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Intensity of urinary schistosomiasis on gender-aged group of primary schools children in Sokoto South and Kware Area, Sokoto State, Nigeria

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Abstract. Study was conducted to determine the prevalence of urinary schistosomiasis among school children in three selected primary schools around Sokoto Metropolis, Nigeria. A total of 375 samples of urine examined for the eggs of *Schistosoma haematobium* and *S. mansoni* using standard filtration technique. The prevalence and parasite load of *S. haematobium* were 60.80% and 43.85/10 mL of urine. The prevalence varied among schools, age of children, gender and water contact. The highest prevalence of 75.20% was recorded in Basansan Model Primary School. Age group 9-12 years had the highest (71.42%) prevalence of infection. Males with the prevalence of 79.57% were more infected than females with prevalence of 29.28%. Based on occupation and water contact activities, the result showed that children of farmers had the highest prevalence of 71.50% and 84.87%, children whose source of drinking water is from Dam, had the highest prevalence of 75.24%. The study area is endemic for urinary schistosomiasis with high significant variation ($P < 0.01$) between the prevalence of the infections in almost all the primary schools. Health Education Campaign, treatment of infected individuals, provision of safe water for domestic uses and control of snails' vector should be encouraged.

Keywords: Prevalence; Schistosomiasis; Intensity; Children; Urine analysis; Gender.

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Introduction

Schistosomiasis is a parasitic disease caused by parasitic flat worms called schistosomes. The disease is contacted through contaminated fresh water by parasites that belong to digenic trematode of the genus *Schistosoma*, which resides in the blood vessels of man and livestock. The disease parasites are released from infected freshwater snails. It is common among children in developing countries as they are more likely to play in contaminated water. About 85% of African population is infected with the disease (Chitsulo et al., 2000).

In Nigeria about five species of the genus *Schistosoma* are pathogenic to man, each having a well defined distribution which is important in diagnosis. These species include *S. haematobium*, *S. mansoni*, *S. japanicum*, *S. intercalatum* and *S. mekongi* (Agi and Okafor, 2005). Among which three species, *S. haematobium*, *S. mansoni* and *S. japonicum* account for more than 95% of all human cases of schistososmiasis found in the world (Mutapi et al., 2003).

The disease caused by *S. haematobium* is characterized by bloody urine, lesion of bladder, kidney failure and bladder cancer in children (Foster, 2006), and is the major cause of female genital schistosomiasis (FGS), which is a risk factor for transmission of sexually transmitted diseases and HIV (TDR, 1996); while the *S. mansoni* infection is characterized by bleeding from gastro-oesophageal region, splenohepatomegaly, persistant bloody diarrhoea, pain, growth retardation, delayed sexual maturity and chronic dermatitis (WHO, 1998).

The important target organs for *S. haematobium* eggs are in the urogenital track and the urinary bladder, ureters and the kidney (Ogboli et al., 2001; WHO/TDR, 2005).

The disease is transmitted by several molluscan species of the genus *Bulinus*, *Biomphalaria*, *Planorbis*, *Oncomelania*, *Lymnaea* and *Indoplanorbis* (Tierney et al., 2005). Urinary schistosomiasis was estimated to affect at least 500 million people in 76 tropical and sub-tropical countries (Tierney et al., 2005).

Though the disease kills few people, its clinical effects, prevalence and association with agriculture and water development projects, movement of population and increase in population density makes it a problem of great health importance (WHO, 2010).

However, schistosomiasis affects 200 million persons worldwide, of whom approximately 20 percent are at least partly disabled by the disease (WHO/TDR, 2005). An estimated 500 million to 600 million people are at risk from this disease worldwide (Fenwick, 2012). Of the 239 million people with active *Schistosoma* infections in 2009 (King et al., 2011), 85% lived in Sub-Saharan Africa, where approximately 112 million and 54 million were infected with urinary and intestinal schistosomiasis, respectively, and the number of persons at risk of infection is greater than 600 million (Martyne et al., 2007).

In Africa and Far East Schistosomiasis affects 115 million people; in Nigeria the disease shows some fluctuation in different parts of the country (WHO, 2010).

Globally, the disease is in the increase in both prevalence and incidence and the possible cause of expansion of irrigated agriculture which provide habitats for vector snails, construction of hydro-electricity generated sites, lack of good sanitary habits and safe water for the growing population (Lozano et al., 2012).

In Sokoto South and Kware Areas of Sokoto State, Nigeria, there is insufficient knowledge of factors associated with schistosomiasis transmission such as, poor sanitary habits, and insufficient safe and potable water, which give rise to chances of Schistosomiasis infection (Abiola et al., 2012).

Available literature indicates that there was no documented research work on the schistosomiasis status in the area. Due to the public health importance of the disease there is need to have its complete picture locally in order to provide a baseline treatment and control strategies of the disease.

This research was undertaken to determine and relate the prevalence of urinary schistosomiasis to gender and different age groups of primary schools children in Sokoto South and Kware Local Government Area, Sokoto State, Nigeria.

Material and methods

Study area

The study was conducted in two districts of Sokoto State *viz* Sokoto Metropolis and Hamma Ali. Sokoto town is located on latitude 13° 02” N and longitude 05°’ 13” E in the Upper Northwestern part of Sokoto State covering about 677 km². The area generally experience high temperatures throughout the year, the rainy season lasts from June to September each year (Topographic Sheet, 1990).

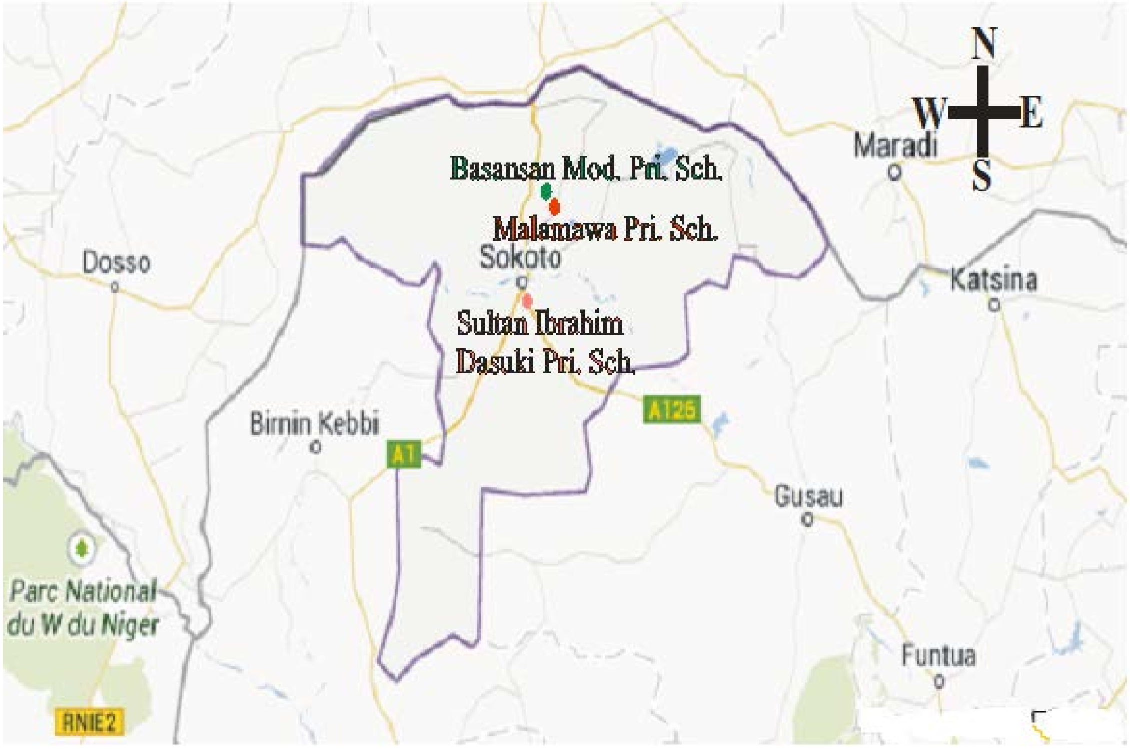

Figure1. Map of Sokoto Metropolis, Sokoto State, Nigeria (Topographic Sheet, 1990).

The water supply in the town is mainly from pipe, bore holes and wells. Sewage disposal is by pit latrine within the compound and refuse disposal is by open dumping system outside the house and subsequent burning of the heap of refuse so far gathered (Topographic Sheet, 1990).

Hamma Ali is a rural district headquarter in Kware Local Government, the district has farmers and fishermen. River Sokoto forms the boundary between the two districts. The settlements in the district are mostly located on low lying terrains with various types of fresh water bodies such as marshes, rivers and ponds. The vegetation is mainly grassland with trees.

The study population

From the two localities three primary schools were randomly selected. Stool and urine samples were collected from 125 pupils in each school. In Sokoto metropolis, Sultan Ibrahim Dasuki Primary School was selected, while from Hamma' Ali District, Malamawa primary school and Model primary school Basansan were selected. All the children examined in this study were aged between 5 to 13 years above attending primary school at the time of investigation. The investigation was made so as to determine the proportion among age of individuals capable of excreting number of schistosomes eggs that are potentially enough to contribute in the transmission process, as shown by Ladan et al. (2013).

Sample collection

Urine sample was collected mainly from school aged children because of their high risk of schistosomiasis infection. The infection status of this group gives a reliable reflection of the general situation of the diseases in an area (Mafiana and Adesanya, 1999; Akogun and Obadiah, 2000).

Three schools were randomly selected in Sokoto Metropolis. In each of the selected schools, 125 children were randomly screened for urinary schistosomiasis giving a total number of 375 samples for the children urine in the study area. Before collecting the samples (urine), the head of the school was briefed on the nature of the research, who in turn mobilized the children. A brief health enlightenment lecture was delivered by the researcher on the possible means of contacting the disease, the hazards associated with the infection and the general preventive measures. For each child examined, a questionnaire (parasitological screening record from appendix) aimed at determining the age, sex, water contact activity, parental occupation and education was administered.

The samples were collected between the hours of 10:00 am - 2:00 pm eggs output from infected children riches peak value around that time of the day (Grist et al., 1998; Rubin and Faber, 1999).

Cleaned labeled specimen bottles were used in the collection of urine samples small. Care was taken to number the containers. Specimen bottles and plastic cups were numbered accordingly, such that they correspond with numbers of the subjects on the questionnaire. Collected samples were taken to the Parasitology laboratory, Department of Biological Sciences, Usmanu Danfodiyo University Sokoto, Nigeria and examined for *Schistosoma* infection. Urine samples were preserved with 1% domestic bleach (Gryseels et al., 2006).

Urine analysis

Urine samples were analyzed according to Adeoye and Akabo (1996) using standard filtration technique. A 5.5cm Whatman's filter paper was inserted in the filtration unit. After shaking the urine sample, 10ml of it was withdrawn with a syringe and injected into filtration unit. After filtration, the filter paper was carefully removed using a pair of forceps and placed on a clean sheet of paper and stained with one or two drops of iodine and 50% ninhydrin solution. The stained filter paper was allowed to dry for about 15 minutes after which it was placed on a clean glass slide and observed systematically under the microscope at x10 and x 40 magnifications. All the eggs were counted and the result was recorded and expressed as number of eggs per 10ml of urine.

Statistical analysis

The data was evaluated using analysis of variance (ANOVA) and Chi-Square to find out the similarities and differences between population and frequency, where histogram and tables were drawn. P value used was under 0.01.

Ethical approval

Before the research commence, Head teachers of the primary schools and parents of the children were enlightened about the risk of the disease. Hence, an approval was gotten from the ethical committee of Sokoto State Ministry of

Health, Nigeria. All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Results and discussion

Prevalence of urinary schistosomiasis among the primary schools children

Out of 375 samples of urine that were examined for *Schistosoma haematobium*, 228 (60.80%) were found infected with the parasite. However, the prevalence of the infection varied among the primary schools studied. Sokoto urban area, Sultan Ibrahim Dasuki Primary School has the lowest prevalence of 42.40% and parasite load with 24.99 per 10 ml of urine. Basansan Model Primary School and Malamawa Primary School in Kware Local Government areas had the highest prevalence of 75.20% and 64.80% respectively. A parasite load of 45.49 per 10ml of urine and 43.86 per 10ml of urine was found in Basansan Model Primary School and Malamawa Primary School respectively. A chi-square analysis showed significant variation ($p < 0.01$) in the prevalence of the infection among the primary schools (Table 1).

Table 1. Prevalence of urinary schistosomiasis among the primary schools children.

Name of School	No. examined	No. positive	Prevalence (%)	Parasite load (10 mL urine)
Sultan Ibrahim Dasuki PS	125	53	42.40	24.99
Malamawa PS	125	81	64.80	43.86
Basansan Model PS	125	94	75.20	45.49
Total	375	228	60.80	43.85

PS = primary school.
The chi squire is: ($X^2 = 73.11$; df = 3; $P < 0.01$).
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

Age related prevalence of urinary schistosomiasis among children in the study area

The age specific prevalence showed that, children within the age range of 9-12 years had the highest prevalence of 71.42% and parasite load of 50.93, followed by 13 years and above with a prevalence of 60.00% and parasite load of 43.86. Those below 8 years had the least prevalence of 43.00% and parasite load of 23.83. The chi square analysis showed significant variation ($P < 0.01$) in prevalence of infection among the age groups are shown in Table 2.

Table 2. Age related prevalence of urinary schistosomiasis among the children.

Age group (years)	No. examined	No. positive	Prevalence (%)	Parasite load per 10 mL of urine
5 - 8	100	43	43.00	23.83
9 - 12	175	125	71.42	50.93
13 - above	100	60	60.00	43.86
Total	375	228	60.80	43.85

The chi square is ($X^2 = 14.38$; df = 2; $P < 0.01$).
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

Gender related prevalence of urinary schistosomiasis in the study area

A total of 235 males and 140 females were sample for this study, their urine examined showed a high significant variation (P < 0.01) between the gender, when analysis of data was considered. However the highest prevalence rate and parasite load was recorded in males with 79.57% and 45.45 eggs per 10 mL compared to female with a prevalence rate of 29.28% and parasite load of 36.58 eggs per 10 mL as shown in Table 3.

Table 3. Gender related prevalence of the children urinary schistosomiasis.

Sex	No. examined	No. positive	Prevalence (%)	Parasite load per 10 mL of urine
Male	235	187	79.57	45.45
Female	140	41	29.28	36.58
Total	375	228	60.80	43.85

The chi square is: ($X^2 = 23.24$; df = 1; P < 0.01).
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

Prevalence of urinary schistosomiasis by occupation of parents in study area

The prevalence of the infection based on occupation of the pupils' parents was recorded. It was observed that children of farmers had a higher prevalence with 71.50%. This followed by children of fishermen with 52.00% and then those from Business parents with 45.71%. Similarly children of civil servants had prevalence of 45.00% while others (those without specific jobs) the least prevalence rate 40.00%. Parasite load in children of farmers, fishermen, businessmen, civil servants and others are 50.69, 43.00, 25.00, 30.76 and 27.77 eggs per 10 mL of urine, respectively. Chi square analysis showed high significant variation (P < 0.01) in occupation related prevalence as shown in Table 4.

Table 4. Prevalence of urinary schistosomiasis by occupation of parents in study area.

Occupation of pupils parents	No. examined	No. positive	Prevalence (%)	Parasite load per 10 mL of urine
Farmers	200	143	71.50	50.69
Fishermen	100	52	52.00	43.00
Civil Servant	20	9	45.00	25.00
Business	35	16	45.71	30.76
Others	20	8	40.00	27.77
Total	375	228	60.80	43.85

The chi square is: ($X^2 = 11.90$; df = 4; P < 0.01).
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

Prevalence of urinary schistosomiasis by water contact activities of children

The prevalence of the infection by water contact activities was recorded. It was observed that children who participated in farming, swimming, and fishing have the prevalence of 84.87%, 78.21% and 52.17%, respectively. Similarly those whose water contact behaviors are through bathing, fetching and washing have prevalence of 29.03%, 28.57% and 22.85% respectively. Parasite load found observed in relation to water contact activities for those involved in farming, fishing, swimming, bathing, fetching and washing were of 54.45, 33.30, 35.44, 38.09, 26.30 and 20.00 eggs per 10 mL of urine respectively. However, chi square analysis showed high significant variation ((P < 0.01) between the prevalence of infection and water contact activities as shown in Table 5.

Table 5. Prevalence of children urinary schistosomiasis by water contact activities.

Water contact activity	No. examined	No. positive	Prevalence (%)	Parasite load per 10 mL of urine
Farming	119	101	84.87	54.45
Fishing	23	12	52.17	33.30
Swimming	101	79	78.21	35.44
Bathing	62	18	29.03	38.09
Fetching water	35	10	28.57	26.30
Washing	35	8	22.85	20.00
Total	375	228	60.80	43.85

The chi square is: ($X^2 = 50.94$; df = 5; $P < 0.01$).
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

Prevalence of urinary schistosomiasis by source of drinking water of children

Prevalence of the infection based on the sources of drinking water has indicated that, those children whose source of drinking water were Dams, ponds and Rivers had the highest prevalence of 75.24%, 70.00%, and 60.00%, respectively. Children that most obtain their drinking water from wells and Boreholes have the least prevalence of 49.24% and 17.64%, respectively (Table 6). Pupils that obtain their drinking water from rivers, ponds and dams had the highest parasite load of 61.22, 39.68 and 41.66 eggs per 10 mL of urine while pupils that obtain their drinking water from wells and boreholes had the least parasite load of 18.46 and 16.66 eggs per 10 mL of urine respectively. However, there is a high significant variation ($P < 0.01$) between prevalence of infection and the sources of drinking water as shown in Table 6.

Table 6. Prevalence of urinary schistosomiasis by source of drinking water of children.

Source of water supply	No. examined	No. positive	Prevalence (%)	Parasite load per 10 mL of urine
River	35	21	60.00	61.22
Well	132	65	49.24	18.46
Pond	90	63	70.00	39.68
Dam	101	76	75.24	41.66
Borehole	17	3	17.64	16.66
Total	375	228	60.80	43.85

The square ($X^2 = 56.30$; df = 4; $P < 0.01$)
The calculated value (X^2) is much greater than the tabulated value under 0.05 and 0.01.

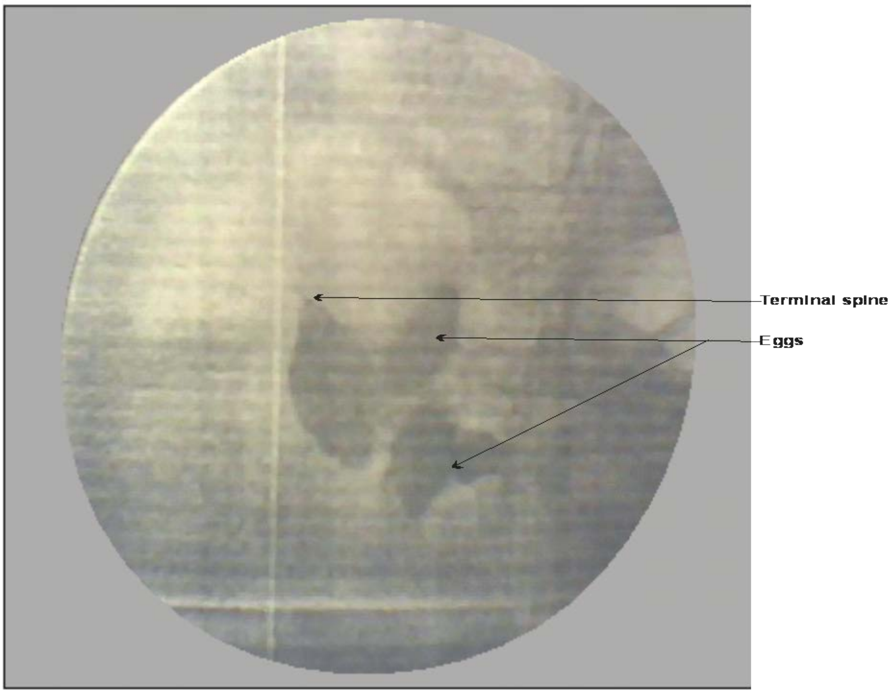

Figure 1. Eggs of *S. haematobium* (x 40 mg) recovered from one of the urine samples.

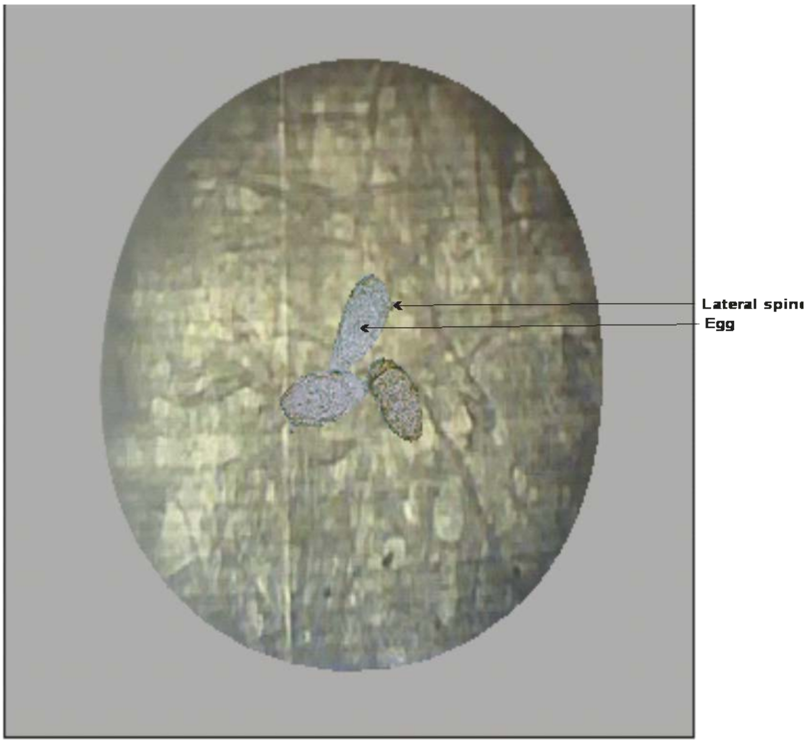

Figure 2. Eggs of *S. mansoni* (x 40 mg) recovered from one of the urine samples.

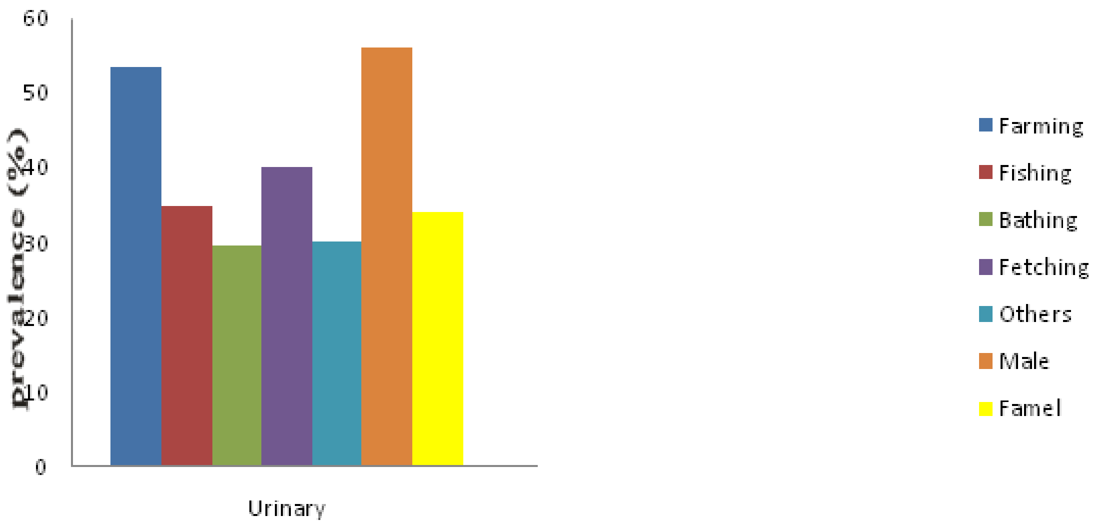

Figure 3. Prevalence of urinary schistosomiasis by water contact activities in the study area.

Discussion

It is clearly established from the result that urinary schistosomiasis is prevalent in the study area. The prevalence of schistosomiasis in the area may be due to the fact that population especially those living in the rural areas are dependent on untreated drinking water bodies for their every day water supply, from where some of the children could be infected. Using and contacting such water bodies on constant basis might possibly be the main reason of the high infection of the disease.

Our study revealed the presence of natural water sources which might serve as the breeding sites for schistosome parasites. This could be explained by the fact that children in most of rural areas surveyed might have contacted the parasites through the water sources which accidently penetrates their skin and later became infected. Nevertheless, the variability found in the prevalence of the infection among the schools examined could be attributed to the fact that pupils living in rural schools of Masanawa and Basansan mostly depend on rivers, dams, ponds, and wells for their water supply from where they may get contact with the disease. However, children within the urban areas (Sultan Ibrahim Dasuki Primary school) depend on other sources with few children depending on wells as their daily water supply. This observation is in line with the findings Senghor et al. (2014) who reported that communities of Niakhar, Senegal are rural, and most of the villages depend on backwater and ponds for their water needs, such as bathing, swimming, fishing and other domestic uses.

The water bodies that provided natural water sources were not determined in this research, but may also serve as habitats to the intermediate hosts' organisms and schistosome parasites. This report correlates with the findings and works conducted in Nigeria where variability and epidemiology of the disease were attributable to water-contact patterns (Ladan et al., 2012; Ugbomoiko, 2000). It is also similar to the observations by Nkengazong et al. (2013), who showed in south west Cameroon that villages without pipe-borne water access maintained a high level of infection.

The age specific prevalence showed that pupils aged 9 - 12 years had the highest prevalence (71.42%), these pupils falls within the primary school age and in the villages this is the population that is most commonly found having prolonged water contact behavior like swimming and playing in bodies of water which are likely infested with infected snails, but pupils living in the urban area (Sokoto Metropolis) or the pupils of Sultan Ibrahim Dasuki primary school are more protected and hence less infected. Some are swimming and playing in bodies of water which are likely infested with infected snails. Other age groups of (13 and above) years are actively involved in such water contact behaviors but more grown-up to be able to protect themselves against possible infection. These reports are in line with the work of Babatunde et al. (2013) who reported an increasing trend of prevalence infection among children aged 3-16 years. But, Monday et al. (2014) claimed that there was a gradual decrease in the trend of prevalence rate of infection among the older age groups.

Reduced worm burden in patients of older ages may be due to development of immunity which is known to occur in the infection. This is in agreement with the results of reductions of eggs studies in other *S. haematobium* endemic areas (Abdel-Wahab et al., 2000; Adamu and Abubakar, 2003; Agi and Okafor, 2005).

The presence and prevalence of schistosome parasites following the urine analysis was determined in this research. The eggs recovered are spherical in structure with terminal ends and their development in the bladder and urine of the infected children might cause itching, paining of genital organ and wasted thick blood after urination. In this regard, Norberg (2004) claimed that in *S. haematobium* infection, the patient produces few symptoms like blood in the urine (haematuria) due to the presence of eggs in the bladder, often in the last few drops. Some time the patients feel irritation while urinating or ejaculation in adults. It has been reported by Mostafa et al. (1999); Despommier (2010) who indicated that, urinary schistosomiasis has the risk of causing haematuria, dysuria, nutritional deficiencies, and lesion of the bladder and in children, growth retardations are well established and finally the work capacity of rural inhabitants is drastically reduced because of the weakness caused by the disease.

In relation to sex, high infection rate observed in males then in females as reported and observed in other endemic areas and same was found by other authors (Ekejindu et al., 2002).

The high prevalence in males than females was reported in this study; the consequent occurrence of the parasitic schistosome may be related to traditional belief and socio cultural behaviors, practices and set up of the people in the study area. These people are predominantly Muslims and Hausa Fulani by tribe. Majority of the females are well protected and restricted in their movement. Their contact to water bodies is therefore less compared to their male counterparts. Moreover females mature earlier than their male counterparts and therefore it is culturally embarrassing even for the young females than the adult ones to swim naked outside. This is in line with the observation made by other authors (Bello et al., 2003; Agi and Okafor, 2005). These reports correlate with the finding of Blair (2011) who is of the view that schistosomiasis was brought into Nigeria by the immigrating Fulani people who traveled West-ward from the Nile Basin.

The prevalence of infection by social status or occupation of pupils' parents showed that children of farmers (71.50%) and fishermen (52.00%) were the most infected in the area. This could be probably attributed to the nature of their occupation that brings them into frequent contact with infested water. Famers are usually in frequent contact with water bodies during irrigation, farming, washing their farm products, bathing and drinking or washing their bodies after a hard day's work. Pupils frequently visit these water bodies for drinking, bathing, swimming, washing, playing etc. it is obvious that fishing cannot be done without water contact. The low infection rate observed among others (40.0%) whose contact with the water is during washing, fetching, sales of water, building etc. businessmen and civil servant could be due to the nature of their work engaging in less water less activities there by not getting exposed to infection (Pukuma and Musa, 2007; Uwaezuoke et al., 2007).

Prevalence of the infection by water contact behavior has been reported by various authors (Adamu et al., 2001). This study has indicated that high prevalence rate of the infection occurs in those whose water contact activities such as farming/irrigation and swimming. The rest of water contact activities had low prevalence which includes washing, fishing, bathing, fetching and others. CDC (2008) report had shown that schistosomiasis disease is acquired through the skin in most cases although, drinking contaminated water with cercariae may result to cercariae penetrating the mucus membrane and thus establishing the infection. They added that swimming, bathing or working in infected water provide the most frequent chances for infection.

Water contact activities are usually encountered more in children and others who go to streams in search of water for domestic, recreational and other purpose. Children between 5-14 years of age are more prone to schistosomiasis and contributed about 85.6% of the environmental contamination with schistosome eggs. The studies also revealed that children show, high duration of water contacts than adults.

Different sources of water supply used for domestic purpose were observed in the study area. The highest infection rate was seen among people who depend largely on rivers, ponds and dams for their water source. This could be attributed to the preference shown by snail vector for slow flowing rivers, or stagnant bodies of water. A similar conclusion had been made by (Okwoli, 1993; Despommier, 2010). Even though provision of safe drinking water from borehole, well etc, have been recommended for the control of Schistosomiasis (WHO, 2010). Prevalence of infection was also observed among people who used water from boreholes, wells and those (others) who used pure (nylon sealed) water, bottled water, tap water etc, at Sokoto city during their business. Probably the infection may be due to the other contact activities with infested water in their area.

This study being the recent research carried out in some selected primary school in Sokoto and in Hamma Ali Kware Local Government Area has shown that Schistosomiasis is more endemic in Hamma Ali than in Sokoto, though of moderate prevalence. This prevalence could be attributed to improper hygiene and poor sanitation, will be a threat to important social and economical activities of the dwellers within the study area. These reports correspond with the work of Monday et al. (2014) who reported that the increased differences in prevalence rate could be associated with many factors among, which are the levels of contact of individuals with infested water bodies, the degree of exposure to infective schistosome cecariae and the peculiar ecological characteristics of different locations.

Prevalence rate of infection observed base on sources of drinking water has indicated that those who largely depend on the river as their source of drinking water have the high rate of infection. It has been observed that in this study, the snail vectors are more abundant during the dry season than during rainy season. The result obtained in this study, however imposes a heavy burden up on the health and well being of individuals.

Conclusion

There is higher prevalence of urinary schistosomiasis infection in most of the rural areas surveyed. Hence, highest prevalence was noted from 9-12 years age group of the children. The prevalence of urinary schistosomiasis in relation to sex showed that males have higher prevalence than females of disease susceptibility. Similarly, in relation to occupation, children of the farmers have higher prevalence of infection. But, in terms of sources for drinking water, the results showed that those children who used dams had higher infection of the disease than those that depend on rivers, wells, ponds or boreholes. The source of infection being open water sources especially slow running streams, dams, ponds and rivers where adults in the study areas par take their activities together with their children are at the higher risks of infection.

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Conflict of interest statement

The authors declare that they have no competing interests.

References

Abdel-Wahab, M. F.; Gomal, E.; Imam, R.; Shaker, N.; Emam, M.; Muhammad, I.; El-Boracy, Y. S.; Thomas, G. The epidemiology of schistosomiasis in Egypt. Fayoum Governorate. **American Journal of Tropical Medicine and Hygiene,** v. 62, No. 2, p. 55-64, 2000.

Abiola A. O.; Nwogu, E. E.; Ibrahim, M. T.; Hassan, R. Effect of health education on knowledge, attitude and practices of personal hygiene among secondary school students in rural Sokoto, North West, Nigeria. **Pub. Med.** v. 22, No. 3, p.181-190, 2012.

Adamu, T.; Abubakar, U.; Galadima, M. The use of reagent strip and questionnaire in rapid assessment of urinary schistosomiasis. **Jounal of Tropical Biosciences**, v. 1, No. 1, p. 133-140, 2001.

Adamu, T.; Abubakar, U. Preliminary studies on the local names, prevailing beliefs and treatment practices of some common parasitic disease in rural areas of Sokoto, Kebbi and Zamfara States, Nigeria. **Nigerian Journal of Parasitology**, v. 24, p. 103-108, 2003.

Agi, P. I.; Okafor, E. J. The epidemiology of *Schistosoma heamatobium* in Odau community in the Niger Delta Area of Nigeria. **Journal of Applied Science and Environmental Management**, v. 9, No. 3, p. 37-43, 2005.

Akogun, O. B.; Obadiah, S. History of haematuria among school - aged children for rapid community diagnosis of Urinary Schistosomiasis. **Nigerian Journal of Parasitology**, v. 17, p. 11-15, 2000.

Babatunde, T. A.; Asaolu, S. O.; Sowemimo, O. A. Urinary schistoomiasis among pre-school and school aged children in two peri-urban communities in South West Nigeria. **Journal of Parasitology and Vector Biology**, v. 5, No. 7, p. 96-101, 2013.

Bello, Y. M.; Adamu, T.; Abubakar, U.; Muhammad, A. A. Urinary Schistosomiasis in some villages around the Goronyo Dam, Sokoto State, Nigeria. **Nigerian Journal of Parasitology,** v. 24, p. 109-114, 2003.

Blair, D. M. Bilharziasis survey in British West and East, Africa, New Zeland and Rhodesia. **WHO Bulletin**, v. 15, p. 202-207, 2011.

CDC. Schistosomiasis. Division of Parasites Diseases. 2008. Available from: <http://www.cdc.gov/ncidod/dpd/parasites/schistosomiasis/factsht_schistosomiasis.htm>. Accessed on: Nov. 27, 2016.

Chitsulo, L.; Engels, D.; Montresor, A.; Savoili, L. The globle schistosomiasis and its control. **Acta Tropica**, v. 77, No. 1, p. 41-51, 2000.

Despommier, G. H. K. **Parasitic diseases**. 5. ed. New York: Apple Trees productions L.L.C.N.Y., 2010.

Ekejindu, I. M.; Ekejindu, G. O. C; Andy, A. *Schistosoma heamatobium* infection and nutritional status of residents in Azi-anam, a riverine area of Anambara State, South-Eastern Nigeria. **The Nigerian Journal of Parasitology,** v. 23, p. 133-138, 2002.

Fenwick, A. The global burden of neglected tropical diseases. **Public Health**, v. 126, No. 3, p. 233-236, 2012. https://dx.doi.org/10.1016/j.puhe.2011.11.015

Foster R. Schistosomiasis in irrigated Estate of East Africa: **Effect of Hygiene**, v. 170, p.185-195, 2006.

Grist, N. R.; Darrel, O. H.; Walker, E.; William, G. R. **Diseases of infection**: an illustrated textbook. London: Oxford University Press, 1998.

Gryseels, B.; Polman, K.; Clerinx, J.; Kestens, L. Human schistosomiasis. **Lancet**, v. 368, p. 1106-1118, 2006. https://dx.doi.org/10.1016/S0140-6736(06)69440-3

King, C. H.; Olbrych, S. K.; Soon, M.; Singer, M. E.; Carter, J.; Colley, D. G. Utility of repeated praziquantel dosing in the treatment of schistosomiasis in high risk communities in Africa: a systematic review. **Plos Negl. Trop. Dis.**, v. 5, p. 1329, 2011.

Ladan, M. U.; Abubakar, U.; Abubakar, K.; Bunza, M. D. A.; Nasiru, M.; Ladan, M. J. Gender and age - specific prevalence of urinary schistosomiasis in selected villages near a Dam site in Gusau Local Government Area. Zamfara State, Nigeria. **Nigerian Journal of parasitology**, v. 32, p. 57, 2013.

Ladan, M. U.; Abubakar, U.; Abdullah, K.; Bunza, M. D. A.; Ladan, M. J.; Adamu, T. Urinary schistosomiasis in selected villages around Gusau Dam Site, Zamfara State, Nigeria. **Niger J. Basic Appl. Sci.**, v. 20, p. 189-194, 2012.

Lozano, R; Naghavi, M.; Foreman, K.; Lim, S.; Shibuya, K.; Aboyans, V.; Abraham, J.; Adair, T.; Aggarwal, R.; Ahn, S. Y.; Alvarado, M.; Anderson, H. R.; Anderson, L. M.; Andrews, K. G.; Atkinson, C.; Baddour, L. M.; Barker-Collo, S.; Bartels, D. H.; Bell, M. L.; Benjamin, E. J.; Bennett, D.; Bhalla, K.; Bikbov, B.; Bin Abdulhak, A.; Birbeck, G.; Blyth, F.; Bolliger, I.; Boufous, S.; Bucello, C.; Burch, M.; Burney, P.; Carapetis, J.; Chen, H.; Chou, D.; Chugh, S. S.; Coffeng, L. E.; Colan, S. D.; Colquhoun, S.; Colson, K. E.; Condon, J.; Connor, M. D.; Cooper, L. T.; Corriere, M.; Cortinovis, M.; de Vaccaro, K. C.; Couser, W.; Cowie, B. C.; Criqui, M. H.; Cross, M.; Dabhadkar, K. C.; Dahodwala, N.; De Leo, D.; Degenhardt, L.; Delossantos, A.; Denenberg, J.; Des Jarlais, D. C.; Dharmaratne, S. D.; Dorsey, E. R.; Driscoll, T.; Duber, H.; Ebel, B.; Erwin, P. J.; Espindola, P.; Ezzati, M.; Feigin, V.; Flaxman, A. D.; Forouzanfar, M. H.; Fowkes, F. G.; Franklin, R.; Fransen, M.; Freeman, M. K.; Gabriel, S. E.; Gakidou, E.; Gaspari, F.; Gillum, R. F.; Gonzalez-Medina, D.; Halasa, Y. A.; Haring, D.; Harrison, J. E.; Havmoeller, R.; Hay, R. J.; Hoen, B.; Hotez, P. J.; Hoy, D.; Jacobsen, K. H.; James, S. L.; Jasrasaria, R.; Jayaraman, S.; Johns, N.; Karthikeyan, G.; Kassebaum, N.; Keren, A.; Khoo, J. P.; Knowlton, L. M.; Kobusingye, O.; Koranteng, A.; Krishnamurthi, R.; Lipnick, M.; Lipshultz, S. E.; Ohno, S. L.; Mabweijano, J.; MacIntyre, M. F.; Mallinger, L.; March, L.; Marks, G. B.; Marks, R.; Matsumori, A.; Matzopoulos, R.; Mayosi, B. M.; McAnulty, J. H.; McDermott, M. M.; McGrath, J.; Mensah, G. A.; Merriman, T. R.; Michaud, C.; Miller, M.; Miller, T. R.; Mock, C.; Mocumbi, A. O.; Mokdad, A. A.; Moran, A.; Mulholland, K.; Nair, M. N.; Naldi, L.; Narayan, K. M.; Nasseri, K.; Norman, P.; O'Donnell, M.; Omer, S. B.; Ortblad, K.; Osborne, R.; Ozgediz, D.; Pahari, B.; Pandian, J. D.; Rivero, A. P.; Padilla, R. P.; Perez-Ruiz, F.; Perico, N.; Phillips, D.; Pierce, K.; Pope, C. A. 3rd; Porrini, E.; Pourmalek, F.; Raju, M.; Ranganathan, D.; Rehm, J. T.; Rein, D. B.; Remuzzi, G.; Rivara, F. P.; Roberts, T.; De León, F. R.; Rosenfeld, L. C.; Rushton, L.; Sacco, R. L.; Salomon, J. A.; Sampson, U.; Sanman, E.; Schwebel, D. C.; Segui-Gomez, M.; Shepard, D. S.; Singh, D.; Singleton, J.; Sliwa, K.; Smith, E.; Steer, A.; Taylor, J. A.; Thomas, B.; Tleyjeh, I. M.; Towbin, J. A.; Truelsen, T.; Undurraga, E. A.; Venketasubramanian, N.; Vijayakumar, L.; Vos, T.; Wagner, G. R.; Wang, M.; Wang, W.; Watt, K.; Weinstock, M. A.; Weintraub, R.; Wilkinson, J. D.; Woolf, A. D.; Wulf, S.; Yeh, P. H.; Yip, P.; Zabetian, A.; Zheng, Z. J.; Lopez, A. D.; Murray, C. J.; AlMazroa, M. A.; Memish, Z. A. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. **Lancet**, v. 380, No. 9859, p. 2095-2128, 2012. https://dx.doi.org/10.1016/S0140-6736(12)61728-0

Mafiana, G. F.; Adesanya, O. O. Urinary Schistosomiasis in Ilewo-Orite, Ogun State, Nigeria. **Nigerian Journal of Parasitology**, v. 15, p. 32-34, 1999.

Martyne, T. S; Essame, O.; Ratard, R. C. High risk behaviours and schistosomiasis infection in Kumba, South-West Province, **Cameroon. Int. J. Environ. Res. Pub. Heath.,** v. 4, p. 101-105, 2007.

Monday, L. E.; Francis, J. I.; Lamidi, B. T.; Mohammad, S. U. Investigating Urinary Schistosomiasis in Bali Town, Bali Local Government Area, Taraba State, Nigeria. **Nigerian Journal of Parasitology**, v. 35, No. 1/2, p. 149-150, 2014.

Mostafa, M. H.; Sheweita, S. A.; O'Connor, P. J. Relationship between schistosomiasis and bladder cancer. **Clin. Micrbiol.**, v. 12, p. 97-111, 1999.

Mutapi, F.; Takafira, M.; Natialia, G.; Willam, F.G.; Cecilia, F.; Nicholas, M.; Rick, M. M. Preferential lgG3 antibody responsiveness to a recombinant antigen dependent on age and parasite burden. **BMC Infect Dis.**, 6: 96, 2006. https://dx.doi.org/10.1186/1471-2334-6-96

Nkengazong, L.; Njiokou, F.; Asonganyi, T. Two years impact of single praziquantel treatment on urinary schistosomiasis in the Barombi Kotto focus, South West Cameroon. **J. Parasitol. Vect. Biol.**, v. 5, p. 83-89, 2013.

Norberg, E. **Communicable Diseases**: a manual for health workers in Sub-Saharan Africa**. Africa Medical and Research Foundation.** 2004.

Ogboli, A. U.; Nock, I. H.; Abdulrahaman, E. M.; Ibrahim, N. D. G. Curative potential of the lead extracts of *Eucalyptus citriodora* Hook on experimental Schistosomiasis in Mice. **Journal of Tropical Biosciences**, v. 1, No. 1, p. 101-105, 2001.

Okwoli, A. *Schistosoma haematobium* infection among primary school children in Benue State, Nigeria. **The Nigerian Journal of Parasitology**, v. 14, p. 5, 1993.

Pukuma, M. S.; Musa, S. P. Prevalence of urinary schistosomiasis among residents of Waduku in Lamurde Local Government Area of Adamawa State Nigeria. **Nigerian Journal of Parasitology**, v. 28, No. 2, p. 65-68, 2007.

Rubin, E.; Farber, L. J. **Essential Pathology**. New York: J. B. Lippincott, 1999.

Senghor, B.; Diallo, A.; Sylla, S.; Doucoure, S.; Ndiath, M. Gaayeb, L.; Djuikwo-Teukeng, F. F.; Bâ, C. T.; Sokhna, C. Prevalence and intensity of urinary schistosomiasis among school children in the District of Niakhar, Region of Fatick, Senegal. **Parasites and Vectors**, 7:5, 2014. https://dx.doi.org/10.1186/1756-3305-7-5

TDR. WHO/UNDP/WLD BNK. Schistosomiasis. WHO/UNDP/WLD BNK., 1996. (13th. Progress Report.).

Tierney, M. L.; Stephen, J. J.; Mcphec, J.; Maxine, A. P. **Current medical diagnosis and treatment**. 44. ed. New York: McGraw Hill. 2005.

Topographic sheet. Alied Surveryors, Surulere, Lagos. Sokoto, South-west, topographic sheet, No. 54, edition 2, with scale, v. 1, 1990. p. 50-60.

Ugbomoiko, U.S. The prevalence, incidence and distribution of human urinary schistosomiasis in Edo State, Nigeria. **Nigerian Journal of Parasitology**, v. 21, p. 3-14, 2000.

Uwaezuoke, J. C.; Anosike, J. C.; Nwoke, B. E. B.; Dozie, I. N. S. Urinary Schistosomiasis in lhitte Uboma Local Government Area of Imo State, Nigeria. **Nigerian Journal of Parasitology**, v. 28, No. 2, p. 90-94, 2007.

WHO. Guide lines for the evolution of soil transmitted helminthiasis and Schistosomiasis at community level. A guide for managers of control programmes. WHO/CTD/SIP/98.1, 1998.

WHO. Freshwater snails: intermediate hosts of schistosomiasis and food borne trematode infections. Available from: <http://www.who.int/water_sanitation_health/resources/vector337to356.pdf>. Accessed on: Jan. 20, 2010.

WHO/TDR. Schistosomiasis, working group. 2005. Available from: <http://www.int/tdr/publication/tdrnews/newsbul/schisto.htm>. Accessed on: Dec. 2, 2007.