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Urinary Schistosomiasis and Concomitant Bacteriuria among School Age Children in Some Parts of Owerri, Imo State

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***Abstract*—** *Urinary Schistosomiasis and concomitant bacteriuria was investigated in some parts of Owerri, Imo State between May 2014 to July 2016. Single urine samples collected from subject aged 7-15 years between 10.00am and 2.00pm hours were examined for the presence of S.haematobium eggs using centrifugation technique and for bacteriuria by standard bacteriological methods. A totoal of 2250 subjects comprised of 1125 males and 1125 females were studied. Overall, 132 (5.9%) had the eggs of S.haematobuim in their urine, while 53 (40.2%) of the 132 who had eggs of S.haematobuim had bacterial growth. The bacteriaisolated include, Escherichia coli, Proteus sp., Pseudomonas sp, Klebsiella sp and Staphylococcus occurred more frequently (12.9%) than the rest of the bacteria species isolated. The antibiogram of the isolated revealed that Augumentin, Zinecf and Nalidixic acid were the most effective drugs in case management of concomitant bacteriuria among school children. This study clearly suggest that bacteriuria is a potent complication in the management of urinary Schistosomiasis. Therefore the complementary incorporation of antibacterial therapy appear essential with other public healh interventions such as access to safe water, improved communication and appropriate management.*

***Keywords*—** *Urinary Schistosomiasis, Concomitant bacteriuria, Prevalence and Susceptibility*.

I. Introduction

Bacterial infections are often recurrent and important complication of the inactive stage of urinary schistosomiasis which may be instrumental in precipitating renal failure (Hicks, 1982). During urinary schistosomiasis, there is breaking down of mucosal barrier (Hicks, 1982), as a result the urinary tract becomes an easy target for invading bacteria (Hicks, 1982). Nmorsi *et al*., 2007 reported that due to disruption of the mucosal barrier, there is a high rate of bacterial super infection, ranging from 30-80% in endemic communities. Several reports have indicated that *S. haematobium*-infected individuals, particularly children, may be more susceptible to bacterial urinary tract coinfection than noninfected individuals in areas where schistosomiasis is endemic. They include Adeyeba and Ojeaga, 2002 in Ibadan, Anosike *et al*.,2002 in Eboyi state, Casmir *et al*., 2009 in Abuja and Hicks *et al*. (1982) in Egypt. On the other hand, rates of bacteriuria have also been reported to be negligible or absent in some endemic populations or among infected individuals. In a Nigerian community where 3097 urine specimens were examined by culture for bacteria and for eggs, no significant difference was found in the rates of bacteriuria between infected and uninfected groups (Pugh and Gilles 1979). A number of similar studies have disputed a link between these two infections (Browning *et al*., 1984, WHO, 1991, Eyong *et al*., 2008). WHO 1991 made reference to two consecutive autopsy studies in Egypt that suggested no association between histological pyelonephritis and urinary schistosomiasis. It also observed that patients with *S. haematobium* infections have high urinary leukocyte counts, most of which are eosinophiles. In contrast to patients with bacterial urinary tract infections, patients with urinary schistosomiasis and leukocyturia tend to have normal peripheral leukocyte counts.

Furthermore, consensus regarding the association between urinary bacterial infection and urinary schistosomiasis is that only patients with significant schistosomal obstructive uropathy, such as hydronephrosis, hydroureter, urolithiasis and bladder outlet obstruction, are predisposed to bacterial superinfection (WHO 1991). The predominant organisms isolated from urine in urinary schistosomiasis were *Escherichia coli, Staphylococcus* sp., *Streptococcus* sp., *Proteus* sp., *Pseudomonas* sp, *Klebsiella* sp. and *Salmonella* sp. (WHO, 1991, Casmir *et al*., 2009).

II. Materials and Methods

Study Area

Imo State is one of the thirty-six states of the Federal Republic of Nigeria. It is specifically in South Eastern Nigeria. It lies between geographic co-ordinates of latitude $4^0$45’ and $7^0$15’ N and longitude of $6^0$50’E with an area of about 5,100sq km (Imo State Government, 2010). The state has a common boundary with Abia state on the East, Anambra state on the North, Rivers state on the South (Fig. 1).

The State is divided into three zones, namely; Owerri zone, Orlu zone and Okigwe zone made up of 27 Local Government Areas. The state has a common boundary with Abia state on the East, Anambra state on the North, Rivers state on the South (Fig. 1). There are lots of streams and rivers transvering through the villages and communities. In some communities there are ponds and water filled quaries created during road and building construction which serve for their domestic

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needs. People of Imo State are mostly of igbo ethnic extraction, public and civil servants, some are into agriculture while a good number are petty traders and casual workers. The people are serviced by several health establishment in the communities.

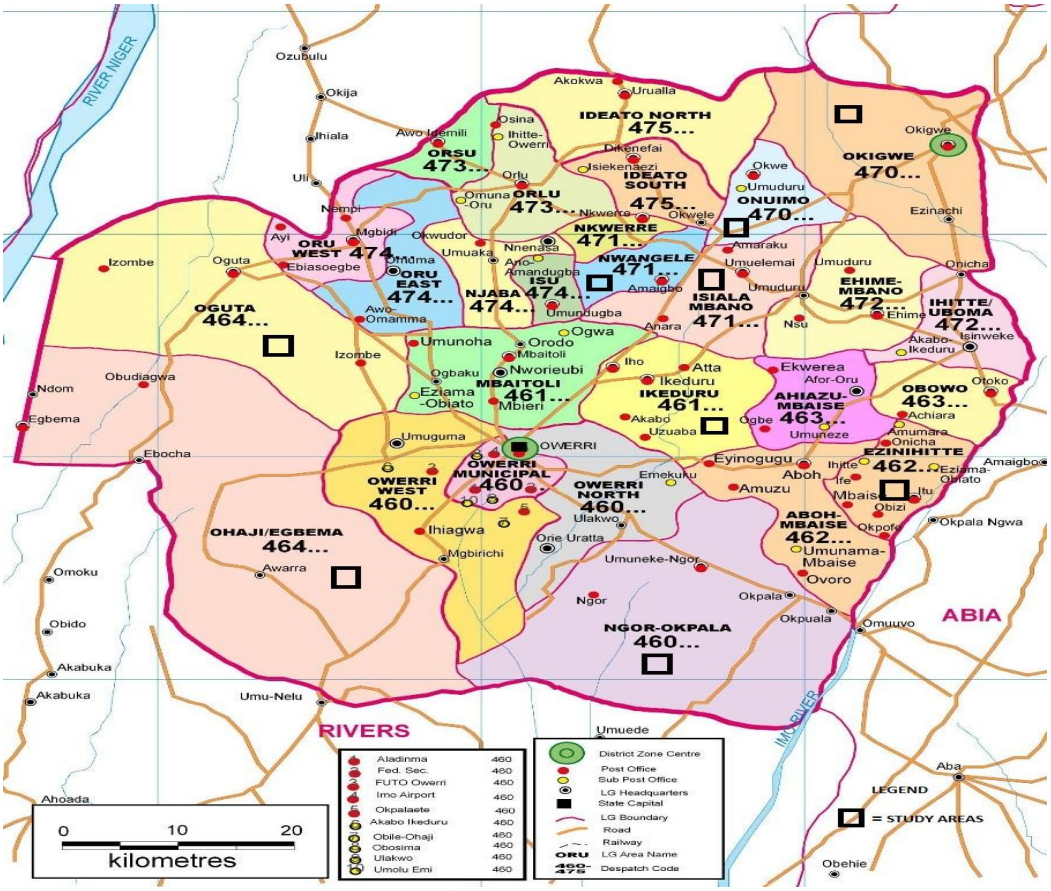

Fig. 1. Map of Imo State showing study areas.

Source: IMSG, 2010

Study Population

Nine Local Government Areas, three from each zone were selected for the study, namely; Oguta, Nwangele and Ohaji-Egbema Local Government Areas were selected from Orlu zone. In Owerri zone, Ikeduru, Ngor-Okpala and Ezinihitte Local Government Area were selected. However in Okigwe zone, Isiala Mbano, Onuimo and Okigwe Local Government Areas were selected. In each Local Government, five schools located in five different autonomous communities were visited. These Local Governments were considered based on the low level of social amenities e.g., portable water in such Local Government Areas. Additionally, level of agricultural and fishing activities and presence of either natural or man-made water bodies were also considered. Communities and villages in these Local Government Areas sampled were also selected based on their perceived proximity to known endemic foci of the disease (Anosike *et al*., 2001). Two thousand, two hundred and fifty children between the age bracket of seven to fifteen years were examined for the study. Out of this number examined, two hundred and fifty children were examined from each Local Government Area and out of this number examined from each Local Government; fifty children were examined from each school located in each autonomous community visited.

Ethical Approval and Informed Consent

The study was approved by the Post Graduate Board of the Department of Animal and Environmental Biology, Imo State University Owerri. With introduction letter from supervisors to State Ministry of Health and authority letters from the Ministry of Health and State Universal Basic Education Board to Local Government Health Units and subsequent authority letter from Local Government Health Units to Head Teacher of school visited, a pre-survey visit was made to the study area using the approach of Hassan *et al*. (2012). During the pre-survey visit, there was discussion with community heads, traditional rulers, local government health centers, headmasters and teachers of different schools in the villages and communities of the local government areas selected for the study. Additionally, villages and communities were educated on the significance of the study.

Questionnaire Administration

A questionnaire containing questions relevant to urinary schistosomiasis was issued to each child examined. It was

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aimed at obtaining information on; sex, age, community, Local Government Area, name of school, Knowledge of signs and symptoms of schistosomiasis, awareness of schistosomiasis and its mode of transmission, levels of parental education and occupation. Additional information on the risk factors where sought which includes; source of water for domestic use, such as well, pipe born water/mono pump, bore hole and river/stream/lake. Type of water contact activities such as swimming, fishing, washing, playing/bathing, collection of snail, fetching water, rice farming was also determined. Each questionnaire was accompanied by a corresponding urine specimen (Rine *et al*. 2013).

The questionnaire was administered with the help of trained field assistants. In all, there were thirty trained field assistants made up of teachers, volunteers from communities and undergraduate students. They were initially trained to enable them understand methods of sample and data collection, objective of the study, need to remain secretive. During questionnaire administration, class teachers and trained field assistants mainly those from communities translated some of the questions and communicated to respondents from lower classes in the local language for better understanding, while those in higher classes were directed to appropriately fill the form.

Sample Collection

This work was carried out between May, 2014 to July, 2016. Method of Olaubi and Olukunle (2013) was adopted. Clean catch urine samples were collected between 10.00am and 2.00pm. Each subject was given a sterile, clean dry screw-capped universal bottle carrying specific identification number. In addition, they were instructed on how to collect the urine samples; equally, they were advised to include the last few drops of the urine passed.

This is necessary, since according to Cheesbrough (1987), these drops often contain highest number of eggs of *Schistosoma haematobium*. Enquiry was made from female subjects to ascertain those in their monthly period. Such subjects were noted and excluded from visible haematuria counts. This, according to Anosike *et al*. (2001) is important to avoid false positive results. Each urine sample was labeled with identification number and placed in cold dark boxes to avoid hatching of eggs. The samples were then transported immediately to the laboratory within three hours for analysis.

III. Analysis of Urine Samples

Urinalysis

Method of Cheesbrough (1987) was adapted. Urine samples were microscopically examined for colour, macrohaematuria and turbidity. Reagent strip urinalysis was carried out using a reagent strip (Medi-Test Combi-9). The strip was used to analyze urine for the presence of blood, glucose, protein, pH, nitrate, urobilinogen, bilirubin, ketone and ascorbic acid. The test was performed by dipping the strip into the urine sample for about 5 seconds, according to (Olalubi and Olukunle, 2013). After this time, the strip was removed and then compared with the colour scale on the container of the strip. Similarly in colour on the strip and that on the container indicates positive result, while dissimilarity indicates negative result.

Microscopic Examination of Urine

The method of Anosike (2001) was adopted. After shaking the urine container, to resuspend urine deposits and other particulate contents, 10ml of the urine sample was transferred to a centrifuge tube using a sterile disposable 10ml syringe.

This was followed by centrifugation at 1500rpm for 5minutes. After decanting the supernatant, the test tube was tapped gently to resuspend urine deposit. With a Pasteur pipette, two drops of the resuspended deposit were transferred to a clean grease free glass slide and then covered with a cover slide. The preparation was examined under the microscope using x40 objective lens with iris diaphragm closed sufficiently to get good contrast. Red blood cells (RBC), White blood cells (WBC), cast yeast cells and eggs with terminal spine were recorded.

Use of Test Strip Method for Diagnosis of Schistosoma haematobium

This was carried out following the standard operating procedure according to the manufacturer. The procedure is as follows; A fresh urine specimen was collected in clean plastic containers. A strip is then removed from its bottle and then labeled with the respondent's identification. Reagent area of the strip was completely immersed into the urine specimen for a minute. After this time, the strip was removed from the urine, while removing the strip; its edge was run against the rim of the container to remove any excess urine. The strip was then placed horizontally on the table so that the chemicals will not mix. Result was taken between 1 to 2 minutes of dipping the strip into the urine sample. This is done by matching the colour of the strip with the colour chart on the bottle label.

Use of Filtration Method

Stages involved are;

The filter holder was unscrewed followed by the insertion of a nucleopore filter between the two parts of the filter holder. This was followed by thorough shaking of the urine specimen for proper mixing, after which 10ml of the specimen was drawn using a 10ml plastic syringe. The plunger of the syringe was pressed down to push all the urine through the filter and out into a bucket. The syringe was then detached carefully from the filter unit followed by drawing of air into the syringe. The syringe was reattached to the filter unit holder to expel any air present. Step D above is important since it helps to remove any excess urine and equally ensures that eggs are firmly attached to the filter. Filter holder was unscrewed, and then with a forceps, filter was removed and placed in an inverted position onto a microscope slide already labelled with respondent's identification number. The top side of the filter where the eggs were captured was placed face-up on the slide. A drop of Lugol's iodine was added and allowed for 15seconds for the stain to penetrate the eggs. This made the eggs more visible. This was then examined under the microscope using x40 objective; total number of eggs seen

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were also recorded. Eggs of *Schistosoma haematobium* if present will stain orange.

Media Used

MacConkey agar

This is a selective medium used for the isolation of coliforms. It is also a differential medium which distinguishes between the lactose fermenting bacteria and non-lactose fermenting bacteria. It contains lactose and neutral red dye, based on this, lactose fermenting colonies appear pink to red in colour and are easily distinguished from colonies of non-lactose fermenters (Prescott *et al*., 2005).

Nutrient agar

Nutrient agar (Lab M Nutrient agar LAB 8) is a general purpose medium that supports the growth of many microorganisms by providing them with organic growth factors. The media was used in the slant form for the preparation of stock culture of the isolates.

Blood agar

Blood agar is a medium to which blood is added for the isolation and cultivation of fastidious microorganisms. The slightly acid pH of the base encourages district haemolytic reactions.

Cystine Lactose-Electrolyte-Deficient Agar (CLED)

Cystine Lactose-Electrolyte-Deficient Agar (CLED) is a medium for the cultivation and estimation of bacteria from urine. The medium employs its electrolyte deficiency to inhibit the swarming of *Proteus* which otherwise would obscure the observation of colonies. Lactose is included in the medium to detect lactose fermenting coliform contaminants which are easily recognized by a colour change of the medium from green to yellow.

Bacteriological Analysis of Urine Samples

Method of WHO (2013) was adapted. Urine samples were inoculated onto different microbiological media such as MacConkey agar, Chocolate agar, Blood agar and CLED agar using calibrated wire loop. This was followed by incubation at 37^0C for 18 to 24 hours. In addition, chocolate agar plates were incubated at atmosphere of about 5-10% CO_2. Urine samples with bacterial growth of 10^5 colony forming unit per ml of urine and above were considered to be significant bacteriuria.

Antimicrobial Susceptibility Testing

Antibiogram of bacterial isolates associated with urinary tract infection among the respondents was determined using the disc diffusion method as described by Prescott *et al.* (2005). The following antibiotics were employed for the sensitivity analysis; amoxil, rifampicin, chloramphenicol, augumentin, ceporex, septrine, ciproflox, gentamycin, streptomycin, levofloxacin, tetracycline, nalidixic acid and zinicef. Surface-dried sterile nutrient agar plates were inoculated evenly with test isolates. Antibiotic discs were carefully placed on the surface of nutrient agar plates under aseptic condition using sterile forceps. This was followed by incubation for 18-24 hours at 37^0C. Diameter of inhibition zones were measured in mm and results recorded. Zones of inhibition $\geq$ 17mm were considered sensitive while zones $\leq$ 13mm were considered resistant.

Statistical Analysis

Statistical analysis was done using chi square, correlation and simple percentage.

IV. Results

Overall Pattern of Distribution of Schistosoma haematobium Infection among School Age Children in the Study Area

The overall pattern of distribution of *Schistosoma haematobium* infection among school age children in the study area is shown in Table 1. *Schistosoma haematobium* eggs were found in school age children in all the local government areas (L.G.As) sampled with an overall prevalence of 5.9% of the 2,250 children sampled. Okigwe recorded the highest occurrence 32(12.8%) of urinary schistosomiasis while the least 2(0.8%) was observed in Nwangele and Ikeduru L.G.As. The result revealed that 23 (9.2%) children were infected in Isiala Mbano, 27 (10.8%) in Onuimo, 15 (6.0%) in Ngor Okpalla and 8 (3.2%) in Ezinihitte L.G.A. Furthermore, 6.8% and 2.4% prevalence of infection were recorded in Oguta and Ohali Egbema respectively. Statistical analysis revealed significant difference in the infection of urinary schistosomiasis in the local government areas studied (x^2= 30.3, P value is < 0.00001 at P$\leq$ 0.05).

TABLE 1. Over all pattern of distribution of Schistosoma haematobium infection among school age children in the study area.

Local Government Area	No. Examined	No. (%) infected with *S. haematobium*	No. (%) uninfected with *S .haematobium*
Isiala-Mbano	250	23 (9.2)	227 (90.8)
Onuimo	250	27 (10.8)	223 (89.2)
Okigwe	250	32 (12.8)	218 (87.2)
Ngor-Okpalla	250	15 (6.0)	235 (94.0)
Ikeduru	250	2 (0.8)	248 (99.2)
Ezinihitte-Mbaise	250	8 (3.2)	242 (96.8)
Oguta	250	17(6.8)	233 (93.2)
Nwangele	250	2 (0.8)	248 (99.2)
Ohaji-Egbema	250	6 (2.4)	244 (97.6)
Total	2,250	132 (5.9)	2,118 (94.1)

Overall Sex-Related Pattren of Schistosoma haematobium Infection among School Age Children in the Study Area.

Table 2 shows the overall sex related infection of *S. haematobium* among the school age children in the study area. The result showed more males 75(6.7%) were infected than females 57(5.1%). However, the sex related occurrence of urinary schistosomiasis was not significant statistically (x^2=3.74 df=9 P=0.05). The sex related prevalence in the specific Local Government Area revealed that more females were infected in Ngor Okpalla (7.2% v 4.8%) and Ikeduru (1.6% v 0.0%) L.G.As. The same prevalence of infections were observed in Ezinihitte Mbaise 4(3.2%) and Nwangele 1(0.8%).

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TABLE 2. Overall sex-related pattern of *Schistosoma haematobium* infection among school age children in the study area.

	MALES			FEMALES		
Local Government Area	**No. Examined**	**No. (%) infected with *S. haematobium***	**No. (%) uninfected with *S. haematobium***	**No. Examined**	**No. (%) infected with *S. haematobium***	**No. (%) uninfected with *S. haematobium***
Isiala-Mbnao	125	15 (12.0)	110 (88.0)	125	8 (6.4	117 (93.6)
Onuimo	125	16 (12.8)	109 (87.2)	125	11 (8.8)	114 (91.2)
Okigwe	125	19 (15.2)	106 (84.8)	125	13 (10.4)	112 (89.6)
Ngor Okpalla	125	6 (4.8)	119 (95.2)	125	9 (7.2)	116 (92.8)
Ikeduru	125	0 (0.0)	125 (100)	125	2 (1.6)	123 (98.4)
Ezinihitte-Mbaise	125	4 (3.2)	121 (96.8)	125	4 (3.2)	121 (96.8)
Oguta	125	10 (8.0)	115 (92.0)	125	7 (5.6)	118 (94.4)
Nwangele	125	1 (0.8)	124 (99.2)	125	1 (0.8)	124 (99.2)
Ohaji Egbema	125	4 (3.2)	121 (96.8)	125	2 (1.6)	123 (98.4)
Total	1125	75 (6.7)	1050 (93.3)	1125	57 (5.1)	1068 (94.9)

Overall Sex-Age Pattern of Schistosoma haematobium Infection among School Age Children in the Study Area.

Table 3 shows the overall sex related prevalence of infection among the sex-age groups of school children examined in the study area. The result showed that the infection of the sexes was dependent on their age. The highest infection was recorded among males and females of 10-12 years age group while the least was observed among female of 7-9 years age group.

Overall Frequency of Significant Bacteriuria among School Age Children Infected with Schistosoma haematobium in the Study Area.

The prevalence of significant bacteria in school age children infected with urinary schistosomiasis is shown in Table 4. From the result, simultaneous presence of bacteria and *S. haematobium* egg were found in 53(40.2%) out of the 132 school children infected with urinary schistosomiasis. Out of the five genera of bacteria isolated *Escherichia coli* and *Staphylococcus* sp. had the highest and least frequency of 17(12.9%) and 6(4.5%), respectively. *Pseudomonas* sp., *Klebsiella* sp. and *Proteus* sp. record varied frequency levels of 9(6.9%), 8(6.1%) and 13(9.8%) respectively. The age related prevalence of bacteria isolates showed that children between 13-15 years recorded highest frequency of bacteria 33(62.3%) while the least 5(9.5%) was observed among 7-9 years age group. Statistically, the occurrence of the bacteriuria was not dependent on age of the children (x^2=4.889, p value 0.080) at P< 0.05.

TABLE 3. Overall sex-age pattern of *Schistosoma haematobium* infection among school age children in the study area.

	MALE			FEMALE		
Age Group (Years)	**No Examined**	**No(%) infected with *S. haematobium***	**No(%) uninfected with *S. haematobium***	**No Examined**	**No(%) infected with *S. haematobium***	**No(%) uninfected with *S. haematobium***
7-9	300	11(3.7)	289(96.3)	228	7(3.1)	221(96.9)
10-12	506	40(7.9)	466(92.1)	496	33(6.7)	463(93.3)
13-15	319	24(7.5)	295(92.5)	401	17(4.2)	384(95.8)
Total	1125	75(6.7)	1050(93.3)	1125	57(5.1)	1068(94.9)

TABLE 4. Overall frequency of significant Bacteriuria among school age children infected with *Schistosoma haematobium* in the study area.

ORGANISMS	**7 – 9 (years)**		**10 – 12 (years)**		**13 – 15 (years)**		**TOTAL**
	M n=11	**F n=7**	**M n=40**	**F n=33**	**M n=24**	**F n=17**	**M + F n= 132**
Proteus sp.	1(9.1)	1(14.3)	2(5.0)	1(3.0)	6(25.0)	2(11.8)	13(9.8)
Pseudomonas sp.	0(0.0)	0(0.0)	1(2.5)	2(6.1)	2(8.3)	4(23.5)	9(6.9)
Klebsiella sp.	0(0.0)	0(0.0)	1(2.5)	2(6.1)	3(12.5)	2(11.8)	8(6.1)
Staphylococcus sp.	0(0.0)	0(0.0)	1(2.5)	1(3.0)	1(4.2)	3(17.6)	6(4.5)
E. coli	1(9.1)	2(28.6)	2(5.0)	2(6.1)	4(16.7)	6(35.3)	17(12.9)
% OCCURRENCE	2(3.8)	3(5.7)	7(13.2)	8(15.1)	16(30.2)	17(32.1)	53(40.2)

The organisms identified with *S. haematobium* is (40.2%)

Prevalence of Co-Infection of Bacteria and Urinary Schistosomiasis among the Sex-Age Group.

The result showed that significantly more children were infected with only urinary schistosomiasis 79 (59.8%) while 53(40.2%) had co-infection of bacteria and urinary schistosomiasis (Table 5). 25(33.33%) male children had co-infection against 28(49.7%) in females. More males (66.6%) had single infection of urinary schistosomiasis than females (50.8%). The age related profile revealed that children of 13-15years had the highest frequency rate of co-infection (80.4%), while age group 7-9 years had the highest prevalence of single infection of *S. haematobium*. The occurrence of the co-infection was not dependent on age of the children (x^2=4.889, P value= 0.080) at P<0.05.

Antimicrobial Susceptibility Pattern of Urinary Tract Bacteria Associated with Schistosoma haematobium Infection in School Age Children.

Results of susceptibility testing on isolates from children infected with urinary schistosomiasis are summarized in Table 6. The antibiogram of bacterial isolates indicated varied degree of susceptibility to common antibiotics administered in

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the study area; rifampicin, augumentin, ciproflox, Nalidixic and zinicef were the most effective drugs for the management of bacterial infections among school children infected with urinary schistosomiasis. The gram positive bacteria, *Staphylococcus* spp indicated 100% susceptibility to augumentin and tetracycline but completely resistant to ceporex and streptomycin. *Proteus* sp and *Pseudomonas* sp were resistant to chloramphenicol while *Klebsiella* sp was 100% susceptible to augumentin but resistant to tetracycline. All the bacteria had poor susceptibility to streptomycin and most to amoxil.

TABLE 5. Prevalence of co-infection of bacteria and urinary Schistosomiasis among the sex-age group.

	Male			Female					
Age group (years)	**Number examined**	**Number infected with Bacteria and *S. haematobium***	**Number infected with *S. haematobium***	**Number examined**	**Number infected with Bacteria and *S. haematobium***	**Number infected with *S. haematobium***	**Total Number examined**	**Total Number infected with Bacteria and S. haematobium**	**Number infected with *S. haematobium***
7-9	11	2(18.1)	9(81.8)	7	3(42.8)	4(57.1)	18	5 (27.7)	13(72.2)
10-12	40	7(17.5)	33(82.5)	33	8(24.2)	25(75.7)	73	15(37.5)	58(70.4)
13-15	24	16(66.6)	8(33.3)	17	17(100.0)	0(0.0)	41	33(80.4)	8(19.5)
TOTAL	75	25(33.3)	50(66.6)	57	28(49.7)	29(50.8)	132	53(40.2)	79(59.8)

TABLE 6. Antimicrobial susceptibility pattern of urinary tract bacteria associated with *Schistosoma haematobium* infection in school age children.

Organisms	**No. (%) of Children**	**No. (%) of bacteria susceptible to:**												
		AML	**RD**	**CH**	**AU**	**CEP**	**SXT**	**CPX**	**CN**	**S**	**LEV**	**TET**	**NAL**	**Z**
Proteus sp.	13(9.8)	2(15.4)	8(61.5)	0(0.0)	13(100.0)	9(69.2)	3(23.1)	7(53.8)	8(61.5)	4(30.8)	6(46.2)	3(23.1)	12(92.3)	11(84.6)
Pseudomonas sp.	9(6.8)	4(44.4)	6(66.7)	0(0.0)	8(88.9)	6(66.7)	1(11.1)	6(66.7)	7(77.8)	2(22.2)	7(77.8)	5(55.6)	8(88.9)	9(100.0)
Klebsiella sp.	8(6.1)	3(37.5)	5(62.5)	5(62.5)	8(100.0)	7(37.5)	0(0.0)	7(37.5)	3(37.5)	2(25.0)	5(52.5)	0(0.0)	6(75.0)	7(87.5)
Staphylococcus sp.	6(4.5)	4(66.7)	5(83.3)	3(50.0)	6(100.0)	0(0.0)	5(83.3)	5(83.3)	1(16.7)	0(0.0)	2(33.3)	6(100.0)	5(83.3)	4(66.7)
E. coli	17(12.9)	3(17.6)	10(58.8)	4(23.5)	15(88.2)	3(17.6)	4(23.5)	13(76.5)	7(41.2)	5(29.4)	8(47.1)	10(58.8)	14(82.4)	16(94.1)
Total	53(40.2)	16(12.1)	34(25.8)	12(9.1)	50(37.9)	25(18.9)	13(9.8)	38(28.8)	26(19.7)	13(9.8)	28(21.2)	24(18.2)	45(34.1)	47(35.6)

AML= Amoxil, RD=Rifampicin, CH=Chloramphenicol, AU=Augumentin, CEP=Ceporex, SXT=Septrine, CPX=Ciproflox, CN=Gentamycin, S=Streptomycin, LEV=Levofloxacin, TET=Tetracycline, NAL=Nalidixic Acid, Z=Zinicef.

V. Discussion

Overall Pattern of Distribution of Urinary Schistosomiasis in the Study Area

The overall prevalence of 5.9% of urinary schistosomiasis was obtained from school age children in the study area. The low prevalence of 5.9% of *Schistosoma haematobium* observed in this study is in agreement with the 5.5% reported by Akinboye *et al*. (2011) among schools in Ibadan, Benwat *et al*. (2011) in Langai community, Mangu L.G.A of Plateau State (6.4%), Okpala *et al*. (2004) among pupils in Apata and Laranto areas in Jos, Nigeria (0.33%), Dawet *et al*. (2012) in Gwong and Kabong in Jos North Local Government Area, Plateau State (2.07%), Okere and Ubachukwu (2013) in Urban and Semi-Urban Communities in South-Eastern Nigeria (4.64%), Ogbonna *et al*. (2012) in Obollo-Eke, Enugu State, Nigeria (18.0%). Other studies also reported prevalence of urinary billharziasis that is comparable or even lower than the findings of this study. For example, prevalence rates of 4.5% and 11.3% were reported in Abini community in Cross River and Ohaji/Egbema in Imo State, respectively by Okoli *et al*. (2006). The low prevalence of *S. haematobium* observed in this study is not consistent with observation made by Ekpo *et al.* (2010) who reported 58.1% prevalence among preschool children in a community near Abeokuta. Similarly, Ugbomoiko *et al*. (2010) reported a prevalence of 62.0% in two peri-urban communities in South-Western Nigeria. Biu *et al*. (2009) reported a prevalence of 24.3% infection among school children in Konduga L.G.A, North-Eastern Nigeria. Furthermore, Babatunde *et al*. (2013) reported a prevalence of 48.2% among pre-school and school age children in two peri-urban communities in South-West Nigeria. Kiran and Muddasiru (2014) reported prevalence of 60.8% among school age children in some riverine areas of Sokoto, Nigeria while Balla and Jabbo (2013) reported prevalence in the rural communities of Mayo-Belwa local government area of Adamawa State, Nigeria. Other studies with results that are not in agreement with the present study include that by Ossai *et al*. (2014) who reported prevalence of 34.1% among primary school children in rural communities in Enugu State Nigeria.

Results from this study indicate that the study area is endemic for urinary schistomiasis. Though an endemic area for urinary schistosomiasis prevalence of 5.9% is still considered to be low; this is because 5.9% is below prevalence of 25.0% which is the maximum prevalence limit of urinary schistosomiasis as recommended by World Health Organization (WHO, 1985). Though low prevalence level of urinary schistosomiasis was observed in this study, the disease is still a serious health challenge that requires attention by Health Care Providers. Its presence no matter how low could be attributed to factors such as ignorance, poor living condition, inadequate sanitation, level of water contact activity with snail infected rivers, streams and ponds (WHO, 2003). The low prevalence of *Schistosoma haematobium* observed in this study could further be attributed to reduction in water contact activities (Dawet *et al*. 2012). The low prevalence may

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also be an indication of the level of awareness about the disease in the study area. This is obvious since according to Jamda *et al*. (2007), health education is a very effective means of improving knowledge about urinary schistosomiasis and has the potential to reduce the prevalence of the disease. Additionally, it is possible that government agencies may have embarked on routine and regular distribution of drugs effective for controlling the disease. Results of this study also revealed that urinary schistosomiasis is endemic in the nine local government area sampled (Table 1). Level of infection however varied with some local governments having higher level of infection than others. This difference in the prevalence rate may be influenced by peculiar ecological characteristics, the degree of exposure of people to water bodies through some indigenous water contact activities and presence of intermediate snail hosts in local rivers (Bolaji *et al*. 2015). No matter the level of infection, so long as there is infection, it is still a serious health issue that requires urgent attention. This trend of results is not unconnected to the fact that most of these local government areas have rural village and community arrangements. Furthermore, the prevalence reported in the present study may be an indication of the rate of *S. haematobium* transmission in these communities. Rivers are the main transmission foci in these local government areas. People depend on these rivers for their fishing occupation, bathing, swimming and other domestic needs. Infection foci may also be traced to their farms. It is possible that these provide avenue for infection transmission and re-infection (Bolaji *et al*. 2015). A close look at the prevalence of *S. haematobium* infection in the nine local government areas studied show that Okigwe had the highest prevalence of 12.8%. Infection rate for *S. haematobium* among school age children in the five different primary schools sampled within Okigwe L.G.A. ranges between 2.0% to 36.0%. The prevalence recorded in this local government is closely in agreement with observation made by Okoli *et al*. (2006) who recorded prevalence of 11.3% in Ohaji/Egbema L.G.A of Imo State. On the other hand, the prevalence level is slightly below 18.7% recorded in Niger-Benue basin of Kogi State by Ejima and Odaibo (2010). Main factors that may be responsible for higher prevalence of urinary schistosomiasis among school aged children in Okigwe L.G.A compared with other local government areas studied may include lower literacy, presence of infected water bodies like streams, ponds where daily activities like washing, fetching of water for domestic purposes, fishing, bathing and swimming take place (Houmson *et al*. 2012). Possible higher level of these predisposing factors may have put school age children at higher risk of infection compared with school age children from other local government areas. Furthermore, the increase in Okigwe may due to the topography and hydrology of Okigwe. The activities of the quarry companies create quarries which are filled with water serving as foci for infection. Also there are several collection of water from the several spring water sources in the area which serve for recreation purposes and for domestic use. Lastly, Okigwe has a large population of cattle rearers from Northern parts of the country which are known to present high infection rates (Balla and Jabbo, 2013).

Sex-Related Prevalence of Schistosoma haematobium infection Among School Age Children in the Study Area.

Males recorded higher prevalence rate of 6.7% than females 5.1%, there was no statistically significant difference in prevalence between male and female ($p<0.05$). The higher infection level of males over females as observed in this study is in accord with observation of Houmsou *et al*. (2012) (45.2% vs 37.2%) in two local government areas of Benue State Nigeria, Bolaji *et al*. (2015) (62.0% vs 54.9%)in Ajase-Ipo, Kwara State, Nigeria, Reuben *et al*. (2013) (18.7% vs 8.1%)in Lafia, Nasarawa State, Nigeria, Adeyeba and Ojeaga (2002) (63.0% vs 50.0%), Okolie (2008) (6.4% vs 3.6%) among the Abriba people of Abia State, South-Eastern Nigeria.

The observed in significant higher prevalence of *S. haematobium* in males and females is in variance with report by Ekpo *et al*. (2010) and Nkegbe (2010) who separately reported a significant higher prevalence in female than male. Other researchers such as Alaku (2013) also observed higher infection rate of 55.5% in females than 35.48% in males, Balla and Jabbo (2013) who reported prevalence of 32.5% and 32.3% in females and males, respectively in Adamawa State. The observed higher prevalence of *S. haematobium* infection in males than females could be attributed to the fact that boys engage more in swimming, fishing and irrigation especially after school hours more than their female counterpart. This practice exposes the boys more to risk of infection, since level of exposure or contact with water containing cercariae of the parasite and the risk of infection are linearly related (Abdullahi *et al*. 2011). Although the female could engage in water fetching and washing beside stream often in the company of their parents or guardians. Their exposure is not as long as those of the boys who may also assist in fetching water (Adeyeba and Ojeaga, 2002)

Age-Related pattern of Schistosoma haematobium Infection among School Age Children in the Study Area.

Prevalence of *Schistosoma haematobium* infection within the study area was observed to be age dependent. Infection with *S. haematobium* was found to be higher among pupils of the age group 10-12 that had prevalence rate of 7.3%. This was followed by those in age group 13-15 with 5.7% and finally those in age group 7-9 with infection level of 3.4%. There was a statistical significant difference of infection in the age groups at $p<0.05$. The observed higher prevalence of infection in 10-12 age group is similar to the findings of Abdullahi *et al*. (2011) where age group of 9-12 had the highest prevalence rate of 20.0%. Also Bello and Edungbola (1992) recorded high prevalence rate among this age group. The prevalence rate of 7.3% found in the 10-12 years in this study also contrast findings of Agi and Awi-Waadu (2008) and Ugbomoiko *et al*. (2010) who found high prevalence rates in a similar age group. Subjects of this age group are very adventurous and often engage in activities that necessitate more contact with water, as a result are always zealous to engage in activities such as fishing, swimming and irrigation than those in of the lower age group. Slightly lower prevalence of 5.7% among children between 13-15years is obvious because this group also engage in water activity but possibly

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are more aware of the disease and some precautionary measures that could be taken to avoid contracting the disease while those between 7-9 years that had least infection level of 3.4% may not always indulge in water contact activities due to their younger age.

Prevalence of Significant Bacteriuria among School Age Children Infected with Schistosoma Haematobium

The study revealed an overall prevalence of 40.2% of significant bacteriuria among school age children infected with *Shistosoma haematobium* in the study area while among those not infected with *Shistosoma haematobium* only 1.0% had bacteriuria. The different levels of bacteriuria prevalence among urinary schistomiasis infected and uninfected school children is similar to findings by Uneke *et al*. (2009) who recoded prevalence of 48.3% bacteriuria among people with urinary schistosomiasis, Anosike *et al*. (2001) reported a prevalence of 67.2% bacteriuria among infected persons, Adeyeba and Ojeaga (2002) observed a prevalence of 75.4% bacteriuria in persons infected with *Shistosoma haematobium* in their study in Ibadan. This high rate of concomitant bacteriuria in children could be attributed to urinary schistosomiasis (Ossai *et al*. 2012). This is because during infestation, as *Shistosoma haematobium* eggs are being ejected into urine, some blood also leaves with the eggs concurrently from the bladder. Blood being a potential culturing medium can encourage the flourishing of bacteria in the urinary tract (Ossai *et al*. 2012). Bleeding could also result through the migrating activities of the spined eggs of *Shistosoma haematobium.* The torn surfaces bleed, releasing blood for microbial utilization and also provide sites for microbial attachment and proliferation (Uwaezuoke *et al*., 2008). The association between schistosomal and bacterial infections could also result from a relationship in which the bacteria either became fixed on the cutaneous surface of the worm in clearly defined places (Penaud *et al*. 1983) or colonize the caecum of the parasite (Ottens and Dickerson, 1972).

Antimicrobial Susceptibility Patterns of Urinary Tract Bacteria among School Age Children Infected with and without Schistosoma haematobium in the study area.

The antibiotic sensitivity/resistance of bacterial pathogens associated with urinary schistosomiasis was examined. Some antibiotics were more effective on some organisms than others. Antibiotics also showed varied inhibitory and sensitivity effects on bacterial pathogens isolated from both school children infected with and without *Schistosoma haematobium.* Augmentin (37.9%), zinicef (35.6%) and nalidixic acid (34.1%) showed highest total inhibitory effect. This finding is in agreement with that by Ebie *et al*. (2001) who reported that nalidixic acid remains the drug of choice for the treatment of urinary tract infections. Above all, they are broad spectrum antibiotics known to be effective against different type of organisms including Gram positive and Gram negative bacteria. Septrine (9.8%), streptomycin (9.8%) and amoxil (12.1%) showed low inhibitory effect. This finding is also in agreement with that by Ebie *et al*. (2001). Low inhibitory effect of these antibiotics could be attributed to the difference in the concentrations of antibiotics, source of isolates and drug resistance transfer (Shewmake and Dillan, 1998). Furthermore indiscriminate use and abuse of some antibiotics such as septrine, streptomycin and amoxil due to the fact that they are cheap could also contribute to the low effect observed.

VI. Conclusion

In conclusion, it is pertinent to state that since the potential exist for possible interaction between *S. Haematobium* infection and bacteria UTI in Urinary *Schitosomiasis* endemic areas further studies are urgently required using the more sophisticated molecular and immunological tools to clearly elucidate this association. There is also the need to incorporate antibiotics in mass Schistosomosidial treatment programmes along with other public health interventions such as acess to safe water, improved sanitation health education, health communication and appropriate case management. These strategies will improve the health of children in endemic areas.

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