

# The effectiveness of schistosomiasis health education sessions in primary and secondary schools in Pemba Island, Zanzibar

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## Research article

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## Abstract

Background: Schistosomiasis seriously endangers the health of African people, hinders local economic and social development, and becomes a serious local public health problem. Since 1994, the Zanzibar government has implemented preventive chemotherapy measures, and the infection rate of the population has been declining. However, due to the singularity of prevention and control measures, the current situation of prevention and control of schistosomiasis is still very serious. This study was to analyze the effects of health education sessions in primary and secondary schools in Pemba Island, Zanzibar. Methods: 5 primary and 3 secondary schools were selected, and schistosomiasis health education sessions were carried out. Students were randomly selected for cognitive level test including 8 knowledge questions and 4 behavior questions before and after the sessions, thereafter the effect of health education was evaluated. Result : A total 712 students were sampled before and after the health education in 8 schools. Before the health education session, the awareness rates for schistosomiasis were 64.62% and 68.75% among primary and secondary school, respectively. After the session, the awareness rates increased to 79.74% and 84.70%, and the difference was statistically significant ( $\chi^2 = 8.23$ ,  $P = 0.0041$ ). Before the sessions, the behavioral correctness rates were 63.96% and 54.79% among boys and girls. After the sessions, the behavioral correctness rates increased to 82.83% and 76.58%, and the difference was also statistically significant ( $\chi^2 = 143.84$ ,  $P < 0.0001$ ). Conclusion : The current awareness and behavioral correctness rates of schistosomiasis were low in Pemba Island, Zanzibar, hence health education needs to be strengthened. The schistosomiasis health education sessions can improve the current cognitive level of schistosomiasis for students. Keywords: Schistosomiasis, Health education sessions, Effect analysis, Zanzibar

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## Background

As a neglected tropical disease, Schistosomiasis is endemic in 76 countries and regions in the tropics and subtropics [1, 2]. It is estimated that 200 million people are infected every year and another 800 million people are at risk of infection. Sub-Saharan Africa (SSA) accounts for more than 90% of cases [3, 4]. Schistosomiasis seriously endangers the health of African people, hinders local economic and social development, and becomes a serious local public health problem.

Zanzibar is a part of Tanzania and is located on the east coast of Africa, with two main islands of Unguja and Pemba. Zanzibar is historically a heavily endemic area for schistosomiasis haematobium. Since 1994, the Zanzibar government has implemented preventive chemotherapy measures, and the infection rate of the population has been declining [5, 6]. However, due to the singularity of prevention and control measures, the current situation of prevention and control of schistosomiasis is still very serious. In 2011, According to the survey of 24 school in Zanzibar, the average infection rate of *Schistosoma haematobium* was 8% (0–38%), and that of Pemba was 15% (1–43%) [7].

There are many prevention and control measures for schistosomiasis, including preventive chemotherapy, snail control, environmental and facility improvement, health education, etc. Among these prevention and treatment measures, health education has less investment and good social benefits. It has a high input-output ratio and is an economic and effective prevention and control method. It is also a basic schistosomiasis control strategy in many endemic countries [13]. In China, health education is highly valued in the prevention and control of schistosomiasis. Governments at all levels have adopted and implemented a variety of health education models such as school health education sessions, snail activities and essay competitions, and have achieved good results. These have been widely recognized and praised by the international community and have good reference [14–16].

At present, the prevention and control measures of schistosomiasis in Zanzibar are still based on preventive chemotherapy, and other related measures are less implemented. Some organizations or institutions have mainly carried out KAP surveys in the local areas [17], and also tried some measures for study but the effect is not obvious [18, 19]. The schistosomiasis health education sessions had not yet been effectively implemented in schools and communities.,

The Zanzibar population structure is mainly based on adolescents hence through health education for adolescents, the awareness rate of the population can be improved, and their behavior can be changed, which has a greater effect on controlling or reducing the prevalence of schistosomiasis. The school is a concentrated place for young people, conducting schistosomiasis health education sessions for students in school, is easy to implement, low-cost and easy to evaluate.

This study carried out schistosomiasis health education sessions for students in primary and secondary schools in three Shehias of Pemba Island, Zanzibar. Through the pre- and post-health education, the effects of health education sessions and its feasibility were evaluated in order to find the weak links and, provide the basis for correcting the content and mode of health education.

## Methods

### Location and population

All students in all primary and secondary schools in the Shehias of Mtangani (south), Kiuyu (central), and Wingwi (north), in Pemba island, Zanzibar. This schistosomiasis health education session covered 5 primary and 3 secondary schools in Mtangani, Kiuyu and Wingwi, Pemba Island, Zanzibar. Primary schools consist of grades 1–6, and secondary schools consist of forms 1–4.

### Health education sessions

Different from other forms of health education in the form of games, this schistosomiasis health education sessions are similar to traditional health education classes, but rich in content and form. Compared to the simple knowledge in the textbook, the sessions content is more systematic, it includes the history of *S.haematobia*, the medium, the way of infection, prevention and treatment, and other knowledge of schistosomiasis prevention and control, and the form is more rich, combining video broadcasting, case explanations, questioning and answering and so on. All of this is to enrich the live teaching mode and create a learning atmosphere. The sessions were conducted at selected schools, covering all students in the school. The number of students for class is kept within 100 people. The number of classes is based on the total number of students. The class time is within one hour. The lectures were carried out by the local NTD staff in Swahili, before the lecture, 30–50 students were randomly selected to finish a test of schistosomiasis prevention and control. After the lecture, 30–50 students were randomly selected to accept the same test a week later. The test questions were completely consistent before and after. Through the comparison of before and after, evaluation of the effect of health education was conducted.

The effect indicators include the awareness rate and the behavioral correctness rate of schistosomiasis. The awareness rate refers to the degree of understanding of schistosomiasis in the surveyed subjects. The calculation formula is the correct knowledge of schistosomiasis/the total knowledge of schistosomiasis\*100%; the behavioral correctness rate refers to the correct proportion of schistosomiasis behavior in the survey. The calculation formula is the correct number of behaviors of the respondent/the total number of behaviors of the respondent\*100%.

## Statistical Analysis

Using EpiData3.1 to establish a database, students' test paper was double entered and consistency tested, using SPSS19.0 statistical software for data collation and statistical analysis. The rate was compared using a chi-square test,  $P < 0.05$  was considered statistically significant.

## Results

### Population samples before and after health sessions

A total of 712 questionnaires were distributed in this study. 356 students were tested before health education and another 356 students were tested after health education sessions, and 712 valid questionnaires were returned. The sampled students were grades 3–6 in primary schools and grades 1–3 in secondary schools. There were 163 male students (45.79%) and 193 female students (54.21%) before health education, 182 male students (51.12%) and 174 female students (48.88%) after health education. The average age was 14.65 and 14.83 years before and after the health education. The knowledge and behavior of schistosomiasis prevention and control before and after the health education are shown in table 1.

#### **Table 1: Number of students for questionnaire before and after health education in Pemba island, Zanzibar**

No	Contents	Before health education (n=356)	After health education (n=356)
1	Do you know schistosomiasis?		
	Yes	204	309
	No	144	46
2	What disease is schistosomiasis?		
	Respiratory disease	10	5
	Mental disease	60	52
	Intestinal infection	21	39
	Parasitic disease	260	260
3	What species cause <i>S. haematobium</i> ?		
	Vesicular blood flukes	196	280
	Intestinal worms	44	21
	Leechs worms	71	38
	Mosquito parasites	41	15
4	What's the intermediate host of <i>S. haematobium</i> in Zanzibar?		
	Fly	42	10
	Snail	265	335
	Mosquito	24	6
	Mended	22	5
5	Which of the following pictures is <i>Bulinus globosus</i> ?		
		17	15
		109	195
		114	55
		110	90
6	Where does the <i>Bulinus globosus</i> live in?		
	Sea	15	10
	Land	29	16
	Pond or stream	293	323
7	What's the way that schistosomiasis enters the human body?		
	Nose	28	11
	Mouth	41	16
	Skin	273	327
8	What are the main symptom of <i>S. haematobium</i> infection?		
	High blood pressure (Hypertension)	27	16
	Fever	17	12
	Hematuria	298	311
	Dizzy	8	17
9	What's the way to prevent schistosomiasis?		
	Do not touch the contaminated water	208	291
	Vaccination	54	28
	Wash hands before meal or after pee	48	21
	Don't touch the infected patient	40	12
10	Can schistosomiasis patient be infected again after treatment?		
	Yes	182	231
	No	154	117
11	Do you think schistosomiasis can be treated?		
	Yes	278	297
	No	61	44
12	Do you pee in ponds or streams?		
	Yes	123	32
	No	172	317

Note: There are missing answers, so the total is not necessarily 356

The awareness rate and behavioral correctness rate before health education sessions.

Table 2 shows that the awareness rates of schistosomiasis among primary school and secondary school were 64.62% and 68.75%, and the behavioral correctness rate were 58.24% and 59.77%, respectively. The awareness rates of schistosomiasis among male and female was 65.64% and 67.49%, and the was 63.96% and 54.79%. Only difference of behavioral correctness rate between male and female was statistically significant ( $\chi^2 = 11.895, P = 0.0006$ ).

Table 2 The detail students' awareness and behavioral correctness rate of *S. haematobium* before health education in Pemba island, Zanzibar

Classification	Content	School		Chi-square test	P value	Gender		Chi-square test	P value
		Primary school (n=182)	Secondary school (n=174)			Male (n=163)	Female (n=193)		
The awareness rate	Do you know schistosomiasis?	73(40.11%)	131(75.29%)	5.2520	0.0219	98(60.12%)	106(54.92%)	0.999	0.3176
	What disease is schistosomiasis?	125(68.68%)	135(77.59%)			114(69.94%)	146(75.65%)		
	What species cause S. haematobium?	106(58.24%)	90(51.72%)			83(50.92%)	113(58.55%)		
	What's the intermediate host of S.haematobium in Zanzibar?	136(74.73%)	129(74.14%)			125(76.69%)	140(72.54%)		
	Which of the following pictures is Bulinus globosus?	62(34.07%)	47(27.01%)			43(26.38%)	66(34.20%)		
	Where does the Bulinus globosus live in?	146(80.22%)	147(84.48%)			137(84.05%)	156(80.83%)		
	What's the way that schistosomiasis enters the human body?	144(79.12%)	129(74.14%)			124(76.07%)	149(77.20%)		
	What are the main symptom of S. haematobium infection?	149(81.87%)	149(85.63%)			132(80.98%)	166(86.01%)		
The behavioral correctness rate	What's the way to prevent schistosomiasis?	103(56.59%)	105(60.34%)	0.2830	0.5946	100(61.35%)	108(55.96%)	11.895	0.0006
	Can schistosomiasis patient be infected again after treatment?	97(53.30%)	85(48.85%)			97(59.51%)	85(44.04%)		
	Do you think schistosomiasis can be cured?	138(75.82%)	140(80.46%)			137(84.05%)	141(73.06%)		
	Do you pee in ponds or streams?	86(47.25%)	86(49.43%)			83(50.92%)	89(46.11%)		

## The awareness rate and behavioral correctness rate after health education.

Between primary school and secondary school, the awareness rate of schistosomiasis was 79.74% and 84.70%, with the statistically significant difference, and the behavioral correctness rate was 78.30% and 81.32%. Between male and female students, the awareness rates of schistosomiasis among male and female were 82.69% and 81.61%, and the behavioral correctness rate was 82.83% and 76.58%. The difference of the awareness rate between primary school and secondary school ( $\chi^2 = 11.607$ ,  $P = 0.0007$ ), and the behavioral correctness rate between male and female students ( $\chi^2 = 8.23$ ,  $P = 0.0041$ ) were statistically significant (Table 3).

Table 3 The detail students' awareness and behavioral correctness rate of *S. haematobium* after health education in Pemba island, Zanzibar

Classification	Content	School		Chi-square test	P value	Gender		Chi-square test	P value
		Primary school (n=182)	Secondary school (n=174)			Male (n=182)	Female (n=174)		
The awareness rate	Do you know schistosomiasis?	144(79.12%)	165(94.83%)	11.607	0.0007	164(90.11%)	145(83.33%)	0.498	0.4803
	What disease is schistosomiasis?	134(73.63%)	126(72.41%)			131(71.98%)	129(74.14%)		
	What species cause S. haematobium?	132(72.53%)	148(85.06%)			139(76.37%)	141(81.03%)		
	What's the intermediate host of S.haematobium in Zanzibar?	168(92.31%)	167(95.98%)			169(92.86%)	166(95.40%)		
	Which of the following pictures is Bulinus globosus?	93(51.10%)	102(58.62%)			110(60.44%)	85(48.85%)		
	Where does the Bulinus globosus live in?	162(89.01%)	161(92.53%)			162(89.01%)	161(92.53%)		
	What's the way that schistosomiasis enters the human body?	169(92.86%)	158(90.80%)			166(91.21%)	161(92.53%)		
	What are the main symptom of S. haematobium infection?	159(87.36%)	152(87.36%)			163(89.56%)	148(85.06%)		
The behavioral correctness rate	What's the way to prevent schistosomiasis?	147(80.77%)	144(82.76%)	1.835	0.1755	154(84.62%)	137(78.74%)	8.23	0.0041
	Can schistosomiasis patient be infected again after treatment?	119(65.38%)	112(64.37%)			125(68.68%)	106(60.92%)		
	Do you think schistosomiasis can be cured?	150(82.42%)	147(84.48%)			161(88.46%)	136(78.16%)		
	Do you pee in ponds or streams?	154(84.62%)	163(93.68%)			163(89.56%)	154(88.51%)		

## Comparison of the awareness and behavioral correctness rate before and after sessions.

The awareness rates of schistosomiasis among all students were significant increasing from 66.64% to 82.16% after health education ( $\chi^2 = 179.279$ ,  $p < 0.0001$ ). The behavioral correctness rates were also significant increasing from 58.99% to 79.78% ( $\chi^2 = 143.84$ ,  $P < 0.0001$ ) [Table 4].

For the primary school, the awareness rates were significant increasing from 64.63% to 79.74% ( $\chi^2 = 82.0284$ ,  $P < 0.0001$ ). The behavioral correctness rates were significant increasing from 58.24% to 78.30% ( $\chi^2 = 66.66$ ,  $P < 0.0001$ ). For the secondary school, the awareness rate was significant increasing from 68.75% to 84.70% ( $\chi^2 = 98.238$ ,  $P < 0.0001$ ), and the behavioral correctness rates were also significant increasing from 59.77% to 81.32% (566/696) ( $\chi^2 = 76.757$ ,  $P < 0.0001$ ).

For the boy student the awareness rates were significant increasing from 65.64% to 82.69% ( $\chi^2 = 110.652$ ,  $P < 0.0001$ ). and the behavioral correctness rates were also significant increasing from 63.96% to 82.83% ( $\chi^2 = 62.561$ ,  $P < 0.0001$ ). For the girl student, the awareness rates were significant increasing from 67.49% to 81.61% ( $\chi^2 = 75.493$ ,  $P < 0.0001$ ); the behavioral correctness rates were significant increasing from 54.79% to 65.58% ( $\chi^2 = 75.541$ ,  $P < 0.0001$ ).

Table 4 The total students' awareness and behavioral correctness rate of *S. haematobium* before and after health education in Pemba island, Zanzibar

Classification	All		Primary school			Secondary school			Male		Female				
	Before (n=356)	After (n=356)	Chi-square test	Before (n=182)	After (n=182)	Chi-square test	Before (n=174)	After (n=174)	Chi-square test	Before (n=163)	After (n=182)	Chi-square test	Before (n=193)	After (n=174)	Chi-square test
The awareness rate	1898/2848	2340/2848	179.3	941/1456	1161/1456	82.028	957/1392	1179/1392	98.238	856/1304	1204/1456	110.652	1042/1544	1136/1392	75.493
The behavioral correctness rate	840/1424	1136/1424	143.8	424/728	570/728	66.66	416/696	566/696	76.757	417/652	603/728	62.561	423/772	533/696	75.541

## Discussion

Schistosomiasis is an infectious disease affected by behavioral factors. The frequency of exposure to epidemic water is closely related to its educational level, occupation, and living habits, and is affected by local social and economic factors. The cognition of schistosomiasis is the basis, which affects people's beliefs and behaviors and is an important factor in the infection and transmission of schistosomiasis [20].

In African countries, students have a higher rate of schistosomiasis infection [21], as well as in Zanzibar [22]. Due to the high proportion of local students, through health education, they can quickly improve their cognition and spread relevant knowledge to their peers and family members to increase the awareness rate of the entire population and have a good blocking effect on disease transmission [17, 23].

In this study, we conducted the schistosomiasis health education sessions at eight schools in three Shehais in Pemba Islands, and conducted awareness and behavioral tests before and after health education. Through statistical analysis, we have more accurate understanding of cognition of schistosomiasis and health education mode among Pemba Island students.

First, despite its own efforts and the help of international organizations, the infection rate of schistosomiasis in Zanzibar (Pemba Island) has been declining, but the cognition level of schistosomiasis is still low. The pre-health education showed that the overall awareness rate and the behavioral correctness rates of students were only 66.64% and 58.99%, respectively, which is similar to previous studies in Tanzania, Cameroon, Senegal, Kenya and other countries [24–27].

Second, the difference in awareness rate in pre-health education is mainly between primary and secondary schools ( $\chi^2 = 5.252$ ,  $P = 0.0219$ ), which has no relationship with gender, but the difference is not obvious (secondary school students have higher awareness rate, but Only about 68%); the difference in the behavioral correctness rate is mainly between boys and girls (the behavioral correctness rates of boys is high, but only about 63%), Not related to the type of school; It suggest that whether it is primary school or secondary school students, The overall cognitive level of students is poor, and the systematic health education training and learning should be strengthened, especially in the identification of intermediate host vesicular snails (Q5) and urinary behavior habits (Q10), the students' cognition is weaker and should be improved.

Third, through this systematic health education activity, the overall awareness rate of students has increased from 66.64% to 82.16%. The difference is significant ( $\chi^2 = 179.279$ ,  $P < 0.0001$ ), it increased of 23.29%. The awareness rate of primary school students increased from 64.63% to 79.74%, it increased of 23.38%, and the rate of secondary school students increased from 68.75% to 84.70%, it increased of 23.2%. There are similar situations in terms of behavioral correctness rate, and this suggested that the schistosomiasis health education sessions have a significant effect on the improvement of local students' cognition level of schistosomiasis, and the effect on primary and secondary school students is similar.

In view of the lack of corresponding health education materials and professional teachers in Zanzibar, it is not enough to rely on the health department's employees to carry out health education for local students. In is necessary to carry out schistosomiasis health education in Zanzibar in the future, and improve the local students' knowledge of schistosomiasis prevention and control. Next, Zanzibar health department should provide professional training for the local teachers with the education department, and they can master the knowledge of schistosomiasis. Schools should set up special health education classes, teaching the knowledge of schistosomiasis with full-time or part-time teachers, and then strengthen assessment. The health department can conduct related essay competitions, snail-survey activities and other activities every year, so that to deepen students' understanding of

schistosomiasis. The health department should develop more publicity materials and products [28], through which these knowledge of schistosomiasis prevention and control will reach thousands of families. Students' health education should be constantly carried out and persevered, and the students' cognitive level should be improved through long-term indoctrination.

## Conclusion

The KAP model is one of the modes that change human health-related behaviors. It is also a behavioral intervention theory, which divides human behavior changes into three successive stages: acquiring knowledge, generating beliefs and forming behaviors. Therefore, it takes a certain time to form an effect. Acquiring knowledge is the foundation, and health education is one of the effective ways. Children are ideal candidates because of their plasticity and high acceptability. At present, the cognitive level of schistosomiasis in students in Pemba, Zanzibar is low. Through our study (schistosomiasis health education sessions), the cognitive level of students (awareness rate and behavioral correctness rate) has been significantly changed. Therefore, this method can be recommended to be promoted throughout Zanzibar.

## Abbreviations

*S. haematobium*: *Schistosoma haematobium*; KAP: Knowledge- Attitude-Practice; Shehia: Zanzibar Administrative Village Unit; NTD: Neglected Tropical Disease; SPSS: Statistical Package for the Social Sciences

## Declarations

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## Availability of data and materials

The transcripts used and analysed during the current study are available from the corresponding author on reasonable request.

## Authors' contributions

DCX planned, designed the study, facilitated the fieldwork, collected the data, and wrote the manuscript. WL planned, designed the study, prepared schistosomiasis health education sessions, and contributed significantly to the writing of the manuscript. SJ planned, designed the study, and facilitated the fieldwork. MZH designed the test form, facilitated the fieldwork, collected the data. FK planned, designed the study, and facilitated the fieldwork. XYW facilitated the fieldwork, collected and analysed the data. KY planned, designed the study, and contributed significantly to the writing of the manuscript. All authors read and approved the final manuscript.

## Ethics approval and consent to participate

The field studies did not involve endangered or protected species. All subject enrollment has been signed the informed consent of this study. For all participants who were not adult, a parent or guardian provided informed consent on their behalf. The study was approved by the local government of Pemba Island. In addition, the Ethics Review Committee of Zanzibar approved all studies

described here (ZAMREC/002/MAY/014). Four main principles in research ethics were applied in this study; to cause no harm to the participants, to obtain informed consent, to protect participants, and not to deceive the participants.

## Consent for publication

All participants signed individual consent forms with consent to publish.

## Competing interests

The authors declare that they have no competing interests.

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