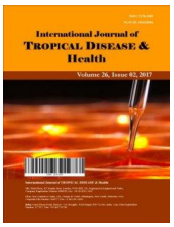

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Presence of an Unmapped Focus for Urogenital Schistosomiasis in the Tiko Health District in Cameroon: Implications for Control

Edith Anguh[1,2*], Simon Ako[1,3], Emmanuel Numfor[1], Z. Bimabam Josiah[1] and Vicky Ndassi[1,4]

[1]Department of Allied Health, School of Health Sciences, Biaka University Institute Buea, P.O.Box 77, Buea SWR, Cameroon.
[2]Department of Parasitology and Microbiology, Faculty of Science, University of Buea, P.O.Box 63, Buea SWR, Cameroon.
[3]Department of Medical Laboratory Science, Faculty of Health Sciences, University of Buea, P.O.Box 63, Buea SWR, Cameroon.
[4]Department of Zoology and Animal Physiology, Faculty of Science, University of Buea, P.O.Box 63, Buea SWR, Cameroon.

Authors' contributions

This work was carried out in collaboration between all authors. Authors EA, EN and VN designed the study. Author ZBJ wrote the protocol. Authors EA, SA, EN, ZBJ and VN performed the field and laboratory work. Author EA wrote the manuscript. Authors SA and EN performed the statistical analysis. Author VN supervised the work and revised the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: Schistosomiasis is known to be endemic in all the 10 regions of Cameroon. In the South West Region, it is concentrated in Meme Division [1] and Bafia health area, [2]. Treatment coverage has been limited to the areas known to be foci for the disease. We studied an area

**Corresponding author: Email: ejiwih@gmail.com;*

(Likomba) where no infected persons were recorded in the past but recently (June 2017), individuals infected with *Schistosoma haematobium* were identified at a hospital in that area.
Methodology: Demographic, socioeconomic and environmental information were collected via a validated questionnaire. In order to establish the prevalence of, and risk factors for infection with *S. haematobium* in the Tiko health district, urine samples were collected into dry containers from 264 children between the ages of 5 and 20 after administration of structured questionnaires. The samples were preserved appropriately and using the sedimentation technique of microscopy, samples were analysed for the presence of *S. haematobium* ova.
Results: It was established that all the subjects had been resident there for at least five years and most of them, their whole lives. Out of 264 individuals, 101 persons were positive for *S. haematobium*. This gave a prevalence of 38%. The prevalence of schistosomiasis was significantly higher (p=0.01) among children aged 5-8 and 17-20 years compared to those aged 9-12 and 13-16 years (P<0.05). A very significant difference was also seen in infection between males and females with males having a prevalence of 48% and females having a prevalence of 27%. Multivariate analysis confirmed that using unsafe sources for household chores and drinking water (P=0.001), bathing in the stream (P=0.00001) and visiting the stream more often (P=0.0001) were the key factors significantly associated with schistosomiasis infection among these children.
Conclusion: There is obviously an active transmission of urogenital schistosomiasis in the Tiko health district. Since the sedimentation method of diagnosis is less sensitive than the syringe filtration method, which is the gold standard, the prevalence is likely to be underestimated in this area. This health district should be included in any future control program in the country.

Keywords: Urogenital schistosomiasis; unmapped; focus; active transmission.

1. INTRODUCTION

Urogenital schistosomiasis, like intestinal schistosomiasis, is a neglected tropical disease and most of the foci for schistosomiasis fall in sub-Saharan Africa [3,4]. However, its control has gained momentum in the last decade (Tcheum Tchuente, 2012, 2017). It is caused by parasitic flukes of the genus *Schistosoma*. *S. haematobium* which is the causative organism for the urinary form of the disease is known to reside in the blood vessels of the bladder and urinary tract, causing serious damage to the tissues of these organs. In endemic areas, the most vulnerable to infection are children between the ages of 5-17 due mainly to the fact that activities like swimming and bathing in streams, bring them into frequent contact with the larval form from the intermediate snail host [5]. In preschool children [6] and school-age children, the chronic form of the disease can lead to anemia, retarded growth, reduced cognitive development (which is known to significantly reduce school performance) and even carcinomas [7,8]. With such serious consequences, there is dire need for stakeholders in the public health sector of endemic countries to implement the already known control measures to curb the rate of infection [9] especially in new foci for the disease. Though the reduction in morbidity of schistosomiasis by control programmes has been demonstrated (and fortunately no resistance to praziquantel has developed), the morbidity due to schistosomiasis has been shown to be greater than was previously thought [10].

Schistosomisis is a public health problem in Cameroon with 5million people at risk of contracting the disease and about 2 million people infected, mainly children [11]. Higher transmission rates are registered in the Northern Savannah areas where *S. haematobium* is endemic but generally, the prevalence of the infection in all endemic areas is quite significant [12,2]. This is as a result of failure to develop a national plan for drug distribution over the 10 regions in known foci for the disease. Such a national plan should reduce the rate of transmission in endemic areas and limit the upsurge of new foci due to migration. This notwithstanding, schistosomiasis control has many other aspects that must be properly addressed if elimination is envisaged. The Cameroon government started a national program to control both urinary and intestinal schistosomiasis using the drug praziquantel in the year 2007. This initiative though successful has not had good coverage due to lack of epidemiological data for the whole nation [11]. It appears there are still foci where the intermediate host exists even without apparent infected cases. The displacement (or migration)

of individuals into such areas can lead to new areas becoming endemic for the disease. Baseline epidemiological data for every possible focus for schistosomiasis in Cameroon is lacking. During routine hospital diagnoses, four cases were identified with urogenital schistosomiasis in June 2017 in the CDC (Cameroon Development Corporation) Tiko Central Hospital. So in March 2018, we sought to establish the fact that there are actually residents in the Tiko health area infected with urinary schistosomiasis and assess the prevalence so as to do a more comprehensive epidemiological survey of the area. The study will enable health policy makers to be informed on the major control method against the disease in this area and educate the inhabitants on its prevention.

2. METHODS

2.1 Study Area

This study was carried out in the Tiko health district about 20 km from the fastest growing city of Buea which is at the foot of Mount Fako. It has a surface area of 4840 square kilometers (sq.km), with a population of 134,649, distributed in 28 villages. Tiko has a population density of 241 inhabitants per sq.km and a population growth of 2.9%. Tiko is 10 meters above sea level at latitude 4°07′N, longitude 9°36′E, it has a relative humility of 83.1% and average rain fall of 4,524 mm. The area has a mean temperature of 27.9°C which favours high release of cercariae into the waters. The Likomba community, which is part of this health district, has a stream flowing through it known as Ndongo, which is the main source of bathing, household washing and swimming for residents of this area. The main occupation here is farming and trading.

2.2 Study Design

The study was a cross-sectional descriptive study in the month of March 2018 (2 weeks), involving children living in the Likomba community. A convenient sampling technique was used to recruit participants into the study. For children less than 13years old, assent was gotten from their parents or legal guardians and for those less than 18years old, consent was gotten from both the parent and the child. A structured questionnaire was administered to the participants to obtain data on socio-demographic and risk factors of urogenital schistosomiasis. Urine samples were collected for the detection of *S. haematobium* ova.

2.3 Data Collection

i) Questionnaires: Demographic information including age, sex, level of education, was collected using structured questionnaires which also addressed the possible risk factors to *S. haematobium* in the health district. The Tiko population examined comprised of individuals between the ages of 5-20 years as they constitute the age group that is most susceptible to infection. The sample size was 264 and all of the participants responded to the questionnaires. Younger children were requested to come along with their parents who helped in answering the questions besides giving their consent.

ii) Urine collection: Each participant who had answered the questionnaire was given a sterile, wide mouthed, screw capped plastic bottle carrying their identification numbers and well instructed on how to collect the urine samples. The younger children, who were 12 years and below collected the urine with the help of their parents. Thus, the Urine samples were collected between 10 am – 2 pm daily for 6days. A total of 264 urine samples were collected between, and after exercise to ensure maximum excretion of eggs. The urine samples were then transported immediately to the CDC Tiko Central Clinic and analysed within two hours of collection.

2.4 Microscopy

The sedimentation technique [13] was used to concentrate the parasite (as this was the technique available in the hospital) for identification under the microscope. 6mls of urine samples were centrifuged at 2000RPM for 5 minutes to obtain sediments, which were then placed on a slide. A drop of iodine was applied to each sediment to ease visibility of the eggs of *S. haematobium* which have a terminal spine and slides view using the X10 objective.

2.5 Data Analysis

Prevalence of *Schistosoma haematobium* was calculated as the proportion of positive samples. Data collected from the field was presented using descriptive statistics and was entered and analysed using the Statistical Package for Social Scientists (SPSS) version 16. Differences in prevalence of infection among different groups (sex and age), were tested for statistical significance using the Chi-square test. The significance level was set at a p-value of 0.05.

2.6 Ethical Considerations

This study was carried out with the approval of the Ethical Review Committee on Health Research, Regional Delegation of Public Health for the South West Region Buea, Cameroon. An institutional ethical clearance was issued by the Biaka University Institute of Buea and permission obtained from the District Medical Officer of Tiko Subdivision. For children less than 13 years old, assent was gotten from their parents or legal guardians and for those less than 18 years old, consent was sought from both the parent and the child. Informed written consent was obtained from each study participant. Each participant was free to withdraw consent at any time. All personal information of the participants was treated confidentially.

3. RESULTS

3.1 Characteristics of Study Population

A total of 264 children were screened for urogenital schistosomiasis, out of which 134 (50.8%) were males and 130(49.2%) were females. The children covered only 4 age groups which included 5-8 years, 9-12 years, 13-16 years and 17-20 years. The 5-8 years age group had 77 (29%), 9-12 years age group had 81(30.7%), while the 13-16 years age group had 69 (26.1%) and the 17-20 had 37(14%). Also, a total of 264 questionnaires were administered and all 264 of them responded. One third of the population was from the lower socio-economic group (CDC plantation farmers).

3.2 Prevalence of Infection

The overall prevalence of Schistosoma haematobium was 38% (101). The age-related prevalence and sex-related prevalence of urogenital schistosomiasis in the study are presented on Table 1 and Table 2 respectively. As far as age is concerned, the group with the highest prevalence was the group 17-20 (45.9%) followed by the 5-8 group (40.6%) then the 13-16 group (36.2%) and finally the group 9-12 (34.5%). It was observed with overwhelming interest that males recorded a much higher prevalence of 48.5% (65) than females with 27% (36).

3.3 Associated Risk Factors in this Likomba Community

The portable water sources in the area are tap water and borehole water but only 140(56%) respondents had one of these two. The rest 124 (44%) used the stream (Ndongo stream) for their domestic activities. The majority (63 out of 101) of those who were infected actually used the stream as a source of water for household chores. Again, the assessment glaringly revealed that those who used the stream as their area of bath had more infected cases than those who took their bath at home. In addition to the above, a comparison was done between those who visited the stream more than twice a day and those who did so less than twice a day; this was to ascertain the possible likelihood that the number of times to visit the stream in a day could also be endorsed as a contributing factor to infection with *S. haematobium.* Hence, it was remarkably observed that those who were infected visited the stream for an average of 2.08 times while those who were not infected visited the stream for an average of 1.7 times.

4. DISCUSSION

Emphatically speaking, it is worth noting that Schistosomiasis which is a serious public health problem has not been properly addressed by many nations in Sub-Saharan Africa. In Cameroon, control efforts have not been consistent to a satisfactory level. Moreover, the absence of national data on the endemicity and epidemiology of urinary schistosomiasis (as well as gastrointestinal schistosomiasis) poses a more serious problem for the assessment of progress in control programs. Effective control programs are supposed to create low transmission areas and if possible zero transmission for the eventual elimination of the disease. None of the control interventions made so far has created any low transmission area from a high transmission area. In this study, nobody who had lived in the area for just a year or lesser was recruited. This was to establish the fact that only permanent residents were infected and therefore there was an active transmission of the disease in the area.

As far as the age sub-groups were concerned, there was a significant difference ($p=0.01$) in the prevalence between the groups. The age group 17-20 registered the highest prevalence (45.95%) unlike the study of Ntonifor et al. [12] and Mewabu et al. [14] where the highest prevalences were in the 9-12 and 10-13 age groups respectively. This could be due to the fact that these older children are more involved in doing household chores such as laundry having longer contact time and bathing in the stream

than the younger ones. Sex-related prevalence was also seen to be significantly different (p=0.01) with the boys having a higher prevalence (48.5%) than the girls (27.69%). Unlike the study of Ntonifor et al. [12], but similar to others [15,14] the boys were more infected than the girls. This shows that they are probably more involved in swimming and bathing since the stream has separate points for bathing for girls and boys; which may have been a restricting factor especially for the girls. As far as risk factors for the disease are concerned, we examined just three namely; source of water for household chores, use of stream for bathing/swimming and frequency of visits to stream in a day. All of these factors were seen to significantly affect infection with the disease. This is not only worthy of note, but also necessitates proper attention for future control programs; so there can be investment in extending the available pipe-borne water (Camwater) to the whole community.

Table 1. Age-related prevalence of children in the Likomba community

Age group (years)	Number examined	Number infected	Prevalence (%)
5-8	77	31	40.25
9-12	81	28	34.57
13-16	69	25	36.23
17-20	37	17	45.95
Total	264	101	38.26

**Chi-square test p=0.01*

Table 2. Statistically significant differences in prevalence based on risk factors (χ^2 test)

Risk factors	Infected	Non-infected	Prevalence	p-value
Source of water				0.001
1. Ndongo stream	63	61	50.8	
2. Camwater	38	100	27.5	
Point of bath				0.00001
1. Ndongo stream	85	52	62	
2. House	16	111	12.6	
Average number of times to visit stream per day	2.08	1.71		0.00001

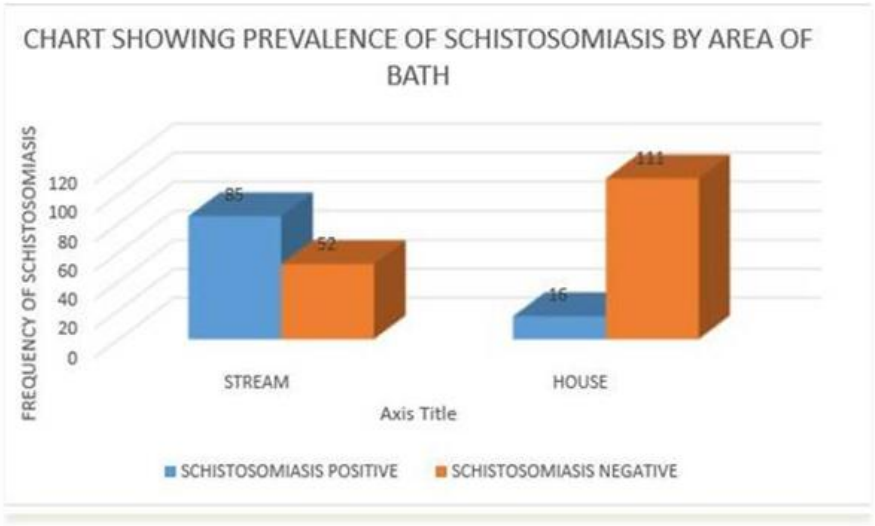

Fig 1: Differences in the number of schistosomiasis-positive and schistosomiasis-negative individuals depending on where they take a bath regularly.

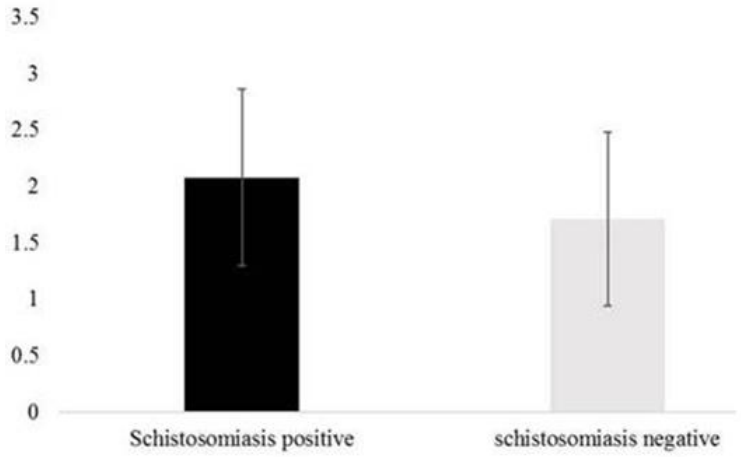

Fig 2: Differences in the average number of times individuals visit the stream daily based on their disease state; positive=2.08, negative=1.71

A total prevalence of 38% was registered which is quite high given that it was the sedimentation technique, which was available at the CDC Central Hospital, that was used. This technique is known to be less sensitive to the syringe filtration technique, which is used in most epidemiological surveys. In the new focus in the study by Ntonifor et al. [12], the prevalence was higher and it could be due to the lower socioeconomic status of that village (Munyenge) setting of the study compared to Tiko. Also, the disease may have been endemic in Tiko for a shorter period before this assessment of prevalence, as it was not long ago that reports of cases in the hospital were gotten. It is very probable that the emergence of urogenital schistosomiasis in the Tiko health district is as a result of migration of people from Kumba, Munyenge and Kotto Barombi, which are established foci for *S. haematobium* [16,17,18], to this area. This mass migration is due to an on-going crisis in the two English-speaking regions of Cameroon which began in October 2016. The movement of people from endemic areas to non-endemic areas where the snail intermediate host is present, may introduce the disease to areas where the disease was absent [19], like many other parasitic diseases, and this movement cannot be prevented.

Thus, future control efforts in Cameroon must focus on national education as well as education of the local populations, with the goal of breaking transmission. It is true that there may continue to be "silent" epidemiological places which are difficult to trace, avoiding the opportune diagnosis and treatment of infected persons [20]. However, if chemotherapy is used to convert known areas of high transmission to low transmission areas, other interventions like educating the public will eventually break transmission. Most importantly, the control against the snail intermediate host and access to treatment should also be considered by stakeholders. This can only be implemented if there is mapping of the snail habitats in Cameroon. A good knowledge of the snail habitats will direct control efforts to specific locations. This will prevent an outcrop of new endemic areas which will undermine past control efforts.

5. CONCLUSION

From the findings of this study, it is obvious that there is an active transmission of urogenital schistosomiasis in the Tiko health district. The factors significantly associated with schistosomiasis infection among these children were; bathing in the stream, visiting the stream more often and using unsafe sources for household chores and drinking water. The provision of clean and safe drinking water, community health education and the distribution of praziquantel in this health district will help curb the spread of the disease and reduce the disease burden. Finally, better methods for diagnosis should be provided to the health establishments to ensure proper diagnosis of infected people in this health district.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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