

Full Length Research Paper

Prevalence of intestinal helminths and their effects on anthropometric, haematological and metabolic parameters among patients of two teaching hospitals in N'Djamena (Chad)

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Received 10 September 2020; Accepted 9 October, 2020

This study was to determine intestinal helminths and their effects on anthropometric, hematological and metabolic parameters among patients in two teaching hospitals in the region of N'Djamena (Chad). Patients consisting of 300 adults at the gastroenterology service of the National Reference Teaching Hospital (NRTH) and 112 children at the pediatric ward in Mother and Child Teaching Hospital (MCTH). Their ages ranged from 3 months to 75 years. This study was conducted from July to September, 2017. Stool samples were collected from all patients and examined using the following techniques: Kato Katz, direct method and Willis floatation. Blood samples were collected to determine haemoglobin, eosinophil and leucocytes. From a total of 412 subjects, 87 (21.11%) had gastrointestinal helminth infections. Ten parasitic species were found: *Hymenolepis nana*, *Ascaris lumbricoides*, *Teania saginata*, *Trichuris trichura*, *Ankylostoma duodenale*, *Schistosoma mansoni*, *Hymenolepis diminuta*, *Enterobius vermicularis*, *Strongyloides stercoralis*, and *Teania solium*. *Hymenolepis nana* and *Ascaris lumbricoides* were isolated from almost all the age groups. Parasitic infections were higher in children (49.10%) while in adults 10.67%. Patients infected by helminth species presented a lower average of haemoglobin level (8.62±1.043). The most frequent symptoms found were diarrhoea (5.33%) and abdominal pain (5.58%).

Key words: Gastro-intestinal Helminths, sex and age, prevalence, anthropometric parameters.

INTRODUCTION

Intestinal parasites affect the human digestive tract and associated organs. The presence of these organisms is

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usually asymptomatic, but in some cases, it causes digestive pathologies. The intestinal parasites are numerous, differ and varied. They are differentiated by their morphologies, their life cycles, and modes of contamination, clinical manifestations, diagnoses and treatments. Intestinal parasitic infections are endemic and are described as the greatest single worldwide cause of diseases (Nematian et al., 2008).

Climatic (temperature and humidity) and socio-economic factors, inadequate hygienic sanitation, poor and bad habits of populations, favour intestinal helminth infections.

World Health Organization estimated that more than 2 billion people around the world are infected with these parasites. In tropical countries, these infections account for nearly 40% of all diseases other than malaria (Dianou et al., 2004). Recent estimates reveal that 740 million people are infected particularly in tropical rural areas (Sub-Sahara Africa, East Asia and Central South America). Each year roundworms and hookworms alone cause 195000 deaths in the world.

Intestinal helminths constitute the second cause of death of children aged less than six years in Africa (Ogbe et al., 2002). They are most common among school-age children who tend to harbour high intensities (Ekpenyong, 2008). These infections can affect the child development, educational achievement, reproductive health, social and economic development (Nematian et al., 2008). 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, anaemia, ulcers and other health problems. Consequently, the infection can slow cognitive development and thus impairs learning; it produces nutritional deficiencies and anaemia in children, especially when hookworm infection is present.

MATERIALS AND METHODS

This cross-sectional study was carried out from July 2017 to September 2017. All the 412 patients involved were offered equal opportunity to participate in the study. A total of 300 adults (72.81%) from 15 to 75 years in National Reference Teaching Hospital (NRTH), and 112 children (27.19%) from 3 months to 12 years in Mother and Child Teaching Hospital (MCTH) participated in this study.

Data were collected using a structured questionnaire when a gastroenterologist performed the clinical examination or a paediatrician, a stool vial of 32 ml and a urine collection tube were given to each patient for stool and urine collection. The stool and urine were collected between 7am and 8am, then labelled and analysed. Complete blood count was performed by obtaining a 5 to 10 ml of blood sample directly from the patients (adults and children) and put it in an anticoagulant tube containing Ethylene Diamine Tetra Acetic Acid (EDTA). Also the anthropometric parameters, weight and height were measured according to the anthropometric level (Juliet, 1997); the height was measured using an electronic weighing balance and a measuring tape to calculate

anthropometric indicators Body Mass Index (BMI) with precision above 0.5 cm, and weight with a graduated platform above 150 kg and 100 g accurate.

Laboratory analysis of stool samples were carried out by direct method, Kato-Katz and Willis floatation techniques were used, also the Complete Blood Count (CBC) were generally determined by a special machine Micros ES 60 HORIBA that analyze the different components of blood within less than a minute.

Statistical analysis

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

RESULTS

The study was done on 412 patients at the National Reference Teaching Hospital (NRTH) and Mother and Child Teaching Hospital (MCTH) from July to September 2017, all of the patients were complaining of different gastrointestinal symptoms with or without anaemia. Out of 412 patients involved, 87 (21.11%) were positive for gastrointestinal helminthic infection. In the present study, the commonest parasitic infections were with *Hymenolepis nana* (6.80%) and *Ascaris lumbricoides* (5.10%). However, *Hymenolepis diminuta* (0.97%), *Enterobius vermicularis* (0.72%), *Strongyloides stercoralis* (0.49%), and *Tenia solium* (0.49%) were less common and were diagnosed in children (Table 1).

The sex

The sample distribution by sex is given in Table 2, it shows that male participation was higher in male 230 (56%) than female 182 (44%). In fact the sex ratio was 1.26 in favour of masculine patients and the male participation at the gastroenterology service was 174 (58%) and female was 126 (42%). On the other hand, the sex distribution among the children at paediatric ward was equal (50%) (Table 2).

Weight according to age

The relationship between infectivity and BMI was determined as normal weight 65.51%, and underweight 34.49% $P= 0.49$ ($P> 0.05$). Those with lower BMI were more parasited than those with higher BMI (Table 3).

Haematological indices and metabolic parameters among patients infected by different parasitic species

This investigation reveals a significant correlation in the

Table 1. Helminths prevalence during the study.

Parasite species	Adults	Children	Total
	(n=300)	(n=112)	(n=412)
	(%)	(%)	(%)
<i>Hymenolopis nana</i>	2.00	19.64	6.80
<i>Ascaris lumbricoides</i>	3.00	10.71	5.10
<i>Teania saginata</i>	1.33	4.46	2.18
<i>Trichuris .trichiura</i>	0.67	4.46	1.70
<i>Ankylostoma duodenalis</i>	1.00	2.67	1.46
<i>Schistosoma mansoni</i>	1.33	0.89	1.21
<i>Hymelopis dimunita</i>	0	3.57	0.97
<i>Enterobius vermicularis</i>	0	2.67	0.72
<i>Strengloides stercoralis</i>	0.67	0	0.49
<i>Teania.solium</i>	0.67	0	0.49
Total	10.67	49.11	21.12

n= Participant's number; n'= Participant's infected number; (%) = percentage.

Table 2. Patient's distribution by sex.

Patient	Adults		Children		Total	
	%	n' (%)	%	n' (%)	%	n' (%)
Female	42	16 (0.12)	50	28 (50)	44	44 (24.17)
Male	58	16 (9.2)	50	27 (48,21)	56	43 (18.7)
P value	0.003 and $\chi^2=8.71$		0.85 and $\chi^2=0.03$		0.17 and $\chi^2=1.83$	
Total	72.81	32 (10.67)	27.19	55 (49.1)	100	87 (21.11)

n= Participant's number; n'= Participant's infected number; (%) = percentage; F= feminine; M= masculine.

Table 3. Effect of helminths on anthropometric parameters.

Age (years)	Underweight BMI <18.5 [n' (%)]	Normal BMI >18.5-24.9 [n' (%)]
3 months-5	7 (6.25)	17 (15.17)
6-10	8 (7.14)	12 (10.71)
11-15	4 (3.57)	7 (6.25)
16-20	6 (2)	5 (1.66)
21-25	1 (0.33)	2 (0.66)
26-30	0	3 (1)
31-35	0	2 (0.66)
36-40	0	5 (1.66)
41-45	2 (0.66)	2 (0.66)
46-50	1 (0.33)	0
51-55	1(0.33)	0
56-60	0	1 (0.33)
66-70	0	1 (0.33)
Total	30 (34.49)	57 (65.51)

n': Participant's infested number; %: Percentage; BMI= Body mass indices.

haematological indices, metabolic parameters and presence of intestinal parasites. The presence of

increased albumin in the urine of 7 patients may suggest a higher rate of infection by helminths. Anaemia was

Table 4. Effect of helminths on haematological and metabolic parameters.

Characteristics	Non infested		Infected by helminths		P-value
	n	%	n'	%	
Anaemia	295	90.76	30	34.48	p<0.05
Eosinophilia	310	95.38	15	17.24	
Leucocytosis	300	92.30	25	28.73	
Albumin	318	97.84	7	8.04	
Total	325	78.88	87	21.11	

n: Participant's non infested number; (%): percentage; n'= Participant's infested number.

detected in 30 (34.49%) of patients with helminth infections. It is also important to notice that there is a significant relationship between the increased duration of parasitic invasion and the decrease of the following blood cells: haematocrit, white blood cells, eosinophils and haemoglobin ($P<0.05$) (Table 4). In addition, there is a significant relationship between increased duration of infestation and other clinical symptoms such as diarrhoea, abdominal pain and vomiting $p<0.05$ (Table 5).

DISCUSSION

Intestinal parasites are among the most common infections in populations all over the world and specially in developing countries. Despite the fact that the infection rate is gradually decreasing but it is still a major public health problem in Chad. However, easy accessibility to treatment and low cost of medication are available; adults and children from developing nations are still highly affected by parasitic infections. This study was carried out in NRTH and MCTH at the gastroenterology service and the paediatrics ward, respectively. Prevalence of intestinal helminths and their effect on anthropometric, haematological and metabolic parameters among patients of these hospitals was determined (correction done). Here did not take into account protozoa, although, these organism constitutes an important part of the pathogen in stool test in laboratories of hospitals in Chad (Hamit et al., 2013).

Our survey showed that 21.11% of patients hosted intestinal helminths (10.67%) at gastroenterology service of NRTH and 49.10% at the paediatric ward of MCTH. The aforementioned prevalence appears to be minimized because specific techniques were not employed for the search of *S. stercoralis* or for *E. vermicularis* which are parasites quite common in children because of their particular cycles. The prevalence mentioned was lower than the prevalence of 51 and 57% obtained by Hamit et al. (2008, 2013), in a study of "An Epidemiological Assessment of the Infectious forms of Intestinal Helminths

in School Children from Chad", and also lower than the prevalence of 60% obtained by Béchir et al. (2011) in Lake Chad region, the prevalence of 57.7% in N'Djamena, and also lower from that obtained in other tropical regions such as Gondar in Ethiopia by Worku et al. (2009), 56% in Ebonyi State South Eastern Nigeria by Elom et al. (2013), and 60% at Mekenéné in Cameroon. The prevalence in the present work was lower (21.11%) in comparison to the study of Shrestha et al. (2011) in Nepal who conducted a study among the population and obtained the prevalence of 20.5%. This level of infestation shows that the intestinal helminths are still a public health problem in Chad.

The infestation rate was slightly higher in female sex than the male sex, where eighty seven cases 87 (21,11%) of patients were infested by helminth species in which 32 (10.67%) adults at gastrology service were infested by at least one helminth egg, and 55 (49.10%) children at pediatric ward which 27 (48.21%) were boys and others 28 (50%) were girls, these results are similar to those of several authors, in Abidjan, Adou-Bryn et al. (2001) in Toumadi and Stephane et al. (2004) in Agboville, and also in Centre, East and West of Cameroon by Tcheum et al. (2012). On the other hand Agbolade et al. (2004), in South West of Nigeria and Hamit et al. (2008, 2013) in N'Djamena (Chad) found that the infestation was high in the masculine sex. This might be due to the reason that females are less likely to take medical treatment than males. In our study, the infection rate has no significant difference to the sex in adults and children ($P>0$) ($P>0.05$) and children ($P>0$) ($P>0.05$) (Table 2).

The children age group (3 months to 5 years) was the most age group infested by helminths species (*H. nana* and *A. lumbricoides*). This result was different from that obtained by does who found the rate of infestation of age group extend between 8 and 13 years, Khadkha et al. (2013) in the Pokhara Nepal found that the infestation was high in the age group (8-12 years), also similar to the result in Southwest of Nigeria. On the other hand, Hamit et al. (2013) found that the infestation was high in the age

Table 5. Percentage of patients according to presence of symptoms.

Symptoms	n' (%)	<i>H. nana</i>	<i>A. lumbricoides</i>	<i>T. saginata</i>	<i>T. solium</i>	<i>T. trichiura</i>	<i>A. duodenale</i>	<i>S. mansoni</i>	<i>H. diminuta</i>	<i>S. stercoralis</i>	<i>E. vermicularis</i>	Total
Abdominal pain	23 (5.58)	6	2	2	0	0	0	0	0	0	1	11
Constipation	7 (1.69)	2	4	0	0	2	0	1	1	0	0	10
Diarrhoea	22 (5.33)	3	5	2	1	0	1	0	0	1	0	13
D. discomfort	5 (1.21)	4	2	1	0	0	0	1	2	0	1	11
Eructation	4(0.97)	2	2	0	0	1	2	1	1	0	1	10
Meteorisme	7 (1.69)	6	1	0	0	2	1	2	0	1	0	13
Nausea	6 (1.45)	2	2	2	1	0	1	0	0	0	0	08
Vomiting	13 (3.15)	3	3	2	0	2	1	0	0	0	0	11
Total	87 (21.11)	28	21	9	2	7	6	5	4	2	3	87

H: Hymenolopis; *A:* Ascaris; *T:* teania ; *Tr:* Trichuris; *An:* Ankylostoma; *S:* Schistosoma; *H:* Hymelopis; *E:* Enterobius; *St:* Strongyloides; n': Participant's infested number; (%): percentage.

group (0-5 years), the contamination of water used for hand washing before meals could also be the source for the gastro-intestinal infections, which could be attributed to the relatively high occurrence of unhygienic habits such as sucking fingers, playing in contaminated areas and defecation in soil or water.

Ten helminths species were diagnosed during this survey including five nematodes (*A. lumbricoides*, *T. trichiura*, *Ancylostomes* species, *E. vermicularis* and *S. stercoralis*), four cestodes (*H. nana*, *H. diminuta*, *T. solium*, *T. saginata*), and one trematode (*S. mansoni*), but Hamit et al. (2013) identified six helminths species in Sudanese zone in which four of them were nematodes, while the same author in the city of N'Djamena 2008 identified the presence of two nematodes (*A. lumbricoides* and *Necator americanus*), one cestode (*H. nana*), and one trematode (*S. mansoni*). Also Nkengazone et al. (2010) reported that *A. lumbricoides* and *T. trichiura* were the most common helminths identified in Kotto Barombi and Marumba II villages in South-West of Cameroon, and Osama et al. (2015) found that out of 798 patients 53 (6.64%) of them were

infested by *A. lumbricoides* and 238 (29.83) infested by *E. vermicularis*. The difference could be due to variation in climate and living condition, analytical methods used, and also depend on educational status of population of this city.

The clinical symptomatology reported on the 87 parasitized patients showed that 5.58% of patients who were infested by intestinal helminths had an abdominal pain and 5.33% had diarrhea, but Osama et al. (2015) in a study of the effect of *A. lumbricoides* and other gastro-intestinal helminths in Qena Inhabitants in Egypt reported that out of 53 (6.64%) of patients who were infested by *A. lumbricoides*, 39 (73.58%) had diarrhoea symptoms, also Akingbade et al. (2013) in a prospective study of 120 cases of diarrheal samples collected from children in Sacred Heart Hospital in Ogun State found that 54.8% of the patients who were infected by *A. lumbricoides* had a diarrhoea symptoms. The low average of diarrhoea symptoms in this study showed that the infestation by *H. nana* cause a severe abdominal pain (Khan et al., 2015).

Most parasites isolated from the infected patients were *H. nana* (32.18%) and *A. lumbricoides*

(24.13%) , but Osama et al. (2015) found that out of 798 analyzed stools *E. vermicularis* were the most parasites isolated 238 (29.83%) followed by *A. lumbricoides* 53 (6.64%). Also Sarmila et al. (2015) in a study of 445 stool samples of school children in Kathmandu Nepal reported that *H. nana* 9 (12%) and *A. lumbricoides* 4 (5.3%) were the most parasites isolated from infested patients, the presence of these parasites are clear indications of poor environmental sanitation, bad personal hygiene, and lack of hand washing culture.

Patients infested by helminths species presented a lower average of haemoglobin level (8.62 ± 1.043), similar results were obtained by Anne et al. (2008) who conducted a study on the effect of intestinal helminths on nutritional status in Brazil rural area, thus the author showed that out of 1113 patients only 125 patients had a lower average of haemoglobin level. The analysis done in two different hospitals laboratory showed that out of 87 infested patients 30 (34.48%) had anaemia, the same results was obtained by Ahmat et al. (2014) in a study of the effect of *E. vermicularis* on some physical and haematological

indexes among children in Babylon province of Iraq who reported that there was a significant relationship between increased duration of infestation and anaemia in infested patients, also Haider et al. (2013) reported that the infestation of *H. nana* comes in second position after *A. lumbricoides* infestations in their effects on haemoglobin level as compared to other species of helminths.

The interpretation of the relationship between the effect of the parasite and the anaemia corresponds to the results of the work of Ahmat et al. (2014), which indicated that the effect of *A. lumbricoides* on the blood cells level decrease due to the competition of this nematode on the food of its host and this depends on the density and the number of this parasite (Osama et al., 2015) or may be due to iron deficiency in the lumen of the gut and impaired the synthesis of haemoglobin and subsequently the synthesis of red blood cells (Ahmat et al., 2014). It had been found that the adult parasites produced haemolysin that could consume RBCs and lead to anaemia and reduced level of haemoglobin (Osama et al., 2015).

The increase of the level of leukocyte count in 25 (28.73%) parasitized patients have also been observed, and this is similar to the result of Sagir et al. (2014), who reported that 53% of patients who were infected by *S. mansoni* in the North of Nigeria had a higher average of leukocytes. Our tables also show that 15 (17.25%) patients infested with different types of intestinal helminths had a high average of eosinophilia level compared to non-infested patients; Osama et al. (2015) noted same observation.

The presence of albumin in the urine of 7 (8.04) infested patients has been observed during the present work, the same result was reported by Anne et al. (2008). Meanwhile Rai et al. (2004) conducted a study on effect of helminths on biochemical and haematological parameters in Nepal, and reported that there was a significant difference in Albumin concentration between infested and uninfested children. Intestinal helminths cause mal absorption of proteins in intestines, which led to decrease levels of albumin and protein energy and cause malnutrition (Annanthakrisnan et al., 1997).

Concerning the anthropometric measurement (BMI), 10 (11.49%) out of 87 patients who were infested by helminths species had an inferior average of body mass index, the observation is similar to result of Anne et al. (2008) in Brazil who reported that the retardation growth were clearly associated with infection of *A. lumbricoides* in children and adolescents, while *Ancylostom* species were significantly associated with low body mass index in adults and elderly, and also can cause a growth retardation in children; these results were similar to those of other authors such as Ahmat et al. (2014) who found a significant relation between enterobiasis and both weight and height deficiency of children in Iraq-Babylon province, and Ali (2010) in a study of effects of

enterobiasis on primary school children and reported that the weight for age and height were found to be lower in the infected children than non-infected group, this may be due to the effect of the parasite on the integrity of the gut due to the irritation of mucosal lining leading to mal absorption, decreased appetite, dyspepsia, and abdominal discomfort.

Conclusion

All age groups of the study population were substantially infested with *H. nana* and *A. lumbricoides*. In the blood of infested patients there was an increase in the average level of leucocyte and eosinophilia, whereas there was a decrease in the average level of haematocrit, haemoglobin and red blood cells, and also a presence of albumin have been noted in the urine of infected patients, indeed the patient's diagnosed positively with the helminths species have a lower average of anthropometric parameters.

In our study, we discover that 87 (21.11%) patients were affected by at least one helminth species. It suggested that the access to primary health care's, the availability of anthelmintic drugs, good hygiene, education and information on parasitic disease contributed to reduce the prevalence of helminthiasis in this city. These helminthiasis represent an indicator of the level of hygiene of a population; their epidemiology is linked to the peril faecal, which explains why the developing countries are the most concerned.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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