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Prevalence of Schistosomiasis among the Bavaido Village Peasants and the Residents of Tshopo River at Kisangani- DR. Congo

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Authors' contributions

This work was done in collaboration with all the authors. Author BME designed the study, performed the statistical analysis, wrote the protocol and produced the first draft of the manuscript. Authors HMP, AAK and CZN managed the analyses of the study. Author FMEL managed the bibliographical research. All authors read and approved the final manuscript.

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ABSTRACT

Schistosomiasis is a pathology, today called Neglected Tropical Disease (NTD). It is a chronic parasitic disease caused by flatworms called Schistosoma or bilharzia, transmitted to humans by a freshwater mollusc. This disease is the 2nd most common parasitic disease in the world. According to the WHO, bilharzia is endemic in 76 countries, 42 of which are situated in Africa. 700 million people are exposed to it worldwide and of the 207 million people infected, the vast majority (85%) live in Africa.

This study was conducted 24 kilometres from the city of Kisangani on the old Buta road in the Democratic Republic of Congo. The population was made up of people living in the Bavaido village

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and the camp on the banks of the Tshopo River and aged between 0 and 59 years. A sampling of 194 urine and stool samples, 84 of which were taken from the inhabitants of Bavaido and 110 from the inhabitants of the camp, was used to carry out this investigation. This descriptive - cross-sectional study carried out from October 29 to November 19, 2018, aims to determine the prevalence of Schistosomiasis in the two settings of our study. At the end of our investigations, we observed that: urine samples revealed 2.4% positive *Schistosoma haematobium* in Bavaido versus 54.5% positive in the camp, while stool samples revealed 4.8% positive *Schistosoma mansoni* in Bavaido versus 7.3% positive in the camp and the age group of 0 - 9 years was more affected with 43.55% of positive results and the female sex predominates with 56.45% positive cases. Furthermore, the predominance of haematuria samples was more prevalent in females (64.7%) than in males (35.3%), making medical interventions appropriate for this population.

Keywords: Prevalence; schistosomiasis; peasants; Riparian; DR Congo.

1. INTRODUCTION

Schistosomiasis (also called Schistosomiasis or bilharzia) is a parasitic disease caused by trematodes of the genus Schistosoma, so 5 species are pathogenic to humans. It is the second-largest parasitic endemicity in the world. It is estimated that there are about 4 million infestations per year and between 300,000 and 500,000 deaths per year. The factor influencing the development of schistosomiasis is the contact with molluscs and larvae (infected freshwater) [1].

The lack of hygiene and certain play habits of school-age children, such as swimming or fishing in infested waters, make these children particularly vulnerable to infection [2].

More than 200 million people worldwide are infected, 85% of them in Africa, but also Europe several cases were observed in Portugal and France. Since 2011 to 2015, cases of schistosomiasis have been reported in Corsica, after people bathed in the Cavu River. The disease is believed to have been introduced by infected people who contaminated the rivers of Corsica by urinating, thus transmitting the parasite to the mollusc vector, present in the rivers of the Isle of Beauty. The situation worries European researchers who are asking many questions about the expansion of schistosome in southern Europe and its virulence in humans [3].

In Africa, despite several years of mass treatment with Praziquantel 600 mg for school-age children, the prevalences of urinary and intestinal bilharzia were still high in the Senegal River basin. For urinary bilharzia, overall prevalences of 39.3% and 37.4% were reported in Mauritania and Senegal, respectively. Depending on the ecological zone, the Delta is more affected with 57.4% [4].

In Cameroon, 82% of cases are found in the three northern regions of the country where both forms of the disease are found. The locality of Meiganga in South-East Adamaoua is a known outbreak of intestinal bilharziasis in Schistosoma mansoni and since 2011 has benefited from campaigns to distribute praziquantel to school-age children in four schools along the Zandaba River where Biomphalaria had been found [5].

The disease was introduced into Congo in the 1920s by foreign workers working on the Congo Ocean Railway (CFCO) between Brazzaville and Pointe-Noire. Parasitological research carried out by Marc Cullough, WHO consultant in 1962 and by the project managers in 1979, had shown that the most common parasite found in Congo was Schistosoma haematobium. Seven out of 12 departments are affected by schistosomiasis. These are Brazzaville, Pool, Bouenza, Lékoumou, Niari and Kouilou and Sangha where one case of Schistosoma Mansoni schistosomiasis has been detected. The most affected areas are located along the railway [6].

In northern Ivory Coast, pastoral reservoirs are favouring sites for the proliferation of several mollusc species that are intermediate hosts of schistosoma. Many artisanal or domestic activities are concentrated around these small dams, which involve different categories of populations using the water bodies [7].

In the Senegal River basin, the construction of the Diama and Manantali dams in the 1980s considerably modified the ecology and contributed to the appearance of the intestinal form of bilharzia in the Delta. Similarly, an increase in the prevalence at high levels of the urinary form has been noted in all ecological zones of the basin [8].

The Democratic Republic of Congo, located in the heart of the tropical zone; very rich in backwaters, freshwater, many river banks that are epidemiologically outbreaks, is not spared from this scourge either. Kimpese is one of the endemic foci of schistosomiasis in the south-western zone of the DRC because of its ecology favouring the multiplication of intermediate hosts. According to a study conducted by Papy Ansobi Onsimbie (2011 - 2015), 4216 cases of schistosomiasis in S. mansoni were reported by health structures from 2011 - 2015. The average incidence rate was 241.56% during the same period. The analysis of the spatial dynamics showed heterogeneity of cases at the towers of the health areas located to the east and south-west of the Health Zone. Cluster detection identified four risk clusters in the Kimpese Rural Health Zone [9]. The country, which has faced decades of war, is one of the poorest in the world, with 50% of the population living without access to safe drinking water and sanitation [10]. In 2012, the Ministry of Health adopted a national plan to combat neglected tropical diseases (NTDs), including schistosomiasis [11] Future mass school-based treatment campaigns for five NTDs, including schistosomiasis, are now being phased in across the country [12].

In Kisangani, where we conducted this study, at the biomedical laboratory of the General Reference Hospital of Makiso, we observed during analysis, 3 cases of Schistosoma in the samples of haematuric urine from the Bavaido village and its surroundings located on the banks of the Tshopo River 24 kilometres from the city, on the old Buta road.

Given the magnitude of this endemic with impact on households unaware of the clinical concepts and the consequences, some are forced to divorce. Other infested households became unable to work. In short, social life is plunging into poverty.

We were motivated to go into the field to evaluate the prevalence of schistosomiasis in these environments to bring the authorities of the country to a decision for the medical care of the population concerned.

2. MATERIALS AND METHODS

Materials and reagent: Microscope, slide, slide cover, conical tube, electric centrifuge, stopwatch, Pasteur pipette, indelible marker, register, ballpoint pen, clean shoot rod, physiological water.

2.1 Methods

Type of study: This study is of the descriptive type - cross-sectional.

Variables used: In this study, we were interested in the following variables related to Schistosomiasis. They are age, sex, living environment, the presence or not of hematuria.

Population and sample:

a) **Population:** The population of this study is composed of 210 people living in the Bavaido village and 285 people living in the Tshopo River Camp, part of our two study environments.
b) **Sample:** We used the occasional sampling technique. A total of 194 urine and stool samples from the selected inhabitants made up this study: 84 urine and stool samples for the Bavaido inhabitants and 110 urine and stool samples for those living in the camp.
c) **Selection criterion:** Any person found in the area and willing to participate in the study.

Data collection technic: To achieve this, two sterile vials (1 for urine and 1 for the stools) were given to each selected respondent at 8:00 am, and each respondent brought their samples back to us sometime later. The stool samples were the first to be processed and examined fresh, followed by the urine samples in the afternoons. We proceeded first by macroscopic observation (to detect hematuria or not) and finally by microscopy (to detect parasites).

Procedure in the laboratory

1) For the urine:

- Identify the conical tubes used should contain the samples using an indelible marker;
- Place the urine in the ¾ of the conical tube;
- Centrifuge by equalizing the tubes at a rate of 2500 t/min for 5 minutes;
- Allow the centrifuge to stop on its own;
- Discard the floating liquid and collect the tube with a Pasteur pipette and put a drop of pellet on the slide and cover it with a cover slide,

- Observe with a low-magnification microscope (10 X or 40 X objective)
- Record the result in the register.

2) For stools (direct examination)

- Identify the cover slide with the indelible marker;
- Put a drop of physiology water on the slide;
- With a twig rod (previously designed), take about one gram of fresh stool;
- Mix with the physiological water on the slide until a homogeneous solution is obtained;
- Cover with an object slide;
- Observe under a microscope at low magnification and note the result.

2.2 Data Processing Techniques (Statistical Analysis)

To analyze our data, we used the following techniques: percentage, average and Chi-Square, whose pictorial shapes are:

Percentage:

% = (Eff . x 100)/ n

n = sample size
Effect = Observed staffing levels
% = percentage

Khi-carré:

$$X^2 = \frac{\Sigma(\mathrm{fo} - \mathrm{ft})^2}{\mathrm{ft}}$$

fo = observed frequency
ft = theoretical frequency
x2 = Chi-square normality test
Σ = the sum

Moyenne:

$$\mathbf{M} = \frac{\Sigma \mathrm{fxi}}{\mathrm{N}}$$

fxi = midpoint
N = total population
M = average

3. RESULTS

3.1 Identification of Selected Respondents

It can be seen from Table 1 that 25% of the respondents in Bavaido whose samples were taken in our study were in the 20 - 29 years age group; then in the camp, the high proportion of respondents is in the 0 - 9 years age group, i.e. P = 0.355 (35%).

In both study settings, the 0-9 age group was in the majority with a proportion of 0.288 or 28.8%.

The average age of the respondents in Bavaido is 30 years, while the average age of the camp respondents is 22 years.

Table 2 shows that women and men are equally represented in both study settings (50% tied). However, more women were selected (53.6%) in Bavaido, while in the camp, more men were selected (52.7%).

3.2 Results of Laboratory Analyses

- Urine analyses revealed 2.4% positive Schistosoma samples in Bavaido compared to 54.5% positive samples in the camp. The calculated Chi-square (60.23) with the degree of freedom (ddl =1) at the threshold (α = 0.05) is higher than the tabulated Chi-square (3.841). Thus the difference is significant in the positive result between the two environments.
- Faecal analyses revealed 4.8% positive Schistosoma samples in Bavaido versus 7.3% positive samples in the camp. The calculated Chi-Square (0.359) with ddl = 1 and α = 0.05, being lower than the tabulated Chi-Square (3.841). The difference is not significant, we accept the null hypothesis.
- The comparison of positive results for urine and stools (Table 3).

Of the 62 positive urine samples, 43.55% were observed in the 0 - 9 year age group, followed by 22.58% in the 10 - 19 year age group.

From Table 5, out of 62 urine samples that showed a positive result, 56.45% was observed in females and 43.55% in males. The high frequency in females was observed at the camp with 56.7% compared to 50% at Bavaido.

From the 12 stool samples that tested positive, 41.7% were observed in the 0-9 year age group, 50% of which were from the camp and 25% from Bavaido. Also, no positive stool results were observed in the 20 - 29 and 50 - 59 age groups.

In Table 7, out of 12 positive stool samples, the high frequency is observed in female respondents (58.3%), of which 50.0% in the camp and 75.0% in Bavaido.

Table 1. Distribution of respondents with samples selected by age in the two sites

Middle / Age Group/year	Bavaido		camp		Total	
	staff	%	staff	%	staff	%
0 – 9	13	15.5	39	35.5	52	26.8
10 – 19	13	15.5	18	16.4	31	16.0
20 – 29	21	25.0	15	13.4	36	18.6
30 – 39	7	8.3	16	14.5	23	11.8
40 – 49	12	14.2	13	11.8	25	12.9
50 – 59	18	21.5	9	8.2	27	13.9
Total	84	100	110	100	194	100

Table 2. Sex distribution of respondents from whom samples (stools and urine) were taken

Middle / Sex	Bavaido		Campement		Total	
	Staff	%	Staff	%	Staff	%
Male	39	46.4	58	52.7	97	50
Female	45	53.6	52	47.3	97	50
Total	84	100	110	100	194	100

Table 3. Laboratory test results for urine and faecal samples in both studied media

Examination and environment Result	Urines						Stools					
	Bavaido		camp		Total		Bavaido		camp		Total	
	Staff	%	Staff	%	Staff	%	Staff	%	Staff	%	Staff	%
Positive	2	2.4	60	54.5	62	32	4	4.8	8	7.3	12	6.2
Negative	82	97.6	50	45.5	132	68	80	95.2	102	92.7	182	93.8
Total	84	100	110	100	194	100	84	100	110	100	194	100

Table 4. Positive urine results by age group of respondents from whom samples were taken

Middle / Age group/year	Bavaido		Campement		Total	
	Staff	%	Staff	%	Staff	%
0 - 9	0	0.0	27	45.0	27	43.55
10 – 19	1	50.0	13	21.7	14	22.58
20 – 29	1	50.0	9	15.0	10	16.13
30 – 39	0	0,0	5	8.3	5	8.06
40 – 49	0	0,0	4	6.7	4	6.45
50 – 59	0	0,0	2	3.3	2	3.23
Total	2	100	60	100	62	100

Table 5. Positive urine results by sex of respondents from whom samples were taken

Middle / Sex	Bavaido		Camp		Total	
	Staff	%	Staff	%	Staff	%
Masculin	1	50.0	26	43.3	27	43.55
Féminin	1	50.0	34	56.7	35	56.45
Total	2	100	60	100	62	100

Table 6. Distribution of positive stool results by age group of respondents from whom samples were taken

Middle / Age Group/year	Bavaido		Campement		Total	
	Staff	%	Staff	%	Staff	%
0 - 9	1	25.0	4	50.0	5	41.7
10 – 19	2	50.0	2	25.0	4	33.3
20 – 29	0	0.0	0	0.0	0	0.0
30 – 39	0	0.0	1	12.5	1	8.3
40 – 49	1	25.0	1	12.5	2	16.7
50 – 59	0	0.0	0	0.0	0	0.0
Total	4	0.0	8	100	12	100

Table 7. Distribution of positive stool results according to the sex of the respondents from whom samples were taken

Middle / Sex	Bavaido		Campement		Total	
	Staff	%	Staff	%	Staff	%
Male	1	25.0	4	50.0	5	41.7
Female	3	75.0	4	50.0	7	58.3
Total	4	100	8	100	12	100

Table 8. Distribution of positive results among respondents who had hematuria in both settings

Middle / Result	Bavaido		Campement	
	Staff n = 0	%	Staff n = 17	%
Positive	0	0.0	17	100
Négative	0	0.0	0	0.0

Table 9. Distribution of positive results of hematuria by gender in the settings

Middle / Sex	Bavaido		Campement	
	Staff n = 0	%	Staff n = 17	%
Male	0	0.0	6	35.3
Female	0	0.0	11	64.7
Total	0	0.0	17	100

Table 10. Age distribution of positive results for hematuria by respondents in both settings

Middle / Age Group/year	Bavaido		Campement	
	Staff n = 0	%	Staff n = 17	%
0 - 9	0	0.0	3	17.6
10 – 19	0	0.0	7	41.2
20 – 29	0	0.0	5	29.4
30 – 39	0	0.0	2	11.8
40 – 49	0	0.0	0	0.0
50 – 59	0	0.0	0	0.0
Total	0	0.0	17	100

No cases of hematuria have been reported in Bavaido. However, at the camp, 17 respondents presented macroscopically with hematuria and tested positive for Schistosoma in their urine.

Hematuria was more prevalent in women (64.7%) than in men (35.3%).

The age group with the highest incidence of hematuria with a positive Schistosoma result was

10-19 years of age (41.2%), followed by 20-29 years of age (29.4%).

4. DISCUSSION

4.1 Identification of Respondents

The study found that 25% of the respondents in Bavaido whose samples were taken were in the 20-29 age group; while in the camp the high proportion of respondents was in the 0-9 age group (35%). A study conducted by Dr Serge MAYAKA in Kiyanika (Bas-Congo) had shown the predominance of the 10 - 14 years age group among the selected students. The minimum age of his students was 5 years and the maximum 25 years. As for gender, the results of the study show that women and men are numerically equal in the two study environments (50% equal). However, the women selected were more numerous (53.6%) in Bavaido than in the camp.

The latter result is a matter of chance since our sampling was occasional. However, we did find the difference in number compared to location.

This could be explained by the fact that these age groups from childhood to adolescence spend a lot of their time in the water, some for playing and swimming, others (women) for their housework, laundry and dishes.

4.2 Results of the Analyses

Urinalysis revealed 2.4% positive samples of *Schistosoma haematobium* in Bavaido versus 54.5% positive in the camp, while faecal analysis revealed 4.8% positive samples of *Schistosoma mansoni* in Bavaido versus 7.3% positive in the camp. Concerning the age group, 43.55% of the positive results were observed in the 0 - 9 years age group. As for sex, 56.45% of positive results were observed in females against 43.55% in males.

In this study, the high frequency of positive stool samples was observed in female respondents (58.3%), of which 50.0% in the camp and 75.0% in Bavaido.

Results obtained in this study show that out of a set of 12 stool samples with positive results, 41.7% were observed in the 0 - 9 years age group, of which 50% in the camp and 25% in Bavaido. Also, no positive stool results were observed in the 20 - 29 and 50 - 59 age groups.

The absence of negative results in the 20 - 29 and 50 - 59 age groups would be justified by the fact that these adults sometimes observe some notions of hygiene, for example: heating the bathing water before it is taken.

These results do not corroborate with those of Willy Nkamnang Guinété, whose results showed the prevalence of Schistosomiasis in the stools (*Schistosoma mansoni*) among respondents in the 20 - 40 age group. On the contrary, his research showed that there was a non-significant difference for gender: 40% was male and 60% female. Moreover, Philippe Cecchi, in a study conducted on Schistosomiasis and population at risk in small dams, found that male adolescents in the age group 10 - 14 years were the risk group for urinary bilharzia regardless of their activity and origin. We believe that ecological conditions: vital activity (fishing), hygienic conditions, women's housework, etc. would be the basis for this result. According to Moussa Abdellahi et al, the prevalence of urinary bilharziasis *(Schistosomiasis haematobium)* was high in Delta (57%), 32.5% in the valley and 25.1%. As shown in our study, the difference in bilharzia infestation in the two environments (Bavaido and camp along the Tshopo River), would simply mean that the prevalences of urinary and intestinal bilharzia vary significantly according to ecological zones.

No cases of haematuria have been observed in Bavaido. However, in the camp, 17 respondents presented macroscopically with haematuria and their urine analyses gave a positive result for *Schistosoma haematobium.* The predominance of hematuria was more prevalent in women (64.7%) than in men (35.3%). The age group with the highest incidence of hematuria with a positive Schistosoma result was 10 - 19 years (41.2%), followed by 20 - 29 years (29.4%).

This is the same finding made by Willy Nkamnang Guinété, where he had also noted 8% of hematuria cases in the sick population. This was proven during our research where any hematuric urine sample received, gave a positive result. This is confirmed by the theory that the macroscopic sign of schistosomiasis is hematuria.

5. CONCLUSION AND RECOMMENDATIONS

At the end of this investigation, we were able to say that both media we're exposed to this pathogen (schistosomiasis). The residents of the Tshopo riverside camp were more infested with bladder schistosomiasis than the residents of the Bavaido village. Out of a total of 194 people submitted to urine and stool examinations in Bavaido village and the Tshopo River camp, 110 (56.7%) were camp residents compared to 84 (43.3%) in Bavaido village.

Given the above results, we make the following suggestions: To the Government of the Republic and its Partners: to make an effort to improve at all costs the living conditions of the population in the production of drinking water; to set up a permanent and regular screening system as well as to ensure regular medical care (at least every two years as stupid the WHO standards) to this population and finally to organize in a regular way health education by sensitizing the two communities. To the community itself: to immediately consult the nearest medical structure in case of signs of the disease and especially in case of hematuria; to set up clean latrines at a distance from the river for the inhabitants on the banks of the Tshopo river) and to avoid making cancan or piss in the water to avoid the spread of the disease and thus protect the others.

CONSENT AND ETHICAL APPROVAL

Adherence to the study was dependent on informed consent and confidentiality of the respondents for adults and guardians of the children as far as they were concerned. Prior authorization was obtained from local administrative and health authorities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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