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Research Article

Prevalence and Risk Factors of Intestinal Schistosomiasis in N'Djamena

Prévalence et Facteurs de Risque de la Schistosomiase Intestinale à N'Djamena

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ABSTRACT

Introduction. Schistosomiasis is an endemic parasitic disease in Chad and continues to cause serious public health problems. The aim of our study was to determine the prevalence and risk factors of intestinal schistosomiasis in N'Djamena (Chad). **Methodology.** We conducted a cross-sectional study over a period of 03 months from July to September 2022 on participants of all ages, who came for stool examination in the "Amitié Tchad-Chine" hospital in the Diguel quarter, located in the 8th municipality, of the Northeastern area of N'Djamena (Chad).**Results.** We included 397 files in our study. The sex ratio was 2,09 and the most represented age group was the 0-14 years old (55,88%). Male participants recorded higher infestation rate (67.65%). Water from traditional sources was the most consumed (79.41%). Most people washed their hands after using the toilet (35.30%). People with abdominal pain and blood-stained stools had respectively 0.3 and 0.4 more risk of having intestinal schososomiasis with an IC of 95% [0 - 0.5]. **Conclusion.** N'Djamena remains an area of intestinal schistosomiasis caused by *S. mansoni*. All age groups are affected; therefore there is a need to increase sensitization on good hygiene practices among the population especially those with frequent abdominal pain.

RÉSUMÉ

Introduction. La schistosomiase est une maladie parasitaire endémique au Tchad et continue de causer de graves problèmes de santé publique. L'objectif de notre étude était de déterminer la prévalence et les facteurs de risque de la schistosomiase intestinale à N'Djamena (Tchad). **Méthodologie.** Nous avons mené une étude transversale sur une période de 03 mois de juillet à septembre 2022 sur des participants de tous âges, venus pour un examen des selles à l'hôpital "Amitié Tchad-Chine" dans le quartier de Diguel, situé dans le 8ème arrondissement, dans la zone nord-est de N'Djamena (Tchad). **Résultats.** Nous avons inclus 397 dossiers dans notre étude. Le ratio de sexe était de 2,09 et le groupe d'âge le plus représenté était celui des 0-14 ans (55,88%). Les participants masculins ont enregistré un taux d'infestation plus élevé (67,65%). L'eau des sources traditionnelles était la plus consommée (79,41%). La plupart des personnes se lavaient les mains après avoir utilisé les toilettes (35,30%). Les personnes souffrant de douleurs abdominales et de selles sanglantes avaient respectivement 0,3 et 0,4 fois plus de risque d'avoir une schistosomiase intestinale avec un IC de 95% [0 - 0,5]. **Conclusion**. N'Djamena reste une zone de schistosomiase intestinale causée par S. mansoni. Toutes les tranches d'âge sont affectées ; il est donc nécessaire de sensibiliser davantage la population aux bonnes pratiques d'hygiène, en particulier celles souffrant de douleurs abdominales fréquentes.

INTRODUCTION

Schistosomiasis is a parasitic disease caused by the trematodes of the genus *Schistosoma*. The disease is reported in 93 countries which accounts for more than 600 million vulnerable individuals with about 200 million infected people. Six schistosomes species are responsible for human schistosomiasis: *S. mansoni, S. hematobium, S. japonicum, S. mekogi and S. intercalatum*. *S. haematobium, S. mansoni* and *S. intercalatum* are more commonly reported in literature in Africa [1], [2], [3]. Humans are infected through skin penetration when they come in contact with water containing the cercariae produced by the intermediate snail host [4]. More than 85% of infested populations are severe and mainly found in sub-Saharan Africa, where more than 20 million suffered from a severe form of schistosomiasis complications, resulting to about 200 000 deaths annually. The socioeconomic consequences on developing countries is enormous, especially in Africa where it constitutes a major public health burden in riskiest children group impeding school attendance, absenteeism illed-health and weak memory, poor performance and productivity, disability and death [5], [6], [7].

HIGHLIGHTS

What is known of the subject

Schistosomiasis is an endemic parasitic disease in Chad and continues to cause serious public health problems.

The aim of our study

Prevalence and risk factors of intestinal schistosomiasis in N'Djamena

Key Results

1. The sex ratio was 2,09 and the most represented age group was the 0-14 years old (55,88%).
2. Male participants recorded higher infestation rate (67.65%).
3. Water from traditional sources was mostly consumed (79.41%).
4. People with abdominal pain and blood-stained stools had respectively 0.3 and 0.4 more risk of having intestinal schososomiasis with an IC of 95% [0 - 0.5].

Implications for future practices and policies

It is necessary to increase sensitization on good hygiene practices among the population especially those with frequent abdominal pain.

Two forms of the disease exist; intestinal and urogenital schistosomiasis. The intestinal form or hepato-splenic bilharziasis caused by *S. mansoni* causes abdominal pain, diarrhea and blood in the stool. It is frequently associated with hepatomegaly (increase in liver volume) in the most advanced stages. Intestinal schistosomiasis is an endemic-water dependent parasitic diseases that are widespread throughout the world, especially in sub-Saharan Africa. The biological diagnosis is based on the search for eggs in stool and the rectal mucosa biopsy, which brings the element of certainty [8]. In Chad, infections with intestinal schistosomiasis remain a real public health problem, due to irregularity in the diagnosis of intestinal parasitic infections in general, consequently the disease burden remain under estimated and thus continuous to cause a lot of morbidity. The study conducted on the prevalence of digestive parasitosis (60.66%) in the town of N'Djamena revealed 0.27% of *S. mansoni* infection [9]. Updating the epidemiological status of *S. mansoni* infection in the N'Djamena town if therefore indispensable to better manage the population at risk. The purpose of our study was to determine the epidemiological profile of intestinal schistosomiasis and associated risk factors in patients in consultation at the « Amitié Tchad-Chine» hospital in N'Djamena (Chad).

PATIENTS AND METHODS

Our study was a cross-sectional study over a period of 03 months (from July to September 2022) at the "Amitié Tchad-Chine" hospital in the Diguel quarter, located in the 8th municipality, of the Northeastern area of N'Djamena. The city of N'Djamena (12°06'N and 12°07'N; and 15°03"E and 15°04'E) has a surface area of 395 km^2. It is located at the center part of Western Chad at the confluent between the Chari and the Logon. Two bridges connect N'Djamena to the left bank of the Chari. N'Djamena has a sahelian type climate with the rainy season that extend from (Figure 1) June to October with the pic observe during the months of July and August for an average rainfall of 144mm and 175mm/year. The average annual temperature is 28°C with maximum value of 45°C in the same years. The city of N'Djamena has ten municipalities where the 8th is our study area [10] (Figure 1). Our Study population was made of participants of all ages, that came for stool examination in the hospital. Participation was voluntary and exclusion criteria included patients who were under treatment for a week or who could provide a stool sample. The size of the sample was determined by the following statistical formula: $N = z^2 \times p\ (1 - p)\ /d^2$ where Z is the interval of trust (95%), p prevalence and degree of confidence (5%). The prevalence used was the one determined by Hamit *et al*., (2020) [9], who found a prevalence of digestive parasitosis of 60.66%. The minimum size of the sample obtained was 368. For patients who agreed to participate in the study, a pre-established technical sheet was administered to obtain socio-demographic and clinical data for the evaluation of risk factors. Subsequently, a sterile and dry plastic bag, of the hygienic paper and an applicator stick were given to each participant for the collection of stool samples. The information of each participant (name, age and identification code) were written on the stool containers which were subsequently half filled with fresh stool and then immediately transported to the laboratory for analysis. Macroscopic observation was made for each sample to appreciate the consistency and color of the stools, the presence of mucus, blood and possible parasitic elements (adults, larvae, scolex, proglottis) that can be seen by the naked eye. Microscopy was done using the concentration Kato-Katz method to search for the infesting forms of schistosomes according to their morphology [12].

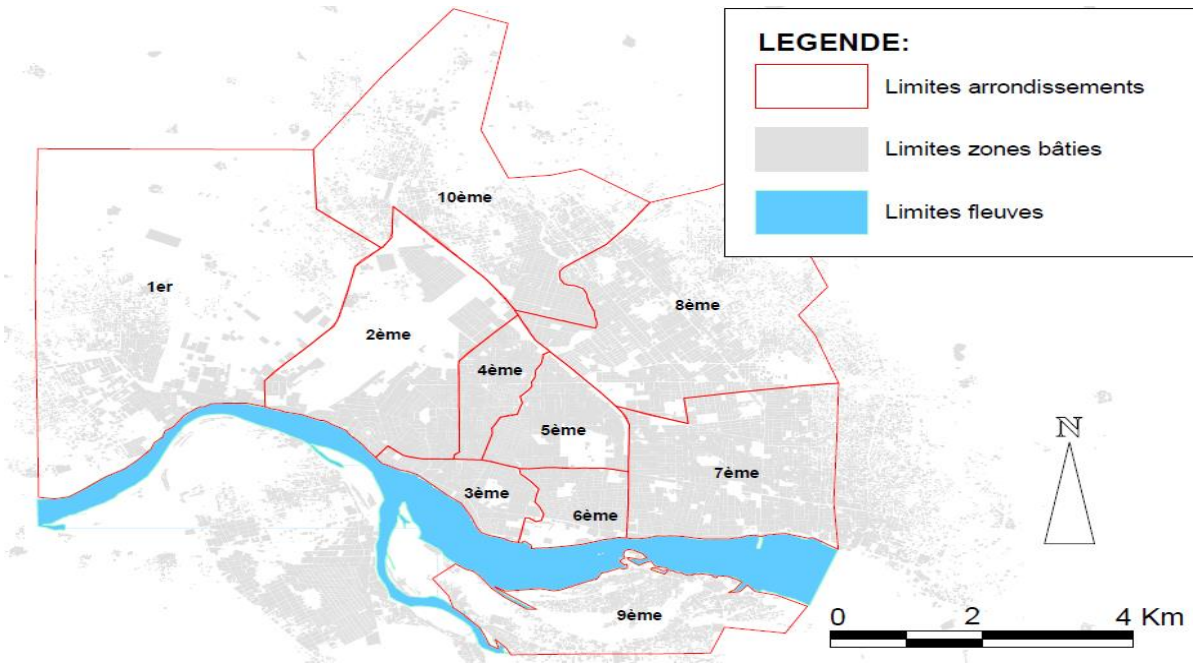

Figure 1. Administrative division of the city of N'Djamena in 2005 [11].

Using a flat edge spatula, a small portion of sieved stools was taken and filled the calibrator mounted on a slide. The calibrator was then removed and the Fecal material was covered by piece of cellophane paper previously soaked in the Kato solution, and then spread over the entire surface of cellophane using a regular wall tube (syringe) by avoiding the formation of air bubbles. The excess solution was wiped off with a piece of hygienic paper so that the piece of cellophane paper remains well fixed. The preparation was kept for 30 minutes followed by microscopy at 10X and 40 X magnifications. The data were processed and filtered using Microsoft Excel software 2016 using version 4.1 of logistic R. The chi-square independence test was used to compare the prevalence between sex, age, type of water used and the education level. The Spearman test used to evaluate the correlation between parasitism and etiological factors.
Two research authorizations were obtained: N°0475/CMT/PC/PM/MSPSN/SE/DG/HATC/SGH/SR H/022 from the direction of the « Amitié Tchad-Chine» hospital in N'Djamena, and N°0834/CMT/PC/PM/MSPSN/SE/DG/HATC/SGH/SR H/022 obtained from the training and research service of the same hospital. An informed consent form was read and signed by each participant. The information collected were treated confidentially.

RESULTS

Out of the 397 samples analyzed from participants of age between 0 and 70 years, a staff of 34 (8.56%) were positive with *Schistosoma mansoni*. All age groups were infested with a significant difference observed for those between 0 to 14 years, that also presented the highest infest rate (55.88%). Male participants recorded higher infestation rate (67.65%, n=23) with the least in educated individuals (61.76%, n= 1). Abdominal pains (44.12%, n=15) and diarrhea (32.35%, n=11) were the most common complaints (Table 1).

Table 1. Infestation of Schistosoma mansoni based on demographic characteristics, the level of education and reasons of consultation of participants

Variables	N	Prevalence of infestation	*P*
Gender			
Female	11	32.35	< 0.05
Male	23	67.65	
Age group (Years)			
0 – 14	19	55.88	< 0.05
15 – 24	6	17.65	
25 – 64	7	20.59	
≥65	2	5.88	
Level of education			
None	8	23.53	0.010
Primary	13	38.23	
Secondary	6	17.65	
University	7	20.59	
Reasons of consultation			
Anorexia	1	2.95	0.001
Constipation	2	5.88	
Diarrheal	11	32.35	
Abdominal pains	15	44.12	
Nausea	3	8.82	
Vomiting	2	5.88	

A strong correlation was found between *S. Mansoni* and abdominal pain. People with these abdominal pain and blood-stained stools respectively had 0.3 and 0.4 more risk of having intestinal schososomiasis with an IC of 95% [0 - 0.5]. A total absence of correlation between *S. Mansoni* and other variables was observed. According to risk factors associated to intestinal schistosomiasis, water from traditional sources was the most consumed (79.41%, n=27) compared to that of drilling and chad-based and water electricity company. The people washing hands with soap (70.59%, n=24) were majority compared to

those who do not use soap (29.41%, n=10). 22 people (64.70%) washed their hands after using the toilet compared to 12 (35.30%) who do not wash their hands after using the toilet. (Table 2).

Table 2. Infestation of Schistosoma mansoni based on behavioral habits of participants

Variables	N	Prevalence of infestation	P value
Water source			
Traditional source	27	79.41	< 0.05
Forage	4	11.77	
S.T.E.E.	3	8.82	
Hand wash with soap			
Yes	10	29.41	< 0.05
No	24	70.59	
Hand wash after using toilet			
Yes	12	35.30	0.001
No	22	64.70	

S.T.E.E: *Chadian company of water and electricity*

DISCUSSION

This study conducted in 2022 revealed a prevalence of 8.56% for intestinal schistosomiases in people whose stool were examined after consultation at the « Amitié Tchad-Chine» hospital of N'Djamena (Chad). This could be related to the existence of the water points that favour the development of the snail intermediate hosts of *S. mansoni* [13]. Previous studies in the same city have shown a prevalence of 1.21% in 2017 at the University Hospital Center National and the University Hospital Center of the mother and Child [14] and 0.27% in 2019 in the neighborhoods of N'Djamena [9]. It is obvious to observe an increase of intestinal schistosomiasis in subsequent years. The northeastern periphery of N'Djamena where more than 20% of the Capital city of Chad, about 200.000 inhabitants, has observed an increase in demographic growth since more a decade. This area is thus subjected to lack of portable water, poor waste management and domestic waste water, and prone to flood due essentially to poor sanitation infrastructures [15]. The population of the 8th municipality (184641 habitants/4373m^2) where this work was conducted is confronted to lack of portable water during the whole year and to damage caused by flood water during the rainy season as was observed during this study [16]. This could explain the prevalence of intestinal schistosomiasis during our study period. The populations of these neighborhoods are subjected to high level of poverty, low level of education and poor hygiene practices, all of which have been demonstrated as risk factors for the spread of infectious agents [9]. The significant difference in infestation observed in participants aged 0 to 14 years (55.88%). could reflect the active nature of children of this age group what expose to activities requiring contaminating water such as bathing, laundry fishing etc. This observation is in line with results obtained elsewhere [17]. Seasonal Parasitism was in favour of male. This could be due the fact that male individual carryout more activities with high exposure of risk in contracting the diseases such fishing and irrigation agriculture for rice cultivation [9]. However, a study conducted in Burkina Faso in 2018 in Panamasso, a village in the Hauts-Basin region, showed that girls were more infested than boys, because of the amplitude of contact with a sore river that habours *Biomphalaria pfeifferi* intermediate host of *S. mansoni*, river used for household activities such as laundry, bathing etc [18]. Our results show that illiterates and those with low level of education had a high prevalence (61.76%) of infestations. Hygiene education which is initiated at nursery level and its application continues throughout the educational carrier. Thus parents who do not benefit from it or who do not master it correctly might not train their children on sanitation education, thus the risk of children being exposed to high level of contracting poor hygiene practices related diseases [19]. Abdominal pains and diarrhea were significantly associated with the risk of infestation. However abdominal pains and blood-stained stools showed strong correlation with *S. mansoni*. In a study conducted in the West region of Cameroon, this abdominal pain was observed in 72% of patients [2]. Our results are in line with literature which shows that intestinal schistosomiasis caused by *Schistosoma mansoni*, is at the origin of abdominal pain, diarrhea and blood in the stools [8]. The improvement in the provision of portable water, washing of anal region after defecation with soap and hands with soap after using the toilet have shown a positive impact in reducing gastrointestinal parasitosis [15]. A Study conducted in 2019 in N'Djamena shown a positive correlation between parasitism and the type of water consumed, the type of toilet used, the manner of cleaning the anal area after defecation and hand wash habit before meals [9]. During this study, it was observed that water from traditional source was the most consumed (79.41%) compared to that of bore holes, Chadian company and electricity sources. Our results would be a consequence of the contamination of water points by the intestinal parasites coupled with the non-compliance with the hygiene rules; Oftenly, the environment around is dirty with stagnant waters that infiltrate in the ground and facilitate the contamination of these water points. These results still demonstrate a very low level of health, food and fecal hygiene and the existence of precarious living conditions [20].

CONCLUSION

Our study, shows in combination with different prior studies that the city of N'Djamena remains an area of intestinal schistosomiasis caused by *S. mansoni*. All the age groups of the population studied were infested, with parasitism being in favour of male participants. This prevalence of *S. mansoni* is an indicator hygiene practices of the population. The epidemiology of this parasite is linked to peri fecal, which explains why developing countries are most concerned. Our study therefore confirms this reality and reveals the persistence for a sustainability condition of this parasitosis.

Conflict of interest

None

Authors' contributions

EES, BO, NL and HMA contributed to the design of the study, ADI and HMA led data collection, EES and ADI led data analysis and draft the manuscript with NBJ and NL. All authors read and approved the final manuscript.

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