Urogenital schitosomiasis among primary school pupils in Amagunze, Enugu State, southeast Nigeria.

by

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Running Title: Urinary Schistosomiasis infection in school pupils in Amagunze

Abstract

Among the neglected tropical diseases, schistosomiasis especially the urinary schistosomiasis has consistently provoked attention due to its morbidity and mortality within infected population. The current infection status in some of the endemic rural areas such as Amagunze is not known. Therefore, this study investigated the current prevalence of urinary schistosomiasis infection among school pupils in Amagunze community by urinalysis. Over all population prevalence was 14.18%. Prevalence was age and sex related. Pupils above 9 years of age have higher prevalence of 10.45% whereas those below 9 years old have 3.73%. Male pupils were more infected (8.9%) than females (5.22%). Cases of hematuria were more in males (2.23%) than females (1.49%). Prevalence of schistosomiasis in Amagunze is on the increase when compared to previous reports. Renewed education and treatment are needed to control and eliminate schistosomiasis infection.

Key words: schistosomiasis, hematuria, cercariae, neoplasia, malignancy

Introduction

Schistosomiasis is a water-borne parasitic disease caused by a platyhelminthic trematode of the genus *Schistosoma* (Colley et al., 2014) with species that either infect the urinary or the intestines of their human host (Jamieson, 2017, Colley et al., 2014). Among the neglected tropical diseases

(NTDs), schistosomiasis, especially the urinary schistosomiasis has consistently provoked attention due to its health debilitating, social and economic effects amongst infected population (Tei-Wu, 2017). The adult worms usually lay eggs in their host; the continuous accumulation of parasite eggs in the liver of the host causes hepatomegaly and liver failure (Gryseels et al., 2006). In the bladder, deposited eggs results in the rupturing of blood vessels and mixing of blood with urine- hematuria (Chen, 2014). Urinary schistosomiasis is considered a risk factor for the second most common urologic malignancy and also responsible for other myriads of disorders that results in morbidity and mortality (Ejima and Odaibo, 2010). Schistosomiasis rank second to malaria in terms of public health importance and has been shown to affect mainly school-aged children in the sub-tropical and tropical countries. Global fatality has been estimated to be about 280,000 cases annually (van der Werf et al., 2003).

Water get contaminated with *Schistosoma* eggs when infected people pass urine (urinary schistosomiasis) or feaces (for intestinal schistosomiasis) containing egg into water (Vale et al., 2017). The eggs subsequently hatch into a larval miracidial stage that swim shortly, locate and penetrate an appropriate snail intermediate host. Further development in the snail host results in the formation of cercariae, which emerge from the snail, locate and penetrate a human during contact with infected water (Gryseels, 1989, Colley et al., 2014, Salawu and Odaibo, 2016).

Women and children are the most affected due to their usual contact with infected water(WHO, 2011, Salawu and Odaibo, 2013). Unfortunately, school children carry the heaviest burden of morbidity due to schistosomiasis infection (Nwaorgu et al., 1998, Mafe et al., 2000, Singh et al., 2016), with serious negative impacts on the overall health status and physical fitness of the children (Nwaorgu et al., 1998, Mwinzi et al., 2015). Apart from the morbidity associated with acute

infections, they affect nutritional status and growth (Donohue et al., 2017) cognitive performance and school attendance (Ezeamama et al., 2012) of these children.

The global distribution has not changed with reported cases in 78 countries(Colley et al., 2014, GREENBERG, 2013). An estimated population of about 780 million people lives at a risk of infection while about 240 million are infected worldwide(Colley et al., 2014, Gryseels, 1989). The greatest prevalence occurs in sub-Sahara Africa where more than 90% of the infected live(Singh et al., 2016).

In Nigeria, both urinary and intestinal schistosomiasis caused by Schistosoma haematobium and Schistosoma mansoni respectively are endemic with vast distribution (Colley et al., 2014, Turner et al., 2017, Ozumba et al., 1989, Udonsi, 1990).

Urinary schistosomiasis is the most common and is endemic in many communities where there are rivers and streams that last more than a year and serve as a source of social and economic activities like swimming, fishing, sand excavation, irrigation, domestic washing etc (Ekwunife et al., 2004, Anosike et al., 2006). The presence of appropriate snail species that serve as intermediate hosts to Schistosoma (Udonsi, 1990, Okafor and Ngang, 2004) and frequenting of both infected and non-infected population to these streams and rivers have sustained the endemicity and new cases of urinary schistosomiasis in many of these communities despite many control and preventive interventions by both government and non-governmental agencies in the past (Mutapi et al., 2017, Mitchell et al., 2014). One of the factors suggested to be responsible for re-occurrence of diseases is lack of follow up screening of the population, proper surveillance and awareness education to catalyze community reawakening(Evans et al., 2013, Amuta and Houmsou, 2014). One of the urinary schistosomiasis endemic communities is Amagunze in Nkanu East Local Government area

of Enugu state south east Nigeria(Ozumba et al., 1989). Several reports have in the past highlighted the effects of Urinary schistosomiasis amongst school children in Amagunze (Ozumba et al., 1989, Ezeadila et al., 2015). The current infection status in some of the endemic rural areas such as Amagunze is not currently known. This research therefore is aimed amongst other things to investigate the current prevalence of urogenital schistosomiasis and create the awareness about the current prevalence of the infection among school pupils in Amagunze community with the view to providing a scientific information that would be required to monitor treatment program, control measures and socio- economic impact.

Materials and methods

Study Area

The study was conducted in three (3) primary schools namely: Community Primary School Isienu, Central Primary School Umunevo, Ajima Primary School, Ukwokani, all in Amagunze community in Nkanu East local government Area Enugu State, south east Nigeria. Nkanu East has a land area of about 307 square kilometers and a population of about 9,598 people (NPC 2006). Amagunze community is about a distance of 65 km from the Enugu State capital – Enugu. The community has a tropical setting with two prominent seasons: rainy (between April and October) and Dry (November to March) seasons. There are rivers and streams that serve as sources of social and economic activities as well as for drinking. The people are agrarian in occupation; mainly subsistent farming, wine tapping, fishing while few are civil servants. There are many primary schools. These schools were located near or along a popular local river known as 'Atavu'. There is also presence of functional health facility.

Study population

The study population comprised of children between the ages of five and fourteen (5 - 14), attending Community primary school Isienu, Central primary school Umunevo and Ajima primary school Ukwokani, Amagunze Nkanu East Local Government, Enugu State. One hundred and thirty-four (134) pupils were randomly selected from elementary classes 1 – 6. They comprised of 70 males and 64 females.

Ethical Consideration

Consent for this study was obtained from all the necessary authorities: Enugu State Universal Basic Education Board (ENSUBEB), the Local Council Education Secretary of Nkanu East, and the Headmaster/Mistress of the various schools. Pupils' parent consents were also obtained through letters. Out of 160 letters given out to parents seeking for their consents to allow their child or children to participate in the research, only 134 parents consented while 16 declined. Details and status of each pupil were treated with confidentiality and used for the purpose of this research only.

Sample Collection

The urine sample of each pupil was collected in a clean, sterile universal urine bottles. Their urine samples were collected between 11 am and 12 noon after a short vigorous physical exercise to potentiate maximum egg yield. Each pupil was instructed to pass mid-stream of their urine into the urine bottles and covered with the bottle cap immediately. The collected samples were labeled according to the sex and age of the pupil to avoid mistaking one sample for another. The urine samples were transported to the laboratory in dark container to stop hatching of matured eggs.

Urine macroscopy

The colour appearance of the urine samples was noted and described either as cloudy, pure amber, red blood or orange. Every colour observation was recorded. Further analysis was done to quantify hematuria intensity using a slight modification of the method of Nworgu et al (1998) by dipping combi 9 strips into freshly voided urine and matching on the colour field at the back of the combi 9 container. Hematuria was quantified as either negative or positive irrespective of low, medium or high quantification.

Urine Microscopy

Urine specimens were examined after centrifugation. Ten ml (10 ml) of urine sample was poured into a test tube and spun at 5000 rpm for 2 mins. The supernatant was decanted and the sediment was examined under x10 and x20 objectives for the detection of Schistosoma haematobium eggs. All the urine samples of the 134 pupils were examined and observed for the presence or absence of Schistosoma eggs, other cellular observation were also noted.

Data analysis

Prevalence was based on egg demonstration per 10ml of urine sample and quantified in Percent value. Differences between groups were analyzed using the statistical software- graph pad prism version 7.0 for windows.

Results

The parasitological and hematuria aspects of urinary schistosomiasis was studied to ascertain the prevalence of the infection in pupils attending Community primary school Isienu, Central primary school Umunevo and Ajima primary school Ukwokani, all in Amagunze Nkanu East Local Government, Enugu State. The total enrolment of pupils in the three study schools was 134 pupils

made up of 70(52.24%) males and 64(47.76%) females. Of the total of 134 urine samples examined for Schistosoma haematobium egg and hematuria, 19 (14.18%) were infected with Schistosoma haematobium eggs (Table 1). Infection seems to be age dependent with 14 (10.45%) pupils above 10 years infected, while pupils lower than 10 years old had 5 (3.73%) infections. Table 2, shows the distribution of Schistosoma eggs by sex. Of the 70 male pupils sampled, 12 (8.96%) of them had eggs in their urine, while 7 (5.22%) females also presented eggs in their urine. In table 3, the number of male pupils between 5-9 years of age with Schistosoma eggs was 3 (4.29%) out of the 29 pupils within that age range sampled. While amongst the male pupils within the age range of 10-14 years old, 9 (12.86%) of them were found to have eggs of Schistosoma eggs. Table 4, showed the Schistosoma egg distribution among female pupils according to age group. We found Schistosoma eggs in only 2(3.18%) female pupils within age range of 5-9 years old. While 5(7.81%) female pupils within 10-14 age range were diagnosed with *Schistosoma* eggs. Table 5, showed Hematuria and egg distribution according to sex. A total of 5(3.73%) pupils had hematuria. The number was made up of 3 (2.23%) male pupils and 2 (1.49%) female pupils that were diagnosed with hematuria only. Also 15(11.19%) male pupils and 11(8.20%) female pupils were diagnosed with both *Schistosoma* egg and hematuria.

Table 6 showed the distribution of hematuria and *Schistosoma* eggs according to age. Four (2.99%) pupils within 10-14 years of age were presenting blood in their urine while only 1 (0.75%) pupil presented blood in urine.

Discussion

This study showed a high population prevalence of 14.18% for schistosomiasis among primary school pupils in Amagunze. Our study agrees that Amagunze falls within the WHO classification

as schistosomiasis endemic area. Comparatively, the results of this study indicates a prevalence which was a little below previous reports (Nwaorgu et al., 1998, Ozumba et al., 1989), but above the reports of (Ezeadila et al., 2015). The prevalence of schistosomiasis in Amagunze seems to be fluctuating indicating that the infection has not been totally eliminated probably because of resurgence and reinfection after mass drug administration (MDA) (Mitchell et al., 2014). MDA aims to reduce morbidity, reduce population infection levels and transmission rates (King et al., 1991, French et al., 2010). Unfortunately long time protection against Schistosomes seems to develop slowly with children in endemic areas who are prone to repeated re-infection (Etard et al., 1995). To keep infection low there should be repeated treatment regimens for an indefinite time period (Chan et al., 1998, Wang et al., 2012). Poor environmental sanitation, inadequate and indiscriminate disposal of human excreta (especially around freshwater bodies), low literacy, lack of basic amenities and behavioral activities, water contact activity and snails infestation of ponds, river, and stream are critical epidemiological factors necessary for the transmission of urino-genital schistosomiasis (Mutapi et al., 2017, Okafor and Ngang, 2004, Udonsi, 1990) and could be responsible for resurgence of schistosomiasis in such a rural community as Amagunze.

Our study also found that prevalence was age related. Pupils below 9 years of age had low infection (3.73%) whereas the highest prevalence was observed amongst pupils above 10 years (10.45%), and there was a statistically significant difference between the numbers that were infected in the two age groups (P=0.05). The finding of this study is in agreement with reports of (Ezeadila et al., 2015). High prevalence among older pupils may be attributed to disposition of older pupils (10-14 years) to factors that favor infection such as urinating while swimming, washing of cloths, fetching water for domestic use, fishing in cercariae infested water etc. Apart

from dug wells, the other main source of water in Amagunze is the "Atavu" river which has been reported to have the snail intermediate host (Ozumba et al., 1989). The 'Atavu' river therefore serves as a good breeding site for *Schistosoma* sp and at the same time for swimming, washing of cloths, fetching water for domestic use, fishing. The low prevalence recorded among pupils below 9 years old could be attributed to low level of contact of this group of pupils with *Schistosoma* infested river water. Many adults especially mothers usually don't allow their kids below 9 years to fetch water, swim or wash clothes alone. However, some of them are reported to accompany their mother to the river during washing of clothes and swimming thereby getting exposed to infection. This probably accounted for the 3.73% infection observed among pupils less than 9 years of age.

Regarding gender distribution, our study also found that prevalence among males (8.9%) was higher than that of females (5.22%). Our finding was in agreement with previous studies (Ezeadila et al., 2015). Culturally, the males are at liberty to move around, fetch water, hunt, fish and swim unlike the females who are culturally restricted to domestic work at home and fetching of water. These behavioral activities are epidemiologically important in the transmission of schistosomiasis (Udonsi, 1990, Gryseels et al., 2006, Donohue et al., 2017) and might be responsible for the higher prevalence observed amongst the males.

Our study also indicated that hematuria cases were more in males (2.23%) than females (1.49%) though statistically there was no significant difference ($P \geq 0.05$) between infections in the two sex groups. Also hematuria was more in pupils above 9 years of age. Duration of infection and worm load are possible factors that increases pathological consequences such as rupturing of veins surrounding the bladder which results in leakage of blood into the bladder. Urinary schistosomiasis

usually is accompanied by micro and macro-hematuria as well as bladder lesions (Gryseels et al., 2006, Salawu and Odaibo, 2014) Urogenital schistosomiasis have been reported to increase the risk of Female Genital Schistosomiasis (FGS) with symptoms such as cervical inflammation, intraepithelial neoplasia, post-coital bleeding and genital ulceration (WHO, 2015)27]. This has been identified as a risk factor in Human Immuno-deficient Virus (HIV) transmission to women [(Salawu and Odaibo, 2013)28]. In males, genital schistosomiasis induces pathology of the seminal vesicles and the prostate with irreversible long-term consequences that may culminate in bladder cancer, urethral fibrosis and hydronephrosis [28]. Also, high infection intensities make eggs of Schistosomes to be trapped in tissues of the liver, spleen and peritoneum with severe and complex pathological consequences that may degenerate to late-stage sequelae

Conclusion

Urinary schistosomiasis prevalence is high in Amagunze despite repeated mass drug administration. Infection is sex and age related. Some infected individuals had hematuria. Those infected were primary school children who are active and full of activities. Infected active primary school pupils would probably serve as source of eggs that will infest streams and ponds thereby making total elimination impossible. There is therefore need for continued treatment, monitoring and public health education to catalyze community reawakening. Also government should provide alternative source of water to reduce incidence of contact with infested water.

Competing interests. There are no competing interests

Author contributions:

Victor S Njom designed various parts of this study. Victor S Njom and Nnenna M Okeanyaego carried out the experiments. Victor S Njom wrote the manuscript. All authors read and approved the manuscript.

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Acknowledgements

We are grateful to Headmasters and mistress of all the primary schools involved in this study. Also we wish to thank all the pupils and parents for their willingness to participate in the research.

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Table 1: Total population prevalence (*Schistosoma haematobium* egg) according to Age group

Age group	No sampled	No uninfected	No infected	% infection
5-9	57	52	5	**3.73**
10-14	77	63	14	**10.45**

Total	134	115	19	**14.18**

Table 2: *Schistosoma haematobium* egg distribution according to sex

Sex	No sampled	No uninfected	No infected	% infection
Male	70	58	12	8.96%
Female	64	57	7	5.22%
Total	134	115	19	14.18

Table 3: *Schistosoma haematobium* egg distribution among male pupils according to age group

Age group	No sampled	No uninfected	No infected	% infection
5-9	29	26	3	4.29
10-14	41	32	9	12.86
Total	70	58	12	17.14

Table 4: *Schistosoma haematobium* egg distribution among female pupils according to age group

Age group	No sampled	No uninfected	No infected	% infection
5-9	28	26	2	3.13
10-14	36	31	5	7.81
Total	64	57	7	10.94

Table 5: Hematuria and *Schistosoma* Egg distribution according to sex

Sex	No sampled	Hematuria + egg	% Hematuria + egg	Hematuria only	% Hematuria only	Egg only	% Egg
Male	70	15	11.19	3	2.23	12	8.96
Female	64	9	6.72	2	1.49	7	5.22
Total	134	24	17.91	5	3.73	19	14.18

360 **Table 6: Hematuria and *Schistosoma* Egg distribution according to Age group**

Age	No sampled	Hematuria + egg	% Hematuria + egg	Hematuria only	% Hematuria only	Egg only	% Egg
5-9	57	5	3.73	1	0.75	5	3.73
10-14	77	19	14.18	4	2.99	14	10.45
Total	134	24	17.91	5	3.73	19	14.18

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