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Full Length Research Paper

Giardia intestinalis and Entamoeba histolytica: Their Prevalence and Hematological Effects on Children between Seven Months to Seven Years at the Mother and Child Teaching Hospital in N'Djamena, Chad

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Abstract

This study was to assess the prevalence of *Giardia intestinalis* and *Entamoeba histolytica* and their hematological effects on children between 7 months to 7 years at the mother and child teaching hospital of N'Djamena. Patients consisted of 200 children who were brought for consultation in the paediatric ward. Our work started from November 2019 to April 2020. Stool samples were collected from patients and examined by direct smears and Willis floatation technique. Hematological parameters examined were: hematocrit, Hemoglobin, red blood cells, leucocytes and eosinophils. From the population studied, 42% had gastrointestinal protozoa infections. Our study recorded the prevalence of *Giardia intestinalis* (25%) and *Entamoeba histolytica* (75%). Parasites were isolated from all the age groups. Infections were higher in males 25% than in females 16.66%. Patients infected presented lower average of hematocrit 30%, hemoglobin 8.62±1.043, red blood cells 2.64±0.38, leucocytes 13.73± 2.62 and eosinophils 6.16%. The most frequent symptoms observed for both parasites were diarrhoea 25 (12.5%), abdominal pain 25 (12.5%), abdominal pain and diarrhoea 21(10.5%) and digestive discomfort 13(6.5%). This study noticed a strong prevalence of *E. Histolytica and G.intestinalis* among the children. A statistical significant different was found between infected and the non-infected subjects (P < 0.05).

Key words: *Giardia intestinalis*, *Entamoeba histolytica*, prevalence, Hematological, child, Chad.

INTRODUCTION

In spite of the hygienic and improvement on health care, parasitic infections are responsible for some of the morbidity and mortality worldwide and especially in tropical regions, particularly in the developing countries. Thus, uncontrolled growth of population, climatic variation, low level of hygienic education and poor nutrition are among some of the causes (Hamit et al., 2020a). In addition to pathogenic intestinal parasites, humans are infected with commensal protozoa that are living and feeding in their gastrointestinal tract. Generally, pathogenesis, complica-

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tions and mortality caused by intestinal parasites in an area depend on the parasite species, immunological, physiological and demographic factors as well as socioeconomic and cultural situations. These infections can cause a wide range of clinical symptoms such as acute watery diarrhoea, abdominal cramps, dehydration, fever, nausea, and vomiting, which are more common among children and may cause failure to thrive (Zemichael et al., 2018). According to Kpurkpur et al. (2016) *Entamoeba histolytica* and *Giardia lamblia* are among some of the highest parasites that infect young children. *G. lamblia*, a flagellated protozoa, colonizes the upper segment of the small intestine and humans are infected through ingestion of parasite cysts. *Giardia* cysts are relatively resistant to environmental conditions, particularly in water. Giardiasis is the disease of all ages; however, its prevalence is higher in children (Betancourt et al., 2014). Clinical picture in newborns and children varies from an asymptomatic infection to an acute infection or a chronic disease with sudden attack of watery diarrhoea, abdominal cramps, malabsorption and weight loss. *Entamoeba histolytica*, a common protozoa of large intestine, has two forms: cyst and trophozoite in its life cycle. The cyst is the transmissible stage, which is transmitted directly or indirectly via the fecal-oral route. The symptoms are diarrhoea, vomiting, abdominal cramps and bloating. Its prevalence is 1.6% - 16% in the developed countries and up to 60% in developing countries (Sedighi et al., 2015).

Children are more susceptible to intestinal protozoa infections and the physical and psychological damages are more predominant among them. Related epidemiologic studies in each area should be conducted in order to control the disease (Kpurkpur et al., 2016).

Intestinal protozoa constitute some of the most causes of death among children in Africa. They are most common among school-age children who harbour high intensities (Ajayi, 2017). These infections can affect the child's development, educational achievement, social and economic development (Khushbu and Satyam, 2016). These parasites consume nutrients from the children they infect, thus retarding their physical development, they destroy tissue, organs, and cause abdominal pain, diarrhoea, intestinal obstruction, anemia, ulcers and other health problems. Consequently, the infection can slow cognitive development and thus impairs learning. It produces nutritional deficiencies and anemia in children, especially when hookworm infection is present (Rejane et al., 2020).

MATERIALS AND METHODS

Permission for this research was demanded and obtained from the ethical committee of the Faculty of Human Health Sciences (FHHS) of the University of N'Djamena, Chad. A questionnaire containing all the information needed was provided to each of the parent who accompanied the child. Each of them was provided with a labelled stool vial. Before receiving the stool vial the parents were thought the safety majors of collecting stool from their children in order to avoid contamination. But the labelled blood collection tubes were handed to the laboratory technicians who collected blood from the patients. The physicians and laboratory technicians participated in our work. This study was carried out from November 2019 to April 2020. All the patients involved were offered equal opportunity to participate in the study. A total number of 200 children from seven months to seven years participated in this study, they consisted of 120 males and 80 females. Data were collected using a structured questionnaire when a paediatrician performed the clinical examination.

Laboratory analysis of stool samples was carried out by direct method and Willis floatation technique. Hematological parameters (hematocrits, hemoglobin, red blood cells, leucocytes and eosinophils) were analyzed using an automatic machine called Micros ES 60 HORIBA.

Statistical analysis was done using SPSS Inc version 20 with statistical significance (p) value of <0.05. The results were analyzed using Chi- X^2 square test to compare two or more proportions.

RESULTS

Table 1 indicates that out of the 200 children who participated in this research 84 (42%) of them were infected. However, males were more infected than females.

The above table shows that patients infected by *G. intestinalis* are fewer than those infected by *E. Histolytica.*

From the above figure, it is important to note that the prevalence of *E. histolytica* is more than that of *G. intestinalis* in all the age groups.

The analysis of protozoa infection and educational level has indicated that 43(51.19%) patients in primary school had *E. histolytica*, meanwhile 12(14.28%) had *G. intestinalis.* Those children in the nursery presented 20(23.80%) of *E. histolytica,* but only 9(10.71%) had *G. intestinalis.* There is a significant different between infection of children by *G. intestinalis* and *E. histolytica* on the educational levels (table 3).

During the investigation, comparison of symptoms presented by both parasites were similar, but large differences in percentages of symptoms were found (Table 4).

The analysis of the hematological parameters shows that leucocytes and eosinophils were higher in infected children than uninfected ones. However, hematocrits, hemoglobin and red blood cells were lower in infected children than uninfected (table 5).

Table1. Prevalence of G. *intestinalis* and *E. histolytica* according to gender.

Gender	N (%)	n (%)
Male	120 (60%)	43 (21.5%)
Female	80 (40%)	41 (20.5%)
Total	200 (100%)	84 (42%)

Legend: N= number of uninfected children, n= number of infected children with the two parasites.

Table 2. Prevalence of *G. intestinalis* and *E. histolytica* in infected children.

Parasites	N	Percentage
Giardia intestinalis	21	25%
Entamoeba histolytica	63	75%
Total	84	100%

Legend: N= number of infected children.

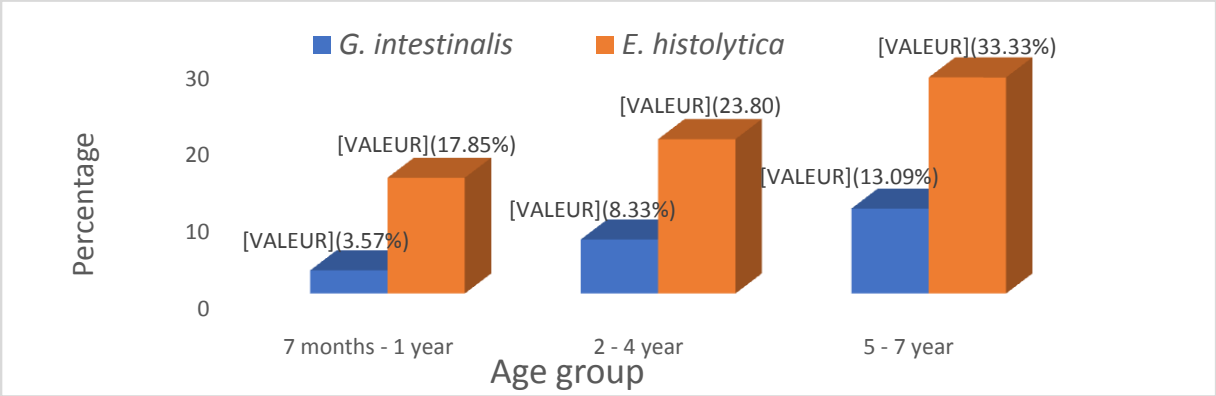

Figure1.The prevalence of *G. Intestinalis* and *E. Histolytica* among children, according to age groups.

DISCUSSION

Gastrointestinal parasites remain a public health problem in many parts of the world and especially in Chad. Our investigation demonstrated that 84 (42%) of patients hosted both parasites at the paediatric ward. The prevalence mentioned above is lower than that obtained by the following authors: Hamit et al. (2020b), Nkengazong et al. (2018). It is suggested that the low prevalence obtained by us (42%) as compared to the above authors may be due to the number of samples, differences of techniques and other factors such as ages of the patients. However, our result proved higher than that obtained by Nsagha et al. (2017) and Zongo et al. (2019) who respectively found 7.3% in Cameroon and 20.8% in Burkina Faso. The higher result obtained by us as compared to them may be attributed to several factors: climatic differences, cultural system, educational level and the differences in health education.

In our research we discovered that the prevalence of the parasites studied was higher in males than females. This is in accord to the result obtained by the following authors: (Zongo et al., 2019; LaBeaud et al., 2014; Mulatu et al., 2015; Alaa hamady obeid Al-Taei, 2019). The reason for males being more prevalent in the contamination with parasites than females may be possibly explained by the vigorous activity of males than females. It is also important to indicate that males eat out of their homes more than females, therefore food prepared out of the homes may have doubtful hygienic conditions.

Children aged between 7 months to 1 year were the least infected by *E.histolytica* and *G. intestinalis*. But children between 2 to 4 years showed a higher infection, meanwhile the highest prevalence was found in children

Table 3. Numbers of infected children according to educational level.

Education level	Numbers and types of parasites		P value
	G.intestinalis	*E.histolytica*	
Primary	12(14.28%)	43(51.19%)	P=0.0001
Nursery	9(10.71%)	20(23.80%)	
Total	21(25%)	63(75%)	

Table 4. Number and percentages of children infected in accordance with the presence of symptoms.

Symptoms	**Type of parasite**		**Total symptoms for both parasites N (%)**
	G.intestinalis N (%)	*E. histolytica* N(%)	
Diarrhoea	15 (17.85%)	10 (11.90%)	25 (12.5%)
Abdominal pain	2 (2.38%)	23 (27.38%)	25 (12.5%)
Digestive discomfort	1(1.19%)	12 (14.28%)	13 (6.5%)
Abdominal pain and diarrhoea	3(3.57%)	18 (21.42%)	21 (10.5%)
Total	**21 (25%)**	**63 (75%)**	**84 (42%)**

Legend: *G= Giardia*, *E: Entamoeba;* N=Number of infected children.

Table 5. Effects of *G. intestinalis* and *E. histolytica* on hematological parameters.

Parameters	Infected children n = 84	Uninfected children n=116
HT (%)	30%	45%
Hb mg/100mL	8 .62±0.43	11.81±1 .19
RBCx106 cell/mm³	2.64±0.38	4.75±5.20
Leucocytes	13.73±2.62	6.62±1.84
Eosinophils	6.16%	1.25%

Legends: HT= hematocrits, Hb= hemoglobin, RBC= red blood cell.

between the ages of 5 to 7 years. It should be noticed that babies between 7 months to 1 year are critically taken care of by their parents than older children. The possibility of contamination of the lowest age groups by parasites is reduced, however ages between 2 to 5 years are more active and could possibly be contaminated because they may eat food even though it may fall on the ground in contact with parasites. Children in primary school were the most infected by the two parasites in our study. This can be clearly understood because of their various activities in primary school. Their rate of being contaminated by parasites is higher. It is worth noting that there are many sources of parasitic contamination as far as children are concerned. The sucking of fingers by children, washing of hands in dirty water before meals, unhygienic habits due to ignorance and the playing in contaminated areas and defecation in soil or water (Kpurkpur et al., 2016).

Our work has discovered that the prevalence of *E. histolytica* is present in all the age groups and it is higher than *G. intestinalis*. The high endemicity of these two parasites were also reported by Zongo et al. (2019) and this result confirms our findings. Concerning clinical symptoms of the infected children, we found that 25(12.5%) of them who were infected by *G.intestinalis* and *E.histolytica* had diarrhea and abdominal pain, 25(12.5%). The clinical symptoms found during our work are closely similar to those reported by Haidee Custodio (2016).

It is generally known that *G. intestinalis* is found in almost every country, meanwhile *E. histolytica* is mostly found in wet, humid and worm climate. The presence of these

parasites is a clear indication of poor environmental sanitation, bad personal hygiene, and lack of hand washing culture (Khushbu and Satyam, 2016). Symptoms of digestive discomfort were more in patients infected with *E. histolytica* than *G. intestinalis*. Abdominal pain and diarrhoea were also found in more patients infected with *E. histolytica*. Contrary to these two symptoms, diarrhoea alone is higher in *G. intestinalis* and lower in *E. histolytica. G. intestinalis* is known to present symptoms almost similar to those of *E.histolytica* , however patients infected by *G. intestinalis* show more severe symptoms that may lead to weight loss. The analysis done in our survey showed that out of 200 consulted children, 84 of them who were infected had a lower average of hematocrits, hemoglobin and red blood cells. The same results were obtained by Ali et al. (2014) and Dos Santos et al. (2016). These results can be caused by iron deficiency in the lumen of the gut and impair synthesis of hemoglobin and subsequently the synthesis of red blood cells. It had been found that the adult parasites produce hemolysin that could consume RBCs and lead to anemia and reduced level of hemoglobin (Ossama et al., 2015). Contrary to the above mentioned low hematological parameters of infected patients, leucocytes and eosinophils presented higher numbers. It is normal that the presence of infections should activate the immune system to produce white blood cells. Leucocytes being part of white blood cells should normally increase. Eosinophils are specialized in fighting parasitic infections, this is the reason for their increase in infected subjects.

CONCLUSION

Intestinal protozoa are spread all over the world. Their prevalence is particularly higher in tropical regions. In Mother and Child Teaching Hospital (MCTH) in the city of N'Djamena, 42% of the children in our study were carriers of the parasites. This prevalence is higher than in previous studies. A strong prevalence of *E. Histolytica* and *G.intestinalis* was noticed. The high prevalence of these parasites may suggest inadequate hygienic practices and low level of health education. In the blood of infected children there was an average decrease in the level of haematocrit, haemoglobin and red blood cells. This could lead to anemia. In order to reduce the prevalence and amelioration of hygienic conditions, access to clean drinking water and a change of mentality or habits are necessary and urgent. An adequate strategy to prevent gastrointestinal parasites should be put in place by the government. Individual and public hygiene should be thought in schools.

Conflict of interest

We the authors declare that there is no conflict of interest concerning the publication of our work.

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