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Prevalence, Peculiarities and Patterns of Urogenital Schistosomiasis and Hematuria in Owena Reservoir Area, Ondo East Local Government Area, Ondo State, Nigeria

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Abstract **Background:** Schistosomiasis, Leprosy, Leishmaniasis, Malaria, Trypanosomiasis and Filariasis are the six major tropical diseases, specially targeted for control by the Special Program for Research and Training on Tropical Diseases of the United Nations Development Programme (UNDP), World Bank and World Health Organization. Out of the above six diseases, schistosomiasis is the second most important tropical diseases, second only to malaria. The distribution of schistosomiasis cuts across 76 countries in Africa, Latin America and Asia. *Schistosoma hematobium* endemicity cuts across 54 countries. **Aim:** To study the prevalence, peculiarities and patterns of urogenital schistosomiasis and hematuria in Owena Reservoir Area for an effective, affordable and sustainable schistosomiasis control in the area. **Materials and methods:** Owena Reservoir Area consists of Owena, Kajola and Baiken communities. A school-based cross-sectional technique was used for urine collection and quantification of *Schistosoma hematobium* eggs which involved 624 pupils in March 2014 and 591 pupils in April 2015. Risk factors, socio-demographic variables were collected using questionnaires. Urine samples were examined for *Schistosoma hematobium* eggs using sedimentation by gravity cum centrifugation. The urine samples obtained from the pupils were divided into two separate 30ml universal sterling plastic bottles with conical bottom. The first of the two 30ml universal sterling plastic bottles were examined for *Schistosoma hematobium* eggs using sedimentation by gravity cum centrifugation. The second of the two 30ml universal sterling plastic bottles were assessed for gross hematuria through visual observation of bloody urine while non-bloody samples were examined for micro-hematuria using one strip of commercially prepared chemical reagent strips COMBUR-9 prepared and marketed by Acun Laboratory USA which was dipped into each urine sample and the color change was matched with standard by the side of the container of the reagent strips. **Results:** Out of the 624 pupils examined in March 2014, 256 (41.0%) were positive for *Schistosoma hematobium* eggs in urine, while in April 2015, 381 (64.5%) out of 591 were positive. Prevalence of hematuria in the three communities shows that in Owena community the age group 21 – 30 had the highest prevalence (49.2%); in Kajola, the age group 5-10 had the highest prevalence (46.2%); while in Baiken community, the age group 5-10 had the highest prevalence (55.5%) – with 95% Confidence Interval in all cases. **Conclusion:** Macrohematuria was identified as a sensitive and specific diagnostic technique for identifying people infected with *Schistosoma hematobium* in the three communities. This parameter may be recommended as a cost saving diagnostic approach during future control efforts, with reference to the April 2015 peculiarities and patterns of infection shown by this study.

Keywords: *Urogenital schistosomiasis, hematuria, macrohematuria, microhematuria, Schistosoma hematobium, Owena Reservoir Area*

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1. Introduction

Schistosomiasis is a snail-borne, parasitic infection caused by blood-dwelling (hence, called blood fluke) trematode worms of the genus *Schistosoma* [1]. The infection is now commonly known as bilharziasis, swimmer's itch, snail fever, katayama fever, blood fluke, *Tsargiyya* in Hausa, *Atosiaja* in Yoruba languages of Nigeria [2,3,4,5,6]. The characteristic symptom of blood in urine (hematuria) results from the entry of blood and eggs into the human urinary bladder as a result of the bursting of veins, due to clogging of the venus plexus which prevent blood flow [6,7,8].

Schistosomiasis remains an important public health problem globally with approximately 779 million estimated to be at risk [6,9]. Within sub-saharan Africa, Nigeria is the country with highest prevalence of human schistosomiasis with about 29 million reported cases in 2008 [9,10]. It is perhaps the most important disease associated with man-made lake and irrigation projects in tropical countries [3,11,12].

There is evidence for a link between the occurrence of human urogenital schistosomiasis and several factors such as knowledge, attitude, perception, behavioural, cultural and religious practices, primary occupation, educational level, household income. All these factors go a long way to influence the transmission of urogenital schistosomiasis in any endemic settlement [13,14,15].

Information on urogenital schistosomiasis transmission and human water contact pattern in Ondo State is scanty despite widespread distribution in some of its neighbouring states [13]. Infections among the people could be managed through chemotherapy. Chemotherapeutic control is used to reduce morbidity in human populations. Out of all the drugs often recommended on their basis of minimal side effects and efficacy, praziquantel is the most widely used, because it is effective against all the species of schistosomes, easily affordable and well tolerated [13].

Urogenital schistosomiasis is highly endemic in three communities (Owena, Kajola and Baiken) of Ondo State, Nigeria [16]. There is a need for sustainable controls targeted towards behavioral modifications by mass sensitization and provision of pipe-borne water facilities and modern toilet systems with a view to discouraging people from having contact with cercacriae-infected water bodies [16].

The aim of this study is to determine the prevalence, peculiarities and patterns of urogenital schistosomiasis and hematuria in Owena Reservoir Area, Ondo East Local Government Area, Ondo State, Nigeria with a view to fashioning out sustainable control strategies of the disease in the study area.

2. Materials and Methods

The study was carried out in Owena Reservoir and its adjoining three randomly selected communities (Owena, Kajola and Baiken) which are rural to semi-urban settlements in Ondo East Local Goverment Area, Ondo State, Nigeria (Figure 1) and lies between latitudes $7^{\circ}00'$ – $7^{0}30^{1}$N and longitudes $5^{0}00^{1}$-$5^{0}30^{1}$E. Further illustrations are presented in the map of Owena showing Owena Reservoir, Owena Dam and the eight sampling sites of Owena, Kajola and Baiken Communities (Figure 2).

2.1. Urine Collection and Quantification of *Schistosoma hematobium* Eggs

A school-based cross-sectional technique was used for urine collection and quantification of *Schistosoma hematobium* eggs [6,9]. This is on the basis that children, especially school age children represent the prime reservoir for the schistosome parasites and children are more amenable to mass chemotherapy than adults [14,17]. From the three studied riverian communities, (Owena, Kajola and Baiken), three schools (one from each of the communities) were selected on the basis of their proximity to the water bodies [11]. These schools include Owena Communitiy Grammar School, Owena; Ebenezer Anglican Primary School, Kajola; and St. Peter's Roman Catholic Mission Primary School, Baiken.

Urine collection and examination for *Schistosoma hematobium* eggs were carried out in March 2014 and April 2015. In 2014, urine samples were collected from a total of 624 school age children in the three communities combined. In 2015, urine samples were collected from the same, above named schools to the total of 591 (made up of 295 males and 296 females). The collection and examination of urine samples were carried out using the sedimentation by gravity cum centrifugation technique as described by [3,18,19,20,21]. Each pupil was given a clean, dry, labelled, wide-mouthed, plastic urine container (300-500ml) to provide a urine sample between the hours of 10am and 12pm GMT, the best time interval of eggs deposit in the bladder [14,22]. The urine sample provided was thoroughly mixed before two 10ml sub-samples were transferred into two separate 30ml universal sterlin plastic bottles with conical bottom [5,11,19].

Immediately after dividing the sample into two sub-samples, the first of the two sub-samples was preserved with a view to preventing the eggs from hatching [6,18] while the second sub-sample was assessed for macrohematuria and microhematuria. Visual observation (the physical appearance of the urine samples color) was used to assess macrohematuria with the positivity based on a bloody red color of the urine, and negativity based on non-bloody color of the urine [18,23]. Microhematuria was immediately determined using one strip of commercially prepared chemical reagent strip COMBUR-9, marketed and prepared by Acon Laboratory, USA, which was dipped into each urine sample and the color change was matched with standard colors by the side of the container of the reagent strips.

Results indicating positive hematuria were characterized as change of the color of the reagent strip from yellow to light green as light hematuria; to deep green as moderate hematuria or to deeper green as heavy hematuria. Negative hematuria indicated no color change of the reagent strip. However, all the positive or negative hematuria results were recorded as either green color change or no color change respectively. Other variables such as sex, weight,

height, religion, tribe of each pupil were 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 variables were determined by oral interview of each pupil.

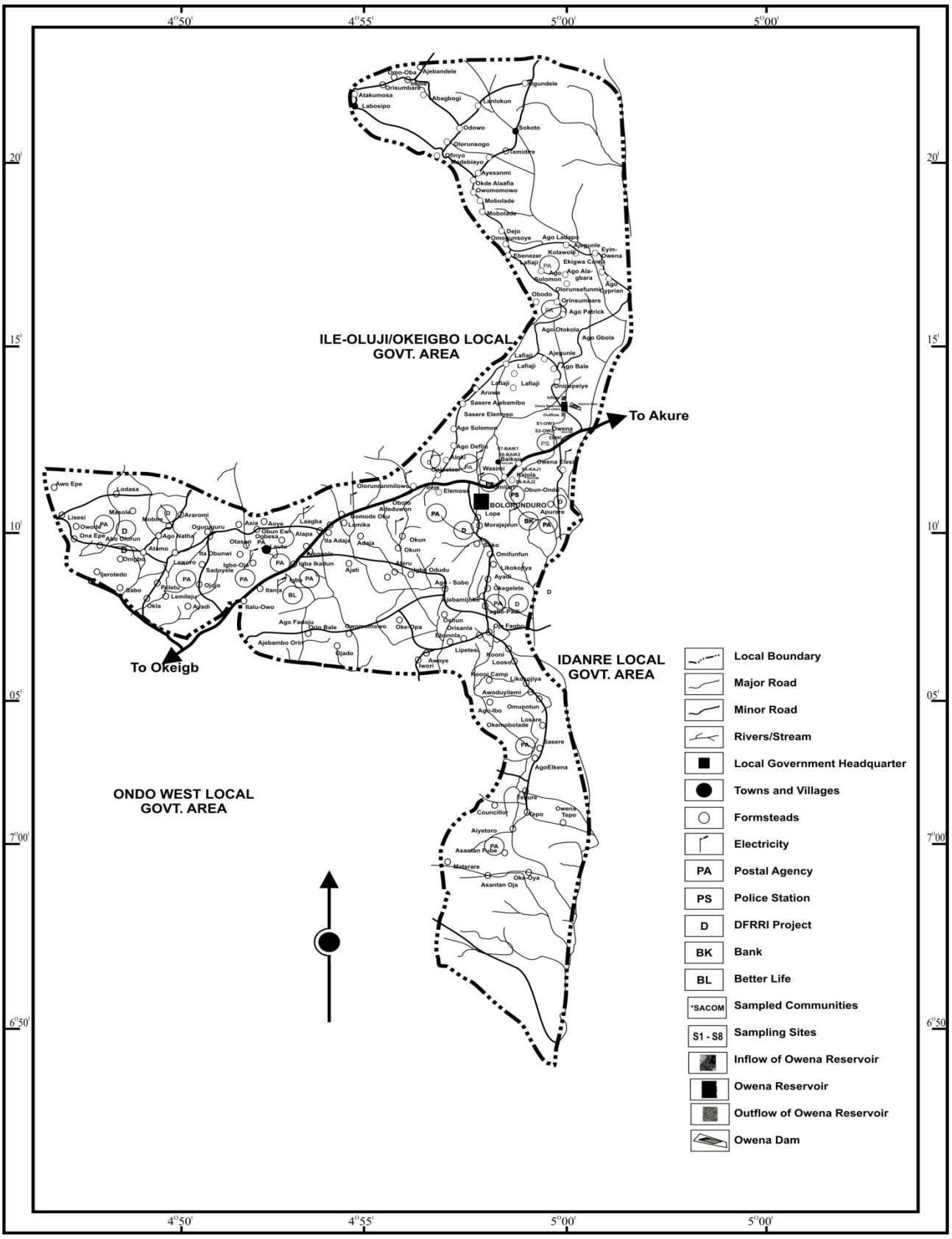

Figure 1. Map of Ondo East Local Government Area, Ondo State, Nigeria, showing Owena Reservoir Area, the three sampled communities (Owena, Baiken and Kajola), Owena Dam, Owena River and the eight sampling sites (Source: Adapted from Map of Ondo East L.G.A., Ondo State, Nigeria - Igboloro and Associates (Planners, Architects and Engineers), No. 3 Ayodele Awodeyi Street, Ketu, Lagos State, Nigeria (2012))

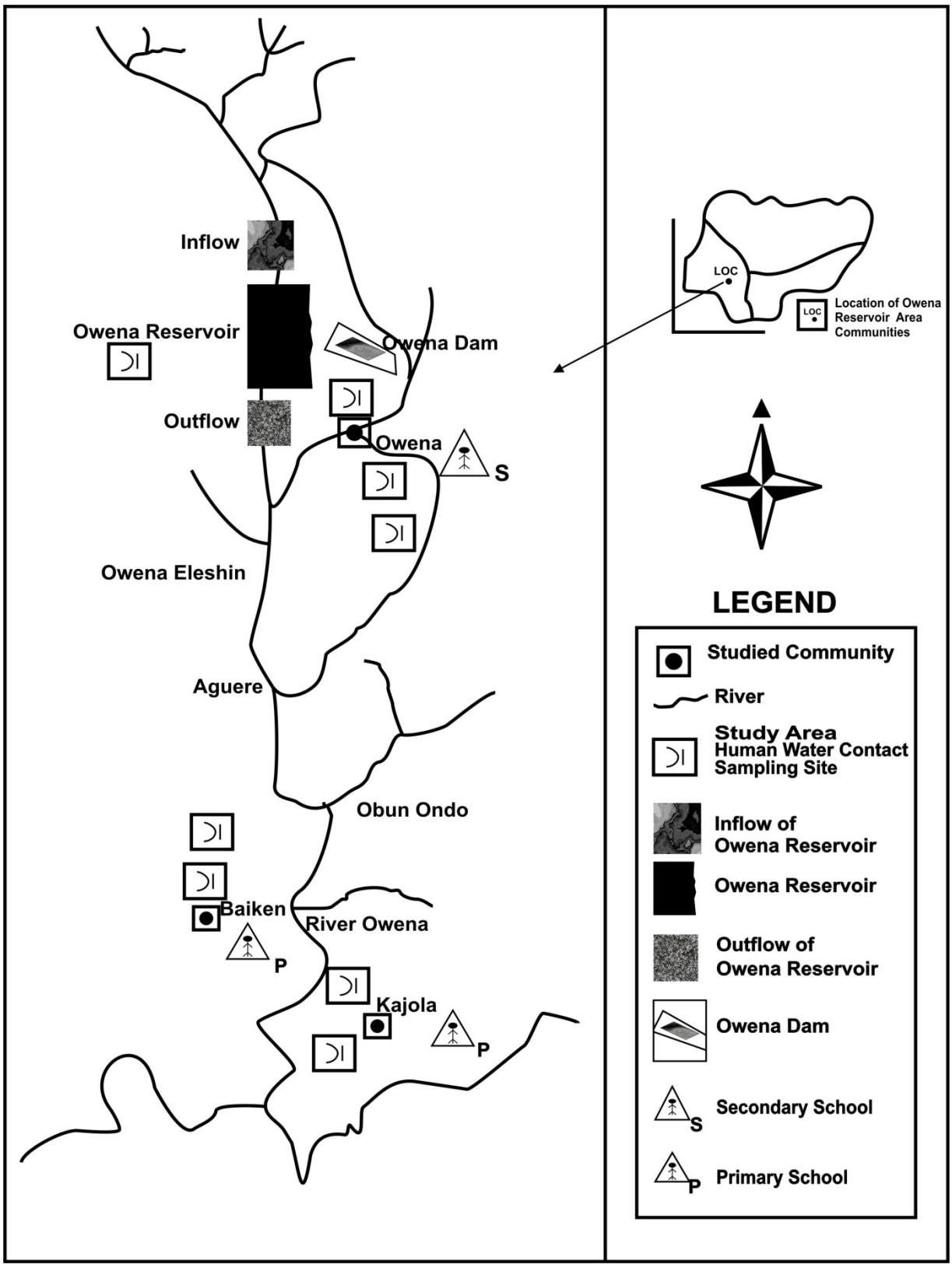

Figure 2. Map of Owena showing Owena Reservoir, Owena Dam, Owena River and the eight sampling sites of Owena, Baiken and Kajola communities (Source: Adapted from Map of Ondo East L.G.A., Ondo State, Nigeria - Igboloro and Associates (Planners, Architects and Engineers), No. 3 Ayodele Awodeyi Street, Ketu, Lagos State, Nigeria (2012))

2.2. Ethical Approval and Informed Consent

Approval for this study was gotten from the Research and Ethics Committee of the Obafemi Awolowo University (OAU), Ile-Ife, Osun State, Nigeria concerning postgraduate studies and research. Laboratory studies were carried out in accordance with the recommendations of the manufacturers of diagnostic test kits and systems using modern laboratory technologies and with due observance of the ethical principles of the Declaration of Helsinki (DoH) in 2013 concerning human research.

Verbal informed consents were gotten as this study was carried out in a rural setting and with very low literacy rate of study participants.

3. Results and Discussion

3.1. Prevalence and Intensity of Hematuria in Owena, Kajola and Baiken communities

In Owena community, the age group that had the highest rate of blood in urine (hematuria) was 21-30 years with 49.2%. The least rate of hematuria was seen in age group 16–20 years with 37.8%.

In Kajola community, age group with the highest rate was 5-10 years with 46.2%, 44.0% was observed in 11-15 years, whereas 16-20 years and 21-30 years age groups had no blood in urine.

In Baiken community, the age group with the highest prevalence was 11-15 years with 56.2%. Prevalence rate of 55.5% was noted in 5-10 years, whereas 16-20 years and 21-30 years age groups had no blood in urine.

From the above, the community with the highest prevalence of hematuria in the 11-15 years was Baiken at 56.2%, and the least was Owena at 39.8% (Table 1).

Table 1. Prevalence of hematuria in 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	38.5
11 to 15	294	177	117	39.8
16 to 20	98	61	37	37.8
21 to 30	65	33	32	49.2
Kajola				
5 to 10	290	156	134	46.2
11 to 15	134	75	59	44.0
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	56.2
16 to 20	0	0	0	0
21 to 30	0	0	0	0

3.2. Peculiarities and Patterns of Hematuria in Owena, Kajola and Baiken Communities

The people in other endemic areas of Nigeria have been found to be commonly ignorant of factors influencing *Schistosoma hematobium* transmission to humans, and hardly know that schistosomiasis is a major public health problem [5,6,24] which is confirmed by the present study. The highly age-dependent exposure in the communities indicates that this may play an important role towards eradicating urogenital schistosomiasis within the three communities. It has now been generally accepted that the strategies of schistosome control should aim at reduction in the infected snail density, wading through infected fresh water bodies unprotected, environmental contamination of streams, rivers, reservoirs, lakes, ponds, dams, and embankments, to a low level of public health implication [5,6,23,25,26,27]. The overall pattern of *Schistosoma hematobium* eggs per 10ml of urine in the three communities also shows that this was sex dependent and age dependent.

In this study, the age group with the highest prevalence was 11-15 years in 2014 (55.38%) and in 2015 (26.25%). The prevalence of infection was also sex dependent. The prevalence of infection for males was 43.59% in 2014 and 71.86% in 2015, and for females, it 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 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 or bath in the water body.

Baiken is the remotest of the communities from the Owena Reservoir Dam with very few pipe borne water supply. The sources of water supply for 55.65% of Baiken residents are rivers, streams, 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 schistosomiasis, Baiken residents should be mostly treated in terms of duration and intensity of treatment. Prevalence, peculiarities and patterns of schistosomiasis and hematuria were also compared to a community ranking and important diseases in the three studied communities done in another study [16] (Table 2).

Table 2. Community ranking and important diseases in the three studied communities (Owena, Kajola and Baiken)

Variable	Cases	Owena (n=242)		Kajola (n=203)		Baiken (n=187)		Total		$\chi 2$	*df*	Sig.
		No	%	No	%	No	%	No	%			
Most important disease in community	Malaria	198	81.82	163	80.30	151	80.75	512	81.01			
	Schistosomiasis	39	16.12	34	16.75	30	16.04	103	16.30	0.662	4	0.956
	Others	5	2.07	6	2.96	6	3.21	17	2.69			
Significance of blood in urine	No infection	22	9.09	0	0.00	0	0.00	22	3.48	57.834	8	0.000
	Infection	24	9.92	30	14.78	50	26.74	104	16.46			
	Menstruation	18	7.44	15	7.39	18	9.63	51	8.07			
	Normal	45	18.60	38	18.72	29	15.51	112	17.72			
	Don’t know	133	54.96	120	59.11	90	48.13	343	54.27			

4. Conclusion

Urogenital schistosomiasis and its concomitant hematuria are prevalent in Owena, Kajola and Baiken communities of Ondo East Local Government Area, Ondo State, Nigeria. In all three communities of Owena, Kajola and Baiken, schistosomiasis would be most difficult to treat and/or eradicate in Baiken community. Efforts by stakeholders should be geared towards implementing full control strategies such as provision of pipe borne water, modern toilet facilities, regular chemotherapy controls to the school age children and adults of age group 21–30 years.

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Conflict of Interest

The authors guarantee responsibility for everything published in this manuscript, as well as the absence of a conflict of interest and the absence of their financial interest in performing this research and writing this manuscript.

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