PREVALENCE AND INTENSITY OF URINARY SCHISTOSOMIASIS AMONG RESIDENCE ALONG RIVER BENUE, ADAMAWA STATE, NORTH EASTERN NIGERIA

Abstract

In Nigeria, infection caused by *Schistosoma haematobium* has been known to be endemic especially among residents along Rivers, and it is responsible for considerable public health problems. This study aimed at assessing the prevalence and intensity of infection among the vulnerable communities. A cross-sectional study involving 1,404 participants within age bracket 5-55 years old and above, in ten communities across five Local Government Areas along River Benue in Adamawa State was conducted. Urine samples were collected from randomly selected study subjects and were examined using centrifugation and sedimentation techniques. Intensity of infection was ascertained as eggs/10mls of urine and values expressed as Mean ± SD. Data on demography were obtained by structured questionnaires. Simple percentage was used and Chi-square as well to ascertain the associations between prevalence and other parameters. $P<0.05$ was considered as significance. The overall prevalence and intensity of infection were 23.2% and 513±0.05 eggs/10ml of urine respectively. Kabawa had the highest infection rate and intensity with 12.4% and 80±0.02 respectively. The lowest was recorded in Kangle (12.3% and 24±0.82eggs/10ml), with significant association between parasite intensity and community ($p<0.05$). Gender related prevalence and intensity revealed that males (25.5% and 289±4.66 eggs/10ml) were more affected than the females (20.8% and 206±4.49 eggs/10ml). Participants within age bracket 5-14 years old had the highest prevalence (36.6%) and intensity (142±0.005 eggs/10ml), while the lowest were recorded among age group 45-54years old with 9.0% and 42±0.040 eggs/10ml. Prevalence and intensity of infection was highest among Subjects fetching water from River/Streams (31.8%, 46±0.080 egg/10ml of urine), whereas the least were observed among borehole fetchers (13.8% and 241±0.302 egg/10ml of urine). Occupational related prevalence and intensity were highest among Fishers with 35.0% and 188±0.012 egg/10ml of urine. Chemotherapy and Health Education should be advocated across the study area.

Keywords: Prevalence, Intensity, *Schistosoma haematobium*, River-Benue, Occupation.

Introduction

Schistosomiasis is an infectious disease caused by parasitic worms found in fresh water. It remains one of the most prevalent neglected tropical diseases. In terms of impact, it is the second most socioeconomically devastating parasitic disease after malaria. Schistosomiasis is an intestinal or urogenital disease caused predominantly in humans by infection with *Schistosoma mansoni*, *Schistosoma haematobium*, or *Schistosoma japonicum*. The less prevalent species are *S. mekongi* and *S. intercalatum* (Nawal *et al.*, 2010). The parasite lives in certain types of fresh water snails such as Bulinus species, serving as intermediate hosts. The infectious form of the parasites is known as cercariae, which emerges from the snail, hence contaminating water

(Daniel *et al.,* 2014**,** Gryeels *et al*., 2006). Due to the aquatic nature of the intermediate snail host, freshwater contact is usually required for an individual to be exposed to infection. Hence, Individuals become infected when cercariae, released by freshwater snails, penetrate the skin during contact with contaminated water (Anderson *et al*., 2016). The disease is mostly common in the tropical areas of the globe especially, in the rural areas where only the surface water bodies are the sources of water supply. Intestinal schistosomiasis presents with bloody diarrhoea and bowel ulceration, portal hypertension, and hematemesis, while Urogenital schistosomiasis is characterized by haematuria, dysuria, bladder wall pathology, hydronephrosis, kidney failure, growth retardations and it can also lead to squamous cell carcinoma. In adults, the infection can cause genital ulcers and other lesions resulting in poor reproductive health, with sexual dysfunction and infertility. The work capacity of rural inhabitants is drastically reduced because of the weakness caused by the parasites.

World Health Organization (2018) reported that 85% of more than 207 million people who live in Africa are infected with schistosomiasis. An estimated 700 million people are at risk of the infection in 78 countries where the disease is endemic, and where prevalence rates can exceed 50% in local populations. Globally, an estimated 12,000 direct deaths from schistosomiasis was reported in 2010 (Lozano *et al.,* 2012), while the WHO in 2014 estimated more than 200,000 annual deaths (WHO, 2014). Generally, agricultural work, domestic chores, recreational activities and playing habits of school aged children, such as swimming and or fishing in infested water brings about predisposition to infection by schistosomes.

In Nigeria, Schistosomiasis is a disease of considerable and growing importance due to inadequate potable water and activities related to water resource development schemes for irrigation, fishing and hydro-electricity. Reports on Nigeria have revealed that it has the greatest number of cases of schistosomiasis worldwide (Salwa *et al*., 2016, Hotez etal., 2012 3), with an alarming figure of about 29 million infected people, among which 16 million are children, and about 101 million people are at risk of (WHO, 2013, 2, Adenowo etal., 2015 10). The National Schistosomiasis Control Programme in collaboration with the Federal Ministry of Health was initiated in 1988 and deliberation on possibility of bringing down the prevalence by 50% within 5 years in operational areas made (Ekpo *et al*., 2004). However, these efforts were hampered by the lack of baseline data on the distribution of the disease in a broad scale. Adamawa State was not among the areas mapped. Thus, schistosomiasis baseline data for any control strategic plan is scarce or lacking in the State. This makes intervention and control measures more difficult as such information is crucial to identify and implement effective control measures. This study was carried out to determine the current status of urogenital schistosomiasis among the inhabitants of ten (10) communities along River Benue of Adamawa State, North Eastern Nigeria.

Materials and Methods

Study Area

The study was conducted in ten communities selected across five Local Government Areas along River Benue in Adamawa State which is located in the north eastern part of Nigeria. Adamawa State lies between latitude 7^0 and 11^0N of the equator and between longitude 11^0 and 14^0 east of Greenwich Meridian. It shares boundary with Taraba State to the South and with Gombe State to the West. It also shares boundary with Borno State to Northwest and international boundary with Cameroun republic to the East. The State covers a land mass of about 39.741 square kilometers, having mountainous land with River Benue, Gongola and Yadzaram running from the North to the South (Adebayo and Tukur, 1999). It has an estimated of population about 3,168,101, made up of 1,606,123 males and 1,561,978 females; giving a population density of 80 people per km^2 (National Population Census, 2006). The State lies within the tropical region having dry and rainy seasons. The rainy season begins from April and last till October with mean annual rainfall of 759mm in the Northern part and 197mm is the Southern parts. The wettest months are August and September. The dry season starts from November and ends in April which is the hammartan period when dust laden North-East trade winds blows from the Sahara desert with a marked effect on the climate of the state. Although the temperature varies from place to place due to altitude and proximity to the Sahara desert, the average minimum and maximum temperature recorded is 25^0C and 40^0C respectively.

All kinds of farming thrive in the area, including fishing and animal rearing. Majority of the farmers are into subsistence farming. The locations selected for this study are close to the rivers and majority of the participants depend on such rivers as their major source of water and use for fishing, irrigation, washing and other activities.

Population and sampling

At the commencement of the study, consent was sought and obtained from the village heads of the study locations. All adult participants, Parents and guardians of younger children and children over 12 years of age were given consent form and were enlightened on the importance of the study. Ethical approval was obtained from the ethical committee of State Ministry of Health, Yola, Adamawa State. Population of the study was randomly selected from communities along river Benue which includes children and adults, males and females of different occupations across ten communities of the study Area. Children who could not control their bowel and urine were not enrolled into the study. One thousand four hundred (1,404) volunteers were randomly selected across the Local Government Areas.

Collection of urine sample

Urine samples were collected from a total of ten communities across five Local Government Areas along River Benue in Adamawa State, by random selection on 1,404 participants that volunteered. This was done between 10.00 am and 1.00 pm corresponding to peak of egg output in urine (WHO, 1991; Cheesbrough, 2009). Clean, dry screw capped specimen bottles were given to each of the participant on the day of collection to avoid specimen outside the specified time. Bottles were labeled immediately and accordingly to avoid mix up. The participants were instructed on how to collect their urine samples without contamination, and to include the last drops of urine, as this is known to contain the highest number of eggs if present (Cheesbrough, 2009). The samples were immediately preserved in 1% household bleach (Ladan *et al*., 2011) and taken to Agape Medical laboratory and Diagnosis, Yola and Institute of Infectious Disease for Poverty (IIDP) Laboratory MAUTECH. Yola, for examination.

Examination of urine sample

Sedimentation method was used to examine the urine samples collected. Each urine sample was thoroughly mixed. About 10mls of it was transferred into a centrifuge tube and spun at 1500 rmp for 5 minutes. The supernatant was decanted and a drop of the sediment was placed on a clean grease-free glass slide, covered with a cover slip and viewed under microscope using x10 and x40 objectives. Samples were considered positive or negative based on the presence or absence of ova of *S. haematobium*. The parasite is characterized by a terminal spine, large, oval in shape and pale yellowish brown in color (Cheesbrough, 2009). Ova of *S. haematobium* were identified and to determine the intensity of the infection in each case, intensity was reported as the number of ova/10ml of urine.

Data Analysis

Data obtained were analyzed with SPSS, version 22. Simple percentage, Chi-square test and mean ± SD were used to analyze the intensity, differences and association of the findings. $p<0.05$ was considered as significant and $p>0.05$ as insignificant.

Results

The prevalence and intensity of urogenital schistosomiasis across the communities are shown in table 1. Of 1,404 participants examined from the 10 communities sampled, 326(23.2%) and 495±7.01 eggs/10ml were recorded for prevalence and intensity, respectively. Among the communities, participants from Ribado had the highest prevalence (30.0%) with intensity of 72±0.87 eggs/10ml of urine, followed by Dolo with 35(29.2%) and 38±1.18 eggs/10mls of urine, while Hoki, 16(15.7) and 34±0.43 eggs/10ml had the least prevalence. Others were Kwale (27.0% and 77±0.51 eggs/10ml), Bandawa (21.8% and 51±0.33 eggs/10ml) and Kabawa (23.5% and 80±0.93 eggs/10ml of urine) with the highest intensity of infection. Statistical analysis showed a significant association between prevalence and intensity amongst the communities in question ($p<0.05$). This result revealed that of the total number examined, males (11.7%, 289±3.94 eggs/10mls of urine) had higher prevalence and intensity of infection than their female (11. 5%, 206±3.07 eggs/10mls of urine) counterpart irrespective of the communities. Prevalence rates of infection were (185/725; 25.5%) and (141/679; 20.8%) among the males and females examined respectively. However, there was no statistical difference ($p>0.05$). Prevalence and intensity by age bracket showed 39.2% and 161±1.96 eggs/10mls of urine among age bracket 5-14 years old, followed by those within age bracket 15-24years with 97(30.3%) and 119±0.97 eggs/10mls of urine, while the lowest was among age group 55 years and above (8.7% and 19±0.83 eggs/10mls of urine). Chi-square analysis showed significant difference between prevalence and intensity in relation to age group ($p<0.05$).

Tables 2, presents some predisposing factors surrounding the participants which prone them to urogenital schistosomiasis. The prevalence and occurrence of urogenital schistosomiasis in relation to the participants' source of water revealed that, participants that patronized Rivers and Streams as source of water, had the highest prevalence (171/516; 33.1%) and intensity (285±3.8 eggs/10mls of urine) of infection.. This was followed by those drinking from wells (114/526; 21.7%, 169±1.96 eggs/10mls of urine), while subjects who were drinking from Borehole had the lowest infection rate of 41/362 (11.33%) with intensity of 41±1.25 eggs/10mls of urine. This finding has revealed that, there is association between prevalence and intensity in relation to source of drinking water ($P < 0.05$). Prevalence of infection was higher in wet season (31.2%, 225±1.64 eggs/10mls of urine) than in dry season (17.7%, 254±0.032 eggs/10mls of urine), although with a higher intensity of infection, and there was a significant relationship between infection and season ($p<0.05$). With regard to occupation, fishermen (80/200; 40.0%, 188±2.20) were the most affected closely followed by farmers (77/253; 30.4%, 134±1.20), whereas business men (23/292; 7.9% were the least infected.

Table 1. Prevalence and Intensity of Urinary Schistosomiasis by Community, Gender, Age, Source of Water and Season group in the study Area

S/No	Predisposition Factors	No. Examined	Prevalence (%)	P. value	Eggs/10mls Mean intensity	P. value	Gender			
							Males		Females	
							Prevalence (%)	Intensity	Prevalence (%)	Intensity
1	Dolo	120(8.5)	35(29.2)	0.03	38 ±1.18	0.88	21(17.5)	25±0.66	14(11.7)	13±0.52
2	Ribado	120(8.5)	36(30.0)	0.01	72±0.87	0.03*	18(15.0)	39±0.52	18(15.0)	33±0.35
3	Labondo	240(17.1)	58(21.6)	0.21	38±0.6	0.07	19(7.9)	27±0.55	39(16.3)	11±0.05
4	Kangle	180(12.8)	39(21.6)	0.00	24±0.62	0.06	27(15.0)	15±0.34	12(6.7)	9±0.28
5	Zuran	96(6.8)	25(26.0)	0.12	52±0.68	0.12	10(10.4)	29±0.19	15(15.6)	23±0.49
6	Kwale	96(6.8)	26(27.0)	0.22	77±0.51	0.25	13(13.5)	35±0.20	13(13.5)	42±0.31
7	Bandawa	174(12.4)	38(21.8)	0.06	51±0.33	0.01*	14(8.0)	27±0.12	24(13.8)	24±0.21
8	Kanti	174(12.4)	29(16.7)	0.01	29±0.86	0.06	20(11.5)	13±0.63	9(5.2)	16±0.23
9	Kabawa	102(12.4)	24(23.5)	0.03	80±0.93	0.18	11(10.8)	54±0.59	13(12.7)	26±0.34
10	Hoki	102(12.4)	16(15.7)	0.11	34±0.43	0.20	11(10.8)	25±0.14	5(4.9)	9±0.29
	Total	**1404(100)**	**326(23.2)**		**495±7.01**		**164(11.7)**	**289±3.94**	**162(11.5)**	**206±3.07**
1	5-14	344(24.5)	135(39.2)	0.02	161±1.96	0.02*	77(22.4)	99±1.02	58(16.9)	62±0.94
2	15-24	320(22.8)	97(30.3)	0.11	119±0.97	0.07	55(17.19)	71±0.32	42(13.1)	48±0.65
3	25-34	268(19.9)	45(16.8)	0.17	100±1.46	0.13	17(6.3)	58±0.93	28(10.5)	42±0.53
4	35-44	158(11.3)	24(15.2)	0.43	61±0.95	0.11	8(5.1)	35±0.62	16(10.1)	26±0.33
5	45-54	119(8.5)	15(12.6)	0.22	35±0.84	0.19	5(4.2)	17±0.51	10(8.4)	18±0.33
6	55 & above	115(8.2)	10(8.7)	0.50	19±0.83	0.15	2(1.7)	9±0.54	8(7.0)	10 ±0.29
Total		**1404(100)**	**326(23.2)**		**495±7.01**		**164(11.7)**	**289±3.94**	**162(11.5)**	**206±3.07**

*Significant (p<0.0%)

Table 2: Distribution and Intensity of Schistosomiasis in relation to Source of Water, Season and Occupation in Relation to Gender in the study Area

S/No	Predisposition Factors (Source of water)	No. Examined	Prevalence (%)	P. value	Mean intensity (Eggs/10mls)	P. value	Gender: Male		Gender: Female	
							Prevalence (%)	Intensity	Prevalence (%)	Intensity
1	Borehole	362(25.8)	41(11.3)	1.04	41±1.25	0.12	18(5.0)	21±0.95	23(6.4)	20±0.30
2	Well	526(37.5)	114(21.7)	0.9	169±1.96	0.32	48(9.1)	105±1.09	66(12.5)	64±0.87
3	River/ Stream	516(36.8)	171(33.1)	0.04*	285±3.8	0.11	98(19.0)	163±1.90	73(14.2)	122±1.90
	Total	**1404(100)**	**326(23.2)**		**495±7.01**		**164(11.7)**	**289±3.94**	**162(11.5)**	**206±3.07**
	Season									
1	Wet	702(50.0)	219(31.2)	1.07	225±1.64	0.23	99(14.1)	130±1.32	120(14.7)	95±0.32
2	Dry	702(50.0)	107(15.2)	0.08	270±5.37	0.210	65(9.3)	159±2.62	42(6.7)	111±2.75
	Total	**1404(100)**	**326(23.2)**		**495±7.01**		**164(11.7)**	**289±3.94**	**162(11.5)**	**206±3.07**
	Occupation									
1	Farming	253(18.4)	77(30.4)	0.55	134±1.20	0.012	42(16.6)	88±1.20	35(13.8)	46±0.00
2	C/Servant	184(13.1)	30(16.3)	0.11	57±1.31	1.021	10(5.4)	32±0.21	20(10.9)	25±1.10
3	Student	335(23.9)	84(25.1)	0.07	70±2.00	0.340	49(14.6)	41±0.20	35(10.5)	29±1.80
4	Business	292(20.8)	23(7.9)	0.01*	36±0.30	0.111	5(1.7)	12±0.22	18(6.2)	24±0.08
5	H/wife	135(9.6)	32(23.7)	0.10	10±0.00	0.0	0.00	0±0.00	32(23.7)	10±0.00
6	Fishing	200(14.2)	80(40.0)	0.03*	188±2.20	0.943	58(29.0)	116±2.11	22(11.0)	72±0.09
	Total	**1404(100)**	**326(23.2)**		**495±7.01**		**164(11.7)**	**289±3.94**	**162(11.5)**	**206±3.07**

*Significant (p<0.0%)

Discussion

Schistosomiasis remains a major public health problem in many developing countries particularly among rural populations in sub-Saharan Africa. Nigeria is considered as the most endemic country for schistosomiasis, with approximately 29 million infected people among which 16 million are children, and about 101 million people are at risk of infection (Salwa *et al*., 2016; Hotez *et al*., 2012; WHO, 2013; Adenowo *et al*., 2015). The present study revealed that the overall prevalence and intensity of *urogenital schistosomiasis* in the study area were 23.2 %, 495±7.01 eggs/10ml with a significant association between prevalence and intensity amongst the communities examined ($p<0.05$). The 23.2% prevalence is high compared to the national average prevalence of about 13%, although lower than the prevalence rate of 36.7% previously reported by Naphtali *et al*. (2017) in Numan LGA of Adamawa State. This implies that the disease is still of public health concern in the study area. The prevalence rate recorded in this study is similar to the reports by Obadiah *et al*. (2018) who observed 21.5% *S. haematobium* infection in some parts of Benue State, 20.8% among pregnant women in Yewa North Local Government Area, Ogun State (Oyetunde *et al*., 2013) and 23.8% in Yemen (Hany *et al*., 2013), but higher than other rates reported by previous studies; 8.3% in Hausa communities in K*ano* State (Salwa *et al*., 2016), 9.8% in preschool -aged children in Yewa North Local Government Area (Oyetunde *et al*., 2014), 11.5% in *Zaria* (Nale *et al*., 2003), 15.3% in *Ebonyi* State (Ivoke *et al*., 2014), and 18.7% in *Plateau* and *Nasarawa* States of Nigeria (Evans *et al*., 2013). However, higher prevalence rates of endemicity of 55% in Guma LGA of Benue State (Amuta *et al*., 2014), 46.6% in Ogbadibo LGA of Benue State (Mbata *et al*., 2009), 44.2% in *Minjibir* LGA of *Kano* State (Duwa *et al*., 2009) and 41.5% in Buruku/ Katsina Ala LGA (Houmsou *et al*., 2012) have been reported. The high intensity of *S. haematobium* infection observed in this study agrees with the report by Naphtali *et al*. (2017). The high prevalence observed in this study may be attributed to the general behavior of the participants living close to river / streams who love to engage themselves in activities such as fishing and farming which could expose them to infested water bodies with cercariae, leading to infection. The difference between the prevalence rate of this study and those previously reported may be due to differences in level of awareness of factors influencing transmission of the disease. Similarly, this could be as a result of socio-cultural, believe, biological, ecological and economic characteristics differences. There was significant difference between *S. haematobium* infection and communities of the participants ($p < 0.05$). The natural water bodies around the various communities and the presence of snail intermediate hosts might have served as the main transmission points.

Our findings showed that the prevalence and intensity of infection was higher among male (25.5%) participants compared to females (20.8%), though there was no statistical significant difference ($p > 0.05$). This agrees with many previous reports in Nigeria (Obadiah *et al*., 2018, Naphtali *et al*., 2017, Salwa *et al*., 2016, Bolaji *et al*., 2015, Ezhim *et al*. 2015, Amuta *et al*., 2014, Ivoke *et al*., 2014, Ojurongbe *et al*., 2014, Bala *et al*. (2012), Mbata *et al*., 2009) and Southwestern Ethiopia (Shashie *et al*., 2015). This gender related differences may be attributed to the facts that, males engaged intensively in water contact related occupation than female in the study Areas. This may also be partially attributed to religious and cultural practices. For instance, in Islamic communities, females are not allowed to swim or bathe in the open water sources and also do not participate in fishing and irrigation activities. By contrast, higher prevalence rates of schistosomiasis were reported among females in comparison to males in Zamfara State (Ladan *et al*., 2011), Ghana (Nkegbe, 2010), and Limpopo Province (Samie *et al*. 2010). This may be indications that females were more exposed to infection through infested water contact activities in their study areas.

The present study showed a significant difference in prevalence and intensity between the age groups ($p < 0.05$). Those within age bracket 5-14 years old had the highest prevalence (39.2%) and intensity (161±1.96 eggs/10mls of urine) rates of infection followed by age bracket 15-24 years old (30.3%, 119±0.97), than other age groups. This is similar to other findings reported by Salwa *et al*. (2016), Mayo *et al*. (2016), Olalubi *et al*. (2013), Hottez *et al*. (2009) and Mbata *et al*. (2009). This could be attributed to their frequent visit to streams and rivers in the quest to swim, bath as well as farming and fishing both in the dry season (irrigation) and rice cultivation during the raining season; thus, they are more exposed than the other age groups. Also, the high intensity of infection recorded in subjects within these age range is expected, because in younger age group infections, egg excretion is more pronounced than in older infections. The high intensity in these age groups may be attributed to increased worm burden and the high fecundity rate of parasite, while the low intensity of infections encountered in adult and elderly subjects with age range of 35–44 years and above could be due to reduced schistosome worms and less egg excretion, and could also be attributed to the development of immunity known to occur in the infection.

In the present study, the prevalence and intensity of infection with respect to source of water showed a significant difference ($p<0.05$). The highest prevalence ((33.1%) and intensity (285±3.8) of infection observed among participants who were using river/streams as their source of water in this study is in line with the findings of Obadiah *et al*. (2018) in Benue State, Salwa, *et al*. (2016) in Kano State, Kiran *et al.* (2016), Bolaji *et al.* (2015) in Kwara State and Hany *et al*. (2013) in Yemen, who reported highest prevalence and intensity among those that depended on Streams and River water as their only source of water in their respective study. Open water body such as streams/rivers which may be contaminated with human and animal excreta is generally known to be a source of *S. haematobiun* infection. Therefore, their frequent visit and prolonged contact with such lead to being exposed to the infective stage (cercariae) of the parasite. With regards to season, a higher prevalence rate of infection of 31.2% was observed during rainy season than dry season (15.2%).

It has been reported that in some regions where men are primarily freshwater fishermen or farmers using irrigation, they have higher rates of schistosomiasis. In the present study, the highest prevalence (40.0%) and intensity (188±2.20) rates of infection were observed among fishermen. This is consistent with the reports of Naphtali *et al.* (2017) who recorded 39.3% in Numan, Adamawa State, 47.6% in Edo State (Rukeme *et al*., 2017) and 32.7% in Keffi LGA of Nasarawa State (Ezhim *et al*., 2015), but contrary to report by Dennis *et al.* (2013) who observed highest prevalence (36.2%) among farmers. This disparity could be associated with the facts that fishermen have more chances to frequently visit streams and rivers, spending most of their time fishing which may expose them to infection.

Conclusion

This study has established that *Schistosoma haematobium* infection is prevalent among the residents living along River Benue in Adamawa State, Nigeria. Although, infection was more among the males than the females, there was no significant difference, but there were significant differences in prevalence and intensity with age, source of drinking water, and occupation. Screening of other family members and treating the infected individuals should be adopted by the public health authorities in combating this infection in these communities. Also, periodic drug distribution, health education regarding personal hygiene and good sanitary practices, precautionary protective measures, provision of clean and safe drinking water are imperative among these communities in order to curtail the transmission and morbidity caused by shistosomiasis.

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