tine in Senegal [27] as having an influence on the nutritional status of children.

A significant correlation was not found between parasitemia and nutritional status according anthropometric indices. But a small

trend of decrease in parasitemia in children having underweight and stunting was observed. In malaria endemic areas, children with stunting are frequently infected with Plasmodium but have a lower parasitemia [28,29].

CONCLUSION

The prevalence of malnutrition is high in children, an association between malnutrition and malaria was not found. More studies are required to investigate another factor associated with nutritional status in children in this area.

LIST OF ABBREVIATION

ENA : Emergency Nutrition Assessment

GIS/UCRC : Geographic Information System/ University Clinical Research Center

ICEMR : International Center for Excellence in Malaria Research

NMCP : National Malaria Control Program

SMART : Standardized Monitoring and Assessment of Relief and Transitions

WHO : World Health Organization

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