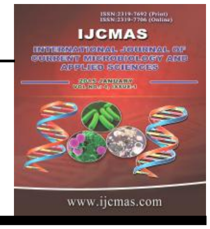

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Original Research Article

Epidemiology of Urinary Schistosomiasis and Soil Transmitted Helminthiasis in a Recently Established Focus behind Mount Cameroon

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A B S T R A C T

Schistosomiasis and soil transmitted helminths (STHs) are among the list of neglected tropical diseases considered for control by the WHO and they currently infect a third of the world's population. An important feature of these parasitic infections is their focal distribution, which has significant implications for control. The present study was aimed at determining the community based prevalence and the transmission dynamics of schistosomiasis and soil transmitted helminth infections in Munyenge Health Area. A cross-sectional community based parasitological survey was conducted at baseline in Munyenge in 2013 using standardized parasitological methods. Subjects' sociocultural and demographic details were recorded. The syringe filtration technique of Christensen *et al.,* (1984) was used to analyze 514 urine samples while the formol-ether concentration technique was used to analyze 314 stool samples. Samples with visible or gross haematuria were recorded prior to filtration. The overall prevalence of schistosomiasis was 40.27% (207). The most infected age group was the 11-20 years age group which had a prevalence of 51.38%(112), while the >50 years age group was the least infected with a prevalence of 8.33%. Soil transmitted helminth infections had an overall prevalence of 33.76% with males being more infected (35%) than females (30.86%). The most prevalent STH was *A. lumbricoides* with (23.81%), while hookworm infection was the least prevalent (3.5%). This study has shown that, age is a major contributing factor for the spread of schistosomiasis and soil transmitted helminth infections in the studied community. The study also provided baseline data on the distribution of urinary schistosomiasis and STHs that form the basis for initiating control and elimination programmes for these neglected tropical diseases in this recently established focus.

Keywords

Urinary Schistosomiasis, Soil Transmitted Helminths, Prevalence, Muyenge, Cameroon

Introduction

Schistosomiasis and soil transmitted helminthiasis are among the major public health problems in the world especially in sub Saharan Africa and are the most common types of parasitic infections in the world (Montresor, *et al.*, 2007). These diseases have major health and socio-economic repercussions, and constitute an important public health problem in developing countries (WHO, 2002). Although there are several factors that increase morbidity and mortality due to schistosomiasis and soil transmitted helminthiasis in the world, lack of personal and environmental sanitation, limited access to clean water, overcrowding and low socioeconomic conditions are the major ones (Tekeste, *et al.,*2013). The prevalence of human helminth infections has been reported in many rural communities of the developing world with emphasis on soil-transmitted helminthiasis (STH) and schistosomiasis (WHO, 2008; Utzinger, *et al.*, 2009). WHO (1998) estimated the common STH infections in the world as: 250 million cases for Ascariasis, 151 million cases of hookworm diseases, 100 million cases of Strongyloidiasis and 45.5 million cases of Trichuriasis and global estimates of infections had been put at over 2 billion, of which ascariasis accounts for about 1.6 billion while trichuriasis and hookworm amount to about 700-800 million.

Schistosomiasis which is considered the second most important water-based parasitic infection after malaria in terms of public health and economic impact affects 200 million people with over 600 million at risk of the disease (WHO, 2008). In Cameroon, schistosomiasis and STH infections are endemic with rural areas being more infected than urban areas (Ndamukong, *et al.*, 2000; Tchuente, *et al.*, 2003, Nkuo-Akenji, *et al.*, 2006, Nkengasong *et al.*, 2010, Mbuh, et al., 2012).

These infections contribute significantly to the vulnerability of our rural populations. Despite more than a decade of serious intervention, they persist in many rural areas. The study was conducted to determine the prevalence, and risk factors related to the transmission of schistosomiasis and soil-transmitted helminth infections in Munyenge.

Materials and Methods

Study Area

The study was carried out in the Munyenge health area about 27 km from Muyuka town in Muyuka. subdivision. Munyenge lies at the foot (behind) of Mount Cameroon with a population of about 15,000 inhabitants. This area is found in the rain forest of the South West Region; with very rich volcanic soils encouraging farming activities. The principal occupation of the people is farming with their main cash crops being cocoa and plantains. It is bounded to the West by Lykoko native, to the East by Masone, to the North by Mount Cameroon and to the North East by Mbonge sub division. It is 1000 meters above sea level. Munyenge health area harbours four small outlet springs situated in the middle of the village. The main source of water for residents of this area is springs. The springs are divided into the female and male sections where all members of the community use for their daily activities. Drinking water, bathing and washing of dresses and household utensils is carried out here. The area is prone to very high average temperatures of about 24-27^{o}C which favour high release of cercariae into the waters.

Study design

A cross sectional survey was carried out in which urine and stool samples were collected from the population and examined to estimate the prevalence of schistosomiasis and soil transmitted helminths in Muyenge. The population examined comprised of individuals between the ages of 2 - 71 years.

Stool sample collection and processing

Patients were given labelled stool containers with tight covers bearing serial numbers of the subjects and were asked to put about 4 g of stool in it. All the stool samples were processed using the formol-ether concentration technique (Christensen, *et al*., 1984). The slides were examined under the light microscope at X100 and X400 magnifications. A small portion of the stool samples were also preserved in 10% formalin for repeating the tests whenever required.

Urine Procedures

Each participant was given a sterile, wide mouthed, screw capped plastic bottle carrying their identification numbers and well instructed on how to collect the urine samples. A total of 514 urine samples were collected between 11 hours – 14 hours, and after exercise to ensure maximum excretion of eggs. The Urine samples were then transported to the University of Buea Life Science laboratory where they were examined using the syringe filtration technique (Christensen, *et al*., 1984). Haematuria was determined by visual observation of urine samples and reagent strips.

Socio demography and risk factor assessment

A well structured questionnaire based on the known risk factors for schistosomiasis and STHs was administered to 425 subjects. The questionnaires addressed socio-demographic information, hand washing, shoe wearing, urination in streams, presence of toilet and its usage, water source for domestic use and other risk factors around.

Data analysis

Data collected from the field was entered and analysed using the Statistical Package for Social Scientists (SPSS) version 16. Differences in prevalence of infection among different groups were tested for statistical significance using the Chi-square test. The student's t-test was used to determine the difference in mean age between males and females. The significance level was set at a p-value of 0.05.

Ethical considerations

This study was carried out with the approval of the Ethical Review Committee on Health Research, regional delegation of health for the South West Region Buea, Cameroon. 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 strictly confidential.

Result and Discussion

Socio-demographic characteristics of study subjects

A total of 514 individuals participated in the parasitological survey (275 females and 239 males). Individuals were categorized into various age groups as shown on Figure 1. The most strongly represented age group was the 11-20 years age group while the least represented was the >50 years age group. The study population ranged from 2-72 years with a mean age of 17.12 years. All subjects submitted urine samples while 314 (61.09%) of same population submitted stool samples.

Prevalence of urinary schistosomiasis and soil transmitted helminths

Results obtained showed that out of the 514 participants examined for urinary schistosomiasis, 207 individuals were infected giving an overall prevalence of 40.27% (Table 1).

Table 1 Sex related prevalence of Schistosomiasis

Sex	No. examined	No. infected	Prevalence (%)
Males	239	82	34.31
Females	275	125	45.46
Total	514	207	40.27

Table 2: Age related prevalence of urinary schistosomiasis

Age group (years)	No. examined	No infected	Prevalence (%)
0-5	36	11	30.56
6-10	137	52	37.96
11-20	218	112	51.38
21-30	44	18	40.91
31-40	34	10	29.41
41-50	33	3	9.09
>50	12	1	8.33
Total	514	207	**40.27**

Table 3: Sex related prevalence of soil-transmitted helminth infections

Sex	No. examined	No infected (Prevalence)			
		A. lumbricoides	*T trichiura*	Hookworm	Total
Males	140	40 (26.43)	6 (4.29)	6 (4.29)	52 (37.14)
Females	174	38(21.71)	11 (6.29)	5 (2.86)	54 (31.03)
Total	314	78 (24.84)	17 (5.4)	11 (3.5)	106 (33.76)

$\chi^2 = 4.53$; df = 2; $p > 0.05$ (Not significant)

Table 4: Age related prevalence of soil-transmitted helminth infections

Age group (years)	No. examined	No infected (Prevalence)			
		A. lumbricoides	*T. trichiura*	Hookworm	Total
0-5	26	9 (34.62)	2 (7.69)	0	42.31
6-10	108	24 (22.22)	6 (5.56)	2 (1.85)	29.63
11-20	110	32 (29.09)	6 (5.46)	6 (5.46)	40
21-30	20	2 (10)	1 (5)	0	15
31-40	19	4 (21.05)	0	1 (5.26)	26.32
41-50	23	4 (17.39)	1 (4.35)	2 (8.7)	30.44
>50	8	3 (37.5)	1 (12.5)	0	50
Total	314	78 (24.84)	17 (5.4)	11 (3.5)	**33.76**

$\chi^2 = 7.84$; df = 12; $p > 0.05$ (Not significant)

Table.5 Sex related Prevalence of haematuria

Sex	No. Examined	No. with Haematuria	Prevalence of Haematuria
males	239	41	17.15
Females	275	56	20.36
Total	514	97	18.87

ρ = 0.379; p = 0.001; positively correlated

Table.6 Relationship between occupation and schistosomiasis

Occupation	No. examined	No. Infected	% Infected	p-value
Farming	298	137	49.1	0.001
Teaching	15	2	13.3	0.37
Pupil	147	62	42.2	0.05
Medical staff	5	0	0	0.64
Trading	49	6	12.2	0.5
Total	514	207		

Table.7 Analysis of Some Risk Factors Associated to Schistosomiasis and soil transmitted Helminths

Variable		No of Respondents	Prevalence (%)	P Value
Type of toilet	Pit	56	18.79	0.533
	Open field	242	81.2	0.053
Wear Shoe always	Yes	27	9.06	0.0002
	No	271	90.93	0.05
Urination in or near water	Yes	257	86,24	0.662
	No	34	11,40	0.822
Water source	Spring	265	88.93	0.005
	Stream	66	22.37	0.001

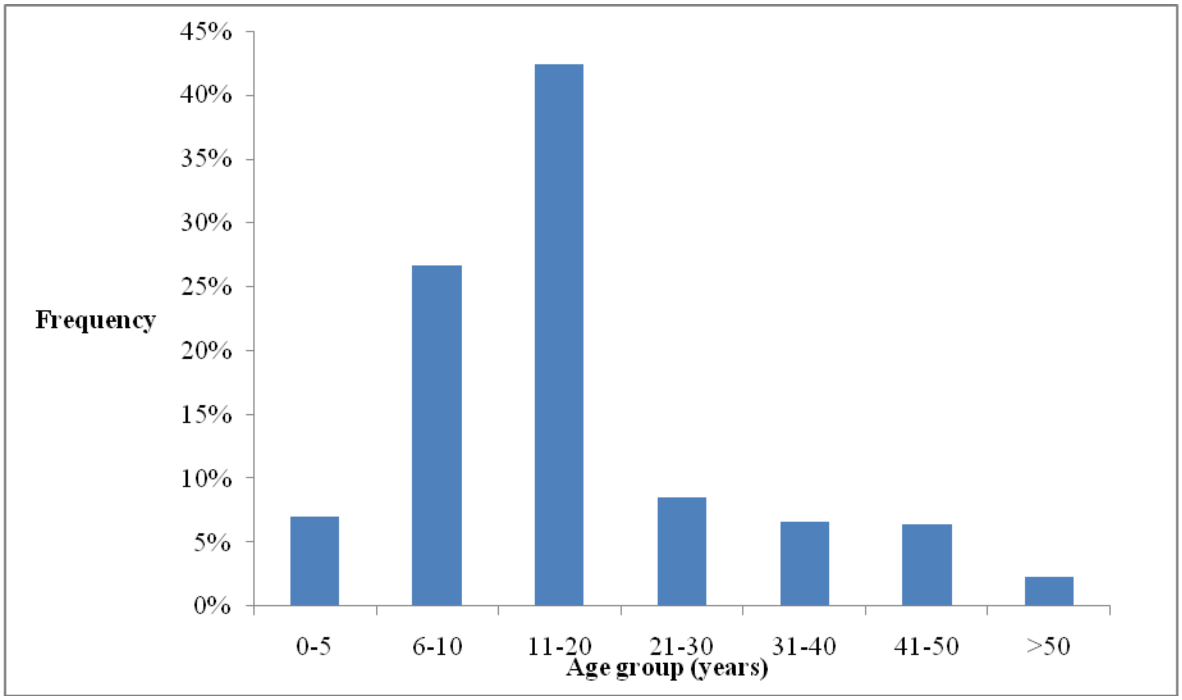

Figure.1 Frequency of the different age groups in the study population

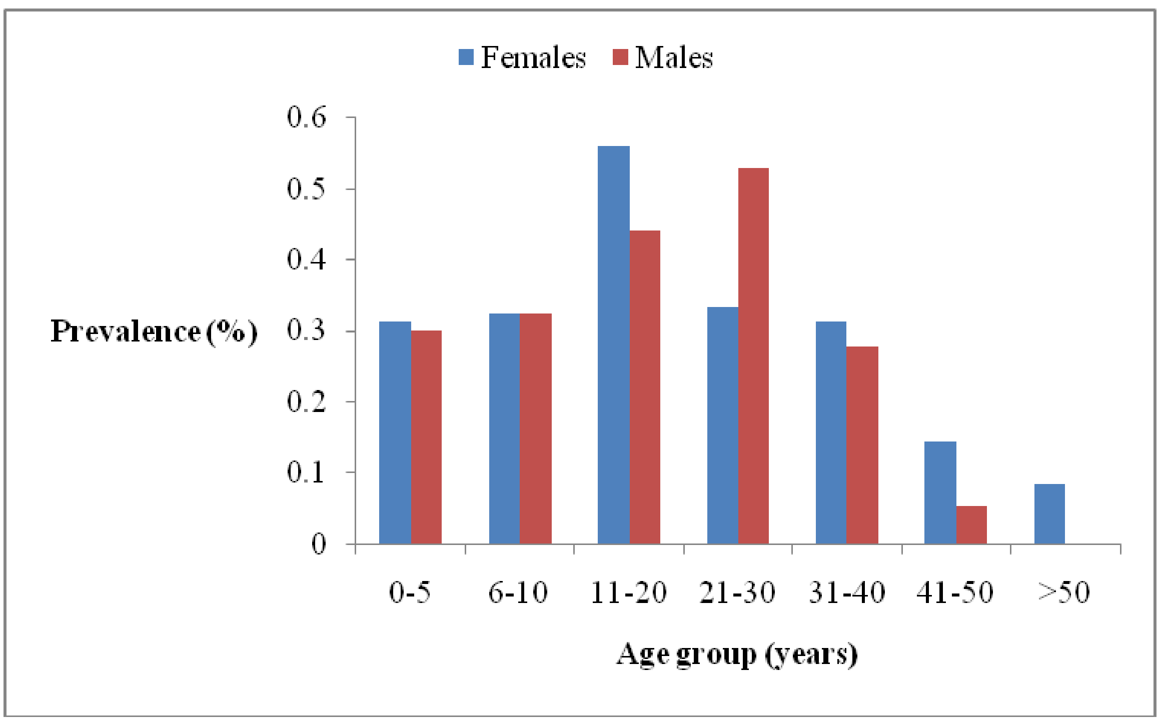

Figure.2 Age and sex related Prevalence of Schistosomiasis

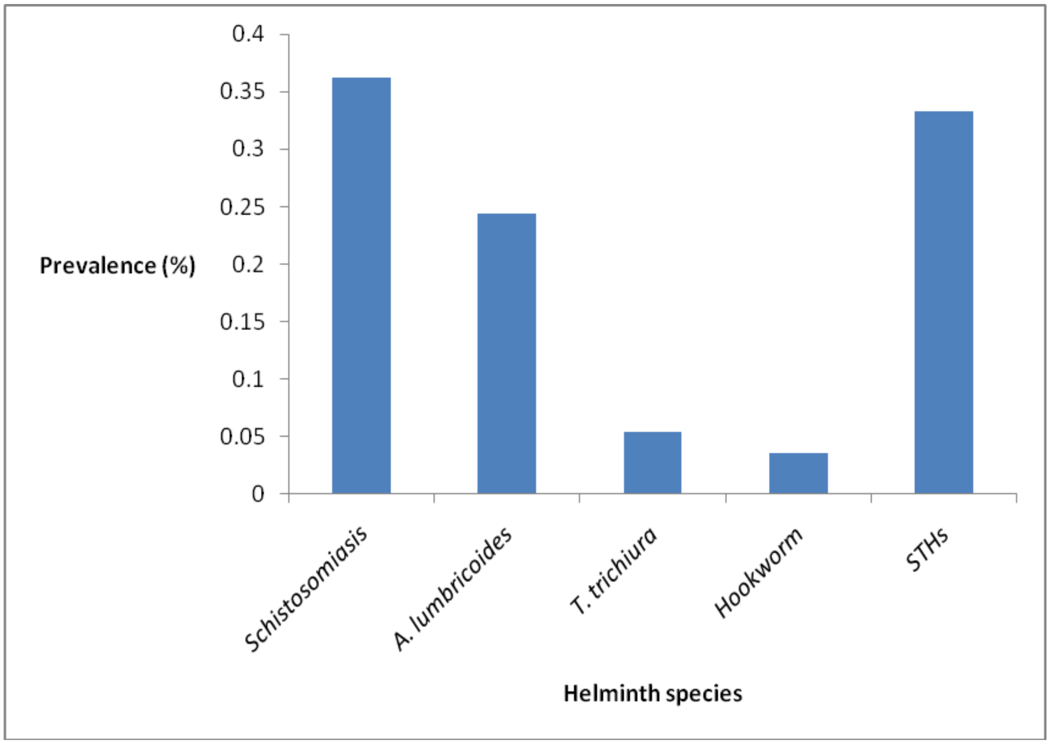

Figure.3 Comparitive study of the prevalence of schistosomiasis and soil-transmitted helminth infections

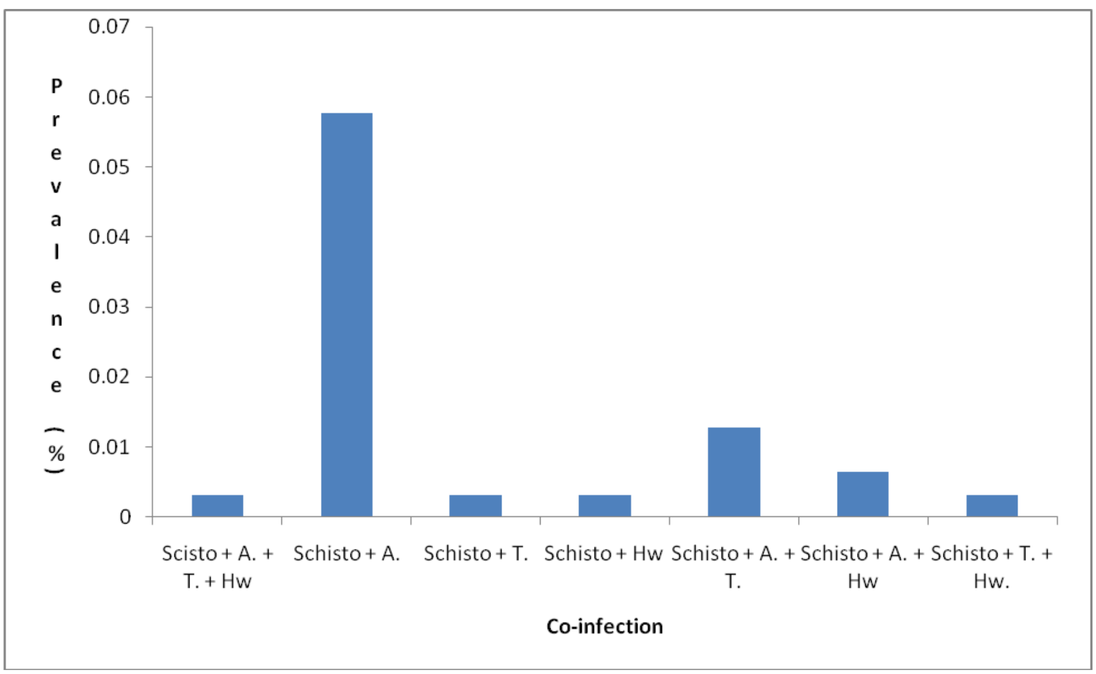

Figure.4 Co-infection with schistosomiasis and soil transmitted helminth infections

The most infected age group was the 11-20 years age group which had a prevalence of 51.38%(112), while the >50 years age group was the least infected with a prevalence of 8.33% (figure 2).

Females were more infected than males except in the 21-30 years age group which showed a striking departure from the trend with males being more infected than females.

Soil transmitted helminth infections had an overall prevalence of 33.76% (Table 3) with males being more infected than females. Prevalence of STH infections in males was 37.14% compared to 31.03% in females. However, the rate of infection was not significantly affected by sex ($\chi^2 = 4.53$; $p > 0.05$) (Table 4). The most prevalent STH was *A. lumbricoides* (24.84%). In contrast, hookworm infections were least common with a prevalence of 3.5%. Table 4 shows that the >50 years age group had the highest prevalence of infection with *A. lumbricoides* followed closely by the 0-5 years age group. Prevalence of infection across age groups was not significantly affected by age at $P \leq 0.05$).

Figure 3 shows the prevalence of schistosomiasis compared to that of STH infections. Schistosomiasis was more prevalent than any STH infection or all STH infections combined. The order of prevalence was schistosomiasis > ascariasis > trichuriasis > hookworm disease. The general prevalence of co-infection is illustrated in Figure 4. Prevalence of co-infection between schistosomiasis and STH infections was 8.97%. Co-infection with schistosomiasis and ascariasis was most common with a prevalence of 5.77% while co-infection with hookworm was least common. Prevalence of haematuria was 18.87% and was more common in females than in males (Table 5). Table 6 shows the relationship between schistosomiasis and occupation. Farming was the most affected occupation, followed closely by the pupils.

Out of the 425 questionnaires that were administered, only 298 (70.11) of the respondents answered and returned them. Illiterate parents were interviewed orally in pidgin by the researchers. Out of those who responded, the majority of them used open fields as toilets (81.2%). Equally most of the respondents always moved bear footed while farming (90.93) while 88.93 of them used spring water for their various water contact activities Table 7.

Schistosomiasis and Soil transmitted helminth infections are among the most prevalent afflictions of humans who live in areas of poverty in the developing world. Due to the geographic overlap of these afflictions and their impact on children and adolescents, World Health Organization (WHO); the World Bank; and other United Nations agencies and bilateral, and civil society are working to integrate STH and Schistosomiasis control through a program of periodic school-based targeted Antihelminthic drug treatments (Crompton, 1999, Alemu, *et al.*, 2011). The overall prevalence of urinary schistosomiasis (40.27%) recorded in the study population is much lower than the school based prevalence reported by Ntonifor *et al.* (Ntonifor, *et al*, 2012) in the same area (78%). The reason for this difference could be due to the awareness through sensitization in the last survey and health education, which must have resulted to some preventive actions and also due to chemotherapy of some of the infected school children since it was a new focus. After the health education, the village head also instituted a periodic cleaning up of the springs which used to be the principal habitats of the snail vectors. Equally, school children are generally the most infected age groups and this further explains the high prevalence observed by Ntonifor *et al.*, (Utzinger *et al*., 2009). In this study prevalence of schistosomiasis and STHs appear to be intimately associated with age. Children were found to be at the greatest risk of infection with *S. haematobium* with the 11 – 20 years age group being at the highest risk of infection with a prevalence of 51.38%. This is in consonant with trends established in schistosomiasis surveys carried out in Cameroon (Tchuente et al., 2003, Ntonifor *et al., 2012*)) as well as other parts of Africa (Aryeetel *et al*., 2000). Being very playful and ignorant, the children bathe and play in the streams more frequently. Young adults and the elderly were less likely to be infected than children of school age with the risk of infection decreasing with increase in age. The >50 years age group was least infected with a prevalence of 8.33%.

Equally in this study, females were more infected than males. This may be related to socio-cultural factors. Women have more contact with surface water through bathing, fetching water, washing cloths and household utensils than males. Similar observations were recorded in Nigeria (Udonsi, 1990, Ntonifor and Ajayi , 2005). A striking departure from this trend was observed in the 21-30 years age group whereby the males were more infected than the females. This might reflect changing socio-cultural values. The society is departing from traditional domestic roles assigned to women with concomitant reduction of risks. In contrast, males in this age group were more involved in agricultural activities especially cocoa farming and other activities that brought them in closer contact with infected streams.
The overall prevalence of soil transmitted helminth infections was 33.76%. This infection rate was quite low. This was most likely due to the deworming program for control of STHs that was currently going on in the study area. The study observed that adults in the community (>50 years age group) were more important epidemiologically than school-aged children in the transmission of STHs.

This might be due to the fact that this is the most active age group, daily involved in agriculture and outdoor activities that put them at greater risk of infection with STHs. Unfortunately, this group is largely ignored by the deworming exercise which is targeted at school age children. Thus infection with STHs would tend to amplify in this age group. Such heavily infected age groups would equally impact environmental contamination with ova considerably. Cases of double and triple infections were also noted as previously recorded by other researchers(Montresor *et al*., 1998, Mbuh *et al*., 2012.).

The analyses showed that, A. *lumbricoides* and *T. trichiura*, co-occurred more as observed in previous works in other endemic regions (Howard, *et al*., 2002, Mbuh *et al*., 2012). The positive association between *A. lumbricoides* and *T. trichiura* can most likely be explained by their common transmission pattern, and could be favoured by behavioural factors. In the present study, it was observed that important determinants of STHs were poverty, absence of pipe borne water and toilet facilities, and absence of adequate sanitation with most of the farmers moving bare footed. A significant association in parasite prevalence was observed between water source, shoe wearing, and open field defecation with increased risk observed in farmers and pupil. Muyenge is a very stony region with most inhabitants finding it very difficult to sink pit toilets and even the few pit toilets are very shallow. Indeed, *A. lumbricoides* and *T. trichuria* are both transmitted by the faecal–oral route. The eggs of both species are resistant to environmental hazards and can persist for some time in the environment, in dust, soil and on vegetables. Social and behavioural factors that lead to infection with one species will increase the probability of infection with the other species (Booth and Bundy, 1992).

Although co-infection between urinary schistosomiasis and soil transmitted helminth infections was observed, it was not very common. The study indicated that schistosomes and STHs were independently distributed among the participants in the community. This was probably due to the fact that the transmission dynamics of urinary schistosomiasis and STH infections are different. Thus, although co-infection of schistosomiasis with STH infections was observed, such co-infection cannot markedly affect morbidity. Infection with schistosomiasis, and soil-transmitted helminths (STHs) has been a matter of great public health concern throughout Africa, and the world for decades.

In conclusion, the present study has given an insight on the baseline prevalence and possible effects of helminthiasis in Muyenge. Though, the prevalence of Schistosomiasis and STHs was low, it could as a matter of time increase again considerably if an effective anti-helminthiasis strategy is not instituted.

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