POSTER

Prevalence of intestinal parasitic infections and correlation with hemoglobin blood concentration among school-age children in Yagoua, Cameroon (Logone Valley)

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OBJECTIVE

Purpose of this cross-sectional study is to describe intestinal parasitic infections' prevalence in a group of school-age children from a low-income country, evaluating the correlation with hemoglobin concentration and supporting the development of control measures.

In developing world, **intestinal parasites infections** (*helminths* and *protozoa*) result in considerable gastrointestinal morbidity, malnutrition and mortality, especially among children. Data on prevalence are limited [1]: most of health statistics are unreliable, and signs/symptoms of infection are generally non-specific, going unreported. The risk of intestinal parasitic infections is influenced by behavioral, biological, environmental and socioeconomic factors [2], like poor hygienic practices/sanitation, poverty and lack of clean water or safe food [3].

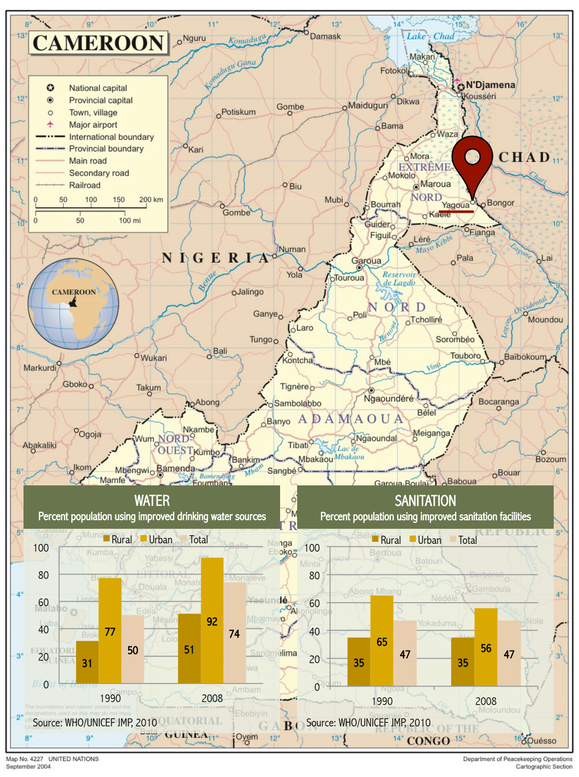
School-age children, defined as children aged 5 to 14 (WHO), have the highest risk of parasitic intestinal infections, the single largest contributor to disease burden in this group. The derived health problems can be long lasting, leading to malnutrition (through diarrhea and malabsorption) and maybe anemia (through loss of blood) [1]. Poly-parasitism is also a common occurrence.

Table I. Hemoglobin thresholds (WHO, UNICEF, UNU)

Children 6 months to 59 months	11 g/dL
Children 5 - 11 years	11.5 g/dL
Children 12 – 14 years	12 g/dL
Non-pregnant women (> 15 years of age)	12 g/dL
Pregnant women	11 g/dL
Men > 15 years of age	13 g/dL

Anemia, today one of the most common nutritional problem in the world (two billion people effected) [4], is usually associated with parasitic disease (malaria and intestinal parasitic infections) through iron deficiency [5]. Anemia is clinically defined as a hemoglobin concentration below the thresholds given by WHO, UNICEF, UNU (Table I).

Yagoua, site of intervention, is located in the **Logone River Valley** in the *"Région de l'Extrême-Nord"*, near the Chad border: here food or waterborne diseases are a common problem, in particular for bacterial and protozoal diarrhea, typhoid fever, and hepatitis A and E, especially for the consumption of microbiologically unsafe surface water [6].



METHODS

The study was conducted in February 2012 in a public school in Yagoua. The protocol was approved by the Directeur du *Comité National d'Ethique du Cameroun* on September 21st 2011 (authorisation n°228/CNE/SE/2011).

Participation was voluntary and free, parents gave their consent to participate after being properly informed. Recruitment was done through different channels (meetings, radio advertising, flyers).

Children (5 to 8 years old, both male and female) underwent an initial clinical assessment and filled a nutritional and health questionnaire. They were screened for intestinal parasites: the *Medical Microbiology Laboratory* of the Regional Hospital of Yagoua examined stool specimens through both a macroscopic (consistency) and microscopic (presence and amount of eggs, cysts and trophozoites) evaluation. Fecal samples were examined using the method described by WHO with a direct saline and iodine preparation [7]. Additionally, a complete blood count was performed. Anemia was defined as hemoglobin concentration below 11.5 g/dL.

Data entry and analysis were done with Microsoft Excel and IBM SPSS 20. This study was part of a RCT carried out in 2012 to assess efficacy of *Moringa Oleifera* implementation in a normal diet.

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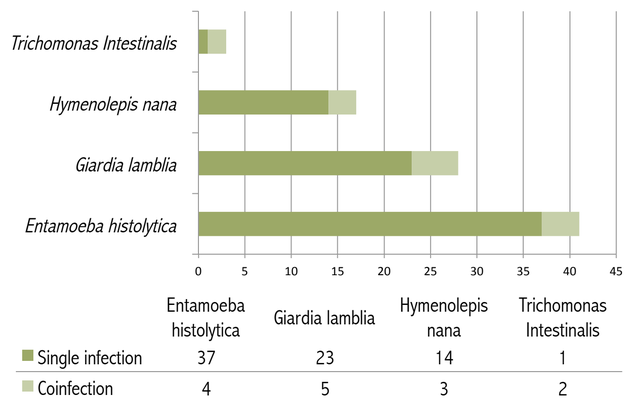
RESULTS

175 children (mean age 6.5 ± 0.8 years) enrolled in the study, 45% boys and 55% girls. 93 children underwent blood test (mean Hb: 11.57 ± 0.91 g/dL), with a 47% prevalence of anemia.

Overall distribution (Table II). In 93 children (53%) research resulted negative, while 82 (47%) were infected with one or more parasites (4% multiple infections). Considering infections globally, the most widespread parasite was *Entamoeba histolytica/dispar* (41, 23%), followed by *Giardia lamblia* (28, 16%), *Hymelonepis nana* (17, 10%) and *Trichomonas intestinalis* (3, 2%).

Table II. Prevalence: subdivision in single and co-infections

Single infections	**75**	**43%**
Entamoeba histolytica/dispar	37	21%
Giardia lamblia	23	13%
Hymenolepis nana	14	8%
Trichomonas Intestinalis	1	0.6%
Multiple infections	**7**	**4%**
E. histolytica/dispar and G. lamblia	2	1%
E. histolytica/dispar and H. nana	2	1%
G. lamblia and T. intestinalis	2	1%
G. lamblia and H. nana	1	0.6%
Negative Research	**93**	**53%**



Sex distribution. Male and female prevalence rates were not significantly different (48.7% versus 45.1%). No difference in type of pathogen involved or intensity of infection was demonstrated.

Hemoglobin (Table III). No difference in hemoglobin level was demonstrated in infected and non-infected children (11.66 ± 1.05 g/dL; 11.5 ± 0.8 g/dL) also considering single/multiple infections or single pathogen. The same is true for prevalence rate in *anemic* and *normal* children.

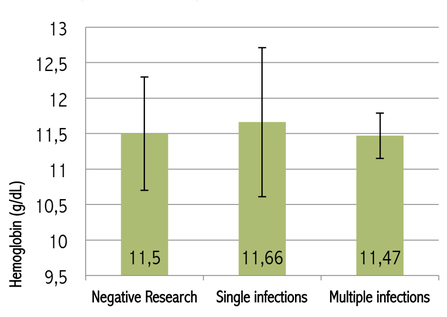


Table III. Hemoglobin concentration and prevalence rate of anemia

	No infection	Single infection	Multiple infection
Hemoglobin	11.5 ± 0.8 g/dL	11.66 ± 1.05 g/dL	11.47 ± 0.32 g/dL
Categorization			
Anemia	22 (47%)	21 (49%)	2 (50%)
Normal	25 (53%)	22 (51%)	2 (50%)

CONCLUSIONS

Very little is known on prevalence of intestinal parasites infections in sub-Saharan Africa and this was the first study in the area assessing their distribution in school-aged children.

A high prevalence was found, with 4% poly-parasitism, suggesting that implementation of deworming campaigns might be a good option for disease control. No association was demonstrated with anemia and literature on this topic is controversial. Unfortunately, logistical issues influenced the number of children that underwent blood tests (53% of the enrolled). Here, high prevalence of anemia is probably due to other causes, like malaria (high incidence trend in the period under study), iron and other micronutrient deficiency or hemoglobinopathies.

Findings might help policy makers for public health interventions, improving prevention strategies in the area (i.e. deworming, safe water use and consumption, hand hygiene campaigns and health education programs). Safe food and water consumption is of great importance in the country, where estimates account that 23% of the population has no access to improved water sources, with enormous disparity in urban and rural areas: surface water is consumed by 5% and 48% of population respectively, with serious problems of microbiological contamination [6, 8].

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