Galore International Journal of Health Sciences and Research
Vol. 9; Issue: 1; Jan.-March 2024
Website: www.gijhsr.com
Original Research Article *P-ISSN: 2456-9321*

Occurrence and Isolation of Urinary Tract Bacteria Associated with Urinary Schistosomiasis Among the School Aged Children in Sorbai and Murbai Area of Kona Ward, Ardo Kola Lga, Taraba State, Nigeria

Elkana D.S.[1], Elkana O.S[2], Adle A.A[3], Obadiah S.Y[2], Babylon P[4], Usman D.D[2], Azuchukwuene G.C.[2]

[1]Department of Nursing Science, Taraba State University, Jalingo, Taraba State, Nigeria.
[2]Department of biological sciences, Taraba State University, Jalingo/ Taraba State, Nigeria.
[3]Department of biological sciences, University of mkar, benue State, Nigeria.
[4]Department of Public Health, Taraba State University, Jalingo, Taraba State, Nigeria.
[5]Department of Environmental Health science, Taraba State University, Jalingo/ Taraba State, Nigeria.

Corresponding Author: Elkana D.S., Email: debbyelkana@gmail.com

DOI: https://doi.org/10.52403/gijhsr.20240113

ABSTRACT

This study was carried out to determine the occurrence and isolation of urinary Schistosomiasis and co-infection with bacteria among the school aged children in two Kona settlements. Schistosomiasis is a parasitic disease caused by blood flukes (trematode worms) of the genus Schistosoma and is common among the rural community dwellers that have occupation or recreation activities that link them with infected water bodies. The disease wreak a lot of havoc in the victims which range from anaemia, increase risk of liver fibrosis and bladder cancer, enlarged liver, difficult and painful urination, infertility etc. Nigeria has been reported to be the most endemic country in the world for schistosomiasis with about 29 million infected cases. However, people with urinary schistosomiasis are vulnerable to secondary infections caused by bacteria as a result of the break down in the mucosa barrier occasioned by the wear and tear of the spiny eggs of the schistosomes. The study employed urine filtration technique using polycarbonate membrane filters to detect *Schistosoma haematobium* eggs in urine. Standard culture techniques to isolate urinary tract pathogens with their susceptibility patterns were carried out. Questionnaires were administered to collect information on socio-demographic data on the children. Of the 1153 urine samples examined, 675 (58.4%) were infected with *Schistosoma haematobium*, out of whom 405 (60.0%) were positive for bacteriuria. Bacteriuria differed significantly between the two settlements (χ^2 =25.55, p=0.000) and sexes (χ^2 =29.55, p=0.000) with females recording high occurrence (84.6%) than males (39.2%). Similarly, significant association in prevalence was observed in the different age groups (χ^2 =92.97, p=0.000) with the 1-5years old being the highest, while the 11-15years the lowest. Spearman correlation coefficient showed significant association between urinary Schistosomiasis and bacteriuria (r=0.518, p<0.01). The different bacterial pathogen isolated in urine samples include: *Escherichia coli* (33.9%), *Klebsiella spp* (15.5%), *Proteus sp* (14.5%) *Pseudomonas aeruginosa* (12.8%) *Staphylococcus aureus* (2.0%). This study revealed a high occurrence of schistosomiasis and significant bacteriuria in the study areas which suggests that bacterial presence may be a potent complication in the management of urinary schistosomiasis.

Keywords: Schistosomiasis, isolation, bacteria, school aged children, antibiotic urinary tract,

sorbai, murbai, kona, ardo kola, Taraba state, Nigeria

INTRODUCTION

Background to the Study

Schistosomiasis is the second most common socio-economically devastating parasitic disease after malaria, affecting about 240 million residents of developing countries. Schistosomiasis is an acute and chronic disease caused by blood flukes (trematode worms) of the genus Schistosoma. (Akinneye JO et at., 2018). WHO reported that estimates showed that at least 220.8 million people required preventive treatment in 2017, while Mawa PA. et al., 2021, reported that 90% of the over 200 million infected people live in sub Saharan Africa.

Nigeria has been reported to be the most endemic country in the world for schistosomiasis. S. haematobium is widely spread mainly in riverine arears and communities around impoundment of river. This disease is common among poor communities that are without clean potable water and proper sanitation. Schistosomiasis is caused by different species of Schistosoma which can be intestinal and urinary depending on the species that is responsible. S.mansoni, S. japonicum, S. menkongi and S. intercalatum are all responsible for intestinal schistosomiasis, while S. haematobium is responsible for urinary schistosomiasis. Water snails of bulinus species are the intermediate host for S. haematobium and S. intercalatum while biompheleria species are the intermediate hosts for S. mansoni, oncomelania is for S. japonicum and for S. mekongi is meotricula aperta. (Center for disease control. DPDx, 2022).

Urinary tract infections (UTIs) represent the most common diseases encountered in medical practice today and occurring from the neonate to the geriatric group. Despite the widespread availability of antibiotics, urinary tract infections remain the most common bacterial infection in the human population. These infections occur as a result of microbial colonization of urine and the invasion of the urinary tract by microorganisms such as bacteria, viruses, yeast and parasites (Koyle *et al*, 2003). The resulting disease condition from UTIs include cystitis and pyelonephritis which are known to be non-age discriminatory affecting both infants older persons.

The children at great risk of kidney damage are infants and young children with febrile urinary tract infection in whom the infection is effective (Kunin 1972, 1979). The incident of primary infection is greatly influenced by age and sex and by predisposing factors that impair the defence mechanism that maintains the sterility of the normal urinary tract. Infection in children is often hard to recognize because of the variable symptomology and the difficulty of obtaining suitable specimens of urine in the very young, but they are of particular importance as causes of permanent damage to the developing kidney (Obi *et al*, 1996). Pyuria is evidenced by the inflammation of the genitourinary tract; it is a common problem with asymptomatic bacteria (Linshaw *et al*, 1996). Urinary Tract Infection of both bacteria and parasitic origins has been associated with high incidence of squamous cell of bladder and cervix carcinoma (Shortliffe, 1995).

Schistosoma haematobium and *Escherichia coli* are the most widely reported UTIs around the world. Urinary tract disease is a specific trait of infection with *Schistosoma haematobium* which affects in a diffuse manner the entire genitourinary tract (Poggensee *et al*, 2005).

Schistosomiasis is a major disease of public health importance, second only to malaria in parasitic infection. Hotez and Kamath (2009), reported that over 270 million cases of urinary schistosomiasis exist in the world.

Statement of the problem

Urinary schistosomiasis is a neglected common parasitic disease of children and no attempt has been made in recent past to report the secondary urinary pathogen that could be associated with the disease among

school-aged children in rural Nigeria. The disease wreak a lot of havoc in the victims which range from anaemia, increase risk of liver fibrosis and bladder cancer, enlarged liver, difficult and painful urination, infertility etc. Nigeria has been reported to be the most endemic country in the world for schistosomiasis with about 29 million infected cases. However, people with urinary schistosomiasis are vulnerable to secondary infections caused by bacteria as a result of the break down in the mucosa barrier occasioned by the wear and tear of the spiny eggs of the schistosomes

The risk factors of agricultural practices, the major occupation of indigenous residents of some settlements in Ardo-kola Local Government Area, exposes them to urinary schistosomiasis and pathogenic bacteria infection, thus there's a need to provide more insights on the relationship between *Schistosoma haematobium* infection and bacteria causing UTI in typical resource poor settings of the tropics.

There is urgent need to control urinary schistosomiasis and concomitant bacteriuria among the school age group.

MATERIALS AND METHODS

The study area

The study was carried out in Murbai and Sobai settlements of Kona ward in Ardo kola LGA which is located in the central part of Taraba State. Ardo-kola LGA is bounded by Jalingo LGA to the North and Gassol LGA to the south and Yorro LGA to the East. Some areas in the local government depend on slow running water, streams and ponds for drinking and daily chores. The main tribes in the Local Government Area are Kona, Mumuye, Fulani and Jukun. The main occupation of the people in the area is farming while very few are involved in trading and civil service.

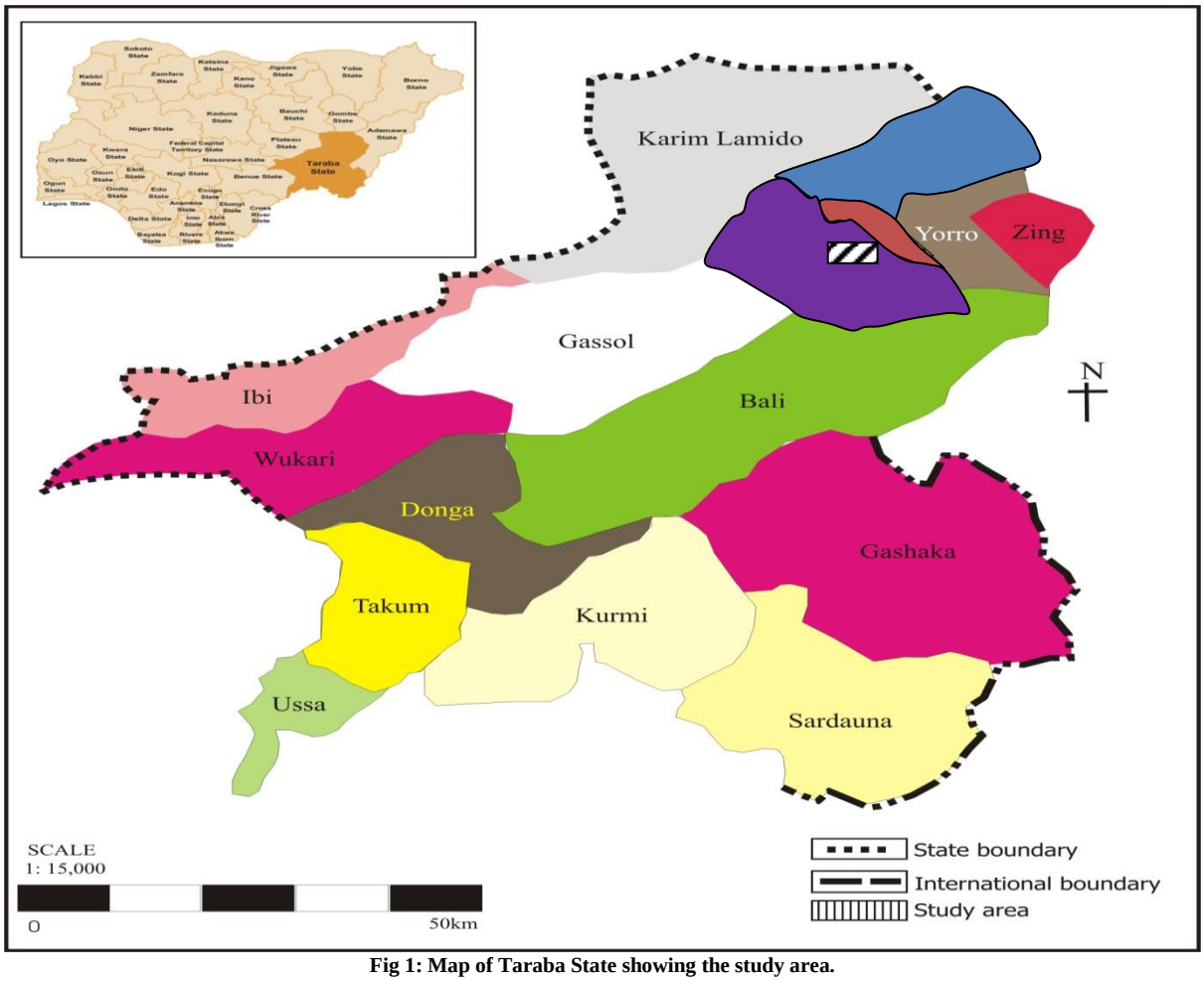

Fig 1: Map of Taraba State showing the study area.
Source: Taraba State Ministry of Land and Survey, 2023.

Permission for the Study

This study received ethical permission from the Primary Health Care Department of Ardo-kola LGA, Taraba state. Additional permission was obtained from the village head and Head Master of the community that participated in the study. Before the commencement of the study, consent of the parents was sought before samples were collected.

Study Design

The study is a cross sectional study carried out, and convenience sampling method was employed in this work among school aged children at Sorbai and Murbai in Kana ward of Ardo kola local government, Taraba State, North-East, Nigeria. All school aged children who consented were screened for the study.

Specimen collection

Sterile universal plastic containers with screw caps that bore identification numbers were given to the children. The children between the ages of 2-16 years were informed on urine sample collection instruction that is, the mid-stream urine. The samples were collected between 10.00am and 2:00pm, because timing for urine collection was critical especially for the detection of *Schistosomiasis haematobium* (WHO, 1980; Cheesbrough, 2005).

The participants were educated on collection of clean catch urine with emphasis on the last drop after which the females were asked to clean their genitalia before passing the urine into the sterile universal plastic.

A total of 1153 urine sample were collected, 675 positive samples with urinary schistosomiasis were examined for bacteriuria using standard culture method described by Cheesbrough (2005).

Urine Filtration Technique

Polycarbonate membrane filter of 13mm diameter and 12 - 14µm pore size was used according to the method described by Cheesbrough (2005). The polycarbonate membrane filter stained with lugols iodine was placed on a microscope slide and examined under the 10x and 40x objective lens. The number of eggs of S. haematobium were counted and expressed as eggs/10ml of urine. Intensity was reported as the number of ova per 10mls of urine and categorized as light intensity of infection (1-50 ova/mls) and heavy (>50 ova/10mls) of urine were found. The presence of pyuria (white blood cells) and red blood cells were also noted.

Urine Culture for Bacteria isolates.

Media:

Four media: MacConkey, Nutrient, Blood and Chocolate media were used respectively for the culturing of the urine to isolate and identify the various bacteria associated with urinary schistosomiasis.

Preparation of Media

Each of the culture medium was measured using the digital balance i.e. 52g and 28.0g respectively and suspended in 1 litre of distilled water and stabilized at 121^0C for 15 minutes, sterile molten medium was poured on different petri dishes and allowed to cool and solidify according to the methods described by Cheesbrough (2005). The dishes were placed upside down to prevent condensation on the lips of the dishes from dropping down and disrupting growing surface. Urine samples were inoculated on the surface of the different media using the streak plate method and incubated at 37^0C for 24 hours. Colony counter was used to count the number of colony forming units (CFU/ml). Significant count was described as bacteria count $\geq 10^5$ CFU/ml. isolated bacteria were identified and characterized using standard methods by (Cowan and Steel 1975; Cheesbrough, 2005; and Graham and Galloway, 2001).

STATISTICAL ANALYSIS

Data obtained was entered in Microsoft excel and exported to the Statistical Package

for Social Sciences (SPSS) version 23.0 for data analysis. Chi-square test was used to compare bacteriuria occurrence between the settlements, age and sexes, of the *Schistosoma haematobium* infected school aged children. Spearman rho's correlation was used to determine relationship between bacteriuria and urinary schistosomiasis.

RESULTS

Distribution of urinary schistosomiasis among school-aged children in two Kona settlements of Ardo-kola LGA, Taraba state, Nigeria.

The description of the community, age and sex related prevalence of urinary schistosomiasis among school-aged children in two Kona settlements of Ardo-kola LGA of Taraba state. A total of 675 (58.5%) children were infected of the 1153 urine samples examined. Prevalence of urinary schistosomiasis was between 51.3% - 60.7% in the two settlements studied, with Sorbai having the highest prevalence of infection (66.7%) while Murbai having the lowest (51.3%). Significant differences in infection were observed between the two settlements ($\chi^2 = 27.9$, $p = 0.000$)

Age related prevalence ranges between 17.6% - 78.7%) with 6 – 10 years having the highest infection rate (78.7%) and 1 – 5 years old having the lowest prevalence of infection (17.6%). Significant difference in infection was observed among the age groups ($\chi^2 = 29.55$, $p = 0.000$).

Sex related prevalence showed that males were more infected (71.2%) than the females (43.7%) with significant difference in infection between the two sexes ($\chi^2 = 93.0$, $p = 0.000$).

Table 1: Distribution of urinary schistosomiasis among school-aged children in two Kona settlements of Ardo-kola LGA, Taraba state, Nigeria

Urinary schistosomiasis						
Prevalence	**Negative**	**Positive**	**%**	**Total**	**χ^2**	**p-value**
By Community:					27.9	0.000
Sorbai	180	361	(66.7)	541		
Murbai	298	314	(51.3)	612		
By age:					29.55	0.000
1 – 5	295	63	(17.6)	358		
6 – 10	118	436	(78.7)	554		
11 – 15	65	176	(73.0)	241		
By sex:					93.0	0.000
Male	180	444	(71.2)	624		
Female	298	231	(43.7)	529		

Occurrence of bacteria isolates among school-aged children examined for urinary schistosomiasis in two Kona settlements of Ardo-kola LGA, Taraba State, Nigeria

Table 2 describes the occurrence of bacteria isolates among school-aged children examined for urinary schistosomiasis in two Kona settlements of Ardo-kola LGA, Taraba state, Nigeria. Of the 675 children infected with urinary schistosomiasis, (33.9%) had *E. coli* as the highest, this was followed by *Klebsiella spp.* (15.8%), *Proteus spp* (14.5%), *P. aeruginosa* (12.8%) and *S. aureus* (2.0%) as the lowest

Table 2: Bacteria isolates among school-aged children examined for urinary schistosomiasis in two Kona settlements of Ardo-kola LGA, Taraba State, Nigeria

S. haematobium	E. coli	(%)	S. aureus	(%)	P. aeruginosa	(%)	Klebsiella spp	(%)	Proteus spp.	(%)
Positive	376	(56.7)	19	(2.8)	141	(20.9)	166	(24.6)	156	(23.6)
Negative	15	(3.1)	4	(0.8)	07	(1.5)	16	(3.3)	08	(1.7)
Total	391	(33.9)	23	(2.0)	148	(12.8)	182	(15.8)	167	(14.5)

Plate 1: Showing colony of *P. aeruginosa* on MacConkey Agar

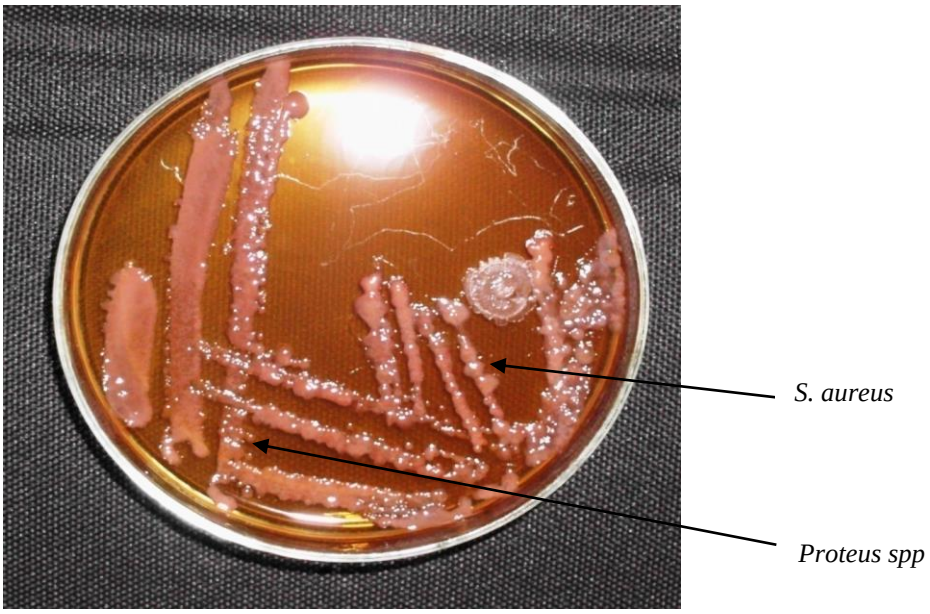

Plate 2: *Staphylococcus aureus* and *Proteus spp* on MacConkey agar

Plate 3: Colonies *E. coli* on blood agar

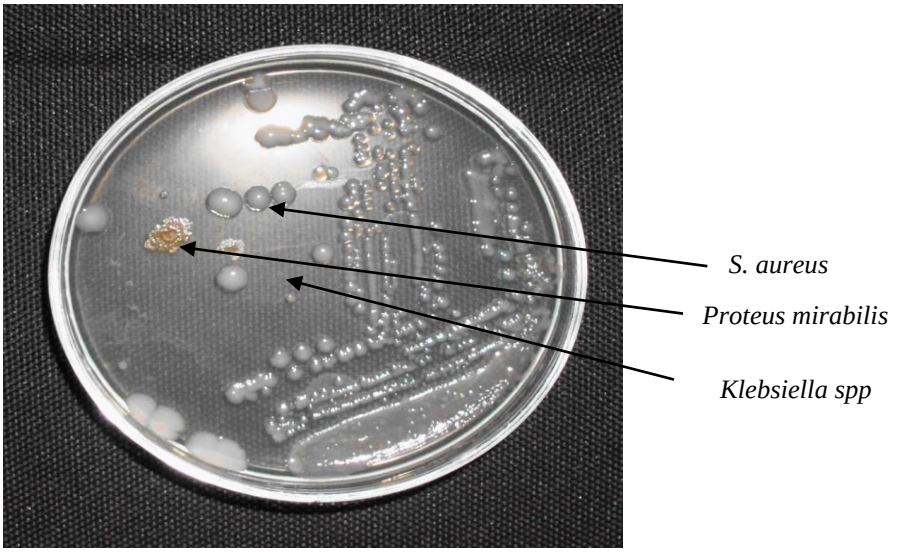

Plate 4: Bacteria colonies on Nutrient agar

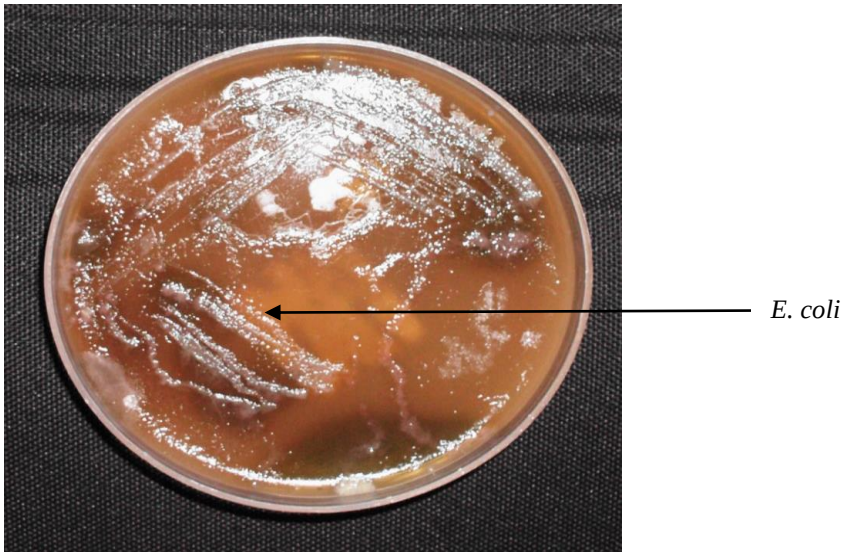

Plate 5: Colonies of *E. coli* on MacConkey agar

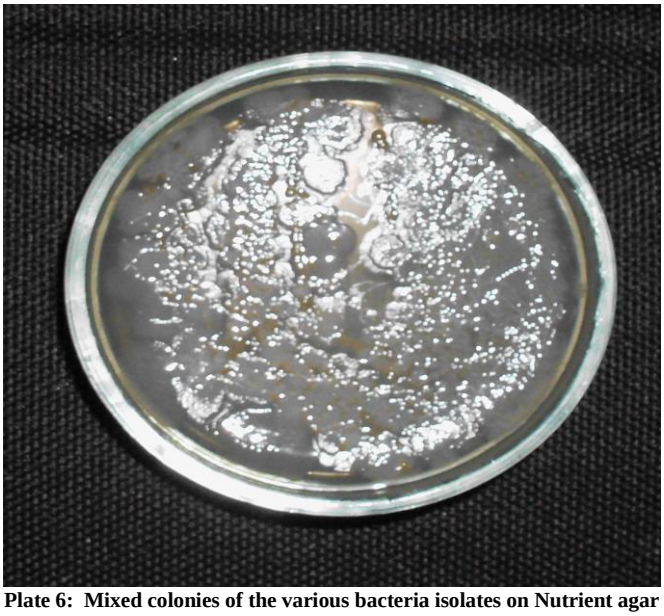

Plate 6: Mixed colonies of the various bacteria isolates on Nutrient agar

DISCUSSION

The occurrence of bacteriuria in this study (60.0%) is higher than 48.3% reported among school children infected with urinary schistosomiasis in a rural settlement of Ngbo-West in Eastern Nigeria (Uneke *et al*, 2009) but lower than (80.3%) reported among children infected with urinary schistosomiasis in the Federal Capital Territory, Abuja , Nigeria (Ifeanyi *et al*, 2009) The bacteriuria occurrence levels among schistosomiasis infected children is also similar to findings reported in Egypt among school children where bacteriuria was 10 times higher in areas endemic for urinary schistosomiasis (Laughlin *et al*, 1979). This high rate of concomitant bacteriuria among school-aged children could be attributed to urinary schistosomiasis. During infestation, *Schistosoma haematobium* are passed into the urine. Blood being a potential culture medium encourages the flourishing of bacteria organisms in the urinary tract. This co-infection has been documented as potential risk factor in the incidence of squamous cancer in later years (Bedwani *et al*, 1998; El-Mawla, 2001; Latif, 2004; Poggensee, *et al* 2005). This study revealed that 39.2% of males and all females were infected with bacteriuria. This finding concurs with the reports of Kunin (1994), Mbata (2007) and Kolawole *et al* (2009) where females were reported to be more infected with bacteriuria than their male counterparts. This study also revealed that bacteriuria is more common with the (1-5) and (6-10) years age groups. Children in these age-groups were seen to be engaged in activities which necessitate more contact with stream water and improper hygienic practices (Fincharm *et al.*, 2003). This study showed that all 675 subjects positive for urinary schistosomiasis, had pyuria (pus cells). This finding is suggestive of inflammatory lesions of the bladder caused by *Schistosoma haematobium*, the eggs deposition in the tissue could give rise to inflammation and granules formation leading to subsequent urinary tract infections. Earlier on, some researchers had implicated pyuria with bacterial infection (Bhatt *et al*, 1984, Adeyeba and Ojeaga, 2002 and Ifeanyi *et al*, 2009).

Some researchers had discovered that *Escherichia coli* occur more frequently than the rest of bacteria isolates and confirm its association with urinary schistosomiasis (Kaye, 1972, Gordon and Stuart, 1989, Roohalla and Stacy, 1995, Adeyeba and Ojeaga, 2002, Nmorsi *et al*, 2007 Uneke *et al*, 2009). The report that *E.coli* is the most frequently encountered urinary tract pathogen is a confirmation of this study where it has 33.9% occurrence followed by *Klebsiella sp* (15.8%), *Proteus sp* (14.5%), *Pseudomonas aeruginosa* (12.8%) and *S.aureus* (2.0%). All children with the primary infection of urinary schistosomiasis had more than one bacterium. When the mucosa is broken, which happens with urinary schistosomiasis, the urinary tract becomes an easy target for invading bacteria. The outcome is manifested in later years since most of the subjects examined had asymptomatic bacteriuria and did not present symptom such as painful micturition. This development poses great danger to the health of the school children (Fincharm *et al*, 2003). In the two settlements studied, the people depend more on traditional medicine which is more or less ineffective in the treatment of urinary schistosomiasis and its associated bacteriuria co-infection because there is virtually no existing health centres and trained community health care personnel in these settlements, thus systemic knowledge about bacteria co-infection and schistosomiasis in the 2-15years age group is scanty which is understandable since methods for schistosomiasis surveys are not optimal for detecting bacteriuria (Fincharm *et al*, 2003).

All the organisms encountered during the course of this study were resistant to Amoxycillin, Augumentin, Cotrimoxazole and Tetracycline. *E. coli* in particular showed a high level of resistance to Amoxycillin and Gentamycin. Similar

results were reported by Galia *et al* (2003), Mordy and Erah (2006), Frank-Peterside and Wokoma (2009) and Ayoade, (2013). Gentamycin, Ofloxacin and Nitrofurantoin were found to be the most effective for all the bacteria isolates except *S.aureus* that recorded 40% susceptibility. Chloramphenicol was found to be the most effective for *S. aureus* (100% susceptibility).

CONCLUSION

The findings from this study revealed that there is high rate occurrence of bacteriuria among school-aged children with urinary schistosomiasis in Sorbai and Murbai settlements of Ardo-kola LGA, Taraba State, Nigeria. Infection rate was highest in the 1-5years old than other age groups, and more in males than females, intensity of *Schistosoma haematobium* greatly influences the occurrence of bacteriuria in school-aged children. Urinary tract pathogen implicated is *E. coli, Klebsiella sp, Pseudomonas aeruginosa, Proteus sp and S. aureus* which is due to unhygienic practices engaged in by the children. The antibiotics susceptibility to these bacteria isolates are ready available in the markets, thus bacteriuria co-infection can be easily treated with these drugs.

This study concludes clearly and suggests that UTI is a potent complication in the management of urinary schistosomiasis. Hence the complimentary incorporation of antibacterial regimen in schistosomiasis control is essential.

Recommendations

The present study recommends that:

- There should be improvement in basic infrastructures such as potable water in rural communities, building of suitable health centres and adequate toilet facilities.
- Periodic epidemiological studies will help in identifying the important UTI pathogen associated with urinary schistosomiasis with a view to developing an effective and proper treatment model.
- All children infected with urinary schistosomiasis should be screened for bacteriuria and appropriate antibiotics concurrently administered along with Praziquantel.
- Intensive and sustained public health awareness and education programmes be carried out to sensitize the people on the risk of urinary schistosomiasis and its co-infection with bacteriuria.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Elkana D.S., Elkana O.S, Adle A.A, Obadiah S.Y, Babylon P, Usman D.D et.al. Occurrence and isolation of urinary tract bacteria associated with urinary schistosomiasis among the school aged children in sorbai and murbai area of kona ward, ardo kola lga, Taraba State, Nigeria. *Gal Int J Health Sci Res*. 2024; 9(1): 118-129. *DOI: https://doi.org/10.52403/gijhsr.20240113*

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