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Short Communication

Effects of Water Source, Sanitation and Hygiene on the Prevalence of *Schistosoma mansoni* among School Age Children in Jawe District, Northwest Ethiopia

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Received 10 Feb 2019

Accepted 21 Apr 2019

Keywords:

Schistosoma mansoni;
Sanitation;
Hygiene;
Pure water

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Abstract

Background: Intestinal schistosomiasis is a disease caused by infection with one of the blood flukes called *Schistosoma mansoni*. The distribution of *Schistosoma mansoni* infection is high in Sub-Saharan Africa due to water source, sanitation and hygiene problems. This study aimed to determine the effect of water source, sanitation and hygiene on the prevalence of schistosomiasis among school-age children in Northwest Ethiopia.

Methods: A cross-sectional study was conducted from Apr 2016 to Aug 2016. Children were selected by systematic random sampling and Formol Ether Concentration Technique (FECT) was used to identify *Schistosoma mansoni* infection. Statistical analysis was done using descriptive statistics and strength of association of schistosomiasis with determinant factors was calculated by bivariate analysis.

Results: Among 333 children, 7% were infected with *Schistosoma mansoni*. Using surface water for drinking, poor hand wash habit and latrine utilization were significantly associated ($P < 0.05$) with *Schistosoma mansoni* infection.

Conclusion: Absence of safe water for bathing, washing and swimming, poor sanitation and hygiene practices were major risk factors for schistosomiasis. Therefore, health education should be given on the transmission of *S. mansoni* infection, pure water, sanitation and hygiene in *S. mansoni* endemic areas.

Introduction

Schistosomiasis is water based parasitic infection that affects more than 800 million people globally, and more than 90%

live in sub-Saharan African countries with poor access to clean water and sanitary facilities (1). WHO estimates that there are about

20,000 deaths of schistosomiasis globally each year (2). *Schistosoma (S) mansoni* is one of the causes of intestinal schistosomiasis (3,4).

Transmission of *S. mansoni* is through exposure of skin to faecal contaminated freshwater containing cercarial stages. The eggs emerge larvae when contact with water and enter freshwater snails for further development. Finally, the cercariae come out from snail and penetrate the human skin during contact with infested water (5).

The prevalence of intestinal schistosomiasis is influenced by Water, Sanitation, Hygiene (WASH) and mass drug administration (6). Contact with freshwater during washing cloth, bathing and crossing is the main risk factor (7). Open defecation and poor hand wash habit are indicators of WASH and influence the prevalence of schistosomiasis (5).

Access to safe water and adequate sanitation are considered to be important components of schistosomiasis control, which at present largely relies on preventive chemotherapy with a single drug, praziquantel (8). Even though re-infection may occur after treatment, the risk of developing severe disease is diminished and even reversed (2). Treatment alone will not break the cycle of transmission; improvements of WASH, infrastructure and appropriate health-seeking behavior are essential to achieve sustained control of schistosomiasis (9). Therefore, integration of WASH and mass drug administration might increase preventive capacity to a higher rank.

School-age children usually being the most affected group since they are playing with water (10). In low socio-demographic areas, there is poor water supply, latrine utilization; sanitation and hand wash habit which facilitates the *S. mansoni* transmission. Institutional based information indicated that the prevalence of *S. mansoni* is one of the primary helminthic infections among children in Jawe district. However, the available information with respect to WASH and *S. mansoni* infection is lacking. Therefore, this study aimed to determine the effect of WASH on *S. mansoni* infection

among school age children, Northwest Ethiopia.

Methods

Study design, area and period

This cross sectional study was conducted among febrile school age children from Apr 2016 to Aug 2016 in Jawe district, Northwest Ethiopia. The annual temperature of the area ranges between 16.68 °C to 37.6 °C. The average annual rainfall is 1569.4 mm.

Overall, 333 school age children were included in this study. Systematic random sampling technique was conducted until the required sample size is achieved. The samples were collected in Jawe health center and Workmeda health center.

All children age ranging from 6-14 yr, attending the above health centers and willing to participate in the study were included. Children under taking anti-helminthic drugs during the data collection time were excluded. The sample size in each health center was allocated by considering the population in the catchment areas. Jawe district is a potential irrigation area to sugar cane using Tana-Beles irrigation project.

Data collection

Demographic information, indicators of WASH and environmental related factors were collected via interview of parents/guardian of the children by health officers.

Informed consent was taken from the participants before the study.

Stool sample collection

Fresh stool specimen was collected from each study participant using clean plastic container labeled with unique identification number. In Formol Ether Concentration Technique (FECT), 0.5 g of stool sample was transferred in to 10 ml of normal saline in a glass container and mixed thoroughly. Two

layers of gauze were placed in a funnel and strained the contents into a 15 ml centrifuge tube. Then 2.5 ml of 10% formaldehyde and 1 ml of ether was added. The test tubes were mixed well and centrifuged at 1000 revolution for three minutes. The sediment was mixed well, prepared on slide and covered with cover slide and saw with microscope.

Quality control

Training of laboratory technicians and health officers on data collection was given before sample collection. Application of standard procedures was checked. The stool cups were labeled based on their serial number. The FECT slides were examined independently with two experienced laboratory technicians and 10% of FECT slides was randomly selected and read by another technician as a quality control. The results of their observation were recorded for later comparison on separate sheets.

Data Analysis

Data were analyzed using SPSS ver. 20 (Chicago, IL, USA) statistical software. Overall magnitude of *S. mansoni* was calculated using descriptive statistics and chi-square. Strength

of association between *S. mansoni* infection and indicators of WASH was calculated by logistic regression and calculating the odds ratios with 95% CI. The differences were considered to be statistically significant if *P*-value < 0.05.

Results

Demographic characteristics

Overall, 333 school age children included in the study; of which 275 (82.6%) from rural with response rate of 94.5%. Female participants accounted for 51.1%. The median age of children was 12 yr with standard deviation of 2.7. The majority of participants were Christian (98.4%) (Table 1).

Schistosoma mansoni infection

The overall prevalence of *S. mansoni* infection among school-age children was 23 (7%). The prevalence of *S. mansoni* among children age groups 11-14 and 6-10 were 8.9% and 4.2%, respectively. The prevalence of *S. mansoni* infection among rural dwellers was 7.3% (Table 1).

Table 1: Demographic characteristics of school age children in Northwest Ethiopia, 2016 [N, %]

Variables		N	<i>S. mansoni</i> distribution		P value
			Positive	Negative	
Age(yr)	6-10	143	6 (4.2)	137 (95.8)	0.10
	11-14	190	17 (8.9)	173 (91.1)	
Sex	Male	163	16 (5.5)	154 (94.5)	0.07
	Female	170	7 (8.2)	156 (91.8)	
Religion	Christian	328	23 (7.6)	305 (92.4)	0.54
	Muslim	5	0 (0)	5 (100)	
Residence	Rural	273	20 (7.3)	253 (92.7)	0.52
	Urban	60	3 (5)	57 (95)	
Total		333	23 (7)	310 (93)	

Multivariate analysis of hookworm infection

Children with stream water source were 13.66 (AOR) times more likely to be infected by *S. mansoni* than who had pipe water source.

Children bathing, fishing, swimming, crossing and washing cloth in surface water were 20.24 (AOR), 7.56 (AOR), 24.04 (AOR), 8.68 (AOR), and 8.99 (AOR) times more likely to be infected by *S. mansoni*, respectively. Chil-

dren washed their hands sometimes were 12.25 (AOR) times more likely to be infected by *S. mansoni* than who washed their hands always. Children who used latrine sometimes

were 7.99 (AOR) times more to be infected by *S. mansoni* than who used latrine always (Table 2).

Table 2: Determinant factors of *S. mansoni* among school age children in Northwest Ethiopia, 2016

Variable		PI		AOR [95%CI]	P-value
		Infected	Non infected		
Water source	Surface	19	82	13.66 (1.42-131.91)	0.02
	Pipe	4	228		
Bathing in surface water	Yes	18	87	20.24 (1.29-16.74)	0.03
	No	5	223		
Fishing in surface water	Yes	15	37	7.56 (1.30-44.19)	0.02
	No	8	273		
Swim in surface water	Yes	18	65	24.04 (2.33-247.63)	0.01
	No	5	245		
Crossing in surface water	Yes	19	75	8.68 (1.24-60.51)	0.03
	No	4	235		
Washing clothes in surface water	Yes	18	57	8.99 (1.50-53.95)	0.02
	No	5	253		
Hand wash habit	Sometimes	20	128	12.25 (1.46-102.86)	0.02
	Always	3	182		
Latrine utilization	Sometimes	16	64	7.99 (1.36-46.80)	0.02
	Always	7	246		

Discussion

Water, sanitation and hygiene are crucial for prevention and control of Neglected Tropical Diseases including schistosomiasis. The prevalence of schistosomiasis is highly influenced by WASH and mass drug administration (5).

The prevalence of *S. mansoni* in the present study was 7% among school-age children, which was comparable with previous study done in Northeastern Nigeria (11), but lower than a study done in Northwest Ethiopia (12), Adwa, Northwest Ethiopia (13) and Southwest Ethiopia (14) and higher than a study done in Gondar town, Northwest Ethiopia (15), and Mali, West Africa (16). The difference might be due to the difference in geographical area, Socio-demographic, methodology, WASH, control strategies and annual deworming.

In the present study, high prevalence of *S. mansoni* was found among children with age range 11-14 which was comparable with previous study done in Adwa, Northwest Ethiopia (13) and Southwestern Nigeria (17).

In the present study utilization of surface water source for home activities is a determinant factor for schistosomiasis which was in agreement with Southwest Ethiopia (14) and Southwestern Nigeria (17).

In our study, fishing in surface water was risk factor for children to be infected with *S. mansoni*. This result was in line with previous study done in Northeastern Nigeria (13).

In this study, swimming in surface water was risk factor for children to be infected with *S. mansoni*. This result was in line with previous study done in Amibera District, Southern Ethiopia (18), and Northeastern Nigeria (11),

We found that bathing and washing clothes in surface water were risk factor for children

to be infected with *S. mansoni*. This result was in line with previous study done in Adwa, Northwest Ethiopia (13).

Poor hand wash habits and latrine utilization are important factors for the high prevalence of helminthic infections (19). Hand washing habits and latrine utilization of children were associated with *S. mansoni* infection in the present study. Similar findings were recorded in Southwest Ethiopia (14), Northwest Ethiopia (13).

Conclusion

Absence of safe water for bathing, washing and swimming, poor sanitation and hygiene practices were major risk factors for schistosomiasis. WASH was not integrated with mass drug administration to prevent *S. mansoni* infection. Therefore, health education should be given on transmission of *S. mansoni* infection and WASH in endemic areas.

Acknowledgements

The authors acknowledge the Dahir Dar University who gave budget to conduct this research and the study participants in this research.

Conflict of interests

The authors declare that there is no conflict of interest.

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