



Soil Transmitted Helminthiases in Rural School Children in Retalhuleu, Guatemala



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Background

Soil-transmitted helminth (STH) infections are amongst the most common diseases of poverty worldwide, despite extensive Mass Drug Administration (MDA) to school age children. Benzimidazole anthelmintics have variable efficacy against the three most common STHs (*Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm), and there are concerns about emerging resistance. Guatemala is endemic for STH, although the regional distribution of each helminth species is not well defined.

Our study was conducted in the town of Retalhuleu, Guatemala, where an estimated 40% of the population lives below the poverty line. Sixty percent of the population do not have access to basic sanitation services, and 40% of children under the age of five live with chronic malnutrition. These factors, as indicated above, predispose communities in Retalhuleu to high STH infection and rapid reinfection following chemotherapy. The Guatemalan Ministry of Health (MOH) has implemented deworming programs in the district for the past 3 years, with a goal of 95% coverage of the town's population through treatment programs that run year long and include MDA campaigns once or twice a year. Deworming is also included in existing health services, such as prenatal care, child immunizations, and health education.

The paucity of published data describing the prevalence and intensity of STH infection in Guatemala poses a significant challenge for evaluating the efficacy of MDA and other control programs. Prevalence data can inform policy decisions regarding MDA frequency, and also enable accurate monitoring of drug coverage, deworming effectiveness and ultimately disease control. Intensity of infection, which is estimated by the concentration of eggs per gram (EPG) of feces, is associated with STH morbidity and is a factor in risk of transmission. These measures, therefore, have a significant public health relevance and are an integral part of monitoring for the impact of preventive chemotherapy interventions.

Aim

Our study's aim was to determine baseline distribution, prevalence and intensity of STH infections in children living in high risk zones of Retalhuleu, Guatemala, and to evaluate the effectiveness of single dose albendazole against each species of intestinal nematode.

Methodology

We conducted a cross-sectional study of 557 children ages 4-16 years from 7 high-risk schools (DAR, Berea Vaquilito, Concepción Ocosito, Lo De Mota, Marina del Rey, San Jose Las Flores, and 3 de Enero) that have implemented biannual deworming. Pre-treatment stool samples were analyzed for fecal EPG via Kato Katz microscopy. Infected children were treated with a single oral dose of 400 mg albendazole and a second stool sample was collected and analyzed 10-20 days post-treatment.

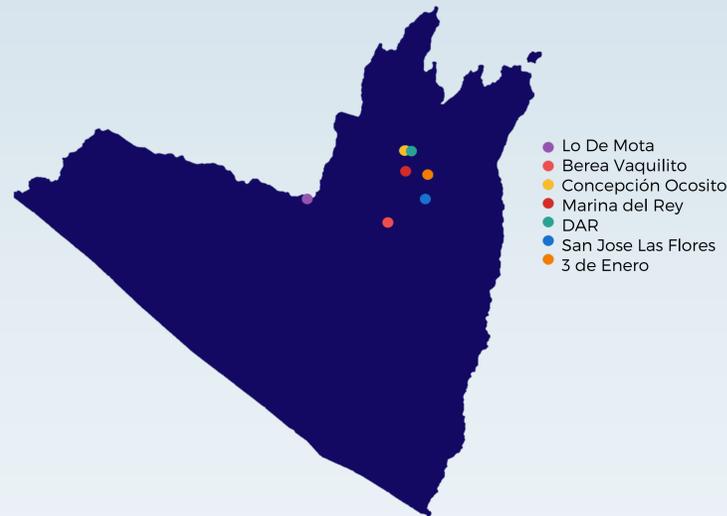


Figure 1: Map of participating schools in the Retalhuleu Department of Guatemala. Seven schools participated in this study. The Retalhuleu Department of Health identified these schools as "high-risk" for helminth infection based on demographic data of pediatric patients seen at their health center. The criteria used for choosing schools included high estimated helminth prevalence, poor sanitation infrastructure and low socioeconomic status.

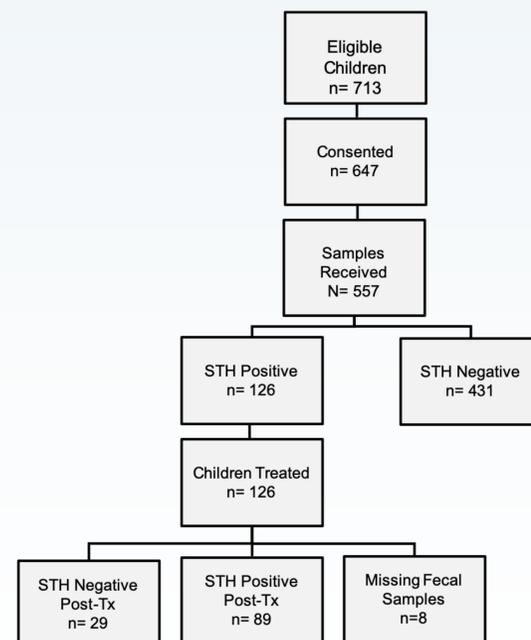


Figure 2: Study Sample Flow Diagram. A total of 713 children aged 4-16 years were eligible for the study, of which 647 provided informed consent. Samples were received from 557 children across all 7 schools. A total of 126 out of 557 tested positive for at least one soil-transmitted helminth (22.6%). The 126 children that tested positive were treated with a single dose of albendazole. Of the 118 post-treatment samples, 89 remained STH positive (Cure rate: 24.6%). The remaining 8 children that had initially tested positive did not return post-treatment fecal samples.

Results

- The overall prevalence of STH infection was 22.6%, with *T. trichiura* alone (16.7%) being more prevalent than *A. lumbricoides* alone (1.4%) and *T. trichiura/A. lumbricoides* co-infection (4.1%). Hookworm infection was not detected in any study subject.
- Prevalence of STH infection by school ranged from 7.5% to 42.9% (DAR: 10.5%; Berea Vaquilito: 7.5%; Concepción Ocosito: 42.9%; Lo De Mota: 33.3%; Marina del Rey: 30.3%; San Jose Las Flores: 37.2%; 3 de Enero: 16.1%).
- Nearly all infections (99.2%) were light to moderate intensity.
- Post-treatment cure rates were as follows: 100% (9/9) for *A. lumbricoides*, 23.3% (21/90) for *T. trichiura* and 4.5% (1/22) for *T. trichiura/A. lumbricoides* co-infections.
- Community-wide fecal egg reduction rates were 99.9% and 50.8% for *A. lumbricoides* and *T. trichiura*, respectively.

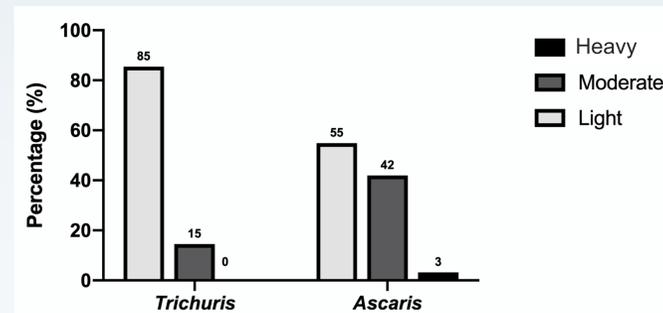


Figure 3: Intensity of STH Infection. Infection groups are separated by helminth type and subdivided based on infection intensity according to WHO guidelines.* Of those infected with *Trichuris*, 85% of the cases were light intensity, 15% were moderate intensity and none were heavy. Of those infected with *Ascaris*, 55% were light intensity, 42% were moderate intensity and 3% were heavy intensity. * Eggs per gram (epg) for *T. trichiura* infection: light 1-999 epg, moderate 1,000-9,999, heavy >10,000; for *A. lumbricoides* infection: light 1-4,999, moderate 5,000-49,999, heavy >50,000

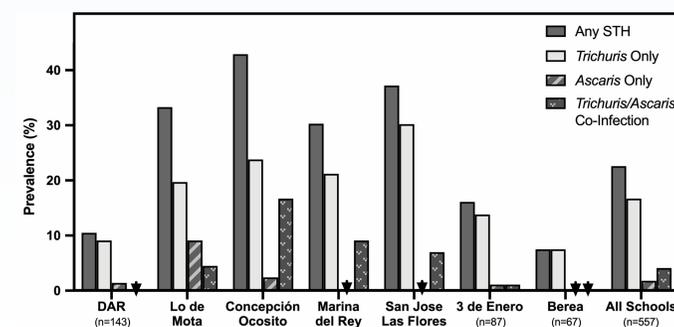


Figure 4: Prevalence of STH infection, categorized by school. Within each school, infection is separated into the following categories: any STH infection, *Trichuris* infection only, *Ascaris* infection only, and co-infection with both *Trichuris* and *Ascaris*. Arrows indicate a prevalence of 0%.

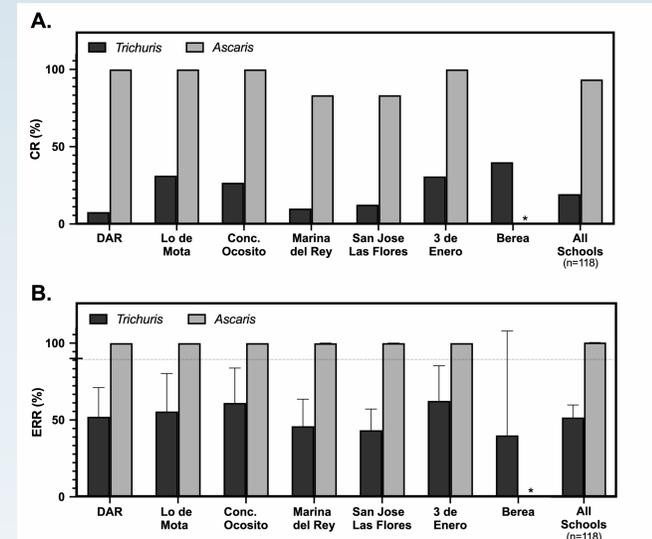


Figure 5: Cure Rate (CR) and Egg Reduction Rate (ERR), categorized by school. Within each school, infection is subdivided into *Trichuris* infection and *Ascaris* infection. Asterisk indicates where data is unavailable for this calculation as no *Ascaris* infections were identified from this school. Overall CR for *Trichuris* infections were significantly lower (17%) compared to *Ascaris* infections (94%).

Conclusion

This study demonstrates a significant prevalence of STH infections, primarily *Trichuris* and *Trichuris/Ascaris* co-infection, in a series of high-risk schools in Retalhuleu, Guatemala despite annual or bi-annual deworming programs. Additionally, our findings confirm poor effectiveness of single dose albendazole for trichuriasis. Follow up studies on benzimidazole response in rural and semi-urban schools in Guatemala are needed for improved surveillance of STH infection and to monitor the effectiveness of deworming programs. These data suggest that control of *T. trichiura* infections will likely require alternative strategies, given the poor response to albendazole in the study population. In light of these findings, there is an urgent need for investment in long-term solutions, e.g. improved water and sanitation, in order to reduce the burden of STH in Retalhuleu and other areas at risk.

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