Journal of Health, Population and Nutrition

RESEARCH

Open Access

Knowledge, attitudes, and practices on urinary schistosomiasis among schoolchildren in Ethiopia: cross-sectional study

Ketema Deribew[1*], Delenasaw Yewhalaw[1,2] and Zeleke Mekonnen[1]

Abstract

Background Urinary schistosomiasis is a disease caused by *Schistosoma haematobium* and is one of the public health problems in Ethiopia. When developing specific schistosomiasis control intervention program, the existing knowledge, attitudes and practices (KAPs) must be taken into account. This study aimed to assess the KAPs of primary schoolchildren towards urinary schistosomiasis in Ethiopia.

Methods A total of 1171 study participants aged 5 to 15 years were selected randomly.

Results Of the 1171 interviewed schoolchildren, 654, or 55.8%, said they had heard of urinary schistosomiasis. Using river or dam water for household consumption had association with urinary schistosomiasis infection history ($P=0.001$). Logistic regression analysis showed that males had higher risk of getting urinary schistosomiasis infection compared to females (OR = 3.01, $P<0.001$). Children in low socio-economic status had higher risk of having urinary schistosomiasis compared to high socio-economic status (OR = 2.81, $P<0.001$). Compared to urban dweller, children in rural area had higher risk of having urinary schistosomiasis (OR = 4.34, $P<0.001$). Respondents who used river water (OR = 2.48, $P=0.005$) and lake or dam water (OR = 3.33, $P=<0.001$) were at higher risk of urinary schistosomiasis infection. Furthermore, respondents swimming or playing in river water had higher risk of urinary schistosomiasis infection history (OR = 1.62, $P=0.005$).

Conclusions There was knowledge gap in schoolchildren about urinary schistosomiasis causes, transmission, symptoms and prevention. Therefore, appropriate health education and behavioral change intervention is needed to create better knowledge and practices in children to prevent and control urinary schistosomiasis. Health organizations and policy makers should contribute to improve knowledge at the school as well as community level.

Keywords Urinary schistosomiasis, Knowledge, Attitude, Practices, Schoolchildren, Ethiopia

*Correspondence:
Ketema Deribew
ketemader@gmail.com
[1]School of Medical Laboratory Sciences, Jimma University, Jimma, Ethiopia
[2]Tropical and Infectious Diseases Research Center, Jimma University, Jimma, Ethiopia

Introduction

Schistosomiasis is a tropical disease affecting mainly tropical and subtropical areas [1]. Globally, more than200 million people are infected and more than 700 million people are at risk [2, 3]. Schistosomiasis is caused by six species of schistosome i.e. *Schistosoma mansoni*, *Schistosoma haematobium*, *Schistosoma japonicum*, *Schistosoma intercalatum*, *Schistosoma mekongi* and *Schistosoma guineesis* [4]. Among these six species, *S. mansoni* and *S. haematobium* are widely distributed in Africa and cause intestinal schistosomiasis and urinary schistosomiasis, respectively [5, 6]. Schistosomiasis is greatly affecting people living in rural and peri-urban areas [7] since they have no access to clean water and have poor sanitation [8, 9].

Schistosomiasis has received little attention particularly in Sub-Saharan Africa (SSA) perhaps because of its mortality rate is considered low compared with many other infectious diseases. But effort to control this disease is growing up [10]. World Health organization (WHO) is encouraging countries to deworm schoolchildren and communities at high risk annually [11] and set goals to control schistosomiasis morbidity and achieving elimination in all endemic countries by 2025. By 2009, 21 countries initiate schistosomiasis control programs [12]. Even though several efforts are done to control morbidity with specific school-based treatment of primary schoolchildren [12], knowledge, attitude and practices (KAPs) of community had major role to control and prevent the disease. Improved sanitation, drug treatment, and health education reduces transmission and re-infection [13].

Ethiopia has conducted schistosomiasis mapping survey in all regions of the country. The national control program was prepared to achieve elimination of schistosomiasis as main public health problem (2020) and to achieve transmission break by 2025. Two forms of schistosomiasis (intestinal and urinary) are the major public health problem of the country. According to Kassa et al. [14] both *Schistosoma. haematobium* and *Schistosoma mansoni* are endemic in Ethiopia. *Schistosoma mansoni* is widely distributed whereas S. *haematobium* is restricted in lowland areas such as Kurmuk district, middle and lower Awash valley, Wabe-Shebele valleys [15] and in Abobo district [16].

In Ethiopia nationwide mass drug administration (MDA) launched in 2015 against soil transmitted helminthiasis (STH) and schistosomiasis and targets 17 million school-aged children (5–14 years). About 56 million people live in schistosomiasis endemic areas in Ethiopia. Schoolchildren carry the majority of schistosomiasis morbidity, which impairs their nutritional, physical and mental development [17].

The WHO recommends that schoolchildren should be the focus group in the control of schistosomiasis and be the study population for the baseline study [18].

Awareness of the community and involvement are cardinal tools for the success and sustainability of any disease control program [19]. In Ethiopia, data on KAPs of schoolchildren with regard to urinary schistosomiasis are scarce and limited. Therefore, this study aims to assess schoolchildren knowledge, attitude and practices on urinary schistosomiasis in three urinary schistosomiasis endemic districts of Ethiopia.

Material and method

Study area

This study was conducted in urinary schistosomiasis endemic districts: Amibara district, Kurmuk district and Abobo district [Fig. 1]. Hassoba village is about 290 km from Addis Ababa, Kurmuk is about 878 Km and Abobo is 822 km from Addis Ababa.

Study design

A cross-sectional study was conducted using schoolchildren during 10 February to May 30, 2022.

The study population

The study population was selected based on previous studies showing endemicity of urinary schistosomiasis in the districts. In these districts, six primary schools were selected with total 2,694 schoolchildren.

Sampling procedure

Purposively three districts selected because in these districts urinary schistosomiasis is reported [15, 16, 22]. Eight villages from 55 villages chosen purposively for the study. Selection is based on endemicity for the disease and village location to irrigation canals, dam water, rivers, marshy areas, and streams. Therefore, schoolchildren with 5 to 15 years of age were considered eligible for this study. Using student registration book as a sampling frame, samples were taken randomly.

Sample size determination

Sample size was determined using the formula:

$$n = \frac{(z)^2 p(1-p)}{d^2}$$

and taking the none response 10%, where n is the sample size, Z is 95% confidence interval (1.96), P is expected prevalence (referring to previous prevalence of *S. haematobium*) and d is precision or margin of error (5%) [20]. Accordingly, urinary schistosomiasis prevalence was 37.0% in Hassoba [21], 50% in Kurmuk and 35.9% in Abobo [16]. A total of **1,171** participants taken from such

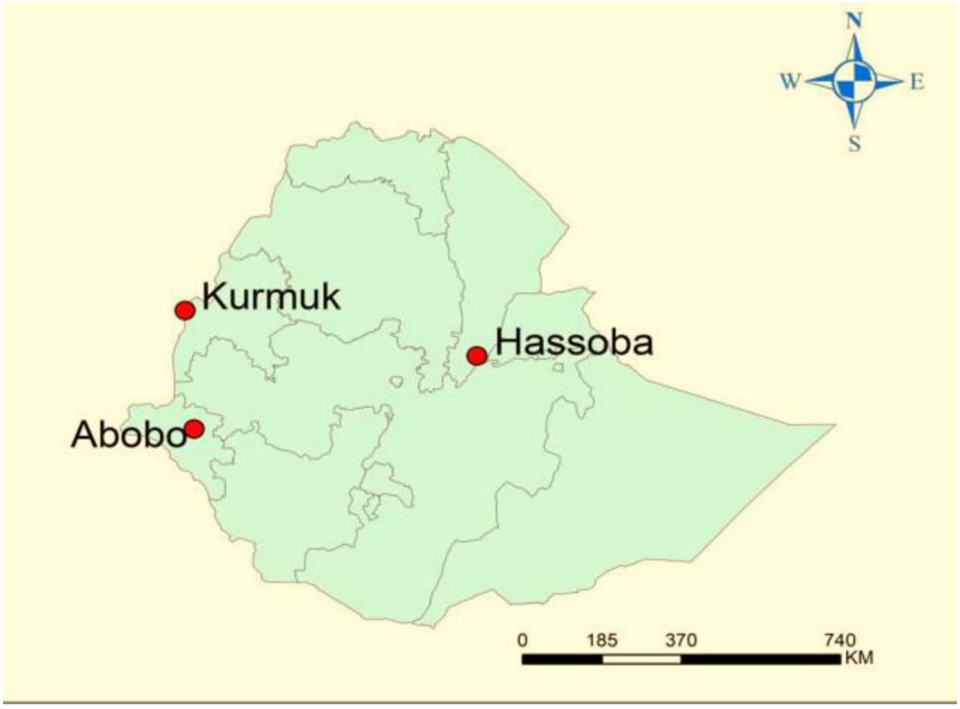

Fig. 1 Map of Study areas

areas. That is **389** from Abobo, **387** from Hassoba, and **395** from Kurmuk.

Questionnaire survey

Questionnaire prepared in English and then translated to local language (Amharic, Agnua, Afar, and Berta language). Pretested structured questionnaires were administered with closed ended questions. Participants asked about their age, sex, socio-economic status, household water source, location (residence), history of schistosomiasis infection and anti-schistosomal treatment. Moreover, schoolchildren knowledge, attitude towards schistosomiasis, and risky practice regarding urinary schistosomiasis infection was assessed by questionnaire. The socioeconomic status of the study participants was classified by assessing household assets, housing materials, water source and sanitation facilities, ownership of land or livestock and monthly household income in local currency.

Data analysis

Data were entered in to Microsoft Excel spreadsheets and analysed using SPSS statistics version 20.0 (IBM corporation, NY, USA). Knowledge about schistosomiasis, attitude and practices were analyzed in proportions and Chi square test and logistic regression was used to test associations between variables. Association between different variables were analyzed using odds ratio. P-value less than 0.05 at 95% CI was considered statistically significant.

The schoolchildren involved in the study voluntarily. During data collection children were informed and guided to apply COVID-19 prevention control protocols.

Result

Socio-demographic characteristics of the respondents

Among the total 1171 respondents, 50.2% were males and 49.8% females. The ages of the participants ranged 5–15 years with a mean age of 12 ± 1.94 years. The majority of schoolchildren were in age group of 14–15 (57.8%). About one-fourth of the participants had relatively low socioeconomic level. Of the total study participants, 162 (13.8%) depend on river, dam/lake and stream water for domestic consumption. A total of 833 respondents had history of urinary schistosomiasis infection. Among this,374 (44.9%) was in Amibara, 281 (33.7%) in Kurmuk and 178(21.4%) in Abobo. Furthermore, 338 (29.9%) had anti-Schistosoma treatment history in the last seven years (Table 1).

Knowledge about urinary schistosomiasis

Table 2 shows knowledge of schoolchildren about urinary schistosomiasis symptoms, causative agent, and transmission and prevention methods. Among the 1,171 participants, 517 (44.2%) participants had heard about schistosomiasis and 654 (55.8%) did not hear about schistosomiasis. The level of knowledge about urinary

Table 1 Socio-demographic characteristics of the study participants in Hassoba, Kurmuk and Abobo primary school children, Ethiopia, 2022

Variable	Response	No. of respondents (%)
Sex	Male	588 (50.2%)
Age group (years)	Female	583 (49.8%)
Socio-economic level	5–7	23 (2%)
Main household water source	8–10	85(7.3%)
Residence of respondents	11–13	386 (33.0%)
History of urinary schistosomiasis while living in the village	14–15	677 (57.8%)
	High	196 (16.7%)
	Medium	668 (57.0%)
History of schistosomiasis treatment while living the village	Low	307 (26.2%)
	Tap/piped	894 (76.3%)
	Well	115 (9.8%)
	River	68 (5.8%)
	Stream	36 (3.1%)
	Lake/dam	58 (5.0%)
	Urban	660 (56.4%)
	Rural	511 (43.6%)
	Yes	363 (31.0%)
	No	833 (71.1%)
	Yes	338 (28.9%)
	No	808 (69.0%)

Table 2 Knowledge of respondents about urinary schistosomiasis in Hassoba, Kurmuk and Abobo primary school children, Ethiopia, 2022

Variables (questions)	Response	*N* (%)
Heard about urogenital schistosomiasis?	Yes	517 (44.2%)
	No	654 (55.8%)
Causes of urinary Schistosomiasis	Schistosoma worms	449(38.3%)
	Growing up	92(7.9%)
	Mosquito	65(5.6%)
	Drinking water used by cattle	147(12.6%)
	Jumping over fire	88(7.5%)
Transmission/Risk factors for contracting urinary schistosomiasis	Don`t know	330(28.2%)
	Contact with feces or urine contaminated water	309(26.4%)
		153(13.1%)
Symptoms of urinary schistosomiasis	Contact with infected person's body	211(18.0%)
		123(10.5%)
Preventive measures for urinary schistosomiasis	Cross water on bare-foot	375(32.0%)
	Consuming unwashed fruits and vegetables	468(40.0%)
		73(6.2%)
	I don't know	114(9.7%)
	Blood in urine	105(9.0%)
	Blood in stool	441 (35.1%)
	Diarrhea	
	Fever and headache	121(10.3%)
	Don`t know	440(37.6%)
	Staying indoors	93 (7.9%)
	No contact with river or dam water	181(15.5%)
		336(28.7%)
	No contact with rain water	
	Eating balanced food	
	Don't know	

schistosomiasis between male and female respondents was similar. Among the 1171 respondents, 449 (38.3%) of the study participants knew that the cause of schistosomiasis is the schistosome worm but 722 (61.7%) did not know the aetiologic agent. About 309 (26.4%) respondents reported that contact with water from a river or dam contaminated with feces and urine are risk factors for contracting urinary schistosomiasis whereas others did not know how the disease is transmitted. Furthermore, 468(40.0%) knew haematuria as the major symptoms of urinary schistosomiasis. Concerning knowledge about prevention of urinary schistosomiasis, 440(37.6%) children said stopping contact with river or dam water help to prevent schistosomiasis transmission whereas others did not know how to prevent urinary schistosomiasis transmission.

Schoolchildren attitudes towards urinary schistosomiasis

Table 3 presents the attitudes of respondents towards urinary schistosomiasis. Among the total study participants, 28.7% strongly believed that schistosomiasis is part of growing up. Majority of respondents (83.5%) reported and agreed defecating by using toilet is necessary. Onethird ofthe total participants agreed that urinating in water was not a risky behaviour. Most of participant s (54.1%) reported that learning about schistosomiasis is important. Of the total participants, 84.6% agreed on going to clinic for treatment when they notice blood in urine. About 45.2% schoolchildren still showed positive attitude for swimming and playing in dam and river water, whatever the risk of schistosomiasis would be. Among the total participants, 55.7% believed that schistosomiasis can reoccur whereas 44.3% respondents disagreed.

Risk practices related to urinary schistosomiasis among schoolchildren

Table 4 presents risk practices towards urinary schistosomiasis. Among the total participants, 746 (63.7%) had reported that they swim/play in dam/river water and the majority was in Amibara (41.7%) and Kurmuk (35.06%). A total of 384 (32.8%) respondents reported that they urinate in dam/river water during playing or swimming and 505 (43.1%) participants claimed that they pass stool and urine in a bush or nearby environment. From the total participants, 261 (22.3%) used always water from a river/dam as main household water source. Most of respondents (70%) reported that they did not wear protective clothes at time of contact with dam or water river. Furthermore, 44.0% of schoolchildren never took anti-schistosomal drugs at school and 13.6% were found actively passing blood in urine. In terms of treatment-seeking behavior, 76.6% of study participants reported that they went to the nearest clinic/health facility for treatment when urinary schistosomiasis symptoms/haematuria

Table 3 The respondents' attitude towards urinary schistosomiasis in Hassoba, Kurmuk and Abobo primary school children, Ethiopia, 2022

Variable(question)	Response *N* (%)			
	SA	A	D	SD
Urinary schistosomiasis is part of growing up	336 (28.7%)	270(23.1%)	274(23.4%)	291(24.9%)
One outgrows urinary schistosomiasis simply	295(25.2%)	285(24.3%)	361(30.8%)	230(19.6%)
Defecating in toilet is very important	693(59.2%)	277(23.7%)	110(9.4%)	91(7.8%)
No problem if I urinate in water	185(15.8%)	214(18.3%)	328(28.0%)	444(37.9%)
It is important to learn about schistosomiasis	633(54.1%)	339(28.9%)	109(9.3%)	90(7.7%)
It is important to periodically screen for schistosomiasis	543(46.4%)	420(35.9%)	131(11.2%)	77(6.6%)
It's important to take anti-schistosomiasis tablet	540(46.1%)	373(31.9%)	146(12.5%)	112(9.6%)
When I see blood in my urine, I should go to hospital	658(56.2%)	332(28.4%)	114(9.7%)	67(5.7%)
I can swim or play in water anyhow	242(20.7%)	287(24.5%)	370(31.6%)	272(23.2%)
Urinary schistosomiasis can reoccur	247(21.1%)	405(34.6%)	291(24.9%)	228(19.5%)

A, agree; **D**, disagree; **SA**, strongly agree; **SD**, strongly disagree

Table 4 Respondents' practices towards urinary schistosomiasis in Hassoba, Kurmuk and Abobo primary school children, Ethiopia, 2022

Variables (questions)	Response (%)		
	A	S	N
Swim and play in river or dam water	230 (19.6%)	516 (44.1%)	425 (36.3%)
Practice of urinating in open water bodies	162 (13.8%)	222 (19.0%)	787 (67.2%)
River or dam water used for household purposes	261(22.3%)	342(29.2%)	568(48.5%)
Boil water for drinking	269 (23.0%)	289 (24.7%)	613 (52.3%)
Cross a river	240 (20.5%)	157 (13.4%)	774 (66.1%)
Use protective clothes when I contact water	352 (30.1%)	231 (19.7%)	588 (50.2%)
When seeing blood in urine, went to healthcare center	601 (51.3%)	296 (25.3%)	274 (23.4%)
Take anti-schistosomiasis deworming tablets at school	262 (22.4%)	394 (33.6%)	515 (44.0%)
Pass stool/urine in a bush or water	238 (20.3%)	267 (22.8%)	666 (56.9%)
Pass blood in urine now	159 (13.6%)	167 (14.3%)	845 (72.2%)

A, always; **S**, seldom; **N**, never

appeared whereas 23.4% did nothing. Only 269 (23.0%) children reported that they used boiled water for drinking always whereas 902 (52.3%) never used boiled water for drinking.

Associations between risk factors and urinary schistosomiasis infection

Risky practices and socio-economic status of schoolchildren (Table 1 & Table 4) are associated with schistosomiasis infection. There was an association between urinary schistosomiasis infection history and low socio-economic status ($P=0.001$). Urinary schistosomiasis infection history was also more associated to rural dweller that urban dweller ($P=0.001$). There was an association between sex and urinary schistosomiasis infection history i.e., males had more infection history than female ($P < 0.001$). There was a strong relation between children who use dam/river water as main household water source and urinary schistosomiasis infection history ($P=0.001$). Swimming and playing practice were strongly associated in male than females ($P < 0.001$) but urination on water showed no difference with gender ($P=0.06$). Blood in urine was significantly associated with respondents age group of 14–15 ($P < 0.001$) but not associated with sex ($P > 0.05$). A respondent who presents blood in their urine are a significant predictor of urinary schistosomiasis infection ($p=0.045$). Majority of school children (74.7%) claimed that they went to healthcare center at time of passing blood in urine but taking anti-schistosomiasis deworming tablets at school was not common practice.

As shown in Table 5, logistic regression analysis showed that male respondents had more risk of having urinary schistosomiasis infection compared to females (OR = 3.01, $P<0.001$). Children in low socio-economic status had higher risk of having urinary schistosomiasis compared to high socio-economic status (OR = 2.81, $P<0.001$). Compared to urban dweller, children in rural area had higher risk of having urinary schistosomiasis (OR = 4.34, $P<0.001$). Respondents crossing river when go to school regularly had risk of 1.8 times than other ($P=0.006$). Respondents who used river water and lake/dam water were at more risk of urinary schistosomiasis infection (OR = 3.33, $P<0.001$ and OR = 2.48, $P=0.005$) respectively. Furthermore, respondents swimming or playing in river water regularly had high risk of urinary schistosomiasis infection history (OR = 1.62, $P=0.005$).

Table 5 Association between respondents' socio-demographic characteristics and practices regarding urinary schistosomiasis infection history, Ethiopia, 2022

Variables		Adjusted odds ratio	95% CI	P value
Gender	Male	3.01	2.24–4.06	*< 0.001*
	Female	Ref	-	-
Socio-economic level	High	Ref	-	-
	Medium	1.37	2.00-3.94	*0.09*
	Low	2.81	0.95–1.97	*< 0.001*
Residence of respondents	Urban	Ref	-	-
	Rural	4.34	3.31–5.69	*< 0.001*
Main household water source	Tap/piped water	Ref	-	-
	Well	1.06	0.68–1.66	*0.78*
	River	2.48	1.29–3.79	*0.005*
	Stream	0.56	0.28–1.12	*0.1*
	Lake/dam	3.33	2.19–4.57	*< 0.001*
Swim/play in river/dam water	Always	1.62	0.75–2.86	*0.005*
	Seldom	1.3	0.97–1.75	*0.07*
	Never	Ref	-	-
Cross a river to school or visiting	Always	1.81	1.18–2.77	*0.006*
	Seldom	1.87	1.31–2.67	*0.001*
	Never	Ref	-	-

Discussion

This study aimed to assess KAPs among primary schoolchildren regarding urinary schistosomiasis in Abobo, Amibara and Kurmuk primary schoolchildren. In such areas, urinary schistosomiasis is prevalent among schoolchildren [16, 21, 22]. In this study, one-fourth of the participants has relatively low socioeconomic status and depends on river, dam/lake and stream water for domestic consumption that might be a hazard for urinary schistosomiasis infection. There is evidence that schistosomiasis affects the poor and the disease infections is especially common among people living in peri-urban or rural areas [7] since they specifically had low socio-economic status with low access to safe water and with poor hygiene and sanitation [8, 9].

Our finding showed that level of knowledge about urinary schistosomiasis between male and female was similar. This is in agreement with the study done in Yemen [23]. In contrast, studies in Zanzibar, Malawi, and Darfur showed that knowledge about the disease was better in male than females [24–26].

This study showed significant difference regarding urinary schistosomiasis infection history between male and female respondents. History of urinary schistosomiasis was associated to males compared to females. This may be attributed to religious and cultural restrictions that limit females' participation in activities such as swimming. Religious and cultural beliefs do not permit females in swimming, in fishing activities or irrigation activities [27, 28] resulting in less chance to be infected.

This study showed that one-third of participants had urinary schistosomiasis infection history and most of them did not get treatment (69%). This might be due to many reasons such as lack of money and not enough awareness about the disease [29, 30].

This study showed 44.2% participants had heard about urinary schistosomiasis but 55.8% had no information / knowledge about schistosomiasis. A systematic review by Sacolo et al. [31] showed lack of comprehensive knowledge relating to schistosomiasis transmission, prevention and control. Similar study showed that limited knowledge, bad attitudes and risky practices in schoolchildren were common [32]. Moreover, KAP study in Zimbabwe showed that misunderstanding about the causes and control of schistosomiasis observed among schoolchildren. Maseko et al. [33] also reported risky practices and some misconceptions among schoolchildren. A study conducted in Yemen also showed that the rural people lack sufficient knowledge regarding the transmission and prevention of schistosomiasis [34]. In this study, majority of schoolchildren had no knowledge of causative agent, symptoms, transmission and prevention of urinary schistosomiasis. These findings are similar with other studies reporting poor knowledge about schistosomiasis in Malawi [35], Zimbabwe [36] and Western Kenya [37]. Our findings disagree with previous studies in Brazil [38], Egypt [39] and Kenya [40] that reported a better knowledge of schistosomiasis among schoolchildren.

This study also revealed misunderstandings about schistosomiasis. Some of respondents believed schistosomiasis is transmitted by mosquito bite and jumping over fire and half of the total respondents believed that when one grows simply developed schistosomiasis. Similar studies in Côte d'Ivoire and Mauritania showed that

knowledge about the disease among the populations was based on their local culture and believes [41].

This study showed higher level of risky practices in schoolchildren regarding urinary schistosomiasis. Majority of children agree that swimming/playing in water and urinating in water had no risk for urinary schistosomiasis transmission. Furthermore, 43.1% of respondents claimed that they defecate in open field that also play a role for transmission of schistosomiasis. This is similar with previous findings conducted in Yemen that reported presence of higher level of risky practices in children [23].

Behavioral change intervention plays main role in practicing schistosomiasis control [42]. Significant achievements in understanding of urinary transmission and individual risk, preventative methods for schistosomiasis, and self-reported changes in risk behaviors were reported by students who had undergone the health education and behavioral changes (HEBC) interventions [54]. Expanding HEBC interventions to schools in high-risk areas and supplementing them with MDA can assist to lower the prevalence of urinary schistosomiasis and increase the likelihood that the disease would finally be eradicated [54].

World Health organization set goal to eliminate schistosomiasis by 2025, with mass drug administration as a main intervention [43]. However, it underscored the need for more focus on snail-related research activities [44]. Though the probability of drug resistance in schistosomes [44], MDA is used as the main pillar to control schistosomiasis. However, only MDA alone cannot help to eliminate schistosomiasis [46, 47]. Therefore, interventions like snail control and education are necessary and implemented side by side with MDA [48, 49]. Best achievement reported China and Egypt in decreasing transmission and morbidity of schistosomiasis [50–52]. School based MDA is important for success with education and the trained personnel working in reducing sources of infection for snails [51, 52]. The same success will be achieved in Ethiopia if an integrated national control approach considers the MDA, snail control and health education. In 2015, Ethiopia launched schistosomiasis control program using school-based MDA. Before MDA intervention urogenital schistosomiasis prevalence was reported as 24.5% [22], and 37% [21] in Hassoba, 35.9% in Abobo [16] and 5.7% in Kurmuk [15]. However, a study conducted after intervention in 2022, reported urogenital schistosomiasis prevalence among schoolchildren in Hassoba, Kurmuk, and Abobo villages as 7.0%, 5.6%, and 24.2%, respectively [53]. Prevalence of urogenital schistosomiasis showed no decline in Kurmuk but a surprising declined in Hassoba and Abobo.

Ethiopia had launched a large-scale nationwide mass drug administration (MDA) in 2015 to controls schistosomiasis. Schistosomiasis control as well as elimination using MDA is difficult since MDA cannot prevent reinfection. Currently, health education and behavioral change intervention have been prioritized in the first among national comprehensive program for schistosomiasis control. In this study, schoolchildren knowledge about schistosomiasis transmission and prevention was poor. Furthermore, several risky practices related to schistosomiasis was reported. Integrated strategies including preventative treatment and morbidity management, health-seeking and risk-reducing behaviors, water, sanitation, and hygiene (WASH), and snail intermediate host management are essential for long-term schistosomiasis control and elimination. Therefore, in Ethiopia the current schoolbased deworming program should be integrated with health education and behavioral change intervention, water sanitation and hygiene, and snail management as national control strategy.

Limitations of the study Some schoolchildren had trouble in answering the questions independently. Some of the responses might have been impacted by the teachers' assistance. Languages applied to carry out the survey are yet another limitation. It's probable that details were lost in the translation process from English to Amharic. Then Amharic to Afargna for Afargna speakers, to Berta for Berta speakers and Anuak language for Anuak speakers, despite the fact that the quality of the translations of data collecting instruments and training materials of researcher was pre-tested.

Conclusions

This study showed that the level of schoolchildren knowledge about urinary schistosomiasis was low. Increasing knowledge among children about schistosomiasis transmission, control and prevention is fundamental. Thus, health education and behavioral change intervention is recommended to create better knowledge about urinary schistosomiasis in schoolchildren. Health organizations and policy makers should contribute to improve knowledge at the school as well as community levels.

Acknowledgements

The author acknowledges the cooperation and support of school children and their parents and guardians in Abobo, Kurmuk and Amibara districts. The author also appreciates Health personnel, head teacher and teachers who participate in this study.

Author contributions

KD: Designed the study, collected the data, analyzed the data and made inputs in manuscript write-up. ZM and DY supervised data collection, critically reviewed the manuscript.

Funding

Financial support for this research was provided by Jimma University for the support of PhD training program. The funder had no role in the study design, data collection and analysis, preparation of manuscript.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethical approval and consent to participate
Ethical approval letter was obtained from ethical review board of Jimma University (Ref No. IHRPGD /3006/18**)** and clinical trial number is not applicable. Permission was obtained from district health officials, head of administrative, the school directors and village leader to conduct this study. Informed written consent was obtained from parents and guardian of schoolchildren. Informed written consent was obtained from the parents/guardian of children and verbal assent from children. Briefly, orientation was given by the principal investigator and school principal in the school meeting to all parents or guardians of children in their local language and they were informed that their participation is voluntary and that they could withdraw their consent at any time and then asked to put their signature on a consent form.

Competing interests
The authors declare no competing interests.

Received: 13 January 2025 / Accepted: 27 February 2025
Published online: 18 April 2025

References

1. Bruun B, Aagaard-Hansen J. The social context of schistosomiasis and its control: an introduction and annotated bibliography. Geneva: WHO; 2008. Available at: https://www.who.int/tdr/publications/documents/social-context-schistosomiasis
2. World Health Organization. Schistosomiasis: number of people treated in 2011. Wkly Epidemiol Rec. 2013;88:81–8. PMID: 23540050.
3. Hotez PJ, Savioli L, Fenwick A. Neglected tropical diseases of the Middle East and North Africa: Review of their prevalence, distribution, and opportunities for control. PLoS Negl Trop Dis. 2012; 6(2):e1475. https://doi.org/10.1371/journal.pntd.0001475.
4. Drudge-Coates L, Turner B. Schistosomiasis-an endemic parasitic waterborne disease. Br J Nurs. 2013; 22(9):S10, S12-4.PMID: 23752571.
5. Colley DG, Bustinduy AL, Secor WE, King CH. Human schistosomiasis. Lancet. 2014;383(9936):2253–64. https://doi.org/10.1016/S0140-6736(13)61949-2.
6. King CH. Parasites and poverty: the case of schistosomiasis. Acta Trop. 2010;113(2):95–104. https://doi.org/10.1016/j.actatropica.2009.11.012.
7. Savioli L, Stansfield S, Bundy DAP, Mitchell A, Bhatia R, Engels D, et al. Schistosomiasis and soil-transmitted helminth infections forging control efforts. Trans R Soc Trop Med Hyg. 2002;96(6):577–9. https://doi.org/10.1016/s0035-9203(02)90316-0.
8. Hotez PJ, Fenwick A, Savioli L, Molyneux DH. Rescuing the bottom billion through control of neglected tropical diseases. Lancet. 2009;373(9674):1570–5. https://doi.org/10.1016/S0140-6736(09)60233-6.
9. Hotez PJ, Molyneux DH, Fenwick A, Kumaresan J, Sachs SE, Sachs JD, Savioli L. Control of neglected tropical diseases. N Engl J Med. 2007; 357(10):1018–27.https://doi.org/10.1056/NEJMra064142. PMID: 17804846.
10. Utzinger J, Becker SL, Knopp S, Blum J, Neumayr AL, Keiser J, Hatz CF. Neglected tropical diseases: diagnosis, clinical management, treatment and control. Swiss Med Wkly. 2012;142:w13727. https://doi.org/10.4414/smw.2012.13727.
11. World Health Organization: Prevention and Control of Schistosomiasis and Soil Transmitted Helminthiasis, Technical Report Series. Geneva: WHO. 2002. Available at: https://apps.who.int/iris/handle/10665/42588
12. World Health Organization. Elimination of schistosomiasis report by the secretariat. A 65thWorld health assembly. Geneva: WHO; 2012. https://apps.who.int/iris/handle/10665/23758. Availabe at.
13. Montresor A, Crompton DWT, Gyorkos TW, Savioli L. Helminths control in school age children: a guide for managers of control programmes. Geneva: WHO; 2002. Available at: https://apps.who.int/iris/handle/10665/42473
14. Kassa L, Omer A, Tafesse W, Taye T, Kebebew F, Beker A, Schistosomiasis. Diploma program for the Ethiopian health center team: Ethiopia public health training initiative. Ethiopia: MOH;2005.Availbe at:https://www.carternter.org/resources/pdfs/health/ephti/library/modules/diploma/schistosomiasisdiploma.pdf
15. Birrie H, Erko B, Medhin G, Balcha F. Decline of urinary schistosomiasis in Kurmuk town, Western Ethio-Sudanese border, Ethiopia. Ethiop Med J. 1996;34(1):47–9. PMID: 8674500.
16. Geleta S, Alemu A, Getie S, Mekonnen Z, Erko B. Prevalence of urinary schistosomiasis and associated risk factors among Abobo primary school children in Gambella regional State, South Western Ethiopia: a cross sectional study. Parasit Vectors. 2015;8:215. https://doi.org/10.1186/s13071-015-0822-5.
17. Picquet M, Ernould JC, Vercruysse J, Southgate VR, Mbaye A, Sambou B. The epidemiology of human schistosomiasis in the Senegal river basin. Trans R Soc Trop Med Hyg. 1996;90(4):340–6.
18. Chandiwana SK, Woolhouse MEJ. Heterogeneities in water contact patterns and the epidemiology of Schistosoma haematobium. Parasitol. 1991;103(3):363–70.
19. Kihara J, Muhoho N, Njomo D, Mwobobia I, Joslyne K, Mitsui Y et al. Drug efficacy of Praziquantel and albendazole in School children in Mwea, Central Province, Kenya. ActaTrop.2007; 102(3):165–71. PMID: 17572368.
20. Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. Gastroenterol Hepatol Bed Bench. 2013;6(1):14–7. PMID: 24834239; PMCID: PMC4017493.
21. .Degarege A, Mekonnen Z, Levecke B, Legesse M, Negash Y, Vercruysse J, et al. Prevalence of Schistosoma haematobium infection among School-Age children in Afar area, Northeastern Ethiopia. PLoS ONE. 2015;10(8):e0133142. https://doi.org/10.1371/journal.pone.013314.
22. Deribew K, Tekeste Z, Petros B, Huat LB. Urinary schistosomiasis and malaria associated anemia in Ethiopia. Asian Pac J Trop Biomed. 2013; 3(4): 307–10. https://doi.org/10.1016/S2221 1691(13)60068-4. PMID: 23620856.
23. Sady H, Al-Mekhlafi HM, Mahdy MA, Lim YA, Mahmud R, Surin J. Prevalence and associated factors of schistosomiasis among children in Yemen: implications for an effective control program. PLoS Negl Trop Dis. 2013;7(8):e2377. https://doi.org/10.1371/journal.pntd.0002377.
24. Kapito-Tembo AP, Mwapasa V, Meshnick SR, Samanyika Y, Banda D, Bowie C, et al. Prevalence distribution and risk factors for Schistosoma haematobium infection among school children in Blantyre, Malawi. PLoS Negl Trop Dis. 2009;3(1):e361. https://doi.org/10.1371/journal.pntd.0000361.
25. Rudge JW, Stothard JR, Basanez MG, Mgeni AF, Khamis IS, Khamis AN, et al. Micro-epidemiology of urinary schistosomiasis in Zanzibar: local risk factors associated with distribution of infections among schoolchildren and relevance for control. Acta Trop. 2008;105(1):45–54.
26. Deribe K, Eldaw A, Hadziabduli S, Kailie E, Omer MD, Mohammed AE, et al. High prevalence of urinary schistosomiasis in two communities in South Darfur: implication for interventions. Parasite Vectors. 2011;4:14. https://doi.org/10.1186/1756-3305-4-14.
27. Evans DS, King JD, Eigege A, Umaru J, Adamani W, Alphonsus K, et al. Assessing the prevalence threshold in school-aged children as indication for treatment of urogenital schistosomiasis in adults in central Nigeria. Am J Trop Med Hyg. 2013;88(3):441–5. https://doi.org/10.4269/ajtmh.12-0511.
28. Senghor B, Diallo A, Sylla SN, Doucouré S, Ndiath MO, Gaayeb L, et al. Prevalence and intensity of urinary schistosomiasis among school children in the district of Niakhar, region of Fatick. Senegal Parasite Vectors. 2014;7:5. https://doi.org/10.1186/1756-3305-7-5.
29. Danso-Appiah A, De Vlas SJ, Bosompem KM, Habbema JD. Determinants of health-seeking behaviour for schistosomiasis-related symptoms in the context of integrating schistosomiasis control within the regular health services in Ghana. Trop Med Int Health. 2004;9(7):784–94. https://doi.org/10.1111/j.1365-3156.2004.01267.x.
30. Danso-Appiah A, Stolk WA, Bosompem KM, Joseph Otchere J, Looman CW, Habbema JD, et al. Health seeking behaviour and utilization of health facilities for schistosomiasis related symptoms in Ghana. PLoS Negl Trop Dis. 2010;4(11):e867. https://doi.org/10.1371/journal.pntd.0000867.
31. Sacolo H, Chimbari M, Kalinda C. Knowledge, attitudes and practices on schistosomiasis in sub-Saharan Africa: a systematic review. BMC Infect Dis. 2018;18(1):46. https://doi.org/10.1186/s12879-017-2923-6. PMID: 29347919; PMCID: PMC5773048.
32. Sacolo H, Chimbari M. Knowledge, attitudes and practices on schistosomiasis in sub-Saharan Africa: a systematic review. BMC Infect Dis. 2018;18:46. https://doi.org/10.1186/s12879-017-2923-6.
33. Maseko TSB, Mkhonta NR, Masuku SKS, Dlamini SV, Fan C-K. Schistosomiasis knowledge, attitude, practices, and associated factors among primary school children in the Siphofaneni area in the lowveld of Swaziland. J Microbiol Immunol Infec. 2018;51(1):103–9. https://doi.org/10.1016/j.jmii.2015.12.003.

34. Sady H, Al-Mekhlafi HM, Atroosh WM, Al-Delaimy AK, Nasr NA, Dawaki S, Al- Areeqi MA, Ithoi I, Abdulsalam AM, Chua KH, Surin J. Knowledge, attitude, and practices towards schistosomiasis among rural population in Yemen. Parasites Vectors. 2015;8:436. https://doi.org/10.1186/s13071-015-1050-8.
35. Poole H, Terlouw DJ, Naunje A, Mzembe K, Stanton M, Betson M, et al. Schistosomiasis in pre-school-age children and their mothers in Chikhwawa district, Malawi with notes on characterization of schistosomes and snails. Parasit &Vectors. 2014;7:153. https://doi.org/10.1186/1756-3305-7-153.
36. Midzi N, Mtapuri-Zinyowera S, Mapingure MP, Paul NH, Sangweme D, Hlerema G, et al. Knowledge, attitudes and practices of grade three primary schoolchildren in relation to schistosomiasis, soil-transmitted helminthiasis and malaria in Zimbabwe. BMC Infect Dis. 2011;11:169. https://doi.org/10.1186/1471-2334-11-169.
37. Odhiambo GO, Musuva RM, Atuncha VO, Mutete ET, Odiere MR, Onyango RO, et al. Low levels of awareness despite high prevalence of schistosomiasis among communities in Nyalenda informal settlement, Kisumu City, Western Kenya. PLoS Negl Trop Dis. 2014;8(4):e2784. https://doi.org/10.1371/journal.pntd.0002784.
38. Uchoa E, Barreto SM, Firmo JO, Guerra HL, Pimenta FG Jr, Costa Le. MF. The control of schistosomiasis in Brazil: an ethno-epidemiological study of the effectiveness of a community mobilization program for health education. Soc Sci Med. 2000; 51(10):1529–41. https://doi.org/10.1016/s0277-9536(00)00052-6. PMID: 11077955.
39. Kloos H, Sidrak W, Michael AA, Mohareb EW, Higashi GI. Disease concepts and treatment practices relating to *Schistosomiasis hematobium* in upper Egypt. J Trop Med Hyg. 1982;85(3):99–107. PMID: 7097828.
40. Musuva RM, Awiti A, Omedo M, Ogutu M, Secor WE, Montgomery SP, et al. Community knowledge, attitudes and practices on schistosomiasis in Western Kenya-the SCORE project. Am J Trop Med Hyg. 2014;90(4):646–52. https://doi.org/10.4269/ajtmh.13-0488.
41. Koffi AJ, Doumbia M, Fokou G, Keita M, Koné B, Abé NN. Community knowledge, attitudes and practices related to schistosomiasis and associated healthcare-seeking behaviours in Northern Côte D'Ivoire and Southern Mauritania. BMC Infect Dis Poverty. 2018;7:70. https://doi.org/10.1186/s40249-018-0453-0.
42. Adoka SO, Anyona DN, Abuom PO, Dida GO, Karanja D, Vulule JM, et al. Community perceptions of schistosomiasis transmission, prevalence and control in relation to aquatic habitats in the lake Victoria basin of Kenya. East Afr Med J. 2014;91(7):23244. PMID: 26862658.
43. World Health Organization. Accelerating work to overcome the global impact of neglected tropical diseases-a roadmap for implementation. Geneva: WHO. 2012. Available at: http://www.who.int/entity/neglected_diseases/
44. Adema CM, Bayne CJ, Bridger JM, Knight M, Loker ES, Yoshino TP, et al. Will all scientists working on snails and the diseases they transmit please stand up? PLoS Negl Trop Dis. 2012;6(12):e1835. https://doi.org/10.1371/journal.pntd.0001835.
45. Seto EY, Wong BK, Lu D, Zhong B. Human schistosomiasis resistance to praziquantel in China: should we be worried? Am J Trop Med Hyg. 2011;85(1):74–82. https://doi.org/10.4269/ajtmh.2011.10-0542.
46. Gray DJ, Mcanus DP, Li Y, Williams GM, Bergquist R, Ross AG. Schistosomiasis elimination: lessons from the past guide the future. Lancet Infect Dis. 2010;10(10):733–6. https://doi.org/10.1016/S1473-3099(10)70099-2.
47. Ross AG, Olveda RM, Chy D, Olveda DU, Li Y, Harn DA, et al. Can mass drug administration lead to the sustainable control of schistosomiasis? J Infect Dis. 2015;211(2):283–9. https://doi.org/10.1093/infdis/jiu416.
48. King CH, Bertsch D. Historical perspective: snail control to prevent schistosomiasis. PLoS Negl Trop Dis. 2015;9(4):e0003657. https://doi.org/10.1371/journal.pntd.0003657.
49. Kariuki HC, Madsen H, Ouma JH, Butterworth AE, Dunne DW, Booth M, et al. Long term study on the effect of molluscicide with niclosamide in stream habitats on the transmission of schistosomiasis mansoni after community-based chemotherapy in Makueni district, Kenya. Parasit &Vectors. 2013;6:107. https://doi.org/10.1186/1756-3305-6107.
50. Liu L, Yang GJ, Zhu HR, Yang K, Ai L. Knowledge of, attitudes towards, and practice relating to schistosomiasis in two subtypes of a mountainous region of the People's Republic of China. Infect Dis Poverty. 2014;3:16. https://doi.org/10.1186/2049-9957-3-16.
51. Wang LD, Chen HG, Guo JG, Zeng XJ, Hong XL, Xiong JJ, et al. A strategy to control transmission of Schistosoma Japonicum in China. N Engl J Med. 2009;360(2):121–8. https://doi.org/10.1056/NEJMoa0800135.
52. Barakat RM. Epidemiology of schistosomiasis in Egypt: travel through time: review. J Adv Res. 2013;4(5):425–32. https://doi.org/10.1016/j.jare.2012.07.003.
53. Deribew K, Yewhalaw D, Erko B, Mekonnen Z. Urogenital schistosomiasis prevalence and diagnostic performance of urine filtration and Urinalysis reagent strip in schoolchildren, Ethiopia. PLoS ONE. 2022;17(7):e0271569. https://doi.org/10.1371/journal.pone.0271569.
54. Person B, Rollinson D, Ali SM, Mohammed UA, A'kadir FM, Kabole F, Knopp S. Evaluation of a urogenital schistosomiasis behavioral intervention among students from rural schools in Unguja and Pemba Islands. Zanzibar Acta Trop. 2021. https://doi.org/10.1016/j.actatropica.2021.105960.

Publisher's note