Effect of Preventive Interventions on Knowledge, Attitude and Practices Regarding Schistosomiasis among Primary School Children in Osun State, Nigeria: A Quasi- Experimental Study

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Abstract

Background: Schistosomiasis is a neglected tropical disease that disproportionately affects underprivileged populations, especially school-aged children who are frequently exposed to infested water sources. Effective control requires combining treatment with preventive strategies such as health education.

Methods:
This quasi-experimental study assessed the effect of context-specific health education and praziquantel treatment on knowledge, attitude, and risky practices regarding schistosomiasis among primary school children in riverine communities of Osun State, Nigeria. Using multistage sampling, 201 and 203 pupils were recruited into intervention and control groups, respectively. A pre-tested self-administered questionnaire was used to collect data at baseline and post-intervention. The study was conducted in three phases: pre-intervention, intervention (health education sessions and treatment of positive cases), and post-intervention. Data were analyzed with IBM SPSS version 25, using Chi-square to test associations, with significance set at $p < 0.05$.

Results:
The prevalence of schistosomiasis significantly declined in the intervention group, from 16.9% at baseline to 3.6% post-intervention, while no reduction was observed in the control group (15.8% at both baseline and post-intervention). Risky practices slightly decreased in the intervention group (88.1% to 87.0%, $p > 0.05$), whereas they increased in the control group (82.3% to 83.9%). Knowledge improved markedly from 27.9% to 99.5%, and favorable attitudes rose from 68.2% to 80.2% in the intervention group ($p < 0.05$).

Conclusion:
Context-specific health education, combined with treatment of positive cases, significantly reduced schistosomiasis prevalence and improved knowledge and attitudes among school-aged children. This approach is vital for effective schistosomiasis control in endemic communities.

Introduction

Schistosomiasis is a neglected tropical disease prevalent in tropical and subtropical regions, particularly among disadvantaged populations lacking access to clean water and adequate sanitation [1]. Several factors influence its distribution in sub-Saharan Africa, including poverty, socio-cultural practices, climatic conditions, proximity to rivers and lakes, irrigation and dam construction, and recreational water activities such as swimming. School-aged children are especially vulnerable due to frequent contact with rivers, lakes, and dams that serve as habitats for snail intermediate hosts of Schistosoma species [1, 2].

Control measures include providing safe water sources, promoting good hygiene practices such as proper handwashing, and discouraging direct contact with infested waters during domestic or recreational activities. Environmental management, including chemical or biological control of snails,

and mass drug administration with praziquantel for vulnerable groups like school-aged children, are also recommended strategies. Continuous health education tailored to cultural practices remains essential in promoting sustainable prevention [3, 4].

Observational studies in several African countries have consistently shown poor knowledge, unfavorable attitudes, and risky practices among children, which hinder effective schistosomiasis control [5, 6]. Few intervention studies, however, have demonstrated measurable reductions in risky practices and infection prevalence [4]. This indicates a need for context-specific interventions that combine treatment with targeted health education to enhance awareness and preventive practices among children in endemic communities.

This study assessed the effect of context-specific health education and praziquantel treatment on knowledge, attitudes, and risky practices regarding schistosomiasis among primary school children in riverine communities of Osun State, Nigeria. Findings from this study will provide valuable evidence to guide schistosomiasis control programs, inform policy decisions, and promote equity in health by reducing disparities among children in endemic communities. Furthermore, reducing schistosomiasis burden will improve school attendance and educational outcomes, thereby supporting sustainable development.

METHODS

This study employed a quasi-experimental intervention design, conducted among school-aged children in riverine communities of Osun State, Nigeria. The target population consisted of public primary school students in Primaries 4, 5, and 6 from selected riverine communities, chosen due to their increased exposure to risky water-contact practices.

Inclusion Criteria

- Public primary school students in Primaries 4, 5, and 6.
- Students who had not received praziquantel treatment in the 5-6 months preceding the survey period.

Exclusion Criteria

- Students absent during the data collection period.
- Those who had taken praziquantel in the six months prior to the study.
- Children whose parents refused to provide informed consent, or students who declined to assent.

Sample Size Calculation

The minimum sample size was estimated using Corlien's formula for comparing two proportions [7]:

n = [(U+V) ^2 * (P1(1-P1) + P2(1-P2)] / (P1-P2)^2

Where:

n = minimum sample size per group

P1 = Expected prevalence of schistosomiasis post-intervention = 55% (Assumption based on literature)

P2 = Baseline prevalence of schistosomiasis = 40% [8]

V = 1.96 (Z-value for a two-sided significance level of 5%)

U = 0.84 (Z-value for a power of 80%)

$n = [(1.96 + 0.84)^2 * ((0.55*0.45) + (0.40*0.60))] / (0.15)^2$

$n = [7.84 * (0.2475 + 0.24)] / 0.0225$

$n = [7.84 * 0.4875] / 0.0225 \approx 169.8 \approx 170$

The calculated sample size was adjusted upwards to account for potential non-response, yielding a minimum required sample of 184 per group. To ensure robustness, a total of 200 students were recruited for both the intervention and control groups, respectively.

Sampling Technique

A multistage sampling procedure was utilized to select participants based on the endemicity of schistosomiasis infection at the Local Government Area (LGA) and ward levels.

Stage 1: Based on a comprehensive list of LGAs with high/moderate infection prevalence obtained from the State Program Manager for the Control of Neglected Tropical Diseases, two LGAs per senatorial district were selected, resulting in a total of six LGAs.

Stage 2: One ward with a high or moderate level of endemicity was selected from each LGA, resulting in six wards.

Stage 3: Two schools were selected from each ward using simple random sampling, resulting in a total of 12 schools.

Stage 4: The number of students per class (Primary 4-6) was obtained from each selected school. Participants were then selected from each class via proportional allocation and simple random sampling.

Table 1: Selection of study sites based on endemicity

Senatorial	LGA	Wards	Endemicity	Selected Schools	Categories
Osun Central	Olorunda	Ilie	High	St James Pry School.	Non-intervention
				AUD Primary Sch.	Non-intervention
	Odo- Otin	Ore	High	St Gabriel Elementary Sch.	Intervention
				Moslem Community Pry Sch.	Intervention
Osun West	Ejigbo	Isale Osolo	High	DC Primary Sch, Isale Osolo A	Intervention
				DC Pry sch, Isale-Osolo B	Intervention
	Ede North	Olusokan	Moderate	Young Tajudeen Sch. Ojoro A	Non-Intervention
				Young Tajudeen School, Ojoro B	Non-Intervention
Osun East	Ife East	Okerewe	Moderate	St Philips Pry school, Ayetoro	Non-intervention
				Ethiopian Pry Sch, Iyerekere	Non-intervention
	Oriade	Ipetu-Ijesa	Moderate	The Apostolic Sch.	Non-Intervention
				RCM school	Non-Intervention

Ethical Considerations

The study protocol was approved by the Ethical Committee for Research and Planning at the Ministry of Health, Abeere, and the Osun State University Health Research Ethics Committee. Informed consent was obtained from parents/guardians, and assent was obtained from the children prior to enrollment. The principles outlined in the Declaration of Helsinki and the Belmont Report were strictly adhered to throughout the study.

Community entry and sensitization meetings were held with relevant stakeholders, including community leaders, school heads, and members of the Parent-Teacher Association (PTA), to ensure the study was conducted in a culturally sensitive and respectful manner.

Following the post-intervention data collection, the control group received the same health education package and praziquantel treatment as the intervention group.

Study Phases

The study was conducted in three phases between March and October 2024.

Pre-intervention Phase (Baseline Assessment: March 4 – 29, 2024)

A pre-tested, semi-structured, self-administered questionnaire was used to obtain baseline data on knowledge, attitudes, and risky practices related to schistosomiasis in both the intervention and control groups.

To determine the baseline prevalence of infection, urine and stool samples were collected and analyzed.

Urine Analysis: Fresh urine samples were collected in wide-mouth bottles. Each sample was centrifuged at 2000 rpm for 5 minutes. The supernatant was discarded, and the sediment was examined microscopically for *Schistosoma haematobium* ova using x10 and x40 objective lenses. A drop of Lugol's Iodine was added to aid visualization [9].

Stool Analysis: Fresh stool samples were processed using the Kato-Katz technique to detect soil-transmitted helminths and *Schistosoma mansoni*. A portion of sieved stool was placed in a template on a slide, covered with glycerol-soaked cellophane, and examined after clearing. Eggs were counted, and the number per gram of feces was calculated [10].

Intervention Phase (April 8 – May 16, 2024)

All participants in the intervention group who tested positive for schistosomiasis during the baseline survey were treated with praziquantel.

A structured health education program was delivered to all participants in the intervention group, regardless of infection status. The program, conducted by the researcher in both English and Yoruba, focused on the etiology, lifecycle, mode of transmission, symptoms, prevention, and treatment of schistosomiasis, aiming to correct misconceptions and address risky practices. Educational materials included pamphlets and posters. Students were divided into sets of approximately 30. Each set received four sessions, delivered twice weekly over a five-week period. Each session lasted approximately 30 minutes and was scheduled during break periods to avoid disrupting academic activities. Contact details for positive cases and key school personnel (class teachers, head teachers, PTA chairs) were collected for follow-up.

Post-intervention Phase (Evaluation: September 18 – 28, 2024)

The same questionnaire and laboratory procedures used at baseline were re-administered to both the intervention and control groups three months post-intervention to assess changes in prevalence, knowledge, attitudes, and practices.

Ethical Provision of Intervention to Control Group (September 29 – October 11, 2024)

Following post-intervention data collection, the control group received the full health education intervention and praziquantel treatment, using the same materials and protocols.

Data Management and Statistical Analysis

Questionnaires were manually reviewed and sorted. Data were analyzed using IBM SPSS Statistics version 25. Categorical variables were summarized using frequencies and proportions. The Chi-square test was used to assess associations between pre- and post-intervention variables within and between the intervention and control groups. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 404 questionnaires were administered (201 in the intervention group and 203 in the control group) at baseline and retrieved. At the post-intervention assessment, response rates were 95% for both groups (192/201 intervention; 192/203 control).

Socio-demographic characteristics

The socio-demographic characteristics of the intervention and control groups were comparable at baseline (Table 2). Gender distribution was balanced, with 91 (45.3%) males in the intervention group and 105 (51.7%) in the control group. Approximately half of the respondents in both groups were aged 11-13 years (Intervention: 93, 46.3%; Control: 104, 51.2%). The majority were Muslim (Intervention: 172, 85.6%; Control: 156, 76.8%) and of Yoruba ethnicity (Intervention: 194, 96.5%; Control: 187, 92.1%). More than half of the respondents' fathers (Intervention: 109, 54.2%; Control: 105, 51.7%) and mothers (Intervention: 122, 60.7%; Control: 105, 51.7%) had secondary education. Most respondents lived less than 5 kilometers from a health facility (Intervention: 140, 69.7%; Control: 147, 72.4%). No variable showed a statistically significant difference between groups (all $p > 0.05$).

Table 2: Socio-demographic characteristics of respondents

Variable	Intervention		Control		Statistics
	Freq (n=201)	%	Freq (n=203)	%	
Gender					
Male	91	45.3	105	51.7	χ^2=1.68
Female	110	54.7	98	48.3	P= 0.20
Age group					
8-10 years	81	40.3	73	36.0	χ^2= 0.56
11-13 year	93	46.3	104	51.2	P=0.58
14-17 year	27	13.4	26	12.8	
Religion					
Christian	28	13.9	46	22.7	χ^2=4.88
Muslim	172	85.6	156	76.8	P=0.74
Traditional	1	0.5	1	0.5	
Class					
Primary 4	64	31.8	84	41.4	χ^2=4.99
Primary 5	48	23.9	49	24.1	P=0.08
Primary 6	89	44.3	70	34.5	
Ethnicity					
Yoruba	194	96.5	187	92.1	χ^2=4.52
Igbo	1	0.5	5	2.5	P=0.10
Others	6	3.0	11	5.4	
Father's educational level					
No education	8	4.0	12	5.9	χ^2=9.25
Primary	48	23.9	63	31.1	P=0.07
Secondary	109	54.2	105	51.7	
Tertiary	36	17.9	23	11.3	
Mother's educational level					

No education	8	4.0	16	7.9	χ^2=7.90
Primary	49	24.4	68	33.5	P=0.08
Secondary	122	60.7	105	51.7	
Tertiary	22	10.9	14	6.9	
Number of persons in the household					
1-5	44	21.9	60	29.6	χ^2=3.11
>5	157	78.1	143	70.4	P=0.08
Distance from health facility					
<5km	140	69.7	147	72.4	χ^2=8.81
>5km	61	30.3	56	27.6	P=0.08

χ^2 = Chi-square, p = p-value

PRE-INTERVENTION DATA

Knowledge of respondents concerning Schistosomiasis

Awareness of schistosomiasis was similar at baseline, with 57 (28.4%) respondents in the intervention group and 73 (36.0%) in the control group demonstrating good knowledge. This difference was not statistically significant ($\chi^2 = 2.68$, $p = 0.10$).

Attitude towards schistosomiasis

At baseline, more than half of the respondents in both the intervention (116, 57.7%) and control (115, 56.7%) groups held a favourable attitude towards schistosomiasis. The difference between groups was not significant ($p = 0.85$).

Risky practices towards schistosomiasis

A high proportion of respondents engaged in risky practices at baseline (Intervention: 177, 88.1%; Control: 167, 82.3%). This difference was not statistically significant ($\chi^2 = 2.68$, $p = 0.10$). While most had access to a toilet (Intervention: 155, 77.1%; Control: 145, 71.4%), common sites for defecation included open spaces and bushes. No significant association was found between group assignment and risky practices ($p > 0.05$).

Prevalence of schistosomiasis

Prevalence of *Schistosoma Heamatobium* is 34(16.3%) in intervention group and 32 (15.7%) in control group respectively. There was no significant difference between intervention and control group (χ^2 =0.10,

P = 0.75)

POST-INTERVENTION DATA

Knowledge of schistosomiasis

For the overall knowledge, there was a significant improvement from 56(27.9%) to 191(95.0%) in the intervention group (χ^2=215.72, P <0.01) while there were no significant increase in the control group. (Figure 1)

Attitude towards Schistosomiasis

Table 3 provides details of attitude towards schistosomiasis at pre- and post-intervention for both intervention and control group. Overall good attitude towards Schistosomiasis among the intervention group increases from 116(57.7%) to 154 (76.7%) (X^2=7.418, P=0.006) while in the control group, it increased from 115 (56.7%) to 117 (57.6%) which was not statistically significant (p= 0.819).

Table 3: Pre and Post-intervention attitude towards schistosomiasis among intervention and control group

Attitude towards Schistosomiasis	Intervention group (n=201)			Control group (N=203)		
	Pre	Post	Statistics	Pre	Post	Statistics
Schistosomiasis is a very serious disease	144(71.6)	153(76.1)	χ^2 =3.44 P=0.06	162(79.8)	158(82.3)	χ^2 =0.40 P=0.53
It is necessary to prevent infection from bilharzias	163(81.1)	170(84.6)	χ^2 =4.210 P=0.04*	177(87.2)	173(90.1)	χ^2 =0.83 P=0.36
It is my responsibility to prevent infection from bilharzias	154(76.6)	168(83.6)	χ^2 =7.857 P=0.01*	154(75.9)	144(75.0)	χ^2 =0.04 P=0.84
It is important to know whether I have schistosomiasis or not	180(89.6)	189(94.0)	χ^2 =13.520 P<0.001*	174(85.7)	162(84.4)	χ^2 =0.139 P=0.709
It is important to avoid contact with water	161(80.0)	164(81.6)	χ^2 =0.35 P=0.55	169(83.3)	160(83.3)	χ^2 =0.000 P=0.983
Defecating in the toilet is important for my health	190(94.5)	191(95.0)	χ^2 =8.13 P=0.06	197(97.0)	184(95.8)	χ^2 =0.42 P=0.52
I would take action if I found that I had schistosomiasis	174(86.6)	179(89.1)	χ^2 =4.77 P=0.06	187(92.1)	181(94.3)	χ^2 =0.72 P=0.40
Taking medication for schistosomiasis is important for my health	188(93.5)	196(97.5)	χ^2 =0.000 P=1.000	198(97.5)	189(98.4)	χ^2 =0.08 P=0.78
If I find that have schistosomiasis, I should go to hospital	192(95.5)	187(93.0)	χ^2 =1.00 P=0.32	197(97.0)	184(95.8)	χ^2 =0.42 P=0.52
If I find that have schistosomiasis, I should see a traditional health practitioner	76(37.8)	50(24.9)	χ^2 =6.245 P=0.01*	62(30.5)	56(29.2)	χ^2 =0.09 P=0.77
I would wish to get more information about bilharzias	172(85.6)	182(90.5)	χ^2 =9.34 P = 0.05*	183(90.1)	177(92.2)	χ^2 =0.51 P=0.48

χ^2 = Chi-square, p = p-value, *statistically significant

Risky practices about schistosomiasis

Those who indulge in risky practices reduced from 177(88.1%) to 167 (83.1%) in the intervention group after intervention while there was an increase in the control group i.e. 167 (82.3%) to 161(83.9%) in the control group. However, the changes were not statistically significant. There was reduction in the practice open defecation using bushes from 101(58.4%) to 91 (54.8%), inside water 4(2.4%) to 2 (1.2%) as well as near inside stream or river water 3 (1.7%) to 2 (1.2%) in the intervention group.

Prevalence of schistosomiasis

Respondents in the intervention group had a statistically significant reduction in the prevalence of schistosomiasis infection from 34(16.9%) to 7(3.5%) (χ^2=18.505, P< 0.001). In the control group, there was no reduction in the prevalence of schistosomiasis.

DISCUSSION

This study evaluated the impact of a context-specific health education intervention on schistosomiasis knowledge, attitudes, preventive practices, and infection prevalence among Nigerian schoolchildren. At baseline, the intervention and control groups were comparable in demographic characteristics and baseline measures, underscoring the validity of subsequent comparisons. About half of the respondents in both intervention and control group were aged 11–13 years which is the age mostly at risk of contracting schistosomiasis according to studies done in South Africa by Igbenegbu et al [11] and Kabuyaya et al [12] and in Nigeria had 12–15 years and 13 years and respectively.

The pre-intervention assessment revealed poor knowledge of schistosomiasis in both groups, a finding consistent with prior research in similar settings [13, 14, 15, 16]. This knowledge deficit is likely attributable to the predominant use of mass media (radio and television) for awareness campaigns in Nigeria, channels to which many schoolchildren from low socioeconomic backgrounds have limited access. The significant improvement in knowledge within the intervention group post-intervention demonstrates that the school-based health education effectively bridged this informational gap. This supports the integration of such targeted, school-centric education into future public health campaigns.

Furthermore, more than a quarter of respondents initially held unfavorable attitudes toward schistosomiasis control, which can hinder the adoption of preventive behaviors. The intervention yielded a statistically significant positive shift in attitudes within the study group, highlighting the role of education in addressing misconceptions and fostering community engagement in disease control.

Risky practices, particularly open defecation, were prevalent at baseline, a reflection of entrenched customs and a critical lack of sanitation infrastructure, as reported elsewhere [15, 17]. The significant reduction in these practices in the intervention group post-intervention underscores the effectiveness of the health education. However, the persistence of these practices in the control group and their link to environmental factors [15, 18] indicates that education alone is insufficient. There is a concomitant need

for governmental and non-governmental stakeholders to invest in providing alternative water sources and improved sanitation facilities as a fundamental part of schistosomiasis elimination programs.

The baseline prevalence of *S. haematobium* infection was lower than in some studies [19] but higher than in others [4, 20], variations likely explained by differences in ecological settings, water contact activities, diagnostic techniques (molecular vs. microscopic), and uneven distribution of infrastructure. The significant reduction in infection prevalence in the intervention group post-intervention—attributable to the combined effect of health education and treatment of positive cases—exceeded the outcomes of similar interventions [4]. This reinforces the value of a integrated approach combining mass drug administration with behavior change communication.

Conclusion

This study concludes that a context-specific, school-based health education intervention, coupled with treatment of positive cases, significantly reduced schistosomiasis infection prevalence, decreased risky water-contact and sanitation practices, and improved knowledge and attitudes among Nigerian schoolchildren. These findings advocate for the formal inclusion of structured health education into school curricula in endemic areas. For sustained impact, such educational initiatives must be supported by broader policy interventions aimed at improving access to clean water and sanitation infrastructure.

Strengths and Limitations

A key strength of this study is its quasi-experimental design, which provides robust evidence for the intervention's effectiveness and offers a replicable methodology for similar endemic settings. The findings have direct implications for practical disease control strategies.

However, the quasi-experimental design also presents inherent limitations. The non-random allocation of participants introduces the potential for confounding variables, and despite efforts to ensure group comparability, the influence of unmeasured factors cannot be entirely ruled out. Furthermore, the use of microscopy, while standard, is less sensitive than molecular diagnostic techniques, potentially leading to an underestimation of the true infection prevalence. Future research would benefit from a randomized controlled trial (RCT) design and the use of more sensitive diagnostic tools to confirm these findings.

Declarations

Ethical approval

This study was approved by the Ethical Committee for Research and Planning at the Ministry of Health in Abeere and Osun State University Health Research Ethics Committee. Other relevant stakeholders such as community leaders, members of parent teachers association, school headmaster/headmistress were also consulted to ensure that the study was carried out in a culturally sensitive and respectful manner.

The ethical principles and guidelines set out by the Declaration of Helsinki, the Belmont Report, and other relevant documents were followed during the conduct of the study.

Consent for publication

Not applicable

Clinical trial

Not applicable

Availability of data and material

The data for this study is provided within the manuscript

Author's contribution

SO, WA and SCA worked on the study design; SO, EDO and SCA were major contributors in writing the manuscript; SO, ALB, SA, and OA collected data; SO and SCA supervised the project; SO, WA, SCA, EDO, and ARA analyzed the data while SO, SCA and ARA ensured ethical compliance. All authors read and approved the final manuscript.

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Competing interests

The authors know no competing interest for this study.

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Figures

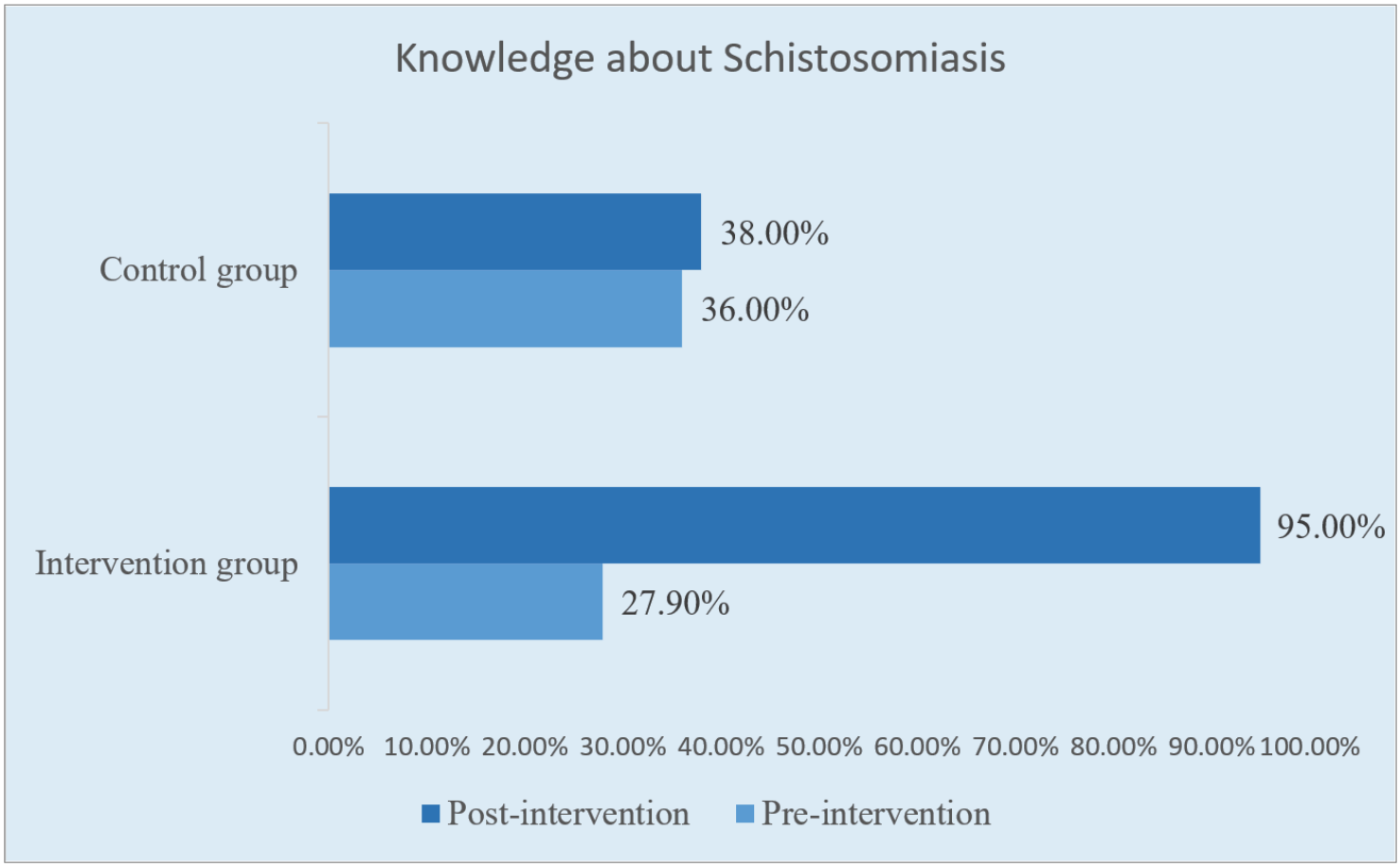

Figure 1

Knowledge about Schistosomiasis at pre and post-intervention