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Short Communication

Current status of schistosomiasis and soil-transmitted helminthiasis in Beyla and Macenta Prefectures, Forest Guinea

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ABSTRACT

A cross-sectional survey was undertaken in children aged 9–14 years in Beyla and Macenta Prefectures, Forest Guinea. Stool samples were examined by Kato–Katz and urine samples were examined by the centrifugation method. The overall prevalence and intensity of infection was 66.2% and 462.4 eggs per gram of faeces (epg) for *Schistosoma mansoni*, 21.0% and 17.8 eggs per 10 ml of urine for *S. haematobium*, 51.2% and 507.5 epg for hookworm, 8.1% and 89.1 epg for *Ascaris lumbricoides* and 2.4% and 16.7 epg for *Trichuris trichiura*. The overall prevalence of schistosomiasis (*S. mansoni* and/or *S. haematobium*) was 70.7%. The prevalence of schistosomiasis was similar to those reported in the 1990s in the region; however, the prevalence of soil-transmitted helminths has since fallen. These findings illustrate the need for schistosomiasis control in Guinea.

1. Introduction

Schistosomiasis and soil-transmitted helminthiasis (STH), two of the most important neglected tropical diseases (NTD), are of public health significance in sub-Saharan Africa.[1] Guinea has long been known to be prevalent with these diseases.[2,3] Surveys in the 1990s showed that in NZérékoré region, Forest Guinea, the prevalence of *Schistosoma mansoni* ranged from 1.5% to 86.1%, that of *S. haematobium* from 14.0% to 75%, hookworm 20–80%, *Ascaris lumbricoides* 21.6–55.0% and *Trichuris trichiura* 3.2–19% according to the published data[4,5] as well as data from the Ministry of Health (M. Bah, personal communication). A school health programme including deworming supported by the World Bank started in 1995 following the surveys[6] but by 2008 <10% of school-age children had been treated, whilst national coverage of deworming in preschool-age children had been achieved, with regular coverage of >90% since.[7] A national control programme for schistosomiasis does not currently exist.

This paper presents the results of a recent survey on schistosomiasis and STH conducted in 2010 in Beyla and Macenta Prefectures, NZérékoré region, Forest Guinea, as part of the health impact assessment in potentially affected communities for a proposed coal mining development.

2. Materials and methods

A cross-sectional survey was conducted in 14 villages. In each village, 30 school children aged 9–14 years were randomly selected from the primary schools or from the

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communities if no school existed in the village, balancing for gender ratio where possible. In total, 420 school children were selected, comprising 262 boys and 158 girls with no mean age difference.

Informed consent was obtained from community leaders and head teachers. The study included only those children who agreed to participate. A single fresh stool sample and a mid-day, post-exercise urine sample were collected from each child who was then given a single dose of albendazole (400 mg). Samples were brought back and examined on the same day in the laboratory. Stool samples preserved in 10% formalin were examined using the Kato–Katz thick smear method. One slide per stool sample was prepared and was examined for *S. mansoni* and STH eggs. Parasitic infection was recorded and the intensity of infection was calculated and expressed as number of eggs per gram of faeces (epg). For urine samples, the volume of urine samples was measured and urine containers were centrifuged for 5 min. The sediment of urine was transferred onto a slide and was covered with a coverslip. These were examined under a light microscope and the number of *S. haematobium* eggs was recorded and intensity of infection was expressed as number of eggs per 10 ml of urine (e/10 ml).

Data were analysed using SPSS software v.18 (SPSS Inc., Chicago, IL, USA). A frequency table with 95% CIs was prepared. Arithmetic mean intensity of infection was used in the analysis.[8,9] Degree of intensity of infection for individual parasites was categorised according to WHO recommendations.[10] Differences were analysed using one-way ANOVA for mean age, Kruskal–Wallis test for intensity of infection and Pearson χ^2 test for prevalence.

3. Results

As summarised in Table 1, the most common parasites were *S. mansoni* and hookworm. The overall prevalence of individual infections was 66.2% (range 13.3–90.0% in 14 sites) for *S. mansoni*, 21.0% (range 0–76.7%) for *S. haematobium*, 51.2% (range 6.7–93.3%) for hookworm, 8.1% (range 0–33.3%) for *A. lumbricoides* and 2.4% (range 0–6.7%) for *T. trichiura*. There were no significant differences in any individual parasitic infection between boys and girls ($P > 0.05$).

Schistosoma mansoni posed the heaviest infection in the area. The mean intensity of infection was 462.4 epg, with 33.3% of children heavily infected and 24.0% moderately infected. The second heaviest infection was *S. haematobium* (17.8 e/10 ml), with 8.8% of children heavily infected. The mean intensity of hookworm infection was 507.5 epg, however the proportion of heavy infections was relatively low (1.7%). Infections with *A. lumbricoides* or *T. trichiura* were both light, with no heavily infected individuals.

Overall, 86.7% (95% CI 83.1–89.6%) of the children surveyed had at least one parasitic infection: 39.0% (95% CI 34.4–43.7%) were infected with one species, 34.0% (95% CI 29.5–38.6%) with two species, 12.6% (95% CI 9.4–15.8%) with three species and 1.0% (95% CI 0–1.9%) with four species. The overall prevalence of schistosomiasis (*S. mansoni* and/or *S. haematobium*) was 70.7% (95% CI 66.2–74.9%), and 16.4% (95% CI 13.2–20.3%) of children were infected with both *S. mansoni* and *S. haematobium*.

Table 1
Observed prevalence and intensity of infections (95% CI) in children aged 9–14 years in Beyla and Macenta Prefectures, Forest Guinea

	No. of subjects	*Schistosoma mansoni*	*Schistosoma haematobium*	Hookworm	*Ascaris lumbricoides*	*Trichuris trichiura*
Prevalence (%)						
Overall prevalence	420	66.2 (61.5–70.6)	21.0 (17.3–25.1)	51.2 (46.4–55.9)	8.1 (5.9–11.1)	2.4 (1.3–4.3)
Sex						
Boys	262	65.6 (59.7–71.1)	23.7 (18.9–29.2)	53.8 (47.8–60.0)	7.3 (4.7–11.1)	3.1 (1.6–5.9)
Girls	158	67.1 (59.4–73.9)	16.5 (11.5–23.0)	46.8 (39.2–54.6)	9.5 (5.8–15.1)	1.3 (0.4–4.5)
Intensity of infection (epg or e/10 ml[a])						
Overall mean epg	420	462.4 (389.9–534.8)	17.8 (11.6–24.0)	507.5 (398.9–616.0)	89.1 (12.9–165.3)	16.7 (0–38.0)
0 epg (%)	–	33.8 (29.5–38.5)	79.0 (74.9–82.7)	48.8 (44.1–53.6)	91.9 (88.9–94.2)	97.6 (95.7–98.7)
Low epg (%)[b]	–	8.8 (6.5–11.9)	12.1 (9.4–15.6)	45.7 (41.0–50.5)	7.6 (5.5–10.6)	2.1 (1.1–4.0)
Moderate epg (%)[b]	–	24.0 (20.2–28.4)	–	3.8 (2.4–6.1)	0.5 (0.1–1.7)	0.2 (0.0–1.3)
Heavy epg (%)[b]	–	33.3 (29.0–38.0)	8.8 (6.5–11.9)	1.7 (0.8–3.4)	0(0.0–0.9)	0 (0.0–0.9)
Sex						
Boys	262	481.0 (386.9–575.1)	21.7 (12.4–30.9)	616.0 (451.9–780.1)	105.6 (0–225.2)	24.2 (0–58.2)
Girls	158	431.4 (317.3–545.5)	11.4 (5.4–17.4)	327.5 (235.6–419.4)	61.7 (18.6–104.8)	4.4 (0–10.7)

[a] Eggs per gram of faeces (epg) for all parasites, except *S. haematobium* that was measured in eggs per 10 ml of urine (e/10 ml).
[b] Intensity of infection for each parasite infection was categorised according to WHO recommendations.[10]

4. Discussion

The overall prevalence of schistosomiasis in this study was high, similar to the results from surveys in the 1990s.[4,5] This may not be surprising as no large-scale praziquantel distribution has been conducted in this region. The actual distribution of *S. mansoni* and *S. haematobium* varied geographically, illustrating their focal nature. Mixed infections of both *S. mansoni* and *S. haematobium* (16.4%) were in line with previous reports in other countries.[11,12] The high level of infection reflects the local transmission dynamics for schistosomiasis, as water contact is frequent as the local streams are the main water sources for domestic use, where children also bath and play.

In comparison, the overall level of STH infections has fallen since the 1990s in Forest Guinea. This decline may be attributed to the annual community-directed treatment with ivermectin in these communities for onchocerciasis control in individuals over the age of 5 years that was introduced in 1997 and also to the biannual deworming of children under the age of 5 years with mebendazole together with vitamin A supplementation that started in 2006. Compared with the low level of *A. lumbricoides* or *T. trichiura* infections, hookworm prevalence remained relatively high, but the intensity of infection was low with only 1.7% of children with heavy infections. This may be due to the drugs being used, as ivermectin and mebendazole have less effect over hookworms.[13,14] A similar situation was also found recently in the neighbouring country Sierra Leone.[15]

The present survey is a timely addition to our understanding of the current situation of schistosomiasis and STH in Forest Guinea and illustrates the need to continue and expand the national NTD control programme to include schistosomiasis control. Plans are underway for an integrated NTD control programme to commence in 2011 in Guinea.

Authors' contributions: MH conceived the survey and designed the study protocol; MJD and MSW supported the study design and managed the field work; HT, MSB and MMK performed collection and interpretation of the data; IF performed collection, entry and interpretation of the data; YZ performed the final analysis and interpretation of the data; YZ and MH drafted and revised the manuscript. All authors critically reviewed and approved the final manuscript. MH is guarantor of the paper.

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Conflicts of interest: None declared.

Ethical approval: Ethical approval for this study was obtained from the National Ethics Committee of Health Research, Ministry of Public Health, Guinea.

References

1. Steinmann P, Keiser J, Bos R, Tanner M, Utzinger J. Schistosomiasis and water resources development: systematic review, meta-analysis, and estimates of people at risk. *Lancet Infect Dis* 2006;**6**:411–25.
2. Koma M, Beer SA. Intestinal schistosomiasis in the Guinea People's Revolutionary Republic (West Africa) [in Russian]. *Med Parazitol (Mosk)* 1982;**60**:43–8.
3. Bosman A, De Giorgi F, Kandia Diallo I, Pizzi L, Bartoloni P, Cancrini G. Prevalence and intensity of infection with intestinal parasites in areas of the Futa Djalon, Republic of Guinea. *Parassitologia* 1991;**33**:203–8.
4. Gyorkos TW, Camara B, Kokoskin E, Carabin H, Prouty R. Survey of parasitic prevalence in school-aged children in Guinea (1995) [in French]. *Sante* 1996;**6**:377–81.
5. Montresor A, Urbani C, Camara B, Bha AB, Albonico M, Savioli L. Preliminary survey of a school health program implementation in Guinea [in French]. *Med Trop (Mars)* 1997;**57**:294–8.
6. World Bank. The World Bank school health programs in Sub-Saharan Africa. Dakar, Senegal: World Bank; 2000.
7. WHO. Neglected tropical diseases. PCT databank. Geneva: World Health Organization; ©2011. http://www.who.int/neglected_diseases/preventive_chemotherapy/databank/en/index.html [accessed 30 June 2010].
8. Fulford AJ. Dispersion and bias: can we trust geometric means? *Parasitol Today* 1994;**10**:446–8.
9. Toure S, Zhang Y, Bosque-Oliva E, Ky C, Ouedraogo A, Koukounari A, et al. Two-year impact of single praziquantel treatment on infection in the national control programme on schistosomiasis in Burkina Faso. *Bull World Health Organ* 2008;**86**:780–7. A.
10. WHO. *Prevention and control of schistosomiasis and soil-transmitted helminthiasis*. Geneva: World Health Organization; 2002. Technical Report Series No. 912.
11. Garba A, Barkire N, Djibo A, Lamine MS, Sofo B, Gouvras AN, et al. Schistosomiasis in infants and preschool-aged children: infection in a single *Schistosoma haematobium* and a mixed *S. haematobium–S. mansoni* foci of Niger. *Acta Trop* 2010;**115**:212–9.
12. Dennis E, Vorkpor P, Holzer B, Hanson A, Saladin B, Saladin K, et al. Studies on the epidemiology of schistosomiasis in Liberia: the prevalence and intensity of schistosomal infections in Bong County and the bionomics of the snail intermediate hosts. *Acta Trop* 1983;**40**:205–29.
13. Gutman J, Emukah E, Okpala N, Okoro C, Obasi A, Miri ES, et al. Effects of annual mass treatment with ivermectin for onchocerciasis on the prevalence of intestinal helminths. *Am J Trop Med Hyg* 2010;**83**:534–41.
14. Keiser J, Utzinger J. Efficacy of current drugs against soil-transmitted helminth infections: systematic review and meta-analysis. *JAMA* 2008;**299**:1937–48.
15. Koroma JB, Peterson J, Gbakima AA, Nylander FE, Sahr F, Soares Magalhães RJ, et al. Geographical distribution of intestinal schistosomiasis and soil-transmitted helminthiasis and preventive chemotherapy strategies in Sierra Leone. *PLoS Negl Trop Dis* 2010;**4**:e891.