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Intestinal Parasitic Infections Among Acute Malnourished Children During Ebola at Ratoma Medical Center of Conakry, Guinea

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Abstract: Intestinal parasitic infections are particularly severe in children in whom they can lead to malnutrition and decreased resistance to infections. In Guinea, no study has examined the burden of intestinal parasitic infections among malnourished children, especially in the context of the Ebola outbreak. The objective of this study was to determine the prevalence of and factors associated with intestinal parasitic infections among acute malnourished children at the Ratoma Communal Medical Center in Conakry in 2015. A 6-month cross-sectional study was conducted from April to October 2015 at the Ratoma Communal Medical Center of Conakry, Guinea. It included all children aged 6-36 months diagnosed with acute malnutrition, whose caregivers consented for the study. A total of 220 children suffering from acute malnutrition were included in the study. The prevalence of intestinal parasitic infections in the sample was 27%. Different parasitic species were identified in the infected children and included *Ascaris lumbricoides* (15%, n =33), Enterobius vermicularis (6%, n=13), Entamoeba coli (5%, n=11), and Taenia saginata (1%, n=3). Only children's age was associated with intestinal parasitic infections (AOR=1.37; 95% CI: 1.18-1.58). Household-based awareness-raising on under-five intestinal infections prevention along with deworming campaigns would constitute effective post-Ebola interventions toward the reduction of intestinal parasitic infections and malnutrition burden in under-five children in Guinea.

Keywords: Intestinal Parasitic Infections, Acute Malnutrition, Children, Ebola, Guinea

1. Introduction

Intestinal parasitic infections (IPIs) constitute a public health challenge especially among children in resource limited settings [1, 2]. For instance, soil-transmitted helminthiasis affects nearly 1.5 billion people and threatens 835 million children worldwide, mostly in developing countries [1].

IPIs are linked to poor hygiene, promiscuity and extreme poverty [3–5]. They are particularly severe in children in whom they can lead among others to malnutrition and decreased resistance to infections [3–5]. Malnourished children, because of their weak immunity [6], might conversely be prone and more vulnerable to comorbidities including IPIs.

In Guinea, little is known about the prevalence of intestinal parasitic infections among children. The annual incidence rate of intestinal helminthiasis was estimated to 223 cases per 1000 population countrywide (behind malaria and upper respiratory tract infections) in 2012 [7]. However, the 2012 Demographic and Health Survey (DHS) reported that only 30% of children received dewormers during the previous six months [8]. This indicator might have worsened during the

2014-2016 Ebola virus disease (EVD) outbreak since routine health activities slowed down [9–11] and this could include community-based activities such as deworming campaigns. In this context what's more characterized by a high prevalence of malnutrition among children (31% for stunting and 10% for acute malnutrition) [8], intestinal parasitic infections are more likely, as comorbidity, to increase the risk of morbidity and mortality especially among acute malnourished children. It is therefore paramount to examine intestinal parasite infections among children suffering from acute malnutrition. This information could contribute guiding interventions for the reduction of both malnutrition and IPIs related morbidity and mortality among children in Guinea. To date, few studies have reported about comorbidities in Guinean malnourished children, especially in the EVD outbreak context.

The objective of this study was to determine the prevalence of and factors associated with intestinal parasitic infections among acute malnourished children at the Ratoma Communal Medical Center in Conakry in 2015.

2. Methods

2.1. Study Design and Setting

This was a 6-month cross-sectional study conducted from April to October 2015 at the Ratoma Communal Medical Center (CMC) of Conakry, Guinea.

The Ratoma CMC is the main public health facility located in the Commune of Ratoma, the largest of the five communes of Conakry (the Guinean capital city). It is a secondary level health facility covering a population of 472,629 inhabitants in 2012, of which 17% were children aged under five years [7].

2.2. Study Population

The study population included children aged 6-36 months diagnosed with acute malnutrition at the Pediatric Unit of the Ratoma CMC. All children in whom acute malnutrition was diagnosed, i.e. with a weight-for-height z-score < 2 standard deviations were included in the study [12].

2.3. Data Collection and Study Variables

Data were collected using a structured and standardized questionnaire, which was tested beforehand in a health center of the Ratoma commune. Data were collected from the consultation register, the patients' medical records and parasitology bulletins. They included children's socio-demographic characteristics (age, sex, caregiver's age, profession, education level, and marital status), symptoms, anthropometric values (weight, height), presence of parasites in the stool (yes/no) and treatment outcome (recovery, relapse, transfer, loss to follow up, and death). The parasitological examination of the stool samples was performed in each selected child by a laboratory technician using the direct method and the Willis technique. The stool samples were collected from the selected children on the day following the acute malnutrition diagnosis. The study data

were collected by two trained medical students. A verbal consent was obtained from each child's caregiver before collecting data.

2.4. Data Analysis

Descriptive variable were presented as proportions or median (with 25% and 75% interquartile range). To identify the factors associated with the presence of parasite in the stool, the Pearson Chi Square, Fischer and Student t tests were used to compare the prevalence of intestinal parasitic infections across the study variables in bivariate analysis. All variables with a P value ≤ 0.20 were included in the logistic regression model. The unadjusted and adjusted odds ratios were derived. The significance level was set at 5% with a 95% confidence interval.

The data were analyzed using the EPI Info software version 7.1.5 (Epi Info ™, CDC Atlanta, USA).

2.5. Ethical Considerations

The protocol of the study was approved by the Scientific Committee of the Chair of Public Health, Faculty of Medicine, and University of Conakry. An inform consent was obtained from each child's caregiver prior to data collection.

3. Results

Socio-demographic and clinical characteristics of children

A total of 220 children suffering from acute malnutrition were included in the study. They were predominantly females (55.45%) and had a median age of 10 months with 25% and 75% interquartile range (IQR) of 8 and 14 months (*Table 1*). They had a median weight of 6.9 kg (IQR: 6.3-7.5 kg), a median height of 70 cm (IQR: 66.5-74 cm), and mostly recovered (84.55%) after the treatment received at the medical center. Children's caregivers had a median age of 25.5 years (IQR: 21.5-30 years); they were married/in union (83.64%), and housewives (34.55%), with secondary school or more level (55%).

Table 1. Socio-demographic characteristics and treatment outcome of acute malnourished children aged 6 to 36 months, seen in Ratoma Communal Medical Center, Conakry (Guinea) (N=220), April-October 2015.

Variables	Number	%
Median age (IQR), months	10 (8-14)	
Sex		
Male	98	44.55
Female	122	55.45
Median height (IQR), cm	70 (66.5-74)	
Median weight (IQR), kg	6.9 (6.3-7.5)	
Caregiver's median age (IQR), years	25.5 (21.5-30)	
Caregiver's profession		
Housewife	76	34.55
Seller	48	21.82
Employee	33	15
Student	32	14.55
Workwoman	29	13.18
Singer	2	0.91
Caregiver's education level		
None	52	23.64

Variables	Number	%
Primary	47	21.36
Secondary or more	121	55
Caregiver's marital status		
Unmarried	36	16.36
Married/In union	184	83.64
Treatment outcome		
Recovery	186	84.55
Loss to follow up	30	13.64
Death	4	1.82

Children's symptoms are shown in *Figure 1*. Most of them presented with emaciation (80%), followed by candida (40%) and diarrhea (40%), anorexia (35%), greenish stools (26%), vomiting (17%), and glairy stools (15%). Few children ($\leq$ 2%) had palor, anal pruritus, abdominal pain, conjunctivitis, abdominal bloating, dehydration, or meteorism.
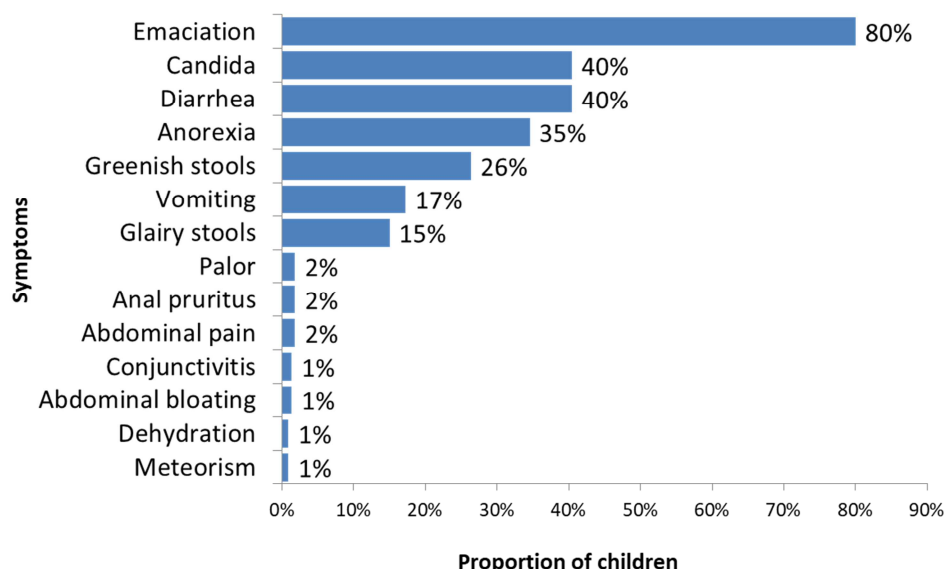

Figure 1. *Symptoms in acute malnourished children aged 6 to 36 months, seen in Ratoma Communal Medical Center, Conakry (Guinea) (N=220), April-October 2015.*

Prevalence of and factors associated with intestinal parasitic infections

The prevalence of intestinal parasitic infections among the sampled children was 27% (n=60) (*Figure 2*). Different parasitic species were identified in the infected children and included Ascaris *lumbricoides* (15%, n=33), Enterobius *vermicularis* (6%, n=13), Entamoeba *coli* (5%, n=11), and Taenia *saginata* (1%, n=3).
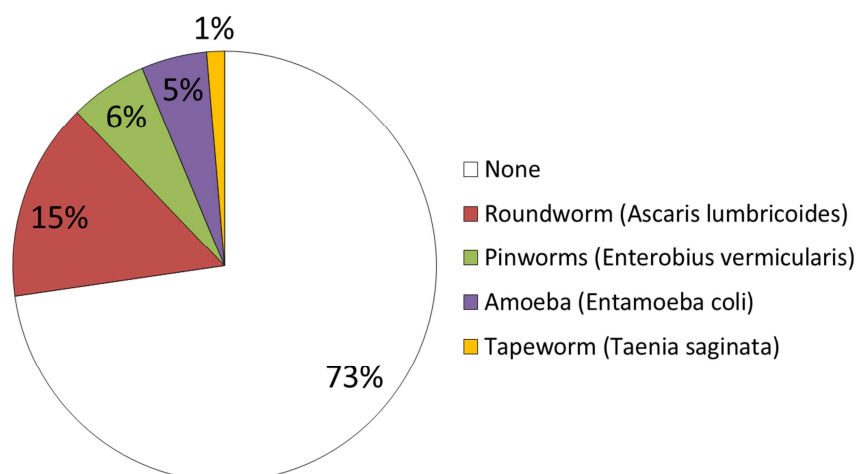

Figure 2. *Prevalence of intestinal parasitic infections among acute malnourished children aged 6 to 36 months, seen in Ratoma Communal Medical Center, Conakry (Guinea) (N=220), April-October 2015.*

The bivariate analysis showed that children's age, height, weight, and the presence of candida were associated with intestinal parasitic infections. However in the multivariate analysis, only children's age was associated with intestinal parasitic infections. They had a mean age positively associated with intestinal parasitic infections, with an AOR=1.37 (95% CI: 1.18-1.58).

Table 2. Factors associated with intestinal parasitic infections among acute malnourished children aged 6 to 36 months, seen in Ratoma Communal Medical Center, Conakry (Guinea) (N=220), April-October 2015.

Characteristics	Presence of intestinal parasitic infection (yes)			
	N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	*P*-value
Mean age (SD)	16.31 (6.32)	1.35 (1.23-1.48)	1.37 (1.18-1.58)	<.001
Sex				
Male	27 (27.55)	1		
Female	33 (27.05)	0.97 (0.54-1.77)	-	.93
Mean height (SD)	74.87 (5.87)	1.21 (1.13-1.29)	0.9 (0.75-1.08)	.25
Mean weight (SD)	7.61 (1.04)	2.58 (1.81-3.68)	1.69 (0.75-3.8)	.21
Caregivers' mean age (SD)	25.65 (5.64)	0.98 (0.93-1.04)	-	.47
Caregiver's profession				
Housewife	18 (23.68)	1		
Other profession[a]	42 (29.17)	1.33 (0.7-2.51)	-	.39
Caregiver's education level				
None	13 (25)	1		
Primary	15 (31.91)	1.41 (0.58-3.38)	-	.45
Secondary or more	32 (26.45)	1.08 (0.51-2.28)	-	.84
Caregiver's marital status				
Married/In union	53 (28.8)	1		
Unmarried	7 (19.44)	0.6 (0.25-1.45)	-	.25
Presence of emaciation				
Yes	30 (33.71)	1.71 (0.94-3.12)	-	.08
No	30 (22.9)	1		
Presence of candida				
Yes	14 (15.73)	0.34 (0.18-0.68)	0.52 (0.24-1.15)	.11
No	46 (35.11)	1	1	
Presence of diarrhea				
Yes	30 (33.71)	1.71 (0.94-3.12)	-	.08
No	30 (22.9)	1		
Presence of anorexia				
Yes	21 (27.63)	1.03 (0.55-1.92)	-	.93
No	39 (27.08)	1		
Presence of greenish stools				
Yes	18 (31.03)	1.29 (0.67-2.48)	-	.45
No	42 (25.93)	1		
Presence of vomiting				
Yes	10 (26.32)	0.94 (0.43-2.08)	-	.88
No	50 (27.47)	1		
Presence of glairy stools				
Yes	13 (39.39)	1.94 (0.89-4.19)	-	.09
No	47 (25.13)	1		
Treatment outcome				
Recovery	53 (28.49)	1		
Loss to follow up	5 (16.67)	0.50 (0.18-1.38)	-	.18
Death	2 (50)	2.5 (0.34-1.38)	-	.36

[a] Seller, employee, student, workwoman, singer

4. Discussion

This study is the first to examine intestinal parasitic infections (IPIs) among malnourished children in the Ebola virus Disease (EVD) context in Guinea. It showed that more than one acute malnourished child out of four (27%) seen at Ratoma Communal Medical Center in Conakry had IPIs, with Ascaris *lumbricoides* being responsible for more than half of these infections. The IPIs were associated with children's age. With regard to the progress to be achieved in child health as a result of the regular deworming campaigns ongoing in the country since years [13], the prevalence of IPIs found among acute malnourished children in our study is likely to indicate a drawback in controlling IPIs among Guinean children. An unpublished study (*Kamano et al,*

Medical thesis, University of Conakry, 2008) reported lower prevalence of IPIs (20%) among acute malnourished children aged 6 to 59 months in the National Institute of Child Health (INSE) in Conakry in 2008 [14]. With the passing of the EVD outbreak that decreased utilization of health services in the country, child health indicators worsened over the years 2015-2016 [9, 10]. The present finding therefore advocates for appropriate actions such as sustaining health coverage for under-five children for essential services like deworming campaigns, regardless of the epidemic context. In addition, another implication of the high prevalence of IPIs among acute malnourished children is the need for systematic investigation (stool examination) on IPIs in any child diagnosed with malnutrition.

This study suggests that more children were old, more they were likely to have IPIs. This should be explained by two

main facts. First, children, as they grow, are more likely to stay far from their caregivers, exposing them to the risk of handling infected/dusty stuffs. Since from the age of four months, the cognitive development of children makes them use their mouth to learn by feeling things out [15], the risk of ingesting infectious germs such as worm eggs/larva should therefore be higher as they grow up [16]. Most IPIs are transmitted by eggs present in human feces, which contaminate the soil in areas where sanitation is poor [1]. Second, children progressively lose their maternal immunity as they grow, thus making them more vulnerable to infections [17]. Bechir et al [18] in Chad in 2008 found that children aged 25 to 59 months had higher prevalence of IPIs than those of lower age group. Household-based awareness-raising on under-five intestinal infections prevention, e.g caregivers' sensitization on IPIs prevention along with the deworming campaigns would contribute to decrease IPIs burden among elder under-five children. A national survey in 2016 showed that in Guinea, only 26.5% of households had improved drinking water sources and toilets and that more than one-third of children aged 0 to 2 years in these households had feces safely evacuated [19].

More than half of the infected children in this sample had Ascaris *lombricoides*. Despite being reported as one of the commonest helminthes among children in sub-Sahara Africa [18, 20], this parasite species is known to impair nutritional status [1] and has been found among other helminthes to be associated with malnutrition in children [21]. This emphasizes the importance of deworming interventions, especially controlling helminthiasis, as key part of malnutrition prevention among children.

The present study had some limitations. The study population was limited to acute malnourished children. Inclusion of children without malnutrition could help to better understand the IPIs burden related to acute malnourished children. The study was also circumscribed to children presenting at a health facility. It therefore cannot give actual prevalence of IPIs among malnourished children since those not attending the selected facility were not included. However, this study has the merit to inform on in-facility IPIs burden among malnourished children in the particular context of the EVD. It also has important implications for post-EVD public health practices and policy for child health improvement in Guinea.

5. Conclusion

The findings of this study showed that more than one acute malnourished child out of four (27%) seen at Ratoma Communal Medical Center in Conakry during the EVD outbreak had IPIs, with Ascaris *lumbricoides* being responsible for more than half of these infections. The IPIs were associated with children's age.

This study urges for sustainable and regular deworming campaigns irrespective of the epidemic context. What's more, household-based awareness-raising of caregivers on child infections prevention with an emphasis on intestinal parasitic infections would contribute to decrease IPIs burden among Guinean children.

In addition, for better child health outcomes, this study recommends to Guinean medical practitioners to systematically investigate on IPIs in front of any case of under-five acute malnutrition.

Authors' Contributions

SS and AD were involved with conception and design of the protocol. SS, BSC, ASM were involved with acquisition of data. SS, BSC, AD and ASM did the data analysis and all authors were involved with interpretation. All authors have given approval for the final version to be published and are accountable. All authors read and approved the final version.

Conflict of Interest

The authors declare that they have no competing interests.

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