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Prevalence of *Schistosoma haematobium* parasitism in rural population of Cubal city, Province of Benguela, Angola

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Abstract

Introduction: *Schistosoma haematobium* infection is a serious public health problem in endemic areas. This parasite damages the urinary tract and induces bladder carcinoma.

Objective: Perform an epidemiological survey of hematobic schistosomiasis in the city of Cubal, province of Benguela, Angola.

Methods: Between the years 2008 and 2012, urine samples were collected from 505 patients aged from 1 to 75 years with clinical signs of haematuria, dysuria and pain on urination. The urine samples collected were placed in conical sedimentation cups and remained refrigerated for 24 hours. After this period, 10 ml of sediment was collected from each sample and centrifuged at 3,000 rpm (revolutions per minute) for five minutes. The sediment was observed between slip and cover slip in light microscope with magnification of 400X.

Results: The presence of eggs with a terminal spine determined the diagnosis of hematobic schistosomiasis in 100% of the 505 examined patients.

Discussion and conclusion: The result highlighted the occurrence of hematobic schistosomiasis in 100% of the people investigated with parasitic symptoms and shows the severity of the disease in the studied region.

Keywords: *Schistosoma haematobium*, parasitism, Angola

Introduction

The province of Benguela is located in the west of Angola and it's capital is the city of Benguela; the province occupies an area of 39,827 km^2 and have approximately $2.1x10^6$ inhabitants, distancing about 690 km from the country's capital. The province is formed by 10 municipalities denominated: Baia Farta, Balombo, Benguela, Bocoio, Caimbambo, Catumbela, Chongoroi, Cubal, Ganda and Lobito.

Induced by successive years of the Angola civil war, the rural exodus had an increasing importance over these time, and Angolans of different ethnicities and regions immigrated, mainly from the province of Huambo to Benquela and Lobito, forcing a large and disorderly growth in cities of these provinces (Dias, 2012).

In the territory of Benguela there are several water courses, belonging to the four hydrographic basins found in the province: Cubal, Handa, Catumbela and Coporolo. Other geographical features are the steppe formations found in the vegetation of the province area, as well as open forest formations and wooded savanas. These environments conditions are suitable for the colonization of molluscs and the formation of schistosomiasis foci.

Hematobic schistosomiasis, also known as biliarsiasis or genitourinary schistosomiasis, is an endemic disease found in 54 countries, especially in Africa and countries of the eastern Mediterranean. In Africa it has already been found in 41 countries. The etiology is pointed to the *Schistosoma haematobium*, and the trematode develops a biological cycle with two distinct genesis: one in the human organism (vertebrate host) and the other within mollusc species of the genus *Bulinus* (invertebrate host). These molluscs colonize still waters or low current streams, becoming these places a source of infection to humans (Coura, 2005; Grysell *et al.,* 2006). People that uses fresh water from rivers or lakes to drink, cook, wash clothes and take bath are at risk of parasitism by *S. haematobium*, as the parasite cercariae can actively penetrate the skin, reach the bloodstream, pass through the heart, lungs, until establish itself in the blood plexus of the bladder. The parasite produces chronic irritation and inflammation of the bladder, and promotes favorable conditions for the induction of bladder carcinoma (Santos *et al.*, 2012; Rubin *et al.*, 2010). The cercariae of *S. haematobium* penetrate the body and are largely directed to the bladder, but may also establish in the adjacent areas of the genital tract, where they cause ulcerative lesions around the vagina and cervix, resulting in a pathological condition clinically named as female genital schistosomiasis (Martial *et al.*, 2013). Recent studies shows that normal bladder cells when exposed to parasite antigens increased their proliferation rate, and in experimental models in murine bladder cells exposed to the same antigen develop dysplastic lesions, suggesting that this antigen may be associated to the process of cancerization (Botelho *et al.*, 2010). In *S. haematobium* infection, an inflammatory cystitis appears due to massive deposition of eggs and formation of granulomas, inducing mucosal erosions followed by hematuria. Subsequently granulomas calcify and develop a sandy appearance which, if severe, can cover the bladder wall and form a dense concentric margin, known as "calcified bladder" in radiographic images. The most frequent complication of infection is inflammation and fibrosis of the ureteral walls, leading to obstruction, hydronephrosis and chronic pyelonephritis. There may also be an association between urinary schistosomiasis and squamous cell carcinoma of the bladder (Kumar *et al.*, 2010). According to WHO (2002), this parasite affects 200 million people worldwide, and 192 million (96%) of parasited people lives in the African continent. Of the total parasite in the world, 120 million are symptomatic, about 20 million have severe disease with associated complications. Mortality is close to 500.000 people a year, which 300,000 of them are in Africa.

Considering the importance of *S. haematobium* as a pathogen and inducer of bladder cancer, this research had as objective to collect data, calculating health indicators about this parasitosis in the city of Cubal, among people with a history of urinary problems in the province of Benguela, Angola.

Materials and Methods

Based on preliminary information on the high incidence of urinary problems among residents of Cubal, this study has an individualized, observational and temporal design, with the research period counting from 2008 to 2012, with convenience sampling by the spontaneous search for health services by the patients, each one representing an unique sample, privileging the nominal variable of parasitic infection.

The chosen technique was the parasitological examination of urine by spontaneous sedimentation followed by induced sedimentation for the identification of individual *S. haematobium* hosts.

The studied population consisted of 505 people aged between 1 and 75 years in five rural communities (Alto Capaca, Rio Bom, Jamba, Yambala, Capupa) of Cubal, Benguela province; all of these patients had clinical complaints of hematuria, dysuria or pain upon urination. The inclusion criteria of the participants was: to live in the province of Cubal, not to be in treatment and expressly consent to participate in the research or have the consent of those responsible, in the case of children. Exclusion criteria were: not residing in Cubal, being in antiparasitic treatment or not accepting to participate in the research.

The urine samples collected were placed in glass containers, identified and sent to the Laboratory of Clinical Analysis of the Health Department of Cubal city. The samples were placed in conical calyces of sedimentation under refrigeration, thus remaining at rest for 24 hours. After that time, 10 ml of the sediment was separed, placed in tubes and centrifuged at 3,000 rpm for five minutes. From the centrifuged sediment an aliquot was separated and deposited in glass slide, covered with coverslip and observed in light microscopy with increase of 400X. The presence of eggs with a terminal spine confirmed the diagnosis of hematobic schistosomiasis.

Results were analyzed by descriptive and analytical statistics, with a "f" test, and Pearson's correlation coefficient, to compare health indicators (Hotz & Fenwick, 2009), between the rural locations, gender of the patients, age group, and between the years of research.

Results

All of the 505 examined patients were eliminating eggs of *S. haematobium* by urine, conferring a prevalence coefficient of 100%. When considering the five communities investigated as population, and evaluating the participation of each one in this prevalence, by arbitrating the level of significance at 5%, there was a significant difference between Alto Capaca, for the other neighborhoods; Rio Bom differed significantly from the other three neighborhoods (Tab. 1).

Table 1- Diagnosed cases for *Schistosoma haematobium* parasitism between 2008 and 2012, from people attended with history of urinary problems at the ambulatories of Cubal city, Angola.

Neighborhoods Of Cubal		Cases for *Schistosoma haematobium* parasitism						
		Number (by years)*						% by neighborhood
		2008	2009	2010	2011	2012	Soma	
Alto Capaca		19	2	14	88	107	∑=230	45,5^{a}
Rio Bom		13	11	5	15	12	∑= 56	11,1^{c}
Jamba		28	19	27	31	16	∑=121	24,0^{b}
Yambala		1	21	0	12	1	∑= 35	6,9^{c}
Capupa		26	9	4	17	7	∑= 63	12,5^{c}
Total	(nº)	87	62	50	163	143	∑=505	100,0
	(%)	17,2^{B}	12,3^{B}	9,9^{B}	32,3^{A}	28,3^{A}	100,0	

* Exponents with unequal letters in the same column indicate a significant difference (p <0.05) between the results; when the letters are equal the difference is non-significant (p> 0.05).
* Exponents with unequal letters in the same line indicate significant difference (p <0.05) between the results; when the letters are equal the difference is non-significant (p> 0.05).

Table 2- Diagnosed cases for *Schistosoma haematobium* parasitism between 2008 and 2012, considering the age class and gender of the patients attended with history of urinary problems in the ambulatories Cubal city, Angola.

Age class (years)	Male*		Female*		Total**	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
01 H 14	123	45,5^{A}	94	40,1^{A}	217	43,0^{a}
15 H 24	52	19,3^{A}	60	25,5^{A}	112	22,2^{b}
25 H 34	27	10,0^{A}	29	12,3^{A}	56	11,1^{c}
35 H 44	24	8,9^{A}	33	14,0^{A}	57	11,3^{c}
45 H 54	18	6,7^{A}	14	6,0^{A}	32	6,3^{c}
55 H 64	22	8,1^{A}	4	1,7^{B}	26	5,1^{c}
65 H 74	4	1,5^{A}	1	0,4^{B}	5	1,0^{d}
Total	270	100	235	100	505	100

Obs.: * Exponents with unequal capital letters on the same line indicate a significant difference ($p < 0.05$); when the letters are the same, indicate a non-significant difference ($p > 0.05$). ** Exponents with unequal lower case letters in the same column indicate a significant difference ($p < 0.05$); when the letters are the same, indicate a non-significant difference ($p > 0.05$).

The results calculated for sample and stratified by gender and age class allowed to characterize that there is an inverse correlation between the age and the prevalence of the infection, but the difference between infections in men and women is not significant for the error type I, admitted a level of significance of 5% (Tab. 2).

Discussion

In the endemic areas of hematobic schistosomiasis, mainly hematuria, dysuria and, possibly, pain while urination are clinical data highly suggestive of the disease. Hematuria in young people is almost always accompanied by the finding of *S. haematobium* eggs in parasitoscopic examinations. In such areas, urine blood testing has been recommended for simplicity and speed to replace microscopic examinations of urinary sediment, especially in epidemiological surveys (Serra-Freire, 2002).

The lack of specific laboratory resources such as cystoscopy, excretory urography and ultrasonography in medical centers in endemic areas of the parasite is a serious problem when it is necessary to evaluate the complications of the disease or to establish a criterion of monitoring and appropriated treatment. As an example, the clinical evolution of the group of brazilian military personnel who participated in a peacekeeping mission of the United Nations in Mozambique in 1994 can be mentioned. On returning from the mission, all participants presented *S.haematobium* eggs in the parasitological examination of urine and also urinary complications were attributed to the parasite. However, the transmission of this helminth did not occur in the American continent due to the inexistence of the host mollusk intercalated in the trematode life cycle (Silva *et al*., 2006).

Ping *et al.* (2014) and Wang *et al.* (2013) cited that only *S. japonicum* is endemic. However, the major concern in the spread of *S. mansoni* and *S. haematobium* is related to the population of about one million Chinese working temporarily in Africa, especially in Angola and Tanzania; being contaminated in the African continent which can introduce helminths acquired from different regions to China when returning to their country. This fact has been one of the major concerns of the public health managers and researchers of this country.

To calculate the incidence of hematobic schistosomiasis among schoolchildren in the city of Maputo, Mozambique, the researchers Gujral & Vaz (2000) conducted a cross-sectional study involving children of both genders, selected at random. They examined single urine samples from 434 schoolchildren and found 11.3% of positivity (49/434). The percentage found is much lower than the prevalence detected in the population of the city of of Cubal (100%). It is possible that in Maputo the incidence is inferior due to a lower exposure of the children to the breeding sites of the molluscs containing the *S. haematobium* cercariae.

Njaanake *et al.* (2016) studied the prevalence of *S. haematobium* infection in primary school children from two isolated villages in Tana, Delta District of Kenya. Urine exams in 262 children revealed positivity for 94% to parasite eggs. These authors considered that the high prevalence of this parasitosis is responsible for a significant morbidity among children of those localities. We corroborate the conclusions achieved by these authors when we found 100% positivity for the patients studied in the rural population of Cubal in the province of Benguela, Angola.

Botelho *et al.* (2016) studied the incidence and the morbity of the parasitism by *S. haematobium* among 90 children and teenagers between 6 and 15 years randomly selected in Guinea-Bissau. The prevalence was 20% (18/90). Our research on the Cubal region registered a 100% positivity, much higher than the scored in Guinea-Bissau, where there is probably less contact of the people with the contamination source. The authors concluded that this observation underscore the notion that this vulnerably but neglected population urgently needs to be targeted for implementation of measures for treatment and control. We share this conclusion and suggest that it would be applied with more emphasis over the province of Benguela, Angola.

Gracio *et al.* (1978) studied bladder schistosomiasis in Angola in the year of 1978. They recorded high prevalences in several provinces of the country, which remains high till now. In one of these studies, the researcher drew attention to the importance of bladder schistosomiasis in Angola, highlighting the prevalence coefficient of 93% in the city of Cubal among school-age children. In this same city our research group registered 100% positivity among 505 individuals aged between 1 and 75 years, characterizing the severity of the disease in this place, over almost four decades.

Conclusion

The result highlighted the occurrence of hematobic schistosomiasis in 100% of the individuals investigated, with symptoms of parasitosis and evidences the severity of the disease in the studied region. We suggest urgent measures for treatment and prophylaxis due to the alarming prevalence of *Schistosoma haematobium* infestation.

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