Brief Report

High Prevalence of Soil-transmitted Helminths in Western Kenya: Failure to Implement Deworming Guidelines in Rural Nyanza Province

by Johanna N. Riesel,[a,b] Frederick O. Ochieng',[a,b] Peter Wright,[a,c] Sten H. Vermund,[a,c] *and* Mario Davidson[d]
[a]*Institute for Global Health, Vanderbilt University School of Medicine, Nashville, TN 37212, USA*
[b]*Lwala Clinic, Rongo 40404, Nyanza Province, Kenya*
[c]*Department of Pediatrics, Vanderbilt University School of Medicine, Nashville, TN 37212, USA*
[d]*Department of Biostatistics, Vanderbilt University School of Medicine, Nashville, TN 37212, USA*

Summary

Soil-transmitted helminth (STH) infections affect an estimated 2 billion people world wide. Children experience the greatest morbidity, limiting their potential in academic and physical endeavors. Our study assessed the prevalence of STH infections in primary school-aged children in a rural village in the Nyanza Province of Kenya. Over two-thirds (68%) of the sampled population tested positive using a direct smear microscopic analysis of single stool samples. Only heavy worm infections would be detected with this technique; thus 68% is a minimum estimate of prevalence. Prior to our study, there were no deworming programs in this village, despite WHO and Kenyan government guidelines supporting regular deworming programs. Our study demonstrates the significant burden of STH infections in a rural Kenyan village and highlights the need for deworming programs in similar venues. We also demonstrate that with basic infrastructure and community involvement, regular deworming can be implemented effectively in remote, rural communities.

Introduction

Soil-Transmitted Helminth (STH) infections affect 2 billion people world wide, making them among the most common infections in the world [1]. Children with a high-worm burden may be stunted in physical and mental maturation, thereby lacking the energy requirements needed for successful involvement in the classroom and community [2, 3]. It is estimated that the disability-adjusted life years lost from all STH infections combined is 39 million life years [4].

STH infections can be easily treated. With one dose of 500 mg mebendazole ($0.02 per child), current STH infections are cleared with virtually no drug side effects [5, 6]. Decreased worm burden can be maintained with the use of shoes, improved sanitation and food hygiene and regular deworming with mebendazole. Deworming can be done periodically, without individual patient diagnosis, given the low cost and benign nature of mebendazole [7, 8].

The Kenyan Ministry of Health's Department of Child Health seeks to promote good health and nutrition, and it recognizes the detrimental effects of STH infections in primary-school-aged children [9]. World wide organizations, such as the WHO, recommend regular dewormings in children to decrease the burden of disease. WHO has set the following target: by 2010, at least 75% of school children in endemic countries will receive regular drug treatment for schistosomiasis and STHs. More recently, WHO reports that deworming helps

Acknowledgement

We thank Drs Christopher Greeley, Sharon Phillips and William Young, the staff of the Walter Reed Project of the U.S. Army Medical Research Unit-Kenya, Andrea Bienski, the Ochieng' family and the participating children and their families.

Funding

Vanderbilt School of Medicine Emphasis Program; Vanderbilt School of Medicine Overall Fund.

Correspondence: Johanna Riesel, Institute for Global Health, Vanderbilt University, 1700 21st Ave S. Nashville, TN 37212, USA.
E-mail: <Johanna.n.riesel@vanderbilt.edu>

doi:10.1093/tropej/fmp043 Advance Access Published on 5 June 2009

TABLE 1
Distribution of STHs by age

	2–5 years ($n=11$) (%)	6–9 years ($n=58$) (%)	10–13 years ($n=113$) (%)	14–18 years ($n=40$) (%)	Combined ($n=222$) (%)
A. lumbricoides	36	64	45	44	49
Hookworm	9	28	27	46	30
T. trichuria	0	7	9	5	7
Larva	18	17	9	8	11
S. Mansoni	0	2	1	0	1
No o/c/p	36	24	36	28	32
Multiple STH					
1	100	64	77	74	74
2	0	29	19	21	21
3	0	7	4	5	5

meet the Milennium Development goals 1–8 [10]. We conducted a stool surveillance study in the rural village of Lwala, in the Nyanza Province of Kenya, to assess the prevalence of STH infections in a remote community.

Methods

Two primary schools near Lwala's recently established community clinic were selected for participation. At School A ($n=150$), 100 students who attended school on Day 1 of the study were asked to participate. At School B ($n=450$), 20 students from each grade 2–8 were chosen by selecting every other student from a school-provided roster. All participants were given stool collection kits (rubber gloves, applicator stick, stool sample container and parental consent form written in the local language, Dholuo) with specific instructions regarding sanitary techniques of collecting and returning the samples. It was emphasized that participants collect a single sample from their first bowel movement of the morning. Of 260 children selected to give stool samples, 250 stool samples (96.2%) were returned. We excluded 28 because too little stool was returned or the stool container was crushed and potentially contaminated. Thus 222 stool samples (85.4%) were analyzed.

One of the authors (J.N.R.) was trained thoroughly in stool processing and egg identification by parasitologists in Kisumu, Kenya. She examined each stool sample twice for STH ova within 7 h of defecation using a direct smear technique. With a field microscope, 2 mg of feces were emulsified in saline and examined on a glass slide [11, 12]. Every child at both schools was dewormed with 500 mg Mebendazole. Identified cases of *Schistosomiasis mansoni* were treated with 40 mg kg^{-1} Praziquantal [5].

Results

Our sample ($n=222$) was 51% male. Two-thirds (68%) were infected with at least one STH. Infection rates were: *Ascaris lumbricoides* (50% of detected infections), hookworm (30%), an uncharacterized larval worm (11%) and *Trichuris trichuria* (7%). Four cases of *Shistosomiasis mansoni* were detected (2%), and 26% of children had more than one infection (Table 1). Hookworm infections were significantly more common in males than they were in females ($p=0.041$), and were especially common in young teens (ages 13- to 14-years old) (Table 1). Every child tested in the 2- to 5-year old age group ($n=11$) had at least one STH. Of the children tested in the 6- to 9-year old age group, 64% had *A. lumbricoides* and 36% had more than one parasite (Table 1). Regular dewormings at local schools have occurred three times per year by Lwala Clinic staff since the completion of this study.

Discussion

Despite national and international guidelines for routine deworming of school children in rural Africa, 68% of our sampled population was infected with one or more helminthes. The low sensitivity of the direct smear technique and the single stool sample submitted from each participant suggest both a high-worm burden and a higher true prevalence rate. The prevalence of parasites such as hookworm, *T. trichuria* and *S. mansoni* is also likely underestimated as these eggs are commonly missed in the direct smear technique due to their size, color and fewer number of eggs laid per day as compared with *A. lumbricoides* eggs [11]. The uncharacterized larvae were either *Strongyloides stercoralis* or hatched hookworm larvae. Subsequently, the results of this study and its implications for the future health of Kenya's children are alarming.

In qualitative interviews, it was apparent that the local community in Lwala was aware of this problem but had a lack of knowledge regarding treatment and prevention strategies. Local government is not deeply engaged in rural villages like Lwala as they are difficult to reach during times of heavy rain and there are many such villages. Successful implementation of deworiming guidelines depends on several factors: political will, vehicular access, infrastructure for school-based mebendazole distribution and sufficient personnel with a vested interest in childhood deworming. We can only speculate as to why recommended guidelines have not been carried out in this community, but this warrants further investigation.

In order to meet the goals of the Kenyan Ministry of Health, the WHO and Millennium Development Goals, efforts must be increased to access hard-to-reach rural villages with routine deworming. An established infrastructure such as a link between a community clinic and primary schools assures continued success with deworming efforts. We have established this link for the Lwala community and will follow up our survey to assess program effectiveness. Extending the deworming efforts to siblings of children enrolled in school will also serve to increase effectiveness in eventual worm eradication. Our study demonstrates the need for grassroots projects with rooted community involvement until government-based efforts can be increased. Such an infrastructure guarantees a higher success rate in regular dewormings, ensuring that rural children are not left behind in global STH infection control.

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