Brief Report

Effectiveness of a School-Based Deworming Campaign in Rural Kenya

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Summary

In 2007, the rate of intestinal helminth infection in primary school-aged children in a rural village in Southwestern Kenya was estimated to be at least 68%, based on direct stool smear. Since the 2007 survey, these same school children have been treated with 400-mg albendazole every 3 months. We repeated a cross-sectional stool survey in the same area in 2010 (i.e. 3 years later) to estimate the current parasite prevalence. While only 44.5% of children were infected in 2010, the decline was not as marked as one might expect from a well-managed quarterly deworming campaign. Due to the relative insensitivity of the technique utilized here—the direct smear examination of a single stool sample—we were only able to identify heavy infections, and the true rate of parasitism is likely much higher, suggesting heavy environmental contamination and rapid re-infection rates. Community education and sanitation improvements are needed for more definitive impact.

Key words: intestinal helminths, school-based deworming, parasites, deworming, albendazole, helminths.

Introduction

Infection by intestinal helminthes in children stunts physical and mental development and can cause anemia, dehydration and malnutrition, leading international health experts such as the World Health Organization to strongly encourage school-based deworming campaigns [1–5]. In Kenya and elsewhere, such efforts have been shown to improve activity level, appetite and growth of primary school-aged children, reinforcing the argument for their existence and need for ongoing quality control [6, 7].

In July 2007, a study published in this journal estimated the rate of infection by intestinal parasites in two local primary schools in Nyanza Province in Southwestern Kenya to be 68% [8]. At that time, the Lwala Community Health Center (then named the Lwala Clinic) implemented a protocol to provide deworming medication (400 mg albendazole) to all children attending the two schools every 3 months. In order to implement the program, a pharmacist or a clinical officer personally travels to each school and distributes medication to each student, after which several doses are left with the head teacher to treat absent students.

The purpose of this study is to assess the success of the new deworming program 3 years after its inception by returning to the schools and measuring

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intestinal parasite burden with the same techniques. The time of stool sample collection corresponded with the end of a 3-month period in the deworming cycle so as to provide information on the state of infection at its peak.

Methods and Materials

Fresh stool samples were collected in the morning from children aged 6–14 years attending two primary schools in Lwala Village in Nyanza Province, Kenya. Ten males and 10 females per class were randomly selected from the roster to provide samples, or, if the classroom had fewer than 20 pupils, each student was asked to participate. Of 243 students asked to participate, 216 (88.9%) samples were returned and 5 were discarded due to too little stool or concern that the sample was contaminated. The samples were analyzed by direct wet mount for the presence of ova and larvae. Approximately 2 mg of stool were emulsified in saline and stained with Lugol's Iodine following the procedure outlined by R. Desowitz [9]. The samples were investigated by light microscope at 100× resolution (10× objective).

After analysis, all children, regardless of observed infection status, were treated with 400 mg albendazole. Students with signs of infection by *Schistosoma mansoni* were also treated with praziquantel at 40 mg/kg [10].

Results

The sample ($n = 211$) was of 51% female. We diagnosed at least one intestinal helminth in 44.5% of students, and 10.0% were infected with two or more. Infection rates were: *Ascaris lumbricoides* (37.9% of students infected), hookworm (9.0%), *Trichuris trichuria* (3.8%), *Strongyloides stercoralis* (2.8%), and *S. mansoni* (1.0%).

We observed a decline of 24% (95% CI: 13.5–34.0%) in the rate of intestinal parasitism among children in the same age groups as in 2007 ($p < 0.0001$) [8]. Declines in prevalence for individual helminthes were noted in all but *S. mansoni* (Table 1).

In 2007, hookworm infections were significantly more common in males, but no correlation to sex was found in the current 2010 study for any worm ($p = 0.7$) [8]. Furthermore, unlike in 2007, there was no statistically significant correlation between age and infection (correlation = 0.06, $p = 0.39$).

Discussion

The success of this deworming campaign is mixed. Although the rate of infection by intestinal parasites in schools benefiting from the deworming efforts of the Lwala Community Health Center has decreased by nearly a quarter over the 3-year period, it remains remarkably high at 44.5%. Notably, as in 2007, this

TABLE 1
Comparison of parasite burdens in 2007 and 2010

Species	6–9 year age group			10–13 year age group			Total: 6–13 year group		
	2007 ($n = 58$) (%)	2010 ($n = 116$) (%)	% change	2007 ($n = 113$) (%)	2010 ($n = 95$) (%)	% change	2007 ($n = 171$) (%)	2010 ($n = 211$) (%)	% change
Any	76	41	−35	64	48		68	44	−24 ($p < 0.0001$)
Ascaris lumbricoides	64	34	−30	45	42	−3	51	38	−13 ($p = 0.01$)
Hookworm	28	8	−20	27	11	−16	27	9	−18 ($p < 0.0001$)
Trichuris trichuria	7	4	−3	9	3	−6	8	4	−4 ($p = 0.16$)
Strongyloides stercoralis[a]	17	4	−13	9	1	−8	12	3	−9 ($p = 0.01$)
Schistosoma mansoni	2	0.9	−1	1	1	0	1	1	0 ($p = 1$)

[a]In 2007, likely *S. stercoralis* specimens were labeled 'larva' [8]. In 2010, we obtained parasitologic confirmation of etiology.

figure is likely an underestimation of the actual prevalence due to the relative insensitivity of the direct wet mount technique [8].

The greatest observed decline was for hookworm (18%, $p < 0.0001$), whereas the decline of *T. trichuria* was small and statistically insignificant (4%, $p = 0.16$). This discrepancy might be attributable to the fact that single dose albendazole has been shown in several trials to eradicate only 58% of *T. trichuria* infections, compared with 95% for *A. lumbricoides* and 78% for both species of hookworm [11]. *Schistosoma mansoni* would not be expected to decline in this study as it is not treatable with albendazole, although we treated the two children whom we diagnosed in the course of this research.

Since stool samples were collected 3 months after deworming, which is the longest period school children go without treatment (unless they seek it independently), these data represent the peak rate of infection. This suggests a rapid re-infection rate, though a nadir measurement, e.g. at 1-week post-treatment, would be helpful for interpretation. One limitation of our study was the unavailability of concentration techniques to quantitatively measure worm burden and to achieve more accurate prevalence rates.

The most successful intestinal parasite eradication campaigns have combined chemotherapy with improvements in sanitation and health education [12]. Because all parasites identified in this population are contracted via contact with contaminated human feces, efforts to improve community knowledge about hygiene practices via hand washing, sanitary food preparation and the availability and utilization of clean latrines and clean drinking water will be necessary to fully relieve the problem of intestinal parasitism in rural Southwestern Kenya, as well as elsewhere, and to meet the Millennium Development Goals.

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