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Full Length Research Article

BACTERIURIA CO-INFECTION AND IMPACT OF URINARY SCHISTOSOMIASIS ON DAILY ACTIVITIES OF WOMEN IN YALA LOCAL GOVERNMENT AREA, CRS, NIGERIA

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ABSTRACT
Urinary schistosomiasis is one of the most important tropical diseases, which has received insufficient attention in developing countries. The burden of urinary schistosomiasis is further exacerbated by co-infection with bacterial Urinary Tract Infections (UTIs). This study was aimed at assessing bacteria co-infection and the impact of urinary schistosomiasis on daily activities of women in Yala L.G.A in Cross River State, Nigeria. Macroscopy, urinalysis, and microscopy were used to examine the 650 urine samples (400 from Okpoma and 250 from Ugaga villages) collected to determine presence of *Schistosoma haematobium* eggs. The presence of bacterial strains in urine samples positive for *Schistosoma* eggs was evaluated using standard microbiological protocol. Questionnaires administered to women provided information on socio-demographic data and water-contact activities. Results revealed that out of the 650 urine specimens examined in the two villages, 202 (31.08%) were infected as overall prevalence. The highest prevalence (48.53%) was found among the 11-22 years age group, and the least (12.80%) among the 59-70 years age group. Statistical analysis at significance level (P≤ 0.05) revealed that there is a significant relationship between occupation and infection rate of schistosomiasis in the area. One hundred and sixty women (72.07%) who were infected complained of suprapubic pain and painful urination. Also, the infection prevented them from going to farm, market, carrying out their daily domestic activities (cooking, washing, fetching water), attending social functions, and performing their functions as caregivers. A total of eight (8) bacteria genera were isolated and identified from 202 urine samples positive for *Schistosoma* eggs. The bacterial species include *Klebsiella* sp. 3 (2.47%), *Staphylococcus aureus* 39 (32.23%), *Enterococcus aerogenes* 6 (4.95), *Escherichia coli* 32 (26,45), *Pseudomonas aeruginosa* 14 (11.57), *Staphylococcus saprophyticus* 10 (8.26), *Enterococcus faecalis* 9 (6.61) and *Proteus* sp. 8 (6.61). Significant bacteriuria was detected in 121 (59.90%) and co-infection was detected in 65 (53.68%) of schistosomiasis cases. This investigation revealed the impact of urinary schistosomiasis on the daily activities of the women and significant bacteriuria in the study area which suggest that bacterial presence may be a potent complication in the management of urinary schistosomiasis. The integration of complementary control strategies such as disease surveillance, chemotherapy, health education, potable water supply, provision of toilet facilities and sanitation in the study area would lead to great success..

Keywords: *Bacteriuria, Co-infection, Impact, Schistosomiasis, Women, Activities.*

1.0 INTRODUCTION

Urinary schistosomiasis is prevalent in Africa and eastern Mediterranean (Adeyeba and Ojeaga, 2002). It is also estimated that about 85% of all cases of this disease are in sub-Saharan Africa (Chitsulo *et al*., 2000). In Nigeria, many rural communities in some states of the country are endemic for *Schistosoma haematobium* infection (Anosike *et al*., 2008; Uneke *et al*., 2009; Abdullahi *et al*., 2010).

Some studies in Cross River State have been on the prevalence of urinary schistosomiasis among school-aged, pre-school children and adults in general; there is still paucity of literature on the impact of this disease on women (Inyang-Etoh *et al*., 2009; Etim *et al*., 2012; Adie *et al*., 2013), hence the need for this survey.

Women in Yala Local Government Area are naturally exposed to the source of infection on account of their care-giving activities. Most of these women have no knowledge of the disease and have never been diagnosed, and the streams remain their main source of water.

Urinary tract infection (UTI) has been reported to be the second most frequent infection in long-term care facilities and the most common cause of hospitalization for bacterial infection (Kone *et al*., 2022). In addition, Medina and Castillo-Pino (2019) asserted that UTIs are most common outpatient infections, with a life time incidence of 50-60% in adult women.

Urinary tract infection is as a result of presence of significant bacteria in urine and significant bacteriuria is defined as a urine sample containing more than 10^5 cfu/ml of urine in pure culture ((Kehinde *et al*., 2011).

Bacterial infections in most cases complicate the course of patients with urinary schistosomiasis because the otherwise so-called normal flora of the urinary tract have a way of entering and invading the underlying internal tissues due to the regular wear and tear of the epithelium by the spiny *Schistosoma* eggs (Alabi *et al*., 2023). Therefore, concomitant bacterial infections have been suggested to be the major pathogenetic elements in schistosomiasis, rather than parasitic effects (Barsoum, 2013). Co-infections of urinary schistosomiasis and urinary tract infections (UTIs) caused by *Schistosoma haematobium* and bacteria respectively are common among women in the tropics (Kone *et al*., 2022). Uneke *et al*. (2009) described UTI as a pandemic disease that its incident is greatly influenced by age and sex and by factors that impair the defense mechanism that maintain the sterility of the normal urinary tract.

Many studies have implicated bacteriuria co-infection with urinary schistosomiasis in the etiology of bladder cancer and other complications (Barsoum, 2013; Ossai *et al*., 2014). UTI is

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responsible for more illnesses and significantly contribute to the cost of providing health globally, leading to a number of deaths either from acute infection or from chronic renal failure. More so, bacterial infections normally take place, when the mucosal barrier is broken down which makes the urinary tract an easy target for invading bacteria (Fincham *et al*., 2003).

Despite the evidence of possible association of bacteriuria with urinary schistosomiasis, the control measures instituted by various agencies against schistosomiasis pay little attention to the complexity of schistosomiasis morbidity in the presence of UTI. This, however, could be due in part to the scarcity of information on the association between these parasitic and bacterial urinary infections. As a result, this study seeks to investigate bacteriuria co-infection and the impact of urinary schistosomiasis on the daily activities of women in Yala Local Government Area, Cross River State, Nigeria.

2.0 MATERIALS AND METHODS

2.1 Study area

(Ottong *et al*., 2010)

Figure 1: Map of Cross River State showing the 18 L.G.As including the study area

This research was conducted in Yala Local Government Area located in the northern part of Cross River State. Yala LGA is in the derived Savannah zone of Cross River State with abundant salt deposits which sustain the local salt industry. The major economic activities in the area are agriculture, fishing, mining, and trading. The major food crops produced are yam, cassava, benniseed (sesame) and maize (Tiku and Godwin, 2012).

2.2 Consent from community leaders

The consents of the two village Heads (Ugaga and Okpoma) and community women leaders were sought; and permissions were granted for the study.

3 Parasitological surveys

A total of 400 mid-stream urine samples and 250 mid-stream urine samples were collected from the women in Okpoma and Ugaga villages, respectively during a period of three month (May to July 2023). Ugaga is a smaller village. The urine samples (650) collected were examined using reagent strip (combi 9) and parasitologically for the presence of eggs of *Schistosoma* (Cheesbrough, 2005).

2.4 Isolation and identification of bacteria in urine samples

The urine specimens, which were positive for the ova of *Schistosoma haematobium* were inoculated on Petri dishes containing Eosin Methylene Blue Agar, MacConkey Agar and Mannitol Salt Agar, respectively and incubated at 37°C for 24 hours. Preliminary identification of bacterial isolates was carried out based on the isolate's colonial characteristics and Gram's staining reaction. Thereafter biochemical characterization of isolates as described by Talaiekhozani (2013).

2.5 Questionnaire survey

A total of 650 questionnaires were administered to the women to ascertain socio-demographic, individual history and knowledge of schistosomiasis infection and the impact on their daily activities.

2.6 Statistical Analysis

Comparison of prevalence by subjects' occupation and the infection was made using Chi square (χ^2) test. Descriptive statistics including percentages and mean values were used to analyse data obtained from questionnaires. P values less than or equal to 0.05 (($P \leq 0.05$) were taken as being statistically significant (Uwero *et al*., 2010).

3.0 RESULTS AND DISCUSSION

3.1 Questionnaire survey

In Okpoma, 350 questionnaires were recovered. The 250 that were administered in Ugaga were all recovered. From the questionnaires collected in the two villages 336 (56%) of the respondents were peasant farmers within the age group of 59-70 years having the highest percentage of 96.05%, the age group of 11-22 years had the least with 18 (10.71%) women as farmers. The traders accounted for 18.67% of all respondents with the age group 23-34 years having the highest percentage of 34.43%. Civil servants made up 2.17% with the age group of 47-58 years being the highest with 9.68%. The least percentage of civil servants was found in the age group 23-34 years. The student respondents were 23.17% with the age group 11-20 years having the highest percentage of 71.19% while the age group 23-34 years had the least with 9.02%. The summary of the individual occupations is presented in Table 1.

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Table 1: Occupation of respondents in Yala Local Government Area

AGE GROUPS	NO. SAMPLED	FARMERS (%)	TRADERS (%)	CIVIL SERVANTS (%)	STUDENTS (%)
11-22	168 (28.00)	18 (10.71)	22 (13.10)	0	128 (76.19)
23-34	122 (20.33)	66 (54.10)	42 (34.43)	3 (2.46)	11 (9.02)
35-46	133 (22.17)	103 (77.44)	26 (19.55)	4 (3.01)	0
47-58	101 (16.83)	76 (75.25)	19 (18.81)	6 (5.94)	0
59-70	76 (12.67)	73 (96.05)	3 (3.95)	0	0
	600	**336 (56.00)**	**112 (18.67)**	**13 (2.17)**	**139 (23.17)**

% = percentage

Most of the women who are farmers in the study area are not educated. Summary of the individual literacy level is shown in Table 2.

Table 2: Literacy level of respondents in Yala Local Government Area

AGE GROUPS	NO. SAMPLED	NO EDUCATION (%)	FSLC (%)	SSCE (%)	TERTIARY EDUCATION (%)
11-22	168 (28.00)	10 (5.95)	115 (68.45)	40 (23.81)	3 (1.79)
23-34	122 (20.33)	26 (21.31)	58 (47.54)	35 (28.69)	3 (2.46)
35-46	133 (22.17)	93 (69.92)	26 (19.55)	10 (7.52)	4 (3.01)
47-58	101 (16.88)	82 (81.19)	15 (14.85)	2 (1.98)	2 (1.98)
59-70	76 (12.67)	74 (97.37)	2 (2.63)	0	0
	600	**285 (47.50)**	**216 (36.00)**	**87 (14.50)**	**12 (2.00)**

No. = number; % = percentage

Women who responded positively to the use of stream as the source of drinking water were 71.67%, while 17.17% responded to the use of well, 10.17% borehole and 1.00% public tap. Use of Stream had the highest percentage of 77.67% for water for other household use, and 13.17% for use of well, 8.83% for borehole and 0.33% for tap. This result indicates that the main source of water in the study area is the stream. Summary of sources of water results is presented in Tables 3 and 4.

Table 3: Sources of drinking water by respondents

AGE GROUPS	NO SAMPLED	STREAM (%)	WELL (%)	BOREHOLE (%)	TAP (%)	OTHERS (%)
11-22	168	115(68.45)	40(23.81)	10(5.95)	3(1.79)	0
23-34	122	92(75.40)	21(17.21)	9(7.34)	0	0
35-46	133	97(72.93)	15(11.28)	20(15.04)	1(0.75)	0
47-58	101	65(64.36)	18(17.82)	16(15.84)	2(1.98)	0
59-70	76	61(80.26)	9(11.84)	6(7.89)	0	0
	600	**430(71.67)**	**103(17.17)**	**61(10.17)**	**6(1.00)**	

No. = number; % = percentage

Thirty-seven percent (37.00%) of the women responded positively to passing blood in urine. The highest number was found in the age group 11-22 years (52.98%) and the least was found in the age group 59-70 years (21.05%). Figure 1 shows presence of haematuria as reported by respondents. The presence of blood in urine was found to decrease with age

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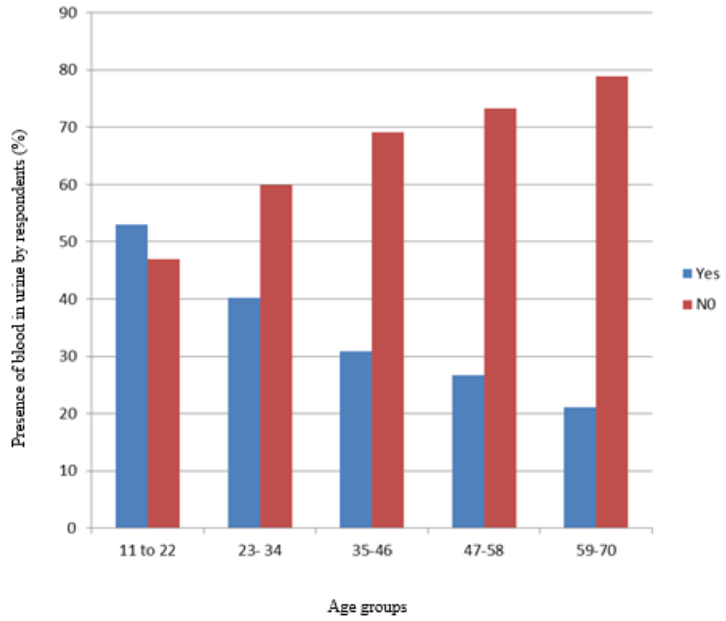

Figure 1: Presence of blood in urine among respondents

3.2 Treatment-seeking behaviour

Treatment-seeking behaviour of respondents shows that 26.58% treated themselves at the health centre, 29.11% at the chemist, 2.53% got their drugs from neighbours and family. While the highest percentage of 41.77% used herbs for treatment with 60.00% among the age group of 59-70. This indicates that most of the women go for herbal treatment as shown Figure 2.

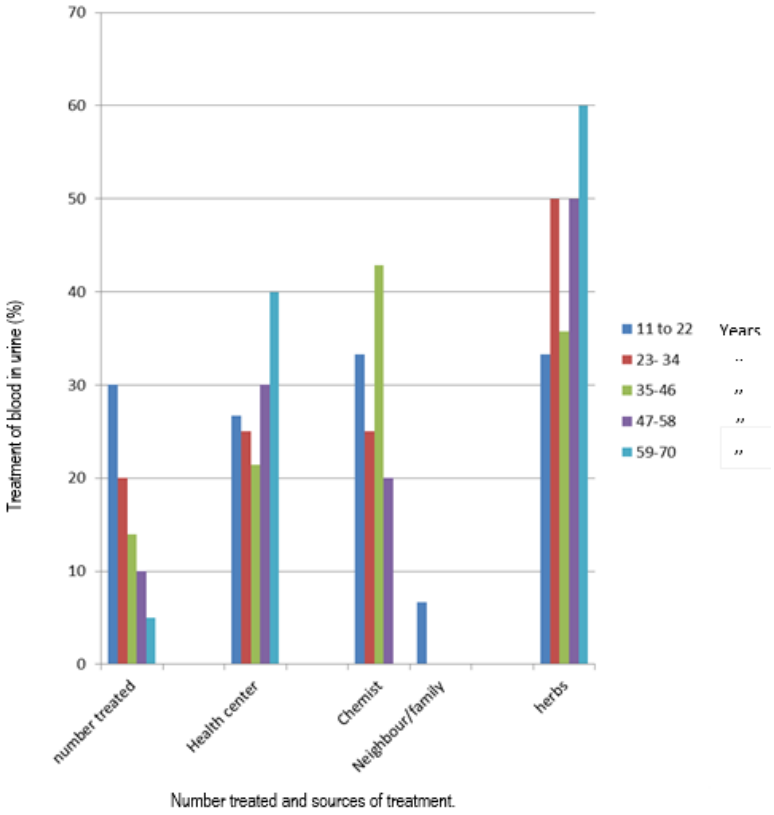

Figure 2: Methods of treatment of blood in urine by respondent

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3.3 Impact of the disease on daily activity activities of women

Results of questionnaire survey showed that the disease affected one hundred and sixty respondents (72.07%) physically, socially, and economically. According to the respondents, the disease prevented them from carrying out their daily activities as housewives, caregivers, mothers, head of households due to the suprapubic pain. Also, some people tended to avoid sharing bathroom with them as the disease was thought to be contagious and prevented them from attending social gathering due to the pains associated with it, while 27.93% of respondents said that the disease does not have any impact on their daily activities as it allows them to go about their normal activities. This result is presented in Figure 3.

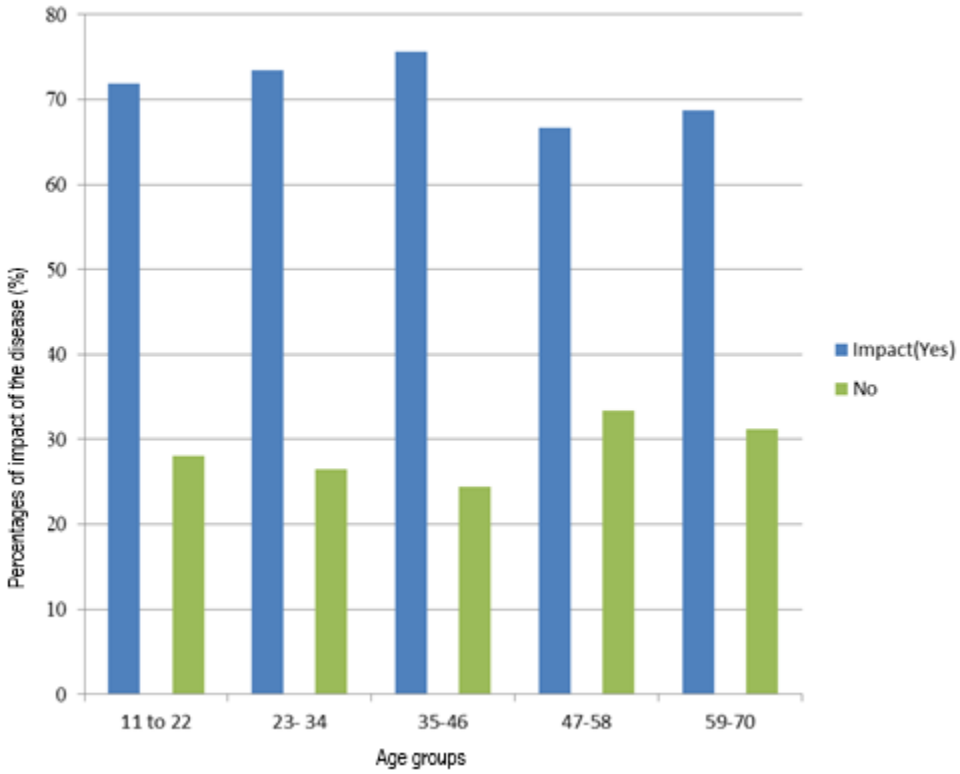

Figure 3: The impact of the disease on daily activities of women

3.4 Knowledge of the disease by respondents

Ninety percent (90%) of the women knew the local name for the disease but none knew it was contracted through contact with cercariae infested body of water.

Thirty five percent (35%) said it was acquired through drinking dirty water, 20% said it was acquired through eating infected crab, 10% said it was acquired through sexual contact and 40% said it is acquired through sexual contact and 5% said it is acquired through toilet. None of the respondents had heard about the word "schistosomiasis" before.

Ninety-five (95%) of the women responded that they fetched water daily, while 67.67% said they encountered the water for agriculture and domestic purposes and 32.33% said they encountered the water for recreation and domestic purposes.

3.5 Macroscopic examination

Macroscopy showed that 46.52% were red-brown and cloudy, 24.75% were brown-cloudy, 27.72% were yellow and cloudy, and 1.00% were amber and clear, while none of the urine samples appeared pale yellow (0.00%).

3.5.1 Urinalysis

Using the reagent strip test showed that the overall prevalence of micro-haematuria at 1+ was 9.23%, at 2+ was 10.00% and at 3+ was 19.23% giving a total prevalence of 34.77% (i.e. 34.77% of the samples had micro-haematuria).

The overall prevalence for proteinuria at 1+ was 6.15 at 2+ was 6.92% and 3+ was 14.46% giving a total prevalence as 10.00% and the total of the overall prevalence as 23.08%.

3.5.2 Microscopy

Microscopy showed that the highest prevalence rate was found among the age group 11-22 years with 48.11% and the least was found among the age group 59-70 years with 12.80%, while overall prevalence was 31.08%. The overall prevalence of schistosomiasis in both villages is presented in Figure 4.

Ugaga village had the highest prevalence (62.00%) with the age group 11-22 years having the highest prevalence of 86.25% and the least was found in the age group 59-70 years with 31.03%. Okpoma had an overall prevalence of 11.75% with the highest found in the age group 11-22 years and 19.05% and the least in the age group 59-70 years with 3.51%. The prevalence decreased with age.

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Of those infected, farmers had the highest overall prevalence of 93 (46.04%) and this was found among the age group 59-70 years and the least were civil servant with 0.50%, as presented in Table 4.

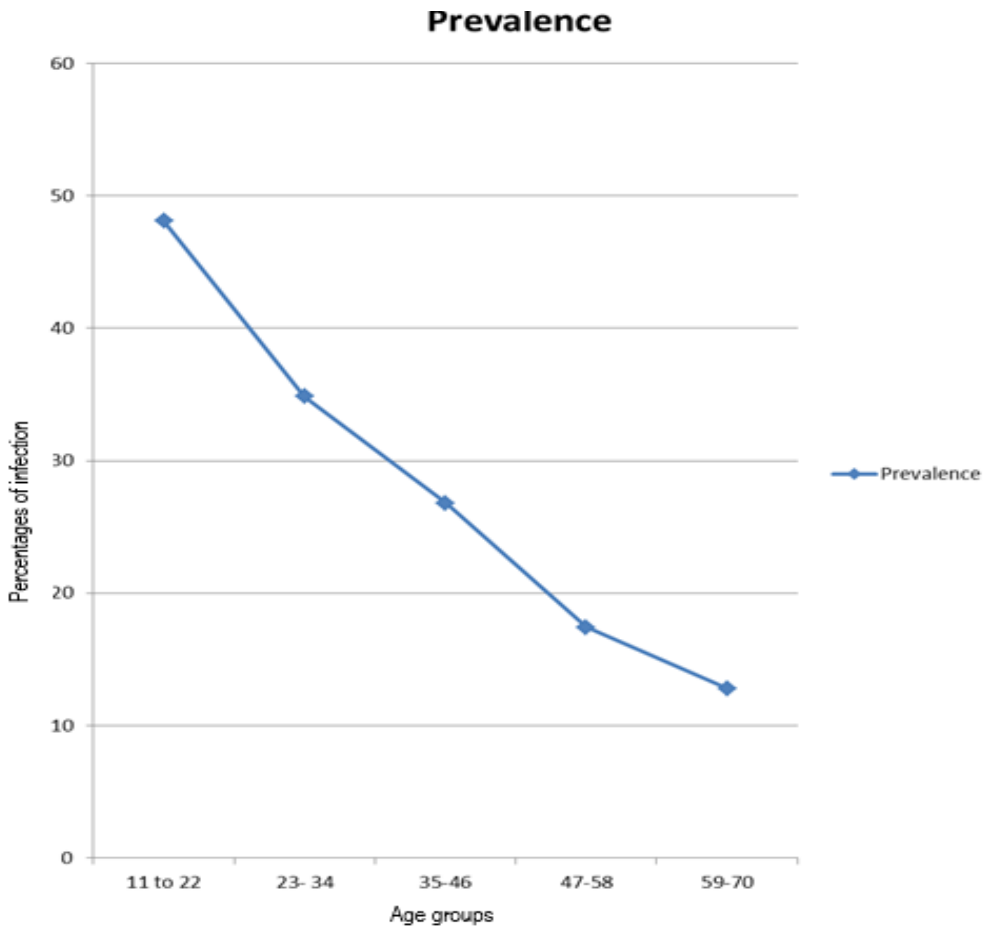

Figure 4: Overall prevalence of S. haematobium infection according to age in the two villages

Table 4: Prevalence of *Schistosoma haematobium* infection according to Occupation

AGE GROUPS	NO. SAMPLED	FARMERS (%)	TRADERS (%)	CIVIL SERVANTS (%)	STUDENTS (%)
11-22	186	122 (18.77)	8 (1.23)	0	128 (19.69)
23-34	132	78 (12.00)	9 (1.38)	1 (0.20)	11 (1.69)
35-46	138s	59 (9.08)	8 (1.23)	0	0
47-58	109	22 (3.38)	4 (0.62)	0	0
59-70	85	18 (2.77)	1 (0.20)	0	0
	650	**299 (46.04)**	**30 (4.62)**	**1 (0.50)**	**139 (21.38)**

No. = number; % = percentage

3.6 Frequency of bacterial isolates and co-infection in *Schistosoma* positive urine samples

A total of eight (8) bacteria genera were isolated and identified from 202 urine samples positive for *Schistosoma* eggs (table 5). The bacterial species, frequency and percentage of occurrence include *Klebsiella* sp. 3 (2.47%), *Staphylococcus aureus* 39 (32.23%), *Enterococcus aerogenes* 6 (4.95), *Escherichia coli* 32 (26,45), *Pseudomonas aeruginosa* 14 (11.57), *Staphylococcus saprophyticus* 10 (8.26), *Enterococcus faecalis* 9 (6.61) and *Proteus* sp. 8 (6.61), respectively. The overall co-infection (bacteriuria and urinary schistosomiasis) from both villages is 65(53.68).

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Table 5: Frequency of bacterial isolates and co-infection in positive urine samples from both villages

Bacterial isolates	Frequency	Percent	Co-infection (%)
Klebsiella species	3	2.47	1 (0.82)
S. aureus	39	32.2	26 (21.48)
E. aerogenes	6	4.95	2 (1.65)
E. coli	32	26.45	18 (14.13)
P. aeruginosa	14	11.57	5 (4.13)
S. saprophyticus	10	8.26	6 (4.96)
E. faecalis	9	7.43	4 (3.30)
Proteus species	8	6.61	3 (2.47)
Total	**121**	**100**	**65 (53.68)**

% = percentage

DISCUSSION

The overall prevalence of urinary schistosomiasis in Yala was high with 31.08% prevalence rate. This result is higher than 23.8% reported by Eyo (2012) in Anambra State. The difference in results may be attributed to absolute dependence of the communities on natural water sources in the areas of study. The figure was much lower than prevalence rate of 91% in Otukwang, Obudu L.G.A, Cross River State Nigeria (Okon *et al*., 2003), whose investigation was among children. The reason for the variation in the prevalence between these two areas of study may be because of socio-cultural and religious factors that expose males to activities at the infested water bodies, such as swimming, washing, and bathing, etc. These activities increase their rate of exposure to infection (Uneke *et al*., 2009).

Among the age brackets, highest prevalence was recorded among the age group 11-22 years with 48.53%. This may be attributed to their care-free attitudes towards swimming, fishing, bathing, and playing in infested water bodies which encourage infection. The least prevalence was found in the age group 59-70 years (12.80%). This is like the work of Eyo (2012) in Anambra State, where the age group 16-20 years had 50% prevalence rate, and this shows that the infection rate decreases with age.

Prevalence according to occupation had the highest prevalence recorded among the farmers with 93(46.04%) as previously found in the study of Anosike *et al*. (2003) in Ebonyi, Benue River valley, southeastern Nigeria. Statistically, there is significant relationship between occupation and infection rate (P≤0.05).

Out of the 37.00% women who responded to passing blood in urine 31.08% were infected. This indicates that there is a strong relationship between blood in urine and the presence of the egg of *S. haematobium* in urine, as was reported by Anosike *et al*. (2001). Haematuria and proteinuria showed a significant relationship with reported blood in urine. This agrees with the works of Lengeler *et al*. (1993), Mafe *et al*. (2000), Gordon and Stapleton (2005) and Uneke *et al*. (2009). Of the 79 (35.59%) women that were treated, they were 59(26.59%) active cases. This could be due to re-infection as they have no other source of water apart from the stream. A few women (26.58%) visited the health center for treatments while a good number of them (29.11%) and (41.77%) visited the chemists and herbal homes, respectively, for treatment. Of the women who were infected, 72.07% complained of suprapubic pain and painful urination as the urine is emitted drop by drop due to muscle spasms of the urethra and urinary bladder. They revealed that the infection prevented them from going to the farm, market and carrying out their daily activities like cooking, washing, fetching water, as caregivers, and attending social functions. Some people avoided sharing bathroom with them as the disease is erroneously believed to be contagious. It can be deduced from the results that due to lack of knowledge about the disease, those infected suffer stigmatization; hence the need for awareness campaigns on schistosomiasis in rural settings to educate the rural dwellers.

Fifty percent (50%) of the infected respondents associated visible haematuria with sexually transmitted diseases. This lends credence to the report of Anosike *et al*. (2006) but disagrees with the observations of Akogun and Akogun (1996) and Anosike *et al*. (2001) in Northern Nigeria where haematuria is regarded as the coming of age.

This study has demonstrated that contact with infested water for various agricultural and socio-cultural purposes remains the sources of infection. These risk behaviours are in line with the observations of Alozie and Anosike (2004) and Odaibo *et al*. (2005), There is a significant relationship between risk of infection and the number and duration of contact with infested water.

Bacterial strains were recovered from 59.97% (121/202) of the urine samples positive for *Schistosoma haematobium* in the study (Table 5). *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus saprophyticus, Enterococcus faecalis* and *Proteus* sp. were the most predominant bacteria isolated. The bacteria strains isolated in this study have been previously reported to be recovered from urine samples (Kone *et al*., 2022; Uwandu *et al*., 2022). *Staphylococcus aureus* had the highest frequency of occurrence at 32.23% (39/121). This study agrees with previously reported findings (Stokes *et al*., 2019; Kitano *et al*., 2021; Alabi *et al*., 2023). High occurrence of *S. aureus* and *S. saprophyticus* in the urinary tract was also in agreement with the report of Bodunrinde *et al*. (2019) and Bayode *et al*. (2020). This could be due to their association with skin and affinity for wet area with high level of salt. However, the higher occurrence of *S. aureus* bacteriuria should be of a great concern as it could be a sign of a serious infection, like *S. aureus* bacteremia or an occult abscess (Stokes *et al*., 2019). Furthermore, *Escherichia coli* had a frequency of occurrence of 26.45% (32/121). *Escherichia coli* has been previously reported as the predominant bacterial strain recovered in urine samples positive for *S. haematobium* (Badunrinde *et al*., 2019). This report disagrees with the reports by Dada and Aruma (2016) that posited *E. coli* as the predominant bacteria encountered in their study. For *P. aeruginosa*, an opportunistic pathogen to be found in urinary tract might be due to the debilitating conditions of the women in these villages. The occurrence rate of co-infection (7.69%) recorded in this study was low compared to 53.7% reported by (Ossai *et al*., 2019). This could be as a result of the people's patronage to local chemists using antibiotics to 'treat' schistosomiasis. *Klebsiella* sp., had the least

frequency of occurrence, which is 2.47% (3/121) of the bacteria isolated in this study. This highlights the need for improved hygiene practices in women to prevent the spread of bacterial UTIs.

Bacterial co-infection in urinary schistosomiasis has been reported to increase the risk of developing kidney infections and can cause a wide range of health conditions (Leutscher *et al*., 2008; Uwandu *et al*., 2022). The condition has also been reported to reduce the efficacy of antimicrobial agents as a result of the antimicrobial agent sequestration within the parasite, which often leads to an inability to completely eradicate the bacteria by antimicrobial agents (Kone *et al*., 2022). It is also reported that antibiotic treatment was usually unsuccessful and persistent bacterial infections may result in the development of antimicrobial resistance (Partin, 2021). The study highlights the prevalence of bacterial co-infections in women with urinary schistosomiasis, which has important clinical implications for the management of the infection. The identification of the predominant bacterial strains causing UTIs in this population can help guide empirical antibiotic therapy and inform future research efforts, antimicrobial stewardship and the judicious use of antibiotics. The findings from this study can be applied in the clinical management of patients with urinary schistosomiasis and co-existing UTIs and can inform the development of diagnostic tests and treatment protocols tailored to this vulnerable population with urinary schistosomiasis and UTIs. However, further research is needed to investigate the antibiotic susceptibility profiles and mechanisms that may underlie antimicrobial resistance in the studied population and develop effective strategies to address the issue.

4.0 Conclusion

The present study confirmed the endemicity of the disease, the health and socio-economic impact on women and the association of bacteriuria with urinary schistosomiasis in the study area. Bacterial co-infection with urinary schistosomiasis has been underreported and portends a public health threat in the study area and the country at large. The findings of this study underscore the need for clinicians and healthcare practitioners to adopt appropriate diagnostic methods and antimicrobial regimens in the management of urinary schistosomiasis co-infections with bacterial UTIs. It is, therefore, recommended that the integration of complementary control strategies such as disease surveillance, chemotherapy, health education, potable water supply, provision of toilet facilities and sanitation in the study area should be adopted and implemented. It is believed that these measures would ameliorate the scourge of these diseases.

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Conflicts of interest

The authors declare no conflict of interest.

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