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Distribution of Urinary Schistosomiasis among School Children Aged 6–17 Years in Naka, GWER West LGA of Benue State, Nigeria

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ABSTRACT

Schistosomiasis remains one of the most prevalent neglected tropical diseases especially in Nigeria which has a very high number of infected people. A cross-sectional study was conducted among 400 school children aged 6 – 17yrs in Naka, Benue State, Nigeria. Urine samples were examined microscopically using standard centrifugation method for the presence of *Schistosoma haematobium* eggs. The overall prevalence of Schistosomiasis was (34.0%). A significant difference in prevalence was observed between the nursery, primary and secondary school children examined. Secondary school children recorded higher prevalence rate (16.25%) than primary school children (9.5%) and nursery school children (8.25%) infected with *Schistosoma haematobium* respectively. Males had statistically higher prevalence rate 105 (26.25%) than females 31 (7.75%). Similarly, infection significantly increased with increasing age. With regards to this work *Schistosomiasis haematobium* peaked between the 11 – 15yrs of age in Naka. Pupil's water contact activities and source of pupil's drinking water are the significant risk factors associated with Schistosomiasis in this area. In conclusion, this study revealed that Schistosomiasis is still prevalent among school aged children in Naka, Benue State, Nigeria. Mass drug administration, health education and promotion as regards to Schistosomiasis should be introduced in schools where it is lacking and strengthened in schools where it is presently thought. That way, the prevalence rate of Schistosomiasis among school aged children might be significantly reduced.

Keywords: Schistosomiasis, urine, *Schistosoma haematobium*

Introduction

Health is a subject of interest to all citizens of Nigeria and is inextricably linked to all aspects of daily living and a prerequisite for a productive and satisfying life (WHO, 2017). A major goal of any health care delivery system today is to reserve and maximize human capital by offering health and social services that will result in the avoidance of diseases. Furthermore, it will offer diagnostic and rehabilitation services for existing diseases (Utzinger *et al.,* 2015).

In spite of major changes and approaches to the health care delivery system, there are many diseases and health problems that still exist and cause problems in the society (Dawaki *et al*., 2018). These diseases and health problems are attributed primarily to personal hygiene and environmental factors. One of these diseases is Schistosomiasis (also known as bilharziasis) which is still prominent in some countries including Nigeria (Webster *et al*., 2013).

Schistosomiasis is a disease caused by a parasitic worm or fluke, a trematode which completes its life cycle in humans and uses snails as intermediate host (WHO, 2016). The pathophysiology of infection results from the reaction of human tissue to the eggs and the fibrotic scarring of the urinary bladder, urethra, ureter and/or the descending colon of the digestive system depending on the type of organism (Hotez *et al.*, 2014).

Schistosomiasis is caused by several different Schistosoma species, each requiring a different approach to treatment and control. The species are *Schistosoma haematobium, Schistosoma mansoni, Schistosoma mekongi, Schistosoma intercalatum and Schistosoma japonicum* (Mazigo *et al.,* 2012).

The *Schistosoma haematobium* causes urinary Schistosomiasis and its intermediate host species are *Bulinus* and *Physopsis africanus snails,* while *Schistosoma mansoni* causes intestinal Schistosomiasis and its intermediate host species are the *Biomphalaria pfeifferi snails.* The incubation period of these organisms is about 4-6 weeks after contraction and the reservoir is man (WHO, 2013).

Schistosomiasis is closely associated with water since the snail intermediate host lives in water and carries the parasite (Hotez *et al.*, 2012). Thus all infected humans have been in close contact with water in one way or the other. Unfortunately water forms the basic requirement for our daily living, forcing humans to maintain close contact with available water resources (Abdulkadir *et al.,* 2017).

Although Nigeria is a country of marked ecological climatic contrasts, some areas of the country do experience seasonal "overflows" of water (Singh *et al.*, 2016). There are also "man-made" contributing factors. In Naka, Gwer-West Local Government Area, streams and Naka central dam, a reservoir for the water created in a dry riverbed, are the main water sources for most of the community in the surrounding areas. There are a lot of human settlements. The geographical distribution and pathophysiology of Schistosomiasis reflect the unique life cycle of these parasites. Schistosomes infect particular species of susceptible freshwater snails in endemic areas (Hotez *et al.*, 2009).

MATERIALS AND METHODS

Study population

Polit and Hungler (2004) described the population as the entire aggregation of cases which meet designated set of criteria. The criteria needed to define and describe this population were that it included randomly 400 school aged children between ages 6 to 17years in Naka, Gwer-West Local Government Area of Benue State, selected from ten different schools. The schools were: Mt. La Salle College Naka, Government Comprehensive Secondary School Naka, Calvin Foundation College Naka, Modern Secondary School Naka, Mt. Sinai Secondary School Naka, Corner Stone Academy Naka, LGEA EPS Primary School Naka, RCM Primary School Naka, Maranatha Secondary School Naka, Christ the King Nursery and Primary School Naka.

Sample Collection

The permission for the protocol of this study was approved by the Postgraduate School University of Mkar, and the ethical clearance was obtained from the Health Department Gwer-West Local Government Area. Announcements were made in churches and a pre-survey visit was done to the schools while consultation / discussions were held with school heads that assisted in mobilizing the school aged children for the study. Ten schools within Naka town were surveyed randomly and in each school children were screened during school hours. Two types of approaches were used to collect samples, namely biophysiological measures and questionnaires. A total of 400 school aged children were sampled for the study according to recommendations of WHO (2012) for Schistosomiasis control. The recommendation is that 200-250 subjects be sampled in each ecological zone (WHO 2012). Each subject was given a 30ml screw capped bottle labeled with instruction to provide terminal urine between 8:00 am and 11am since eggs output from infected persons riches peak value around that time of the day (king *et al.,* 2008, Parkin *et al*., 2018). Each bottle was labeled to correspond to the number assigned to each subject's questionnaire. The urine samples were preserved by adding two drops of 10% v/v domestic bleach (sodium hypochlorite) solution (Swai *et al.*, 2006). It was then transported immediately to the Medical Microbiology Research Laboratory of Benue State University Teaching Hospital for analysis.

Microscopic Examination

Urine examination for *Schistosoma haematobium* eggs was carried out on 400 samples. The standard centrifugation method as described by Cheesbrough, (2008) was employed. A sterile disposable 10ml syringe was used to draw urine sample into centrifuge tube using C2 series Centurion Scientific Centrifuge (United Kingdom), and this was centrifuged for 4mins at 3,000rpm. The supernatant was decanted while the sediments were re-mixed by tapping the bottom of the tube and a little drop placed on a slide. This was covered with a cover slip and examined microscopically, using X10 and X40 objectives for the identification of the eggs of the disease agent *Schistosoma haematobium.* The eggs of S*chistosoma haematobium* identified by their possession of terminal spine guided by a pictorial chat by (Tchuem *et al*., 2003). This process was carried out on the remaining sediments.

Analysis of data

Statistical package for social sciences SPSS was used for analysis. First a description of the data was done. Percentages were calculated. The study was also based on exploration and describing the factors which could be associated with the high incidence of the disease. The strength of the association was determined by means of the Chi-Square Test. This test merely indicated whether there is a statistically significant correlation between certain factors. The data were also graphically presented in Tables.

RESULTS

The distribution of urinary Schistosomiasis among the schools showed overall prevalence rate of 34.0% of *Schistosoma haematobium* infection among nursery, primary and secondary school children in the study area- Naka Gwer West of Benue State Nigeria as shown in table 1.

Table 2 showed females had 31(7.75%) Schistosomiasis infection rate compared to 105 (26.25%) males. It was observed that children who were involved in farming, swimming, and fishing had the prevalence of 13.75%, 3.0%, and 9.75% respectively. Similarly, those who contact river and dam water for bathing, fetching and washing had prevalence of 4.0%, 2.5%, and 1.0% respectively as shown in table 3.

Prevalence of the infection based on the sources of drinking water of studied children indicated that, those pupils whose source of drinking water were dams, ponds and rivers had the highest prevalence of 19.0%, 6.25%, and 5.25% respectively and wells and boreholes had the least prevalence of 3.25% and 0.25%, respectively as shown in table 4.

Table 1: Distribution of Urinary Schistosomiasis Based on Education in Naka, Gwer-West LGA of Benue Stat

Distribution	No. Examined	No. Infected
Nursery school	116	33(8.25%)
Primary school	132	38 (9.5%)
Secondary school	152	65 (16.25%)
Total	**400**	**136 (34.0%)**

X^2 (df =2) 8.393, P = 0.015, (P<0.05)

Table 2: Schistosomiasis Infection Based on Gender

Sex	No. Examined	No. Infected
Male	217	105 (26.25%)
Female	183	31 (7.75%)
Total	**400**	**136 (34.0%)**

X^2 = (df = 1) 43.751, P = 0.000, (P<0.05)

Table 3: Schistosomiasis Infection Distribution Based on Age

Age (Years)	No. Examined	No. Infected
6 – 10	46	8 (2.0%)
11 – 15	239	84 (21.0%)
16 – 17	115	44 (17.0%)
Total	**400**	**136 (34.0%)**

X^2 = (df =2) 5.957, P =0.051, P<0.05

Table 4: Prevalence of urinary Schistosomiasis by Water Contact Activities of Pupils in the Study Area.

Water Contact activity	No. examined	No. positive	Prevalence (%)
Farming	129	55	13.75
Fishing	23	12	3.0
Swimming	111	39	9.75
Bathing	62	16	4.0
Fetching water	40	10	2.5
Washing	35	4	1.0
Total	**400**	**136**	**34.0**

χ^2 (df = 5) 50.94; *P* = 0.01 (P<0.05)

Table 5. Prevalence of Urinary Schistosomiasis by Source of Drinking Water of Pupils in the Study Area.

Source of water supply	No. examined	No. positive	Prevalence (%)
River	59	21	5.25

Pond	102	25	6.25
Well	90	13	3.25
Dam	142	76	19.0
Borehole	7	1	0.25
Total	**400**	**136**	**34.0**

χ^2 ($df = 4$) 56.30; P = 0.000 ($P < 0.05$).

DISCUSSION

Schistosomiasis remains a major public health problem in many developing countries particularly among rural populations in sub-Saharan Africa (WHO, 2013). Nigeria is considered as the most endemic country for Schistosomiasis, with approximately 29 million infected people and 101 million people at risk of infection (Adenowo *et al.,* 2015). An overall prevalence rate of (34.0%) of *Schistosoma haematobium* infection was recorded among nursery, primary and secondary school children in the study area- Naka, Gwer West LGA of Benue State Nigeria. This prevalence is in agreement with other rates reported by previous studies of (37.9%) in Cross River State (Akeh *et al*., 2010, Nale *et al*., 2013), (43.7%) in Ebonyi State (Ivoke *et al.,* 2014) (41.6%) in Kano State (Sarkinfada *et al.,* 2009) and similarly, in Bende LGA of Abia state (41.5%) of prevalence was recorded. (Okoli *et al*., 1999, Nwosu *et al.*, 2005). However, higher prevalence rates were reported earlier in the same state, Benue (Amuta *et al.,* 2014). A previous study among school children in the Minjibir local government area of Kano State found that (44.2%) of the children were infected with *Schistosoma haematobium* (Duwa *et al.,* 2009). Another study showed that (50.3%) of children, aged 5-17 years, were infected with *Schistosoma haematobium* (Bassey *et al.,* 2004). Moreover, similarly high prevalence of urinary Schistosomiasis was reported among preschool children from Ogun, Southern Nigeria (Ekpo *et al.,* 2010, Hotez *et al.,* 2012).

On the other hand, lower prevalence rates were reported in other states of Nigeria. An overall Schistosomiasis prevalence of (6%) was reported in Yobe State, Northeastern Nigeria 10% *Schistosoma haematobium* (Bassey *et al.,* 2004). Similarly, another study from Ogun State reported that the prevalence of *Schistosoma haematobium* infections was (2.3%) (Agbolade *et al.,* 2007). A recent study among 2,064 participants from Anambra State, Nigeria reported that (15.7%) of them were infected with *Schistosoma haematobium* (Ugochukwu *et al*., 2013). Moreover, it was shown that Schistosomiasis is focally distributed and prevalence rates vary in different communities and locations of Nigeria (Ekpo *et al.,* 2010, Bigwan *et al*., 2012). In this regard, the present study revealed a significantly variation of prevalence rates among the studied school age children, with the secondary school age children having the highest prevalence (16.25%) while the lowest prevalence was found in nursery school children (8.25%). Globally, high prevalence rates of urinary Schistosomiasis have been reported in other countries in Africa (Tanzania, Ghana and Ethiopia) (Adenowo *et al.,* 2015, Abebe *et al.,* 2014) Asia (Philippines) (Olveda *et al*., 2014) and Latin and South America (Brazil) (Martins-Melo *et al.,* 2014).

Findings from this work showed that the prevalence of Schistosomiasis infection was significantly higher among male participants compared to females and this is consistent with previous reports in Nigeria (Duwa *et al.,* 2009, Abdullahi *et al.,* 2009, Bigwan *et al*., 2012 and Ivoke *et al.,* 2014). Likewise, this finding is in agreement with previous studies from Brazil, Yemen, Zanzibar and South Darfur (Enk *et al.,* 2010, Deribe *et al.,* 2011). By contrast, a significantly higher prevalence of Schistosomiasis was reported among females in comparison to males in Ghana (Nkegbe *et al.,* 2010). In this study, it's found that males have a more intense exposure to the sources of infection compared to females. Findings showed that (55.25%) of the participants admitted to have contact with a water body, for domestic purposes (28.7%) and swimming (12.75%), and these were the most reported reasons. Moreover, the male participants who had contact with a water body (swimming) were significantly higher than their female peers (Dawaki *et al.,* 2018). This could be 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 (Okoli *et al.,* 1999, Sady *et al.,* 2013). Moreover, males were more likely to be knowledgeable of the existence of an open water source in their area compared to females (Kapito -Tembo *et al.,* 2009).

Similarly, we found that the prevalence of infection was significantly higher among participants aged below 17 years compared to those aged ≥ 17 years; the highest prevalence rate (21.0%) was reported among those aged 11-15 years, while children aged 10 years and below had the lowest prevalence (2.0%) compared to other age groups. A previous study among 167 preschool children from Ogun State, Southern Nigeria revealed that (58.1%) of these children had urinary Schistosomiasis (Ekpo *et al.,* 2010). The control of Schistosomiasis in Nigeria consists of a school-based mass drug administration, with an absence of any provision for nursery school children. Hence, provision for their treatment should be considered in control programs. In accordance with the findings from this work, previous studies have shown the age-dependent occurrence of Schistosomiasis and indicated that the prevalence peak occurs during the adolescence and then decreases slowly (Ekwunife *et al.,* 2005, Nmorsi *et al.,* 2005, Abdullahi *et al.,* 2009). The excessive mobility of adolescents in terms of swimming, bathing and playing in open water could explain the higher prevalence rate in this age group. Moreover, previous studies from Nigeria, Kenya and Malawi reported an increasing trend of infection among children aged 6-13 years with a decline from the age of 14 years (Nduka *et al*., 1995, Satayathum *et al.,* 2006, Kapito – Tembo *et al.,* 2009).

The findings from this study suggest that improving socioeconomic status alone may not contribute to a significant reduction of Schistosomiasis prevalence rate in these communities, so integrated control measures should be implemented. In this regard, community awareness and better understanding of the social, cultural and behavioral determinants are imperative for designing effective control strategies (Nyantekyi *et al*., 2013). Moreover, participation of the target communities in the control activities is one of the essential strategies for the success and sustainability of disease

control programs (Sady *et al.,* 2013, Alemu *et al*., 2013). In low socioeconomic level communities, intervention through public awareness is often recommended as a first line of action to create the enabling environment for other strategies to thrive (Ekeh *et al*., 2013). Stories of success in eliminating and reducing the transmission, prevalence and intensity of Schistosomiasis have been documented in Africa (Egypt and Morocco) (Hotez *et al*., 2012; Barakat *et al*., 2013), Asia (China and Japan) (Utzinger *et al*., 2009; Rollinson *et al*., 2013) and Latin America (Dominican Republic and Puerto Rico) (WHO, 2013, Rollinson *et al*., 2013). Moreover, a recent study suggested and discussed an agenda to enhance collaboration between China and Africa on Schistosomiasis control in order to translate and apply the Chinese experience in African countries (Xu *et al*., 2016).

CONCLUSSION

Schistosomiasis is still prevalent among school age children in Naka, Benue State, Nigeria; 34.0% of the participants were found to be positive for Schistosomiasis. Screening of other family members and treating the infected individuals should be adopted by the public health authorities to combat this infection in the community. Besides mass drug administration, school and community-based health education regarding good personal hygiene and sanitary practices is imperative among the community in order to significantly reduce the transmission and morbidity of Schistosomiasis. Health education and promotion of awareness to Schistosomiasis should be introduced in schools where it is lacking and strengthened in schools where it is presently taught and School teachers should be trained in Schistosomiasis detection, prevention and control.

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