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Importance of Malacological Factors in the Transmission of *Schistosoma haematobium* in Two Dams in the Province of Oubritenga (Burkina Faso)

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Abstract: A study on malacologiques factors in the transmission of *Schistosoma haematobium* took place in December 2007 at the villages of Daguilma and Tanguiga in Burkina Faso in order to combat schistosomiasis is diversified both in humans than in the intermediate host. A malacological investigation was followed by a parasitological study in order to give a progress report on the dynamics of urinary schistosomiasis and also, that of the mollusc intermediary host in the study area. Malacological Investigations at the dams of the two villages indicated *Bulinus truncatus* mollusk as host responsible for the transmission of urinary schistosomiasis. The natural infestation tests underscored made that only *Bulinus truncatus* was responsible for the transmission of urinary schistosomiasis. The parasitological results obtained showed an overall prevalence rate of *Schistosoma haematobium* from 11.2 to 15.6% and Daguilma to Tanguiga. The study by sex showed that Daguilma, the difference in prevalence was not significant (p = 0.2311) among men (16.6) and females (06.4%). In contrast to Tanguiga, this difference in prevalence between men (23.4) and women (03.3%) showed a slight significance (p = 0.0407). The results concerning parasite *Schistosoma haematobium* and malacological and in the villages of Daguilma and Tanguiga has helped to highlight the expansion of urinary schistosomiasis; the importance of the behaviour of the local population and the presence of *Bulinus truncatus* in the dam of Daguilma village.

Key words: Mollusk, *Schistosoma*, Daguilma and Tanguiga, Burkina Faso

INTRODUCTION

Each year, 200,000 deaths are associated with schistosomiasis which affect rural areas but also the suburban and urban environments (van der Werf *et al*., 2001). It is therefore a major health hazard especially in Africa, where, under developments, lack of hygiene, persistent urinary and faecal peril, promote contamination.

Schistosomiasis is endemic in 76 countries, mostly in Africa. Thus, urinary schistosomiasis caused by *Schistosoma haematobium* affects 54 countries in Africa and the eastern basin of the Mediterranean (WHO, 1994). At the year 2000 more than 200 million people were infected through the world by schistosomiasis (intestinal schistosomiasis and urinary schistosomiasis) which 85% is found in Africa (Chitsulo *et al*., 2000). But at 2004 a more than 112 million person infected by urinary schistosomiasis (*Schistosoma haematobium*) through the world and the number of subjects at risk of infection stands at around 436 million in sub-Saharan Africa (WHO, 2004).

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Indeed the ecosystem is complex and supply of the means of production by survival but can be a source of spread of disease. By creating restraint water for development (of water facilities and hydro-electric) man created by these developments ecological disruption that may lead to the proliferation of biological species initially scarce, including are disease vectors including shellfish intermediate hosts of schistosomes (Poda *et al*., 2003). This has been helped by the vast hydraulic programs that have been carried out for agricultural needs and/or energy. Indeed the outbreaks of schistosomiasis in sub-Saharan Africa, as a result of changes in the environment, have been reported several times (N'Goran *et al*., 1997; de Clercq *et al*., 2000). These water facilities by environmental conditions favourable to constitute for all components of a complex pathogen (hosts and parasites), are homes where transmission is very active. The various water facilities were constructed to improve the water network in the country, unfortunately favourable to the development of the two forms of bilharzia (intestinal and urinary form) which cause enormous health problems (Poda *et al*., 2003).

Parasitological investigation in Burkina Faso, have highlighted the high endemicity of *Schistosoma mansoni* and *Schistosoma haematobium*. These studies have also confirmed that in terms malacological, Burkina Faso presents itself as a crossroads of mollusk intermediate hosts of schistosomiasis in West Africa (Poda *et al*., 2004a). In the Sourou's hydroagricole complex, for example, the prevalence of infection in humans have increased from 19 to 70% from 1998-1999 at Guiédougou the oldest engineered facility. For intestinal bilharzia, almost absent until 1987, it prevalence ranging from 8 to 91% at 1998 in villages along the adjustments (Poda *et al*., 2004b). Another example is given by the Kou valley, where, prevalence increased from 14% before, the adjustment to 80% in 1974 to form urine and 1.3 to 45% for the intestinal form. The same trends are emerging in recent adjustment like Bagré, Ziga and Kompienga. The water facilities constitute factors of the disease amplifiers by the increase in surface water, the density of the human population, but also and especially in the density of shellfish vectors of the disease. Thus the control of schistosomiasis has become increasingly difficult.

Studies in Burkina Faso, showing the importance of schistosomiasis have prompted health authorities to set up the National Programme for the Fight against Schistosomiasis (PNLSc) create at 2004 based on a mass treatment on the entire national territory.

Despite the efforts of PNLSc, it is necessary to reflect on the opportunities for reinfection of urinary schistosomiasis because Gönnert and Andrews (1977) claimed that a real hope for the eradication of schistosomiasis had been born with the discovery of praziquantel. This hope was quickly initiated by the possibility of reinfection after treatment and the emergence of resistant strains of parasite to this drug (Fallon *et al*., 1995; Ismail *et al*., 1996).

The present study was initiated in order to contribute to the sustainable reduction of schistosomiasis in Burkina Faso.

The objective of this study is to assess the density, the issue cercarienne shellfish hosts in public areas at risk (water facilities) and the profile parasitological urinary schistosomiasis after the various campaigns of mass treatment against schistosomiasis in the villages of Daguilma and Tanguiga. This could help to diversify the methods to combat schistosomiasis.

MATERIALS AND METHODS

Study Areas

The villages of Daguilma and Tanguiga are located in the Northern Sudanese region. Daguilma sites and Tanguiga are in the province Oubritenga located at the centre of Burkina Faso in savannah zone herbaceous sparseness. The average annual rainfall is 867 mm with a maximum of 250 to 300 mm in August. The dry season lasts for 6 to 7 months.

Table 1: Distribution of subjects by age and sex from locality

		Age group (year)				
Localities	Sex	5-15	16-30	31-45	≥46	Total (%)
Daguilma	Man	30	3	4	7	42 (47.2)
	Female	34	3	5	5	47 (52.8)
	Total of Daguilma	64	6	9	12	89 (100)
Tanguiga	Man	34	4	6	3	47 (61)
	Female	19	6	3	2	30 (39)
	Total of Tanguiga	53	10	9	5	77 (100)

The villages of Tanguiga and Daguilma are belong tow departments: Dapelogo and Loumbila. Daguilma's village is located beside the dam of Loumbila. While the village of Tanguiga owns a dam located in its immediate vicinity, which is less important than Loumbila's and it is almost dry in the dry season. In both places, the water supply is provided by domestic drilling and traditional wells. Both villages are economically different. The standard of living is relatively higher in Daguilma. Indeed, in this village, in addition to farming activities, the villagers engaged in gardening and fishing throughout the dry season.

In demographic terms, Daguilma village has a population of 854 people. The village has a primary school of six classrooms equipped with a latrine. The village of Tanguiga has a total population of 1561 inhabitants. Tanguiga has a primary school in three classes located approximately 1 km from the dam.

On the parasitological, Traoré *et al*. (1990) had reported prevalence rates in *Schistosoma haematobium* 85 and 55.4%, respectively in 1990 in the villages of Daguilma and Tanguiga.

Study Population

A total of 166 subjects were including. Then 89 men and 77 women (sex ratio H/F 1.15). The age of the subjects was between 5 and ≥46.

Table 1 shows the characteristic of the study population by age and sex from localities.

Collection Malacological Data

The research of molluscs in the study areas was carried out during three weeks in the month of December 2007 at the two dams in the villages of Daguilma and Tanguiga. All along the water, the supports are verified by direct examination, forcing the prospector to take extra precautions (wearing boots and gloves). The molluscs harvested are willing between two layers of cotton wet (wet and wrung heavily) in a box of plastic Petri or in a similar container. On the ground, prospectors were equipped with a cooler containing ice-boats which allowed the preservation of specimens harvested shellfish populations. The molluscs are returned to the laboratory for testing of natural cercaria emission after the identification of mollusc from the morphology of the guard. But Traoré *et al*. (1990) don't collected malacological data.

Control of Parasites Among Molluscs

Mollusc harvested on the ground and returned to the laboratory are placed in small tablet containing water drilling (at one mollusc/tablet) and exposed to artificial light sources (36 watts of neon) for 4 h, mostly between 12.00 and 4.00 pm. This exposure to light causes a release cercaria from mollusc infested. The positive individuals are counted and put into livestock, in the perspective of species identification of schistosome subject of their infestation. Those negatives are kept in breeding from for a month, to allow the development of the parasites in pre patent and checked again.

Identification of the Species Cercaria from Mollusc

For the identification of the schistosome species (cercariae), different techniques are used for this purpose. Our choice fell on chronobiology of the broadcast cercaria (rate of emergence of cercariae) through a camera, chronocercariometer of Theron simplified, which can automatically collect the amount of larvae issued by the mollusc for every positive hourly from morning to evening. The marker allows for discrimination between net cash schistosome parasite of man whose peak emission of cercariae is between 12 and 14 h and those cercariae of cattle whose peak is between 9 and 11 h.

Collection Parasitological Data

At 1990, the authors used the method of the reactive strip witch they use to put in urine. Then when the reactive strip is colour red, the patient is seek, if note the patient is note seek.

At 2007, the urine samples were collected between 10 am and 14 pm the same day. The content of the pot is mixed manually and then 10 mL of urine are taken with a syringe that is passed through a filter of Nytrel (mesh, 40 μm). The filter is removed from the filter with tongs and placed on a slide, we add a drop of Lugol's solution (coloring eggs), then covered with a cover slip. Reading is made immediately after filtration magnification x100 and met all eggs are numbered.

RESULTS

Malacology

The malacological surveys have shown that the only species *Bulinus truncatus* was found in the dam of Daguilma with low density observed during the survey at tree weeks in the month of December 2007. After testing the issuance of cercariae emission few specimens were parasitized naturally, show the existence of pockets of transmission in which the risks humans and animals may overlap. For snail data, 27 snails (*Bulinus truncatus*) were found in the dam of the village. Two of these nail were naturally infected by cercaria.

By contrast in the dam Tanguiga, any mollusc could not be identified because, the dam was drained. In the dam of the village of Tanguiga, no snail was found.

Parasitological

In localities of the provinces Oubritenga, microscopic examination of urine showed that *S. haematobium* was found in the villages of Daguilma and Tanguiga respectively, with the overall prevalence of 11.2 and 15.6% (Table 2).

In Daguilma, this difference in prevalence was not significant (p = 0.2311) among men (16.6) and female (06.4%).

In contrast to Tanguiga, this difference in prevalence between men (23.4) and women (03.3%) showed a slight significance (p = 0.0407).

Table 2: Parasitological data (%) by sex and age from villages

		Age group (year)				
Localities	Sex	5-15	16-30	31-45	≥46	Total
Daguilma	Man	16.6	14.3	25.0	0	16.6
	Female	5.8	20.0	0.0	0	6.4
	Total Daguilma	10.9	16.6	11.1	0	11.2
Tanguiga	Man	20.6	66.6	0.0	0	23.4
	Female	0.0	16.6	0.0	0	3.3
	Total Tanguiga	13.2	41.6	0.0	0	15.6

DISCUSSION

After the malacological investigation, temporal distribution of *Bulinus tuncatus* in the month of December 2007 in the dam shows that *B. truncatus* seems to be the main vector in the transmission of *S. haematobium* in the village of Daguilma after the issuance natural cercariae. The results also, join those of Niger (Labbo *et al*., 2008) where, surveys have highlighted homes at risk in irrigated as two intermediate hosts in case of *B. truncatus* and *B. globosus* are at the root of the parasite transmission.

The natural infestation of mollusk comes from the urine released directly into the dam by the subjects who are sick in the village of Daguilma. The higher mollusk issuer's cercaria in the aquatic habitat is high over the risk of transmission of urinary schistosomiasis increases. These results were similar to those of Njiokou and collabators at 2002 in urban Cameroon.

The surveys of parasitological results highlight the presence of schistosomiasis, caused by *S. haematobium* in subjects from the villages of Daguilma and Tanguiga, confirming the results of the investigation of malacological. Both villages are a hotbed of active urinary schistosomiasis, which can be considered to extend the zone hotbed of urinary schistosomiasis because, of the proximity of each of the villages towards the dam located within it. Overall household levels are endemic variables reflecting the focal nature of the disease. This situation involves the endemic level of initial activities carried out to the villages of potential transmission and species of mollusc vector (Njiokou *et al*., 2004).

In Daguilma, a prevalence of 11.2% was recorded, while in Tanguiga this prevalence is reported at 15.6%. Indeed in the same locality before, campaigns of mass treatment based on the chemotherapy had reported an overall prevalence of 85 to Daguilma and 55.4% to Tanguiga (Traoré *et al*., 1990). The people of the two villages had been treated one year before our investigation, reducing infestation levels of the two villages at levels of hypo endemicity.

The farming practices such as gardening practiced in the dam during the months of November to March, increasing the chances of transmission parasite, a phenomenon that is reflected in the prevalence of parasitic data. Also, very close dependence of people in two villages truthful with the two dams for washing and bathing explain the observed prevalence, especially considering that our sampling method was concerned that subjects acknowledging that there were contacts with the dam. In addition to the activities (bathing and washing) common to both sexes, boys fishing for long hours, which brings them into contact with the longest dam that girls and explains the high prevalence in young boy by compared with girls. The prevalence of urinary schistosomiasis presents no significant difference between the two villages ($p = 0.4099$). In addition, patients of the two villages are pretty much working-age adults (aged 16-30 years), contrary to what is usually described. (Bundy and Guyatt, 1996; Mott *et al*., 1990). Women from the village of Tanguiga are not very infested (1 out of 30), this might be explained by the fact that they do not take part in water activities, unlike Daguilma where girls are investing. In the village of Tanguiga, the gendering of water contact space and activities resulted in an underreporting of male water contacts. The reason appears to be that male work long time in water, where, male remained during the day, while female worked at distant agricultural sites. Our study confirms the higher prevalence of infection in males and agrees for what had been reported for *S. haematobium* in the Daguilma and Tanguiga. However, the odds of infection in males compared with that in females are the same for prevalence of infection thresholds. Thus, even though males are in general more infected than females, the distribution of individuals in each village of infection group is similar for the two genders. It may be that males and females progress through of infection with a similar rate.

This was not the case when age groups were compared. The prevalence of infection increased with age group. Young children are less likely than older age groups to be infected or at least less infected, but the odds of being more infected (compared with non-heavily infected) is similar in all age groups. This may be because there are only a very small number of heavily infected individuals in all age groups. This is consistent with the usually observed increase in prevalence of infection. Again, this age difference is most likely due to differences in the frequency of water contacts but could also be linked to puberty.

CONCLUSION

Preventive measures focus on treatment with chemotherapy should be accompanied by awareness of the populations to healthy and struggles against the mollusks to reduce to sustainable levels the endemicity of urinary schistosomiasis among human populations on the outskirts of Daguilma and Tanguiga. In this way, the spread of the disease is likely to be hindered or blocked when molluscs are colonizing the dams. Indeed, the treatment has enabled the significant reduction in the prevalence of *Schistosoma haematobium* in the villages of Daduilma and Tanguiga. The population must be educate on health care through hygienic care.

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