Hydrology: Current Research
ISSN: 2157-7587

Hydrology
Current Research

Peletu et al., Hydrol Current Res 2018, 9:1
DOI: 10.4172/2157-7587.1000289

Research Article Open Access

Transmission of Urinary Schistosomiasis among School Aged Children in Owena, Kajola and Baiken Communities Bordering Owena Reservoir/Dam, Ondo East Local Area, Ondo State, Southwest, Nigeria

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Abstract

Background: Schistosomiasis is a snail-borne, water-based parasitic infection caused by blood-dwelling (hence called blood-fluke) trematode worms of the genus *Schistosoma.* It is a disease of the poor and marginalized. *Schistosomiasis* remains an important public health problem globally with approximately 779 million estimated to be at risk. This study was carried out to ascertain the prevalence of the disease among school children in the three communities: Owena, Kajola and Baiken with a view to providing important parasitological information and boosting can sustainable control strategies of the disease.

Methods: A school based cross-sectional technique was used to collect data on risk factors from 624 school children in March 2014 and 591 in April 2015. Urine samples were collected between the hours of 10:00 am 12:00 pm GMT in dry labeled wide mouthed. Plastic urine container (300-500 ml) each 10 ml was centrifuged and examined for the presence or absence of more nutobiuk eggs. Using X40 objectives of a light microscope. Infection intensity was recorded as number of eggs per 10 ml of urine sample. The intensity of infection was graded as heavy 500 eggs/10 ml urine, moderate (51-499 eggs/10 ml urine) or light (50 eggs/10 ml urine). Data obtained were analyzed using version 20.0 of the Statistical Package for The Social Sciences (SPSS) for windows Software Packages (SPSS on Chicag oil, 2013).

Results: Our of the 624 pupils examined in 2014, 256 (41.0%) were positive for *S. haematobium* eggs in urine, while in 2015, 381 (64.5%) out of 591 were positive. Thus, there was a 23% increase in prevalence between the two genera. Individual intensity of infection varied from 1-6, 468 eggs/10 ml urine. Meaning the most heavily infected pupil in 2015 exceeded more than 68% infection in 2014. The arithmetic memory 2016 in moles was 0.65 in 2015 it was 0.09, while that of females in 2014 was 0.05 and 0.08 in 2015.

Conclusion: This study area in Owena, Kajola and Baiken communities bordering Owena Reservoir/Dam, Ondo East Local Government Area, Ondo State, Nigeria show risk communities for urinary schistosomiasis. The overall pattern of *S. haematobium* eggs per 10 ml urine in the three communities in the two years (March 2014 and April 2015) study shows that it was sex and age dependent. The age-group with highest prevalence is 11-15 years in 2014 and 55.4% in 2015 with range infection for males was 43.6% in 2014 and 71.86 in 2015, while that of females was 37.0% in 2014 and 57.0% in 2015. Therefore, it is recommended that all school-age children especially those in 11-15 age-group should be treated using chemotherapy method. Pipe-borne water to prevent people having contact with the infected fresh water, sewage disposal facilities provided, mass educational therapy (societal sensitization/ health education) is required to reduce infection and transmission of urinary schistosomiasis.

Keywords: *Schistosoma haematobium* urinary; Microhaematuria; Schistosomiasis; School-aged pupil; Ondo State; Nigeria

Introduction

Out of the five schistosomes species infecting humans, *Schistosoma mansoni* and *Schistosoma haematobium* are of great medical importance [1-4]. *Schistosoma haematobium* is found in the venous plexus draining the urinary bladder of human [5,6]. Infection results from the parasite depositing terminal spined eggs which clog the venous plexus, preventing blood flow, which leads to the bursting of the veins, allowing blood and eggs to enter the urinary bladder, resulting to the characteristic symptom of blood in urine, haematuria [6-8].

Chronic pathology and morbidity of urinary shcistosomiasis are caused by eggs trapped in tissues during the pervesical migration or after embolisation (blockage) in the livers spleen, lungs or cerebrospinal system [9,10]. Once in the tissues, the eggs secrete proteolytic enzymes that provoke granulomatons inflammation, ulceration, pseudopolyposis of the vesical and ureteral walls [8,11].

Schistosomiasis is a snail-borne, water-based parasitic infection caused by blood-dwelling (hence called blood-fluke) trematode worms of the genus *Schistosoma* [12]. The infection is now commonly known as bilharziasis; swimmer's itch, snail fever, katayama fever, blood fluke, *Tsargiyya* in Hausa, *Atosiaja* in Yoruba languages in Nigeria [4,8,13-16].

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Received September 19, 2017; **Accepted** October 31, 2017; **Published** January 02, 2018

Citation: Peletu BJ, Ofoezie IE, Olaniyan RF (2018) Transmission of Urinary Schistosomiasis among School Aged Children in Owena, Kajola and Baiken Communities Bordering Owena Reservoir/Dam, Ondo East Local Area, Ondo State, Southwest, Nigeria. Hydrol Current Res 9: 289. doi: 10.4172/2157-7587.1000289

Schistosomiasis, filariasis, leprosy, leishmaniasis, malaria and trypanosomiasis are the six major tropical diseases, specially targeted for control by the Special Programme for Research and Training on Tropical Diseases of the United Nations Development Programme (UNDP), The World Bank and The World Health Organization. [1,3,10,14,15,17,18]. Schistosomiasis is the second important tropical disease inferior to malaria [8].

The distribution of schistosomiasis cuts across 76 countries in African, Latin Ameria and Asia. *Schistosoma haematobium* endemicity cuts across 54 countries in Eastern Mediteranean. *S. mansoni*is endemic in 53 countries of Caribean, South America, the Eastern Mediteranean and Africa. *S. intercalatum*is reportedly endemic in 10 Central African nations [1,3,10].

Ofoezie [13] reported that the disease is endemic in 23 of the 36 states in Nigeria while its status in 13 other states is unknown (i.e., no record does not mean no case). Recent studies have shown that the disease also occurs in some of these states with unknown status e.g., Ondo [3,15,19].

In sub-Saharan Africa there is evidence of a link between the occurrence of human schistosomiasis and several human factors such as religion, primary occupation, educational level, household income, sanitary facilities, principal source of water supply, age variation, distance of river from residence, and the proportion of individuals less than 15 years old in households [20-22]. By consensus, however, the most important driving factor is availability of appropriate water habitats for snail breeding with human water contact patterns, which on its own is driven by poverty and ignorance.

Although, Ondo State has now joined the unenviable list of states where schistosomiasis occurs, epidemiological information of the disease in the state is still very scanty. Ondo State is drained by Owena River and while prevalence of infection has been reported from various communities along some tributaries of the river, there is no information on detailed transmission studies along Owena River itself [3,15,19]. The damming of Owena River since 1966 underscores the importance of elucidating its contribution to schistosomiasis transmission in the State. For instance, studies by Ogbeide et al. [23] show that the reservoir and its tributaries provide water to over 95% of residents in Ondo, Akure and Ado-Ekiti, as well as, several other smaller settlements along their courses. In spite of this, there is no detailed information on schistosomiasis transmission along the river basin. It cannot be over emphasized that no sustainable schisitosomiasis control can be achieved for Ondo State until a clear picture of the status and contribution of Owena River and Owena Reservoir to overall transmission in the state is elucidated. This is the hallmark of this investigation.

No up-to-date thorough work in Nigeria has been done on the transmission of urinary schistosomiasis among school aged children in Owena, Kajola and Baiken Communities bordering Owena Reservoir, Ondo East Local Government Area. The main objective of the study is to determine the prevalence and the intensity of urinary shcistosomiasis in terms of eggs count/110 m/g urine as regards the source of water supply in the three selected communities around Owena Reservoir (Dam) school aged children.

Materials and Methods

Study area

The cross-sectional study was carried out in Owena Reservoir and its adjoining three randomly selected communities (Owena, Kajola and Baiken) which are rural to semi-urban settlement in Ondo East Local Government Area, Ondo State (Figure 1) and lies between 7°00′-7°30^1 N and longitudes 5°00^1-5°30^1 E. Further illustrations are presented in the map of Owena showing OwenaDam and the eight sampling sites of Owena, Kajola and Baiken Communities (Figure 2) and the map of Owena showing Owena Reservoir and the eight sampled sites.

Urine collection and quantification of *Schistosoma haematobium* eggs

A school-based cross-sectional technique was used for urine collection and quantification of *Schistosoma haematobium* eggs [8,24]. This is on the basis that children, especially school aged-children represent the prime reservoir for the schistosome parasites and children are more amenable to mass chemotherapy than adults [10,25]. From the three randomly selected riparian communities, (Owena-Ondo, Kajola and Baiken) three schools (one from each of the communities) were selected on the basis of their proximity to the water bodies [26]. These schools include Owena Communitiy Grammar School, Owena, Ebenezer (Anglican Primary School, Kajola) and St. Peter's (RCM) Primary School, Baiken. Urine collection and examination for *Schistosoma haematobium* eggs were carried out in March 2014 and April 2015.

Data collection

In 2014, urine samples were collected from a total of 624 school aged-children in the three communities combined. In 2015, urine samples were collected from the same above-named schools to the total of 591. The collection and examination of urine samples were carried out using the sedimentation by gravity cum centrifugation technique as described by Asaolu et al. [27-30]. Each pupil was given a clean dry labeled wide mouthed plastic urine container (300-500 ml) to provide a urine sample between the hours of 10 am and 12 pm GMT, the best time interval of eggs deposit in the bladder [10,31]. The urine sample provided was thoroughly mixed before two 10 ml sub-samples were transferred into two separate 30 ml universal sterlin plastic bottles with conical bottom [26,27,32]. Immediately after dividing into two sub-sample, the first of the two subsamples was preserved with a view to preventing the eggs from hatching [8,29] while the second content was assessed for gross (visible) haematuria and micro-haematuria. The first content was preserved with 5 ml of 10% formalin, covered tightly, properly labeled and taken to the parasitology laboratory at the University of Ibadan, Department of Zoology for examination for the presence of *Schistosoma haematobium* eggs.

Laboratory analysis

In the laboratory the preserved urine samples were properly shaken, held in and upward position for at least four hours to allow schistosome eggs settles by gravity in the groove of the conical bottom [27]. The clear supernatant was carefully withdrawn with a needle attached syringe. The remaining content (the sediment) was thoroughly mixed. From each sample, 10 ml of the urine (sediment) was transferred to a centrifuge tube and spun at 5000 revolutions per minute for five minutes in a centrifuge [30]. The supernatant was discarded, and the sediment transferred into a clean grease-free slide, covered with a cover slip and examined microscopically using X40 objective of a light microscope to identity *Schistosoma haematobium* eggs, which is characterized by the presence of a terminal spine. The intensity of infection was graded according to [16,29,30,33] as heavy (≥ 500 eggs/10 m/urine) moderate (51-499 eggs/10 m/urine) or light (≥ 50 eggs/10 ml/urine). Each of the

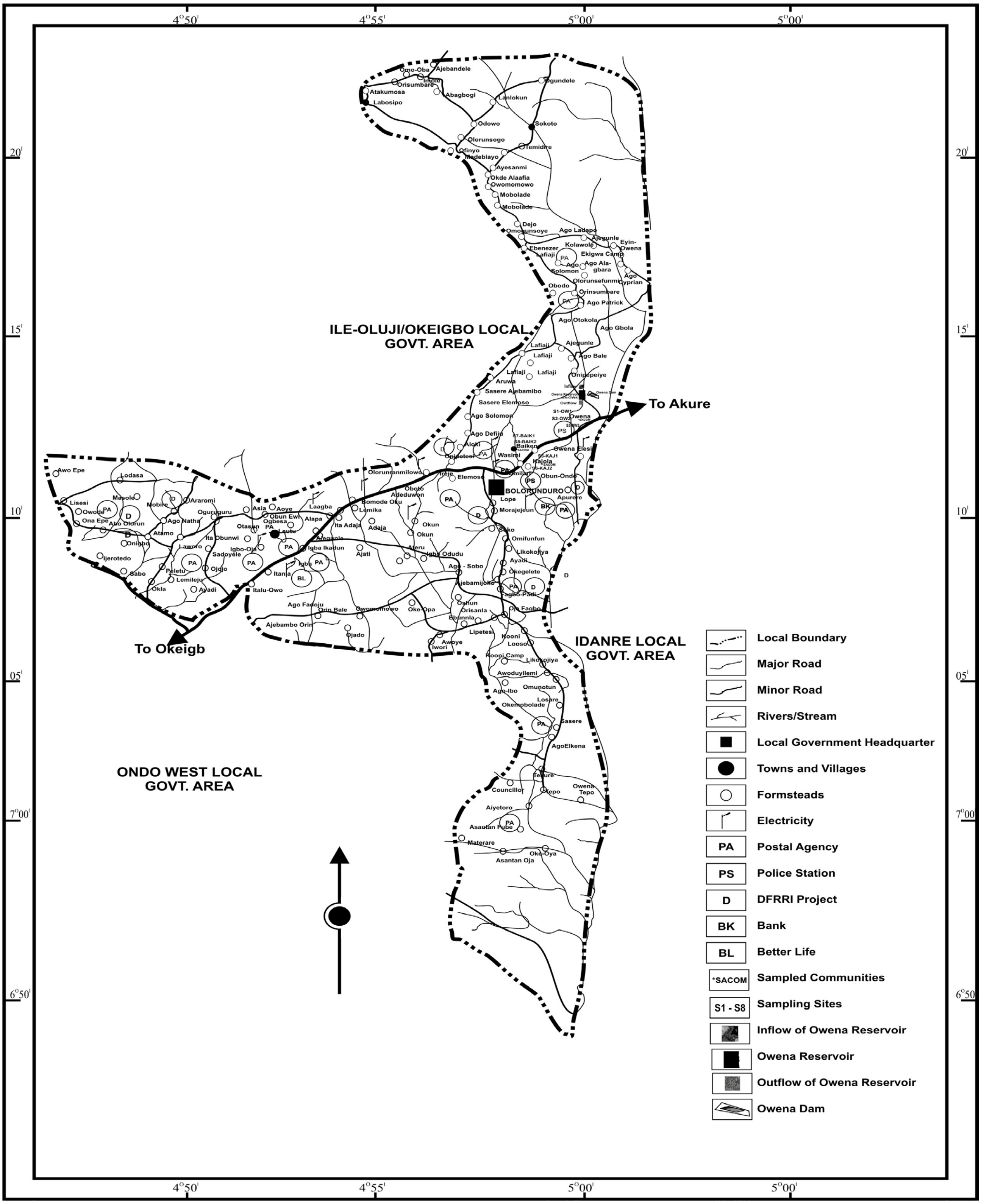

Figure 1: Map of Ondo East Local Government Area, Ondo State, Nigeria, showing Owena Reservoir Area, the three sampled communities (Owena, Baiken, and Kajola), Owena Dam, Owena River and the eight sampling sites. Source: Igboloro and Associates (Planners, Architects and Engineers), 3, Ayodele Awodeyi Street, Ketu, Lagos, Lagos State, Nigeria (2012).

samples was recorded as *S. haematobium* eggs per sediment volume expressed as number of eggs per 10 ml urine [27,34]. Using the second content of the two sub-samples, microhaematuria was assessed. Micro-haematuria was determined using one strip of commercially prepared chemical reagent strips Combur-9, marketed and prepared by Acon Laboratory, USA, dipped into each urine sample and the colour change was matched with standard colours by the side of the container of the reagent strips. Results indicated positive haematuria, which changed the colour of the strip from yellow to light green (light haematuria), deep green (moderate haematuria) or deeper (Heavy green (heavy haematuria) while negative haematuria indicated no colour change of the reagent strip. However, all the positive/negative haematuria results were recorded as either green colour change or no colour change respectively. Other variables such as sex, weight, height, religion, tribe of each pupil was determined. Height was measured with a calibrated pole, with individuals standing barefoot on the flat cemented floors of their classrooms. Body weight was determined using a standard bathroom scale. Religion, tribe and other variable were determined by oral interview of each of the pupils.

Administration of structured questionnaire

Relevant data were collected using interview based on pre-tested well-structured questionnaire in the language preferred by the interviewee, commonly English, Yoruba, Igbo, Hausa and others. From March 2014 to April 2015, 765 questionnaires were administered to school aged-children, some of their teachers and other adult members of the three communities. Out of 765 questionnaires distributed, only 632 (82.6%) were recovered. Out of the 632 questionnaires recovered, 580 (91.8%) was from school aged-children children and 52 (8.2%) from adults in the communities. The questionnaire was used to collect demographic and socio-economic data, with a view to exploring the schistosomiasis-related knowledge perception, attitude, understanding of transmission of each participant [16]. Other variables collected included personal biodata (sex, name, age, marital status, tribe, religion educational background, occupation) period of residency in the communities, source of water supply, access to sanitation facilities (latrine type, water closet, dunghill, open space of defecation). Details of the questions in the questionnaire are presented.

Statistical analysis

The egg counts, the 2-score data of distribution pattern was determined by the kolmogorov-smirnov goodness of fit less for normality, the normal probability plots and/or the Shapiro-Wilk test for normality [35]. Various transformations, since none of these variables were normally distributed, were tested resulting into a logarithmic transformation of eggs positive only. Egg counts. Consequently, data were analysed by parametric tests and the rest by the non-parametric test. Parasitological (Human Infection).

Prevalence of *S. haemtobium* contingency test were used to compare prevalence and reinfection between the three communities, sex, age-groups, occupation, tribe, religion. The multivariate logistic regression analysis was used to determine the relative predictive strength after adjusting for the effect of other variables, since many of these factors were inter-related. The result presented as off ratio which implies the increase in odds of an event when the value of an independent variable increases by one [36].

Intensity of infection

Intensity infection of all analyses were performed only on the log transformed positive egg counts with only geometric mean egg counts presented in the tables. Differences dichotomous (e.g., sex) variable were determined by the student t-test, between more than two-level discrete (e.g., occupation) or categorized continuous (e.g., age groups, variable by one-way analysis of variance. Relationship between egg counts and continuous independent variables (e.g., age) were determined by the Pearson's product moment correlation coefficient [37].

Infection pattern by age and sex

There is significant different (x^2=4.04, df=3 p<0.04). There is significant different in the age group (x^2=0.17, df=1 p<0.02) between males and females.

The overall pattern of *S. haematobium* prevalence in March 2014 and April 2015 are presented in Table 1. Prevalence of infection was highest (55.5%) in the age group 11-15 years in 2014 and least (27%) in the age group 5-10 years old. In 2015, the highest prevalence of 73.09% also occurred among the age bracket 11-15 years old while the least (53.6%) was recorded among the 5-10 years old bracket. Thus, while peak prevalence increased by 17.6%, the least increased by 26.6. As regard sex as a variable, the intensity is sex dependent. In 2014, the prevalence rate of makes was 43.6% in 2014 and 71.9% in 2015, for females, the prevalence rate was 39.0% in 2014 and 57.1% in 2015.

Results

Prevalence and intensity of infection in urine sample

Table 1 summarizes the prevalence and mean intensity ($\log_{10}$ egg counts per 10 ml urine), of infection in different population groups examined. Out of 624 pupils examined in 2014, 256 (41.0%) were positive for *S. haematobium* eggs in urine, while in 2015, 381 (64.5%) out of 591 were positive. Thus, there was a 23% increase in prevalence between the two years. Individual intensity of infection varied from 1-6,468 eggs/ 10 ml urine meaning the most heavily infected pupil in 2015 exceeded more than 68% infection in 2014. The arithmetic means of 2014 in male was 0.65, in 2015 it was 10.09, while that of females in 2014 was 0.5 and 0.8 in 2015.

Table 2 illustrates the infection pattern by communities. In Owena, the prevalence increased from 40.7% in 2014 to 66.8% in 2015. In Kajola communities in 2014 the rate was 37.8%, in 2015, 69.67%. In Baiken communities, the rate was 45.8% in 2014, and 65.8% in 2015. The average rate for each community was 53.8% at Owena, 48.9% at Kajola, and 55.8% at Baiken, indicating that Baiken is the most (55.85%) infected community is the two- year study. This is because Baiken community is at the extreme end from the main road the remotest part of the three communities, lacking pipe born-water system, depending only on natural fresh water bodies, the reservoir, Owena River courses, as well the lowest treatment facilities after being infected with urine schistosomiasis. The overall distribution of infection in the three combined communities is significantly difference (p<0.001).

Prevalence and intensity of haematuria in Owena, Kajola and Baiken (March 2014 and April 2015)

In Owena, for the two-year (March 2014-April 2015) studies the age group that had the high rate of blood in urine (haematuria) was 21-30 years with 49.2%, the least 21-30 years with 37.8%. At Kajola community, age group with the highest rate was 5-10 year with 46.2%, the least 11-15 years with 4.0%, 16-20 years and 21-30 years had no blood in urine. At Baiken community, the age group with the highest prevalence was 11-15 years with 56.2% the least 5-10 years with prevalence of 55.5%. From the above, the community with overall

Variable	Cases	Number Examined		Number Positive		Prevalence (%)		Mean Log10 (eggs/10 ml urine)			
								2014		2015	
		2014	2015	2014	2015	2014	2015	Mean	± St. D	Mean	± St. D
Sex	Male	273	295	119	212	43.59	71.86	145.2	116.93	192.95	112.78
	Female	351	296	137	169	39.03	57.09	175.68	159.54	174.03	119.53
Total		624	591	256	381	41.01	64.46	160.44	126.21	183.49	104.45
x^2							0.17				
Df							1				
P-value							0.02				
Age Group (Years)	5 to 10	263	231	71	123	27	53.25	120.33	125.5	135.75	89.56
	11 to 15	283	275	157	201	55.48	73.09	165.16	113.98	183.03	102.15
	16 to 20	57	41	22	28	38.6	68.29	39.2	17.51	45.76	20.56
	21 to 30	21	44	6	29	28.57	65.91	18.52	11.49	46.3	18.56
x^2							4.04				
Df							3				
P-value							0.04				
Tribe	Yoruba	534	500	215	319	40.26	63.8	263.09	250.36	294.27	219.15
	Hausa	5	7	2	5	40	71.43	15.67	21.13	27.81	37.79
	Igbo	68	65	31	44	45.59	67.69	48.2	18.64	58.9	12.97
	Others	17	19	8	13	47.06	68.42	24.02	20.45	33.47	30.41
x^2							0.69				
Df							3				
P-value							0				
Religion	Christianity	468	450	186	284	39.74	63.11	231.25	217.69	265.7	194.09
	Islam	95	86	38	59	40	68.6	57.67	32.35	71.2	13.69
	Others	61	55	32	38	52.46	69.09	48.49	14.9	54.03	15.57
x^2							0.99				
Df							2				
P-value							0.02				

Table 1: Prevalence and mean intensity log10 (egg count per 10 ml/urine) of *Schistosoma haematobium* infection in different population sub-groups in Owena, Kajola and Baiken Communities (March 2014 and April 2015).

haematuria prevalence was 43.5% was Owena Community the least 45.4%. What would have been accounted for was that Owena school age children are prone to poor treatment and relatively depended for their means of water supply (Table 3).

Table 4 summarizes the community perception of schistosomiasis. A total of 632 school aged individuals were interviewed in respect of their knowledge, attitude, perception and understanding of the symptoms, etiology and mode of transmission of schistosomiasis. Out of these, 592 (93.4%) responded haematuria (blood in urine) was well recognized in the three communities as a sign of urinary schistosomiasis. Danger of blood in urine has no significant difference ($p<0.05$) in the community. Their perception of the risk factors associated with schistosomiasis infection was discovered to vary according to the educational background, tribe, and occupation of respondents. Generally, the more educated people are, tribally the Yorubas, and the civil servants were more likely to see schistosomiasis as a serious health problem than other groups.

About 88.8% of respondents had seen snails around the reservoir, but most were ignorant (88.9%) of the fact that snails were involved in the transmission of urinary schistosomiasis. These variations were significantly different ($p<0.05$). As regards water supply (source of water), most (53.3%) of the residents of the communities made use of river, while the least (2.4%) used pond. Most (91.6%) of the residents used river as sanitary facility. As regards treatment of the disease, most of the residents (62.0%) used self-medication as method.

Discussion

The overall pattern of *Schistosoma haematobium* eggs per 10 m/urine in the three communities in the two-year (March 2014 and April in 1015) study shows that it was sex and age dependent. In this study, the age-group with the highest prevalence was 11-15 years in 2014 and 55.38% in 2015, with range infection of 26.25%. The infection was also sex dependent. The prevalence of infection for males was 43.59% in 2014 and 71.86% in 2015, and while that of females was 37.03% in 2014 and 57.0% in 2015. This is because more males took part in more complete water contact activities such as swimming, bathing with higher duration of contact, than the females in the communities. Those in 11-15 years old age group got themselves involved in swimming, bathing than other groups. Most of the females were not always allowed to swim in the river, with the ignorant belief that the only source of water supply in the communities could be contaminated if women under menstruation wash of bath in the water body. The importance of community on the access to modern water supply. Baiken is at the remotest part of the communities, from the Owena community with few Pipe-borne water. 55.65% of Baiken residents source of water supply is rivers, stream, indicating that they have the highest exposure of water contact than other communities. It may be suggested that, though the two communities Owena and Kajola may be treated, of the disease schistosomiasis, Baiken residents should be mostly treated.

Conclusion

The study concluded that schistosomiasis transmission which was active in the reservoir is a public health concern to the exposed populations was caused by ignorance, poor sanitary facilities, and water supply with intensive water contact patterns.

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Community	Number Examined		Number Positive		Prevalence (%)		Mean Log10 (eggs/10 ml urine)			
							2014		2015	
	2014	2015	2014	2015	2014	2015	Mean	± St.D	Mean	± St.D
Owena	241	229	98	153	40.7	66.8	0.6	± 0.76	0.9	± 0.71
Kajola	217	207	82	126	37.8	60.9	0.51	± 0.69	0.83	± 0.71
Baiken	166	155	76	102	45.8	65.8	0.7	± 0.78	0.95	± 0.75
χ^2						0.272				
Df						1				
Sig.						0.001				

Table 2: The prevalence of Owena, Kajola and Baiken communities (between March 2014 and April 2015). Source: Peletu- Field Survey of Owena Reservoir Area, Owena, Kajola and Baiken communities (between March 2014 and April 2015).

Age group (years)	Total Examined	Number Negative	Number Positive	Prevalence (%)
Owena				
5 to 10	13	8	5	38.46
11 to 15	294	177	117	39.8
16 to 20	98	61	37	37.76
21 to 30	65	33	32	49.23
Kajola				
5 to 10	290	156	134	46.21
11 to 15	134	75	59	44.03
16 to 20	0	0	0	0
21 to 30	0	0	0	0
Baiken				
5 to 10	191	85	106	55.5
11 to 15	130	57	73	56.15
16 to 20	0	0	0	0
21 to 30	0	0	0	0

Table 3: Prevalence of haematuria in Owena, Kajola and Baiken Communities (between March 2014 and April 2015). Source: Peletu- Field Survey of Owena Reservoir Area, Owena, Kajola and Baiken Communities (between March 2014 and April 2015).

Variable	Cases	Owena (n=242)		Kajola (n=203)		Baiken (n=187)		Total		χ^2	*df*	P-value
		No	%	No	%	No	%	No	%			
Period of notice of Blood in Urine	Not Applicable	84	34.71	47	23.15	47	25.13	178	28.2	13.988	8	0.82
	1 Month and Below	23	9.5	27	13.3	23	12.3	73	11.6			
	2 Months to 1 Year	24	9.92	33	16.26	26	13.9	83	13.1			
	2 to 5 Year	98	40.5	91	44.83	83	44.38	272	43			
	6 to 10 Year	13	5.37	5	2.46	8	4.28	26	4.1			
Danger of blood in urine	Very Dangerous	21	8.68	33	16.26	76	40.64	130	20.6	97.04	6	0
	Moderate	49	20.25	36	17.73	19	10.16	104	16.5			
	Not Dangerous	118	48.76	55	27.09	45	24.06	218	34.5			
	Don't Know	54	22.31	79	38.92	47	25.13	180	28.5			
Educational background	None	14	5.79	3	1.48	0	0	17	2.7	555.75	6	0
	Primary	8	3.31	194	95.57	179	95.72	381	60.3			
	Secondary	216	89.26	4	1.97	2	1.07	222	35.1			
	Tertiary	4	1.65	2	0.99	6	3.21	12	1.9			
Ethnic Group	Yoruba	216	89.26	181	89.16	163	87.17	560	88.6	3.024	6	0.806
	Hausa	3	1.24	4	1.97	5	2.67	12	1.9			
	Ibo	22	9.09	18	8.87	19	10.16	59	9.3			
	Others	1	0.41	0	0	0	0	1	0.2			
Snails seen around reservoir/river	Yes	214	88.43	183	90.15	164	87.7	561	88.8	0.629	2	0.73
	No	28	11.57	20	9.85	23	12.3	71	11.23			
Snails responsible for blood in urine	Yes	17	7.02	25	12.32	28	14.97	70	11.1	7.233	2	0.027
	No	225	92.98	178	87.68	159	85.03	562	88.9			
Usual source of water supply	Rain	35	14.46	29	14.29	28	14.97	92	14.6	6.97	8	0.539
	Well	54	22.31	53	26.11	49	26.2	156	24.7			
	River	138	57.02	101	49.75	98	52.41	337	53.3			
	Pond	6	2.48	4	1.97	5	2.67	15	2.4			
	All	9	3.72	16	7.88	7	3.74	32	5.1			

Sanitary facility	Water Cistern/Closet	6	2.48	6	2.96	4	2.14	16	2.5	23.87	4	0
	River	208	85.95	191	94.09	180	96.26	579	91.6			
	Dung Hill	28	11.57	6	2.96	3	1.6	37	5.9			
Treatment for schistosomiasis infection	Treatment at Local Health Officers	16	6.61	5	2.46	17	9.09	38	6	53.213	6	0
	Self-Medication	117	48.35	133	65.52	142	75.94	392	62			
	Other Methods	34	14.05	26	12.81	6	3.21	66	10.4			
	None	75	30.99	39	19.21	22	11.76	136	21.5			
Age Group (Years)	5 to 10	5	2.07	137	67.49	119	63.64	261	41.3	304.69	12	0
	11 to 15	134	55.37	61	30.05	60	32.09	255	40.4			
	16 to 20	38	15.7	0	0	0	0	38	6			
	21 to 30	37	15.29	1	0.49	0	0	38	6			
	31 to 40	12	4.96	1	0.49	3	1.6	16	2.5			
	41 to 50	12	4.96	3	1.48	4	2.14	19	3			
	51 to 60	4	1.65	0	0	1	0.53	5	0.8			

Table 4: Group and community response (%) to questions addressing schistosomiasis transmission patterns in Owena, Kajola and Baiken communities (Owena Reservoir Area) (between March 2014 and April 2015).

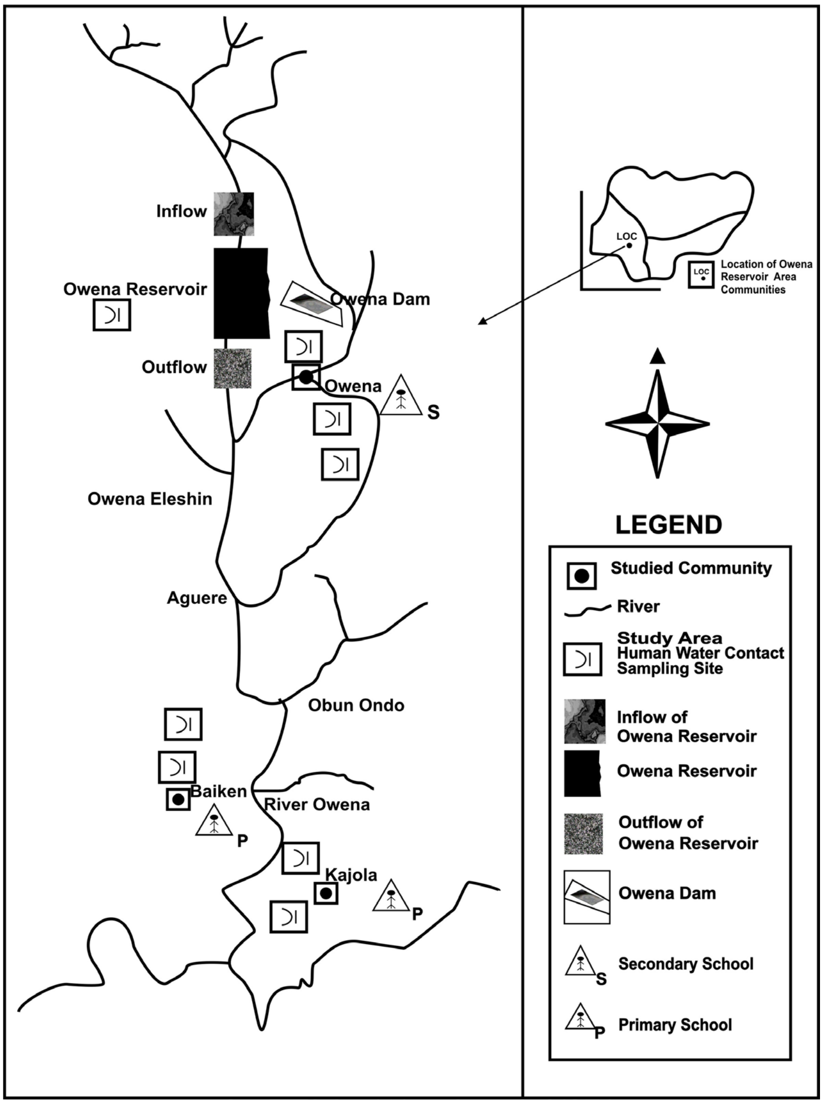

Figure 2: Map of Owena showing Owena Reservoir, Owena Dam, Owena River and the eight sampling sites of Owena, Baiken, and Kajola communities. Source: Adapted from Map of Ondo East LGA, Ondo State, Nigeria- Igboloro and Associates (Planners, Architects and Engineers), 3, Ayodele Awodeyi Street, Ketu, Lagos, Lagos State, Nigeria (2012).

Acknowledgements

The authors express our thanks to the communities' heads, parents, school children, Ondo State Ministry of Education, Teaching Service Commission (TESCOM) for their cooperation in the collection of all the data for this 24 months (August 2013-July 2015).

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