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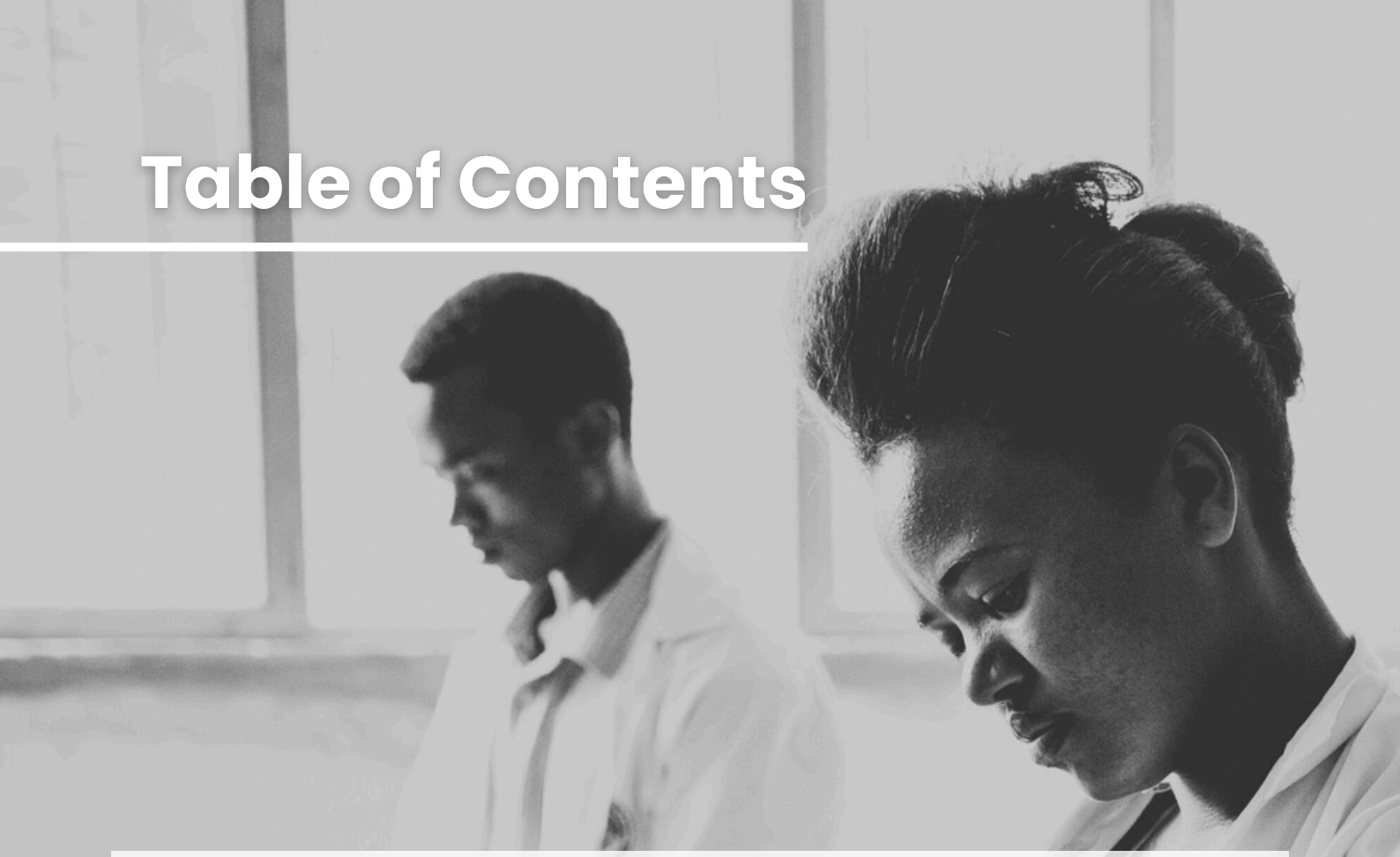
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Environmental and Ecological Surveillane

Seasonal and Spatial Dynamics of Freshwater Snails and Schistosomiasis in Mizan Aman, Southwest Ethiopia

Meleko, Asrat, Naomi Caplan, Dorin Brener Turgeman, Azeb Seifu, Zvi Bentwich, Michal Bruck, Nisan Z. Kesete, Willemijn Zaadnoordijk, and Noa Dahan.

Introduction: Freshwater snails, particularly snails from the genus Biomphalaria, play a key role in the transmission of schistosomiasis, a parasitic disease prevalent in tropical regions. Schistosomiasis poses a significant public health challenge in these regions, leading to chronic illness, reduced productivity, and impaired childhood development, particularly in communities with limited access to healthcare and sanitation. Understand- ing the seasonal and spatial variations in snail populations and infection rates is crucial for controlling schistosomiasis, especially in areas like Southwest Ethiopia, where the disease burden is high.

Methods: This study was conducted in Mizan Aman, Southwest Ethiopia, across two seasons, dry and wet. A total of 1150 snail samples were collected from 20 freshwater sites, and their species, abundance, and infection status were assessed. Environmental parameters, including temperature, pH, salinity, and conductivity, were measured to analyze their impact on snail populations.

Results: Four snail species were identified, Biomphalaria pfeifferi, Biomphalaria sudanica, Lymnaea natalensis, and Bulinus globo- sus, with B. pfeifferi and B. sudanica being the most prevalent. Snail abundance varied by site and season, with 598 in the dry season and 552 in the wet season. Snail abundance and species composition showed significant spatial variation, with higher counts in sites like Sasin and Agu 1, while some sites had no snails. Biomphalaria snails, particularly B. pfeifferi, are the principal intermediate host for Schistosoma mansoni. The overall preva- lence of Biomphalaria snails exceeded 85% in both seasons, and their average infection rate in Mizan Aman was 13.5%. This infection rate showed a strong correlation ($r = 0.733$, $p < 0.001$) with the incidence of schistosomiasis cases in the community. Seasonal variation in environmental factors, such as temperature and pH, had no significant effect on snail abundance; however, water salinity showed to be correlated with snail abundance during the dry season. Furthermore, community-led vegetation clearance at selected sites significantly reduced snail abundance.

Conclusions: This study highlights the seasonal and spatial dynamics of freshwater snails, particularly Biomphalaria species, in relation to schistosomiasis transmission in Mizan Aman, Southwest Ethiopia. The findings confirm that B. pfeifferi species is the predominant intermediate host for schistosoma in this region and that schistosomiasis infection rates among snails significantly correlate with human cases in the community. While environmental factors such as temperature and pH showed no significant influence on snail abundance, water salinity had an impact during the dry season. Additionally, community-led vegetation clearance was an effective intervention in reducing snail populations. These results emphasize the need for targeted, site-specific control measures integrating ecological and community-based interventions to sustainably reduce schistosomiasis transmission.



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Seasonal and Spatial Dynamics of Freshwater Snails and Schistosomiasis in Mizan Aman, Southwest Ethiopia

Asrat Meleko [1,2], Naomi Caplan [1], Dorin Brener Turgeman [1], Azeb Seifu [1], Zvi Bentwich [1,3], Michal Bruck [1], Nisan Z. Kesete [1], Willemijn Zaadnoordijk [4] and Noa Dahan [1,*]

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Schistosomiasis Control in Ethiopia: The Role of Snail Mapping in Endemic Communities

Meleko, Asrat, Sarah Li, Dorin Brener Turgeman, Michal Bruck, Nisan Z. Kesete, Willemijn Zaadnoordijk, David Rollinson, Galia Sabar, Zvi Bentwich, and Rachel Golan.

I**ntroduction:** Schistosomiasis, a neglected tropical disease (NTD), remains a public health problem in Ethiopia. Freshwater snails, acting as intermediate hosts, release cercariae, the infectious parasite, into the water, which penetrate human skin that encounters infested waters. The objective of this study was to map snail abundance along rivers and study its association with schistosomiasis infection in communities using these rivers.
Materials and Methods: A cross-sectional study was carried out at 20 river sites in Mizan Aman city administration, Bench Sheko zone, South West Ethiopia Peoples (SWEP) region, Ethiopia, to study the distribution of host snails and transmission sites for intestinal schistosomiasis. This study used a quantitative database consisting of data on the prevalence of infected snails, the characteristics of rivers and riverbanks, and the prevalence of schistosomiasis in the community, based on stool samples collected from community members near the sampling sites.

Results: Aquatic snails were found in 11 of the 20 sites sampled. A total of 598 snails was collected, including *Biomphalaria pfeifferi*, *Biomphalaria sudanica*, *Radix natalensis* and *Bulinus globosus* species; the most abundant species was *Biomphalaria pfeifferi.* Stool samples were collected from 206 community members from all 20 sites. Forty-one (19.9%) were positive for *Schistosoma mansoni*. A positive correlation was found between the presence of snails and positive stool samples ($r = 0.60$, $p = 0.05$) and between the presence of infected snails and the prevalence of infection ($r = 0.64$, $p = 0.03$). Locations with muddy riverbanks were associated with the presence of snails ($r = 0.81$, $p < 0.001$).

Conclusions: These results emphasize the importance of mapping snails for the control of schistosomiasis by defining hotspots of infection and identifying factors associated with the presence of infected snails. The results support the need for a continuous mapping of snails and the introduction of snail control as a major element for the successful control of schistosomiasis in endemic communities.

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Schistosomiasis Control in Ethiopia: The Role of Snail Mapping in Endemic Communities

Asrat Meleko [1,2], Sarah Li [3], Dorin Brener Turgeman [1], Michal Bruck [1], Nisan Z. Kesete [1], Willemijn Zaadnoordijk [4], David Rollinson [5,6], Galia Sabar [7], Zvi Bentwich [1,8] and Rachel Golan [1,9,*]

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Behavior-Change and School-Based Sanitation

High prevalence of soil-transmitted helminths and schistosomiasis among primary schoolchildren in Southwest Ethiopia: the need for health strategies alongside mass drug administration.

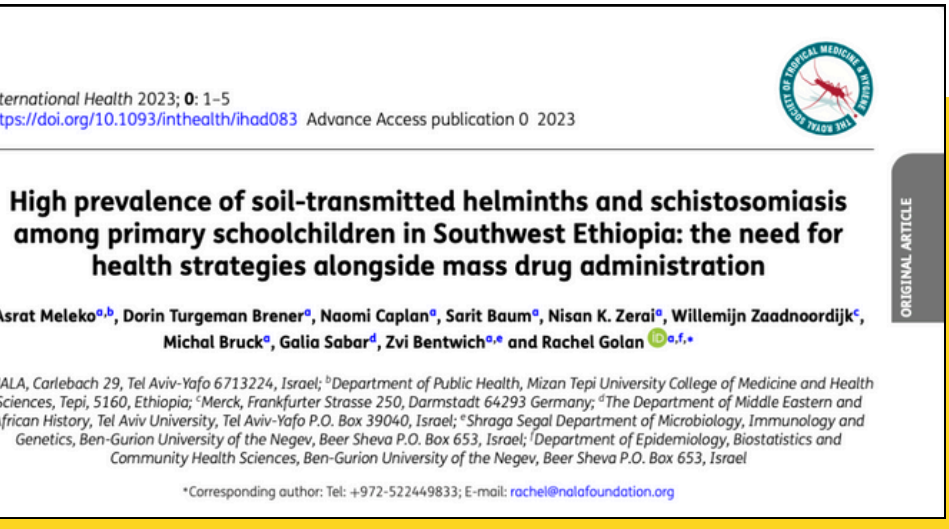
Gizaw, Zemichael, Tsegaye Adane, Jember Azanaw, Ayenew Addisu, and Daniel Haile.

Background: Soil-transmitted helminths (STH) and schistosomiasis remain widely prevalent in Ethiopia. The aim of this study was to evaluate the prevalence of STH and schistosomiasis among schoolchildren in Gidi Bench district (Southern Nations, Nationalities, and People's Republic, Southwest Ethiopia) and the association with knowledge and health-related behaviors.

Methods: A cross-sectional study was conducted. Stool samples, analyzed by the Kato-Katz technique and a knowledge, attitudes and practices questionnaire, were collected.

Results: Out of 611 participants (mean age 12.8±3.1 y), 129 (21.1%) were infected with schistosomiasis and 382 (62.5%) had STH. More than 30% (n=195, 31.9%) were infected with a single intestinal parasite, while 138 (22.6%) and 47 (7.7%) were infected with two or three parasitic infections, respectively. Boys and those who did not participate in school clubs had higher infection rates (p=0.05). Lower parasitic infection was associated with using a latrine when available, washing hands and vegetables and wearing shoes regularly. Higher rates of infection were found among those who reported swimming and washing cloths and utensils in the river regularly.

Conclusions: Schistosomiasis and STH were highly prevalent among schoolchildren in Gidi Bench district. Infection rates were associated with gender, lack of knowledge on parasitic infections and unhealthy behaviors. Findings from this study may assist in decision making regarding disease prevalence and methods of control alongside mass drug administration.



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High prevalence of soil-transmitted helminths and schistosomiasis among primary schoolchildren in Southwest Ethiopia: the need for health strategies alongside mass drug administration

ORIGINAL ARTICLE

Asrat Meleko[a,b], Dorin Turgeman Brener[a], Naomi Caplan[a], Sarit Baum[a], Nisan K. Zerai[a], Willemijn Zaadnoordijk[c], Michal Bruck[a], Galia Sabar[d], Zvi Bentwich[a,e] and Rachel Golan [a,f,*]

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ORIGINAL ARTICLE

Motivating school communities towards behavior change and local ownership: a gamification intervention to prevent trachoma at primary schools in southern Ethiopia

Naomi Caplan[a], Bharat C. Sanka[b], Asmro Mulat[a], Dorin Turgeman Brener[a], Sarit Baum[a], Azeb Seifu[a], Nisan Z. Kesete[a], Michal Bruck[a], Leah G. Wohlgemuth[c], Melaku M. Debela[c], Reut Barak Weekes[d], Galia Sabar[e], Zvi Bentwich[a,f] and Rachel Golan [a,g,*]

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Motivating school communities towards behavior change and local ownership: a gamification intervention to prevent trachoma at primary schools in southern Ethiopia

Caplan, Naomi, Bharat C. Sanka, Asmro Mulat, Dorin Turgeman Brener, Sarit Baum, Azeb Seifu, Nisan Z. Kesete et al.

Background: Ethiopia alone carries 49% of the global burden of trachoma, associated with a lack of safe water, sanitation and hygiene (WASH) and poor health practices. The aim of this study was to examine whether gamification among schoolchildren and promotion of local ownership of school WASH is associated with healthy behaviors and WASH infrastructure improvements.

Methods: Application of the Accelerate gamification intervention for elimination of trachoma, with an emphasis on gamification among schoolchildren and community involvement in motivating face-washing, handwashing and functional use of latrines, was undertaken.

Results: The study was conducted over 9 mo in 223 rural schools from six districts within the intervention area, reaching 93 518 schoolchildren. At baseline, students were observed washing their hands after using latrines in 23 (10.3%) schools. This increased to 132 (59%) schools ($p \leq 0.001$) at follow-up. The number of latrines increased from 585 at baseline to 594 at follow-up ($p=0.031$). The availability of handwashing stations in schools increased from 31 (13.9%) with water access (8%) and soap (5%) to 155 (69.5%) schools with handwashing stations with water access in 153 (98.7%) ($p<0.001$) and soap in 121 (78%) ($p<0.001$).

Conclusions: Motivational strategies such as gamification among schoolchildren and promotion of local ownership of school WASH may be associated with healthy behaviors and WASH infrastructure improvements.

Deworming school children in Ethiopia: The importance of a comprehensive approach

Ali, J., Polland, A., Adlerstein, D., Gziabher, Y. G., Sabar, G., Liss, Y., & Bentwich, Z.

Introduction: A quarter of the world's population, most commonly in developing countries like Ethiopia, are infected with intestinal parasites. School age children are the most affected segment of the population. The World Health Organization (WHO) recommends periodic deworming of all at-risk people living in endemic areas.

Methods: In 2009, Ben Gurion University, in partnership with the NALA Foundation and in collaboration with the Organization for Social Services and AIDS (OSSA), an Ethiopian non-governmental organization, and the health and education bureau of Tigray Regional State, launched a deworming project for school children in Mekele City, Ethiopia. During its four years of implementation (2009-2012), we evaluated the effi cacy of this intervention in controlling helminthic infection in participating schools. The program entailed a comprehensive approach, combining intensive health education with water sanitation and mass drug administration and with pre- and post-intervention stool surveys, during each year of the intervention.

Results: A total of 23,214 students were dewormed in four annual deworming campaigns. The results of the sequential stool surveys demonstrated a signifi cant and consistent decrease in the prevalence of both schistosomiasis and soil-transmitted helminthes infection in all the school children who participated in the project, and was sustained throughout the intervention period, decreasing from 52.8% at the beginning to 6.4% at the end.

Conclusions: Results suggest that a comprehensive program, which combines mass drug administration with health education and water sanitation, can lead to sustained control of helminthic infections in school children living in highly endemic areas for these infections. Though continued evaluation of this program is warranted to determine how long and permanent such a control can last, deworming programs of this type are likely to prove useful throughout Ethiopia and other developing countries where these infections are highly common and where their long-lasting control is greatly needed.

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Research Article

Deworming school children in Ethiopia: The importance of a comprehensive approach

Abstract

Introduction: A quarter of the world's population, most commonly in developing countries like Ethiopia, are infected with intestinal parasites. School age children are the most affected segment of the population. The World Health Organization (WHO) recommends periodic deworming of all at-risk people living in endemic areas.

Methods: In 2009, Ben Gurion University, in partnership with the NALA Foundation and in collaboration

WASH and Household Sanitation

Sustainable Elimination of Schistosomiasis in Ethiopia—A Five-Year Follow-Up Study

Gal, Lotte Ben, Michal Bruck, Robyn Tal, Sarit Baum, Jemal Mahdi Ali, Lemlem Legesse Weldegabriel, Galia Sabar, Rachel Golan, and Zvi Bentwich

Background: In 2009, Mekele, the capital of the Tigray Region in Ethiopia, presented a mean prevalence of 44.7% of schistosomiasis (*S. mansoni*) in school children. Termed a public health problem, NALA, an international public health non-governmental organization, and their partners implemented a novel model of intervention, which aimed to compliment mass drug administration (MDA) campaigns with behavioral change (BC) and improved sanitation to achieve sustained elimination of schistosomiasis. The four-year intervention (2009–2012) covered 38 primary schools. The objective of this study was to examine factors associated with control or resurgence of the disease, and the association between the behavioral change program and disease prevalence, ten years after initiation.

Methods: Eleven primary schools were selected for this follow-up study. All students provided a stool sample and filled in a knowledge, attitude and practice (KAP) questionnaire.

Results: In seven out of eleven schools (63.6%) the prevalence of schistosomiasis was maintained below 2% ten years after the initiation of the intervention. In four schools, prevalence returned to pre-intervention levels, defining them as persistent hot spots (PHS). Students from PHS schools scored lower on KAP questionnaires compared to students from responder schools; 3.9 ± 0.9 vs. 4.2 ± 0.9 (p-value < 0.001) for practice questions and 4.4 ± 1.4 vs. 4.6 ± 1.5 (p-value = 0.03) for attitude questions. The prevalence of schistosomiasis correlated positively with age, (p-value = 0.049), sex (relative risk = 1.7, p-value < 0.001), and location. Semi-urban locations (n = 382) had higher disease prevalence than urban locations (n = 242), (22.7% vs. 5.5%, p-value < 0.001). Students residing in semi-urban areas and close to a river (<500 m) were at higher risk of contracting schistosomiasis than those living in urban areas far from the river (RR = 5.95, p-value < 0.001). Finally, a correlation between prevalence and proximity of schools to rivers was found (semi-urban areas; RR = -0.91, p-value = 0.001 vs. urban areas; RR = -0.51, p-value = 0.001). Soil-transmitted-helminths prevalence in 2009 was 8.1% and declined during the intervention years to 0.5%. Prevalence in 2018 was found to be stable at 0.8%.

Conclusion: These results demonstrate the long-term success of NALAs' comprehensive model of intervention for elimination of schistosomiasis in school children, combining behavioral change and improved sanitation with MDA.



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Environmental Health and Preventive Medicine

RESEARCH ARTICLE Open Access

Childhood intestinal parasitic infection and sanitation predictors in rural Dembiya, northwest Ethiopia

Zemichael Gizaw[1*], Tsegaye Adane[1], Jember Azanaw[1], Ayenew Addisu[2] and Daniel Haile[1]

Childhood intestinal parasitic infection and sanitation predictors in rural Dembiya, northwest Ethiopia

Gizaw, Zemichael, Tsegaye Adane, Jember Azanaw, Ayenew Addisu, and Daniel Haile.

Background: Intestinal parasites are a common problem in the world. The greater proportion of infections is associated with poor water, sanitation, and hygiene (WASH). This study was conducted to assess intestinal parasites, WASH condition, and their association in rural Dembiya, northwest Ethiopia.

Methods: A cross-sectional study was employed. Two hundred twenty-five children aged 6–59 months were included. Mothers were interviewed using a structured questionnaire, and the living environment was observed using checklists. Kato-Katz technique was used to determine the intensity of parasitic infections. Escherichia coli (E. coli) was used as a biological indicator for drinking water quality. Multivariable binary logistic regression analysis was conducted to identify WASH predictors of parasites on the basis of adjusted odds ratio (AOR) with 95% confidence interval (CI) and $p < 0.05$.

Results: The prevalence of intestinal parasites was 25.8% (95% CI = 20.3–32.0%). Ascaris lumbricoides (78%), hookworm (12%), Hymenolepis nana (7%), Enterobius vermicularis (5%), Schistosoma mansoni (3%), Giardia lamblia (3%), and Trichuris trichiuria (2%) were identified infections. Intestinal parasites were associated with poor child hand washing practice [AOR = 3.86, 95% CI = 1.53, 9.75], unprotected water sources [AOR = 7.79, 95% CI = 3.30, 18.40], access to water below 20 l/c/d [AOR = 3.05, 95% CI = 1.28, 7.23], poor food safety[AOR = 4.33, 95% CI = 1.62, 11.58], and poor sanitation [AOR = 5.01, 95% CI = 1.56, 16.16].

Conclusion: A. lumbricoides, hookworm, H. nana, E. vermicularis, S. mansoni, G. lamblia, and T. trichiuria were identified. Child hand washing practice, service level of water supply, water sources, food safety, and sanitation were associated with intestinal parasites. WASH promotion is needed to prevent infections.

We welcome collaboration and partnerships.

If you are interested in joining forces to advance research, drive innovation, and create meaningful impact together, please reach out to us at:

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