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Full Length Research Paper

Investigation of an epidemic outbreak of urinary bilharziosis in the locality of Katadji (Sikensi) in the south of Côte d'Ivoire

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Abstract

A review of data for the year 2017 revealed an increase in suspected cases of urinary bilharziosis at the Katadji Rural Health Center. This study was carried out in order to confirm suspected cases of endemo-epidemic bilharziosis, to determine the cause and to propose control and prevention measures. Urine and stool samples were taken after administering a questionnaire to people who came for consultations for haematuria or a gastrointestinal problem, and suspect cases from the three primary schools in Katadji. Then an epidemiological investigation of each case was carried out to identify the sites of exposure. Laboratory examinations were carried out for S. haematobium in the urine and S. mansoni in the faeces in order to confirm the cases. 139 urine samples and 83 stool samples were collected. Results show that 74 samples are positive for S. haematobium (53%) with high parasite burdens. All the confirmed cases have in common a water contact with the rivers (M'gbebou and Kpinnankpin) which cross the village. No cases of intestinal bilharzia were found in the stool. The cause of the epidemic seems to be the rivers (M'gbebou and Kpinnankpin) that run through the village of Katadji.

Key words: Bilharziosis, Parasite, *S. haematobium*, Hematuria, School-age children.

INTRODUCTION

Bilharziasis or schistosomoses are chronic parasitic affections due to sex-separated flatworms, bilharzias or schistosomes, parasites of the visceral venous plexus. The massive egg-laying of these schistosomes in some organs leads to various lesions and disorders. Bilharzia occurs in tropical and subtropical areas of the world where climatic, ecological, socio-economic and hygienic conditions facilitate the spread of the endemic [Odeniran et al., 2020; Freeman et al., 2017]. *Schistosoma manson* bilharziasis and *Schistosoma haematobium* bilharziasis are present in Côte d'Ivoire [M'Bra et al., 2018; Gbalégba et al., 2017; Angora et al., 2019; Tian-Bi et al., 2018]. *S. haematobium* bilharzia or urogenital bilharzia, where one of the manifestations is haematuria, is a disease with indirect transmission linked to the excretic peril. As for *S. mansoni*, it is manifested by mucous stools with the presence of blood.

More than 200 million people are infected with schistose-

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miasis in 76 countries around the world. About 80% of these cases are in Africa [Dejon-Agobé et al., 2020; WHO, 2019]. In Côte d'Ivoire, the results of parasitological surveys have shown that urinary and intestinal schistosomoses remain endemic with unfavourable hygiene and sanitation conditions despite control efforts [Assaré et al., 2016, 2015, 2014; Angora et al., 2019].

The public health intervention recommended by the WHO to combat schistosomiasis morbidity in endemic areas is chemoprevention (CP), which consists of the periodic administration of praziquantel [WHO, 2020, 2019]. Chemoprophylaxis needs to be implemented in 52 countries. At least of 237 million people need chemoprophylaxis for schistosomiasis, 90% of whom are in sub-Saharan Africa [WHO, 2012b]. The WHO has set a target of treating at least 75% of school-age children with chemoprophylaxis in all schistosomiasis endemic countries by 2020 [WHO, 2012a]. Many countries have implemented chemoprophylaxis programmes, which have shown beneficial effects on morbidity, prevalence of infection and transmission [Touré et al., 2008; Utzinger et al., 2005]. In 2015, more than 66.5 million people (53.2 million school-age children and 13.3 million adults) received a CP against schistosomiasis [WHO, 2016]. Despite great progress in the fight against schistosomiasis over the last decade and regular treatment with praziquantel for exposed populations in Côte d'Ivoire, the disease remains a public health problem in areas where it was previously endemic [Angora et al., 2019]. The prevalence observed are generally high in the localities around the hydraulic installations. These are generally reference points for the surrounding populations in terms of water needs, thus multiplying the contacts between people and water. These contacts are at the origin of the permanent infestations and reinfestations responsible for the high morbidities [Utzinger et al., 2011; King, 2010]. The aim of this work is to confirm cases of bilharziasis, identify suspect cases, describe the epidemiological profile in terms of time place personal and the factors favouring this parasitosis in order to propose control and prevention measures.

MATERIALS AND METHODS

Type and study area

A cross-sectional descriptive study with data collection was carried out from 18 to 19 January 2018 in the health district of Sikensi, which is one of the four departments of the Agnéby-Tiassa region in the south of Cote d'Ivoire. The Sikensi Department is located in the southern part of Côte d'Ivoire (5◦ 40' 34" N, 4◦ 34' 33" W), 67 km from Abidjan and 155 km from Yamoussoukro, the political capital. The relief is not very rugged with small hills, valleys and marshes. The department is marked by a multitude of rivers, most of which dry up during the long dry season. The communities have limited access to reliable pipe-borne water and are obliged to rely on water from the two rivers that run through their villages for laundry and other domestic uses. In addition, the schoolchildren bathe in these waters when they return from school.

Collection of urine and stool samples

After signing the consent from, urine and stool samples were taken and a questionnaire administered to anyone who came to the village health centre for a haematuria or gastrointestinal problem. Then an epidemiological investigation of each case was carried out to identify the places of exposure. A questionnaire was administered to collect data about each participant's habits and behaviors, such as swimming/bathing in open freshwater bodies, washing clothes in rivers, and fishing.

Stool and urine samples were also taken from exposed persons, particularly schoolchildren aged.

Before sampling, the objectives of the study and the procedures to be followed were explained in simpler terms accessible to both teachers and students. Two 125 mL bottles were distributed to each student to collect their urine and faeces. At the end of the study, each participant received treatment with praziquantel at a dose of 40 mg per kg body weight.

Microbiological analysis of urine and stool samples

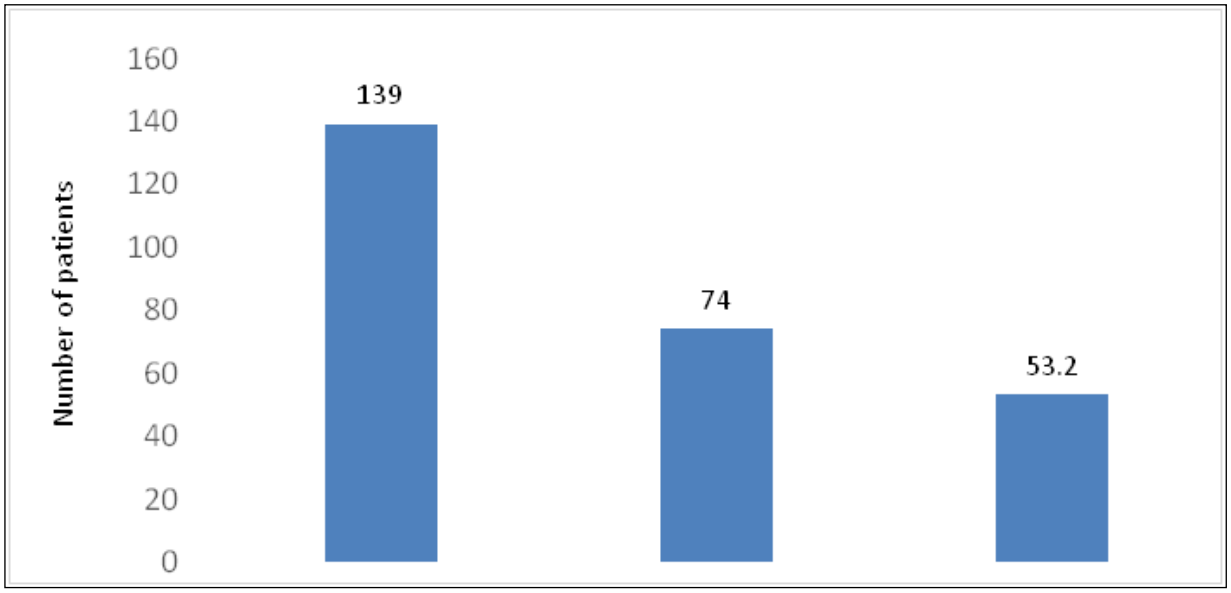
Microbiological analysis was carried out at the Parasitology Laboratory of the Pasteur Institute of Côte d'Ivoire. On the faeces, we performed a direct examination in physiological water, a Kato technique and a simplified Ritchie technique.Two thick smears from each stool sample were microscopically examined to identify eggs of *S. mansoni*, soil-transmitted helminths and protozoan cysts. After For urine analysis, we used a concentration technique by centrifugation. In brief, 10 mL of urine was vigorously shaken and filtered through a Nytrel filter with a 40 µm mesh size and examined microscopically for the presence of *S. haematobium* eggs.

RESULTS

A total of 139 urine and 83 faecal samples were taken during the investigation.

Urine analysis results

Results show 74 samples are positive for *S. haematobium* (53%)(Fig1)with high parasite burdens (Fig2). The most children were from the districts of Dubai (44%) and Chicago (26%) (Fig 3). The age of the patients varied between 6 and 15 years with an average of 10 years



Total number of urine Parasitized urine Percentage of positives.
Fig 1. Overview of urine analysis of the epidemiological investigation at Katadji (Sikensi).

Fig 2. Eggs of *Schistosoma haematobium* observed in urine.

(Fig 4). Women are as infected as men, with 52% and 51.1% respectively. All the confirmed cases have in common a water contact with the rivers (M'gbebou and Kpinnankpin) that cross the village (Fig 5 and 6).

Stool analysis results

Fecal analysis revealed no cases of intestinal bilharziasis, however, 50.3% of the patients had other parasites such as *Enteromonas hominis*, whipworm eggs, hookworm larvae, and numerous protozoan cysts (Figs. 7 and 8). For these parasitoses, 40% of women and 53% of men are infected.

DISCUSSION

Schistosomiasis remains a public health concern in sub-Saharan Africa. A precise knowledge of risk areas and

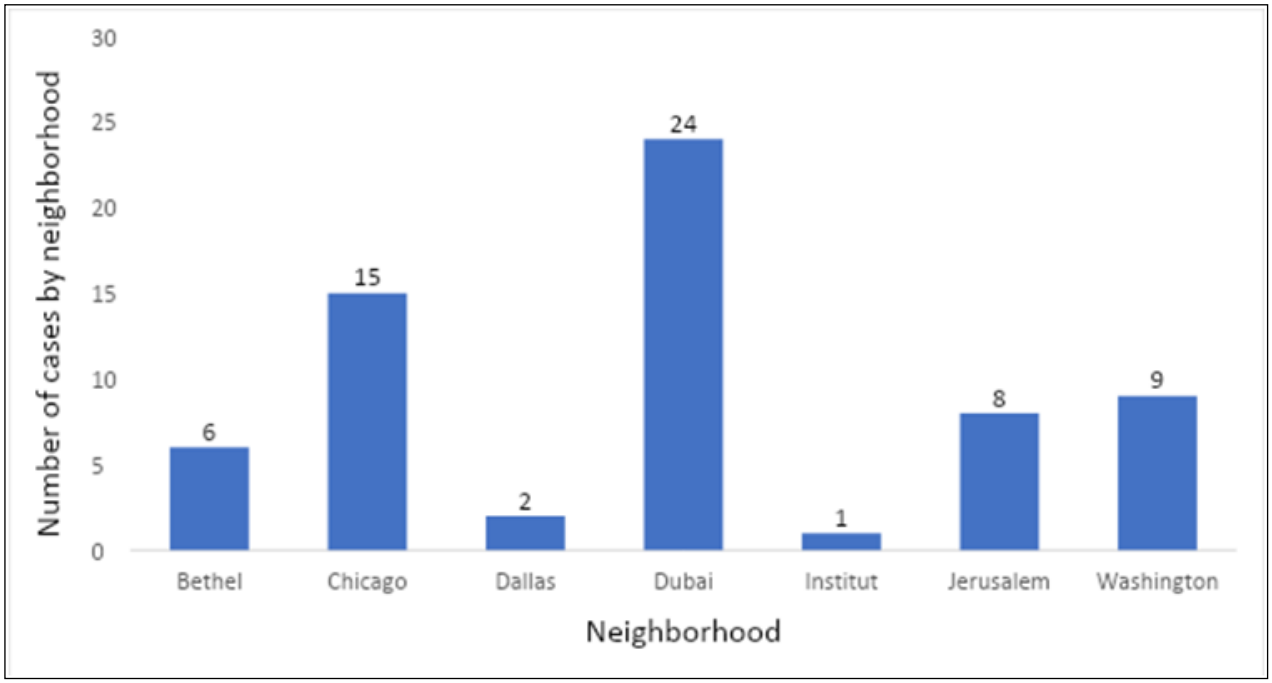


Fig 3. Distribution of the number of cases according to living location.

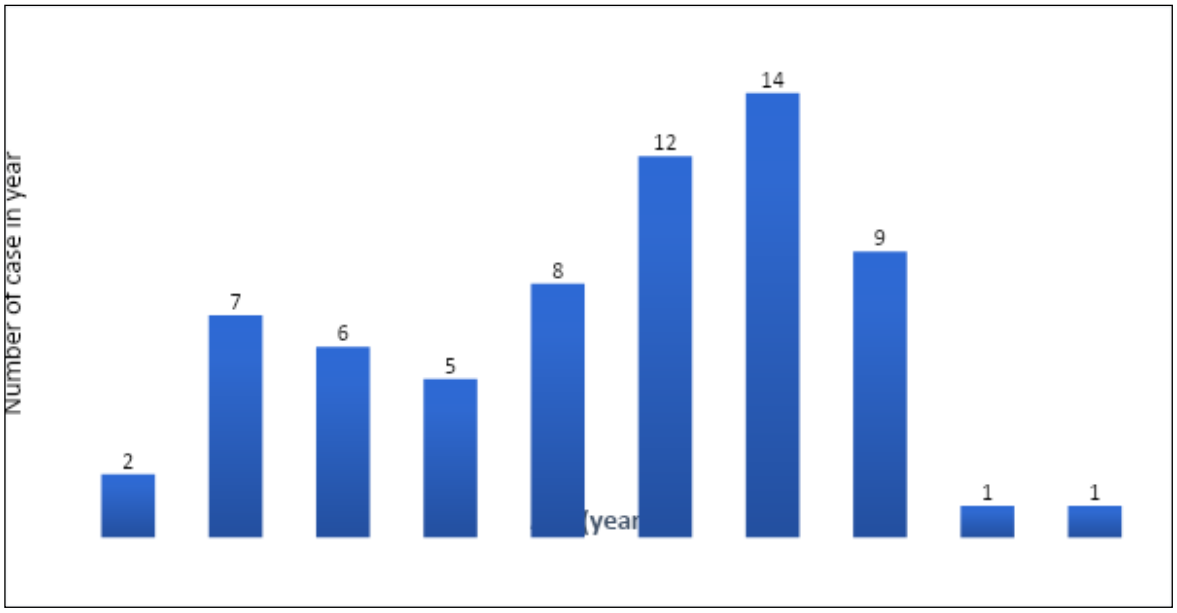


Fig 4. Distribution of the number of cases according to age.

risk factors is required for an effective public health interventions. This study has allowed us to fifty-three percent (53%) positive samples for *S. haematobium* with high parasite burdens. The results are similar to those obtained by Soumahoro et al (42.8%) and Ly et al (50.8%) respectively in the village of Guébo 2 in Abidjan (Côte d'Ivoire) in 2014 and in 3 localities along the Niger River in the region of Ségou (Mali) in 2019 [Soumahoro et al., 2014; Ly et al., 2019]. Hematuria was the main symptom known to be associated with urogenital schistosomiasis and very often used for in- direct diagnosis of the disease.

The N'gbebou River

The Kpinnankin river.

Fig 5. The two rivers crossing the village of Katadji (Sikensi).

Fig 6. Schoolchildren bathing in the rivers.

There is an increase in the infestation rate depending on age. The age of patients varies between 6 and 15 years with an average age of 10 years; 50% of confirmed cases are under 11 years old and 50% are over 11 years old. Subjects aged 12 years are the most infected. This age stratification is also found in the studies of Ly et al. [Ly et al., 2019]. This observation can be explained by the fact that these children have risky behaviours that expose them to the infestation compared to adults [Angora et al., 2019].

The study showed a similar prevalence of *S. haematobium* infection in boys and girls. Although fresh-

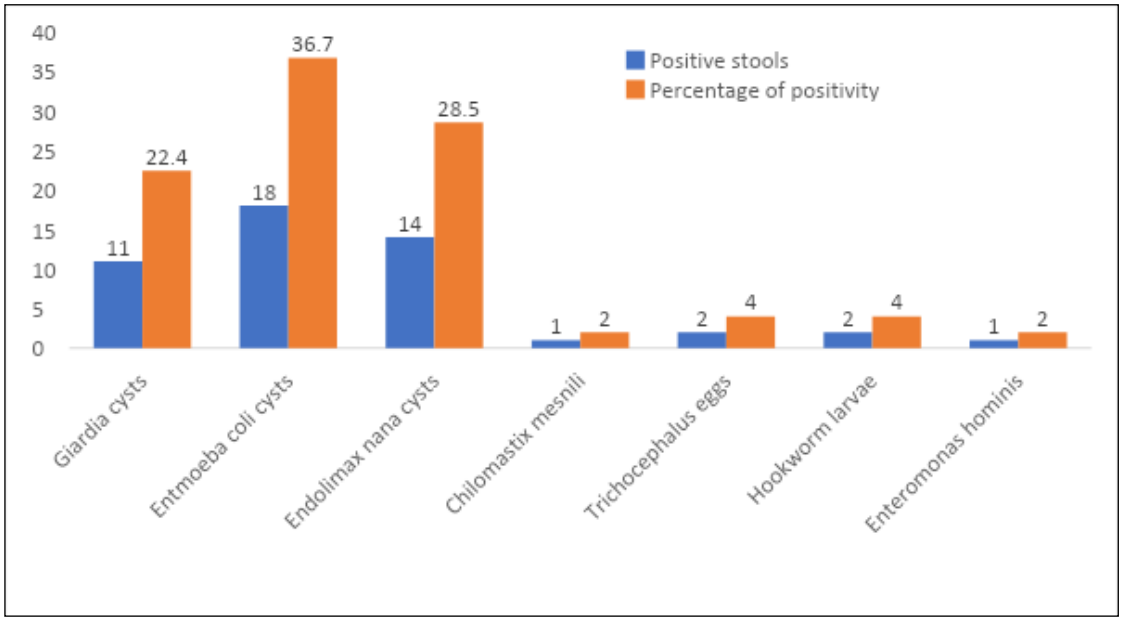


Fig 7. Overview of stool analysis according to the parasites found.

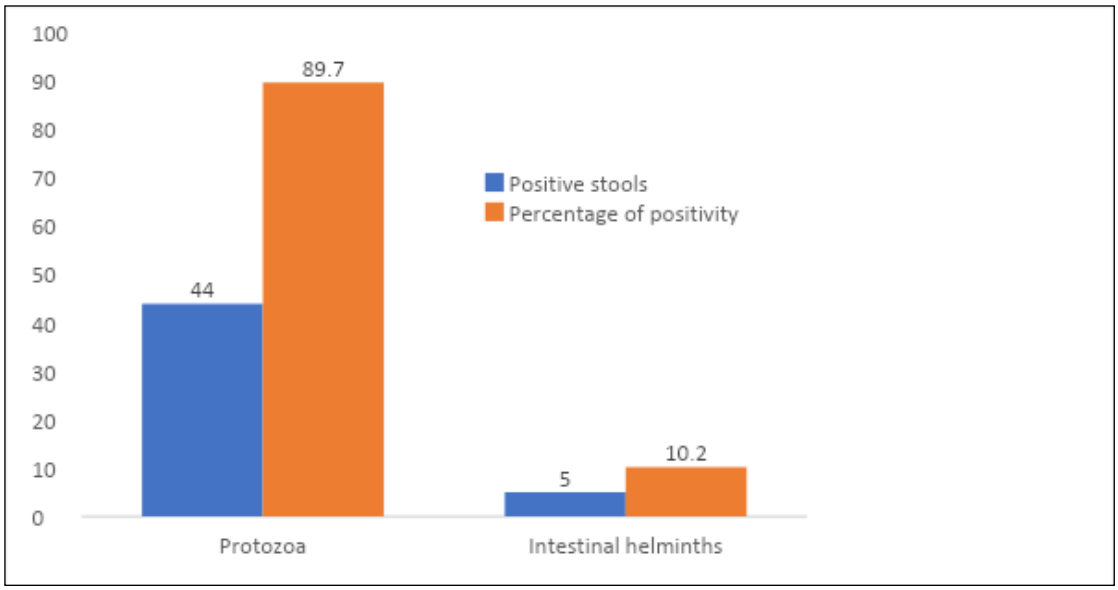


Fig 8. Classification according to the type of parasitosis.

water contact is obviously the main risk factor for schistosomiasis, it is known that some factors such as age and gender can affect this risk factor through age- or gender-related behaviors. Some studies found that males are more at risk to be infected with schistosomiasis than females. For some authors, young age increases the risk to be infected with schistosomiasis [Ndassi et al., 2019; Dejon-Agobé et al., 2020].The questionnaire made it possible to incriminate the barrage as a favorable environment for the development of molluscs and therefore conducive to the transmission of cercariae [Russell et al., 2020; Le Govic et al., 2019]. This has been proven in other previous studies in several localities in Côte d'Ivoire where the existence of a favourable environment for the development of molluscs was essential for the transmission of this pathology [Assaré et al., 2015; M'Bra et al., 2018b]. Unfortunately, it has not been possible to do a malacological exploration to confirm the release of Schistosome furcocercias the release of Schistosome furcocercias into the environment.

Lack of hygiene, limited access to potable water and sanitation could also be factors associated with the transmission of this disease in this locality [Utzinger et al., 2011; King, 2010].

The presence of two rivers (M'gbebou and Kpinnankpin) multiplies man-water contacts and could be the exposure factor. All the confirmed cases have in common an evident hydrous contact at risk of bilharziasis with frequenting two rivers crossing the village: the M'gbebou (50%) and the Kpinnanpkin (50%). The cause of the epidemic seems to be the rivers (M'gbebou and Kpinnankpin) crossing the village of Katadji because all the infected people have admitted having bathed there. The presence of S mansoni was not noted in any stool. The current study study has several limitations, and hence, the findings should be interpreted with care. First, stool and urine samples were collected only on a single day, though duplicate Kato-Katz thick smears were examined from each stool sample to enhance diagnostic sensitivity.Other parasites are also found during parasitological stool examinations with 50.3% positivity. The presence of these parasites is a sign of insufficient fecal and food hygiene of these populations. Helminth eggs are rarely observed due to the frequent use of anthelmintic drugs (especially albendazole and mebendazole). Intestinal protozoa remain very important due to systematic de-worming campaigns using albendazole and mebendazole, which are ineffective on their cysts and vegetative forms.

CONCLUSION

Epidemiological investigation confirms cases of urinary bilharziasis in Sikensi. However, no cases of intestinal bilharziasis have been confirmed. All the confirmed cases of urinary bilharziasis have in common an evident risky water contact with the rivers crossing the village. At the end of the study, a deworming with Praziquantel was carried out by the National Programme for the Fight against Neglected Tropical Diseases by Preventive Chemotherapy (PNLMTN-CP). Despite regular treatment with praziquantel for exposed populations in Côte d'Ivoire, the disease remains a public health problem in areas where it was previously endemic. It is therefore important to carry out studies to understand the sociological (resistance of the population to treatment, prejudices, cultural habits), environmental (malacological investigation, river...) and biological (hybrids, resistance to praziquantel, parasitological investigation) factors that contribute to the persistence of the disease. A deeper comprehension of at-risk populations and the dynamics of infection transmission by new hybrid schistosomes may help to elucidate their action on intermediate hosts, the efficacy of praziquantel and the associated morbidity in humans.

AUTHORS' CONTRIBUTIONS:

KT, MTB and IT contributed to the conception and design of the study; KT, AFTN, NTL and ACK conducted the analysis; KT, MTB, YKD, LFK, LK, and IT contributed to the interpretation of data; KT drafted the manuscript. All authors participated in critical revision of the manuscript and read and approved the final version. KT and OAT are guarantors of the paper.

ETHICAL CONSIDERATIONS

This study was carried out with the authorization of the head of the Institut Pasteur of Côte d'Ivoire. Authorizations from the health authorities and school authorities were obtained prior to the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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